A RAPID GLOBAL EFFECTS CAPABILITY

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A Rapid Global Effects Capability

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Foreword

It is my great pleasure to present another issue of The *Wright Flyer Papers*. Through this series, Air Command and Staff College presents a sampling of exemplary research produced by our residence and distance-learning students. This series has long showcased the kind of visionary thinking that drove the aspirations and activities of the earliest aviation pioneers. This year's selection of essays admirably extends that tradition. As the series title indicates, these papers aim to present cutting-edge, actionable knowledge—research that addresses some of the most complex security and defense challenges facing us today.

Recently, The *Wright Flyer Papers* transitioned to an exclusively electronic publication format. It is our hope that our migration from print editions to an electronic-only format will fire even greater intellectual debate among Airmen and fellow members of the profession of arms as the series reaches a growing global audience. By publishing these papers via the Air University Press website, ACSC hopes not only to reach more readers, but also to support Air Force–wide efforts to conserve resources. In this spirit, we invite you to peruse past and current issues of The *Wright Flyer Papers* at https://www.airuniversity.af.edu/AUPress/Wright-Flyers/.

Thank you for supporting The *Wright Flyer Papers* and our efforts to disseminate outstanding ACSC student research for the benefit of our Air Force and war fighters everywhere. We trust that what follows will stimulate thinking, invite debate, and further encourage today's air, space, and cyber war fighters in their continuing search for innovative and improved ways to defend our nation and way of life.

BRIAN HASTINGS
Colonel, USAF
Commandant

Abstract

The United States is increasingly concerned with its ability to project power and influence world events. A rapid change in various technologies and their integration into strategies used by adversaries of the United States complicates matters, leading to nontraditional challenges. Slower growth in the world economy has led to shrinking and static defense budgets not only for the United States, but also for allies and adversaries as well. The change in strategic defense spending has steered defense investments in many areas including, but not limited to, basing, emerging technologies, future platforms, and force structure.

Research included historical references, primary resources, and secondary sources. Additionally, interviews, panels, wargames, and workshops were the key methodologies for conducting research.

A Rapid Global Effects Capability will provide the Air Force with operational agility. This ability will enable the Air Force to achieve the core missions of Multi-Domain Command and Control, Adaptive Domain Control, Global Integrated Intelligence, Surveillance, and Reconnaissance, Rapid Global Mobility, and Global Precision Strike by 2035. The ability to rapidly deliver global effects will have implications to both domestic and foreign policy.

Acknowledgments

I would like to thank the Air University Team at Maxwell Air Force Base, AL, for their support and mentorship during this research effort. In particular, I would like to thank Lt Gen Steven Kwast for his mentorship and the latitude that he has given research students in researching topics that impact Airmen across the United States Air Force.

This research would not have been possible without the support of the team at the Air Force Research Institute led by Lt Gen (Ret) Al Peck. Thank you for your patience and understanding.

The LeMay Center Wargaming Institute and Air Force Research Laboratory are responsible for many of the wargames, workshops, and products referenced. Thank you for your leadership in this field and willingness to reach across institutions with an eye toward the future.

I would like to thank the fine people from the following commands and organizations that have contributed to this research: United States Air Forces Europe, Air Education and Training Command, Air Mobility Command, Air Force Space Command, Air Force Global Strike Command, the Air Warfare Center, the Defense Advanced Research Projects Agency, Los Alamos National Laboratory, and Sandia National Laboratory. In particular, I would like to thank Maj Gen Timothy Zadalis for his mentorship and willingness to expose the USAFE Team to emerging technology. This research would not have been possible without the partnership of civilian industry partners and policy experts. My true appreciation goes to the Center for New American Security, the Heritage Foundation, the Center for Strategic and Budgetary Analysis, and SpaceWorks Enterprises.

To all that have helped in this endeavor and to the patriots who keep the United States safe . . . Thank You!

Purpose

The purpose of this research is to provide the Secretary of the Air Force, Chief of Staff of the Air Force, the Air University Commander, and government policy makers with credible research regarding some of the potential policy implications of a Rapid Global Effects Capability.

Problem Statement

The United States is increasingly concerned with its ability to project power and influence world events.[1] A rapid change in various technologies and their integration into strategies used by adversaries of the US complicates matters, leading to nontraditional challenges.[2] Slower growth in the world economy has led to shrinking and static defense budgets not only for the US, but also for allies and adversaries as well. The change in strategic defense spending has steered defense investments in many areas including, but not limited to, basing, emerging technologies, future platforms, and force structure.[3]

Thesis Statement

A Rapid Global Effects Capability will provide the Air Force with operational agility.[4] This ability will enable the Air Force to achieve the core missions of Multi-Domain Command and Control (MDC2), Adaptive Domain Control (ADC),Global Integrated Intelligence, Surveillance, and Reconnaissance (GIISR), Rapid Global Mobility (RGM), and Global Precision Strike by 2035.[5] The ability to rapidly deliver global effects will have implications for both domestic and foreign policy.

Setting

The political environment is calling for a change in investment strategies as they relate to technology. Senator John McCain highlighted the need to allow the military services to have more ownership over acquisition processes. In granting this, the armed forces would be better able to enforce acquisition reform and advance accountability. He also stressed the importance of the new National Defense Authorization Act (NDAA) (2015) and the need to incentivize commercial investment in a speech to the US Chamber of Commerce.[6]

In congressional testimony, the Vice Chairman of the Joint Chiefs of Staff (JCS) identified Russia as the leading threat to the existence of the US.[7] Furthermore, many strategists believed that the only options the military could offer to the president of the US during Russian aggression in Crimea was

either nuclear attack or acquiescence. These viewpoints are an example of the shifting nature of warfare; one in which agility is needed to address a plethora of varied threats.

The 2015 *US National Security Strategy* (NSS) outlines the strategic foundation of the United States. It states, "The world is connected by shared spaces—cyber, space, air, and oceans—that enable the free flow of people, goods, services, and ideas. They are the arteries of the global economy and civil society, and access is at risk due to increased competition and provocative behaviors. Therefore, we will continue to promote rules for responsible behavior while making sure we have the capabilities to assure access to these shared spaces."[8] The strategy notes that global access is a fundamental requirement of these shared spaces, and is important for the global economy, peace, and progress. However, the US must choose which development priorities are most important to its national security, particularly in the pursuit of emerging technologies.

To maintain dominant and balanced air, space, and cyberspace forces in the 2030s, the US armed forces must invest in *operational agility* enabled by emerging technologies to achieve their core missions. In choosing its development priorities, the US must identify what it considers to be its strategic risks throughout the world. The 2015 NSS lists these strategic risks as:

- Catastrophic attack on the US homeland or critical infrastructure.
- Threats or attacks against US citizens abroad and our allies.
- Global economic crisis or widespread economic slowdown.
- Proliferation or use of weapons of mass destruction or both.
- Severe global infectious disease outbreaks.
- Climate change.
- Major energy market disruptions.
- Significant security consequences associated with weak or failing states (including mass atrocities, regional spillover, and transnational organized crime).[9]

These strategic risks are global, broad, and increasingly dynamic in nature. As an example of a service's response to the identified strategic risks, in 2015, the United States Air Force (USAF) produced the Air Force (AF) Future Operating Concept (FOC).

