Project 3 - Military Equipment

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Github Repo: https://github.com/m6urns/project3-equipment
Presentation:https://docs.google.com/presentation/d/1oSwjNQ4d6dcz07clE2jlK3e2gb81K8nNvAsduJNeN20/edit?usp=sharing

Introduction

This project provides an analysis of military equipment data focusing on Ukraine and Russia, with a broader assessment of military capabilities from various countries. The data was collected from a Wikipedia page that lists countries by their military equipment levels, Oryx, which documents equipment losses during the ongoing conflict between Ukraine and Russia and the IISS Military Balance 2021 Report which provides a detailed breakdown of military dispositions and equipment specifications across global forces. The goal of the analysis is to compare military capabilities, visualize equipment statistics, and assess the impact of the conflict on both nations' military resources. By evaluating the types of equipment that have been lost or are in use, the analysis can help the U.S. The Department of Defense and other stakeholders identify which assets have been most effective and where future equipment donations might be strategically focused.

Dataset

We compiled and utilized data from three sources for this analysis. These sources were from Wikipedia for our big picture analysis of carriers, submarines, and military satellites. We also utilized this data for a comparison of the relative military strengths of Russia and Ukraine. The data sourced from Wikipedia is from 2016, and represents estimates of military budgets, and equipment dispositions. The second dataset that we scraped for in-depth analysis of equipment losses for Ukraine and Russia was from Oryx. This data represents a list of equipment losses for both sides in the Ukraine conflict from early 2022 onwards, each piece of equipment includes a publicly sourced image of the loss for confirmation. To enable us to utilize this data to make meaningful decisions regarding the strengths of BMP-1 versus BMP-2 AFVs we utilized data sourced from the IISS Military Balance 2022 report, a well regarded academic source for military dispositions.

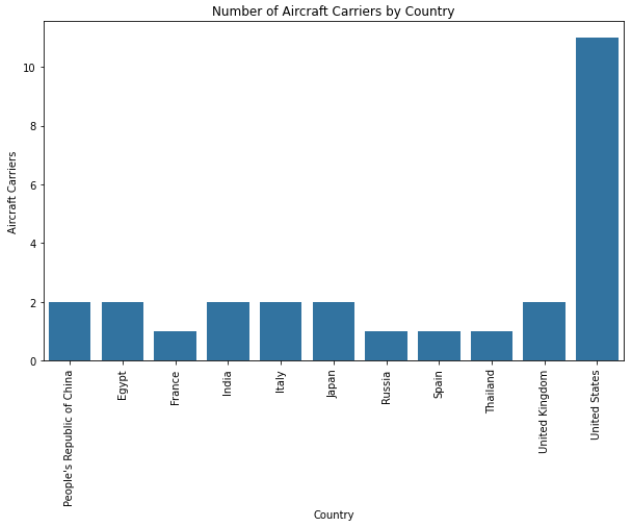
Analysis Technique

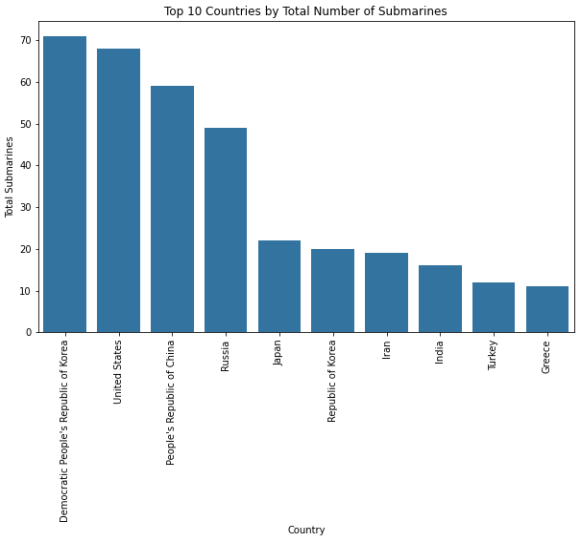
For the analysis of military equipment used around the globe and in Ukraine and Russia, we scraped three websites full of relevant information. We started analyzing the military power of countries all around the globe, comparing their corresponding equipment with other countries

and why some countries focused in particular on certain technologies. Wanting to dive deeper into a relevant topic we focused on the war in Ukraine involving large amounts of military equipment. Historical data of the losses of BMP's, a commonly used Soviet amphibious tracked infantry fighting vehicle were portrayed in a plot over time to see which country suffered more losses. Then looking to put in perspective these losses we utilized a final source to provide a baseline to perform statistical analysis on BMP losses for Ukraine and Russia. We used a T test for difference in means to perform this analysis.

