### 1AC---Plan

#### PLAN: The United States federal government should cooperatively prohibit the foreign transfer of space weapon systems with supersonic combustion ramjet or hypersonic atmospheric re-entry with Russian Federation and People’s Republic of China.

### 1AC---Proliferation

#### CONTENTION 1: Proliferation

#### Scenario 1---Crisis Stability

#### Hypersonic weapons proliferation is inevitable---causes crisis instability due to speed and maneuverability and destabilizing countermeasures like launch on warning---also zaps power projection including carriers through asymmetric leverage

Richard H. Speier 17, Adjunct Staff with the RAND Corp. He received a Bachelor of Arts degree in Physics from Harvard College and a Ph.D. in Political Science from the Massachusetts Institute of Technology, Hypersonic Missile Nonproliferation: Hindering the Spread of a New Class of Weapons, https://www.rand.org/pubs/research\_reports/RR2137.html

To understand the implications of hypersonic missile proliferation, it is necessary to understand the advances these missiles offer compared with current military capabilities. Hypersonic vehicles have been in existence since the dawn of the space age. Manned hypersonic air vehicles were flown over 50 years ago, when the National Aeronautics and Space Administration (NASA) first flew the X-15 hypersonic test vehicle in 1959. (Appendix A contains more details about hypersonic flight vehicles.) The focus of this study, however, is on two new types of hypersonic vehicles and their constituent enabling technologies: HGVs and HCMs.

The principal concerns about HGVs and HCMs are the current development efforts by the major powers (Russia, China, and the United States) and the potential interest by other countries to acquire these systems because of their unique military utility, i.e., their reach and ability to penetrate most air defense systems, derived from the missile’s maneuverability, speed, and altitude.1 It is the combination of these characteristics that makes these systems challenging to develop and to defend against. In contrast, subsonic cruise missiles offer good maneuverability but relatively low speeds, and ballistic missiles offer hypersonic speed but little or no maneuverability We believe that the unpredictable trajectories, resulting in target ambiguity, and the ability to penetrate most defenses, will affect some nations’ defense postures and increase instability in some regions. We note that these new missiles will almost exclusively affect nations that are otherwise equipped with effective defenses against ballistic missiles. This may be a substantial number of nations over the coming decades. The next sections describe the major advantages and attributes of HGVs and HCMs and their strategic implications.

Principal Characteristics of HGVs

HGVs are unpowered vehicles that “glide” to their target at the “top” of the atmosphere, reaching between about 40 km to 100 km in altitude. Even in this rarified atmosphere, they are designed to produce lift that is equal to their weight to keep them aloft at hypersonic speeds. A typical operational concept of an HGV involves launching it on a ballistic missile and releasing it at the appropriate altitude, velocity, and flight path angle to enable it to glide to its target. The initial release conditions are driven by the intended trajectory (downrange and crossrange) and the characteristics of the vehicle, e.g., lift and drag. We note that HGV trajectories are very different from maneuvering reentry vehicles (MaRVs) developed in the past. As Figure 2.1 shows, the MaRV trajectory is mostly in ballistic mode above 100 km with some maneuvers executed post-reentry. In contrast, the HGV spends a negligible portion (if any) of its flight in ballistic mode. The capabilities of hypersonic missiles give them both offensive and defensive advantages. From an offensive perspective, maneuverability can potentially provide HGVs the ability to use in-flight updates to attack a different target than originally planned (within the reach of the weapon system) as shown in Figure 1.32 With the ability to fly at unpredictable trajectories, these missiles will hold extremely large areas at risk throughout much of their flights. 3 There are also major defensive differences between MaRVs and HGVs. The post-reentry high–gforce maneuvers for both missiles would challenge terminal defenses, but because the majority of the MaRV trajectory is ballistic, midcourse ballistic missile defense systems that operate in the exo-atmospheric region remain effective against MaRVs but not against HGVs. In other words, a MaRV has all the attributes and vulnerabilities of a ballistic RV with the exception of the post-reentry phase.

Although HGVs are not usually powered, a small propulsion system providing additional velocity or some attitude or directional control could also be integrated into the vehicle. However, the value of such an engine would need to be traded against the costs associated with additional weight and added complexity.

HGVs as Weapons

Defense Penetration

The trajectory and capabilities of HGVs provide them with some unprecedented attributes that may be disruptive to current military doctrines of advanced nations. HGVs have the reach and speed of ballistic missiles, but, unlike these missiles, they fly at lower altitudes and have relatively unpredictable trajectories that can include significant cross-range and terminal maneuvers. These characteristics make HGVs challenging to defend against because they tend to fly outside the altitude and speed envelopes of most modern air and missile defense systems. They can defeat current ballistic missile defense systems because of their unpredictable long-range trajectories, maneuverability, and flight altitudes. Terminal air defense systems would also be challenged by HGVs because of their high speeds and potential endgame maneuverability. Nations that do not possess advanced defense systems capable of defending against ballistic missiles would likely not experience as great a change in threat from these new weapons because they are already vulnerable to ballistic missiles. The possible exception is warning time. Hypersonic weapons do substantially increase the threat for nations with otherwise effective missile defenses. Hypersonic weapons will not be fielded in quantity for perhaps another decade, and the proliferation to lesser nations would come later—after ballistic missile defenses had been improved and more widely deployed.

Compressed Timelines

Nations that do not possess (or have access to) space-based sensor systems to detect ballistic missile launches and that rely on ground-based sensors, such as radars, to detect incoming mid- to long-range ballistic missiles, could experience a further compression of their decision/ response timelines. The reasoning is that typical ballistic missiles tend to fly at higher altitudes than HGVs and should therefore be detectable earlier. Figure 2.2 illustrates this effect. Due to the Earth’s curvature and the HGV’s low-gliding altitude as compared with that of a similar range ballistic missile, radar or other line-of-site sensors will likely not detect an HGV as early as they would a ballistic missile. For example, a radar operating from the surface of a smooth Earth would detect a 3,000-km-range RV about 12 minutes before impact, but would not detect an HGV until about six minutes before impact. We note that potential defensive systems that intend to intercept incoming ballistic missiles before they deploy their payload, e.g., in the boost phase, would retain their effectiveness against HGV weapons.

Principal Characteristics of HCMs

As the name implies, an HCM is a cruise missile that operates at hypersonic speeds. As such, it compresses the defense response timeline and challenges many of the current defense systems because of its high speed and maneuverability. Hypersonic weapons could be launched from the ground, from aircraft, or from ships. An HCM would likely accelerate to around Mach 4 or 5 before an air-breathing engine capable of producing thrust at hypersonic speeds, e.g., a supersonic combustion ramjet (scramjet), further accelerates and then maintains the missile’s speed.

There are different options for propelling an HCM to Mach 4 or 5, where the scramjet would take over. Rocket boosters are the most likely option especially for early generation HCMs, because they offer simplicity and affordability, although they may be the largest and heaviest option because they need to carry both their propellant and oxidizer.4 Of course, any acceleration option must be affordable, because it is a one-time-use propulsion system. In order to achieve appropriate pressures for combustion in the scramjet engine, an HCM will likely cruise at an altitude of 20 to 30 km.

HCMs as Weapons

The principal advantages of an HCM would be its speed and maneuverability. Combined, these would provide a very responsive and flexible offensive weapon that could, for example, hold targets within a 1,000-km radius of the launch aircraft at risk and could strike these targets within several minutes. Cruise missiles are difficult to defend against because of their unpredictable trajectories. The additional speed provided by an HCM, relative to other cruise missiles, would further complicate defense system timelines, as well as potentially be more effective against kinetic defenses, e.g., missile interceptors. Compounding the defensive challenges even further, HCMs would fly at altitudes higher than most current surface-to-air missile systems are capable of reaching. Defenses could be designed to fly higher, but the interceptors still would need to confront the HCM’s speed and maneu verability. Furthermore, as described next, an HGV’s high kinetic energy affords significant destructive power, even without, or in addition to, the destructive power of an explosive warhead.

Destructive Power from High Speed

Hypersonic weapons can deliver nuclear or conventional warheads. However, another attribute common to both HCMs and HGVs is the potential to use solely kinetic energy to destroy or damage an unhardened target. This is made possible by the combination of their high speed, or kinetic energy, and their accuracy. Their high impact speed can also be leveraged to help defeat underground facilities.5 Figure 2.3 provides a rough estimate of the effective explosive TNT equivalence of a high-speed mass, such as a conventional strike vehicle with no onboard explosives. The effective TNT equivalence calculation assumed that the explosive force is directional and focused within the approximate cross-sectional area of the impacting vehicle.

Summary of Challenges for Defensive Systems

As mentioned previously, speed complements hypersonic missiles’ maneuverability to significantly increase effectiveness. Defenders with capable terrestrial and space sensors will have only a few minutes to know these missiles are inbound, and lesser adversaries will likely not have any significant warning. Given short timelines and high speed, only very responsive and capable defensive measures would have any chance of defeating the incoming missiles. This likely means that new, space- or terrestrial-based area defense systems, such as boost intercept6 or highly capable midcourse intercept systems,7 would be required. These types of systems do not currently exist and would require significant investments to develop and deploy. Advanced terminal (or point) defenses could provide some effectiveness against these high-speed maneuverable missiles. However, such point defenses would likely only be deployed to protect high-value facilities or weapon systems; protecting all potential targets including civilian facilities could be costprohibitive. Furthermore, even if a target is equipped with advanced point defenses such that it is able to defend against an HCM or HGV, it may still be vulnerable to salvos of such weapons, especially if these simultaneous attacks use maneuverable vehicles capable of controlling the timing and direction of the attacks.

Defenders may work to develop directed energy defenses, such as lasers, but if such systems were terrestrial-based, they would be challenged by clouds or other atmospheric disturbances and by the need to hit and destroy fast-maneuvering missiles that are equipped with capable thermal protection systems. While a laser beam travels at the speed of light, rendering a near instantaneous time of flight, the beam must dwell continuously and for a significant length of time on a spot on the target to destroy it. The hypersonic weapon’s thermal protection system may inherently harden the missile against laser weapons, such that the required laser spot dwell time may be relatively long to burn through or sufficiently degrade the thermal protection system (potentially several tens of seconds or longer).8 Altitude will also contribute to these missiles’ effectiveness, at least in the near term. HCMs will likely be capable of flying at altitudes between 20 km and 30 km, and HGVs will fly at altitudes between about 40 km and 100 km. While the HCM’s flight altitudes may be within the upper end of the operating envelope of today’s most capable surface-to-air missiles, the combination of altitude, maneuverability, and speed would greatly limit the effectiveness of these defenses. HGVs will fly above the maximum effective altitudes of most surface-to-air missiles, but very likely below the altitudes where exo-atmospheric defenses are designed to intercept inbound RVs.

Long-Term Planning Perspectives for HGV and HCM

Technologies

Both HGVs and HCMs offer advanced warfighting capabilities. However, the HCM is also an important stepping-stone to larger manned and unmanned hypersonic vehicles with the potential for military and civilian uses. Prospective applications include military strike and intelligence, surveillance, and reconnaissance aircraft. Furthermore, these vehicles will offer the opportunity to test new flight designs under actual flight conditions. For example, once an HCM is fielded, states will be less reliant on ground test facilities and computer models. Instead, test vehicles will be able to investigate different materials, flight control mechanisms, and flight envelopes under actual flight conditions. Further, availability of flight test data to calibrate ground test facilities and computational models will increase greatly.

Strategic Implications of Hypersonic Weapons

Compressed Timelines

The U.S. military uses an acronym to describe the decisionmaking and action process cycle: OODA (Observe, Orient, Decide, Act). These four steps take time, and hypersonic missiles compress available response time to the point that a lesser nation’s strategic forces might be disarmed before acting. As an illustration of the time required to act with respect to an existential missile threat, the Nuclear Threat Initiative organization estimated a timeline for a U.S. response to a massive Russian intercontinental ballistic missile (ICBM) attack, as follows:9 • 0 minutes—Russia launches missiles • 1 minute—U.S. satellite detects missiles • 2 minutes—U.S. radar detects missiles • 3 minutes—North American Aerospace Defense Command (NORAD) assesses information (2 minutes max) • 4 minutes—NORAD alerts White House • 5 minutes—first detonations of submarine-launched ballistic missiles • 7 minutes—locate president and advisers, assemble them, brief them, get decision (8 minutes max) • 13 minutes—decision • 15 minutes—transmit orders to start launch sequence • 20 minutes—launch officers receive, decode, and authenticate orders • 23 minutes—complete launch sequence (2 minutes max) • 25 minutes—Russian ICBM detonations.

This timeline is not, of course, representative of two hostile parties in closer proximity or with less effective warning systems than Russia and the United States. Nor is it representative of less-than-Armageddon possibilities. However, for adjacent enemies within a 1,000-km range, a hypersonic missile traveling at ten times the speed of sound could cover that distance and reduce response times to about six minutes. 10

Targets

As discussed earlier, hypersonic missiles increase the threat over current generations of missiles in cases where the target nation has missile defenses. The targets in such nations would primarily be high value and heavily defended. Prime targets could include destroying a nation’s leadership and command and control, referred to as “decapitation,” to prevent the target nation from responding with an effective follow-on attack. Other key targets could be carrier strike groups, with the objective of striking a key blow or pushing the naval formation further from the coast. And, because of their time sensitivity, strategic forces and storage facilities for weapons of mass destruction (WMDs) could warrant hypersonic attack.

Implications for Targeted Nations

Any government faced with the possibility that hypersonic missiles would be employed against it—particularly in a decapitating attack— would plan countermeasures, many of which could be destabilizing. For example, countermeasures could include devolution of strategic forces’ command and control so that lower levels of authority could execute a strategic strike, which would obviously increase the risk of accidental strategic war; or strategic forces could be more widely dispersed— a tactic risking greater exposure to subnational capture. An obvious measure would be a launch-on-warning posture—a hair-trigger tactic that would increase crisis instability. Or the target nation could adopt a policy of preemption during a crisis—guaranteeing highly destructive military action.

To be sure, such measures could be invoked against threats from current types of missiles.11 But, for nations with effective ballistic mis sile and/or cruise missile defenses in the time frame when hypersonic missiles might proliferate, the hard choices would be forced when facing hypersonic threats.

Advanced nations with adequate resources could take other steps against hypersonic threats. They could strengthen the resilience of their command and control, harden the siting of their strategic forces, and make a deterrent force mobile or sea-based. These tactics may or may not be effective, especially for lesser nations. And they certainly will be expensive—putting them out of reach of some. Even for major powers, the proliferation of hypersonic missiles will create new threats by allowing lesser powers to hold them at risk of effective missile attacks especially against “unhardened” targets, e.g., cities. Over the coming decades, the ability of a lesser nation with a handful of ICBMs to threaten major powers will continue to decrease as wide area missile defenses continue to improve. However, HGVs and HCMs will be more difficult to defend against.

