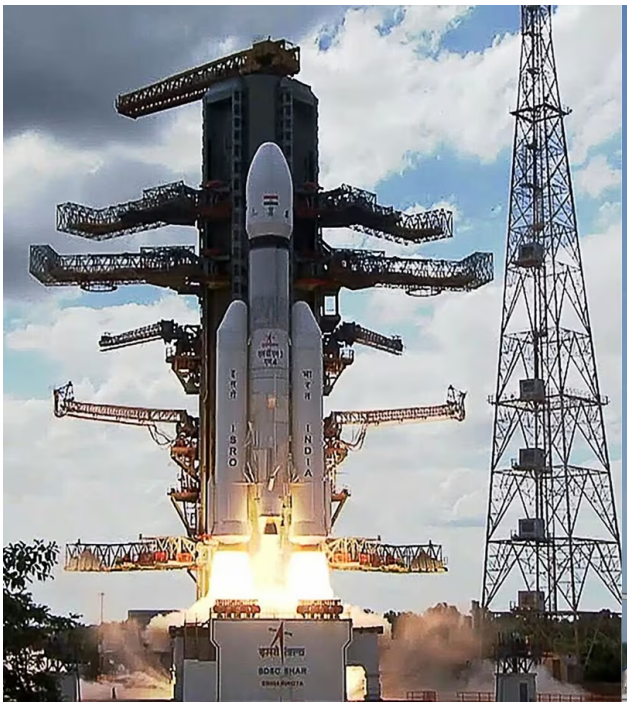
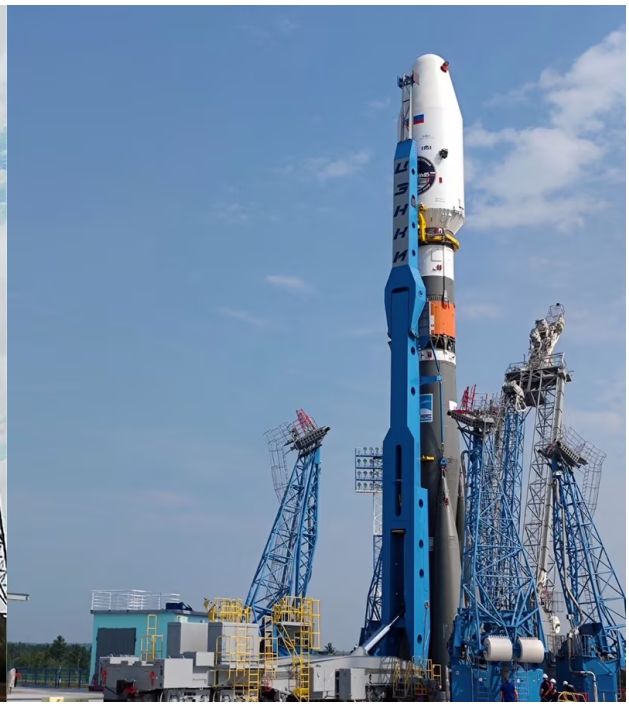
First Committee: DISEC
Background Guide

Georgia Tech Model United Nations

the 24th GTMUN
High School Conference
October 9th-10th, 2023





Topic 1
The Risks of a Modern Space Race

Introduction

Ever since the launch of Sputnik, space technology has been on the agendas of policy makers around the globe. The events that have characterized space history have been driven by the actions of bodies in efforts not to fall behind their adversaries. These tensions have led to "space races": phenomena defined as competitions between rivals to achieve superior spaceflight capability.[1]

When a "space race" is mentioned, it is usually in reference to the geopolitically-charged buildup between the United States and the Soviet Union during the 20th century, where each country strove to advance for reasons related to an ideological conflict - factors beyond national security.

[1] The Described and Captioned Media Program, "The Space Race"

During the 1970's this competition gave way to cooperation, and programs like the International Space Station furthered this attitude towards multilateral agreements.[2]

Of late, however, this paradigm has shifted, and humanity is on the precipice of a new space race. This has been marked by developments in many countries to expand their footprint in space technologically, territorially, and even militarily, but characteristics of the new space race have raised alarm bells in the minds of policy makers and private corporations alike.

