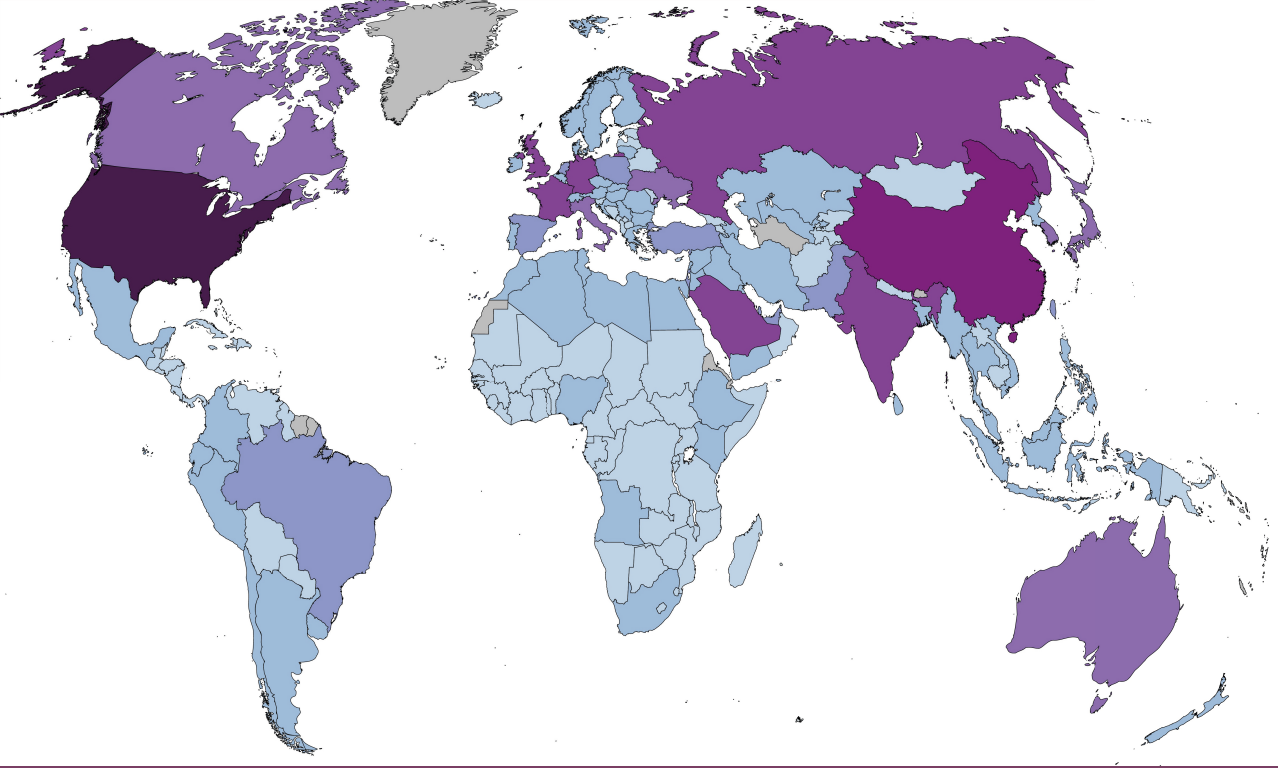

Defence Economic Outlook 2023

An Assessment of Military Strength among Major Global Powers 2000-2030

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Summary

This study assesses and compares the military strength of major global powers, in terms of military expenditure, military equipment and economic resources.

Currently, in 2022, the US has a clear military advantage over near peer rivals and invests significant resources to maintain its lead. However, during the past two decades, China has steadily narrowed the military gap. Since 2000, China's military spending has more than quadrupled, enabling a rapid and comprehensive modernisation of its armed forces. Russia also invested heavily towards military modernisation during this period, but has incurred heavy losses during its invasion of Ukraine. India has increased its military spending during the past two decades, becoming the world's fourth-largest spender. Military expenditure in Western Europe has also increased markedly in recent years.

The US will continue to enjoy an overall military advantage in 2030. However, China seems to be on track to become the world's largest economy around the same time, which will likely further decrease the US-China gap in military strength. European countries plan to strengthen their militaries, but it remains to be seen whether the ambitious goals can be realised. Meanwhile, Russia will likely need to replace much of its lost equipment, while facing severe sanctions.

Keywords: Defence economics, great power rivalry, military expenditure, military equipment

Sammanfattning

Denna studie bedömer och jämför militära styrkeförhållanden mellan globala stormakter, i termer av militära utgifter, militär utrustning och ekonomiska resurser.

I dagsläget, år 2022, har USA ett tydligt militärt övertag gentemot närliggande rivaler och investerar betydande resurser för att behålla sin ledning. Under det senaste två decennierna har dock Kina stadigt minskat det militära gapet. Sedan 2000 har Kinas militära utgifter mer än fyrdubblats, vilket har möjliggjort en snabb och omfattande modernisering av dess väpnade styrkor. Ryssland allokerade också mycket resurser till militär modernisering under denna period, men har ådragit sig stora förluster under invasionen av Ukraina. Indien har ökat sina militära utgifter under det senaste två decennierna, till världens fjärde högsta. Militära utgifter i Västeuropa har också vuxit markant de senaste åren.

USA kommer att fortsätta att inneha ett övergripande militärt övertag 2030. Kina förefaller dock vara på väg att bli världens största ekonomi vid samma tid, vilket sannolikt kommer att minska gapet mellan USA och Kinas militära styrka ytterligare. Europiska länder planerar att stärka sina militärer, men det återstår att se om de ambitiösa målsättningarna kan förverkligas. Ryssland kommer sannolikt att behöva ersätta mycket av sin förlorade utrustning, samtidigt som landet står inför svåra ekonomiska sanktioner.

Nyckelord: Försvarsekonomi, stormaktsrivalitet, militära utgifter, militär materiel

Preface

The Swedish Defence Research Agency (FOI) has a long-established tradition of conducting research regarding military expenditure, including global military expenditure, the Swedish defence expenditure, and research concerning defence specific purchasing power. The recurring reports of the Defence Economic Outlook series provide an assessment of the global military strength of major global powers, such as the US, China, India, Russia and large Western European countries, in terms of military expenditure, and equipment quantities and quality. This issue covers the trends involving these aspects in the period between 2000 and 2022, as well as an assessment of future trends until 2030.

The report is written on behalf of the Swedish Ministry of Defence, within the Defence Economics and Materiel Supply Project. The project and the author would like to express their sincerest gratitude and appreciation to Lucie Béraud-Sudreau (SIPRI), who reviewed this report, and Richard Langlais, who reviewed its language.

Maria Ädel (FOI)
Project Manager, Defence Economics and Materiel Supply
Stockholm, 16 May 2023

Abbreviations

APC	Armoured personnel carrier
APFSDS	Armour-piercing fin-stabilised discarding sabot
ASM	Anti-ship missile
ASW	Anti-submarine warfare
E4	The UK, France, Germany and Italy
FOI	Swedish Defence Research Agency
FREMM	European multi-mission frigates
FTI	*Frégates de taille intermediare*, French
GDP	Gross domestic product
HP	Horsepower
IISS	International Institute for Strategic Studies
IFV	Infantry fighting vehicle
IMF	International Monetary Fund
LCS	Littoral Combat Ship
MBT	Main battle tank
MER	Market exchange rate
MLRS	Multiple launch rocket system
NATO	North Atlantic Treaty Organization
NBC	Nuclear, biological, chemical
OECD	Organisation for Economic Co-operation and Development
PPP	Purchasing power parity
RHAe	Rolled-homogenous-armour equivalents
SAM	Surface-to-air missile
SIPRI	Stockholm International Peace Research Institute
SSBN	Ballistic missile submarine
SSK	Nuclear-powered attack submarine
SSN	Diesel-electric-powered attack submarine
TT	Torpedo tube
USD	United States dollar

Contents

1 Introduction

The aim of this report is to assess and compare the military strength of major global powers, including the US, China, Russia, India as well as the Western European powers of the UK, France, Germany and Italy. This comparative analysis includes the aspects of military expenditure and economic resources, as well as the quantities and quality of military equipment. The relevant timeframe is the current situation, with a consideration of the major trends between 2000 and 2022. The report also provides a broad assessment of future trends, from 2023 to 2030, among the same major powers.

This report is the fourth edition of the recurring Defence Economic Outlook (DEO) series,[1] published by the Swedish Defence Research Agency (FOI). While DEO 2016 focused on input measures, such as military expenditure and gross domestic product, DEO 2018 added the aspect of military equipment quantities. DEO 2020 took an additional step by assessing indicators of military equipment quality and future trends. It also added data collected by FOI on naval tonnage, estimates of future economic output and future quantities of navy equipment. The 2023 edition closely follows the 2020 format, but apart from updating data and assessments, it also adds India to the list of included major global powers.

The DEO report series adds to the work of the Stockholm Peace Research Institute (SIPRI) and the International Institute for Strategic Studies (IISS) by including complementary measures such as naval tonnage, purchasing power parity (PPP), equipment quality and future estimates. Although far from providing a complete comparative analysis of global military strengths, taken together the included aspects should provide a nuanced assessment of general international trends in military and defence economic strength.

The DEO report series is also part of a larger project at FOI, which aims to develop the methods included in the series and to complement existing databases, by compiling open-source data. The project also involves developing tools for assessing military equipment performance or quality.[2] Furthermore, it includes studies related to defence-specific purchasing power,[3] as well as country-specific or regional defence economic studies.

[1] Previous reports in the series include Olsson, Per; Dahl, Alma & Junerfält, Tobias (2020) *Defence Economic Outlook 2020 – An Assessment of the Global Power Balance 2010–2030*, Olsson, Per; Alozious, Juuko & Ädel, Maria (2018) *Defence Economic Outlook 2018 – Global Outlook with a Focus on the European Defence Industry*, Olsson, Per & Bäckström, Peter (2016) *Defence Economic Outlook 2016 – Global Outlook with a Focus on the Baltic Sea*.

[2] See, e.g., Olsson, Per (2022) "Measuring Quality of Military Equipment," *Defence and Peace Economics*.

[3] See, e.g., Ädel, Maria; Johnson, Andreas & Junerfält, Tobias (2022) *Dealing with Defence-specific Purchasing Power – A Discussion and Further Development on Current Methodology*.

2 Methodology

In the context of international relations, military strength can be used by a given country as a mean of achieving its political goals, either through the use of force, coercion, or as deterrence. In this report, military strength is assessed through, and limited to, factors that are measurable.

However, this limited definition of military strength needs to be separated from the broader concept of military capability, which includes factors such as training, morale, or geostrategic context, neither of which can be easily quantified. This means that the measures included only illustrate military strength from a limited number of perspectives, and do not tell us about the ability of a given country to prevail in every, or any, type of conflict.

2.1 Method and Data

The methodology of this report closely follows the 2020 edition in the DEO series, which was in turn developed on the basis of previous DEO reports, from 2018 and 2016. Similar to those previous DEO reports, this study assesses military strength in terms of military expenditure, military equipment quantities and equipment quality. It also outlines trends in gross domestic product (GDP), which serves to illustrate the economic resources available for building military strength.

The data on military expenditure, GDP, and military equipment quantities have been collected from well-established data sources. The data on indicators of equipment quality, naval tonnage and future quantities of navy equipment are obtained from various open sources and compiled into databases at FOI. In this report, these data are referred to collectively by the designation “FOI”.

As mentioned in the introduction, this report focuses on the major global powers of the US, China, Russia, India and the four largest military spenders in Europe (the UK, France, Germany and Italy), hereafter referred to as the E4.

Military Expenditure

Military expenditure measures the amount of resources that a given country allocates towards military defence and defence-related items. While military expenditure should not be equated with military strength, it is a prerequisite for building that strength. As such, military expenditure provides an important aspect when assessing and comparing the military strength of major global powers.