The AF FOC is representative of each service's changing views on the nature of warfare. It outlines what the USAF believes the required force structure, missions, and investment strategy should be to effectively address the

strategic risks outlined in the 2015 NSS. Written with the years 2035-2040 in mind, "it identifies four emerging trends that are highly likely to characterize the future: increasing speed and proliferation of technological change, geopolitical instability, increasing scarcity of natural resources, and an increasingly important and vulnerable global commons."[10] As a result of these emerging trends, the USAF identified operational agility as the cornerstone of future mission success.[11]

Operational agility will be the USAF's and other service's key to future warfare. The AF FOC states that operational agility provides "the ability to rapidly generate—and shift among—multiple solutions for a given challenge."[12] It also states that operational agility will rely upon "flexibility, speed, coordination, balance, and strength."[13] Key to future warfare, operational agility will ensure that the armed forces have the ability to react to a diverse range of situations and threats anywhere in the world. Operational agility will allow the armed forces of the US to succed in their missions.

The core missions that each service identifies aids in achieving the national security priorities of the US. The top priority of the Department of Defense (DOD) is to protect the US and its citizens from attack. This has been the foundational charge for the DOD since its inception. To meet this requirement, each service in the DOD outlines their respective core missions. Throughout history, the core missions of each service have evolved with the current operating environment.

For instance, the AF FOC highlights the evolution of the Air Force core missions as:

1947	**Today**	**Future**
Air Superiority	Air & Space Superiority	Adaptive Domain Control
Air Reconnaissance	Global Integrated ISR	Global Integrated ISR
Airlift Mobility	Rapid Global Mobility	Rapid Global Mobility
Strategic Air Force	Global Strike	Global Precision Strike
Coordination of Air Defense	Command and Control	Multi-domain Command and Control

Figure 1. Evolution of the Air Force Core Missions[14]

Emerging technologies are enabling this evolution in core missions and are transforming the way that the AF conducts its missions in support of the NSS. A diverse set of emerging technologies have made it feasible to develop a Rapid Global Effects Capability.

Concept Description

Mr. Barry Hellman from the Air Force Research Laboratory (AFRL) has been conducting research and development on a Rapid Global Effects Capability. His concept is a launch-on-demand "space truck" based in the US. Technical analysis is underway concerning the advantages and disadvantages of vertical and horizontal takeoff and landing. The design has a reusable first stage booster that returns to the launch site approximately 30 minutes after initial launch.

The "space truck" portion of the concept launches from ground into low Earth orbit between an altitude of 300 and 600 thousand feet, or into space, with re-entry airspeeds of approximately Mach 25. The concept's initial design allows it to have a 20,000 pound payload, or a 6,000 pound soft payload anywhere in the world within two hours.[15] The "space truck" deploys a payload to a target area and then recovers to the launch site or to another designated site.[16]

The deployable payload releases approximately 2,500 – 4,000 miles before to the target area. The payload reaches the ground approximately 20 minutes after release. This creates a three to four minute communications blackout period.[17] The anticipated G-loading is six on ascent and nine for capsule reentry. Mr. Hellman bases his concept on technologies that are currently in development in both the military and commercial sectors.[18]

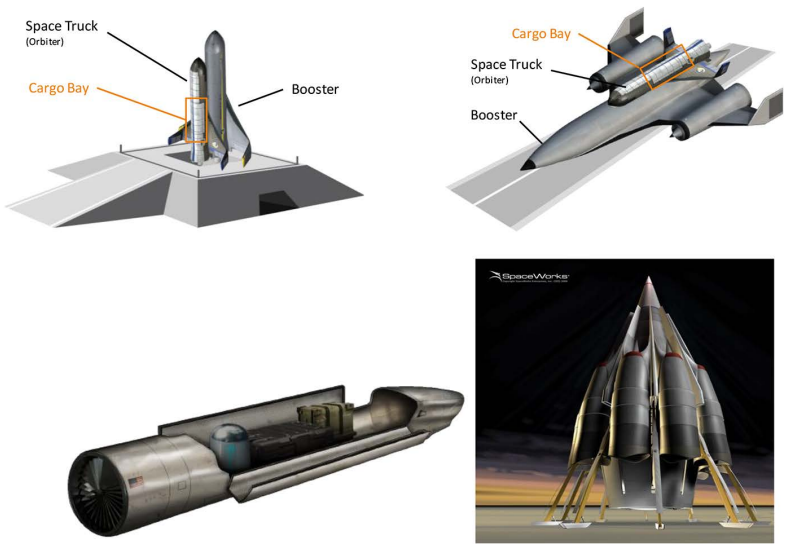

Figure 2. Artist depictions of Rapid Global Effects Capability platforms.[19]

Figure 3. Artist depiction of Expendable Entry Capsule and its deployment.[20]

The DOD and commercial industry are currently conducting technological research applicable to a Rapid Global Effects Capability. Commercial investment has led to an environment in which the technology readiness levels (TRLs) of the technology needed to field a Rapid Global Effects Capability is achievable. The TRLs for the technologies currently in research are at a TRL 5 or above.[21] According to NASA, "once the proof-of-concept technology is ready, the technology advances to TRL 4. During TRL 4, multiple component pieces are tested with one another. TRL 5 is a continuation of 4, however, a technology that is at five is identified as a breadboard technology and must undergo more rigorous testing than technology that is only at TRL 4."[22] Using technologies that are already being developed allows for government investment later in the development process, thus cutting overall acquisition and costs to the US government. Companies such as SpaceWorks, SpaceX, Blue Origin, and Masten Space Systems are conducting similar research and development.

Industry Research

Research and development of a multitude of new technologies is further advancing the concept of a Rapid Global Effects Capability. In the commercial sector, SpaceX Designs is the most noticeable entity in the field of space exploration. They are focusing research and design on efforts to reduce the cost of accessing space through reusable platforms. Ultimately, their goal is exploration and colonization of Mars by humans. Recently, they have had many important successes.

In 2014, SpaceX and their "commercial space program received approval to transport a crew to the International Space Station – SpaceX's first such

mission."[23] These missions represent a shift in US government use of commercial space vehicles to travel to or from space. However, this shift is not without a level of accepted risk. In January of 2016, "SpaceX's. .. attempt to land a rocket upright on a platform in the Pacific Ocean failed in a spectacular fashion."[24] Therefore, it is important to distinguish acceptable levels of risk from reckless risk in the research and development of technologies associated with space exploration and a Rapid Global Effects Capability.

Acceptable levels of risk are possible due to flexibility in the commercial research and development process. Traditional acquisition, research, and development processes controlled by the US government cannot compete with this process and level of risk. The SpaceX use of the Falcon 9 rocket is an example of unacceptable levels of risk. SpaceX is able to deliver that capability at one-tenth of the cost of NASA's approach with their Falcon 9.[25]

Blue Origin and Masten Space Systems are also leading the way in various technological development projects involving space exploration. In a historic moment on 24 November 2015, "Jeff Bezos' rocket ship achieved a breakthrough.. . by traveling 329,839 feet into outer space and then landing upright upon its return to Earth."[26] This was the first launch of a rocket in which portions of the rocket were recoverable and could be used again. Bezos' proclaimed, "Full reuse is a game changer, and we can't wait to fuel up and fly again."[27] He compares reusing rockets to airlines that fly their commercial aircraft repeatedly. On 2 April 2016, Blue Origin made their third launch of their New Shepard rocket. "Both the rocket and the capsule, which will eventually carry paying customers, landed successfully. During this test, the capsule was carrying two microgravity experiments from the Southwest Research Institute and the University of Central Florida."[28] Ultimately, reusable rockets will have a dramatic impact on the overall cost to access space.