Relevant risks center on two main areas: the economic and the militaristic. For decades, the United Nations' Outer Space Treaty has marked the general consensus on both of these areas, stating that space is not subject to claims of sovereignty and celestial bodies will only be used for peaceful purposes.[3] There is a discrepancy, however, between the words of this treaty and the recent actions of many nations, as seen below.

Economically, governments, institutes of higher education, and corporations have been interested in harnessing the potential industry of space. Bao Weimin, a Director of the Science and Technology Commission of the China Aerospace Science and Technology Corporation has suggested the formation of an "Earth-Moon Special Economic Zone", aiming to ensure China determines who benefits from lunar resources like lunar ice for fuel and rare metals for electronics.[4] These actions have long-term effects on international relationships between major world players, so the United Nations is paying special attention to affairs in this realm.

ASM-135 ASAT Anti-satelite missile

Militarily, governments are keeping pace with one another by establishing space forces, and various actors are proving their capabilities through displays of force. The United States, India, China, and Russia have all successfully tested anti-satellite missiles in the past two decades, and weaponry programs are developing in many of these countries.[5] An outer space arms race has many potentially devastating risks, and thus there has been discourse in recent DISEC sessions encouraging disarmament.[6]

[2] Royal Museums Greenwich, "Space Race Timeline"

[3] UNOOSA, "The Outer States Treaty"

[4] China Briefing, "China Proposes Establishing Moon-Based Special Economic Zone."

[5] Ban Ki-moon, "Global Strategy for Women's and Children's Health."

[6] UN Press, "We Have Not Passed the Point of No Return ... Battlefield"

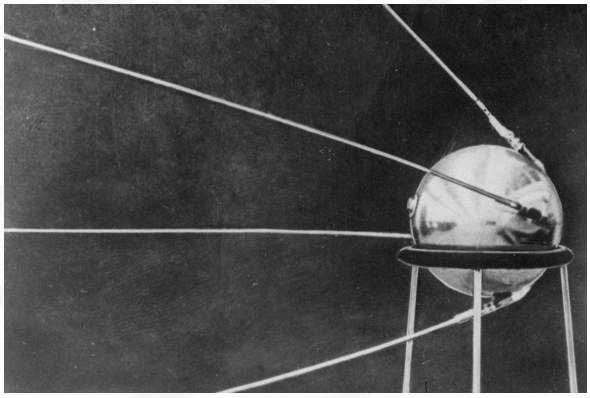
Outer space is a complex frontier that has sparked many governments, businesses, and research institutions to collaborate and compete to maneuver into an advantageous position considering the risks and opportunities present in the future of this area.

History

The history of actions that have brought humanity to the situation it finds itself in today is one with many twists, turns, and complex agreements. It can be characterized into three phases, the rise of space technology as it emerged from theory into reality, the famous space race that occurred in the background of the Cold War, and the time transitioning the end of the old space race and the beginning of the new.

Space technology began as a science purely theoretical in nature. Contributions from Newton, Euler, and Lagrange in the 18th and 19th century built a foundation of mathematics that allowed 20th century scientists to truly stand on the shoulders of giants. Tsiolkovsky's discovery of the rocket equation and Goddard's work in practical rocket propulsion engines finally put the pieces together for the famous space race to begin in the 1950's.[7, 8]

The USSR was behind some of the earliest practical advancements in outer space. Sputnik 1 was the first technology ever put into space in October 1957. In April 1961, Yuri Gagarin manned Vostok 1 and became the first human in space. The Soviet Luna 2 was the first probe to ever make impact with the surface of the moon, but then the United States' NASA program picked up speed.[9]



Sputnik 1tv

Apollo 8 took the first men to lunar orbit on Christmas Eve 1968, and by Summer 1969 Apollo 11 allowed Armstrong to take his small step (or giant leap). The next major event was one characterizing the shift towards cooperation, with the Apollo-Soyuz Test Project resulting in the 1975 space rendezvous and docking of an American and a Soviet crew, marking the practical end of this Cold War space race.[10]

[7] NASA, ""The Tyranny of the Rocket Equation"

[8] National Air and Space Museum ,"Robert Goddard and the First Liquid-Propellant Rocket."