The data on military expenditure have been collected from the *SIPRI Military Expenditure Database*.[4] It is worth noting that SIPRI’s definition of military expenditure not only includes direct expenditure on armed forces, but also indirect military

[4] SIPRI (2023a) *SIPRI Military Expenditure Database*.

spending, such as paramilitary forces, military space activities and military pensions, as well as research and development.[5] In the SIPRI database, a few countries have missing data for recent years. When this issue occurs, the latest known data point for such countries are used to calculate the world total.[6]

Military expenditure is often indicated in USD, expressed in terms of market exchange rate (MER). This includes the data from SIPRI. The use of USD does raise some issues, however. First of all, MERs tend to fluctuate on a yearly basis, depending on the relative value of local currencies versus the USD. Secondly, MER does not account for differences in purchasing power. Generally, the amount of goods and services that can be bought for a certain amount of USD varies between countries. Usually, a given amount of USD can buy larger amounts of goods and services in lower-income countries compared to high-income countries. This phenomenon may also be of relevance when discussing and comparing military expenditure. The use of purchasing power parity (PPP) aims to address these issues by comparing prices of constructed "baskets" of comparable goods and services, thereby adjusting for exchange rate fluctuations and differences in prices between countries. PPPs can be especially valid when comparing high- and low-income countries, which have large domestic defence industries. The data on PPPs have been collected from the Organisation for Economic Co-operation and Development (OECD).[7]

However, using PPP estimates in the context of military expenditure does not come without its own issues. Military spending includes several expenditure types, both in terms of manpower and equipment, which are specific to defence and unlikely to be reflected in the general PPP measures adapted to compare GDP. Consequently, general PPP is unlikely to be directly transferable to military expenditure without first adjusting for these likely differences.[8] Instead, defence-specific PPPs would ideally be used to adjust military expenditure for differences in purchasing power. Attempts have been made to develop such estimates and the continued development of this work should be of great interest to this report series.[9] However, since these defence-specific PPPs are still in in their developmental stage, they are not used in this report; instead, general PPP values are relied on.

This study does not mean to suggest that PPP is preferable to MER as a method of estimating military expenditure. However, adjustments for PPP do address some

[5] For a more detailed description of SIPRI's definition, see SIPRI (2023b) *SIPRI Military Expenditure Database: Sources and Methods*. (Accessed 25 April 2023).
[6] Tian, Nan, et al. (2023) seem to use a similar method of calculation, given the world total provided by *Trends in World Military Expenditure, 2022*.
[7] OECD (2023a) *Purchasing power parities (PPP)*. (Accessed 25 April 2023).
[8] For a discussion of the potential benefits and problems with using PPPs for estimating military expenditure, see, e.g., SIPRI (2023c) *Frequently Asked Questions* – 12. (Accessed 25 April 2023).
[9] See, e.g., Robertson, Peter E. (2021) "The Real Military Balance: International Comparisons of Defense Spending", *The Review of Income and Wealth*. FOI has also conducted research regarding defence-specific PPP, see Ädel, et al. (2022) *Dealing with Defence-specific Purchasing Power – A Discussion and Further Development on Current Methodology*.

of the issues with MER, thereby providing an alternative approach to quantifying military spending. Therefore, differences in purchasing power between countries should at least be included as part of the discussion.

Economic Resources

The economic resources available to major powers are of interest to this study as they help underpin military spending. Similarly to previous DEO reports, these economic resources are expressed in terms of GDP.[10] The data on GDP between 2000 and 2021 have been collected from the World Bank,[11] while GDP data for 2022 and 2023 have been collected from the International Monetary Fund (IMF).[12]

In this report, GDP is generally expressed in terms of MER. However, PPP-adjusted GDP is used as a point of comparison, similarly to military expenditure and using the same OECD data. However, even in the context of GDP, for which the general PPP estimates have been adapted, PPPs still entail some issues. The exact content of the "baskets" of goods and services on which PPP estimates are based, may vary somewhat between countries, as could the relative value of included goods and services. In other words, it can be difficult to find perfectly comparable "baskets". Consequently, PPPs could risk either over- or underestimating a given country's purchasing power. Nevertheless, given the issues associated with MER discussed above, PPP estimates of GDP are used here to provide a complementary perspective on the economic resources available to the major world powers.

Military Equipment Quantities

In addition to military expenditure, military equipment quantities offer a complementary aspect when assessing and comparing military strengths between major global powers. For navy equipment, this report lists the numbers of surface combatants, including aircraft carriers, amphibious assault ships, cruisers, destroyers, frigates and corvettes, as well as nuclear and conventional submarines. These vessel types often perform different roles and can vary greatly in size. Therefore, to assess fleet sizes, total naval tonnage is used as an alternative measure. For army equipment, the numbers of main battle tanks, infantry fighting vehicles and armoured personnel carriers, as well as artillery pieces and multiple launch rocket systems, are included. For air forces, the numbers of combat aircraft, transport and tanker aircraft, as well as bombers, are listed.

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[10] Apart from the general observation that economic size and military expenditure tend to correlate over time and between countries, several studies show a statistically significant and positive correlation between the development of GDP and military expenditure, even when controlling for other factors; see, e.g., George, Justin et al. (2019) "Asia-Pacific Demand for Military Expenditure: Spatial Panel and SUR Estimates", *Defence and Peace Economics*, 30:4 and Douch, Mohamed & Solomon, Binyam (2014) "Middle Powers and the Demand for Military Expenditure", *Defence and Peace Economics*, 25:6. In these studies, GDP or gross domestic income are often used as control variables.

[11] World Bank (2023a) *GDP Constant 2015 US$*. (Accessed 25 April 2023).

[12] IMF (2023b) *World Economic Outlook Database*. (Accessed 25 April 2023).

The data on military equipment quantities in this report have been collected from various volumes of *The Military Balance*, published by the International Institute for Strategic Studies (IISS).[13] The report includes equipment classified as being "in active service". However, it should be noted that the IISS definition, "in active service," generally does not account for availability. This implies that the numbers of platforms available for operational use are likely lower than the quantities presented below. The data concerning naval tonnage have been compiled from various open sources, referred to here as "FOI".[14] For further details on this report's classification system and the assumptions used regarding military equipment quantities, see Appendix C.

Military Equipment Quality

The assessment of military equipment quality presented here contains an initial categorisation according to modernity, where the included types of navy, army and air force equipment are classified as either modern, intermediate, or legacy. Though some variation occurs, the basis for this classification generally corresponds to the age or generation of a given system. However, this only serves to distinguish between older and newer equipment: the quality of modern equipment may also vary significantly between countries. Therefore, the initial broad categorisation is complemented by outlining a series of quality indicators for key equipment classified as modern within each service branch, in this report; surface combatants, main battle tanks and combat aircraft.

For navy surface combatants, performance indicators include the number of missiles, maximum range and top speed for both surface-to-air missiles (SAMs) and anti-ship missiles (ASMs). Furthermore, the numbers of torpedoes and helicopters carried are also included as broad indicators of anti-submarine warfare (ASW) capabilities.[15] Army main battle tank performance is assessed through the indicators of firepower, protection and mobility.[16] Meanwhile, air force combat aircraft performance is assessed through the speed and range of the aircraft as well as its number of hard points, that is, the attachment locations of, for example, missiles, bombs, or additional fuel tanks, on the structure of a military aircraft.[17]

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[13] IISS (2023) *The Military Balance 2023*, IISS (2015) *The Military Balance 2015*, IISS (2010) *The Military Balance 2010*, IISS (2005) *The Military Balance 2005*, and IISS (2000) *The Military Balance 2000*.

[14] US tonnage has been obtained from the Naval Registry (nvr.navy.mil); Russian tonnage mainly from Russianships (russianships.info); and French, German, UK and Italian tonnage from their respective official government, or navy homepages. Chinese tonnage has been obtained from international institutes, such as Janes, IISS or news outlets such as Navaltechnology.com and Military-today.com.

[15] For a discussion regarding estimates of surface combatant performance, see, e.g., Arena, Mark V. et al. (2006) *A Macroscopic Examination of the Trends in U.S. Naval Ship Costs Over the Past Several Decades.*

[16] For a more detailed discussion regarding estimates of main battle tank performance, see, e.g., Olsson, Per (2022) "Measuring Quality of Military Equipment", *Defence and Peace Economics*.

[17] For a more detailed discussion regarding estimates of combat aircraft performance, see, e.g., Horowitz, Stanley A. et al. (2016) "Inflation adjustments for defence acquisition", *Defence and Peace Economics*.

The data on these performance, or quality, indicators have been collected from a wide range of open sources.[18] Focusing as it does on this limited number of variables, this report does not claim to offer any detailed assessment of the complex issue that is presented by estimating military equipment quality. However, it does give some indications of the differences in equipment performance between the major global powers. For further details on the methods, data and assumptions regarding equipment quality, see Appendix D.[19]

Future Trends

This report's assessments of future trends are based on a number of methods and a wide range of open-source data.

As mentioned above, the GDP data for 2000 to 2021 have been obtained from the World Bank, while estimated growth rates for 2022 to 2028 have been collected from the International Monetary Fund (IMF).[20] The use of two separate sources was necessary in order to construct a continuous time series denoted in constant 2015 USD, i.e., adjusted for inflation. By combining the real GDP levels from the World Bank with the real growth rates from the IMF, a time series from 2000 to 2028 was constructed. However, the timeframe of this report goes beyond 2028. In order to present estimates of future trends in GDP, the average annual growth rates of the previous ten was used, provided by IMF for 2019–2028. These growth rates were then prolonged, with some minor adjustments, to serve as rough estimates of future macroeconomic trends between 2029 and 2035.[21]

Trends in future military expenditure depend both on the economic resources of a country, i.e. its GDP, and the political priority it gives to military expenditure, represented by military expenditure as share of GDP. While only a tentative assessment can be made concerning the first factor, the second would at best be highly speculative. Therefore, this report does not provide any assessment of future military expenditure. However, future military spending is discussed under the assumption that military expenditure as share of GDP will remain the same in 2030 as in 2022.

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[18] For surface combatants, the numbers of missiles, torpedoes and helicopters were obtained from IISS (2023) *The Military Balance 2023*, and complemented by information on missile ranges and speeds collected from other institutes, such as CSIS, or online sources, such as Seaforces.org, Navaltechnology.com, Navyrecognition.com, and Armyrecognition.com. Main battle tank performance data were obtained from US Training and Doctrine Command (2014) *Worldwide Equipment Guide 2014*, Vol. 1, as well as Steelbeast.com. Aircraft generations, numbers of hardpoints, range and speed, were obtained from online sources, such as Military-today.com, Aircraft-technology.com, and manufacturer data.

[19] Other methods for assessing military equipment quality include evaluations by procurement agencies, scenario-based evaluations, or simulations performed by operation analysts, as well as rankings determined by expert assessments. For an example of studies utilising the latter method, see Middleton, Andrew et al. (2006) "The Effect of Defence R&D on Military Equipment Quality," *Defence and Peace Economics*.

[20] IMF (2023b) *World Economic Outlook Database*. (Accessed 25 April 2023).

[21] IMF (2023c) *Real GDP growth (Annual percent change)*. (Accessed 25 April 2023).

The assessment of future quantities of military equipment in this report is limited to naval vessels. This is solely due to data availability, because ship and submarine hulls are usually constructed several years before being commissioned into active service and data on vessels in various stages of construction are often obtainable through open sources. In this study, surface combatants and submarines launched by the beginning of 2023 are assumed to have been taken into active service by 2025. Ships and submarines laid down, or officially planned, are assumed to having been commissioned by 2030.[22] These estimates have also been complemented by reasonable assumptions about future naval quantities.

It is far more difficult to obtain data on the overall larger volumes of army and air force equipment, which unlike ship hulls are often built indoors and are consequently more difficult to observe and estimate. Future quantities of army and air force equipment are discussed, rather than estimated.

Future trends in equipment quality are also limited to being discussed, rather than quantified. This is due to the significant uncertainties and secrecy regarding the performance of future equipment. Assessments based on open sources, such as those only involving discussions, can only be speculative at best and in this report are therefore limited to a few known systems. A detailed description of the data and assumptions on future trends are presented and explained in Appendix E.

2.2 Delimitations

The aim of this report is to assess and compare the military strength of major global powers between 2000 and 2030. This focus means that other forms of power, apart from military strength and the economic resources underpinning that strength, are beyond the scope of this study. The assessment of economic resources focuses on GDP, but does not explore economic power further, which means that this report does not examine topics of geoeconomics, such as financial and technological power, nor power through trade and investment.[23] Furthermore, it neither assesses economic productivity, investment in research, or the technological level of a given country; nor does it address issues related to soft power through cultural influence or popular perception.[24]

The DEO report series focuses on major powers by comparing military strength and economic resources. This may be construed as an invitation to deterministic thinking and the conclusion that great-power rivalry will eventually lead to conflict, armed or otherwise. However, political relationships and priorities may

[22] Data on future naval equipment have been obtained from a range of open sources, such as Janes, The-Diplomat.com, Navaltechnology.com, Defensenews.com, and Navyrecognition.com.
[23] For FOI studies on geoeconomics, see, e.g., Johnson, Andreas & Junerfält, Tobias (2023) *Början till slutet för dollarns dominans?* FOI-R--5432--SE [SWE].
[24] For a global ranking of soft power, see, e.g., McClory, Jonathan (2018) *The Soft Power 30 – A Global Ranking of Soft Power 2018*.

change quickly and rivalry between major world powers does not make armed conflict unavoidable.[25] Nor does it exclude cooperation in areas where the interests of major powers align, such as in combating climate change or global poverty. Great-power rivalry does mean, however, that the continuation of international tensions remains a reality and that in this context it is important to have an informed picture of the global military power balance.

