

**Modern Day Oppenheimer: How the Race to Mach 10 Can Result in a New Destroyer of  
Worlds- The Geopolitics of Hypersonics**

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On my honor as a University Student, I have neither given nor received unauthorized aid on this  
assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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## STS Research Paper

### Introduction

Upon returning home from work, or while sipping their morning coffee, millions of Americans turn to news channels and websites as a method to learn about current events and are immediately flooded with stories of violence, environmental destruction, and social/political turmoil. Today's news outlets are mainly covering the wars in Gaza and Ukraine, thus bringing many ethical debates regarding wartime to the forefront of many American minds. Just 5 years ago, the Department of Defense (DoD) listed hypersonics as a critical technology for development and effectively confirmed the existence of a new arms race between the United States and China (Weber, 2024). This established the key actors in the research and development (R&D) of hypersonics technology in a geopolitical context as the United States, the adversaries, and the technology itself. The United States and China each have their own motivations for R&D of hypersonic technology. The most pervasive of these motivations is geopolitics. While it appears that it would not directly affect the day to day of most citizens, the development of hypersonic technology has great power to change geopolitical dynamics as well as cause adverse environmental effects – both of which can easily influence social dynamics in our increasingly polarized political sphere (Pletzer et al., 2022) . Despite these issues, it is a socially- constructed necessity that this technology be developed in order to ensure the United States's continued status as a global superpower. It is important to understand that this thesis serves not to discuss hypersonic technology's importance to national security or to make a judgement regarding its morality, but to account for the adverse effects of its development. The research question posed is the following: how has geopolitics necessitated a race for hypersonic weapons?

## **Significance**

### *Significance of this work*

The purpose of this STS research is to display the geopolitics governing, associated with, and induced by the hypersonics arms race. The urgent importance of understanding this topic is highlighted most eloquently in Jerome Gavin's "Hypersonic Missiles: A New Arms Race" (Pandit, 2022). As geopolitics are affected by the war industry, the war industry is shaped by geopolitics. The article reports and elaborates upon a series of comments made by the commander of U.S. Northern Command and the North American Aerospace Defense Command. Navy Vice Adm. Jon A. Hill, director of the Missile Defense Agency, testified that countering hypersonic weapons is a challenge now and for the future. To strengthen this point, the commander, Gen. Glen D. VanHerck, testified "I believe the greatest risk for the United States stems from our inability to change at the pace required by the changing strategic environment." (Pandit, 2022). The pace of said environment is set by other countries, and the U.S is struggling to keep up due to technological and fiscal limitations. The race is on. This geopolitical dynamic is the main catalyst for the urgency behind developing hypersonic technologies, and thus the foundation for the social and environmental issues that come with it.

## **Methodology**

### *Approach*

The approach to answering this research question begins with a careful literature review of geopolitics associated with and induced by the hypersonic arms race. The current American socio-political sphere, not only following the COVID-19 Pandemic but also in response to the

war in Ukraine, is also to be extensively researched in order to provide a larger socio-political context to the R&D of this technology.

It is important to recognize the deontological origins of this topic. Deontology asserts that all actions should be guided by a sense of duty. Specifically, the intention behind the action is the most important thing to analyze. The *purpose* of this thesis is to educate engineers who want to work in hypersonics by providing a well-researched resource that focuses on social, geopolitical, and environmental implications of developing hypersonic technology. This idea was born from a deontological belief that as engineers we have a professional responsibility to know and understand the potential consequences of our work. Thus, this thesis is meant to serve as a well-researched guide for engineers interested in entering the field of hypersonics.

The race is on.

## **Literature Review and Discussion**

This section aims to provide a thorough literature review of topics pertaining to the geopolitical reasons for and impacts of developing hypersonic weapons. The literature review will begin with an analysis of how the COVID-19 Pandemic shaped the current sociopolitical sphere in America and then transition to an in-depth case study on the Russo-Ukrainian War. This case study will first provide a brief history of relations between the two nations that resulted in the current conflict and then discuss the use of hypersonic weapons in the war. It will conclude with investigations of American views on the parties involved in the war and the United States' place in global affairs. Following the case study, geopolitical relations between the United States and China will be outlined and discussed. The systemic, existential, and economic threats China poses to the United States will be discussed, thus completing the literature review.