Masten Space Systems, founded by Dave Masten, is a smaller company in comparison to SpaceX and Blue Origin. Located in the Mojave Desert, they are taking strides to redefine space launch and access. On their company website they laud, "You don't need to be a hundred miles above the Earth's surface to alter the future of space exploration, you just need to be a hundred miles north of Los Angeles. At our testing facility here in the Mojave Desert, we rapidly mature the technologies of the present into the space exploration capabilities of the future."[29] The US government has realized their expertise in reusing rockets by awarding them contracts in the development of their XS-1 concept.

While difficult to compete with commercial design and acquisitions processes, the US government is investing in technologies involving a Rapid Global Effects Capability. The Defense Advanced Research Projects Agency

(DARPA) is exploring a similar concept with their Experimental Spaceplane (XS-1) concept.

DARPA believes that there is an increasing demand for reusable launch vehicles for the future. They base their beliefs on a growing commercial demand for flexible space launch options that both the US and international community are demanding, as well as an increasing DOD demand for flexible launch options in response to the changing nature of warfare. The key in each case is the need for flexible launch options.[30]

In the commercial sector, DARPA outlines the spacecraft market, spacecraft cost, and spacecraft technology as areas influencing the need for flexible launch options. They predict that there will be a large growth in the market of spacecraft development. However, the current market is unprepared to meet this demand. DARPA also predicts that emerging technologies will reduce the cost of commercial satellite costs, therefore driving the demand for low-cost spacecraft to deliver low-cost satellites. DARPA also sees a notable reduction in the size of spacecraft technology in the future.[31]

In the defense sector, DARPA outlines expendable vehicle launch sites, contested space environment, and reusable first stage launch sites as areas influencing the need for flexible launch options. They believe that coastal launch sites are important to contributing to expendable systems and that expanded launch flexibility reduces US vulnerabilities from adversaries. They also highlight the changing dynamics of space threats and how they drive a responsive launch capability. DARPA also stresses that operations that focus on being similar to aircraft will lead to flexible basing and potential inland basing options.[32]

Combining DARPA's view of the changing commercial and defense sectors has led them to design the XS-1.

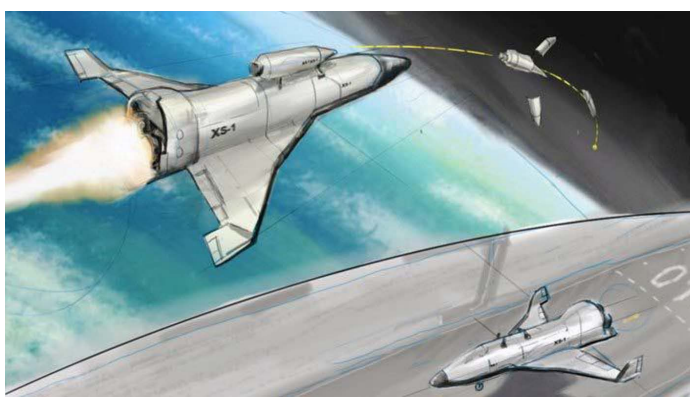

Figure 4. Artist Depiction of DARPA's XS-1.[33]

While DARPA's XS-1 design allows it to operate like a traditional aircraft squadron, there are some notable advantages and differences. One of XS-1's goals is to provide global reach anywhere in the world within 90 minutes. It will have the ability to fly globally at any time. It will use unpredictable overflight patterns that make it difficult for adversaries to target, engage, and defeat. These aspects will ensure survivability in an anti-access area denial (A2AD) environment.[34] With the future in mind, the goal is to show reusability with 10 flights within 10 days.[35]

Reusable, low-cost launch capabilities will make rapid global presence a reality for the US. Currently, access to space costs around $10,000 per kilogram. Low-cost access to space is considered by many to be a factor 10 times lower than that.[36] This number is relative, however, to the economic incentives that asteroid mining and associated activities in space could provide to mankind to offset costs. However, there are policy implications to consider with its development.

Air Force Internal Policy Implications of Development

A Rapid Global Effects Capability will have internal policy implications for the USAF and its future, core missions. The AF FOC outlines operational agility as the critical factor in its future, core missions, and warfighting capability. The AF core missions of the future will be ADC, GIISR, RGM, Global Precision Strike, and MDC2.[37]

Operational agility is a cornerstone of ADC. The AF FOC defines ADC as "the ability to operate in and across air, space, and cyberspace to achieve varying levels of domain superiority over adversaries seeking to exploit all means to disrupt friendly operations."[38] This core mission is essential to achieving the national security objectives of the US.

GIISR operations are another increasingly important core mission of the AF. The AF FOC highlights that "GIISR continues to enable current and future operations through the cross-domain synchronization and integration of: planning and operation of Intelligence, Surveillance, and Reconnaissance (ISR) assets; collection using near-ubiquitous sensors; and processing, exploitation and dissemination (PED) of finished intelligence."[39] It is a key mission support area that links the other core missions together.

RGM allows the United States to project global power. The AF FOC states, "at its core, RGM has always focused on the relocation of manpower and physical materials, but this process now occurs through a much wider portfo-

lio of physical—and virtual—methods across multiple domains."[40] Without RGM, the US does not have the ability to represent a global presence.

Global Precision Strike remains the pinnacle core mission of the AF. The US's evolution in this domain has allowed it to deter adversaries prior to conflict, and win the nation's wars if deterrence fails. However, the global strike mission has changed over time. The AF FOC notes that "integration enable AF assets to conduct *integrated multi-domain* global precision strike using a *balanced capabilities mix* of forces, in collaboration with joint and multinational partners."[41] The ability to rapidly perform the global strike mission, to be rapidly present anywhere in the world, while intertwined with other core missions will continue to become more important in the future.

At the center of each core mission previously discussed is the core mission of MDC2. Rightfully, the AF FOC describes C2 as "fundamental to military operations."[42] C2 enables the other core missions to execute effectively. Unfortunately, adversaries of the United States are actively working to prevent the armed forces from achieving their core missions. It will take the vision and leadership of current and future generations for the US to maintain its competitive advantages.

An important aspect to future investment is the potential inspiration that the USAF will have on future generations of leaders. A research study was conducted with the Auburn University AF Reserve Officer Training Corps (ROTC) Detachment. The intent of the research was to brief the detachment on the Rapid Global Effects Capability concept and receive feedback from a generational and inspirational perspective.

The following questions were asked of the cadets in a survey and their responses are annotated:

- Does this inspire the next generation of Air Force Leaders?
  - 100% (64 out of 64) said they were inspired
- Does this motivate you to join/stay in the Air Force?
  - 95% (61 out of 64) said this motivates them to join/stay in the Air Force
- Would you want to be a part of this concept?
  - 94% (60 out of 64) said they would want to be a part of this concept
- What is one word you would use to describe this concept (some words were used more than once)?
  - Wow, Efficient, Deadly, Innovating, Thrilling, Air Superiority, Intimidating, Futuristic, Interesting, Future, Exciting, Effective, Superior, Intriguing, Capability, Revolutionary, Expensive, Powerful, New-Age, Powerful, Controversial, Mind-Blowing, The Future, Intriguing, Awesome, Ambitious, Cool.[43]

Overall, the cadets at the Auburn ROTC Detachment were very receptive and motivated concerning a Rapid Global Effects Capability concept. The ability of the USAF to attract and retain the best and brightest leaders from around the world is the cornerstone of success. A strategy of investing in capabilities that achieve decisive effects against adversaries while inspiring current and future generations is a prudent course of action for the USAF.