Implications for Major Powers

The ability of hypersonic missiles to penetrate advanced missile defenses will increase the risks for nations with such defenses. Lesser powers with hypersonic weapons may see these weapons as a deterrent against greater power intervention, and feel free to pursue potentially destabilizing regional agendas. Moreover, lesser nations with hypersonic missiles could affect the force deployments of major powers. As noted above, carrier strike groups might be pushed further out to sea or an intervening power’s regional military bases might become exposed to more effective attacks.

#### Launch on warning causes accidental nuclear war---hypersonic weapons guarantee escalation

Dean Wilkening 19 is a physicist at the Johns Hopkins University Applied Physics Laboratory, Hypersonic Weapons and Strategic Stability, Survival, 61:5, 129-148

Finally, Russian and Chinese conventionally armed hypersonic weapons cannot threaten the US strategic nuclear arsenal to any significant degree, so a US capability to hold mobile ICBMs at risk would be a one-sided advantage. Consequently, it would not lead to a reciprocal fear of surprise attack. However, it almost certainly would induce Russia and China to modernise their ICBM forces, which could lead to arms-race instability. More problematically, Russia or China could adopt a launch-on-warning posture to mitigate the vulnerability of their mobile ICBMs. As noted, launching a nuclear retaliatory strike based only on tactical warning would be the height of folly. What makes launch-on-warning particularly troubling in the hypersonic age is that, whereas the impact area of a ballistic missile can be determined with reasonable accuracy within a few minutes after launch, hypersonic boost-glide vehicles’ and cruise missiles’ substantial manoeuvrability enables them to divert to targets hundreds of kilometres to either side of their initial trajectory. Therefore, Russia and China would not know the intended targets of a US hypersonic attack until the last few minutes before impact, potentially inducing fears that their strategic nuclear forces might be under attack when they were not. The compressed timeline associated with hypersonic attacks – whether ballistic, boost-glide or cruise – also contributes to crisis instability because there will be precious little time for careful decision-making in the midst of an attack. Hypersonic weapons, however, are only one aspect of a trend towards increasing speed in modern conventional war brought about by technical advances in new anti-satellite weapons, cyber attacks and possibly artificial intelligence. This, combined with the lack of accurate attack assessment for non-ballistic hypersonic weapons, means that misperception, misunderstanding and miscommunication in the midst of war are more likely, contributing to inadvertent escalation.

#### Carrier vulnerability undermine naval leadership

Henry Holst 14, a M.A. candidate in Strategic Studies and International Economics at Johns Hopkins School of Advanced International Studies, “The U.S. Military's Ultimate Fear: Are Aircraft Carriers Too Big To Fail?” 8-12-14, <http://nationalinterest.org/blog/the-buzz/the-us-militarys-ultimate-fear-are-aircraft-carriers-too-big-11066?page=3>, DOA: 1-12-15, y2k

The threat of a full carrier-strike group anchoring offshore has always been a cornerstone of U.S. deterrence. The sinking of a U.S. aircraft carrier--possibly by A2/AD style weapons--would likely be the defining moment where the era of perceived U.S. global military dominance would come to an end. Such an event--greatly magnified by a 24-hour global news cycle and the rise of social media—would alter the entire globe’s political and strategic balance. Any regime seeking to carve out local spheres of interest would scramble to seek the means to fend off the U.S. Navy. After all, the U.S. Navy is the single most important force providing security for the globalized economic system. Clearly American security assurances wouldn’t carry as much weight with a carrier sitting at the bottom of the sea.

#### Naval power solves naval arms races and wars---vulnerability causes nuclear strikes

Robert C. Rubel 14, Dean of Naval Warfare Studies at the Naval War College, “Navies and Economic Prosperity: The New Logic of Sea Power,” in Writing to Think: The Intellectual Journey of a Naval Career, https://www.kcl.ac.uk/sspp/departments/dsd/research/researchgroups/corbett/corbettpaper11.pdf

.¶ Let us start with naval arms races. We must admit that nations build navies for a range of reasons beyond protection of merchant shipping. These may include the desire to protect a vulnerable coast line, deter depredations by other powers and even generate prestige. There is, perhaps, one element of Mahan’s syllogism that continues to be true: at a certain level of economic activity and wealth, nations start building navies. A capable, ocean-going navy is a sign that a nation has “arrived” as a major power. Whether such navy building is a herald of future war or is a politically neutral phenomenon is not clear, although the historical record is cause for concern. Today, China, Japan, India, Brazil and other nations are building navies. They each have their reasons, but the prospects that such building programmes will lead to suspicion, alarm, fear and ultimately war may depend very much on how the current leading navies and their parent nations proceed.¶ An important reason the world system has been able to stitch itself back together after the world wars is the military superiority of the United States. A liberal democratic trading nation, it has coupled this superiority with free trade policies to stimulate economic growth. Capital, goods and people can flow freely around the globe, generating systemic behaviour. A key element of American military superiority is command of the seas, a term denoting the inability of any other navy to impose a strategic defeat on the U.S. Navy on the high seas. It is this command, like that achieved by the Royal Navy in the nineteenth century, which helped create the necessary conditions for system formation. When it is lost, as it was in 1914 and 1941, the world fragments and falls into war.¶ The challenge becomes how to use command of the sea to manage or influence the emergence of other navies such that true naval arms races do not occur. The right way to do this is not completely clear but there appear to be several sure-fire losing strategies. The first is for the United States to start the arms race itself by reflexively viewing the emergence of the Chinese Navy or others as a threat. Policies and patterns of building and deployment based on alarm and fear will generate reciprocal responses in China and elsewhere. This is why CS21 does not mention China or any other nation by name, something often criticized by those with an alarmist bent. Among the ways the U.S. Navy can stimulate Chinese alarm is to openly consider interdiction of their seaborne commerce in exercises, war games or articles. Not only would this strengthen the hand of Chinese alarmists, but commerce interdiction would probably be infeasible on a number of counts anyway. Another good way to invoke this kind of reciprocal security dilemma is to link sea control and power projection. After the Cold War, the U.S. Navy focused so narrowly on power projection that it and some of its allied navies forgot how to talk about sea control.12 While progress has been made in this area, there is still a sense in the doctrine that U.S. forces will use land strikes to neutralize shore based antiaccess systems with sea control being an exercise in access generation that is prerequisite to projecting power ashore.13 One can imagine the effect such talk has on a nation like China that has suffered humiliation and exploitation from the sea at the hands of western nations. Already, the Chinese are reacting to the most recent U.S. concept of this ilk, Air-Sea Battle: “If the U.S. military develops Air-Sea Battle to deal with the [People’s Liberation Army], the PLA will be forced to develop anti-Air-Sea Battle.”14¶ A second way to increase the odds that navy building will lead to war is for the leading navies to allow vulnerabilities to emerge. The U.S. Navy did this in two ways during the 1930s and up to 1941. First, it was slow to recognize and accept that the bomb-carrying aircraft had replaced the major calibre gun as the dominant naval weapon. Although war games at the Naval War College and demonstrations by Billy Mitchell provided clear indicators, it took the December 1941 disasters of Pearl Harbor and the sinking of the HMS Repulse and Prince of Wales to force the new reality on the admirals. Today, the new reality is that the anti-ship missile is the arbiter of what floats and what does not. This is a condition that has existed since the early 1970s but has not been compellingly revealed due to the lack of an all-out naval battle, just as there was no all-out naval battle between 1922 and 1941 to reveal the bomb’s superiority. Vulnerability can also be generated by concentration. In 1941 the bulk of the U.S. fleet was concentrated at Pearl Harbor, leading Admiral Yamamoto to think that a single knock-out blow was possible. Although today the U.S. Navy is strategically dispersed around the world, its principal combat power is concentrated into eleven aircraft carriers. Taking several of these out would seriously compromise the strategic capabilities of the U.S. Navy, not to mention the potential adverse effects of derailing U.S. policy as happened via the loss of eighteen Special Forces soldiers in Somalia, or conversely stimulating escalation, possibly to the nuclear level. Moreover, a hit on a nuclear carrier that killed hundreds, if not thousands, of U.S. sailors in a single blow might easily generate national outrage and serve to escalate the conflict far above initial intentions. In naval warfare, history has shown that the tactical offense has most often trumped the tactical defence, and thinking that aircraft carriers can be defended against the array of existing and potential anti-ship missiles is not much different than the outlook of battleship admirals in the fall of 1941.15¶ The combination of vulnerability issues suggests that the U.S. Navy and any allied or cooperating navies that seek to constitute a combat credible force in ocean zones threatened by anti-ship missiles will have to disaggregate their power into a dispersed grid of submarines, destroyers and unmanned vehicles, themselves armed with highly lethal anti-ship missiles. Their purpose should be clearly articulated as defending the system by deterring aggression via the sea by means of defeating—at sea—any attempt to do so. Even the best anti-ship missile cannot hit what cannot be found. By disaggregating naval combat power and equipping it to exert sea control—at sea—we thereby eliminate both forms of naval vulnerability that contribute to naval arms races, and the deterioration of deterrence.¶ There is one other vulnerability issue that must be considered, and that is positioning. If caught out of position when a crisis erupts, the reactive movements of naval forces can catalyse rather than deter military action. In 1982, during the crisis leading up to the Falklands War, fears that the British were gathering up naval forces to send south helped put the Argentine Junta in a now-or-never state of mind, which precipitated their invasion and the war.16 If catalysis is to be avoided, naval forces must maintain a persistent presence in such areas where deterrence is necessary. This is why CS21 prescribes concentrated, credible combat forces be stationed forward in East Asia and the Persian Gulf. The Navy’s inventory of ships, aircraft and other systems must be sufficiently large such that this presence can be maintained indefinitely without “using up” ships and sailors at an unsustainable rate.¶ If command of the seas is achieved and maintained wisely by not provoking alarm and not allowing naval vulnerabilities to occur, the seas can constitute a massive geopolitical shock absorber, preventing conflicts in one area of the world from spilling over into others, mainly by keeping hostile armies from moving by sea, and allowing one’s own to do so. Even though this condition holds today as a function of American command of the sea, there has emerged, since the attacks on the World Trade Center in New York, the prospect of terrorists and their weapons being smuggled by sea to the shores of America, Europe, China, Japan and other developed countries. Given the disruptive potential of terrorist attacks, it is reasonable to regard them as only a step down from major power war as a threat to the system. Although the attacks of 9/11 were perpetrated by the radical Islamic organization al Qaeda, in the future such strikes might be staged by any number of groups. Although neutralization of such organizations by intelligence or law enforcement agencies is the preferred method, the lack of success to date in doing so for narco-traffickers and other criminal enterprises leaves us to consider at-sea interdiction as a necessary measure.¶ The seas, of course, are huge, and at any moment they are dotted with tens of thousands of ships. There is not now nor has there ever been a navy of sufficient size to hermetically seal off the seas to smugglers. The only way to make the seas a barrier to terrorists is to have every costal nation effectively guard its own waters and establish good teamwork between its navy, intelligence service and law enforcement agencies. Some nations do but many do not. Thus CS21 calls for building capacity in those developing nations whose navies or coast guards are embryonic.¶ The mission of capacity building requires a very different kind of naval force than the one needed to prevent major power war. The main “weapon system” of such a force is the sailors and other personnel that train, educate and influence those in developing countries that will become sailors. The sheer number of countries needing such assistance suggests these missions be conducted from relatively inexpensive ships that can be procured in some numbers. In addition to actual naval forces deployed for capacity building purposes, the navies of developed nations employ their shore training and education infrastructures. The importance of naval academies and war colleges in building not only capacity but relationships cannot be overstated.¶ Beyond capacity building, making the seas a barrier to terrorists requires information about who is at sea, what is in the containers and holds, and where they are. Not only are new forms of surveillance needed, but also intensive information sharing so that two and two can be put together to reveal suspicious activity. To manage this, the U.S. Navy is developing a global network of maritime operations centres that will develop regional pictures that will be shared globally. This, in turn requires an international effort to develop trust and confidence so that information flows freely.¶ If an adequate degree of maritime security can be achieved, the seas will constitute a geopolitical shock absorber in another way. In the wake of 9/11 the United States had no equivalent of the First Lord of the Admiralty, Admiral Lord St Vincent, who supposedly advised a jittery parliament in 1801, “I do not say my lords that the French will not come, I say only that they will not come by sea.” Without the assurance of the seas as a barrier to further attack, it was as if New York City was connected to Kabul and Baghdad by a land bridge. The Bush Administration was spooked by the prospect of a WMD attack and rather stampeded itself into two simultaneous Eurasian land wars that got the United States mired down and over-extended. The comfort of insulating oceans can provide, among other things, a certain poise to the deliberations of the National Security Council and time for cooling off and reflection before committing the nation to war. Moreover, in the wake of the pull-out from Iraq and an increasingly rapid drawdown in Afghanistan, both the current and former U.S. Chiefs of Naval Operations have advanced the notion of an “offshore option” for anchoring forward U.S. military capabilities in the future.17 This would increase the proportionate contribution of naval forces to the U.S. effort to maintain global stability.¶ The threat of terrorism emanates principally from an area of a world that has been variously referred to as the “arc of instability” and Barnett’s Non-Integrating Gap. It encompasses much of Africa and the Middle East as well as parts of Southeast Asia. It is where most failed states exist but also where much of the natural resources necessary for the world economy are found. Thus the nations that constitute the global economic system can ill afford a hands-off strategy of containment, hoping to seal off the area against the spread of terrorism until it heals itself. Therapeutic incisions have been and will continue to be necessary at various times and places.¶ Because of the undeveloped nature of this area of the world, along with the fact that most of its inhabitants live within several hundred miles of the coast, naval force projection capability from a sea base will be necessary. The early phases of the Afghanistan operations were of this nature and we can confidently expect that if and when the world’s developed nations reach a consensus about going into Somalia to cure the piracy problem, it will be a sea-based expeditionary operation. Thus, protection of resource areas will require that some number of navies possess substantial sea-based expeditionary force capability, preferably of a kind that can integrate multi-national contributions easily. Rendering disaster relief, as was done in the tsunami relief effort in 2004, the Haiti earthquake and the Japan tsunami, is also an important form of sea-based force projection that mitigates economic damage to the system. It is likely that future sea-based expeditionary operations will be international, and so that capability must be conceptualized and practiced.¶ The mere presence of naval forces in areas of the world that are the source of resources, notably oil, seems to have a beneficial economic effect. Both routine presence of naval forces and their responses in crises were shown to have a substantial economic benefit in a 1997 study by the U.S. Naval Postgraduate School.18 It found that the initial naval response to the Iraqi invasion of Kuwait is likely to have increased global GDP by over $86 billion.19 Perhaps the least dire threat to the global system is piracy —albeit one that is currently seizing the headlines. Somali pirates, a manifestation of a failed state in the Non-Integrating Gap, hijack merchants and demand ransom for the crew and ship. The actual chance of a particular merchant being hijacked is less than one in nine hundred,20 and shipping companies seem more inclined to pay the ransom than install armed guards aboard their ships. However, the publicity has galvanized nations and their navies to take action. A previous bout of piracy in the Straits of Malacca was cured by the joint action of local navies. The Somalia/Gulf of Aden situation is more problematic since there is no effective governmental authority ashore. However, the emerging world response to it reveals some important facets of an emerging global naval infrastructure that supports the global system of commerce and security.¶ In Mahan’s day, the movement of major naval forces was noted by many countries, sometimes with alarm, as it might presage invasion, or at least a round of coercive diplomacy. In fact, when the PRC announced it was dispatching a small squadron to the Gulf of Aden, there was alarm in some quarters in the United States and other countries that this was a sign of an expansionist China. The Chinese themselves announced that their ships would operate independently in the Gulf of Aden to protect their own merchants. However, after several weeks on station two things happened: the alarm about their movement died off and the Chinese commander suggested a cooperative zone defence in order to make most efficient use of the international naval forces on station. Moreover, not only the Chinese are there, but the Russians, NATO, EU (different task force), the Japanese, Koreans, Singaporeans and even the “rogue” nation of Iran. Everybody is cooperating—why, how and what does it mean?¶ To start with, we must acknowledge the uniqueness of the Gulf of Aden situation. Somalia is a failed state that possesses neither resources nor location that would incite major power rivalry over influence ashore there. There is a universal confluence of interests centred on the protection of shipping. The unusual absence of major power competition allows naval operations to follow their natural course and provide a unique opportunity for us to see the security side of the global system in action.¶ The Chinese, Russians, Iranians and other naval forces have become virtually invisible in the Gulf of Aden because they have fallen in on an existing framework and infrastructure of sea power that girdles the globe. This infrastructure (perhaps more accurately the maritime security subsystem of the global economic system) consists of both physical and intangible elements. On the physical side, there is the U.S. Navy’s world-wide logistics system. It operates 24/7/365 and is composed of a web of bases, husbanding (victuals) contracts and replenishment ships, augmented by the supply ships of the Royal Navy, Japan and other allies. This system can support international naval operations anywhere in the world. In addition, there are GPS and communication satellites as well as the ubiquitous internet. Among the intangibles are the UN Law of the Sea that provides a clear framework for who can do what in whose waters, any number of other international agreements governing a range of maritime issues, and a world conditioned to see U.S. Navy and allied ships cruising the littorals of Eurasia. Perhaps another intangible element is CS21 itself, which casts the United States and its navy in a defensive posture (defence of the global system). This makes it easier politically for other nations to deploy their ships on a cooperative mission and make use of the U.S. Navy’s logistics system. It also appears that the navies of the world are getting comfortable with looser coordination arrangements. Before the internet, strict communications, protocols, and structured command and control schemes were necessary. With the internet, everyone can talk more extensively and in new ways such that restrictive command arrangements are not so necessary. This in turn obviates the need for formal agreements prior to conducting cooperative operations. With the political and technical barriers to entry low, nations become more willing to send their navies on cooperative ventures.¶ Previously we discussed the seas as geopolitical shock absorbers, both to limit other nations’ options for aggression and to provide our own government time for reflection and preserving the option of doing nothing. In the cooperative naval operations off Somalia, we see another aspect of the phenomenon emerging in a very positive way. It turns out that ships from the Chinese, Japanese and South Korean navies have taken to operating together in the Gulf of Aden. Strange bedfellows indeed, but as both the Japanese navy’s operations chief and a Chinese maritime scholar have said to the author on different occasions, cooperating on easier missions can build trust and confidence that will provide a basis for achieving resolution of more difficult maritime issues between the nations. This is indeed geopolitical shock absorbing of the most congenial kind.¶ We have now arrived at a point where we can put all of the elements of modern naval endeavour together in a new syllogism. Navies protect their nations’ economic prospects by operating cooperatively to defend all elements of the global system of commerce and security. Their necessary functions range from averting naval arms races to rendering disaster relief to, yes, protecting shipping. But it is not an every navy for itself process; the more cooperation, the better. It may even turn out that sustained and habitual international naval cooperation will someday make the concept of command of the sea irrelevant. Until then, the U.S. Navy must exert careful stewardship over its command of the sea, keep its global logistics system robust and develop the capacity to catalyse a global maritime security partnership on a broad front by being in a lot of places at the same time. Other navies must also look at the world in systems terms if they are to most effectively develop utility arguments and determine how to most effectively target their limited resources.¶ If one accepts the arguments that underpin the new syllogism of how navies support economic prosperity, then reasons for optimism become clear. Naval building programmes in China, India and elsewhere do not have to lead to war as has happened in the past in Europe; there is a reasonable prospect that the seas can be denied to terrorists; the seas can be used to bring the Non-Integrating Gap into the system; and the emerging pattern of naval cooperating can not only secure the seas but reduce the likelihood of conflict and war.¶ None of this will happen if nations let their navies decay. The unique thing about navies is that their optimum utility is in time of peace. When sea power is hitting on all cylinders, it is invisible. An investment in sea power is most appropriate and effective at a point when threats are not apparent. In Mahan’s day the syllogism of sea power focused on the sovereign interests of individual nations and its application led eventually to war.¶ Today we see the world as a system, with a sea power logic that is expressed in systems terms. Its application, that is, investment in navies structured along systemic lines, promises a massive return in the form of an extended and improving peace and—despite the current global economic woes—prosperity.