*Setting the Stage: Political Realism, The Policy of Mutually Assured Destruction, and Historical Context*

A critical aspect of the United States' foreign relationships and position as a global superpower is their technical and militaristic advantage over other countries. While the development of weapons technology is a controversial issue among idealists and altruists, those who align themselves with the analytical framework of realism within foreign relations would argue that research and development of these technologies is required to ensure geopolitical stability by maintaining a balance of power. Several beliefs are associated with realism in international relations. Human nature is a starting point for classical political realism (Korab-Karpowicz, 2023). Realists view human beings as inherently egoistic and self-interested to the extent that self-interest overcomes moral principles. Realists, and especially today's neorealists, consider the absence of government, literally anarchy, to be the primary determinant of international political outcomes (Korab-Karpowicz, 2023). The lack of a common, rule-making and enforcing authority means, they argue, that the international arena is essentially a self-help system. Each state is responsible for its own survival and is free to define its own interests and to pursue power. Insofar as realists envision the world of states as anarchic, they likewise view security as a central issue (Korab-Karpowicz, 2023). To attain security, states try to increase their power and engage in power-balancing for the purpose of deterring potential aggressors. This point is, in a nutshell, the heart of the Policy of Mutually Assured Destruction.

Political realists view security as "if my gun is bigger than yours, you are not a threat to me. If your gun is bigger than mine, then I must build an even bigger one to be safe from you". This mentality has driven technological development for centuries, a notable example being the Cold

War. The Cold War was a period of geopolitical tension between the United States and the Soviet Union and their respective allies, the Western Bloc and the Eastern Bloc, that started in 1947 after the end of World War II and lasted to 1991 (Editor, 2024). The conflict was based on the ideological and geopolitical struggle for global influence by these two superpowers, following their roles as the Allies of World War II that led to victory against Nazi Germany and Imperial Japan in 1945. During World War II, atomic weapons were developed in the United States under the Manhattan Project and used against Imperial Japan to turn the tide of the war. Just four years after the end of WW2, the Soviet Union exploded an atomic bomb and began the nuclear arms race. While this famous arms race formally ended in 1991 with the collapse of the Soviet Union, it permanently changed geopolitics by placing an increased emphasis on technological advantage. This change, combined with other tensions, has led to the present-day race for hypersonics.

#### *Post- Covid America According to Scientific Studies*

The following section is included to provide the reader with an understanding of how the COVID-19 Pandemic caused sociopolitical changes in America that affect the race for hypersonic technology. It is meant to help preface a later section on the societal effects of hypersonic weapon development by providing ample context for the current sociopolitical sphere.

In March of 2020, the COVID-19 Pandemic caused a worldwide shutdown of everyday life. The hustle and bustle of American culture was brought to a sudden, screeching halt as people were confined to their homes for the better part of a year and a half. As one would expect, this caused multiple cultural, economic, and social shifts in American society, including its relationships

with government and mass media. One study shows public trust in the government at an all-time low post the COVID Pandemic (Bell, 2023), as shown in Figure 1.

#### Public trust in government near historic lows

*% who say they trust the government to do what is right, just about always/most of the time*