[9] Royal Museums Greenwich,"Space Race Timeline"

[10] Royal Museums Greenwich,"Space Race Timeline"

The period from 1980's into the new millennium in outer space was characterized by two developments: space shuttles and space stations.

The premise of space shuttles, primarily the United States' program, was to develop reusable space technology.[11] This is still a crucial concept in space technology for today, because reusability allows for cost effectiveness, which in the spaceflight business is hard to find. The rise of the Soviet-Russian Buran shuttle program showed that even after the true end of the space race, actors still looked to obtain technological parity with their adversaries.[12]

The Space Shuttle "Endeavor"

Buran-Class "Buran"

The development of space stations mirrored the patterns we have seen with other technologies. The Soviet Union built the Mir modular space station in 1986 in an effort to produce a long-term research outpost in space, and they were largely successful, with Mir being deorbited in 2001. Midway though Mir's lifespan, in 1998, construction on the International Space Station began, driven by a coalition of space agencies including the American NASA. The International Space Station has been described as the most expensive item ever constructed, and has a planned deorbiting year of 2031, when by then it will have served as the enabler of unique experiments about topics from gravity to water purification for 31 years.

The most recent measurable pattern of development leading into the current situation is the marginal privatization of spaceflight. In the early 2000's the United States government forged partnerships with many private entities interested in developing space technology.[13] The 2000's and 2010's marked the time period in which familiar names like Virgin Galactic, Blue Origin, and SpaceX rose to prominence.

This series of events forms the essence of how space technology has advanced into its current situation, brimming with actors beyond just the Soviet Union and United States.

[11] Tim Sharp, "Space Shuttle: The First Reusable Spacecraft"

[12] Cathleen Lewis, "The Soviet Buran Shuttle: One Flight, Long History."

[13] The Washington Post, ""Linking NASA and the private sector to further space exploration.""

Current

The recent actions and statements of 5 specific actors in combination with various others on the relative periphery of the issue characterize the current situation of space technology, especially pertaining to a potential modern space race and its risks. These players include the United States, China, India, Japan, and private organizations.

The government of the United States and their space agency, NASA, are still an influential force in the realm of spaceflight, and especially space policy when it comes to any modern space race. In the resources NASA makes publically available, they recognize that as an organization they began to race a competitor, but they explicitly state that this is not what they will be doing going forward, rather pushing cooperation with various other actors. This is in contrast to the statements of General David Thompson,vice chief of space operations for the U.S. Space Force. In early 2022 he admitted that"We [the US] are absolutely in a strategic competition with China and space is a part of that".[14] The discrepancy in these two statements alongside the development of the American-led Artemis program to establish a permanent base on the moon and gateway to mars show that the United States will clearly be a strong player in any possible modern space race.

The Chinese Communist Party and their principle space actor, the CNSA, is one of the most active programs in the world when it comes to practical space actions like orbital launches. Chinese President Xi Jinping has made the nation's position clear: China's 'Space Dream' is to overtake all nations and become the leading space power by 2045.[15] China will not only be a player in the standard race objective to reach the moon and mars, but also in the referenced race to militarize space. In 2015 China established the PLASSF, 4 years before the United States developed the equivalent space force. Part of the Chinese national objective is to become the leading world power, so they will be a force to be reckoned with in an impending space race.

India as an actor and its ISRO agency have shifted their space related priorities to national security, another confirmation that an arms race in space will be an aspect of a modern space race. India maintains their stance that space should be a peaceful realm, in line with the Outer Space Treaty, however in the interests of their own national security they have tested anti-satellite missile capabilities (ASAT), following China's development of the same technology.[16] Although ASAT technology has never been deployed by one actor against another, this response by India can already be seen as an action in the early militaristic modern space race.