While inspirational to future generations of leaders, the precise impacts that a Rapid Global Effects Capability would have on the core missions of the USAF are currently unknown. Few people can truly envision the potential impact of a Rapid Global Effects Capability and how to properly employ it. In an effort to bridge the gap between today's core missions and the core missions of the future, the USAF Wargaming Institute conducted a wargame on the potential impact of a Rapid Global Effects Capability.

USAF Wargame Results

The AFRL and Air University sponsored a wargame in June 2015 to determine how a Rapid Global Effects Capability might impact AF core missions. The wargame team traveled to four locations to conduct research: Air Mobility Command, AF Space Command, AF Global Strike Command, and the Air Warfare Center at Nellis AFB. Their research found that 92 percent of participants either "Agreed" or "Strongly Agreed" that the Rapid Global Effects Capability concept was relevant to their mission set.[44]

Participants agreed that the concept would be most effective in conventional strike, C2, ISR, and humanitarian relief missions. Particularly, participants believed that time sensitive missions and targets are uniquely suited to be matched against a Rapid Global Effects Capability.[45] In a fiscally constrained environment, this may augment current conventional forces in achieving current and future missions. However, there is a counterargument as to what current assets or fiscal policies may have to change in order to invest in the development of a Rapid Global Effects Capability. While outside the scope of this research, it warrants a discussion at the service and department levels when prioritizing strategic investment strategies occurs.

There were areas, however, where the participants agreed the concept should not be used. Most participants agreed that the concept should not be used for nuclear weapons transport or employment. Participants also questioned the impact of signaling Rapid Global Effect Capability to adversaries as well as stabilizing versus destabilizing effects.[46]

Each group of participants also brought up the ability of a Rapid Global Effects platform to deliver drone technology in futuristic strike packages. For

instance, a 20,000 pound payload could deliver 20 remotely-piloted aircraft; each with differing capabilities including strike, communications nodes, and ISR. In effect, a Rapid Global Effects Capability could deliver an autonomous strike package with a degree of artificial intelligence (AI) in which each drone could "talk" to other drones. They could have the ability to operate independently or in an autonomous swarm.[47] A counterargument to this possibility is that remotely-piloted assets coud instead be delivered by air or sea-based platforms. However, this also creates traditional logistics lines of support. A continental US (CONUS) based Rapid Global Effects Capability limits traditional logistics lines that become expensive. A Rapid Global Effects Capability complements other technologies that are emerging, particularly the technologies that Deputy Secretary of Defense Work said will be critical to the DOD's third offset strategy.

Deputy Secretary of Defense Work's Five Points of Interest and The Future

In November 2015, Deputy Secretary of Defense Robert O. Work outlined five points of interest in emerging technologies. They include learning systems, human-machine collaboration, human-machine combat teaming, assisted humano, and networked-enabled, cyber hardened autonomous weapons.[48] These five points of interest will shape investment and policy for the AF moving forward. There is recent research that complements these points of interest.

Significant research is underway on autonomy and swarming technology. The AFRL is researching autonomy to counter land mines and sea mines. A dominant question is, "How do we deal with data overload?" Is there a way to couple autonomy and AI with human decision makers to reduce tasking overload? Reid Porter works on Data Analytics and Autonomy at Los Alamos National Laboratory and is answering this very question. A Rapid Global Effects Capability offers the solution for delivering a host of emerging technologies, taking advantage of speed and maneuver to create an advantage.

Air University recently conducted a wargame to discover the impact that an autonomous swarm capability could have on an integrated air defense system. The technology, called CLEAVER, is a cruise missile launched from an airlift asset. A C-17 can carry a substatinal number of the CLEAVER as it is a light-weight system. CLEAVER has standoff capability outside of A2AD environments, such as evidenced by the one that China is creating in the South China Sea. However, the wargame displayed that CLEAVER's range is limited because of the delivery requirement from a traditional airlift asset. The

CLEAVER system also has the ability to form an integrated network with other CLEAVER assets that are airborne. CLEAVER assets have the ability to perform strike, C2, and ISR missions. Additionally, CLEAVER would have the ability to carry directed-energy capabilities.[49]

Perhaps the most high-profile directed-energy technology is a system called Counter-electronics High Power Microwave Advanced Missile Project (CHAMP). CHAMP is a joint concept technology demonstration led by the AFRL's Directed-Energy Directorate at Kirtland Air Force Base to develop an air-launched directed-energy weapon capable of incapacitating or damaging electronic systems.[50] This directed-energy technology, combined with a Rapid Global Effects Capability, offers operational agility to the armed forces.

A Rapid Global Effects Capability has the potential to link Deputy Secretary of Defense Work's five essential elements of the Third Offset strategy. A Rapid Global Effects Capability could manipulate the aspect of time. It could promote human-machine collaboration, human-machine combat teaming, assisted human operations, and network-enabled, cyber hardened autonomous weapons. A Rapid Global Effects Capability could have the ability to deliver a swarm of autonomous drones, strike assets, ISR capability, and even enable satellites to orbit.

The combination of a Rapid Global Effects Capability, autonomy, swarming, and directed-energy technology allows for the armed forces to achieve operational agility. As a result, this technology will allow the AF to achieve its core missions of ADC, GIISR, RGM, Global Precision Strike, and MDC2 by 2035. A Rapid Global Effects Capability could have a profound impact on the combat forces of the US. Research involving United States Air Forces Europe (USAFE) was conducted to analyze the impact that a Rapid Global Effects Capability may have on its operations.

In an effort to further explore the lessons learned from the AF's Wargaming efforts, interviews were conducted with key staff members of USAFE. Those staff members have articulated the potential benefits that a Rapid Global Effects Capability could bring to the challenges they face in their theater. Key areas of discussion were USAFE presence and posture, command and control (C2), command relationships (COMREL), basing, force structure, and interoperability.

In discussions involving the US's military involvement in Europe, there exists and previously existed a balance between presence and posture. Each office at USAFE is addressing to some extent a decreasing US presence in Europe. Members cite basing and personnel downsizing as concerns. Members also cite concerns over the signaling that deployment of the A-10 in Europe sends to potential adversaries. In April 2015, "demonstrating its commitment

to a 'free' and 'secure' Europe, the United States deployed 12 F-15C Eagles and approximately 350 Airmen to Iceland and the Netherlands."[51] The USAF is deploying weapons systems, maintenance, and support personnel to Europe to deter Russian aggression and assure its allies. This is both time-consuming for personnel and expensive.