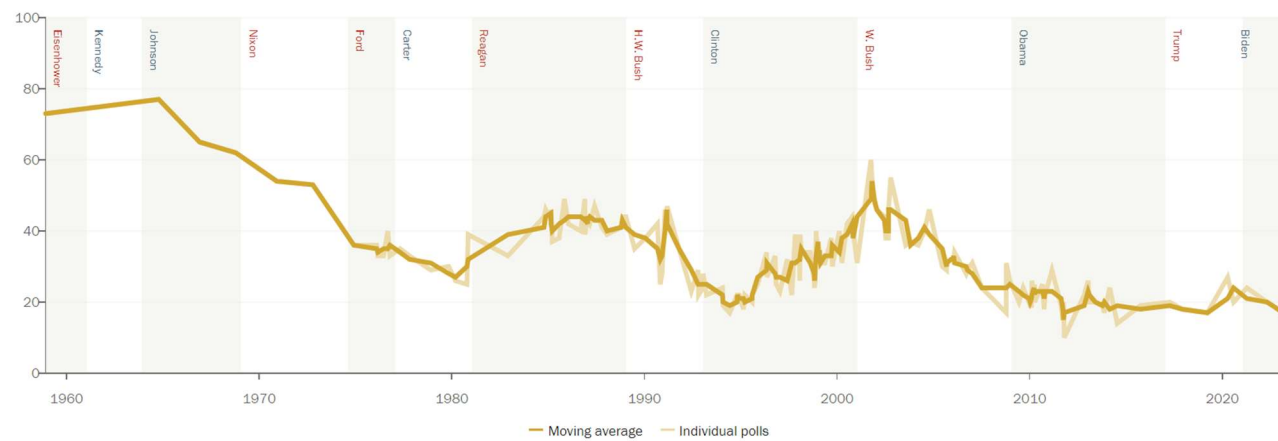


Figure 1: Public Trust in Government, 1959-2023

Another study conducted by the International Monetary Fund (IMF) found that trust in both governments and scientists is negatively affected by epidemic exposure. Importantly, however, not everyone's expressed and displayed level of trust is affected equally. They reported the largest effect of epidemic exposure is on trust among the young—more specifically, on young adults aged 18 to 25. Their work provided the first large-scale evidence on the effects of epidemics on political trust for individuals in their impressionable years and showed that adults who experienced the pandemic during their impressionable years have lower general trust in the government than those who experienced it in adolescence or in later adulthood.

Yet another study taken over the 50 year time period between 1972 and 2022, a tumultuous 50 years to say the least, shows that there has simultaneously been an increase in Americans who

don't trust mass media sources "at all" and a decrease in those who trust it a "great deal/ fair amount"(Brenan, 2023b).

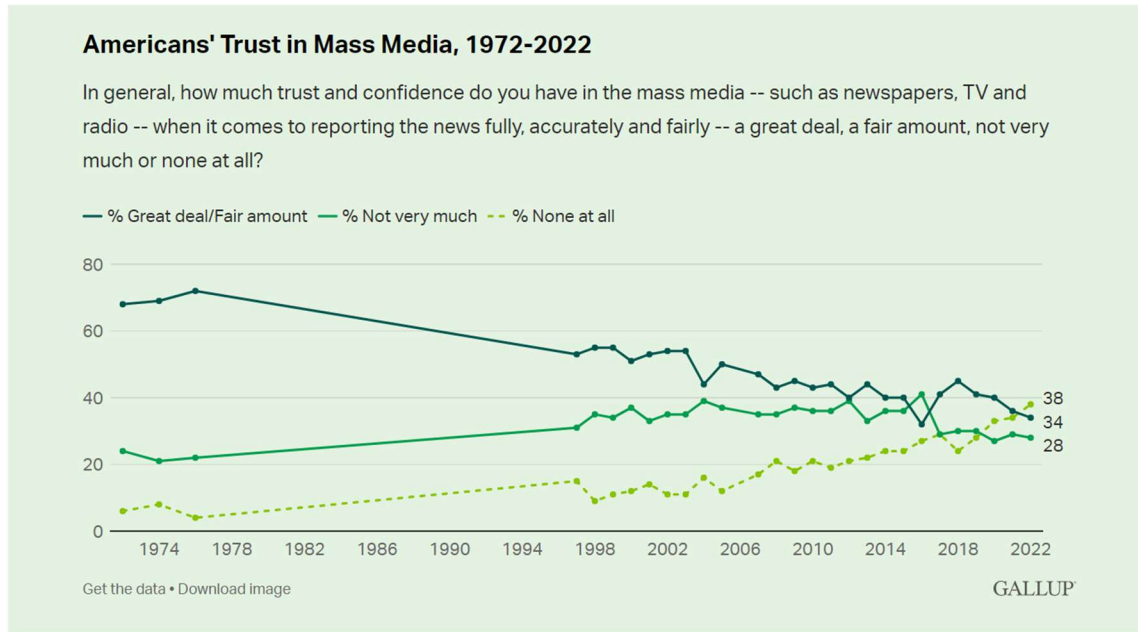


Figure 2: Public Trust in Mass Media, 1972-2022

Many Americans have asserted that the COVID-19 Pandemic had an almost entirely negative impact on society and politics during a 2021 study conducted by the Pew Research Center (Brenan, 2023b). Roughly one-quarter (26%) of responses pointed to the ways in which our government, political culture or society in general has seemingly degraded over the course of the pandemic. Some expressed frustration with the government's lackluster response to the spread of the disease, while others were baffled over financially ruinous lockdowns in response to what they view as an overhyped danger. Some expressed annoyance over mask-wearing requirements that they viewed as infringing on their personal freedom, while others were dismayed that their fellow Americans refused to respect their safety by wearing a facemask in public places. These



results illustrate deepening political divides and reduced public trust in government in the United States, both of which affect, albeit indirectly, the race for hypersonics.