The report series also limits its analysis to seeing states as the main driving actors. This focus excludes the roles of international organisations and non-state actors on the global stage. Furthermore, the focus on the major global powers limits the analysis to the US, China, Russia, India and the E4, which risks missing the combined power of regional partnerships, or clusters of smaller countries, such as the Visegrad, or the Nordic, countries.[26]

The definition of Europe as a major global power varies in this report. While generally referring to Western Europe, the exact selection of countries included varies depending on which factor is being analysed. When discussing GDP and the available economic resources compared to those of other powers, the Eurozone represents Europe, as it is arguably the region's main economic block. However, when military expenditure and equipment are assessed here, the focus is on the four largest military spenders in Europe, the E4. These are Europe's key military powers, in a group that includes the UK, which is not a part of the Eurozone.

Assessing military equipment quality is a very complex matter and there is a multitude of factors that any simplified analysis, by its very design, will omit. Furthermore, in a real world situation, any single piece of military equipment cannot be evaluated in isolation. Not only will its operational availability depend on the degree of maintenance, spare parts and ammunition, its operational utility will also depend on the skill of its crew, whether it is being operated as designed, and the availability of logistical support, as well as its interaction and interoperability with other types of equipment. The performance data presented in this report are presented free of such operational contexts. It therefore neither can, nor is intended to, answer which country would win a certain, or any type of, engagement. However, performance data do provide a broad idea of relative strengths given a limited number of quality indicators.

The assessment of military equipment in this report is limited to a number of key systems and does not represent the whole range of equipment types. Furthermore, the assessment is limited to conventional weapons, meaning that analyses of nuclear, space, cyber, psychological and intelligence capabilities are not included.

[25] While some historic great power rivalries, such as those between an incumbent and an emerging power, have led to conflict, others have led to compromise and eventually cooperation; see Allison, Graham (2017) *Destined for War – Can America and China Escape Thudydides's Trap?*

[26] The "Visegrad countries" include the Czech Republic, Hungary, Poland and Slovakia. The Nordic countries include Denmark, Finland, Iceland, Norway and Sweden.

This limits the conclusions made in this report, as nuclear capabilities are important aspects of military strength. Cyber, space, psychological and intelligence capabilities act as complements to conventional military capabilities during conflicts as well as providing non-military and asymmetric capabilities in peacetime, potentially yielding high results with limited resources. However, these aspects are beyond the scope of this study.

Although part of conventional warfare capabilities, quantities of ammunition is not included in this report. The main reason for this delimitation is that comparable open source data on ammunition is generally unavailable, as information on ammunition stocks and production capacity is often restricted or secret.

As outlined in the previous section, estimates of future military equipment quantities are limited to navies, due to the lack of available data regarding future army and air force equipment. Similarly, due to its uncertainty and the secrecy surrounding it, future military equipment quality is only discussed in broad terms, based on critical assessments of open-source data. With regard to future equipment quality, this report does not include an analysis of defence industrial capabilities and features very limited assessments of future technological trends.[27] This may limit the precision of any statement about future trends in military equipment quality.

It is important to note that this study's assessments of future trends should not be viewed as predictions; rather, they constitute broad estimates based on current trends and developments. These assessments are only relevant in the absence of major disruptive events, such as another war, an economic, or political, collapse involving one or several major world powers, or another global pandemic.

To reiterate, this report does not aim to answer which country would win an armed conflict, now or in the future. If at all possible, such an assessment would have to take a much wider range of factors into account and be highly context-specific. Any comprehensive assessment of military capability should include in-depth analyses of factors such as military doctrine, training, communications, logistics and leadership, as well as political goals and geostrategic conditions. However, these important aspects are also beyond the scope of this report. While military expenditure, economic resources, and equipment quantities and quality remain input measures and should not be equated with the far more complex concept of military capability, these indicators should be able to provide a broad picture of the relative military strengths of major global powers.

[27] For studies assessing global defence industrial trends, see, e.g., Hartley, Keith & Belin, Jean, eds. (2020) *The Economics of the Global Defence Industry* and Olsson, Per, Dalberg, Sanna & Junerfält, Tobias (2022) *Defence Industrial Outlook – A Global Outlook with a Specific Focus on the European Defence Fund*.

3 Global Military Strength

During the past decade, great power rivalry has re-emerged as the main international security concern. In an increasingly multipolar world, both China and Russia have demonstrated greater willingness and ability to challenge the established dominance of the US and its allies. The West has been pushing back against such challenges, and tensions between major world powers have been rising steadily. A violent culmination of this great-power rivalry erupted on 24 February 2022, when Russia invaded Ukraine.

The invasion was not the first time during the past decade that Russia has used military means in pursuit of political goals; Crimea was annexed in 2014 and Russia intervened in Syria from 2015. These operations were supported by increased military spending during the past two decades, which mainly served to finance the modernisation of Russia's armed forces. Despite substantial efforts, however, Russia has so far not achieved its military goals in Ukraine, incurring heavy losses in personnel and equipment and revealing several shortcomings within its Armed Forces. Sanctions imposed by the US and the EU in response to the invasion will also make it more difficult for Russia to rebuild its armed forces.

The past decade has seen heightened tensions between the US and China, the world's two largest economies and military spenders. Despite the war in Ukraine, both countries still view each other as their respective main geostrategic rival. Taiwan serves as the main flashpoint between the two superpowers. China views the self-governing island as a runaway province, whereas the US, which supports Taiwan militarily, sees it as a fellow democracy. During the past decade, China has also reinforced its claims on most of the disputed South China Sea, including the construction of artificial islands, and engaged in violent border disputes with India. China has increased its military expenditure significantly between 2000 and 2022, supporting a rapid and comprehensive modernisation of its armed forces. This development has been supported by solid economic growth. However, that growth rate has slowed in recent years.

The US has refocused its military capabilities to better suit the purposes of great power competition and the changing international security environment. In recent years, the US has once again begun to increase its military spending, investing in new technologies and generations of equipment to regain or extend its lead. This comes after a long period of focusing on its wars in Iraq and Afghanistan, from where it has gradually withdrawn during the past decade.

Meanwhile, several European countries have either increased, or declared an ambition to increase, their military spending. This trend began earlier, partly due to mounting pressure from the US to meet the NATO goal of spending 2 percent of GDP on defence by 2024, but after Russia's invasion of Ukraine this process has

accelerated significantly. In recent years, steps have also been taken to deepen EU defence integration, to enhance European strategic autonomy.[28]

The following sections assess and compare the military strengths of major global powers in terms of military expenditure and economic resources, as well as of the quantities and quality of military equipment.

3.1 Military Expenditure

In 2022, global military expenditure amounted to USD 2,449 billion, an increase by 85.6 percent since 2000.[29] On average, the countries of the world spent 2.1 percent of their GDP on defence and defence-related items in 2022.

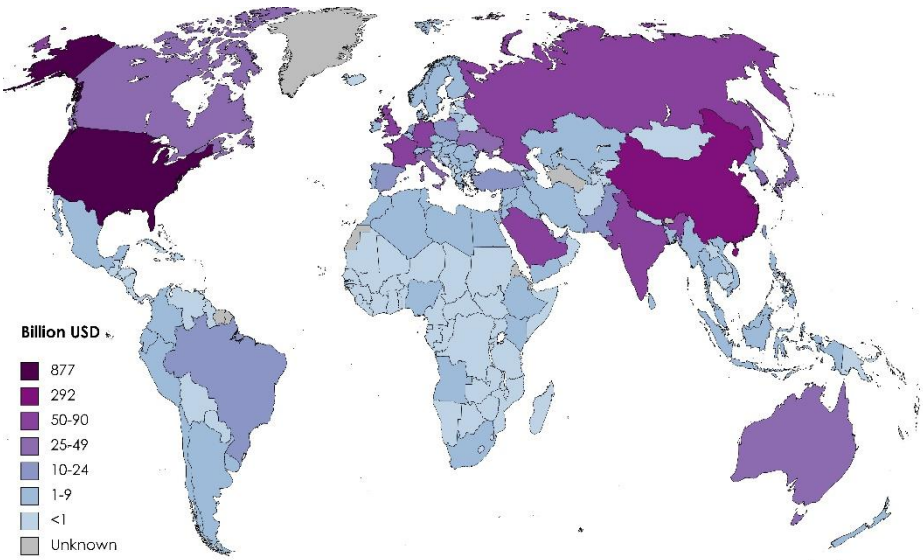

Figure 3.1: Global military expenditure, 2022 (current USD). Source: SIPRI (2023a)

The US remains the world's largest military spender, by far, with military expenditure amounting to USD 877 billion in 2022; see Figure 3.1. China is the world's second largest military spender, with USD 292 billion the same year, a third of the US amount. Russia, the world's third largest spender, allocated USD 86 billion to its military, over a third of China's spending. In 2022, India spent USD 81 billion towards military expenditure and Saudi Arabia USD 75 billion. Taken together, the combined military expenditure of the North Atlantic Treaty Organization

[28] Most notably, the Permanent Structured Cooperation (PESCO) and European Defence Fund (EDF) initiatives, both launched in 2018.

[29] Note that the sum of USD 2,449 billion is indicated in current prices, while the 16.4 percent increase is given in constant 2021 prices; SIPRI (2023a) *SIPRI Military Expenditure Database*.

(NATO), excluding the US, amounted to USD 355 billion the same year, according to SIPRI. For a detailed list of data and trends in global military spending among the world's top 25 spenders, see Appendix A.

Figure 3.1 seems to confirm the long-established position of Western military dominance. However, much has changed during the past two decades. Despite its enduring lead, the US share of global military expenditure has decreased markedly, from 43.3 percent in 2000 to 39.0 percent in 2022; see Figure 3.2. For NATO, excluding the US, the global share of military spending decreased from 22.8 percent in 2000 to 15.8 percent in 2022. Meanwhile, China's share of world military spending has more than quadrupled, from 3.0 percent in 2000 to 13.0 percent in 2022. Russia has increased its share drastically, from 1.2 to 3.8 percent, while India has increased its share from 1.9 to 3.6 percent during the same period.

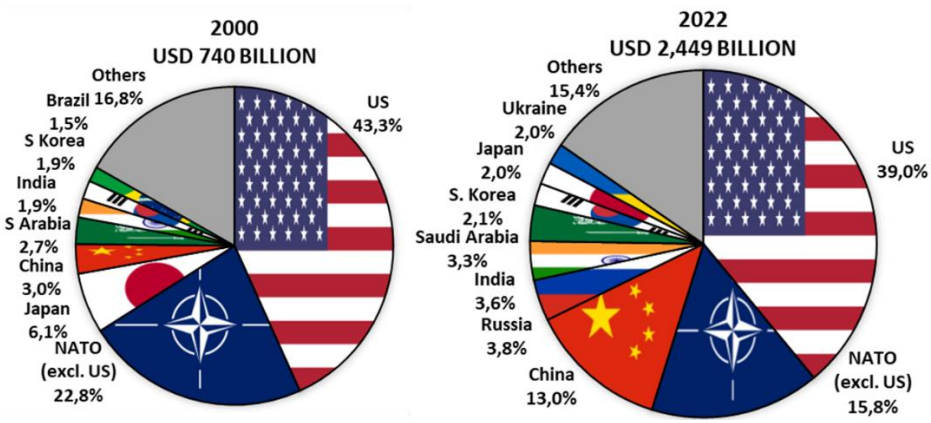

Figure 3.2: Share of global military expenditure, 2000 and 2022 (current USD).
Source: SIPRI (2023a)

Despite the fact that US and Western European countries have increased their military spending in recent years, the overall trend for global share of military expenditure between 2000 and 2022 has been decreasing for Western powers and increasing for major non-Western powers. This trend can mainly, albeit not exclusively, be attributed to China, and to a much lesser extent Russia and India.