[14] Kelly Greico and Mercy Kuo,""The China-US Space Race Is a Myth.""

[15] CNBC,"China space goals sets up new frontier in the tech battle with the U.S."

[16] Rajeswari Rajagopala, "India's Space Priorities Are Shifting Toward National Security."

Japan is pushing an alternative policy with their agency, JAXA. In their 2008 Basic Space Law, they established a framework allowing private space companies to mine extraterrestrial resources.[17] This is coming to fruition in 2023, as a Japanese private space company, ispace plans to execute the first ever fully private lunar rover mission by April.[18]

This transitions into a discussion of many companies that will play a role in the private realm of the modern space race, nicknamed the billionaire space race. Elon Musk's SpaceX, Jeff Bezos' Blue Origin, and Richard Branson's Virgin Group are all competing for public partnerships, and their own niches to further space technology, and obviously make a profit.

SpaceX's Falcon Heavy

Any modern space race, whether in its militaristic, economic, or private facets, will probably center around some of these actors, and for this reason their current stances are notable to this organization. Importantly, however, all of these actions still take place around the leading international legislation on the issue - the Outer Space Treaty - which is still in effect.

The Chinese Communist Party and their principle space actor, the CNSA, is one of the most active programs in the world when it comes to practical space actions like orbital launches. Chinese President Xi Jinping has made the nation's position clear: China's 'Space Dream' is to overtake all nations and become the leading space power by 2045.[15] China will not only be a player in the standard race objective to reach the moon and mars, but also in the referenced race to militarize space. In 2015 China established the PLASSF, 4 years before the United States developed the equivalent space force. Part of the Chinese national objective is to become the leading world power, so they will be a force to be reckoned with in an impending space race.

[17] JAXA, "Basic Space Law"

[18] Forbes, "See The Historic First Ever Private Moon Landing As Japan's ispace Sends Rover To Lunar Surface."

Directives

As the Disarmament and International Security Committee of the United Nations General Assembly, your purpose is as follows:

- To establish general principles of cooperation in the maintenance of international peace and security, including the principles of governing disarmament and the regulation of armaments.
- To give recommendations with regard to such principles to the Members or the Security Council.

Considering the current situation of this topic in combination with the purpose of this committee, the following questions may guide your actions.

- How has your country played a role in the history of space technology? How does this inform its actions going forward, particularly in regard to a competitive buildup of resources?
- Leading up to present day, what actions has your nation taken to further the relevant goals of this committee pertaining to space technology?
- What actions do you propose this body takes in order to further the goals of this committee when it comes to this topic?
-

Considering the rules and regulations of this committee, please remember to keep your nation's history and positions in mind when creating blocs and writing papers.

Topic 2
The Ethics of Arms Sales During Conflict

Introduction

One key concept has surrounded the sale of arms during conflict throughout history: ubiquity. To put it simply, a research effort concluded that all 11 major arms exporting states have given weapons to sides actively in conflict in the 21st century, and 31 of 32 studied conflicts received weapons from major arms exporting states.[19]

The purpose of this committee can be found in its name: disarmament and security. As a body which works to promote these two concepts, it is important to study all aspects of this complex situation before arriving at a potential resolution.

It is crucial to understand the general structure of arms sales from exporting countries to truly

[19] Carnegie Corporation of New York,""Who Arms the World's Conflicts? | Scholarship & Policy.""

grasp the events that are presently taking place in this realm. This can be done by way of case study, a prototypical example being the role of the United States in Yemen.

US-backed Saudi airstrike during the Yemeni Civil War

American defense companies like Raytheon and Lockheed-Martin spend billions to lobby American politicians and make contributions to various campaigns. This is an action performed so that in return, the American politicians will promise exports to various countries in the throes of war. Regarding the example, the United States sold arms to Saudi Arabia, Egypt, Jordan, Bahrain, and the United Arab Emirates: all part of the coalition intervening in Yemen.[20]

In few words, the motivation behind the arming of sides in conflict by exporter countries is economic. The exporter governments make deals, the private corporations make money from the deals, and the governments receive portions of this money in return: the military-industrial complex.