In summary, the COVID-19 Pandemic caused a generalized decrease in trust in the government, deeper political division, and distrust in mass media. Thus, the current sociopolitical sphere of America is predisposed to further divisiveness and adversity to governmental control.

### *Case Study: Ukraine, Geopolitics, and Hypersonics*

On February 24, 2022, Russia invaded Ukraine and sparked a war between the two nations (Fitzgerald, 2024). Prior to the invasion, there had already been eight years of conflict in eastern Ukraine between Ukrainian Government forces and Russia-backed separatists. However, the story begins much earlier.

### *The History- How Geopolitical Relations between Russia and Ukraine Sparked the War*

In December of 1991, shortly after the fall of the Soviet Union, Ukraine became an independent nation (Fitzgerald, 2024). Just three years later, the Budapest Memorandum was signed following Ukraine's agreement to transfer all nuclear weapons from the Cold War to the Russian Federation, making Ukraine a non-nuclear power. In addition to Ukraine, the Budapest Memorandum was signed by the United States, the United Kingdom and Russia. All the signatories committed to honoring Ukraine's sovereignty and its rights to its territory (Fitzgerald, 2024). In early April of 2008, a NATO summit began with intense debate about extending a Membership Action Plan (MAP) to Ukraine. Russian President Vladimir Putin made his opposition to Ukrainian membership known to NATO leaders, at one point allegedly telling President George W. Bush that Ukraine is "not even a real nation-state." NATO did not offer

Ukraine a MAP. In 2013, President Yanukovych, who ran for president again and won in 2010, changed political direction and began to orient Ukraine toward Russia (Fitzgerald, 2024). There were protests across the country, centering on Maidan Square in Kyiv. At least 130 people, primarily civilians, were killed. Yanukovych fled to Russia and the new leadership committed to orienting Ukraine toward the European Union. Russia seized Crimea, a Ukrainian peninsula with a predominantly ethnic Russian population, in early 2014 during the aftermath of the Euromaidan protests. The annexation prompted international outrage and was condemned by the United States and European Union. In April of 2019, Volodymyr Zelenskyy, a former comedian, overwhelmingly defeated incumbent Petro Poroshenko in a presidential election. Early in 2021, Zelenskyy cracked down on pro-Russian Ukrainian oligarchs, including Viktor Medvedchuk, a close friend of Putin (Fitzgerald, 2024). Subsequently, Putin deploys increasing numbers of troops near the Ukrainian border and publishes an article claiming that Russians and Ukrainians are “one people.” By December, tens of thousands of Russian troops are deployed to the borders and Putin issues demands to NATO and the United States. Among these demands is that Ukraine never be admitted to NATO – a request rejected by the Biden administration. In February of 2022, Russia recognizes breakaway Ukrainian regions as sovereign. Days after recognizing the breakaway territories, Russia launched a full-scale invasion of Ukraine (Fitzgerald, 2024). The invasion began in the eastern Ukrainian territory of Donbas. Zelenskyy declared martial law in Ukraine and officially broke diplomatic ties with Russia. Putin’s actions were condemned across the world and within Russia. The war began and continues to this work’s publication in spring 2024. Over the past two years, a series of battles and political moves between Russia, Ukraine, and the United States, who stepped in to aid Ukraine early into the war, have occupied the news articles and the attention of invested nations all over the world.