With respect to a Rapid Global Effects Capability, members note that its posture could offer a balance to changes in the US presence in Europe.[52] They believe that posturing with CONUS assets that have the ability to rapidly respond to combatant commanders critical needs holds merit in the overall presence andposture dilemma. However, those interviewed also caution that posturing an asset like a Rapid Global Effects Capability comes with C2 and COMREL challenges.[53]

Emerging technologies are presenting challenges to USAFE C2 dynamics as well as COMREL. For instance, USAFE members highlight how the operation of remotely-piloted aircraft (RPA's) have outpaced current AF and Joint Doctrine.[54] USAFE is at the leading edge in this field and are solving doctrinal challenges at the tactical and operational level in order to support commander and warfighter needs. Currently, RPA's are controlled from CONUS, launched from USAFE, in support of three different commands (USAFE, US Africa Command and US Central Command).[55]

NATO's Ballistic Missile Defense (BMD) C2 structure has current challenges. The US must rely on coalition BMD capabilities to mitigate the high-demand, low density asset challenge.[56] This issue has become more problematic due to recent refugee migrations from areas of conflict throughout the Middle East to Europe. In the past, NATO nations have agreed to contribute two percent of each country's gross domestic product to the collective defense of the alliance. Allies to the US in NATO, now strained with millions of refugees, are finding it difficult to maintain this spending rate on defense.[57]

Emerging technologies will continue to test C2, COMREL, and current doctrinal policies. USAFE members note that a Rapid Global Effects Capability will have similar challenges to the RPA community in each of these areas, both within CONUS and in various geographic areas throughout the world. USAFE members note that a Rapid Global Effects Capability may be able to aid in the BMD challenges that US European Command is facing. Sacrificing a window of time in order to position critical assets away from BMD duties may be a trade-off that NATO leadership is willing to take. The US would have the ability to maintain its deterrent capability while ensuring allies with a diverse platform and a different response window.[58]

USAFE is currently undergoing many vast basing changes to support its force of the future. USAFE is currently divesting Royal Air Force (RAF)

Mildenhall, RAF Alconbury-Molesworth, and streamlining Lajes Air Base. Upgrade projects include special operations facilities at Spangdahlem Air Base and tanker facilities at Ramstein Air Base. Challenges include funding, RC-135 host nation sensitivities, and high-density operations in Germany.[59]

Changes in basing are representative of the challenges that USAFE is facing with presence. A Rapid Global Effects Capability has the ability to offer operational flexibility from CONUS for USAFE that will help alleviate some basing challenges. USAFE members cite that a Rapid Global Effects Capability would alleviate host nation sensitivity to RC-135 basing and operational employment. Basing of the RC-135 has become a sensitive issue due to previous allegations that the US used various means to collect intelligence on allies. Also, with additions to basing structures in Germany, USAFE members note that congested airspace is becoming an issue for joint training and operational missions. Utilizing a CONUS-based platform for some missions would enable other legacy platforms to perform more high-demand missions for the major and combatant commanders.[60]

USAFE team members also note that a Rapid Global Effects Capability could impact force structure. An example of current force structure challenges at USAFE is the alert posture of two C-130 aircraft at Ramstein Air Base (AB) in the "New Normal Now" structure.[61] The alert posture allows USAFE to respond to contingency operations in USAFE and Air Forces Africa. Thus, two aircraft are unavailable for other daily missions in order to support the alert tasking. Depending on the requirement, a Rapid Global Effects Capability could deliver equipment and supplies to a remote location in Africa. A Rapid Global Effects Capability will allow greater operational agility while potentially returning two C-130's, associated aircrews, maintenance, and support personnel to perform immediate needs within USAFE. USAFE members also note that it will also allow for a more immediate response to contingencies in which traditional assets may not have the ability to support (due to large distances in Africa).[62]

USAFE operations are always concerned with interoperability with NATO partners.[63] USAFE professionals caution the DOD to consider how a Rapid Global Effects Capability may interoperate with NATO partners.[64] For instance, should a Rapid Global Effects Capability system base and operate from Lajes AB? What are the C2 implications in NATO for a Rapid Global Effects Capability? These are credible questions that the US should consider when developing future concepts.

The areas that USAFE interviewees highlight are applicable to other commands and the AF at large. They particularly highlight how new and future technologies will test our current doctrine models while alleviating some

challenges and providing support to warfighters and commanders. Additionally, they point to how these emerging technologies will impact domestic and international policy.

External Policy Implications of Development

Research points to external policy implications of the development of a Rapid Global Effects Capability. In particular, professionals have expressed their interest in treaty implications, such as the 1967 Outer Space Treaty, Strategic Arms Limitation Talks (SALT-II), and Strategic Arms Reduction Treaty.[65] [66] There are also international airspace questions that one should consider that affects development.

One-hundred and two countries were involved in the 1967 Outer Space Treaty. An additional 27 have signed, but not ratified, the treaty. Most countries and industries use this as the international standard for conduct in and through space. It uses the Antarctic Treaty as a model and seeks to "prevent 'a new form of colonial competition' and the possible damage that self-seeking exploitation might cause."[67] It begins by stating:

> Inspired by the great prospects opening up before mankind as a result of man's entry into outer space,
>
> Recognizing the common interest of all mankind in the progress of the exploitation and use of outer space for peaceful purposes,
>
> Believing that the exploitation and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development,
>
> Desiring to contribute to broad international co-operation in the scientific as well as legal aspects of the exploitation and use of outer space for peaceful purposes,
>
> Believing that such co-operation will contribute to the development of mutual understanding and to the strengthening of friendly relations between States and peoples . . .[68]

This introduction undeniably sets forth the understanding for all parties that the treaty for space should be for peaceful purposes for each nation and all mankind. The treaty references resolution 1884 which calls "upon States to refrain from placing in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction or from installing such weapons on celestial bodies."[69] Article IV of the Outer Space Treaty goes on to outline this in detail by saying, "States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner."[70]

Article IV has remarkable implications for the development of a Rapid Global Effects Capability.

The language that the signatories use in Article IV is lacking for the modern era. In 1967, the entities capable of space launch and exploration were clearly defined sovereign states. Currently, this model has reversed itself with private industry leading the space development and exploration efforts around the world. This is not surprising considering the age of the treaty is nearing 50 years old. This fact, however, is representative of how emerging technology will push external policy decisions and treaties to change in comparison to historical models.

Article IV also forbids states from placing nuclear weapons or other weapons of mass destruction in orbit. The intent of this article concerns the potential destabilizing effects that weapons of mass destruction could bring to the world from space. Conversations with wargame participants brought up this concern regarding the Rapid Global Effects Capability.

Participants in the wargame recommended against using such a concept for nuclear weapons, component, or material transportation or employment.[71] Their main justification was the destabilizing effects such a step would have upon the international policy arena. However, they did caution that the US should continue to pursue such technology and have the capability to rapidly employ nuclear weapons with a Rapid Global Effects Capability. Especially if the national security of the US required it. For instance, if a near-peer adversary intened to develop that capability, the US could not afford to let the adversary develop the capability uncontested.

A Rapid Global Effects Capability is different from conventional Intecontinental Ballistic Missiles (ICBM) and the Ground Based Strategic Deterrent under development. It has both conventional and nuclear mission applications. Also, depending on the choices made in development, it has the potential to be a highly mobile asset. Ultimately, if a Rapid Global Effects Capability is chosen to support a nuclear mission, it would offer the US options in additiona to the nuclear triad. In an era when the US is investing heavily in the revitalization of its nuclear force, this warrants consideration.

Concerning Article IV, a Rapid Global Effects Capability is within the international norm for the delivery of nuclear weapons or weapons of mass destruction. This is due to the fact that the capability would transit space (low Earth orbit) in order to deliver the munitions. It would not place a nuclear weapon or weapon of mass destruction into orbit. Further, Article IV "allows fractional orbital bombardment systems (FOBS), a 1960s Soviet ICBM program that after launch would go into a low Earth orbit and would then deorbit for an attack."[72] Thus, a Rapid Global Effects Capability meets the obligations of the Outer Space Treaty.

Article VI states:

> States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by nongovernmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.[73]

This article impacts both external and internal policy of the US.