The above description of military expenditure is provided in terms of USD market exchange rates (MER). However, as described in Chapter 2, this measure does not account for potential differences in purchasing power between countries. Purchasing power parities (PPP) adjust for differences in purchasing power, for instance when comparing GDP between countries. When applying PPPs on military expenditure, the relative size of China's, Russia's and India's military spending increases significantly compared to the amounts given in terms of market exchange rates, as seen in Figure 3.3.

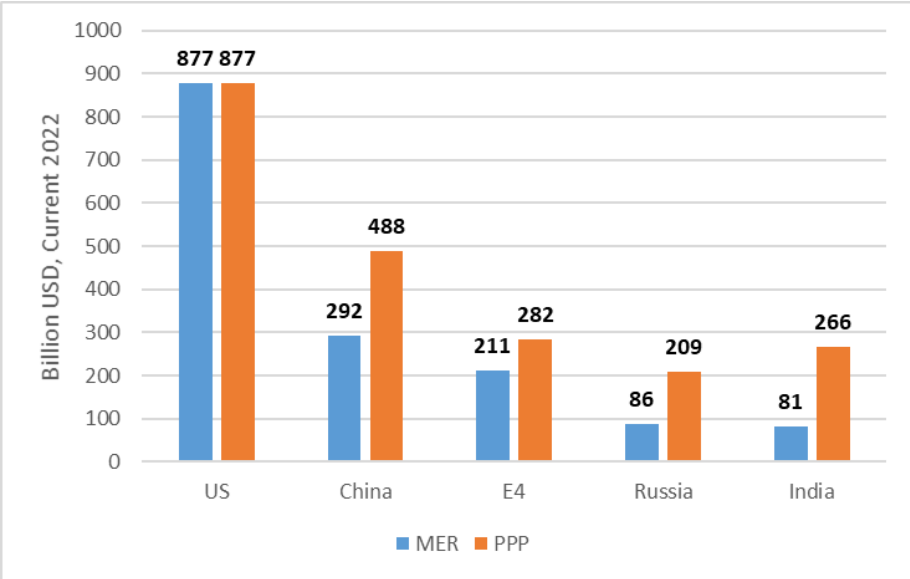

Figure 3.3: Global military expenditure in terms of market exchange rate (MER) and purchasing power parity (PPP), 2022. Sources: SIPRI (2023a), OECD (2023a).

Meanwhile, the level of US spending remains unchanged, as USD is the benchmark for PPP, while the combined expenditure of France, Germany, the UK, and Italy (E4) increases slightly when adjusted for purchasing power. If military expenditure has a structure similar to that of the overall economy, and if PPP actually reflects economic activity in terms of comparable goods and services, the adjustment for PPP implies that the US advantage in terms of military expenditure becomes comparatively less pronounced than indicated by MER.

However, it is important to remember that PPP is not directly transferable from GDP to military expenditure; see the discussion in Section 2.1. The relative purchasing power regarding military goods and services could differ significantly from civilian goods and services. Nevertheless, the average wages of soldiers and officers are likely markedly lower in countries such as China, Russia and India compared to the US or the EU. The same should be true for average wages within the defence industry, which should affect the prices of military equipment. Therefore, while it is inadvisable to view PPP-adjusted military expenditure as being more correct than MERs, it is similarly inadvisable to disregard purchasing power when discussing military expenditure.

3.2 Gross Domestic Product

Economic resources, here illustrated in terms of GDP, constitute a key prerequisite for military spending. GDP also indicates the level of consumption, production, trade and investment of a given country, providing information about its global

economic influence. However, such analyses are beyond the scope of this study. For a detailed list of trends in GDP among the top 25 economies worldwide, see Appendix B.

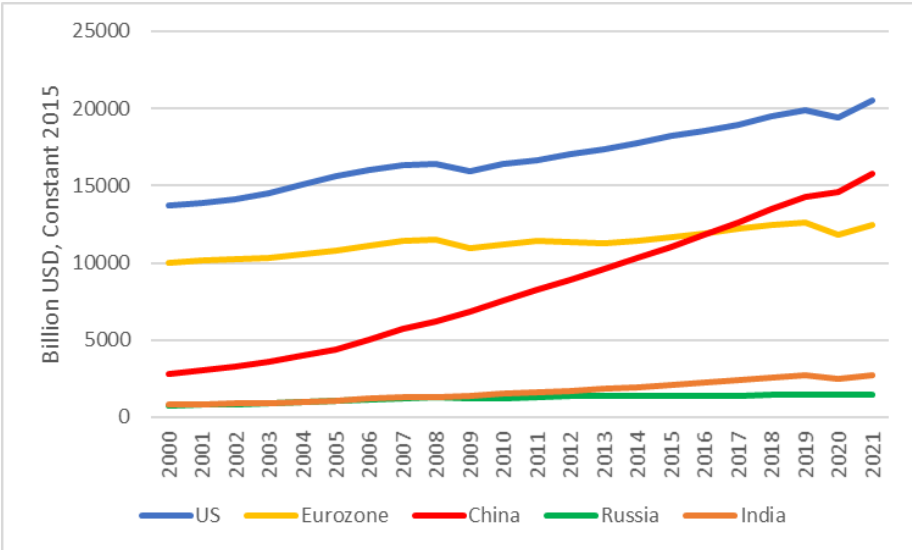

Figure 3.4: GDP of major world powers in USD (constant 2015), 2000–2021.
Sources: World Bank (2023a)

In 2021, the US still maintained its century-old position as the world's largest economy by some margin, followed by China, Japan, Germany, the UK and India. Even though this ranking may seem stable, the past two decades have seen a significant shift in the global economic power balance towards emerging economies, China in particular; see Figure 3.4. In 2021, the US accounted for 24.2 percent of global GDP, which can be compared to its 31.1 percent share in 2000. Meanwhile, China's share of world output reached 18.4 percent in 2021, more than five times its 3.5 percent share in 2000. The Eurozone's share of the world economy remained largely unchanged, from 19.0 to 19.1 percentage points, during the same period. Meanwhile, Russia's share doubled from 0.8 to 1.8 percent. Similarly, India's global share increased from 1.4 to 3.3 percent.[30]

During the past two decades, the world economy has witnessed several years of crises and recoveries. The early 2010s saw a recovery from the 2008 global financial crisis, but in the last years of that decade trade disputes between the US and China weighed on the world economy. Then the COVID-19 pandemic struck, causing widespread human suffering as well as worldwide economic distress and major supply chain disruptions throughout 2020. The global economy recovered in 2021, but the stimulus packages that had helped to mitigate some of the negative

[30] World Bank (2023b) *GDP Current US$.*

effects of the pandemic contributed to spurring inflation once demand picked up, while supply chains had still not recovered. Then came Russia's invasion of Ukraine, further worsening the global economic outlook.

In January 2023, the IMF predicted a slowing economic recovery for the year, with world output growing by 2.9 percent. The US economy is expected to grow by 1.6 percent, China's by 5.2 percent, the Eurozone's by 0.8 percent and India's by 5.9 percent. It is estimated that Russia's sanction-hit economy will grow by 0.7 percent, following a 2.1 percent contraction in 2022.[31] However, predictions about future growth rates must be viewed with caution, especially given the many uncertainties currently facing the global economy. Several risks, such as disruptions due to the war in Ukraine, the fear that the conflict will spread, lingering inflation, the effects of tackling that inflation through increased interest rates, and technological and trade disputes between the US and China, as well as tensions surrounding Taiwan, will continue to cast a shadow over global economic recovery in the years to come.

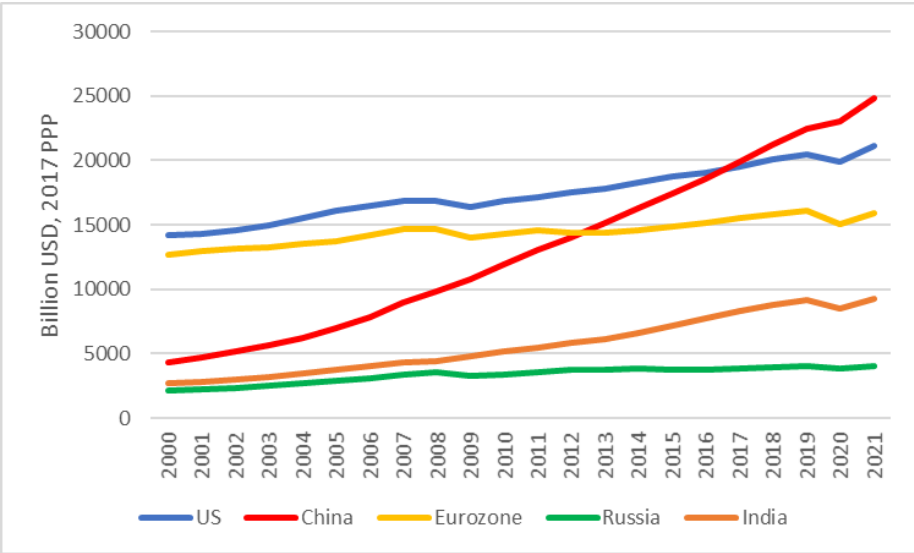

Figure 3.5: GDP of major world powers in USD PPP (constant 2017 international dollars), 2000–2021. Source: World Bank (2023c)

Whether or not China will continue to catch up or even surpass with the US in terms of GDP at MER is still an open question, which is discussed further in Chapter 4. However, when adjusting GDP to account for purchasing power, this shift in global economic power has already occurred. Explained above as accounting for price differences, PPPs measures the size of an economy in terms of comparable goods and services. By this measure, China surpassed the US to become the

[31] IMF (2023a) *World Economic Outlook – A Rocky Recovery*, April 2023, p. 9.

world's largest economy in 2017; see Figure 3.5. Using this approach, India's and Russia's shares of the world economy also increase significantly compared to GDP in terms of MER. When adjusted for purchasing power, India becomes the world's third largest economy, overtaking Japan and Germany. Russia becomes the sixth largest economy, in terms of PPP, as opposed to the eleventh, in terms of MER.[32]

As noted above, GDP can be seen as a prerequisite for military expenditure. Military expenditure in turn is a prerequisite for building military capability. Military equipment can be seen as an intermediary good of sorts, an output of expenditure, but an input to capability. An assessment of military equipment quantities and quality may therefore add further understanding of the relative military strengths of the major world powers.

3.3 Quantities of Military Equipment

The assessment of military equipment quantities in this report focuses on larger military systems in navies, armies and air forces. This includes surface combatants, submarines, armoured vehicles and artillery, as well as combat aircraft, bombers and transports. For a detailed description of the data and the assumption used, together with detailed graphs and tables on military equipment quantities among major global powers, see Appendix C.

Quantities of Navy Equipment

The quantities of navy equipment among the major world powers from 2000 to 2023 are illustrated in Figure 3.6. As seen in the figure, the US Navy decreased its overall numbers slightly during the period, while increasing the number and share of destroyers. Meanwhile, the Chinese People's Liberation Army (PLA) Navy has undergone a drastic expansion, increasing its quantity of surface combatants and submarines by 57 percent, to become the numerically largest navy in the world. China's number of destroyers has increased significantly, while a new class of corvettes has also contributed greatly to this expansion. The E4 have decreased their combined quantity of surface combatants and submarines over the past two decades, a reduction that has been evenly distributed among vessel types. The Russian Navy has decreased its number of naval platforms by about one sixth, mainly by reducing its large nuclear submarine fleet and the number of large surface combatants. In addition, the sinking of the *Slava*-class cruiser *Moskva*, on 14 April 2022, removed one such large surface combatant from the Russian Navy. Meanwhile, the Indian Navy is small compared to those of the other major world powers, but has expanded by 24 percent.

[32] World Bank (2023c) *GDP PPP Current International US$* and World Bank (2023b) *GDP Current US$*.