*The Relevance: How Hypersonics Changed the Climate*

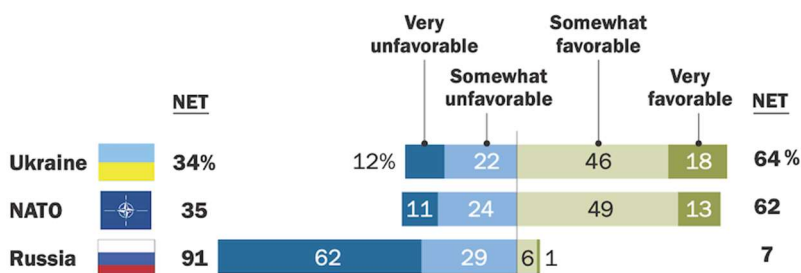
As of February 12th, 2024, a preliminary analysis concluded that Russia hit Kyiv the previous week with the hypersonic Zircon missile, its first use in the nearly two-year old war. Oleksandr Ruvyn, director of the Kyiv Scientific-Research Institute for Forensic Examinations, said on his Telegram channel that his institute completed a preliminary analysis of missile fragments from a Russian attack on Feb. 7 (Dysa, 2024). He included a video of alleged missile wreckage showing specific markings. "In this case, we see elements that are characteristic of the 3M22 Zircon missile. Parts and fragments of the engine and steering mechanisms have specific markings," he wrote. The Zircon has a range of 1,000 km (625 miles) and travels at nine times the speed of sound, according to Russia (Dysa, 2024). This presents a new challenge to Ukraine's air defenses- a challenge they cannot overcome without assistance. The United States has performed foundational research into the technological challenges of flying at hypersonic speeds since at least the 1950s but has not yet fielded such weapons for both scientific and policy reasons (Swagel, 2023). Hypersonic missiles are expensive, and there have been questions about the value of the capabilities they might provide. Achieving the desired performance for those weapons would require significant investment in additional research. Nevertheless, because of their potential, the U.S. military has established accelerated programs for hypersonic missiles, sharply increasing its support and funding, testing prototypes, and creating units in anticipation of fielding the weapons in the next few years. The Department of Defense has spent more than \$8 billion since 2019 on programs to develop hypersonic missiles in hopes of catching up to Russia and China (Swagel, 2023) - the motivations for which are discussed in a subsequent section.

### *The Response: How American Citizens are Reacting to the War*

In the midst of a major international conflict in Ukraine and an expansion of NATO in Europe, Americans have distinct opinions on the key players in the war. Majorities of U.S. adults have favorable views of Ukraine itself, as well as the North Atlantic Treaty Organization, and have confidence in Ukraine's leader, President Volodymyr Zelenskyy (Lippert, 2024). At the same time, few have positive opinions of Russia or confidence in its ruler, President Vladimir Putin. And a 64% majority view Russia as an enemy to the United States, rather than as a competitor or partner.

#### **Americans see NATO and Ukraine positively, but view Russia negatively and see it as an enemy of the U.S.**

% who have a \_\_\_ opinion of...



% who say Russia is a(n) \_\_\_ of the U.S.



Note: Those who did not answer not shown.

Source: Survey of U.S. adults conducted March 20-26, 2023. Q3e-f, h & Q49.

"Americans Hold Positive Feelings Toward NATO and Ukraine, See Russia as an Enemy"

PEW RESEARCH CENTER

Figure 3: American Views on NATO, Ukraine, and Russia

Over the past few years, there have also been shifts in how Americans view their place in the world (Lippert, 2024). A majority (55%) says that the U.S. should pay less attention to problems overseas and concentrate on problems at home, compared with 43% who say it's best for the future of the country to be active in world affairs. This represents a shift in opinion since 2021, before Russia invaded Ukraine, when 50% of Americans wanted to focus on domestic troubles and 49% wanted to be active in world affairs (Lippert, 2024). As is typical of American public opinion, there are partisan divides on many of the international issues surveyed. Democrats and independents who lean toward the Democratic Party are on balance more favorable toward Ukraine, NATO and key European leaders. Republicans and independents who lean toward the Republican Party are more likely to want to pay attention to domestic issues, rather than be active in foreign affairs, and are more inclined to say the U.S. should follow its own interests.