Having understood the motivations that surround arms sales, the focus can shift to the ethics that arms sales are founded on. To this, the committee must turn to the United Nations Guiding Principles on Business and Human Rights. "The responsibility to respect human rights requires that business enterprises avoid causing or contributing to adverse human rights impacts through their own activities, and address such impacts when they occur".[21] This clause informs the stance of this committee.

The actors that fuel this arms trade have, in reference to the words from the UN principles, the responsibility to avoid contributing to the horrors of war that they currently promote through their practices.

The sixteenth United Nations Sustainable Development Goal pertains to the promotion of a peaceful society for sustainable development.[22] The current state of the arms trade in regard to its practices and the ethics behind them are not furthering this goal. Due to this, it is on the agenda of this committee to discuss methods in which the situation can be improved. Curbing the unethical arms trade can be curbed and promoting development in areas rife with conflict like Yemen will be two crucial objectives of any resolution.

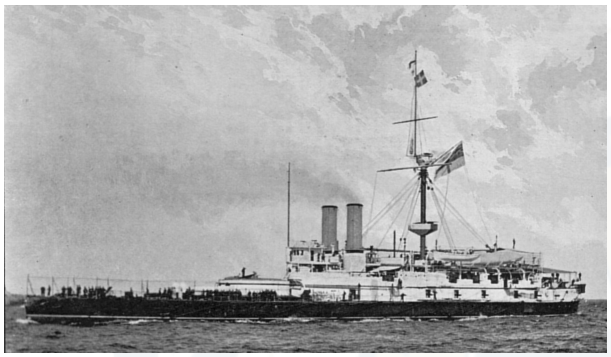
[20] Dan Auble,""Capitalizing on Conflict: How U.S. arm sales fuel the humanitarian crisis in Yemen."

[21] OHCHR,""GUIDING PRINCIPLES ON BUSINESS AND HUMAN RIGHTS."

[22] United Nations,"#Envision2030 Goal 16: Peace, Justice and Strong Institutions | United Nations Enable"

History

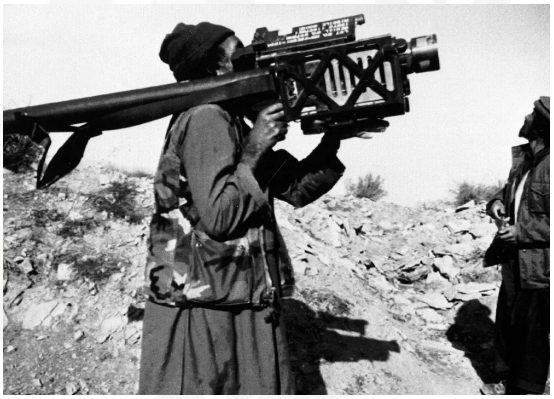
The history of the arms industry as it is relevant to today's situation started in the mid-19th century. During this time, the first military-industrial companies rose out of the presence of a shortage. Essentially, smaller industrializing countries could no longer produce the arms they needed from the resources they had, so there was a market for companies to pick up contracts to produce these arms.



HMS Victoria, the first battleship produced by Armstrong

An early example of arms trading occurred in the late 1800s. William Armstrong opened a shipbuilding factory, the only one at the time that could produce a battleship from start to finish.[23] Some of the warships his company produced were later under the possession of the Japanese Navy, and played a role in defeating the Russians in 1905.[24] A private British company sold arms to the Japanese, who used them to defeat the Russians, marking the continued formation of the arms trading patterns still seen today.