#### Scenario 2---Middle East

#### Tech transfer enables Iranian acquisition of hypersonic capabilities

Zachary Keck 19 is a Wohlstetter Public Affairs Fellow at the Nonproliferation Policy Education Center, Iran and North Korea: Soon To Build Hypersonic Missiles? 9-15, https://nationalinterest.org/blog/buzz/iran-and-north-korea-soon-build-hypersonic-missiles-80836

Key Point: The concern is that once Russia and China have perfected their own hypersonic capabilities the technology will begin spreading, as it often has historically with everything from missiles to nuclear weapons technology.

It is extremely likely that Iran and North Korea will acquire hypersonic missiles, according to a senior U.S. general.

Back in April of last year, Lt. Gen. Samuel Greaves, the director of the Missile Defense Agency, testified to the Senate Appropriations Defense Subcommittee. During the hearing, Sen. Susan Collins asked Greaves about the risk that China and Russia’s hypersonic missile technology will be proliferated to countries like North Korea and Iran. “I assess that risk as extremely high,” Greaves responded. “I don’t see what will prevent it from happening.” He added that this is the reason why “the hypersonic threat is something that we need to address expediently.”

Hypersonic missiles travel at speeds greater than Mach 5, or between 3,106 and 15,534 miles per hour. There are two basic types of hypersonics. The first are called hypersonic glide vehicles (HGVs), which are launched into the atmosphere from a rocket and glide to their targets at altitudes of between forty and one hundred kilometers—or even higher. These HGVs typically fly at faster speeds than the second type of hypersonics, hypersonic cruise missiles (HCMs). As their name suggests, HCMs are cruise missiles that fly at hypersonic speeds. During their entire flight, they are powered by rockets or high-speed jet engines like scramjets.

Hypersonic missiles are uniquely destabilizing in a number of ways. For one, their extreme speed greatly compresses reaction times and reduces the effectiveness of defensive systems. Their altitude and maneuverability also pose tremendous issues. With regard to the former, HGVs travel at altitudes lower than ballistic missiles while HCMs fly higher than traditional cruise missiles. In both cases, this limits the ability of traditional missile defense systems to shoot them down. Especially with HGVs, the high maneuverability poses a biggest issue. HGVs combine the best characteristics of traditional ballistic and cruise missiles. They travel at incredible speeds like traditional ballistic missiles, but don’t fly along a predictable trajectory like ballistic missiles. Instead, they are highly maneuverable, similar to cruise missiles.

Currently, the only three countries with mature hypersonic research programs are the United States, China and Russia. As Ankit Panda first reported, China conducted two tests of a new hypersonic missile, the DF-17, in November 2017. An unnamed U.S. government source told him at the time that “the missile is explicitly designed for operational HGV implementation and not as a test bed.” The source also noted that this was “the first HGV test in the world using a system intended to be fielded operationally.”

Russia’s President Vladimir Putin also recently claimed that his country has built an “invisible” Kinzhal hypersonic cruise missile that can travel at speeds of Mach 10. While the United States has refused to confirm Putin’s claim, Gen. John Hyten, the commander of U.S. Strategic Command (STRATCOM), has said, “I can tell you that we have observed both Russia and China testing hypersonic capabilities.” He added: “You should believe Vladimir Putin about everything he said he’s working on.”

The concern is that once Russia and China have perfected their own hypersonic capabilities the technology will begin spreading, as it often has historically with everything from missiles to nuclear weapons technology. Greaves is hardly the first person to raise concern about the proliferation problem. Last year, the RAND Corporation published a pathbreaking study about this problem. The report outlined some of the dangers that the proliferation of hypersonic missiles would create, including forcing nations to adopt risky strategies to avoid decapitation and counterforce strikes. These include the devolution of command and control, which would give lower-level officials the ability to launch strikes, and forcing nations to disperse their strategic forces to prevent them from being wiped out in a first strike.

Unlike Greaves, RAND proposed a clear policy to prevent this future. The report explained that China, Russia and the United States agreeing to not export or co-develop hypersonic capabilities would go a long way to at least greatly slowing their proliferation. That is because there are formidable technical barriers that make developing hypersonic missiles difficult, time consuming and expensive. These barriers include, according to the report, “thermal management and materials [namely, the missiles experience intense heat over prolonged periods of time]; air vehicle and flight control; propulsion for HCMs; and testing, modeling, and simulation.”

Of course, this calls for diplomacy that is outside the purview of the director of the Missile Defense Agency. For its part, Greaves said that the MDA is working with the Pentagon to develop better defenses against hypersonic missiles. He added that Mike Griffin, the new undersecretary of defense for research and engineering, has made hypersonic missile defense a top priority. According to Greaves, defending against hypersonic missiles “starts with birth to death tracking of that maneuvering target.”

#### That escalates Iran-Israeli conflict---hypersonic bypasses their defense

Richard H. Speier 17, Adjunct Staff with the RAND Corp. He received a Bachelor of Arts degree in Physics from Harvard College and a Ph.D. in Political Science from the Massachusetts Institute of Technology, Hypersonic Missile Nonproliferation: Hindering the Spread of a New Class of Weapons, https://www.rand.org/pubs/research\_reports/RR2137.html

The Broader Picture of Increased Risk

The ability of hypersonic forces to penetrate defenses and compress decision time could aggravate the instabilities in regions that are already tense—for example, Iran-Israel and North Korea–Japan. Conflicts in these regions could evolve to include major powers aligned on opposite sides. An Israel-Iran conflict, with the United States and much of Europe aligned with Israel and Russia and perhaps China aligned with Iran, would create new paths for escalation to an even-larger conflict. The basic roles of external actors would not necessarily change—the alignments would stay the same—but external powers might suddenly find themselves in a more-unstable situation in which their patron states are increasingly trigger-happy. As noted previously, lesser powers could gain influence over major powers by threatening a hypersonic attack. At the least, lesser powers might be emboldened if they saw themselves as possessing a deterrent against major power intervention. Finally, because hypersonic weapons increase the expectation of a disarming attack, they lower the threshold for military action.

The powerful capabilities of hypersonic weapons could make the acquisition of hypersonic technology a desirable goal for a number of countries. So, where is there a potential for hypersonic weapons proliferation?

#### That collapses crisis bargaining---Iranian push for escalation dominance causes Israeli retaliation---goes nuclear

Louis René Beres 19, Ph.D., Emeritus Professor of Political Science and International Law at Purdue, What Happens to Israel if the US and Iran Go to War? 9-15, <https://www.algemeiner.com/2019/09/15/what-happens-to-israel-if-the-us-and-iran-go-to-war/>