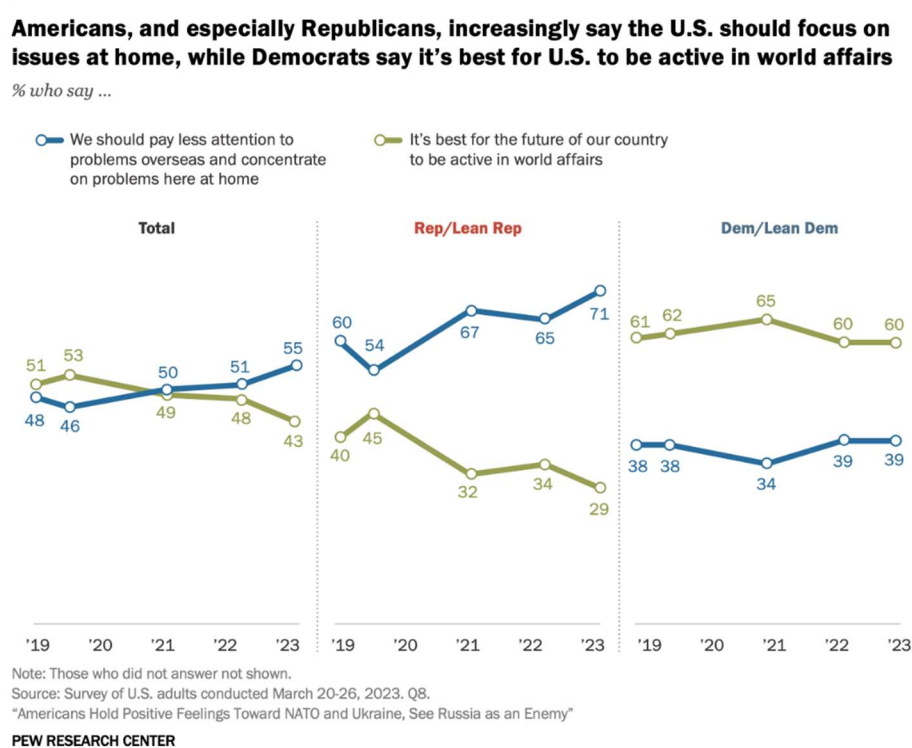


Figure 4: American Views on the United State's Place in Domestic and Foreign Interests

These statistics, as provided by the Pew Research Center, reflect a changing American opinion in our place in world affairs. Despite the fact the majority of Americans believe the U.S should focus on domestic issues, the bi-partisan nature of American politics has polarized the issue between democrat and republican affiliated citizens. This polarization is made more intense by lingering tensions from the COVID-19 pandemic and displays how domestic politics affect opinions on world affairs. Citizens are mostly saying the U.S should stay out of it, but geopolitics, as explained in the follow section, are demanding not only that we play the game but that we win.

And no one said anything about playing fair.

### *Geopolitics and Hypersonics*

#### *China, Russia, and the Hypersonic Arms Race*

Russia's repeated use of advanced hypersonic missiles as part of its bombardment of Ukraine may be getting the bulk of the West's attention, but United States defense officials say it is China that has the world's leading hypersonic arsenal (Loanes, 2023). The Defense Intelligence Agency's chief scientist for science and technology told U.S. lawmakers in March 2023, "While both China and Russia have conducted numerous successful tests of hypersonic weapons and have likely fielded operational systems, China is leading Russia in both supporting infrastructure and numbers of systems." A representative from the Defense Intelligence Agency (DIA), Paul Freisthler, testified in front of the House Armed Services Committee around the same time and stated that "Over the past two decades, China has dramatically advanced its development of conventional and nuclear-armed hypersonic missile technologies and capabilities through intense and focused investment, development, testing and deployment." Thus, despite the hypersonic

capabilities of Russia and the development of hypersonic programs in a number of other countries such as Australia, Iran, both North and South Korea, Brazil, Germany, Israel, India, and Japan, the increase in funding and tempo of the US program comes as a result of relations between the US and China being the worst they've been in decades (Loanes, 2023).

### *Geopolitical Relations with China*

Many U.S. and Chinese leaders have referred to the U.S.-China relationship as the most consequential bilateral relationship in the world. An article published by the Brookings Institution in early February of 2024 included research-backed opinion pieces by multiple authors regarding this assertion (Allison, et. al). Graham T. Allison argued the U.S.-China relationship is the consequential bilateral relationship in the world for the following reasons: China is

- 1) one of only two nations that poses an existential threat to the United States.
- 2) the only nation that poses a systemic threat to the U.S. position as the global leader, architect, and guardian of the post-World War II international order.
- 3) the second backbone of the world economy.

Allison's arguments serve as the framework for this section, which will be divided into three parts which correspond to the three points.