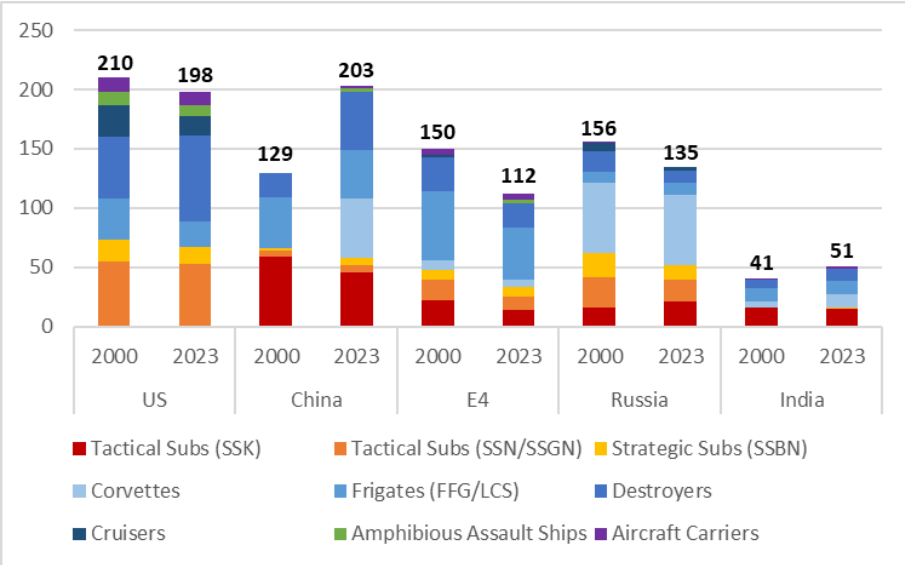

Figure 3.6: Quantity of surface combatants and submarines among major world powers. Sources: IISS (2000, 2023)

While Figure 3.6 compares the numbers of surface combatants and submarines for the navies of the major world power, it does not account for the differences in sizes of these vessels. The included surface combatants range from huge aircraft carriers and amphibious assault ships to large cruisers, destroyers, smaller frigates and even smaller corvettes. The figures for submarines similarly include huge nuclear-armed strategic submarines with nuclear propulsion, large torpedo- and missile-armed tactical submarines with nuclear propulsion and, generally, smaller tactical submarines with conventional propulsion. In order to account for these differences, naval tonnage can offer an alternative when assessing the sizes of navies.[33] When taking tonnage into account, the relative size of each navy becomes radically different when compared to the numbers of vessels.

The most visible difference, when considering tonnage, is how vast the US naval advantage becomes, see Figure 3.7. The explanation for this is quite straightforward. The US has far more aircraft carriers and, generally, larger destroyers, compared to other major powers. Even though the Chinese Navy consists of a larger number of surface combatants and submarines, the combined tonnage of the US Navy is three times that of the PLA Navy. On the other hand, the Chinese Navy has more than tripled its tonnage since 2000 and has overtaken both the E4 and

[33] The tonnage for maritime vessels is expressed in terms of displacement, i.e., the amount of water displaced by the hull of a given vessel. In this report, displacement is measured in metric tonnes, fully loaded displacement for surface combatants and fully submerged for submarines. The data on tonnage have been collected from various open sources and are referred to collectively as "FOI"; see Section 2.1 for details.

Russia. Furthermore, a much greater increase in Chinese tonnage compared to the increase in the number of vessels would imply that the average PLA Navy vessel has become significantly larger.

The E4 navies have increased their combined tonnage during the past two decades, even as the number of vessels has decreased, implying that the average E4 navy vessel has become larger. Russia decommissioned several large surface combatants and nuclear submarines in the 2000s, causing its naval tonnage to decrease more sharply than the number of vessels during the past twenty years. India lags far behind the other major world powers in terms of total tonnage, but the average tonnage of an Indian naval vessel is on par with that of a Chinese vessel.

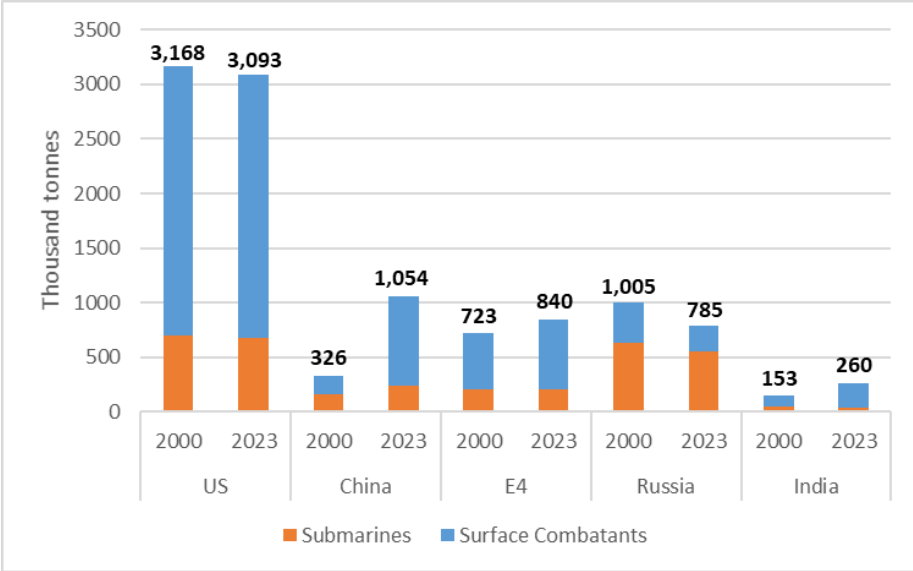

Figure 3.7: Tonnage of surface combatants and submarines among major world powers. Sources: IISS (2000, 2023), FOI

Tonnage might be a crude measure, but not irrelevant with regard to naval capabilities, as larger vessels provide more space for armament,[34] sensors and other electronic hardware. On the other hand, even smaller vessels carrying missiles can provide significant lethality to a navy. Therefore, neither the number of vessels nor combined naval tonnage should be seen as the better measure. Instead, these perspectives complement each other when quantifying and comparing the navies of the major world powers.

[34] Note that there seems to be a correlation between total tonnage and the number of missiles carried; see, e.g., Table E.7 in Appendix E of this report.

Quantities of Army Equipment

The quantities of army equipment among the major global powers have developed differently during the past two decades; see Figure 3.8. Generally, the quantities of main battle tanks (MBTs), artillery pieces and multiple launch rocket systems (MLRSs) have decreased. The numbers of infantry fighting vehicles (IFVs) and armoured personnel carriers (APCs) have decreased, except for China and India. While the US has a numerical advantage in terms of IFVs and APCs, China has an advantage in terms of tanks and artillery (Art).

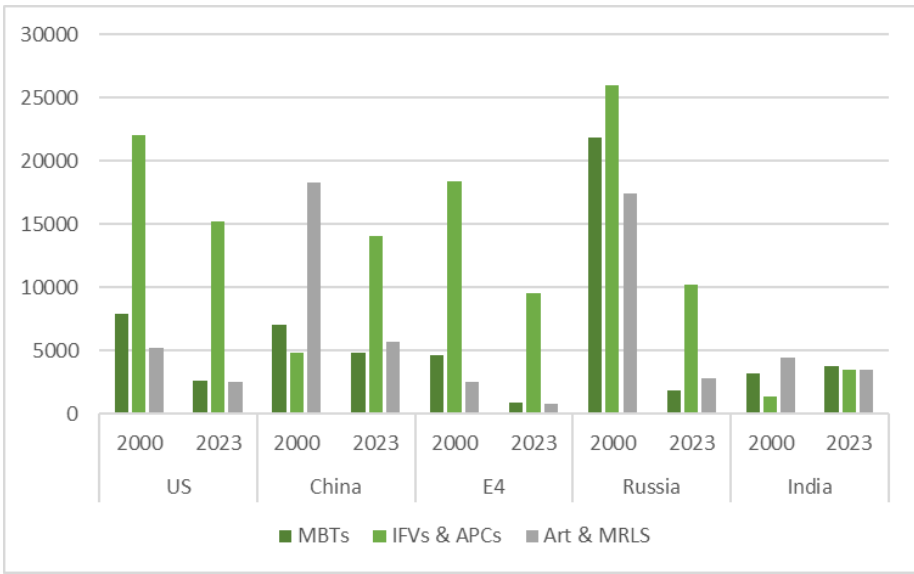

Figure 3.8: Quantity of army equipment among major world powers. Sources: IISS (2000, 2023)

The quantity of active-service tanks in the US Army was reduced by two-thirds between 2000 and 2023, though the US still maintains a sizeable amount in reserve. At the beginning of 2023, the Chinese PLA had the world's largest number of main battle tanks in active service, 4,800 in total, excluding light tanks. During the past two decades, the armies of France, Germany, the UK, and Italy have decreased their tank numbers drastically. By 2023, the E4 had reduced their combined tank force by four fifths compared to 2000. Russia has decreased the number of its tanks by seven eighths since 2000. Furthermore, Russia has incurred heavy losses of tanks in its war against Ukraine. However, it has likely managed to replace a large part of those losses with tanks from its large reserves, which at the beginning of 2023 were estimated as comprising approximately 5,000 tanks.[35] India is the only country among the major world powers that has increased its number of tanks.

[35] IISS (2023) *The Military Balance 2023*.

The numbers of IFVs and APCs in the US Army have decreased, especially the lighter-wheeled APCs, which were favoured in Iraq and Afghanistan during the 2000s and 2010s. These have since been gradually phased out, as the US shifts its focus to great-power rivalry. China has also increased the number of its IFVs and APCs, in an effort to modernise its army. The E4 have decreased their numbers of IFVs and APCs, but retain these vehicle types to a much greater extent than tanks and artillery, also due to the focus on international operations during the 2000s and 2010s. Russia has decreased its quantity of IFVs and APCs by three fifths during the past two decades, whilst also suffering heavy losses in its war against Ukraine. Meanwhile, India lags behind the other major world powers in terms of IFVs and APCs, implying that its huge army has a low degree of mechanisation.

The number of artillery pieces and MLRSs has decreased among all the major world powers. A large part of this reduction is due to the phasing out of towed artillery in favour of more mobile self-propelled systems, generally capable of more rapid and accurate fire. The US Army has decreased its number of artillery pieces by half between 2000 and 2023. While China has reduced its number or artillery pieces by two thirds, the PLA still retains the largest quantities of artillery in active service among the major world powers. Similarly, the E4 have cut their combined number of artillery pieces by two thirds during the same period. Russia has also reduced the number of active-service artillery pieces drastically, by five sixths, between 2000 and 2023. However, Russia still retains a large number of artillery pieces and MLRSs in reserve, though their exact availability is unclear. India maintains a large number of artillery pieces, the second largest quantity among the major powers. During the same period, India has also reduced its numbers far less than the other countries included here have, by only one fourth.

Quantities of Air Force Equipment

The numbers of combat aircraft have decreased among almost all the major global powers, even in countries where military expenditure has increased, during the past two decades; see Figure 3.9.

This trend can most likely be explained by the choice of quality over quantity, as individual platforms have become more advanced and more expensive. Over the past two decades, the US Air Force has reduced its combat aircraft numbers by a third, but it still maintains a clear numerical advantage over other major world powers. China has also reduced its numbers significantly, but the PLA Air Force still maintains the second largest combat aircraft fleet globally. The E4 have similarly reduced their combined combat aircraft stock drastically. In contrast to the other major world powers, India has slightly increased its number of combat aircraft during the past two decades. The Russian Air Force has reduced its number of combat aircraft by a third during the same period. However, Russia still fielded more combat aircraft, in the beginning of 2023 than the E4 air forces combined. Russian losses of combat aircraft in Ukraine have been modest compared to the losses of ground equipment.

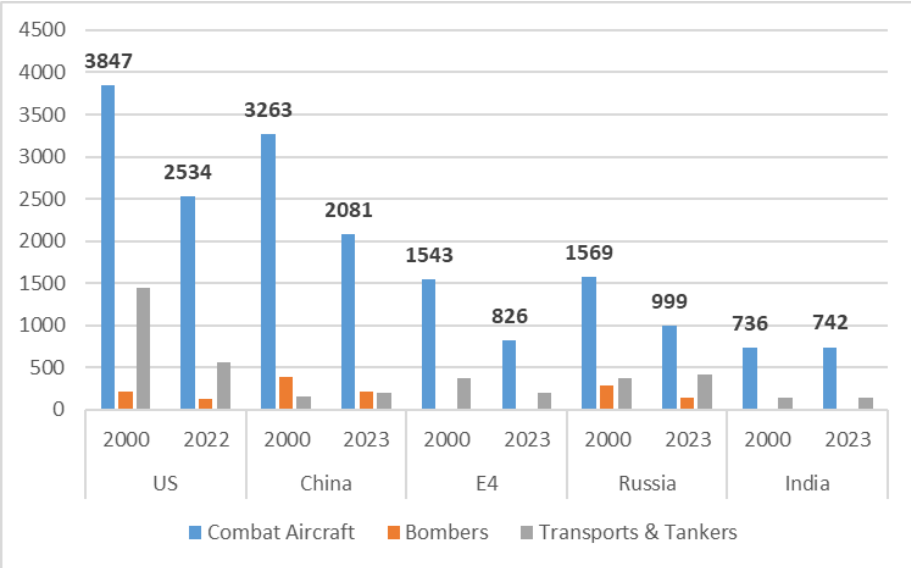

Figure 3.9: Quantity of aircraft among major world powers. Source: IISS (2000, 2023)

The US maintains a small, but operationally important fleet of advanced bomber aircraft. Even though China has more bombers than the other major powers, most are of older designs compared to their US counterparts. Neither the E4 nor India have purpose-built bombers, instead relying on multirole combat aircraft for bombing missions. Like China, Russia still relies on older Soviet designs that have been upgraded, but not replaced. The US also has a numerical advantage in terms of transport aircraft, which are generally larger than Russian, European or Chinese equivalents.