In 1885, the French noticed the economic potential of the arms trade and repealed their ban on weapons exports. Arms dealers then later played a massive role in supplying the sides of World War I, where they were regarded as "Merchants of Death" because in their business, more conflict means more money - the principle ethical challenge that has and will continue to provide the backdrop to this entire industry.[25]



Afghan Muhajadeens with American-made FIM-92 Stinger

As time progressed into the 20th century, governments started to exercise a larger responsibility in the regulation of arms dealing by the private corporations that worked inside and beyond their borders. Naturally, the arms industry started to become a political tool, especially during the Cold War in which the United States and the Soviet Union armed various sides in "Proxy Wars" in Korea, Vietnam, and Afghanistan.[26]

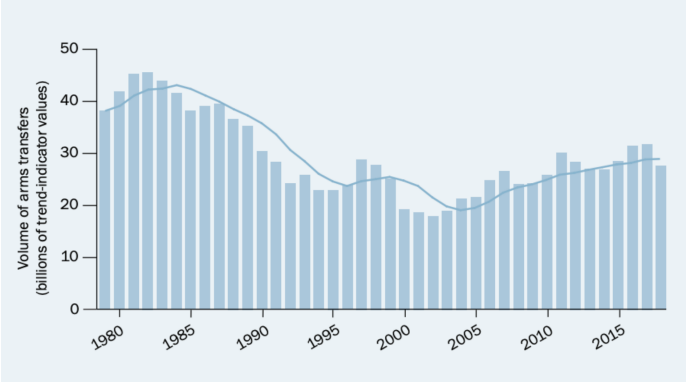
[23] St James' Heritage and Environment Group, "Armstrong Whitworth."

[24] Maritime Foundation, "William Armstrong – the magician of the north - Maritime Foundation."

[25] Lawrence White, "merchants of death - Political Dictionary."

[26] World101, "Eight "Hot Wars" During the Cold War."

Following the end of the Soviet-Afghan proxy war, the Berlin Wall fell, and the Cold War came to a close in 1991 with the dissolution of the Soviet Union as a whole. When examining the state of the arms trade after this data, a clear pattern emerges. From the end of the Cold War until 2000, the monetary value of global weapons exports decreased as a result of this period of relative peace. After 2000, however, the value increased again until, in 2016 the global arms trade once again exceeded the value it held at the end of the Cold War.[27]



SIPRI Arms Transfer Database, Mar 2019

This increase coinciding with the dawn of the new millennium can be attributed to a variety of factors, but they all follow the structure of the modern military-industrial complex previously explained.

As a concept, the fueling and in some cases prolonging of conflicts through the sales of arms for profit under the guise of assisting a noble cause has existed for many years. Throughout history, the actors, weapons, and causes have changed, but the motivations have remained relatively constant, still informing the foundations of this situation up to the present day.

Current

To understand the current situation of the arms industry on all levels, it is important to analyze the important actors on both sides of these transactions in addition to the recent actions of this committee.

When it comes to exporters, the United States simply dwarfs the rest of the world. The Stockholm International Peace Research Institute (SIPRI) is the organization of the most authority on this topic, and measures the exchange of arms in "Trend Indicator Values", a variable looking to quantify this inherently difficult-to-measure statistic. By millions of Trend Indicator Values, the United States exports nearly 5 times more weapons than the next largest exporter, France. After that the most developed nations of the world take their places, with Russia, China, Italy, Germany, and the United Kingdom all being major players in the industry, but simply nowhere close to the Americans.[28]

[27] World Economic Forum, "5 charts that reveal the state of the global arms trade."

[28] SIPRI, "SIPRI Arms Transfers Database."

The other half of the exporting side of this equation pertains to the private space of the military-industrial complex. Here again, the United States defense industry reigns largest. The five largest defense companies by income are all American. Only the Chinese Aviation Corporation Industry and the British BAE systems come close to familiar names like Northrop-Grumman, Boeing, and Lockheed-Martin.[29] It is clear to see that in both public and private aspects, the United States are the arms exporters of the world.