### *Existential Threat: Weapons Technology*

In 2024, there are two—and only two—nations in the world that have nuclear arsenals that can literally erase the United States from the map (Allison, et. al). Despite growing hypersonic weapons programs in a variety of countries including high-risk entities like North Korea, China has the most well supplied, extensively researched, and advanced hypersonic weapons program

in the world. China, therefore, poses a genuine existential threat—that is, one that threatens our existence—to the United States. It is one of only two nations, the other being Russia, with which the United States is required to survive in a relationship cold warriors described as MAD (mutually assured destruction)—a condition that creates an overriding shared imperative for both countries’ leaders to avoid a nuclear war in which their countries would be the first victims. This threat is heightened by the clear technological disadvantage of the United States and its poor relationship with China (Allison, et. al).

*Systemic Threat: New World Order*

China is the only nation that poses a systemic threat to the U.S. position as the global leader, architect, and guardian of the post-World War II international order. This systemic threat is perhaps the prominent concern of the U.S government regarding China; to put it plainly, their stick looks to about as large as ours – and we aren’t even sure we’re seeing all of it. With four times the U.S. population, an economy that has over the past generation soared to overtake the United States as the world’s largest in purchasing power parity terms, its role as most nations’ No. 1 trading partner, the world’s leading manufacturer, and a serious competitor in most advanced technologies (including artificial intelligence), China is the only nation that could displace the United States as the world’s leading power (Allison, et. al). China sees itself returning to what it believes is its rightful place at the center of the world—a position from which it was toppled two centuries ago when Westerners with technology arrived to imperialize and humiliate it. The United States is a colossal ruling power that created a remarkable international order in the aftermath of the deadliest war in history. That order has allowed us—and the world—to enter a historically unprecedented 79th year of a long peace—a period without great power war. This security and economic order has enabled more people to see greater



increases in their well-being than at any equivalent period in history. This international order includes the status of the U.S dollar as world's reserve currency. This status confers some benefits to the United States, including borrowing money abroad more easily and extending the reach of U.S. financial sanctions. China, as well as other emerging economies, have increasingly sought ways to conduct trade in non-dollar currencies, a process known as de-dollarization, especially given the fallout from the Russian invasion of Ukraine and the repercussions of the COVID-19 pandemic (Siripurapu, 2023). While it is unlikely the U.S dollar will be replaced as the world reserve currency anytime soon, the threat is enough to spur the U.S government into action. To protect the U.S's position, many are calling for us to build a bigger, better, very fast metal stick.

*Economic Threat: Second Backbone of the World Economy*

In the first half of the 20th century, America began to move away from industrialism and into consumerism, the hallmark of American culture today. It is common to see a "made in China" tag on pretty much everything these days, as China is the Manufacturing Workshop of the World. Their status as the #1 manufacturer of consumer products has made China the #1 trading partner of most countries in the world (including the European Union and Japan) and the main supplier of most critical items (including everything green and clean) in global supply chains (Editor, 2023). China's importance to economic and consumer stability was made most evident during the COVID-19 Pandemic. Economic shocks caused by the pandemic combined with shutdowns rapidly rotated consumer demand towards goods and away from in-person services. This collision of pandemic-induced supply shocks and strong demand for goods generated inflationary pressure across the global economy (Editor, 2023). As suppliers were unable to meet elevated demand, the true cost of highly efficient, but fragile global supply chains became clear.

China's position as essentially the sole manufacturer of consumer goods was one of the largest contributors to the supply chain issues that we are still seeing the ripple effects of years later. This highlighted for the United States, and the rest of the world, how imperative China has managed to make itself to the world economy. American culture has become so, well, consumed by consumerism that it is unlikely we will revert to industrialism to combat China's position, so the U.S government seeks to assure their dominance via other methods, namely defense.

## **Conclusion**

In March of 2020, the COVID-19 Pandemic began and politics, both domestic and global, changed. Public trust in government and mass media both plummeted as the chasm of U.S political division deepened. In February of 2022, Russia invaded Ukraine and began a multi-billion-dollar war that has changed American views on our place in global affairs. Russia's use of hypersonic weapons in the war with Ukraine has only highlighted the importance of their development. While it is never wise for the U.S to take their eyes off Russia, the existing reasons for the U.S's trepidation towards China- its existential, systemic, and economic threat- combined with rising tensions and our clear technological disadvantage have necessitated a new arms race.

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