Concluding Remarks on Quantities of Military Equipment

During the past two decades, there has been an international trend towards decreasing quantities of equipment, even in countries where military expenditure has increased. The most likely explanation is that fewer platforms are needed and afforded, as the quality of individual weapon systems improves and unit costs increase over time. The exemptions to this general trend, such as the expansion of the PLA Navy, are only possible due to an exponential increase in military expenditure. As other PLA branches have decrease equipment quantities, the increase in naval vessels could also indicate a prioritisation of the PLA Navy.

Overall, the US has maintained its quantitative edge in the air, in terms of combat aircraft as well as transports and tankers. Meanwhile, the military power balance of equipment quantities at sea and on land remains more mixed. While the US still has an edge in terms of large surface combatants and nuclear-powered submarines, the Chinese navy has become the numerically largest navy in the world. China also

has a numerical advantage in terms of tanks, while the US has maintained its advantage in terms of IFVs and APCs. China, India and Russia have also maintained a larger number of artillery pieces compared to the US and the E4.

Although the US spent nearly three times as much as China on its military, and has spent far more than that historically, China still has 80 percent as many combat aircraft, comparable numbers of army equipment and more naval vessels than the US. Similarly, while Russia spends less than the UK alone, and has done so for most of the post-Soviet era, Russia still retains more submarines, tanks and combat aircraft than the four major European powers combined. This could indicate that there is some merit to the idea that China and Russia do have greater purchasing power, not just in relation to GDP, but also related to military expenditure.

However, equipment quantities do not tell the whole story. As seen above, the US Navy is still unrivalled in terms of tonnage, providing some indication about differences in capabilities. Furthermore, the average Chinese or Russian combat aircraft may not display the same performance as its US counterpart. European or US tanks, infantry fighting vehicles and artillery pieces may also have a qualitative edge over Chinese and Russian dittos. Therefore, in order to provide a more complete assessment and comparison of military strength among the world's major powers, there is a need to look more closely at quality indicators for military equipment.

3.4 Quality of Military Equipment

This report's assessment of military equipment quality includes an initial categorisation by modernity, where key systems within the branches of navy, army and air force are classified as either modern, intermediate, or legacy, based on age, or generation. These key systems include surface combatants, main battle tanks and combat aircraft. As the quality of modern equipment may vary quite significantly, this broad categorisation is complemented by a series of quality indicators for the same key systems, such as firepower, protection levels, speed and operational ranges. For a detailed description of the methods and the assumption used, together with more detailed graphs and tables on trends in equipment quality among major global powers, see Appendix D.

Quality of Navy Equipment

Navy surface combatants are categorised based on which year the lead or first ship of the class was commissioned, taken into active service. The category of "new" includes ship classes that were commissioned from 1990 and onwards. The cate-

gory, “intermediate,” includes those between 1970 and 1989, while “legacy” comprises classes taken into service before 1970. However, there are some exemptions to this general rule.[36]

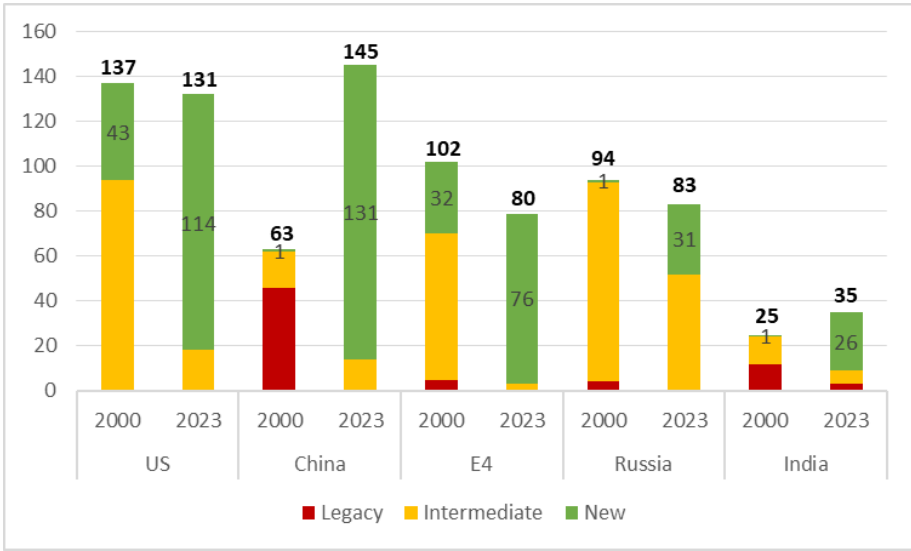

Figure 3.10: Surface combatants by generation among major world powers.
Sources: IISS (2000, 2023)

According to the categorisation used in this report, the US Navy’s 2023 surface combatant fleet could be considered nearly completely modern; see Figure 3.10. Meanwhile, China has added new surface combatants at a rapid pace, from just one newly commissioned vessel in 2000 to 131 in 2023, surpassing the US number of “modern” vessels. The combined surface fleet of the E4 is almost entirely new, with 76 out of 80 vessels belonging to classes where the lead ship was commissioned after 1990. The Russian Navy has been relatively slow to add new surface combatants, but has modernised by upgrading Soviet era vessels. Meanwhile, the Indian Navy has modernised at a steady pace, with 26 out of 35 ships being newly commissioned in 2023.

Differences in quality indicators among newly commissioned surface combatants are listed in Table 3.1.[37] Note that the table includes only a handful of new ship classes for each of the major powers and does not include aircraft carriers or am-

[36] The surface combatants of the Chinese PLA Navy and the Indian Navy are the main exemptions. Both countries were late to develop an indigenous arms industry; vessels taken into active service from 2000 and onwards are classified as new; as intermediate, between 1980 and 1999; and legacy, from before 1980.

[37] The numbers of missiles, torpedoes, helicopters and vessels are obtained from IISS (2023), complemented by missile ranges and speeds from various institutes or online sources. These complementary data are referred to collectively in Table 3.1 as “FOI”. Note that short-range point-defence missiles are not included in the missile tally, neither as separate launchers nor as quad-packed in missile launch cells.

phibious assault ships. The quality indicators listed in the table include the maximum number of missiles carried, and the maximum ranges and speeds of surface-to-air-missiles (SAMs) and anti-ship missiles (ASMs). Note that the values for range and speed refer to the best available missile, which is not necessarily the most commonly available, in each category. Maximum missile range is indicated in kilometres and speed in terms of Mach. Indicators also include anti-submarine-warfare (ASW) metrics such as the number of torpedo tubes (TT) and number of helicopters carried. The 2023 quantities for each ship class (e.g., 42 *Arleigh Bourke IIA* destroyers) and the total number of that ship type (e.g., 72 US destroyers) are also included in order to give a sense of how commonplace a certain class is.

Table 3.1: Performance of selected modern surface combatants among major world powers, 2023. Sources: IISS (2023), FOI.

Class (Country)	**No. Mis-siles**	**SAM Range/ Speed**	**ASM Range/ Speed**	**ASW TT/ Hel.**	**Quant. 2023 No./Type**
A. Bourke IIA (US)	96	240/3.5	240/3.5	6/2	42/72
Independence (US)	8	-/-	250/0.9	-/1	12/22
Type 055 (China)	112	200/4.0	540/*3.0	6/2	7/49
Type 052D (China)	64	200/4.0	540/*3.0	6/1	25/49
Type 054A (China)	40	40/3.0	200/0.9	6/1	31/41
Type 056A (China)	4	-/-	200/0.9	6/-	50/50
Forbin (France)	56	120/4.5	180.0.9	4/1	2/10
Sachsen (Germany)	40	170/3.5	124/0.7	6/2	3/12
Type 45 (UK)	56	120/4.5	240/0.9	4/1	6/6
Bergamini (Italy)	24	120/4.5	180/0.9	2/1	8/10
Gorshkov (Russia)	48	150/6.0	300/2.4	8/1	2/10
Grigorovich (Russia)	32	50/4.0	300/2.4	4/1	3/10
Steregushchiy (Ru.)	20	50/2.6	130/0.8	8/1	8/59
India (Visakhapatnam)	48	150/2.0	500/3.0	4/2	1/10
India (Shivalik)	48	-/-	500/3.0	4/2	3/12

* The YJ-18 ASM has a flight speed of Mach 0.8 and terminal attack speed of Mach 3.0.

Modern surface combatants share several features. They generally have some degree of stealth incorporated into their hull designs and are often equipped with advanced radar, sonar and combat management systems. The ship classes included in Table 3.1 also carry at least one multi-purpose main gun and close-in-weapon-systems (CIWS) for short range defence. Although the ships vary in range and endurance, their top speeds are generally around 30 knots.

However, there are also differences in the capabilities of the surface combatants of the major world powers. Modern US surface combatants, such as the *Arleigh Bourke IIA*-class destroyers, generally carry more missiles than their international counterparts. These large destroyers also make up most of the US Navy's surface combatants. Meanwhile, some of China's newly commissioned destroyers, such as the *Type 055* and *Type 052D*, have reached missile carrying capabilities similar to their US or E4 equivalents. However, these constitute a fourth of the PLA Navy's newly commissioned inventory, which consists of large numbers of

smaller surface combatants, such as the *Type 054A* frigate and *Type 056A* corvette. Furthermore, the US operates eleven massive nuclear powered aircraft carriers, while China currently operates two conventionally powered carriers. A third Chinese carrier, larger than the previous two, is currently undergoing sea trials and has yet, as of 1 January 2023, to enter service.

The modern destroyers and frigates of the E4 navies are generally in the mid-to-large range among comparable surface combatants. UK Type 45 destroyers are small compared to US destroyers, but German *Sachsen* and Italian *Bergamini* frigates are large enough to be classified as destroyers in many other navies, but carry few missiles relative to their size. Russia's *Admiral Gorshkov* frigates are roughly the same size as their European counterparts, while the *Admiral Grigorovich* class is smaller and has fewer missiles. Meanwhile, the *Steregushchiy* class is fairly large and well-armed compared to the corvettes of other navies. The Indian *Visakhapatnam*-class destroyers are comparable to European destroyers in size, while the *Shivalik* class is large compared to other frigates.

According to the data presented in Table 3.1, US surface combatants seem to have a clear advantage in terms of anti-air capabilities, with longer-ranged high-speed surface-to-air missiles. By the same logic, China, India and Russia have an advantage over the US and E4 in terms of surface warfare, possessing longer-ranged high-speed anti-ship missiles. However, it is worth noting that US surface combatants often operate in carrier groups, allowing carrier-based aircraft to carry anti-ship missiles well beyond the range of any ship-launched missile. The numbers of helicopters carried also provide the US surface combatants with comparatively robust surveillance and ASW capabilities. There are several other important factors, other than armament, to take into account when assessing surface combatant performance, but this brief overview does provide some insights into the various capabilities of surface combatants among the major world powers.

Quality of Army Equipment

Main battle tanks constitute the heavily armed and armoured spearhead of modern mechanised armies. In this section, tanks are categorised according to modernity, by generation. First-generation main battle tanks were introduced in the late 1940s; second-generation tanks, in the 1960s; and modern third-generation tanks, from the 1980s and onwards.

During the last two decades, the US Army has reduced the size of its tank force to 2,645 third-generation Abrams tanks, but has kept an additional 2,000 Abrams in reserve; see Figure 3.11. While all Abrams tanks are third generation, some have been upgraded from the basic M1A1 and M1A2 models to the modernised M1A2 SEPv2 and SEPv3 variants. China has the world's largest tank force in active service, and the largest inventory of third-generation tanks, which include the modern Type 99A and Type 96A. However, nearly one third of the PLA tank force still consists of older or obsolete tank models.