The global situation of arms importers is a space much more volatile, changing annually as conflicts do the same. Naturally, there are two characteristics that regularly play a role in the reasons countries import more weapons. The first factor is an actor's proximity to conflict, and the other is their industrial independence or lack thereof. Actors who are both located in volatile areas and do not have very strong industrial sectors are primed to import a large amount of weapons - for example, Kuwait, Israel, and Qatar.[30]

Having examined actors on both sides of arms industry transactions, it is important to form a complete picture, especially pertaining to the ethics of the situation, through understanding the actions of this committee and the United Nations as a whole.

The largest recent multilateral agreement passed regarding this issue is the Arms Trade Treaty, adopted by the United Nations in 2013.[31] It focuses on regulating the international trade of weapons in an effort to generally promote peace through transparency and cooperation between actors.

In 2021, the United Nations Security Council adopted Resolution 2616 to solidify their position against the illicit arms trade by encouraging member states to share information about possible flows in order to push targeted arms embargoes to protect human rights and promote security.[32]

[29] DefenseNews,"Top 100

[30] Global Economy,"Arms imports by country, around the world "

[31] UNRCPD,"Arms Trade Treaty"

[32] United Nations Digital Library System,""Resolution 2616 (2021) "

Directives

As the Disarmament and International Security Committee of the United Nations General Assembly, your purpose is as follows:

- To establish general principles of cooperation in the maintenance of international peace and security, including the principles of governing disarmament and the regulation of armaments.
- To give recommendations with regard to such principles to the Members or the Security Council.

Considering the current situation of this topic in combination with the purpose of this committee, the following questions may guide your actions.

- Is your nation an exporter or an importer of arms? How big of a role does it play in the nation's economy?
- Does your country have a notable private defense industry? How has your nation's private industry played a role in influencing public policy in the past?
- What conflicts is your nation currently involved in, whether directly or through supplying an actor?

Considering the rules and regulations of this committee, please remember to keep your nation's history and positions in mind when creating blocs and writing papers.

Work Cited

2008. Basic Space Law (Law No.43 of 2008). https://stage.tksc.jaxa.jp/spacelaw/country/japan/27A-1.E.pdf.

n.d. Top 100. Accessed May 10, 2023. https://people.defensenews.com/top-100/.

"Arms imports by country, around the world | TheGlobalEconomy.com." n.d. The Global Economy. Accessed May 10, 2023. https://www.theglobaleconomy.com/rankings/arms_imports/.

"Armstrong Whitworth." n.d. St James' Heritage and Environment Group. Accessed May 10, 2023. https://stjameschurchnewcastle.files.wordpress.com/2018/01/30-a4-pages-for-resource-pack-dec16-v4.pdf.

Auble, Dan. 2022."Capitalizing on Conflict: How U.S. arm sales fuel the humanitarian crisis in Yemen." OpenSecrets. https://www.opensecrets.org/news/reports/capitalizing-on-conflict/yemen-case-study.

Blatt, Talia M. 2020."Anti-Satellite Weapons and the Emerging Space Arms Race." Harvard International Review. https://hir.harvard.edu/anti-satellite-weapons-and-the-emerging-space-arms-race/.

"China Proposes Establishing Moon-Based Special Economic Zone." 2019. China Briefing. https://www.china-briefing.com/news/china-proposes-establishing-moon-based-special-economic-zone/.

"China space goals sets up new frontier in the tech battle with the U.S." 2021. CNBC. https://www.cnbc.com/2021/06/30/china-space-goals-ccp-100th-anniversary.html.

"Eight"Hot Wars" During the Cold War." n.d. World101. Accessed May 10, 2023. https://world101.cfr.org/how-world-works-and-sometimes-doesnt/conflict/eight-hot-wars-during-cold-war.

"#Envision2030 Goal 16: Peace, Justice and Strong Institutions | United Nations Enable." n.d. the United Nations. Accessed May 10, 2023. https://www.un.org/development/desa/disabilities/envision2030-goal16.html.

"5 charts that reveal the state of the global arms trade." 2019. The World Economic Forum. https://www.weforum.org/agenda/2019/03/5-charts-that-reveal-the-state-of-the-global-arms-trade/.