The US government is responsible for the actions of industry leaders such as SpaceX and Blue Origin in their pursuit of space exploration and development. For instance, if a private industry rocket launch damages a nation's satellite after being launched the US is responsible. If private companies begin asteroid mining, the US government is responsible for their regulation and protection. If international treaties bound the US to bear responsibility for their industries' actions, it would be prudent to have the capability to do so. A Rapid Global Effects Capability and the technology related to it would help the US meet their treaty obligations. The capability to rapidly launch into space ensures that the US can protect and regulate interests in space.

Article VII further outlines international responsibility when it states:

> Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the Moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the Moon and other celestial bodies.[74]

Clearly, the US government has a responsibility to be involved in the governing of developing space-related technology as well as the regulation of space exploration in the industrial sector.

Article X states:

> In order to promote international co-operation in the exploration and use of outer space, including the Moon and other celestial bodies, in conformity with the purposes of this Treaty, the States Parties to the Treaty shall consider on a basis of equality any requests by other States Parties to the Treaty to be afforded an opportunity to observe the flight of space objects launched by those States. The nature of such an opportunity for observation and the conditions under which it could be afforded shall be determined by agreement between the States concerned."[75]

Due to the fact that the Outer Space Treaty determines that states are responsible for their industries' actions in space, this presents an interesting dilemma. Could adversaries to the US require private US companies to provide sensitive information to meet treaty obligations? What constitutes observing the flight of space objects? Could adversaries invoke Article X and request to observe the private industry launches of SpaceX or Blue Origin? By being able to observe space objects launched from the US, adversaries are better able to target those objects. As space exploration and development continues, defense related systems will require maneuverability and speed in order to defeat adversaries' observations in accordance with Article X.

Article XI states:

> In order to promote international co-operation in the peaceful exploration and use of outer space, States Parties to the Treaty conducting activities in outer space, including the Moon and other celestial bodies, agree to inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities.[76]

This article has profound implications for external policy considerations. If a private company discovers valuable minerals on a celestial body, the US is bound by the Outer Space Treaty to make that information public, reporting it to both the UN and the scientific community. This, in turn, will produce a "rush" in the international community to mine these minerals similar to gold rushes tha occurred throughout our history. Again, the US is bound by international treaty to regulate private industries based out of the US. It would be prudent to have the space launch capability to enforce international treaties and laws in space.

A Rapid Global Effects Capability would have vast implications for access to space. Not only would it provide the capability to influence traditional military operations on Earth, but also it would provide the US with rapid access to space as well. As technologies emerge that influence space operations, having the capability to rapidly deploy assets such as Cubesats would be highly beneficial. This allows for the reconstitution of compromised traditional

satellites. Also, a Rapid Global Effects Capability would allow for the deployment of personnel or equipment into space for mining operations. The deployment of personnel would help enforce international treaties and laws in space.

The Outer Space Treaty allows for the development of a Rapid Global Effects Capability. The Outer Space Treaty even allows for weapons transport and delivery as long as those weapons are not nuclear or considered weapons of mass destruction. The broader external policy implications come with the development of emerging technologies that will push the US and the international community into space. The US will be responsible for the industrial base within the US and their actions. As a result, the US will need the capability to rapidly respond to challenges within and through space. The Strategic Arms Limitation Talks (SALT) and Strategic Arms Reduction Treaty (START) will also influence future US policy.

The Strategic Arms Limitation Talks "banned FOBS or any significant advancement in ICBM key performance parameters, but was not ratified by the US due to other Soviet treaty violations."[77] However, SALT-II was traditionally honored by both the US and Soviet Union. SALT-II has been replaced with the "Strategic Arms Reduction Treaty (START), Comprehensive Nuclear-Test-Ban Treaty, and New START which has been ratified and is applicable through 2021."[78] Currently, these treaties prevent both the US and Russia from pursing the development of FOBS. These treaties do not "address conventional weapons in space, orbital or suborbital; however, the range and capability of carrier systems such as cruise missiles that could carry nuclear arms are limited . . .but not the manned aircraft that carry them."[79]

The development of a Rapid Global Effects Capability is allowable according to the New START Treaty and is in line with the historical framework of previous treaties such as SALT-II. According to the framework of the New START Treaty, it is beneficial for a Rapid Global Effects Capability to be a manned platform if the US is interested in having the option to have a nuclear capability. If the US chooses to focus on conventional capabilities, this provides an opportunity for enhanced human-machine operations or remotely-piloted options. Due to these current treaties, it is also important to understand at what altitude space begins.

A nation's sovereign territory includes the airspace above it. However, it does not include the "space" above it. The Karman Line is at an altitude of 100 kilometers above the Earth's surface. It "represents the boundary between the Earth's atmosphere and outer space according to the Federation Aeronautique Internationale, an international standard setting and record-keeping body for aeronautics and astronautics."[80] At this altitude, an aircraft or space vehicle has to "fly faster than orbital velocity to have enough lift to overcome drag."[81] However, it is important to note that this is not international law, nor is it included in any international treaties.

The US has "consistently maintained that discussions of delimitation between air and outer space are premature and advocates the removal of delimitation from the agenda of the Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space."[82] The current international standard is that airspace below 100 kilometers is a nation's sovereign territory and above 100 kilometers is international space.[83] This allows nations to place satellites, launch rockets, or allow entery of space vehicles in any orbit. A Rapid Global Effects Capability that utilized low Earth orbit meets the current international standards and would not violate other nation's sovereign territory or airspace.

Policy Implications Concerning Near-Peer Adversaries—China and Russia

Recently, the Vice Chairman of the JCS said that Russia was the number one existential threat to the US.[84] Many other strategists believe China to be the number one long-term threat to the United States.[85] Each country provides specific, yet sometimes similar, threats to the US.

China is expanding its sphere of influence regionally. China is currently interested in expanding into the South China Sea. They are focused on expansion due to a ballooning population that needs the support of natural resources. Also, China is interested in the military advantages that the South China Sea possesses.[86]

The South China Sea has important strategic implications. Robert Kaplan notes that "the South China Sea functions as the throat of the Western Pacific and Indian oceans—the mass of connective economic tissue where global sea routes coalesce."[87] It also has substantial oil reserves that serve China's economic development interests. Militarily, the South China Sea forms a geographic barrier to the potential invasion of China.

China is creating an A2AD environment in the South China Sea. Kaplan notes that "domination of the South China Sea would certainly clear the way for pivotal Chinese air and naval influence throughout the navigable rimland of Eurasia—the Indian and Pacific oceans both."[88] Russia is also presenting strategic problems for the US and putting stress on the national security objectives.

Russia is a prideful nation that is attempting to regain its international prestige. After the downfall of the Soviet Union, many former Soviet bloc states separated from the nation and declared their independence. The Soviet Union's economy collapsed and with it so did its military capability. Today, Russia is pursuing international actions to reassert itself in the world.[89]

Russia has shown recent military aggression in both Georgia and the Ukraine. In each instance, the international community condemned the actions but did little militarily to respond. Economic sanctions of Russian banks and key leaders were the major responses that the international community imposed for each aggression. They also believed options were limited and did not pursue military options as they feared conflict escalation.

Russia has also projected global power into the Middle East—in the Syrian conflict and the fight against the Islamic State in Iraq and Syria.[90] Fareed Zakaria notes that "global power is, above all, dominance over ideas, agendas, and models."[91] Russia is attempting to dominate the agenda in the Middle East and assert its influence. Again, the US believes that it has few options available to counter this power projection threat.