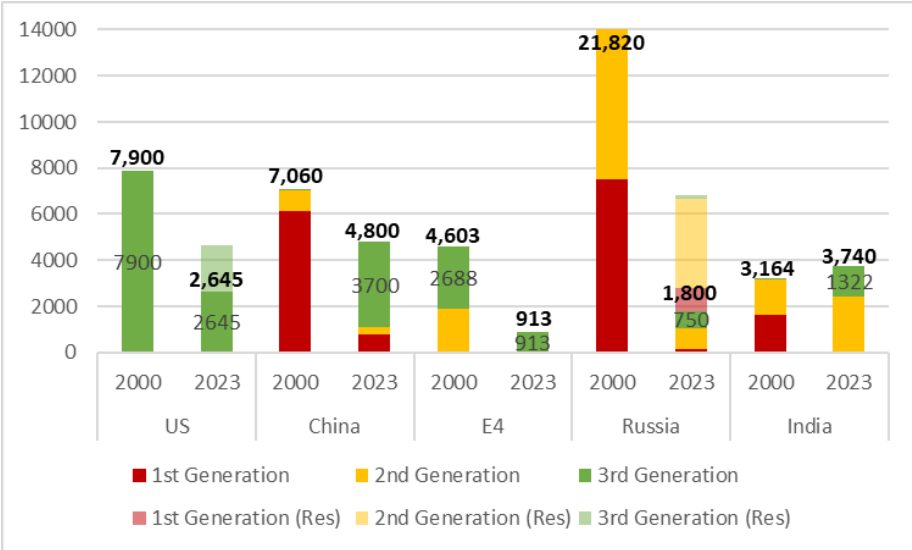

Figure 3.11: Main battle tanks by generation among major world powers.
Sources: IISS (2000, 2023)

The combined E4 tank force is entirely modern, but has been reduced during the last two decades to about 200 tanks per country. These small tank forces include the French Leclerc, German Leopard 2, the UK Challenger 2 and the Italian Ariete. India has increased its number of tanks with second- and third-generation tanks, mainly by acquiring the Russian T-90S and T-72M. Russia's third-generation tank inventory mainly consists of upgraded Soviet-era designs, such as the T-72B3, or modern derivatives, such as the T-90.

Main battle tank performance can be described as a combination of firepower, protection and mobility. In Table 3.2, the firepower for a given tank is indicated by the penetration depth of the best available kinetic projectile, from a distance of 2000 metres, indicated in millimetres of rolled homogenous armour equivalents (RHAe), i.e., steel equivalents. Similarly, armour is indicated by the protection against kinetic penetrators at the front of the turret, usually the most strongly protected area of a tank, also in millimetres RHAe.[38] Mobility values are measured by horsepower through tonnes. Note that the values presented in the table have been collected from open sources and should be seen as estimates.

The quality indicators in Table 3.2 show that the US M1A2 SEPv2 Abrams has an edge in terms of firepower, compared to other third-generation tanks. Protection data for the latest version M1A2 SEPv3 is unknown, but likely higher than the

[38] As modern main battle tank armour usually consists of composite armour, reactive armour, or both, protection levels are usually converted into and expressed as millimetres of rolled homogenous steel equivalents, i.e., how much steel the composite, or reactive armour, is equal to.

SEPv2 version. It also features the Trophy active protection system (APS) against anti-tank missiles. China's most modern tank, the ZTZ-99A, is on par with its Western counterparts, at least on paper, and features a laser dazzler APS. However, the advanced ZTZ-99A is far less common than the less capable Type 96A.

Table 3.2: Performance of selected modern main battle tanks among major world powers, 2023. Sources: US Training and Doctrine Command (2014), Steelbeast.com, IISS (2023).

Type (Country)	Gen.	Firepower (mm RHAe)	Armour (mm RHAe)	Mobility (HP/ tonne)	Quantity 2023
M1A2 SEPv3 (US)	+3	-	>950	-	500
M1A2 SEPv2 (US)	+3	840	950	23.1	1,605
ZTZ-99A (China)	+3	800	990	25.9	600
ZTZ-96A (China)	-3	660	780	18.6	1,500
Leclerc (France)	3	690	890	26.6	215
Leopard 2A7 (Ger.)	+3	-	>970	-	98
*Leopard 2A6 (Ger.)**	+3	750	970	24.0	223
Challenger 2 (UK)	+3	610	1,250	19.2	227
T-90A (Russia)	3	660	840	23.7	200
T-72B3 (Russia)	-3	660	780	18.9	250
Arjun (India)	3	-	-	-	122
T-90S (India)	3	~660	~840	~23.7	1,200

* Data actually represent the older Leopard 2A5 version, exported to e.g. Denmark and Sweden.

European tanks generally score high on the included performance indicators. The German Leopard 2 is a well-balanced platform, with versions having been exported to a large number of countries around the world. Following Russia's invasion, several EU member states have pledged to donate Leopard 2s to Ukraine.[39] The UK's Challenger 2 has the highest level of protection among the listed tanks. In January 2023, 14 Challenger 2s were transferred to Ukraine.[40] The French Leclerc is not as armed as the Leopard 2 nor as protected as the Challenger 2, but among the included tanks it scores the highest in terms of mobility. The specifications of India's Arjun tank are unknown, while the T-90S is assumed to perform similarly to the Russian T-90A.

The reputation of Russia's army equipment has suffered during its war against Ukraine, with heavy losses of armoured vehicles. This includes losses of the Russian third-generation tanks, T-90A and T-72BM, which have been used in Ukraine and incurred losses. Table 3.2 shows that Russian third-generation tanks such as the T-90A and T-72BM are not on par with their US or German counterparts.[41] However, this does not entirely explain Russian tank losses, as insufficient training, tactics and logistics also seem to have played crucial roles. By 1 January 2023,

[39] Debusmann, Bernd; Wright, George & Radford, Antoinette (2023) "Germany confirms it will provide Ukraine with Leopard 2 tanks," *BBC News*, 25 January 2023. (Accessed 15 February 2023).
[40] Beale, Jonathan & Andersson, Jasmine (2023) "UK to send Challenger 2 tanks to Ukraine, Rishi Sunak confirms", *BBC News*, 15 January 2023. (Accessed 15 February 2023).
[41] See, e.g., Olsson, Per (2022) "Measuring Quality of Military Equipment", *Defence and Peace Economics*.

Russia had lost more than 1,500 tanks of nearly every type and generation. However, proportionally fewer third-generation compared to second-generation tanks have been lost.[42] This may be explained by differences in survivability, but can also be a matter of how often, where, and by whom the different tanks are used.

It is possible that Russia has been able to replace about a third of its lost tanks, mainly by taking older ones out of storage. This would imply an overall deterioration in average quality and modernity. However, such estimates are highly uncertain and should be seen as an indication rather than any kind of prediction.

Quality of Air Force Equipment

The US Air Force's numerical advantage is reinforced when accounting for quality parameters; see Figure 3.12. Having pioneered fifth-generation fighters back in the 1980s, the US held a virtual monopoly on such aircraft until the 2010s. The US is in the middle of a process of gradually replacing many of its fourth-generation fighters with the fifth-generation F-35.

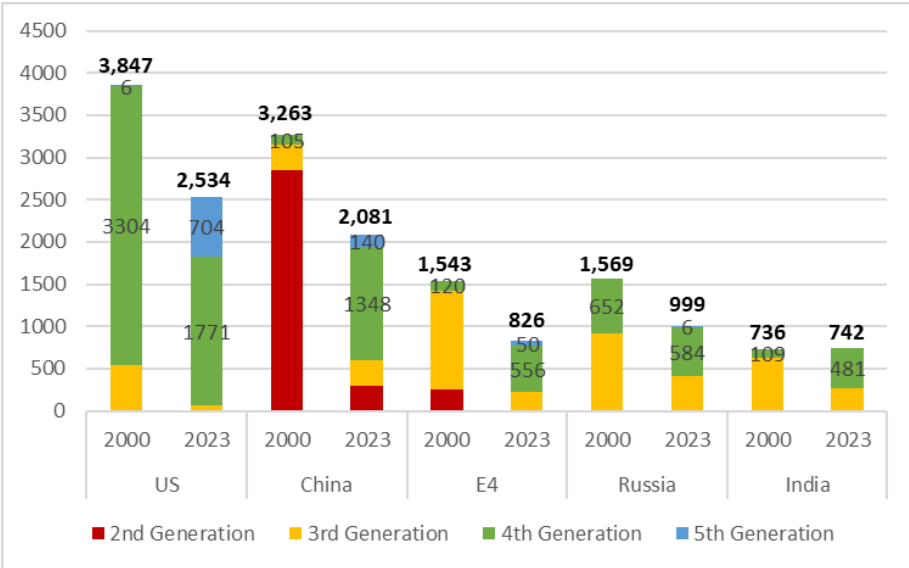

Figure 3.12: Combat aircraft by generation among major world powers.
Sources: IISS (2000, 2023)

The Chinese PLA Air Force has come a long way during the past two decades, currently fielding over a thousand fourth-generation combat aircraft and having begun to introduce the J-20 fifth-generation aircraft. However, China still operates several types of older third- and even second-generation combat aircraft and has

[42] Oryx (2023) *Attack On Europe: Documenting Russian Equipment Losses During The 2022 Russian Invasion Of Ukraine*. (Accessed 2023-02-01).

yet to catch up to the other major powers in terms of aircraft development, not least when it comes to developing advanced turbofan jet engines domestically.

While the UK and Italy have acquired US F-35s, the E4 have not developed their own fifth-generation fighters, instead having chosen to upgrade fourth-generation aircraft. The E4 also operate several third-generation aircraft. Russia has begun to slowly introduce the Su-57 fifth-generation fighter, having six in active service by the end of 2022. However, the Russian Air Force mostly relies on various fourth-generation combat aircraft, while also operating a large share of third-generation aircraft.

Combat aircraft performance is assessed by listing the number of hard points, i.e., stations for missiles, bombs, or additional fuel tanks, combat range (in km) and maximum speed (in km/h). The generation of the aircraft, fifth or fourth, is also presented as a proxy indicator of quality. Fifth-generation combat aircraft combine stealth, i.e., radar absorbent materials, minimised radar cross-section and IR signature, with high manoeuvrability and advanced avionics.

Table 3.3: Performance of selected modern combat aircraft among major world powers, 2023. Sources: IISS (2023), FOI.

Type (Country)	Gen.	No. Hard-points*	Range (Km)	Speed (Km/h)	Quant. 2023
F-35 (US)	5	10(4)	1,667	1,960	539
F-22 (US)	5	12(8)	>3,000	2,470	165
F-16 (US)	4	11	3,333	2,205	515
F-15E (US)	+4	11	3,840	3,018	220
J-20 (China)	5	10(6)	3,400	2,100	140
J-10 (China)	4	12	3,000	2,450	588
Rafale (France)	+4	14	3,125	2,205	132
Eurofighter (UK/G/It)	+4	13	3,790	2,470	359
Su-30MKI (India)	+4	12	3,000	2,120	263
Tejas (India)	4	8	1,850	1,960	30
Su-57 (Russia)	5	12(6)	3,500	2,100	6
Su-35 (Russia)	+4	12	3,600	2,390	96
Su-27 (Russia)	4	10	3,680	2,879	119

* The number of missiles carried internally is marked in parentheses.

The aforementioned US advantage in combat aircraft may not be immediately evident from looking at Table 3.3.[43] Most aircraft seem to perform similarly. If anything, the US F-35 seems to underperform in terms of range and speed. However, among single-engine combat aircraft, it is worth remembering that the F-35 is a fifth-generation aircraft, which relies more on its stealth and avionics capabilities than its range and manoeuvrability. The other single-engine aircraft, such as the US F-16, Chinese J-10 and Indian Tejas are non-stealth fourth-generation aircraft, with inferior stealth capabilities and older avionics.

[43] The data on aircraft generations, number of hardpoints, range and speed are obtained from various open sources, referred to collectively in Table 3.3 as "FOI"; see Section 2.1 for details.

When trying to find the most relevant comparisons between similar types of aircraft, the US advantage becomes apparent. When comparing the fifth-generation US F-22 with the Chinese J-20, it is clear that the US aircraft is capable of carrying more missiles and reaching higher speeds.[44] Similarly, when comparing twin-engine air-superiority fighters such as the Russian Su-35 and Su-27 with their US counterpart, the F-15E, the US aircraft also performs slightly better. India operates the imported French Rafale, along with the license-produced Russian Su-30MKI. These perform on par with their original counterparts, while the domestic light-combat aircraft, Tejas, performs slightly below other single-engine combat aircraft.