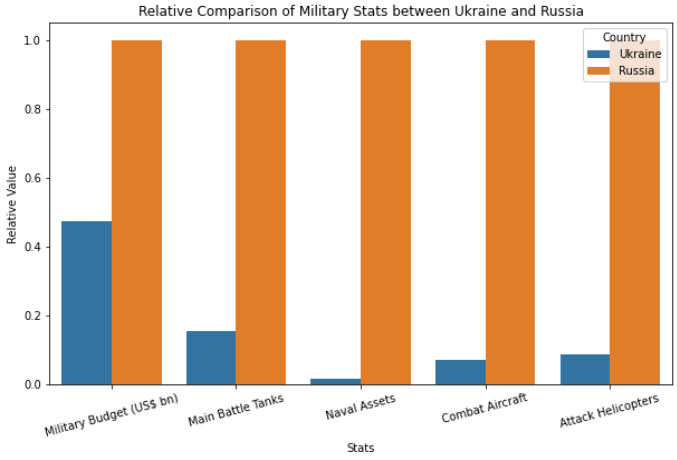
Results

Initial results utilizing military equipment used across the globe shows the US absolutely dominating in the field of aircraft carriers, especially when taking into account that many of the other aircraft carriers operated by other countries are "mini carriers" and can only launch and land helicopters. Looking at the number of submarines by country showed the expected large numbers used by China, United States and Russia, however the country that topped them all was North Korea. After some digging into how North Korea could host such a large fleet of submarines from a considerably smaller defense budget, we realized that none of the submarines were nuclear and are incapable of common functionalities that makes the submarines obsolete other than for spying. Some sources also state that some of the submarines may not even be seaworthy due to their incredibly old age.



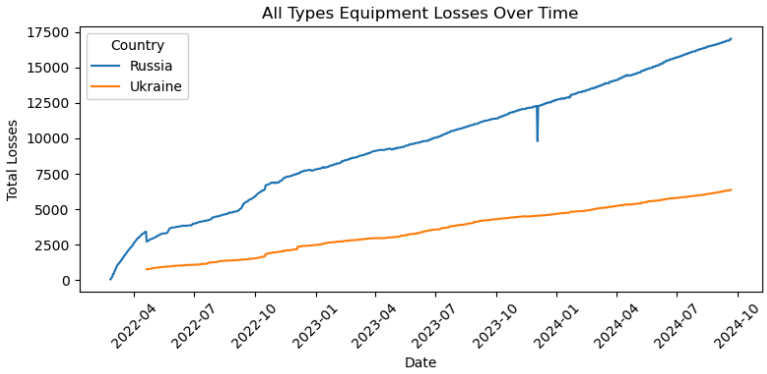


Looking deeper into the Ukraine-Russia war, we analyzed the capabilities of the two countries before the war in February 2022 began.The charts point out a very large difference in equipment levels for many of the formal sections of the military and no comparison for many other sections in which Ukraine had no equipment to even compare to Russia. This makes sense due



to Russia's status as a global hegemon. Surprisingly however, Ukraines defense budget was only half of Russias which is significantly higher than we originally predicted due to Russia being such a large military power.

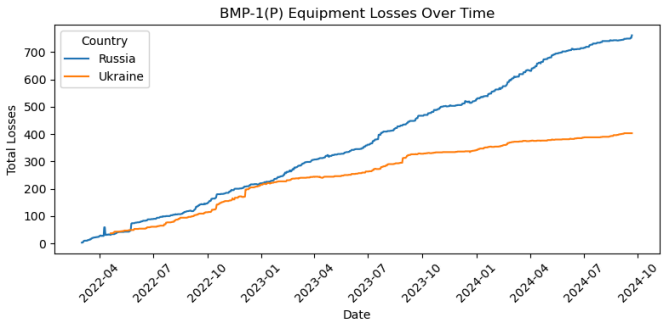
Utilizing the Oryx dataset we decided to further examine equipment attrition in the current Russia-Ukraine conflict. Our goal in this analysis was to determine whether differences in tactics or systems would have a discernible impact on attrition rates. We first examined the collected data visually, to determine whether there was an apparent visual difference in equipment attrition.