All useful replies must extend beyond narrowly partisan simplifications. They will, therefore, be many-sided, nuanced, and subtly overlapping. At a minimum, once a shooting war were actually underway, full-scale military engagements could quickly and substantially involve Israeli armed forces (the IDF). In plainly worst case scenarios, these clashes would involve assorted unconventional weapons and directly impact Israel’s civilian populations. Looking ahead, the most fearful worst case narratives could sometime involve nuclear ordnance. In anticipation, serious strategic thinking is required. Even during the seemingly favorable time that Israel remained the only regional nuclear power, an American war with Iran could still elicit Israeli nuclear deterrence threats and/or Israeli nuclear reprisals for enemy-inflicted harms. For Israel, moreover, such threats or reprisals could be entirely rational. But how might such portentous circumstances emerge, as a “bolt-from-the-blue” spasm of violence, or in less blatant stages, that is, in difficult to fathom increments of harm? Most credibly, perhaps, a “collateral war” would come to Israel as a catastrophic fait accompli, a multi-pronged belligerency wherein even the most comprehensive security preparations in Jerusalem/Tel-Aviv could suddenly prove inadequate. What could happen next? The only meaningful answer to such inherently problematic queries must be a candid affirmation of strategic unpredictability. In science and mathematics, after all, accurate statements of probability must be drawn systematically from the discernible frequency of relevant past events. Significantly, however, in those increasingly dense strategic matters currently before America and Israel, there are no relevant past events. There is more strategy to ponder. For the moment, at least, Donald Trump has favored or revealed absolutely no tangible military doctrine. Accordingly, once confronted with a “no doctrine” war launched against Iran by this American president, whether as a defensive first-strike or a retaliation, Israel’s senior strategists would need to fashion their own corresponding doctrines. Inevitably, they would have to proceed without the benefit of normally indispensable bodies of associated historical information. How precisely should Jerusalem/Tel Aviv most accurately anticipate Iranian or Iranian-surrogate attacks on Israeli targets? As an antecedent question, how should these decision-makers and planners best identify which of these vulnerable targets would be judged presumptively “high value”? At some point, such an Intelligence Community/Ministry of Defense (MOD) operational challenge could even include the small defending the country’s Dimona nuclear reactor. Israel is less than half of the size of America’s Lake Michigan. Literally. In both 1991 and 2014, the ultrasensitive facility at Dimona came under rocket and missile attack from deliberate Iraqi and Hamas aggressions, respectively. In an upcoming war with the United States, Tehran would likely regard certain direct attacks upon selected Israeli targets as proper “retaliations” for American strikes — whether these strikes were an initial move of war against the Islamic Republic and its surrogates, or a more-or-less foreseeable response to Iranian first strikes, Here, too, Iranian forces could potentially gain operational access to hypersonic rockets or missiles. Should this access be obtained, Israel’s critical capacity to shoot down hypersonic glide vehicles (HGVs) and/or hypersonic cruise missiles (HCMs) might subsequently prove inadequate. What would happen next? In essence, when the pertinent options are examined dialectically, as they should, it could be to Tehran’s perceived advantage to ostentatiously drag Israel into any US or Iran-initiated war. Striking the US homeland itself would prove vastly more difficult for Iran, and also more likely to elicit variously intolerable reprisals. Wittingly or unwittingly, a Trump-initiated war against Iran would strengthen Saudi military power specifically and Sunni Arab military power in general. While such an expected strengthening might now seem less worrisome to Israel than further Iranian militarization, this delicate strategic calculus could change very quickly. In this easily imagined case, Israeli planners would need to recall and reexamine the presumptively truthful adage: “Be careful what you wish for.” There is more. Should the Trump-led American military find itself in a two-front or multi-front war — a complex conflict wherein American forces were battling in Asia (North Korea) and the Middle East simultaneously — Israel could unexpectedly find itself fighting on its own. For such an exceptionally complicated scenario to be suitably appreciated, Israeli strategists would first need to bear in mind that the “whole” of any deterioration caused by multi-front engagements could effectively exceed the sum of constituent “parts.” This means, among other things, that Israeli strategists and planners will need to remain aptly and persistently sensitive to all conceivable synergies. In this connection, it goes without saying that the Trump administration is unaccustomed to such challenging intellectual calculations. Somehow, for these planners in Washington, complex strategic decision-making can be extrapolated from the unrelated worlds of real-estate bargaining and casino gambling. Far better for Washington and Jerusalem to recall timeless insights of Carl von Clausewitz. For the still celebrated author of On War, the determining standard of reasonableness in any military contest must always lie in its presumed political outcomes. For a state to get caught up in war — any war — without any clear political expectations is a mistake, always, on its face, or prima facie. For more years than we may care to recollect, futile American wars have been underway in Iraq and Afghanistan. In time, for both Iraqis and Afghans, once-hoped-for oases of regional stability will regress to what English philosopher Thomas Hobbes would have called a “war of all against all.” At best, what eventually unravels in these severely fractured countries will be no worse than if these wars had never even been fought. This will not be a desired political outcome. Over the years, with the now obvious exception of North Korea, America’s principal doctrinal enemy has changed, dramatically, from “communism” to “Islamism” or “Jihadism.” This time, however, the ideological adversary is palpable, real, and not merely presumptive. This time, also, it is a formidable and finely-textured foe, one that requires serious analytic study, not ad hoc responses or seat-of-the-pants presidential eruptions. At times, to be sure, real or contrived bellicosity can helpfully serve American national security policy objectives, but not where it is wholly detached from any previously-constructed theoretical foundations. There is more. The Jihadist enemy of Israel and America remains a foe that can never be fully defeated, at least not in any tangibly final sense. To wit, this determined enemy will not be immobilized on any of the more usual or traditional military battlefields. Never. If at some point a particular jihadist adversary has seemingly been vanquished by US military forces in one country or another, it will likely re-group and reappear elsewhere. After Iraq, after Afghanistan, even after Syria (which now winds down with US and Russian support of a genocidal regime that has been historically hostile to Israel), America will face resurgent adversaries in hard-to-manage and geographically far-flung places. These locales include Sudan, Mali, Nigeria, Yemen, Somalia, Egypt, and perhaps even Bangladesh or (in the future) “Palestine.” Daily, in the Middle East, an American president and his advisors are sounding alarm bells over Iran — and this after the United States, not Iran, withdrew from an international legal agreement that was less than perfect, but (reasonably) better than nothing at all. When all these intersecting factors are taken into suitable intellectual account, there remains a residual argument (one that might quickly be anticipated in Israel) that a US-generated war with Iran would de facto amount to an anti-nuclear preemption or to some similarly purposeful act of “anticipatory self-defense.” Here, and with little reasonable doubt, the American war would be widely regarded as “cost-effective” or “net gainful” in Jerusalem/Tel Aviv. This visceral assessment, however, could become more a matter of what Sigmund Freud called “wish fulfillment” than of any serious strategic assessment of risks and benefits. Plausibly, there could be only a tiny likelihood that American bombs and missiles would be adequately targeted on widely multiplied/hardened/dispersed Iranian nuclear infrastructures. In reality, at least at present, a US war against Iran would be contrary to Israel’s core national security interests and obligations. Glib reassurances to the contrary from Jerusalem or Tel Aviv or Washington (or from both capitals) could be prospectively lethal for Israel. Though assuredly genuine, the threat from Iran should never be taken as an opportunity for simplifying political rhetoric. Instead, this threat should be assessed and calibrated dialectically, as reliably as possible according to normally verifiable standards of enemy force posture estimations. If, at any point during crisis bargaining between Iran, Hezbollah, Israel, and the United States, one side or the other should place too great a value on achieving “escalation dominance” and too little on parallel considerations of national safety, the expanding conflict could quickly turn “out of control.” Such consequential deterioration would be especially or even uniquely worrisome if Israel threatened or actually launched some of its presumptive nuclear forces. This is the case, moreover, irrespective of any promised strategic support for Israel from the United States. In sum, especially now, if Israel should look to the United States for seamlessly capable geo-strategic leadership, it would be taking very great and genuinely unprecedented national security risks. At a minimum, Israel has the incontestable right (and also the obligation to its own citizens) to expect fully decipherable expressions of US military doctrine. Going forward, unless it should insist more firmly and conspicuously upon maintaining this utterly critical right, Israel could at some point have to face certain starkly injurious security outcomes. It is altogether foreseeable that such intolerable security outcomes could prove irremediable and irreversible. For Israel and the United States, it is high time for sober humility and determined caution. Without exception, all mentioned Iran-centered quandaries represent turbulent and uncharted waters. In principle, perhaps, they can be successfully navigated, but only after markedly abundant applications of both intellect and perspicacity.

#### Hypersonic weapons acquisition drives missile arms race in the Middle East generally

Tim Fernholz 19, senior reporter at Quartz, the global business news outlet, where he covers geopolitics and the space industry, The world is heading for a new missile arms race, 6-9, https://qz.com/1637386/the-trump-era-has-brought-the-world-a-new-missile-arms-race/

China has also been helping Saudi Arabia develop its own missile force, much to the dismay of the American government. The Saudis are responding to Iran’s buildup of short-range missiles, which was the reason given by the US for pulling out of a global deal to restrict Iran’s nuclear program, though those missiles were not clearly forbidden. Still, the use of missiles by both sides in their proxy war in Yemen has led to civilian casualties, and is also leading other Middle Eastern states to expand their access to ballistic rocket weapons. Perhaps most concerning to US war planners are hypersonic missiles, which fly much faster than traditional cruise missiles—as fast as five times the speed of sound—but at far lower altitudes than traditional ballistic missiles, making them difficult to intercept.

#### Missile prolif causes fast escalation in the Middle East

Josh Levinger 6, Research Assistant with the Center for Future Civic Media at MIT, Fall 2006, “Ballistic Missile Proliferation Among the “Axis of Evil”: Iran, Iraq, North Korea and Pakistan,” http://www.levinger.net/josh/files/range/paper.pdf

The real threat posed by ballistic missile proliferation is to regional stability. Introducing long range missiles and nuclear warheads into inflamed regions such as the Middle East, the Indian subcontinent, and East Asia, opens the possibility for accidental launch and rapid escalation. While the United States and the Soviet Union stared each other down at the nuclear threshold for decades, other adversaries may not have as advanced a military decision process, or the experience of living with the threat of total annihilation. The future of missile proliferation looks bleak, with the impending disintegration of the NPT and the circumvention of the MTCR. On the other hand, the foreign market for budding missile designers appears to be booming. Perhaps there are job offers waiting for this graduating senior in Pyongyang, Tehran or Islamabad.

#### Mid-east war draws in great powers

James Stavridis 13, James Stavridis is a retired four-star U.S. Navy admiral and NATO supreme allied commander who serves today as the dean of the Fletcher School of Law and Diplomacy at Tufts University, "Flash Point in the Eastern Mediterranean," 7-19-2013, Foreign Policy, http://foreignpolicy.com/2013/07/19/flash-point-in-the-eastern-mediterranean/, DOA: 8-13-2015, y2k

But sailing away would be a huge mistake. Like the Balkans in the years leading up to World War I, the Levant and the Eastern Mediterranean are a pile of tinder that could ignite a much wider conflict. As with the assassin’s shot that killed Archduke Franz Ferdinand, it is difficult to predict precisely what could broaden the conflict, but it is impossible to ignore the possibility. Conflicts between Sunnis and Shiites are bubbling over. Old tensions persist and new ones have arisen over economic resources, notably natural gas fields — portions of which are claimed by Cyprus, Israel, Gaza, Syria, and Lebanon. And great power interest remains as high as ever, with Russia and the United States routinely operating warships in the region. China and India have also sent naval assets to the Eastern Med, where they join traditional NATO deployments from the navies of the 28-nation alliance. The ships merely reflect a broader military presence. Today, the Syrian civil war is ground zero, with Iran, Russia, and China on one side, and the United States, Saudi Arabia, the Gulf States, and much of NATO on the other. The spark could come with a confrontation between warships, a major terrorist attack by Iranian-sponsored Hezbollah, or the use of chemical weapons, either in the civil war itself or, worse, in Europe.

#### Scenario 3---North Korea

#### Hypersonic weapons cause an emboldened North Korea

John A. Tirpak 17 Editorial Director of Air Force Magazine, RAND Authors Urge Hypersonic Missile Non-Proliferation Deal, Fast, 9-27, https://www.airforcemag.com/rand-authors-urge-hypersonic-missile-non-proliferation-deal-fast/

There are two kinds of potential weapons in the Mach 5+ category: Hypersonic Cruise Missiles and Hypersonic Glide Vehicles. Both fly at relatively low altitudes—exo-atmospheric—and at speeds that existing missile defense systems can’t intercept. Proliferation of such weapons would be destabilizing because of their ability to rapidly decapitate an adversary’s leadership or offensive capabilities, in turn giving the intended target the incentive to pre-empt the attack, faced with a “use-it-or-lose-it” situation. Hypersonic missiles can also fly so fast that the defending country would not be able to determine the intended target until the last few seconds of flight, making point defense impossible.

“It’s in their interest” to control such technology, Richard Speir said of the US, Russia, and China. “They don’t want their neighbors to have this. But there’s not a lot of time.” He said the countries with the most advanced hypersonic technology outside the “big three” could have practical weapon “in several years.” Among them are France, Britain, Australia, India, and Iran.

Having the ability to threaten the major powers, even with a small number of hypersonic weapons, “emboldens lesser powers” like North Korea, to use them, study author George Nacouzi said. This, in turn, “lowers the threshold” for a conflict escalating to nuclear weapons because of the damage hypersonic weapons can do. Even without a warhead, a hypersonic missile’s kinetic energy could pack a punch measured in single-digit kilotons.

#### That makes crises escalation inevitable and they go nuclear---empirics don’t check

Anne Gearan 17, White House correspondent for The Washington Post, A nuclear-armed North Korea could make smaller disputes with Pyongyang much more dangerous, 8-10, https://www.washingtonpost.com/world/national-security/a-nuclear-armed-north-korea-could-make-smaller-disputes-with-pyongyang-much-more-dangerous/2017/08/10/b62ee0ce-7dd7-11e7-9d08-b79f191668ed\_story.html

But the nuclear standoff also carries the risk that future, smaller disputes with Pyongyang, however manageable in the past, will become far more consequential.

North Korean leader Kim Jong Un may consider his atomic bombs a license to pursue hostile actions far short of nuclear war, security analysts said. Mutual nuclear capability raises the stakes for any kind of confrontation, and defense analysts and North Korea watchers worry that a miscalculation or rash action on either side could quickly escalate.

North Korea has a demonstrated history of provocative behavior, including a cyberattack on Sony Corp., the sinking of a South Korean warship and the shelling of a South Korean island.

“I worry if something like that happens, what is the risk of escalation?” said Ben Rhodes, who was deputy national security adviser to President Barack Obama. “If everybody is on tenterhooks, you have the type of incident that was manageable in the past suddenly explode.”

North Korea said Wednesday that it is examining plans for firing missiles over the waters off Guam, home to U.S. military bases. Kim and President Trump also have exchanged threats and insults, including Trump warning of “fire and fury” if North Korea doesn’t cease its threats, and Kim calling Trump “senile” in response.

Trump said Thursday that his comments may not have been “tough enough” and that “things will happen to them like they never thought possible.”

Rhodes and others pointed to the 2010 sinking of the Cheonan warship, which killed 46 South Korean sailors, as an example of a conventional attack that would have more dangerous implications now.

“We’re not, I think, in a real crisis right now,” Rhodes said. “But the problem is, we’ve made the inevitable back and forth with North Korea feel much more risky.”

South Korea blamed Pyongyang but did not retaliate with direct military action, and the international crisis abated.

The United Nations issued a statement condemning the attack but didn’t name an alleged attacker; the United States said the ship was hit by a North Korean sub-launched torpedo.

Kim may calculate that his arsenal means he has even less to lose from such military actions, which do not involve nuclear weapons, and there is a risk that Trump might react to such an event in ways that heighten tension, said Jim Walsh, an Asia security expert at the Massachusetts Institute of Technology.

The current “bluster and bluffing” on both sides probably won’t amount to much, he said, but is alarming nonetheless. Trump sends a message that he is “not serious” when he uses rhetoric such as the “fire and fury” threat, and he may need to send a very serious and unmistakable message to defuse a crisis later on, Walsh said.

“We are probably not going to get into a war with North Korea because the young Chairman Kim wakes up one morning and decides to come after the United States,” he said. “But you can have war on the Korean Peninsula, and the main path to a war no one wants is miscalculation — little crises resulting in decisions no one wants to make.”

North Korea’s warning about Guam, where Secretary of State Rex Tillerson’s plane refueled Wednesday, said it could create an “enveloping fire” around the Pacific island.

“Their rhetorical reaction was always going to be strong — it always is,” said Evan Mederios, who directed Asia policy at the National Security Council.

Mederios said he worries that an emboldened North Korea could “mess around” on a new scale.

“Cyberattacks, more missile tests,” Mederios said. “A sixth nuclear test is certainly in the cards.”