Work Cited

Grieco, Kelly A., and Mercy A. Kuo. 2022."The China-US Space Race Is a Myth." The Diplomat :: Asia. https://thediplomat.com/2022/01/the-china-us-space-race-is-a-myth/.

Guide, Step. n.d."Arms Trade Treaty - Office for Disarmament Affairs - Regional Centre for Peace and Disarmament in Asia and the Pacific." UNRCPD. Accessed May 10, 2023. https://www.unrcpd.org/conventional-weapons/arms-trade-treaty/.

"GUIDING PRINCIPLES ON BUSINESS AND HUMAN RIGHTS." n.d. ohchr. Accessed May 10, 2023. https://www.ohchr.org/sites/default/files/documents/publications/guidingprinciplesbusinesshr_en.pdf.

Lewis, Cathleen. n.d."The Soviet Buran Shuttle: One Flight, Long History." National Air and Space Museum. Accessed May 10, 2023. https://airandspace.si.edu/stories/editorial/soviet-buran-shuttle-one-flight-long-history.

"Linking NASA and the private sector to further space exploration." 2015. The Washington Post. https://www.washingtonpost.com/politics/federal_government/linking-nasa-and-the-private-sector-to-further-space-exploration/2015/01/22/d022b34e-a24b-11e4-9f89-561284a573f8_story.html.

"The Outer Space Treaty." n.d. UNOOSA. Accessed May 10, 2023. https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html.

Rajagopalan, Rajeswari P. 2022."India's Space Priorities Are Shifting Toward National Security." Carnegie Endowment for International Peace. https://carnegieendowment.org/2022/09/01/india-s-space-priorities-are-shifting-toward-national-security-pub-87809.

"Resolution 2616 (2021) /." 2021. United Nations Digital Library System. https://digitallibrary.un.org/record/3952180?ln=en.

"Robert Goddard and the First Liquid-Propellant Rocket." 2016. National Air and Space Museum. https://airandspace.si.edu/stories/editorial/robert-goddard-and-first-liquid-propellant-rocket.

Work Cited

"See The Historic First Ever Private Moon Landing As Japan's ispace Sends Rover To Lunar Surface." 2022. Forbes. https://www.forbes.com/sites/jamiecartereurope/2023/04/25/see-the-historic-first-ever-private-moon-landing-as-japans-ispace-sends-rover-to-lunar-surface/?sh=3b9a94ea27e9.

Sharp, Tim. 2021."Space Shuttle: The First Reusable Spacecraft." Space.com. https://www.space.com/16726-space-shuttle.html.
"SIPRI Arms Transfers Database." 2023. SIPRI. https://www.sipri.org/databases/armstransfers.

"The Space Race." n.d. The Described and Captioned Media Program. Accessed May 10, 2023. https://dcmp.org/media/16518-the-space-race.

"Space Race Timeline." n.d. Royal Museums Greenwich. Accessed May 10, 2023. https://www.rmg.co.uk/stories/topics/space-race-timeline.

"The Tyranny of the Rocket Equation." 2012. NASA. https://www.nasa.gov/mission_pages/station/expeditions/expedition30/tryanny.html.

"'We Have Not Passed the Point of No Return', Disarmament Committee Told, Weighing Chance Outer Space Could Become Next Battlefield | UN Press." 2022. UN Press. https://press.un.org/en/2022/gadis3698.doc.htm.

White, Lawrence C. n.d."merchants of death - Political Dictionary." Political Dictionary -. Accessed May 10, 2023. https://politicaldictionary.com/words/merchants-of-death/.

"Who Arms the World's Conflicts? | Scholarship & Policy." n.d. Carnegie Corporation of New York. Accessed May 10, 2023. https://www.carnegie.org/our-work/article/who-arms-the-worlds-conflicts/.

"William Armstrong – the magician of the north - Maritime Foundation." 2021. The Maritime Foundation. https://www.maritimefoundation.uk/publications/maritime-2021/william-armstrong-the-magician-of-the-north/.