Emerging technology will allow the US armed forces to achieve their future, core missions with operational agility. In doing so, the armed forces will offer the US leadership a more expansive list of options to choose from. Ultimately, the objective of the investment in emerging technology is peace through deterrence while achieving the national security objectives of the US. A Rapid Global Effects Capability will aid in this effort.

A Rapid Global Effects Capability will mitigate China's A2AD environment. It will offer an asymmetric advantage that the Chinese will have to consider in their strategic investments for the future. The Chinese attempt to create a defensive barrier with land-based missiles in the South China Sea is a moot point considering CONUS-based assets.

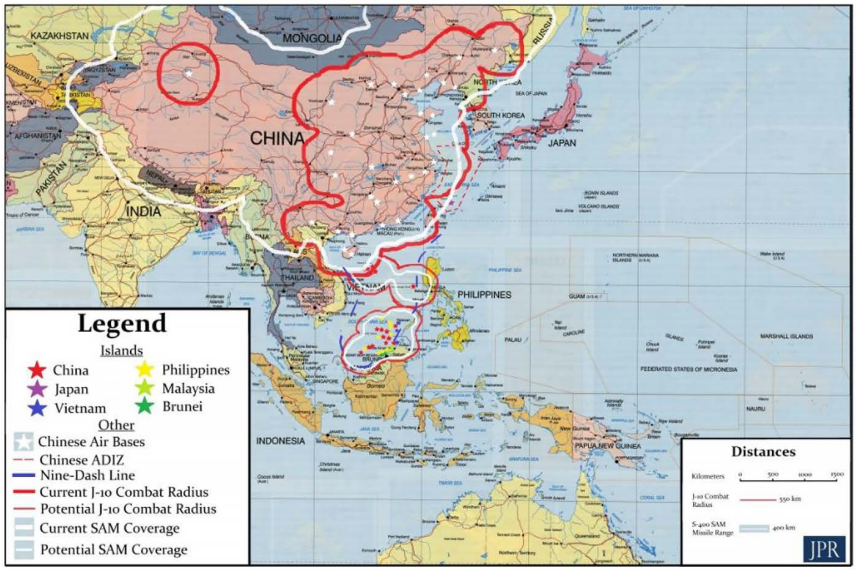

Figure 5. Coverage Expansion from S-400 SAM and J-10 Deployment to South China Sea Airfields[92]

For instance, a Rapid Global Effects Capability system launched from CONUS delivers a swarm of autonomous CLEAVER drones and aids in negating specific areas of negates China's A2AD environment. The CLEAVER swarm will use operational agility and maneuver to overwhelm China's defenses.[93] There is a counterargument that CLEAVER assets could be delivered by current conventional assets, such as a C-17 or B-52. Based on wargames that have been conducted, however, this severely limits the range and available targets.[94]

These technologies will have the ability to achieve any of the AF core missions.[95] As a result, it will also achieve the US national security objectives in promoting and ensuring global access to sea lines of communications and natural resources in the South China Sea. These technologies will deter aggression from Russia as well.

As noted previously, there were few options to stop Russian aggression in Ukraine and Georgia. Many feared escalating the situation, so the response from the US militarily was not to act. The launch of a Rapid Global Effects Capability to deliver an autonomous swarm of CHAMP cruise missiles could have a stabilizing effect.[96] They could use directed-energy to eliminate any electronic capability that advancing Russian forces were using. The combination of these emerging technologies could make a Russian Surface-to-Air threat noted below virtually nonexistent.

Table 1. Russian SAM Capabilities[97]

Missile Name	Range (nm)	Max Alt (ft)	Speed (Mach)	ABM (nm)	IOC	Notes
SA-2 Guideline	23.2	90,000	3.5	N/A	1959	
SA-3 Goa	15.7	60,000	3.5	N/A	1961	
SA-5 Gammon	162	115,000	3.5+	N/A	1967	
SA-6 Gainful	16	43,000	1.8	N/A	1979	
SA-7 Grail	3.5	15,000	1.7	N/A	1966	MANPAD
SA-8 Gecko	8.6	37,000	2.4	N/A	1975	
SA-9 Gaskin	4.3	26,000	1.8	N/A	1968	
SA-10 Grumble	49	82,000	5+	19	1980	ACM
SA-11 Gadfly	17.3	62,000	3	N/A	1983	
SA-12A Gladiator	40.5	82,000	5.75	UNK	1987	
SA-12B Giant	54	98,400	8	21.6	1992	AHV, ABM
SA-13 Gopher	2.7	20,000	2	N/A	1978	
SA-14 Gremlin	3.2	18,000	1.75	N/A	1978	MANPAD
SA-15 Gauntlet	6.5	20,000	3	UNK	1990	ACM, APGM
SA-16 Gimlet	3.1	12,000	1.7	UNK	1986	MANPAD
SA-17 Grizzly	28	82,000	3.5	12.5	1998	
SA-18 Grouse	3.2	11,000	UNK	UNK	1983	MANPAD
SA-19 Grison	7.5	20,000	3.3	N/A	1998	
SA-20A Gargoyle	80	89,000	8.2	22	1993	ACM
SA-20B	124	89,000	8.8	22	1997	ABM
SA-21 Growler	216	115,000	UNK	UNK	2007	AHV, ABM

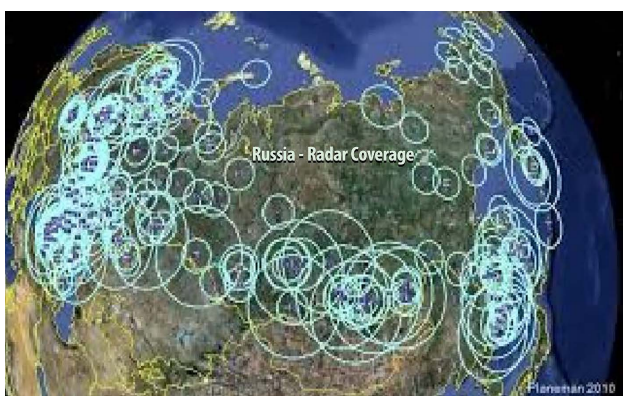

Figure 6. Russian Surface-to-Air Missile Coverage[98]

This could deescalate a Russian advance and create a situation for the Russians to respond to with either escalation or retreating. Escalation may be a cost too high for the Russians. Perhaps nonlethal effects delivered outside Russia against Russian-supported forces would prevent an escalated response. Research has, however, exposed some policy questions concerning both China and Russia.

Many interviewees questioned basing a Rapid Global Effects Capability solely in the CONUS. It was widely agreed that this basing dynamic would drastically reduce overseas basing and logistics costs, as well as the personnel strain of members of the armed forces living overseas. However, a CONUS-based system leaves the only available target for adversaries within CONUS.99 Interviewees consider this to be a destabilizing aspect of the system. They recommend considering the placement of a Rapid Global Effects Capability within allied countries such as Great Britain and Australia. Other sites recommended for basing included the Ascension Islands in the Atlantic Ocean, Guam AB in the Pacific Ocean, and Diego Garcia AB in the Indian Ocean, reducing the risk of an adversary striking CONUS. This also provides for operational agility through global presence. However, this would create additional logistics considerations that a CONUS-based system would not encounter. Signaling is also a concern that some mention in association with a Rapid Global Effects Concept.[100]

In the wargame that the AF conducted in June 2015, tactical experts cited signaling as one of their main concerns for the operational use of a Rapid Global Effects Capability. Quite simply, would allies and adversaries detect the launch of this concept and misinterpret it as a nuclear ICBM launch? This is a valid question and concern for a number of reasons.