#### Hypersonic prolif bypasses their defense---shreds deterrence

Reihan Salem 18, president of the Manhattan Institute and a contributing editor of National Review, What a Hypersonic-Missile Future Would Mean for National Security, 4-27, https://www.nationalreview.com/corner/hypersonic-missile-future-russia-national-security/

Though hypersonic weapons still have a way to go, we need to brace ourselves for a world in which they are ubiquitous. For most of American history, we have been shielded from rival powers by the vast expanse of the Atlantic and Pacific Oceans. The advent of the nuclear age brought our splendid isolation to an end, yet the logic of mutually assured destruction afforded a kind of security. One wonders how hypersonic weapons will change the landscape. It is often said that war with North Korea is unthinkable, as Seoul is within range of North Korean artillery. Soon, hypersonic weapons might see to it that we are all in the same boat — living cheek by jowl with those who have the power to destroy us. Preserving our military edge in such a world will be more than a little challenging.

#### That undermines security assurances---causes broader Asian conflicts and draws in China---makes further proliferation inevitable

Michael Heazle 17, Associate Professor in International Relations with the Griffith Asia Institute and the Department of International Business and Asian Studies at Griffith University, The unacceptable dangers of accepting a nuclear North Korea, 8-22, <https://www.lowyinstitute.org/the-interpreter/unacceptable-dangers-accepting-nuclear-north-korea>

As horrifying as the idea of war with North Korea is, the cost of a North Korean attack is a risk rather than a certainty and needs to be considered in comparison with the risks of accepting a nuclear North Korea. Among the risks that have long motivated staunch opposition to Pyongyang entering the nuclear club are the following, all of which very likely could lead to even more difficult choices and far more tragic outcomes in the future:

US extended deterrence credibility would be damaged, perhaps irreparably; both China and North Korea would use this to their advantage, especially China in further establishing its territorial claims and its ability to tactically leverage other states in the region. 'If the US won't risk conflict with North Korea, why would it do so with China?' would be the conclusion drawn by US allies and others in the region when pressured by Beijing.

An emboldened North Korea would further develop its nuclear capability, using it to lever a growing list of concessions from the US, South Korea, and Japan. Kim will likely believe he is much closer to reunifying the Peninsula under Pyongyang.

Japan and South Korea, now in an even more unstable and uncertain environment, go nuclear, and Vietnam will probably want to follow. Northeast Asia thus becomes significantly more dangerous and conflict-prone over the next decade or so.

The threat of North Korea leaking its nuclear secrets, as Pakistan did, cannot be entirely dismissed, making further proliferation more likely.

#### Extinction

Andrew Freedman 17, Mashable's Senior Editor for Science and Special Projects, Internally cites Robock and Toon---scientists at Univ of Colorado and Rutgers University, Nuclear war with North Korea 'would be suicidal', climate experts warn, 8-9, https://mashable.com/2017/08/09/north-korea-nuclear-war-climate-change-winter/

It's winter, 2018, in Iowa, five months after the last of the nuclear bombs detonated across megacities in northeast Asia, from Seoul to Tokyo to Shanghai. Radioactive fallout was the initial concern, but now something else is going awry: the weather. American farmers accustomed to snow and cold during the winter would be forgiven for mistaking their corn and wheat fields for the Arctic tundra, as temperatures dip well below zero at night, and barely recover above 10 degrees Fahrenheit during the day, under a milky, leaden sky. Forecasters say the corn and wheat harvest may be significantly shortened this year, and for the next several years. In fact, fears of a famine on an international scale are settling in. This is what our world could look like just a few months to years after a regional nuclear war breaks out on the Korean Peninsula and spreads to include China and possibly Russia. Whether from a deliberate strategy or a terrifying miscalculation, such a war could trigger a global climate catastrophe, experts warn, that is not being factored into leaders' planning. Such a war could cause the planet to cool by up to 10 degrees Celsius, or 18 degrees Fahrenheit, with larger regional swings and extremes, according to Owen Brian Toon, a scientist at the University of Colorado at Boulder. The amount of cooling could be far lower, depending on whether the conflict were more limited in scope. Apocalyptic visions of a so-called global “nuclear winter” were popular during the Cold War when envisioning a U.S. conflict with the then-Soviet Union, but the odds of a regional nuclear war in recent times have jumped higher after President Donald Trump’s bellicose rhetoric toward North Korea on Tuesday. Trump's words, threatening to meet North Korea's threats with a "fire and fury like the world has never seen" were the starkest warning of a nuclear strike from any U.S. president in modern times. It's not just national security experts who are horrified by Trump's words. Trump's rhetoric, and history of openly considering using nuclear weapons, is also concerning to climate scientists. Two researchers, in particular, are taking note of the North Korean threat: Alan Robock, of Rutgers University, and Toon. Robock and Toon are modern day Cassandras, having warned for decades about the potentially ruinous climate change consequences of a nuclear war, most recently focusing on regional conflicts. Robock has conducted much of the research into the idea of a nuclear winter, whereby a global thermonuclear war vaults so much smoke into the upper atmosphere to block out the sun for years afterwards, causing temperatures to plunge and killing off vital crops and plant and animal species. Unlike the character from Greek mythology, they don't make prophesies so much as publishing peer-reviewed scientific studies. But, like the mythical character, few have paid attention to their warnings. Right now, both Robock and Toon are focused on the mounting tensions on the Korean Peninsula, where a nuclear-armed dictatorship threatens to strike the U.S. or its allies, potentially igniting a regional nuclear war. Robock says most people, including high-ranking defense officials, are unaware that a nuclear war occurring halfway around the world from the U.S. could seriously harm the homeland, by altering the climate. A new little ice age Simulations in the 1980s, he said, found that temperatures would plunge so far after a U.S.-Soviet nuclear war that high temperatures in the summer temperatures would stay below freezing worldwide. The modern-day nuclear scenario that Robock, Toon and others have studied closely involves an exchange of nuclear weapons between India and Pakistan, with about 50 bombs of 15 kilotons each, which is less than half of those nations' nuclear arsenals. A 2007 study published in the journal Atmospheric Chemistry and Physics found that, if these weapons were aimed at the center of large cities, the direct fatalities would be "comparable to all of those worldwide in World War II." Such a war would induce massive firestorms in urban areas that could send up to 5 million tons of smoke high into the upper atmosphere, where tiny particles known as aerosols would scatter sunlight, preventing it from reaching the Earth's surface. This would turn the planet's climate sharply colder, despite the effects of human-caused global warming, and impact areas far from the actual fighting. The global cooling from such a regional war could be near 1.25 degrees Celsius, or 2.25 degrees Fahrenheit, studies have shown. Once in the stratosphere, the particles contributed by the smoke would stick around for a long time, Toon and Robock's simulations show. Observations after volcanic eruptions and wildfires support the model simulations. “It circles the globe and stays there for many years," Toon said. Toon cites firestorms during World War II in Hiroshima and Dresden, Germany, as real-world examples of what computer model simulations show could occur from a nuclear war taking place in an urban setting. And it's not just one computer model simulation that is projecting a sharp global cool down and potential famine from a nuclear conflict, Toon says. “This is something that has been confirmed now in multiple climate models,” Toon said, citing both U.S. and European modeling studies. “It would be suicidal" In an interview, Robock warned that a nuclear war on other side of the Earth, “using much less than one percent of the current nuclear arsenal,” or just .03 percent of the explosive power of all the world's nuclear weapons in existence, could produce “a larger climate change than ever recorded before in human history.” Not just a regional issue Toon also said the central lesson of much of the research into how the climate would respond to a limited nuclear war is not at all comforting. “It really suggests that it would be damaging for the world's climate to have even a small nuclear war, to the extent that even if a major power like the US were to launch a nuclear attack against another country,” then the damage to agriculture and ecosystems could “potentially lead to a nuclear famine.” “It would be suicidal," he said of using even a limited number of nuclear weapons. Robock said that an India-Pakistan nuclear scenario would cause such severe climate change worldwide that agriculture in the main growing regions of the U.S. and China would be reduced for more than a decade afterwards. These two areas supply most of the grain that feeds the world, and slashed production could lead to widespread famine. “That’s our shocking result that we’ve gotten so far,” Robock said of his research. A war between North Korea and the U.S. would likely involve fewer nuclear weapons than India versus Pakistan, which could limit the global environmental impacts. However, if it draws in China and Russia, which both border North Korea, then all bets are off, Robock says. North Korea is thought to have anywhere between 10 and 60 nuclear weapons, not all of which are operational. However, once started, nuclear wars can spiral out of control. “Another issue is once a nuclear war would start it’s really hard to control it,” Robock said, noting that China could be drawn in quickly. “So the scenario could get really horrible.” "If they used 10 weapons instead of 100 you might get one-tenth of the [climate change] response" when compared to India and Pakistan, Robock said.

#### Scenario 4---India

#### Indian hypersonic weapons generate crisis instability with Pakistan---causes nuclear war

Michael Peck 19, Wohlstetter Public Affairs Fellow at the Nonproliferation Policy Education Center, Why India’s Hypersonic Missile Could Trigger A Nuclear War, 6-21, https://nationalinterest.org/blog/buzz/why-india%E2%80%99s-hypersonic-missile-could-trigger-nuclear-war-63627

India’s test of a hypersonic missile signifies more than the advance of Indian weapons technology.

Ironically, the first launch of the Hypersonic Technology Demonstrator Vehicle, or HSTDV, was a failure. The HSTDV, which is shaped almost like a sailing ship, is supposed to be a testbed for developing future hypersonic weapons such as cruise missiles. It is launched atop an Agni 1, an Indian ballistic missile.

“The vehicle was test launched using the Agni 1 missile platform that was to take it up to a predetermined altitude where scramjet technology—the ability to fly at speeds in excess of Mach 6 while using atmospheric oxygen as oxidizer—had to be validated with separation of the platform and a short flight at high altitude,” according to India’s Economic Times.

“Sources said that while the missile on which the platform was mounted successfully took off from the range, the test could not be completed to demonstrate the vehicle at hypersonic speed as the Agni 1 did not reach the desired altitude for the test. Scientists are looking at the technical reasons behind this and are studying all available data.”

While that doesn’t necessarily mean the HSTDV has a problem, it’s not good news for India’s strategic nuclear deterrent. “The Agni 1 is a nuclear-capable missile that is in service with the strategic forces and has been successfully tested several times in the past,” noted the Economic Times. “Its failure to reach the desired altitude is a reason for concern and is being studied.”

Yet unproven or not, the existence of an Indian hypersonic project is an ominous step for India’s cold war with its neighbor Pakistan. Hypersonic missiles—defined as rockets with a velocity of at least Mach 5, though Russia and America are developing Mach 20 weapons—are dangerous because of their speed. Though the weapons have yet to be tested in combat, the U.S. military is concerned that Russian and Chinese hypersonic weapons may travel so fast that they can’t be intercepted. At the tactical level, this means that aircraft carriers and air bases could be destroyed by a salvo of missiles.

But on the strategic level, hypersonic weapons are truly frightening. A hypersonic missile can deliver a nuclear warhead more quickly than a ballistic missile. Or, a hypersonic missile armed with a conventional warhead might be able to destroy an opponent’s nuclear missiles in a first strike, but without the attacker having to resort to nuclear weapons.

Whether or not such a strike would be successful, or whether anyone would be confident enough to risk a nuclear exchange by using hypersonics, isn’t the point. Unlike the United States versus Russia and China, whose homelands are separated by thousands of miles of ocean, the distance between New Delhi and Islamabad is just over 400 miles. A Mach 5 or 10 weapon missile launched from India or Pakistan could hit its target in minutes (Russia’s Avangard hypersonic glider reportedly has a speed of Mach 20, with the United States working on a weapon equally as fast).

Knowing that India has hypersonic weapons could make Pakistan feel trapped in a “use them or lose them” mindset regarding its nuclear weapons.

#### Indo-pak war is probable and outweighs

Toby Dalton 16 is the co-director and a senior fellow of the Nuclear Policy Program at the Carnegie Endowment, Pakistan and India: The Art of Peace, 9-19, https://carnegieendowment.org/2016/09/19/pakistan-and-india-art-of-peace-pub-64638

Yet, as long as Pakistan and groups such as Lashkar-e-Taiba (LT) do not clearly demonstrate their renunciation of cross-border violence, and India does not demonstrate that it will reciprocate by accommodating the interests of reasonable Kashmiri stakeholders in a peace process, more violence with the potential to escalate the conflict remains all too possible. This is why we have written Not War, Not Peace? — to analyse the implications of possible Indian policies and capabilities to deter and to respond to another major terrorist attack on India. At stake is the potential for war that could escalate to nuclear devastation of Pakistan and India. This would be the most destabilising and catastrophic event in the international system since World War II. For a problem this profound, it is notable that no theories in the existing international relations literature, or in other states’ practices, offer guidance as to how India and Pakistan could most effectively proceed here. Unlike any other nuclear-armed antagonists, India and Pakistan directly border each other, have unresolved territorial disputes (Kashmir and Sir Creek), and have engaged in armed conflict four times, not to mention multiple other militarised crises in places such as Siachen and across the LoC in Kashmir. Furthermore, terrorism poses a threat that could instigate future conflict. Studies on deterring and defeating terrorism have not addressed situations in which the major antagonists possess nuclear weapons. Theories and case studies of nuclear deterrence and escalation management have not involved cases in which terrorists are the instigators of aggression and may not directly be under the control of state leaders.

#### Export control is key---domestic hypersonic initiatives inevitably fail, so India will purchase weapons from Russia---destabilizes South Asia and independently causes Pakistan to increase alert levels

Samran Ali 19 is a Research Assistant at the Center for International Strategic Studies (CISS). His areas of interest include the arms control, non-proliferation and strategic issues of South Asia, INDIAN HYPERSONIC WEAPONS BRING NEW CHALLENGES TO SOUTH ASIA, 9-13, https://southasianvoices.org/indian-hypersonic-weapons-bring-new-challenges-to-south-asia/

India is currently developing a hypersonic version of its anti-ship/land-attack Brahmos supersonic cruise missile. A joint venture between Russia and India, Brahmos has a maximum speed of Mach 2.8. The hypersonic version of Brahmos will be known as Brahmos II, which will have a speed of more than Mach 5 and will be powered by a supersonic combustion ramjet, or “scramjet,” engine. Unlike a ramjet engine, a scramjet engine uses oxygen from the atmosphere rather than an onboard tank, which makes the missile lighter and faster.