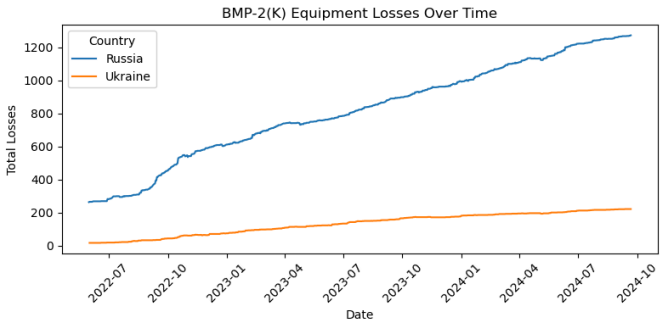


Examining this data for all types of equipment made it apparent that there was a difference in the amount of equipment attrited during the current conflict. To gain greater insight into differences in equipment quality and tactics we needed to determine what types of equipment both sides were using, and in significant enough amounts for the losses to be meaningful. To do this we extracted a table of the equipment that both Ukraine and Russia utilize, and that have more than 100 reported losses. We also consulted the 2022 IISS Military Balance report for data on equipment stocks at the beginning of the war.

Equipment Type	Confirmed Losses	2021 Stocks RU	2021 Stocks UKR
BMP-1(P)	878	450	213
BMP-2(K)	1093	2900	890
122mm 2S1 Gvozdika	227	150	292

Filtering for this set of equipment yielded three results, we anticipated more than this, but this may be because of the relatively low number of shared core systems for Ukraine. We determined that two of these platforms would be most interesting to compare, the BMP-1 and the BMP-2, both armored infantry fighting vehicles, which have had extensive use in the current conflict. To begin our comparison of these two systems we first plotted the losses of each platform across the duration of the conflict.





Both of these plots made it clear that at least visually the losses for Russia were much greater. This made sense given the prevailing paradigm of offensive/defensive operations. Most interesting however was the divergence in overall losses for BMP-1 losses beginning in December 2022 to January 2023. This may reflect a change in battlefield dynamic, the Kherson offensive began in the Fall of 2022, and put Russia on a defensive. A similar trend can be seen in the losses to BMP-2 stocks. In both however, losses continued to diverge even as the offensive ended. We theorize that this may be a result of new aggressive tactics introduced by Russia at this time.

We lastly wanted to determine whether there was a significant difference in the losses for these two platforms, both differences between countries, and within the platforms themselves. We utilized the 2021 IISS stocks as a basis for this analysis, and compared total losses for both counties and platforms until September 22nd, 2024. Performing this analysis provided us with a number of interesting insights.

There was a significant difference in losses between the BMP-1 and the BMP-2 platforms (T-statistic: 10.45, P-value: 0.009). Meaning that the BMP-1 was significantly more likely to be lost in combat than the BMP-2. This is a valuable insight as far as operator safety, as it can be assumed that a large number of these losses would have also resulted in loss of the operators. We also analyzed the difference in losses between Ukraine and Russia for both of these platforms and found that there was not a significant difference between country loss rate for these systems (T-statistic: 0.005, P-value: 0.997). We also were able to draw some conclusions regarding the accuracy of IISS data, and determined that the number of BMP-1 systems was significantly underestimated in 2021. This is probably because of the reactivation of systems that had been previously put into storage. This information could be important to take into consideration in future conflicts, accounting for even deactivated systems could provide a more comprehensive estimate of the force that a country can bring to bear in the event of an existential conflict.

Technical

Looking first at the Wikipedia data, we had to concatenate separated floating point values, remove null fields, remove additional citations that were represented as data points and slice for only the necessary country data. After preparing the rest of the data in a double array where each first array was a country and the second array was all of the information associated with that country. Utilizing this format, we were able to show comparative levels of aircraft carriers, submarines and military satellites. Choosing to focus more on the Ukraine-Russia war, we isolated the Russian and Ukrainian data and compared the relative military capabilities of each.

The Oryx data was scraped using a combination of BS4 and requests Python libraries. We also made use of the Web Archive API to determine what versions of the Oryx sites were available in the archive. We then scrapped the last available daily version of the BS4 web page for that day's data. Because of the duration of this scraping, and the size of the scraped individual datasets, we saved these into separate daily CSV files. Lastly to streamline the import process

for using our scraped data we compiled all of the daily information into a single CSV file. This file was loaded for all of our analysis of Oryx data. For both Wikipedia data and Oryx data we utilized Seaborn for data visualization. For statistical testing of our data we utilized the stats package for T testing.