Near-peer adversaries such as China and Russia would be able to distinguish between the launch of a Rapid Global Effects Capability and an ICBM.101 Types of fuel used for propulsion, horizontal vs. vertical takeoff options, launch locations, and most importantly trajectory are factors that would distinguish between the two capabilities. A Rapid Global Effects Capability is being designed to launch into low Earth orbit, while an ICBM goes into a much higher, elliptical "flight path" in order to re-enter the atmosphere and strike its target.[102] Near-peer allies would also be able to distinguish between these launch factors as well as have the added benefit of potential intelligence sharing.

Adversaries that do not have the capabilities of China and Russia pose a separate challenge. Countries such as Iran and North Korea may not have the capability to distinguish between a Rapid Global Effects Capability and an ICBM launch. However, they do have considerable conventional military

capabilities that they could utilize if they felt that they were a target of an ICBM.[103] The USAF can address signaling concerns with horizontal takeoff capability, basing location decisions, doctrine that prevents the use of a Rapid Global Effects Concept with nuclear capabilities, and deception operations. Alternatively, the US could opt to publically use a Rapid Global Effects Capability and the current ICBM fleet to diversify its nuclear capability and present adversaries with more expansive dilemmas on how to counter US nuclear doctrine and operations. Interviewees and wargame participants also brought up the issue of creating a potential arms race.

The concern of an arms race is a valid concern and one that military strategists and US policy makers must consider. The US, in general, has not been concerned with arms races due to a dominant economic presence and historical success during the Cold War. However, these aspects are not guarantees for success in the future.

A Rapid Global Effects Capability would have considerable impact on the future, core missions of the USAF.[104] A discussion about the trade-off between investments in this future concept, legacy systems currently in use, and how each would complement each other moving forward is appropriate. While outside the scope of this study, the economic factors include impact on personnel, basing, and investment in other emerging technology are all critical to the overall discussion. However, preliminary research supports the conclusion that a Rapid Global Effects Capability, while enabling the future, core missions, would give the USAF flexibility in personnel decisions, basing options, and complement legacy systems in their current operations. These aspects present a dilemma for both China and Russia.

In terms of an arms race, China and Russia would face difficult investment decisions moving forward.[105] Each have made considerable investments in creating A2AD environments, particularly China. A capability that can manipulate distance and time like a Rapid Global Effects Capability would severely disrupt those efforts. Adversary decisions would have to be made regarding how to invest in order to counter that capability. The most likely option is to develop some kind of defensive capability to limit its effectiveness. Thus, a Rapid Global Effects Capability has the potential to become part of a greater cost-imposition strategy for the US. Ultimately, the US's goal is to maintain peace by creating a situation in which it holds the military advantage and is better able to influence adversaries with other instruments of power.

Analysis

The research has demonstrated that a Rapid Global Effects Capability will have a significant impact on domestic and foreign policy as well the ability of the USAF to accomplish its core missions in the AF FOC. Domestically, it will highlight a new era in AF technological investment and acquisition strategy while inspiring the youth of tomorrow. Foreign policy will shift with the impact on current treaties, a wide range of deterrent effects, and impact on combatant commander operational plans. For the AF core missions, new dimensions in the vertical nature of warfare will change dramatically while igniting a new interest both in space and in service to the nation.[106] This research has also identified key areas in which a Rapid Global Effects Capability may impact future operations in Europe. This impact is possible through a new paradigm by commercial investment in technology while partnering with government and academic institutions.

Technological investment in capabilities like a Rapid Global Effects Capability could provide the president with more options to achieve operational agility. Operational agility allows for the armed forces to achieve their future, core missions. An example of this is the AF's 2035 core missions of ADC, GIISR, RGM, Global Precision Strike, and MDC2. In achieving their core missions, the US armed forces ensure that the nation's national security objectives are achievable.

Recommendations

1. Pursue a Rapid Global Effects Capability through a dedicated acquisition model outside of traditional government acquisitions modeling and timelines. Invest with the appropriate amount of risk in order to fail early and smartly, driving advancement in the technological fields that the USAF needs.

2. Enable and partner with commercial industry leaders to field a fully operational Rapid Global Effects Capability on a 10 year developmental timeline.[107]

3. Dedicate an Air Force major or lieutenant general as the program manager who reports directly to the Secretary or Deputy Secretary of Defense. This level of commitment has historical precedence as is evidenced by the placement of Gen Bernard Schriever in Southern California to develop the USAF's future ICBM program. Today, his success is seen in one pillar of the US's nuclear triad.

4. Establish a dedicated field office in Seattle, Washington, San Francisco, California, or Los Angeles, California. This office should be for the sole

purpose of Rapid Global Effects Capability development and should not be co-located with other acquisition programs. The location will allow for daily interaction with the industries associated with development, while creating a necessary buffer between the development team and traditional military development protocols. This will allow the pursuit of the effort to fail early and smartly, creating agility in the process so that the program manager can redirect efforts easily.

5. Assign leaders from various backgrounds (military, civilian, and academia), services, and year groups to the field office. The program manager (major or lieutenant general) should sign performance reports as the additional rater on performance reports with the Secretary or Under Secretary of Defense. This provides for program legitimacy throughout the USAF and ensures that the best in each career field and year group are placed on the field office team. Make this a joint creditable assignment.

All recommendations are the opinion of the author and not Air University, USAF, or DOD opinion. Conclusions and recommendations are based on research and previous experience. The author realizes that many of the recommendations, if implemented, would be nontraditional in their application.

Notes

(Notes appear in shortened form except where indicated. For full details, see the appropriate entry in the bibliography.)

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95. LeMay Center Wargaming Directorate personnel, wording.

96. Hall, interview.

97. "Anti Aircraft Systems 2012," Military Periscope.

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102. Scott Carsetter (Washington DC, Center for Strategic and Budgetary Analyis Space Workshop), comments made 9 and 10 November 2015.

103. Heritage Foundation, multiple interviews.

104. LeMay Center, *A Rapid Global Effects*.

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106. Woodrow Meeks inspired ideas for this paragraph from a meeting on Rapid Global Effects Capability Concept," (meeting, Air University, Maxwell AFB, AL, 21 October 2015).

107. Timeline based on estimates from AFRL and SpaceWorks.

Abbreviations

AB	Air Base
ADC	Adaptive Domain Control
AF	Air Force
AFRL	Air Force Research Laboratory
AI	Artificial intelligence
BMD	Ballistic Missile Defense
C2	Command and Control
CHAMP	Counter-electronics High Power Microwave Advanced Missile Project
COMREL	Command relationships
DARPA	Defense Advanced Research Projects Agency
DOD	Department of Defense
FOBS	Fractional orbital bombardment systems
FOC	Future Operating Concept
GIISR	Global Integrated Intelligence, Surveillance, and Reconnaissance
ICBM	Intecontinental Ballistic Missiles
ISR	Intelligence, Surveillance, and Reconnaissance
JCS	Joint Chiefs of Staff
NSS	National Security Strategy
PED	Processing, exploitation and dissemination
RAF	Royal Air Force
RGM	Rapid Global Mobility
ROTC	Reserve Officer Training Corps
RPA	Remotely-piloted aircraft
SAM	Surface-to-air-Missiles

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