However, the development of Brahmos II has been slow as it has encountered a number of setbacks over the years, and the cruise missile has yet to be tested. In 2009 the hypersonic version of Brahmos was projected to be ready by 2013. However, in 2018—almost a decade later—the chief executive of Brahmos Aerospace, Sudhir Mishra, suggested that it would take an additional “seven to ten years” for Brahmos to reach hypersonic speeds. Some commentators have remarked that Brahmos’ hypersonic version may never be realized owing to the numerous delays. However, even if India shelves the plan of developing its own hypersonic Brahmos, the lack of international controls over hypersonic proliferation could open the door for future purchases of hypersonic technologies from Russia.

Despite setbacks, India’s flight test of its hypersonic vehicle, the HSTDV, indicates that New Delhi is committed to developing hypersonic technologies. While India’s Defense Research and Development Organization (DRDO) claimed the test was successful, the launch platform—Agni-I—failed to take the HSTDV to the altitude necessary for the scramjet engine to operate. Regardless, the flight test is the first step towards the realization of an indigenous hypersonic vehicle and the successful development of Brahmos II, and the HSTDV could give India two separate hypersonic cruise missile systems.

India has three key motivations for developing such a sophisticated weapons system. First, India aspires to be a world power. This means being on par with the United States, Russia, and China in the realm of indigenous technological advancement—Indian Defense Minister Rajnath Singh has emphasized the importance of developing missiles indigenously. Second, India considers China an economic and political rival, and may feel the need to catch up to China’s emerging hypersonic capabilities. Third, hypersonic weapons could give India a strategic edge over Pakistan by complicating Pakistan’s ability to develop countermeasures. Finally, the domestic political and scientific communities in India also drive such ambitions. The above motivating factors intensify the push for developing this dangerous weapon system, which has the potential to create instability and uncertainty in a nuclear environment

Hypersonic Weapons in South Asia’s Strategic Calculus

Hypersonic weapons pose a risk to strategic stability in South Asia. Indian and Pakistani nuclear warhead numbers are in the same range. India and Pakistan have both developed short-range ballistic missiles, Pakistan with the nuclear Nasr missile and India with the conventional but nuclear capable Prahaar missile. Both are developing multiple independently targetable re-entry vehicle (MIRV) technology. Indian acquisition of hypersonic weapons—combined with the strengthening of India’s intelligence, surveillance, and reconnaissance (ISR) capabilities, missile defense, and nuclear submarines—may tilt the strategic balance in India’s favor. In combination, these systems are a potent weapon for preemption. Thus, Pakistan may fear an Indian capacity for a first strike against its strategic assets. In the event of a crisis, Pakistan may preemptively launch its own weapons for fear of losing them to a decapitating Indian first strike. These fears are further augmented by the eroding credibility of India’s nuclear no-first-use policy.

The ambiguity that accompanies hypersonic weapons is an added threat to nuclear stability in South Asia. The speed of hypersonic weapons increases their kinetic kill-energy so that even conventionally-armed hypersonic weapons can cause enormous destruction. Thus, there is the potential for a successful counterforce first strike without even using a nuclear warhead. Before the missile reaches its target, it may be impossible to determine whether it is carrying a conventional or nuclear warhead. This ambiguity could risk a conventional attack being mistaken for a nuclear attack and cause the incident to escalate across the nuclear threshold.

Another issue is the lack of controls over hypersonic weapon proliferation in South Asia. There is no international treaty or measure to limit such proliferation among the United States, China, and Russia because each of these countries are interested in acquiring these weapons. India has also rejected many bilateral arms control proposals offered by Pakistan, including a bilateral test ban agreement and a strategic restraint regime agreement. Indian hypersonic weapons would have serious consequences for Pakistan. Pakistan does not have a ballistic and cruise missile defense system, while India is strengthening its air and missile defenses. Therefore, Pakistan may eventually come under pressure to develop or obtain its own hypersonic weapons unless the global powers decide to stop the proliferation of such weapons, particularly in South Asia. Pakistan may also be forced to make doctrinal changes such as greater ambiguity in its nuclear use policy or operational changes such as enhancing the readiness of its nuclear weapons.

However, amid speculations that the United States, Russia, and China are edging towards arms racing, and as Cold War era arms control treaties are becoming irrelevant, the likelihood of initiatives to stop the proliferation of hypersonic technologies is low. The Intermediate-Range Nuclear Forces (INF) Treaty has died and New START may follow the same path. Unless third parties begin to take the proliferation of these weapons more seriously, hypersonic weapons have the potential to exacerbate escalatory dangers in South Asia.

#### Weapons on high alert erodes nuclear security

Kerr & Nikitin 12 Paul K. Kerr and Mary Beth Nikitin, Analyst and specialist in Nonproliferation, Pakistan’s Nuclear Weapons: Proliferation and Security Issues, 5-10, <https://nsarchive2.gwu.edu/nukevault/ebb388/docs/EBB035.pdf>

In addition to the above scenarios, the security of Pakistan’s nuclear weapons could also be jeopardized by another conflict between India and Pakistan, Michael Krepon argued, explaining that an “escalating war with nuclear forces in the field would increase the probability of accidents, miscalculations, and the use of nuclear weapons.” This is because [w]hen tensions rise precipitously with India, the readiness level of Pakistan’s nuclear deterrent also rises. Because the geographical coordinates of Pakistan’s main nuclear weapon storage sites, missile, and air bases can be readily identified from satellites—and therefore targeted by opposing forces—the dictates of deterrence mandate some movement of launchers and weapons from fixed locations during crises. Nuclear weapons on the move are inherently less secure than nuclear weapons at heavily-guarded storage sites. Weapons and launchers in motion are also more susceptible to “insider” threats and accidents.126 Such a war, Krepon added, would also place stress on the army’s unity of command. Krepon has also pointed out that Islamabad faces a dilemma, because less-dispersed nuclear weapons may be more vulnerable to a disarming military strike from India.127

#### Pakistan is the ground-zero of loose nukes---insider threats increase risks of nuclear thefts

Miles A. Pompera 17, Senior Fellow, James Martin Center for Nonproliferation Studies, Nuclear terrorism – Threat or not? AIP Conference Proceedings 1898, 050001 (2017), 11-15, https://aip.scitation.org/doi/pdf/10.1063/1.5009230

In particular, the regional instability and ongoing terrorist activity in South Asia, as well as the potential for collapse in North Korea, present concerns for the security of nuclear weapons. For example, Pakistan is the most oft-cited example where a “loose nuke” scenario could occur. Public statements from the US and Pakistani officials express confidence in the security of Pakistan’s nuclear arsenal, but there is evidence that these statements may have less merit than it appears. In 2013, the Washington Post reported that secret documents provided by National Security Agency whistle blower Edward Snowden revealed that then Director of National Intelligence James Clapper had warned that “knowledge of the security of Pakistan’s nuclear weapons and associated material encompasses one of the most critical sets of…intelligence gaps,” which was concerning “given the political instability terrorist threat, and expanding inventory [of nuclear weapons] in that country.”71 Other experts note that the Pakistani authorities have a dismal record thwarting insider threats – the AQ Khan network operated under the noses of the Pakistani establishment for years – and that the greatest risk of a loose nuke stems from insiders in the Pakistani nuclear establishment working with outside Islamist militants.72 Moreover, the divide within the Pakistan’s military, particularly the fact that senior military officials have been found to have proven ties to religious extremists, make safeguarding its nuclear weapons much more difficult.73

#### Causes nuclear terrorism

Rajan Menon 10 is a professor of international relations at Lehigh University, –Tom Zoellner is the author of Uranium: War, Energy and the Rock that Shaped the World, ARE WE SAFE FROM NUKES? https://www.zocalopublicsquare.org/2010/07/26/are-we-safe-from-nukes/foreign-policy/

Nuclear weapons once preoccupied all Americans. During the Cold War, as the U.S. and the Soviet Union amassed arsenals, aimed them at each other, and held the world in a delicate balance appropriately abbreviated as MAD, global leaders realized the need to control nuclear weaponry even as they sought to attain or expand their capability. Today, more countries are members of the nuclear club, and more non-state actors are trying to join, but awareness about the danger of nuclear weapons seems disproportionately low. Before Zócalo and KCRW present Countdown to Zero, a documentary pressing for global disarmament, we asked four academics, writers, and scientists to explain just how dangerous the world is today, and how we can rein in loose nukes. First, there’s the problem posed by sheer volume. Take shipping containers, which are considered a prime means for smuggling nuclear weapons or fissile materials into the U.S. In 2007, 13 million containers arrived at our 361 major ports. Only six percent were physically inspected and eight percent were run through gamma ray scanners. Another three billion pounds of cargo arrives annually in the U.S. on passenger and cargo planes, from 94 countries with varying levels of stringency when it comes to inspection. Then there’s the challenge of thwarting people engaged in nuclear terrorism. In 2005, the year the numbers rose to equal the pre-9/11 figures, 86 million people arrived at American airports and an additional 26 million entered as passengers or crews on ships. (And I haven’t even gone into the traffic across our borders with Mexico and Canada.) The United States also contains an array of tempting targets – skyscrapers, mega-malls, sports stadiums – and holds 31 cities with a population of at least 500,000. There is also the difficulty of stopping the theft of nuclear bombs and fissile materials so they don’t travel to begin with. Here, too, the challenge has become more formidable because the nuclear problem has been transformed. During the Cold War we worried about maintaining deterrence, which has worked-so far. The other concern was the spread of the bomb. Here, too, the record is encouraging. In the early 1960s President John F. Kennedy opined that there would be up to 20 nuclear-armed states by 1975; there are fewer than half that today. But there’s reason to worry about the security of nuclear sites, particularly in Russia, North Korea, and Pakistan. Worse, the possibility of prolonged chaos, or even a breakdown of governmental authority, cannot be ruled out in Pakistan and North Korea. So are we safer? Yes, in the sense that considerable attention and resources have been directed at the loose nukes problem since the collapse of the Soviet Union and particularly since 9/11. But given the problems I’ve discussed, the question of how safe we are can’t be answered with any certainty. Terrorist groups need only a single success; our security systems cannot avoid a single failure. A lasting solution, one at which the nuclear powers – especially the United States and Russia – have been miserable failures, requires developing a system for the international control of the nuclear fuel cycle and the development of a concrete plan toward verifiable disarmament. President Obama and his staff twisted arms and convinced representatives of 46 nations to attend the Nuclear Security Summit in Washington, D.C. this April, where they signed a pledge to put plutonium and highly-enriched uranium out of the reach of terrorists and rogue groups within four years. This goal was overambitious, of course, but it was designed to shake the bureaucratic stupor out of national atomic agencies, where inertia often reigns (including in the U.S. Energy Department). It is an excellent start, and the world may never know if a catastrophe was averted because of this far-sighted initiative. Unfortunately, there is not much political coin that comes from this kind of work – just as there is very little that is sexy about bridge repair or road reconstruction – even though it makes for good public policy. Furthermore, those who combat loose nukes are, by definition, always fighting blind. It will always be impossible to say that somewhere in this wide world, somebody is not stashing away a cache of stolen uranium and plotting their own personal Armageddon, just as we can never know if Obama’s refusal to ignore this issue may have saved one city, or 10. What is clear is that another summit is an imperative. Press estimates put the total of unaccounted nuclear material already out there as enough to construct 120,000 bombs. The work goes on, as it endlessly must.

#### Terrorism causes extinction- retaliation

Ayson 10 Professor of Strategic Studies and Director of the Centre for Strategic Studies: New Zealand at the Victoria University of Wellington (Robert, July. “After a Terrorist Nuclear Attack: Envisaging Catalytic Effects.” Studies in Conflict & Terrorism, Vol. 33, Issue 7. InformaWorld.)

But these two nuclear worlds—a non-state actor nuclear attack and a catastrophic interstate nuclear exchange—are not necessarily separable. It is just possible that some sort of terrorist attack, and especially an act of nuclear terrorism, could precipitate a chain of events leading to a massive exchange of nuclear weapons between two or more of the states that possess them. In this context, today’s and tomorrow’s terrorist groups might assume the place allotted during the early Cold War years to new state possessors of small nuclear arsenals who were seen as raising the risks of a catalytic nuclear war between the superpowers started by third parties. These risks were considered in the late 1950s and early 1960s as concerns grew about nuclear proliferation, the so-called n+1 problem. It may require a considerable amount of imagination to depict an especially plausible situation where an act of nuclear terrorism could lead to such a massive inter-state nuclear war. For example, in the event of a terrorist nuclear attack on the United States, it might well be wondered just how Russia and/or China could plausibly be brought into the picture, not least because they seem unlikely to be fingered as the most obvious state sponsors or encouragers of terrorist groups. They would seem far too responsible to be involved in supporting that sort of terrorist behavior that could just as easily threaten them as well. Some possibilities, however remote, do suggest themselves. For example, how might the United States react if it was thought or discovered that the fissile material used in the act of nuclear terrorism had come from Russian stocks,40 and if for some reason Moscow denied any responsibility for nuclear laxity? The correct attribution of that nuclear material to a particular country might not be a case of science fiction given the observation by Michael May et al. that while the debris resulting from a nuclear explosion would be “spread over a wide area in tiny fragments, its radioactivity makes it detectable, identifiable and collectable, and a wealth of information can be obtained from its analysis: the efficiency of the explosion, the materials used and, most important … some indication of where the nuclear material came from.”41 Alternatively, if the act of nuclear terrorism came as a complete surprise, and American officials refused to believe that a terrorist group was fully responsible (or responsible at all) suspicion would shift immediately to state possessors. Ruling out Western ally countries like the United Kingdom and France, and probably Israel and India as well, authorities in Washington would be left with a very short list consisting of North Korea, perhaps Iran if its program continues, and possibly Pakistan. But at what stage would Russia and China be definitely ruled out in this high stakes game of nuclear Cluedo? In particular, if the act of nuclear terrorism occurred against a backdrop of existing tension in Washington’s relations with Russia and/or China, and at a time when threats had already been traded between these major powers, would officials and political leaders not be tempted to assume the worst? Of course, the chances of this occurring would only seem to increase if the United States was already involved in some sort of limited armed conflict with Russia and/or China, or if they were confronting each other from a distance in a proxy war, as unlikely as these developments may seem at the present time. The reverse might well apply too: should a nuclear terrorist attack occur in Russia or China during a period of heightened tension or even limited conflict with the United States, could Moscow and Beijing resist the pressures that might rise domestically to consider the United States as a possible perpetrator or encourager of the attack? Washington’s early response to a terrorist nuclear attack on its own soil might also raise the possibility of an unwanted (and nuclear aided) confrontation with Russia and/or China. For example, in the noise and confusion during the immediate aftermath of the terrorist nuclear attack, the U.S. president might be expected to place the country’s armed forces, including its nuclear arsenal, on a higher stage of alert. In such a tense environment, when careful planning runs up against the friction of reality, it is just possible that Moscow and/or China might mistakenly read this as a sign of U.S. intentions to use force (and possibly nuclear force) against them. In that situation, the temptations to preempt such actions might grow, although it must be admitted that any preemption would probably still meet with a devastating response. As part of its initial response to the act of nuclear terrorism (as discussed earlier) Washington might decide to order a significant conventional (or nuclear) retaliatory or disarming attack against the leadership of the terrorist group and/or states seen to support that group. Depending on the identity and especially the location of these targets, Russia and/or China might interpret such action as being far too close for their comfort, and potentially as an infringement on their spheres of influence and even on their sovereignty. One far-fetched but perhaps not impossible scenario might stem from a judgment in Washington that some of the main aiders and abetters of the terrorist action resided somewhere such as Chechnya, perhaps in connection with what Allison claims is the “Chechen insurgents’ … long-standing interest in all things nuclear.”42 American pressure on that part of the world would almost certainly raise alarms in Moscow that might require a degree of advanced consultation from Washington that the latter found itself unable or unwilling to provide. There is also the question of how other nuclear-armed states respond to the act of nuclear terrorism on another member of that special club. It could reasonably be expected that following a nuclear terrorist attack on the United States, bothRussia and China would extend immediate sympathy and support to Washington and would work alongside the United States in the Security Council. But there is just a chance, albeit a slim one, where the support of Russia and/or China is less automatic in some cases than in others. For example, what would happen if the United States wished to discuss its right to retaliate against groups based in their territory? If, for some reason, Washington found the responses of Russia and China deeply underwhelming, (neither “for us or against us”) might it also suspect that they secretly were in cahoots with the group, increasing (again perhaps ever so slightly) the chances of a major exchange. If the terrorist group had some connections to groups in Russia and China, or existed in areas of the world over which Russia and China held sway, and if Washington felt that Moscow or Beijing were placing a curiously modest level of pressure on them, what conclusions might it then draw about their culpability.

### 1AC---Solvency

#### CONTENTION 2: Solvency

#### Plan topically hinders the circulation of hypersonic technologies through restricting exports of space weapons such as X-37---they are used as the testbed and the basis for perfecting capabilities integral to hypersonic weapons

Subrata Ghoshroy 15 research affiliate at the Massachusetts Institute of Technology’s Program in Science, Technology, and Society, USA, The X-37B: Backdoor weaponization of space?

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On October 17, 2014, the US Air Force cryptically announced the return of its uncrewed X-37B Orbital Test Vehicle-3 after nearly two years in space. Headlines uniformly described this remotely piloted spacecraft as “mysterious,” leading to speculations about what it did during all that time in the heavens (Martinez, 2014; Weinberger, 2012). To add to the mystery, when the Air Force did its habitual live-streaming of the launch of the shuttle-like spacecraft, whoever was in charge had made it a point to turn off the video just before the main engine cutoff, so the craft’s initial orbit would be unknown. (Amateur trackers did eventually find it, however.)

If such actions were intended to quiet interest in this “baby space shuttle,” then they had the opposite effect. If anything, the lack of information about the craft and its orbit whetted appetites and added to the thrill, especially after the X-37B was discovered to have made changes in its orbit during its first mission, and the amount of time it stayed up in space kept getting longer and longer. Analysts speculated that the potential applications could range from targeted intelligence-gathering to space weaponry. Most guesses were within the realm of possibility; some were less credible. But it seems clear that the X-37B is indeed being used to help develop critical technologies that lead down the path to the eventual weaponization of space. The X-37B is a story about hypersonic propulsion, reusable spacecraft, and super thermal materials that can withstand unimaginably high temperatures. Much of the data about the spacecraft has been hidden via classification, but some is in the public domain and available via open-source materials, allowing for an overall picture to be pieced together and viewed without threatening the security of any vital individual components or harming national security.

The ostensible purpose of the X-37B program is to develop a reusable launch system like the earlier space shuttle but smaller and cheaper, that can quickly respond to evolving military needs in space. Yet another purpose, arguably more important for the military but often overlooked, is that it provides a much-needed platform for testing space weapons technologies that the previous shuttle program could not readily provide. Hence the secrecy. While not alone, the X-37B is an integral part of the Air Force’s efforts to militarize space and eventually weaponize it.

Fanning the flames

Through the X-37B program, the Air Force is gathering data on the travel of objects at extremely high speeds and developing cutting-edge space technologies that allow those objects to navigate and be controlled remotely over long distances. It is able to field-test on the very edge of space the latest thermal protection systems, high-temperature structures and seals, and lightweight electromechanical flight systems, which are part of what allows the craft to glide stealth-like to the ground. All of these features are vital for engaging what the military calls “time sensitive” targets in “anti-access/area-denial” environments—or, in plain English, for using high-speed missiles in counter-terrorism operations or for overcoming antimissiles. At such speeds, an enemy may barely have the time to detect an incoming missile on a radar screen before being destroyed.

A hint of the thought process behind the X-37B can be found in a speech given on December 5, 2014 in Washington, DC by the leader of the US Air Force Space Command, Gen. John E. Hyten. He said: “We don’t ever want to go to war in space, but we need to be prepared to fight a war in that environment” (Ingalsbe, 2014). His speech continued in this vein, making it seem as if Hyten believes that a space war is inevitable and that the United States has to prepare for it now.

Unfortunately, American political and military leaders seem to be betting that investing heavily in technological superiority will let the United States prevail in a space war—instead of concentrating on leading the world toward a space treaty that would ban all weapons from space.

Ironically, the United States could have the most to lose in a Cold War-style space race, because it has the most skin in the space game. The United States has the overwhelming majority of satellites in orbit—for commercial, telecommunications, environmental, research, and military uses. According to the Union of Concerned Scientists’ database, there are 1,235 operating satellites in orbit; of this number, the United States has 512 satellites, Russia has 135, and China 116, with the other 472 spread among many countries. The number of America’s military satellites alone—159—is larger than either Russia’s or China’s total number of satellites.1

Even a minor space battle could result in the near-Earth heavens being littered with debris, rendering them uninhabitable for all satellites. As was graphically illustrated in the fictional Hollywood movie Gravity last year, the presence of even a relatively small amount of space junk can wreak serious havoc. Yet a portion of the X-37B’s mission appears aimed at testing technologies that—while potentially useful for satellite repair—could also be the foundation for a space warfare capability.

A convoluted history

The X-37B has its origins in a more benign project, the X-37, a joint program between NASA and the Defense Department. Given that the secret spacecraft’s overall design doesn’t appear to deviate much from the days of the more open X-37 program, one can imagine that at least part of the mission now is the same as it was then: doing experiments to develop technologies for a reusable spacecraft that could shuttle cargo and astronauts to low-Earth orbit.

Space enthusiasts have long dreamed of getting into orbit without using an expendable rocket, and hence reaching space cheaper, faster, and more reliably. The unmanned X-37B seems to promise much of that: Although it is launched vertically from a launchpad, when this remotely operated vehicle returns to the ground it lands horizontally on an airstrip, like an airplane. Therefore, the vehicle can be thought of as a hybrid of spacecraft and aircraft. It can withstand the vacuum of space and maneuver there, yet it has wings that give the X-37B aerodynamic lift once it reenters the Earth’s atmosphere—allowing it to descend and land, gliding back home just like the space shuttle. The wings also help it to brake.

With its use of a rocket to get off the ground, the X-37B is still a long way from the ultimate ideal of a true space plane, which would take off from the ground horizontally and use aerodynamic lift to get into space without the need for an expendable rocket or other external assist. But true believers expect that such experimenting will ultimately lead to this goal—which would theoretically be a less costly, more reliable, and more controllable way of regularly getting humans into space. The space shuttle, with its rocket-assisted launch, got us partway there, and the unmanned X-37B could conceivably be viewed as a logical extension of this approach in some ways.

But the technological hurdles to cheaper space access are high, as the recent test of the US private-sector rocket system SpaceX showed (Kramer, 2015). It failed to land its first-stage rocket in one piece, something essential to reuse.

There is one other major challenge for a reusable spacecraft: It must fly at least five times faster than the speed of sound, or somewhere in the range of 3,800 miles per hour, a speed known as “hypersonic.” By comparison, a typical passenger jet aircraft has a maximum cruising speed of 550 mph, or about 0.8 Mach. A high-end fighter jet like the F-16 Eagle or the Russian MiG can fly at Mach 2 or higher—which is supersonic.

A spacecraft typically experiences speeds that are much greater than the fastest fighter jet. The usual reentry speed of the space shuttle was about 17,500 mph, or roughly Mach 25, which NASA calls “high hypersonic.” At these hypersonic speeds, friction heats the spacecraft body to such extremely high temperatures that only specialty metals and alloys can withstand them (NASA, 2015). This “reentry problem” was solved early in the space program by using spacecraft that only needed to survive one-time use. The solution is much more complex for a vehicle that must be turned around quickly and sent back up into space again.

But whatever has been learned from the shuttle-like X-37B about the process of handling hypersonic speeds, extreme temperatures, and reentry technologies for peaceful space uses can easily be applied to less benign flying objects, such as hypersonic missiles. Which is one of the many places of the X-37B project where things get tricky, and could lead to the backdoor weaponization of space.

Even in the days of the more open X-37 program, certain sensitive design parameters were classified. And after NASA was forced to drop its end of the project because of budget pressures, the spacecraft became more of a “black” program under the X-37B name. The project was first transferred to the Defense Advanced Research Projects Agency (DARPA) and then to the Air Force’s Rapid Capabilities Office. Where the craft’s development ultimately wound up says much about the nature and urgency of its mission, because the latter office is tasked with expediting the process of developing and putting into the field select combat support and weapon systems. And to do so rapidly, as the name suggests (US Air Force, 2009).

From a purely technical standpoint, there appears to be not much difference in the basic engineering design between the X-37 and the X-37B. Here are some comparisons, all drawn from publicly available nonclassified documents: the X-37 was 27.5 feet long, whereas the X-37B is 29 feet 3 inches. The wingspans are respectively 15 feet and 14 feet 9 inches. The X-37 weighed slightly less (10,000 pounds) compared with the X-37B (11,000 pounds). The dimensions of the cylindrical experimental bay—7 feet long by 4 feet in diameter, or roughly the size of a pickup truck—are the same for both vehicles. Both craft were designed for a minimum on-orbit duration of approximately nine months, which the X-37B has already exceeded by a large margin (Boeing, 2015; NASA, 2003).

As for what the X-37B can do, the Air Force openly announced a list of technologies being tested. It includes advanced guidance, navigation, and control; thermal protection systems; high temperature structures and seals; lightweight electromechanical flight systems; and autonomous orbital flight, reentry, and landing. Officials also said that they anticipate that multiple missions will be required to satisfy all the test program objectives, with the exact number of missions yet to be determined (Badger, 2012).

Little is publicly known about the X-37B’s latest mission, or indeed any of its activities. The US Air Force launched the robotic plane on December 11, 2012 atop a United Launch Alliance Atlas 5 rocket from its Cape Canaveral base in Florida. The robotic craft returned to Earth on October 17, 2014, gliding to a stop on Runway 12 at Vandenberg Air Base in California. What it did during its 674 days in orbit is unknown, but it was aloft far longer than the 270 days planned.

There is no doubt that the military wants to continue to keep some parts of the mission secret, especially those that involve making a rendezvous with another craft, the ability to do in-orbit maneuvers to spy on other satellites, and the release or retrieval of micro satellites. These capabilities have already been demonstrated by the space shuttle, but not in a military setting. The handlers of the X-37B are likely doing them in secret to make sure the craft can do them reliably.

What we do know is that the X-37B’s payload bay is likely too small to carry large telescopes to conduct reconnaissance. And the National Reconnaissance Office (NRO) already has plenty of other assets to do that. (This little-known US government agency is responsible for designing, building, launching, and maintaining America’s spy satellites, which it has done for “customers” such as the CIA for over 50 years (National Reconnaissance Office, 2012).) But according to Jonathan McDowell, an astrophysicist at the Harvard-Smithsonian Astrophysical Observatory, the NRO may be involved with the X-37B in another way, most likely in testing new sensors in space. He thinks that this testing could be one of the reasons the last mission with X-37B was extended significantly—a particular sensor might have worked better than expected, he theorizes, and the people operating it wanted to collect as much test data as possible.

Admittedly, however, little hard information on this aspect of the mission has been made public, and so there is no way to make definitive statements. But the Air Force has shown that it is aggressively developing technologies for hypersonic travel to space, and that the X-37B is the lynchpin of those efforts. The Air Force is not shy about its interest in hypersonics and space at all; in discussing its budget for fiscal year 2015, the Under Secretary of the Air Force Eric Fanning said that it has spent over the past 16 years more than $100 billion in “cutting-edge space technologies” (Palacios, 2014).

It’s all about being hyper

So what exactly are the technologies the Air Force would like to develop? In his testimony before the House Armed Services Committee on March 26, 2014, the deputy assistant secretary for Science, Technology, and Engineering, David E. Walker, laid out some priorities. At the top of his list of what he called “game-changing technologies” was hypersonics (House Armed Services Committee, 2014).

Walker said that getting objects to travel at super-high speed provides options for engaging “time sensitive” targets in “anti-access/area-denial” environments. These are code words for counterterrorism operations, as well as for dealing with growing Chinese anti-ship missile capabilities that could pose a threat to the US Pacific naval fleet.

Walker also said that the Air Force is interested in developing a hypersonic cruise missile called the High Speed Strike Weapon (HSSW). For it to mature, several crucial technologies must be developed. Among them are materials that can withstand high temperatures; guidance, navigation, and control systems that work at hypersonic speeds; and thermal protection and heat management—the very same technologies being developed under the guise of the X-37B.

Hypersonic technology will be applicable to the so-called “tactical boost-glide” system for prompt long-range strike that the United States has begun testing. In that system, a booster rocket accelerates to speeds of Mach 5 or above and then launches a vehicle that glides over a long distance unpowered, reentering the atmosphere at hypersonic speeds. The United States wants to develop a missile system at the higher realms of the hypersonic that can strike anywhere on Earth in less than 90 minutes; a boost-glide vehicle is one possible method for doing so.

The advantages of such a system are many: Conventional bombs are dropped from aircraft moving, at best, between 700 miles per hour and 800 mph. Boost-glide systems, on the other hand, could cover long distances at speeds of up to 7,000 mph to surprise the adversary after a quick reentry. It is a highly destabilizing system: an adversary will have little notice, and minimal chance of establishing radar contact. And since boost-glide is a large part of what the X-37B does, it is a fair bet that there is some technology transfer going on.

Piggybacking research

In addition to the direct testing of boost-glide systems, the X-37B offers the Air Force a chance to test a whole gamut of hypersonic technologies. In a sense, the plane serves as an integrated test bed for all sorts of weapons that travel at hypersonic speeds—such as DARPA’s X-51 Waverider, a program in which an air-breathing missile known as the “scramjet” reportedly reached 5.1 Mach and touched the low end of the hypersonic world for several seconds. At such extreme airspeeds, the missile could reach any target in the world in an hour or less, a tremendous boon to strategists. This demonstration, if true, showed for the first time that a hypersonic missile was indeed feasible—and it could be a missile that did not need to carry the enormous weight of liquid oxygen needed for combustion.

So, even if the X-37B does not have scramjets, it is developing reentry technologies at hypersonic speeds. And obviously, combining the air-breathing supersonic propulsion system of the Waverider with what has been learned about reentry technology developed from the X-37B could help to develop an extremely fast boost-glide missile for prompt global strikes.2

Hypersonic propulsion and flight involve working out many problems at once: extreme airspeeds, temperatures, pressures, and stresses, along with compact airframes and low weight. Solving them all requires the latest new materials and advances in high-performance computing—but the key item is actual flight data from real-world tests. Such data are essential to verify results obtained from computer simulations, but it is very difficult to create such hypersonic test conditions in a laboratory. In this regard, the X-37B provides much-needed flight data which were not easily available from the space shuttle because crewed missions did not allow for a lot of risky experiments.

#### Reining in space weapons with hypersonic systems solve---prevents circulation of dual-use capabilities

Venkatasubbiah Siddhartha 17, Adjunct Faculty, International Strategic and Security Studies Programme, National Institute of Advanced Studies, Bengaluru, Spaceplanes, Hypersonic Platforms and the Missile Technology Control Regime, http://isssp.in/wp-content/uploads/2017/12/ISSSP-Report.pdf

In Space launch systems, there is -- besides the well-known manned Space Shuttle of the United States – the ongoing development in the US, as also in India, of reusable unmanned space vehicles. The orbital-delivery components of these vehicles are designed to re-enter the atmosphere at hypersonic speeds, and to survive that re-entry, intact, for refurbishment and re-use. The technologies that enable such survival can be utilised for the development of hypersonic boost-glide platforms for ordnance-delivery. Such enabling technologies are characterised as being ‘dual-useable’. Besides the United States, Russia and China, other nations possessing the applicable enabling technologies are also experimenting with, or evaluating, hypersonic boost-glide platforms for precision-delivery of military ordnance – conventional or potentially nuclear. India and other co-members of the Missile Technology Control Regime (MTCR), adopt a common approach to controlling the export from their territories of specified classes of missiles, and of missile-usable systems and technologies, so as to slow or stymie the development of missiles and Unmanned Ariel Vehicles (UAVs) by those countries which have to import critical technologies for the development of their own missiles or UAVs. India shares missile non-proliferation objectives and responsibilities with other members of the MTCR. It is in India’s foreign policy and geo-strategic interests to propose extension of MTCR to control over international trade in re-usable Space launch systems and their enabling dual-useable technologies. Specifically, India may propose to co-members inclusion of new entries in the MTCR Annex as detailed in the concluding section.

#### The *direct* effects of the plan would be to regulate individual components that contribute to offensive space weapons---means any technologies that could be used for hypersonic weapons would be affected

Pericles Gasparini Alves 00, PhD, University of Geneva, THE TRANSFER OF DUAL-USE OUTER SPACE TECHNOLOGIES: CONFRONTATION OR COOPERATION? http://www.unige.ch/cyberdocuments/theses2001/GaspariniP/these.pdf

For many years, EtSC States have controlled technology transfers based on their national legislations and the selective arrangements, in view of avoiding the development of ballistic missiles, military-grade satellites and ground related systems. These controls have been argued to have affected various key areas of outer space programmes; including raw material, components and their technologies, equipments and their technologies, as well as the flow of services and the development of cooperative ventures in general. In order to illustrate specific areas of control, Diagrams III.1.A through III.1.C and Tables III.1.20 though III.1.22 provide some examples where technology control can constitute a significant obstacle to the development of different components of space systems, which affect directly or indirectly entire programmes.

In the case of space launchers, control affects key areas related to liquid fuel precursors, manufacturing equipment and technology, stage separation and electronic components, telemetry, engines, and navigation systems—inertial platform and guidance equipment. Beyond these areas, restrictions are believed to affect services which, as in the case of equipment and technologies, could also be used for both civil and military purposes. Technology controls related to satellites occur in different areas as well. For example, military satellites are expected to be autonomous spacecraft and often need different highly sophisticated motors in order to propels and maintain them in Earth orbit for the longest period of time. One way of controlling the development of military spacecraft is therefore by restricting the transfer of satellite apogee motors which apply the same principle that are used in liquid rocket propulsion motors. Indeed, restrictions are covered by the same national laws and selective arrangements. So is the case of altitude control motors, that also function on the same principle of rocket motors.

Satellite instruments are also targeted by technology transfer controls. Military satellites are positioned in geostationary orbit to detect events and low Earth orbit military spacecraft are used to provide more detailed information. In addition, new satellites can be launched for dedicated missions in low orbit at around 110 km for a few days or weeks. CCD cells in these satellites are considered to be sensitive technology, where a special ceramic material sensor is attached to the CCD cameras. Denials which have occurred in this area tend also to affect civil-oriented programmes which use this type of camera for a variety of civil missions. Another area affected by control restrictions is satellite energy sources. All-weather satellites and radar technology need considerable energy constantly. This is one of the reasons why satellites are also powered with nuclear energy and solar panels. Some highly sophisticated technology used in military satellites indicate a 30 per cent performance in energy sources— notably in American military satellites, a much higher percentage than observed in current civil-purpose spacecraft—around 10 to 15 per cent. Solar panels becomes therefore one of the key technologies in controlling dual-use satellite systems and equipment. Other major restrictions cover geopositioning systems, which is used in satellites for altitude control.

Understanding the dual-use nature of tracking systems is also important in order to grasp the extent to which controlling key technologies is efficient to hamper developments in the civil space sector. For instance, inclination orbit satellites need more than one ground antenna installation to send or receive information between a satellite and its operator or user, while polar and geostationary orbits only one such installation. Detection and telecommand for orbital and mission correction are normal functions of satellite operations. However, dedicated military satellites (which need to be directed at different areas as the need arrises) might require more orbital changes than their civil-use counterpart, while orbital correction are made by both civil- and military-use spacecraft. In addition, military satellites also need to correct their orbital parameters more often, since they tend to change orbits more frequently than civil-use ones. Therefore, equipment and technology related to basic satellite altitude and orbital control, reaction speed, and cryptology functions find themselves under sone restrictions.

#### That’s the normal means process for weapons review---parts that lead to hypersonic space weapons would be restricted

Dr. Thompson Chengeta 17, LL.D, University of Pretoria, LL.M., Harvard Law School, LL.M., University of Pretoria, LL.B., MSU, ARE AUTONOMOUS WEAPON SYSTEMS THE SUBJECT OF ARTICLE OF ADDITIONAL PROTOCOL I TO THE GENEVA CONVENTIONS? https://jilp.law.ucdavis.edu/issues/Volume-23-1/Article%203%20-%20Chengeta.pdf

The US also expressly provides that even weapon systems must be subjected to a weapon review. 42 The US Department of Defense defines weapons systems as: [the] weapon itself and those components required for its operation, including new, advanced or emerging technologies which may lead to the development of weapons or weapon systems and which have significant legal and policy implications. [Weapon] systems are limited to those components or technologies having a direct injury or damaging effect on people or property (including all munitions and technologies such as projectiles, small arms, mines, explosives, and all other devices and technologies that are physically destructive or injury producing).

#### Restricting space launch systems solve---the same hardware and components are used for making hypersonic missiles

Richard H. Speier 17, Adjunct Staff with the RAND Corp. He received a Bachelor of Arts degree in Physics from Harvard College and a Ph.D. in Political Science from the Massachusetts Institute of Technology, Hypersonic Missile Nonproliferation: Hindering the Spread of a New Class of Weapons, https://www.rand.org/pubs/research\_reports/RR2137.html

Many (though not all) of the projects involving international partners claim to be for commercial, nonmilitary purposes. Such peaceful use assertions are frequent problems in nonproliferation policy. Nuclear nonproliferation policy must deal with the issue of “peaceful nuclear explosions”; missile nonproliferation policy must deal with the issue of “space launch vehicles.”22 Both involve hardware and technology that are interchangeable with the lethal items against which the policy is formulated. Similarly, many hypersonic technology programs may have a dualuse character. Such hardware and technology may eventually be used for space launch and civilian transport of passengers and cargo. However, similar technologies, and in some cases hardware, can contribute to hypersonic missiles. Furthermore, once a nation acquires hypersonic capabilities, its intentions can change. Technology once thought to be of use only to reduce the cost of space launches can be repurposed to create a deterrent effect against regional rivals or to increase the state’s prestige in the international community. Ultimately, unless a nation declares outright that it is seeking missile delivery vehicles for its military, there are limits to knowing how the program will end up. This is one of at least five challenges (discussed next) for controlling the proliferation of such capabilities.

#### Only trilateral export control solves---unilateral actions cannot prevent global hypersonic proliferation

Richard H. Speier 17, Adjunct Staff with the RAND Corp. He received a Bachelor of Arts degree in Physics from Harvard College and a Ph.D. in Political Science from the Massachusetts Institute of Technology, Hypersonic Missile Nonproliferation: Hindering the Spread of a New Class of Weapons, https://www.rand.org/pubs/research\_reports/RR2137.html

Unilateral actions against missile proliferation will have limited effectiveness without reinforcing actions by other key nations and be counterproductive if other major powers do not take similar actions. Russia or China can undercut U.S. restraint. For that reason, it is important to explore possible international measures. Multilateral Measures Negotiations and coordination with other governments take time, so it is worth asking how much time is available for hypersonic missile nonproliferation measures before the hardware and technology are too widespread to contain. It appears that there will be a decade or less during which hypersonic missiles and their enabling technologies will remain in the hands of a few key actors and will not become fielded. Although there are predictions that hypersonic missiles will be ready for military use in the 2017-to-2020 period, the history of such complex systems suggests otherwise. Given the rate at which governments move, now is the time to raise the possibility of the control of such systems with other governments. As the history of other nonproliferation regimes demonstrates, sooner is better than later. One occasional proposal for controlling hypersonic missiles is to negotiate either a global ban or a nonproliferation treaty to stop their spread. However, the history of technology bans negotiated between the current “haves” and the “have-nots” is not promising. Typically, the have-nots demand a price for their restraint—often in the form of access to civilian forms of the items to be banned. The NPT includes a provision agreeing to share the benefits of “peaceful nuclear explosions,” and proposals for a ballistic missile NPT typically include a provision to share space launch vehicle technology.4 One proposal is to initiate a test ban on hypersonic missiles among the United States, Russia, China, and perhaps France and India.5 However, all of these proposals for bans run up against the question of whether the United States, Russia, and China—now heavily invested in hypersonic developments—would give up the weapons. Without foreclosing the possibility of bans, this report will look at other options that do not require them. Another frequent suggestion for dealing with proliferation is to promote confidence-building measures. These measures are designed to reduce tensions by such means as preannouncement of tests or mutual observation of facilities. However, because they do not necessarily hinder the spread of the hardware and technology in question, their nonproliferation value is questionable. Yet another approach is to offer incentives to nations to abjure hypersonic missiles. These might be positive incentives such as offers of nonhypersonic military aid in return for hypersonic restraint. However, such an approach raises the classic problem that to pay a price for someone not to do something is to encourage that someone to find more objectionable activities not to do. There are also negative incentives, i.e., sanctions. However, sanctions generally require widespread support, and this requires widespread agreement that the particular instance of the sanctioned activity is sufficiently objectionable—a difficult standard to meet except in the cases of such rogue nations as Iran and North Korea.6 Shared defenses against hypersonic missiles are one form of positive incentive that might be considered. The National Defense Authorization Act of Fiscal Year 2017 call for examination of such defenses includes provisions for working jointly with other nations. However, as noted previously, the prospects are not clear for effective defenses against hypersonic missiles. Even shared warning of an impending hypersonic attack—perhaps relying on some form of satellite observation—would, if feasible, offer no more than a few additional minutes of reaction time. Multilateral export controls are international measures that have already been well tested. These require only the actions of the nations possessing the technology in question, not the have-not nations. As is detailed in Appendix C, hypersonic missile technology is exceedingly complex. For example, igniting a scramjet engine has been compared to lighting a match in a 5,000 km/hr wind. During flight, the shape of a hypersonic missile will change; so flight controls need to be adaptive to compensate for this effect. Propulsion (for HCMs), materials, thermal management, flight control, and testing are challenges even for the United States, Russia, and China. Consequently, for other nations, such hypersonic developments could be prohibitively difficult, without experienced foreign support. Because a number of regimes for technology export controls currently exist, there is a substantial body of experience to extend them to hypersonic missiles. We examine such an approach more deeply in the remainder of this chapter. Potential Export Controls The United States, Russia, and China are key players in any discussion about the control of hypersonic technology capabilities. No export controls against the spread of such capabilities can be effective unless at least these three nations support them. If one of the three chose to freely export hypersonic weapons, the restraint of the other two would be undercut. Some would add France and India to this group—and with France, its nonproliferation experience might give it an important role.7

#### Russia and China say yes

Richard H. Speier 17, Adjunct Staff with the RAND Corp. He received a Bachelor of Arts degree in Physics from Harvard College and a Ph.D. in Political Science from the Massachusetts Institute of Technology, Hypersonic Missile Nonproliferation: Hindering the Spread of a New Class of Weapons, https://www.rand.org/pubs/research\_reports/RR2137.html

What would be the attitudes of the three governments toward export controls on hypersonic weapons and their technology? Of course, it is impossible to know this with confidence without approaching them through diplomatic channels to obtain an official response. And such responses can vary from time to time depending on other aspects of the relationships of these governments. The authors met with subject-matter experts on these governments or in some cases officials of the governments. Those meeting with the authors were generally optimistic on the attitudes of the governments toward a nonproliferation policy. Without giving up current programs, the three might very well be disposed to try to prevent further proliferation.8 The maps in Figures 4.1–4.3 show some reasons why Russia and China might prefer to avoid a world in which hypersonic weapons were widely marketed. Both would face challenges to defend against Japanese hypersonic weapons—Russia at least in its far east and China in its most critical cities and infrastructure. The same Chinese cities and infrastructure would be vulnerable to intermediate-range Indian missiles. To these reasons, one could add the North Atlantic Treaty Organization (NATO) military threats to European Russia; a Poland able to purchase hypersonic missiles on the world market would be especially objectionable to Russia.