E4 combat aircraft generally perform quite well in an international comparison of missiles, range and speed. It is worth remembering that several vital performance factors, such as observability, avionics and the capabilities of individual missiles, are not included in the assessments of this report. However, when comparing combat aircraft of similar generations, mission sets and design purposes, it seems that the US continues to enjoy a clear advantage in the air.

3.5 Concluding Remarks on Global Military Strength

The US remains the world's foremost military power, spending USD 877 billion on its military, or 39 percent of the world total. This is more than the other included major world powers combined. However, China has steadily modernised its armed forces, significantly narrowed the military spending gap, and fuelled a rapid and sustained GDP growth during the past two decades. Russia and India have also increased its military spending drastically since 2000, becoming the world's third and fourth largest military spender respectively. China, Russia and India have also maintained large manpower and equipment quantities in relation to their military spending, which would indicate at least some difference in purchasing power. In the light of Russia's invasion of Ukraine, several European countries have drastically increased, or pledged to increase, their military spending. Meanwhile, Russia has suffered heavy losses and is faced with severe financial and technological sanctions.

The US and European countries generally maintain a qualitative edge in military equipment, with only the latest Chinese, Russian and Indian systems reaching similar capabilities. The US advantage over other major powers is especially pronounced when it comes to combat aircraft, aircraft carriers and nuclear submarines. Even though China has managed to narrow the quality gap for several types of equipment during the past two decades, in recent years, the US has renewed its

[44] The exact range of the F-22 could not be determined by this study and is therefore not compared with that of the J-20. Although the J-20 seems to have a larger body, which could allow for more fuel, the engine's fuel efficiency is also a determinant of range.

efforts to maintain and even widen this capability gap again. Moreover, heightened tensions between the US and China have led the US to take measures to restrict technology transfers to China.

Just as with previous editions of the DEO series, the indicators used in this report do not constitute a comprehensive analysis of equipment quality. Even if they did, any assessment of equipment quality would not be the same as an assessment of overall military capabilities. The modernisation of equipment needs to be followed by an upgrade in training, tactics, doctrine and leadership, otherwise, the equipment is just expensive chunks of alloys and composites. Nevertheless, combined with military expenditure and equipment quantity, the assessment of equipment quality presented above does provide an added perspective to understanding the current global power balance.

This chapter provided a broad assessment and comparison of the military strength of major global powers during the past two decades, in terms of military expenditure, GDP and military equipment. The following chapter provides assessments and estimates of how these trends in military strength are likely to develop from 2023 until 2030.

4 Future Trends

During the last decade, global great-power rivalry has intensified significantly. On 24 February 2022, this rivalry turned lethal, as Russia invaded Ukraine. Besides being an attack on the sovereignty of Ukraine, the war is also an open challenge to the prevailing European security order, built around the guarantees provided by the US via NATO, along with the political and economic community within the EU. Following the invasion, Western countries have rallied together, condemning and sanctioning Russia, while providing humanitarian aid as well as military equipment and training to Ukraine.

Even before Russia invaded Ukraine, its economy was stagnant and declining as a share of global GDP. In response to the war, Western countries turned Russia into the world's most sanctioned country. Through intervention in the currency market and high energy prices, Russia has managed to shield its economy from some of the worst immediate effects of the sanctions. However, the long-term effects of the sanctions may be more severe, as they limit the access to foreign technology and investment.[45]

Despite the ongoing war in Ukraine, arguably the most significant great-power rivalry remains that between the US and China. During the last decade, the world's two largest economies and military spenders have clashed over issues regarding security, trade and technology. The US has also criticised China's human rights record, its initial handling of the COVID-19 pandemic and its claims of sovereignty in the South China Sea. China, for its part, condemns such criticism as attempts to vilify it and contain its rise. In turn, China has accused the US of protectionism and for destabilising the security environment of East Asia. The most contentious issue between the two superpowers is Taiwan, seen by China as a runaway province and by the US as an allied democracy.

While the rivalry between the US and China manifests itself around specific issues and ideological differences, it has intensified with the structural changes in the global power balance, where China has become increasingly capable and willing to challenge the US within several domains. However, the continuation of such a development is far from guaranteed. During the last decade, the US has expended much effort to maintain and even widen its technological, economic and military advantage. While maintaining a neutral stance with regard to Russia, India has sought closer ties with the US, in the common interest of counterbalancing China. Therefore, it seems likely that great-power rivalry will continue to dominate inter-

[45] Oxenstierna, Susanne & Wannheden, Emil (2022) *The Russian economy and military expenditure in light of the war in Ukraine and economic sanctions*. FOI Memo 8023.

national affairs during the coming decade. The following sections outline estimated trends among the major global powers for GDP, military expenditure and military equipment.

Assessment of Gross Domestic Product 2023–2030

During the next ten years, China seems set to surpass the US as the world's largest economy, in terms of nominal GDP. This report estimates that that shift will occur in 2033; see Figure 4.1. This assessment is based on IMF projections between 2023 and 2028, complemented by the assumption that the growth rates of the previous ten years will continue until 2035. IMF projects that the Chinese economy will grow by around per annum 4.1 percent from 2023 to 2028. This growth rate is assumed to largely continue beyond 2028, in this report. Meanwhile, the IMF projects that the US economy will recover by an average yearly growth rate of 1.8 percent from 2023 to 2028, assumed to continue beyond 2028. However, this outcome is in no way guaranteed. The Chinese economy faces several downward risks, such as mounting debt levels, an ageing population and limits on access to key foreign technology. Furthermore, the estimated values are indicated in USD at MER, which means that the assessment is vulnerable to changes in the relative currency value of the USD and the Chinese RMB.

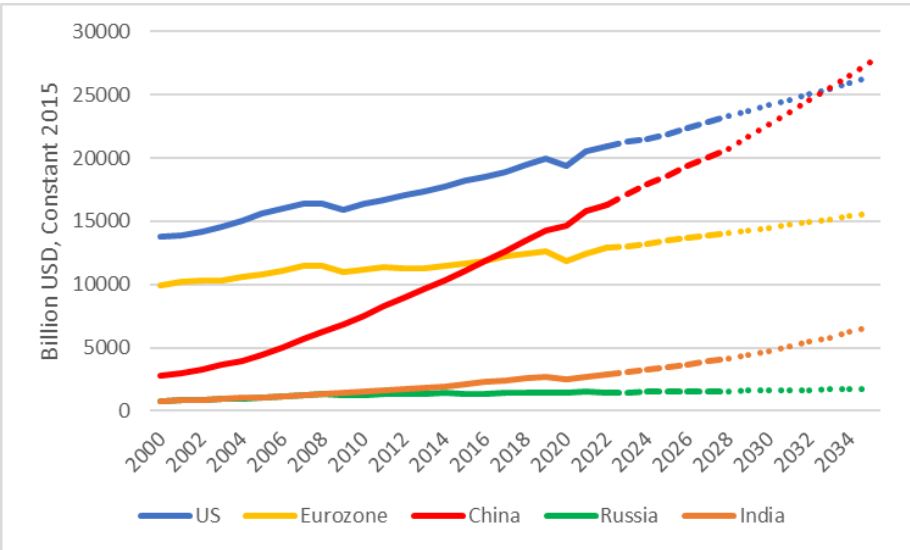

Figure 4.1: GDP of major world powers in USD (constant 2015), 2000–2035.
Sources: World Bank (2023a), IMF (2023a, 2023b, 2023c)

If China were to become the world's largest economy, this would likely have a more psychological and symbolical effect than real economic impact, since the two economies would be of similar size long before reaching parity. It is also worth remembering that in terms of purchasing power parity, the shift had already occurred in 2016, while forecasts by the OECD estimate that China's PPP-adjusted

GDP will be 52 percent larger than that of the US by 2030.[46] As discussed earlier, this measure is also important when assessing economic strength as it provides an estimate of GDP in terms of goods and services.

It is estimated that the Eurozone will recover by a yearly average of 1.5 percent between 2023 and 2028. The Eurozone is assumed to continue growing by 1.5 percent, somewhat slower than the US, beyond 2028. The Russian economy, following a contraction of 2.1 percent in 2022, is projected to recover by an average of 1.0 percent per annum between 2023 and 2028. Afterwards, it is estimated to grow by 1.5 percent until 2030, based on the average growth rate of the previous decade. While Russia's growth rate is on par with that of the Eurozone, the absolute gap between the two will continue to expand, given that the Eurozone economy is several times larger.

Similarly, it is estimated that India's yearly economic growth rate will be 7 percent after 2028, which is much faster than China's. However, given the differences in economic size between the Asian giants, the absolute gap will persist during the coming decade. It is even likely to increase in the short run, as 4 percent growth adds far more value to a USD 16 trillion economy than 7 percent does to a USD 3 trillion economy.

When doing these types of forecasts, it is important to remember that the future is not set in stone. Economic forecasting is difficult at the best of times. However, the ongoing war in Ukraine, high inflation rates and persistent tensions between great powers, make predictions about the future even more uncertain. For a detailed description of this report's data and assumptions concerning future GDP trends, see Appendix E.

Assessment of Military Expenditure 2023–2030

Future military expenditure among major world powers will depend on at least two factors: the GDP growth of each country and the priority each country gives to military expenditure as share of GDP. Momentarily assuming, however unrealistically, that the military expenditure share of GDP would remain the same for major world powers in 2030 as in 2022, it would be possible to say something about military expenditure based on trends in GDP.

In this hypothetical scenario, the US would still allocate twice as much as China towards military spending, even as their economies reached parity in terms of MER. The reason for this is that the US devotes a larger share of GDP to its military, 3.5 percent, compared to China's 1.8 percent. In other words, if China wants to close the military expenditure gap further by 2030, it has to increase its military spending as share of GDP. Similarly, if India were to continue spending 2.7 percent of its GDP on military expenditure, it would spend one third as much as China, even as its economy only amounts to one fifth of the latter's in 2030. Russia's

[46] OECD (2023b) *GDP Long-Term Forecast*. (Accessed 25 April 2023).

military expenditure is also relatively large compared to its economy. Nevertheless, the Eurozone is likely to outpace Russia in terms of military spending in the coming decade. Several European countries have pledged to increase their military spending significantly and the combined economic size of the Eurozone is nine times that of Russia's.

This broad assessment of future military spending is conditioned upon two things: that the GDP estimates for 2030 are fairly accurate (of course); and that the military spending as share of GDP does not alter significantly.

Assessment of Military Equipment 2023–2030

Trying to estimate future quantities of military equipment held by the major world powers is generally difficult, if not impossible, using open sources. For a detailed list of future quantities and a description of the underlying assumptions, see Appendix E.

Naval Equipment 2023–2030

For naval equipment, however, the few number of platforms and the long lead times involved means that naval construction is relatively easy to track using open sources. FOI has compiled data over naval vessels under construction and therefore projections about future naval equipment quantities can be made.[47] Projections until 2025 are fairly straightforward, as most of the ships likely to be in service by then either will have been launched, or in the final stages of construction at the beginning of 2023. Projections until 2030 have required a higher degree of estimation and, sometimes, informed guesswork based on reasonable assumptions about shipbuilding pace and capacity.

The US Navy is set to shrink somewhat until 2030, see Figure 4.2, as commissioned surface combatants and submarines will not fully replace the numbers that will be retired. By 2030, the US Navy is estimated to have 135 surface combatants and 57 submarines. It is likely that most of the increase in surface combatants will consist of *Arleigh Burke* Flight IIA and III destroyers. At the same time, the number of aircraft carriers and amphibious assault ships will remain stable, as the *Ford* class and the *America* class replace older aircraft carriers and amphibious assault ships, respectively. Meanwhile, the number of US submarines is planned to decrease between 2023 and 2030, as the *Virginia* class will not replace the older *Los Angeles* submarines on a one-for-one basis.

Current navy plans involve three alternatives, ranging between 366 to 608 vessels, while putting different emphasis on large and small surface combatants, and amphibious and support ships, but generally entail a significant number of unmanned

[47] Data on future naval equipment are obtained from a wide range of open sources and referred to collectively in Figure 4.2 as "FOI"; see Section 2.1 and Appendix E for details.

vessels.[48] Regardless of the feasibility of these plans and overall future quantities, the US Navy will still enjoy a numerical advantage in terms of aircraft carriers and large surface combatants, until 2030. Moreover, even though the number of nuclear submarines is likely to decline, the current US advantage is large enough to maintain a numerical lead in the near future. Furthermore, the continued introduction of the *Virginia* class will serve to maintain and even widen the US submarine technology advantage over near-peer rivals.

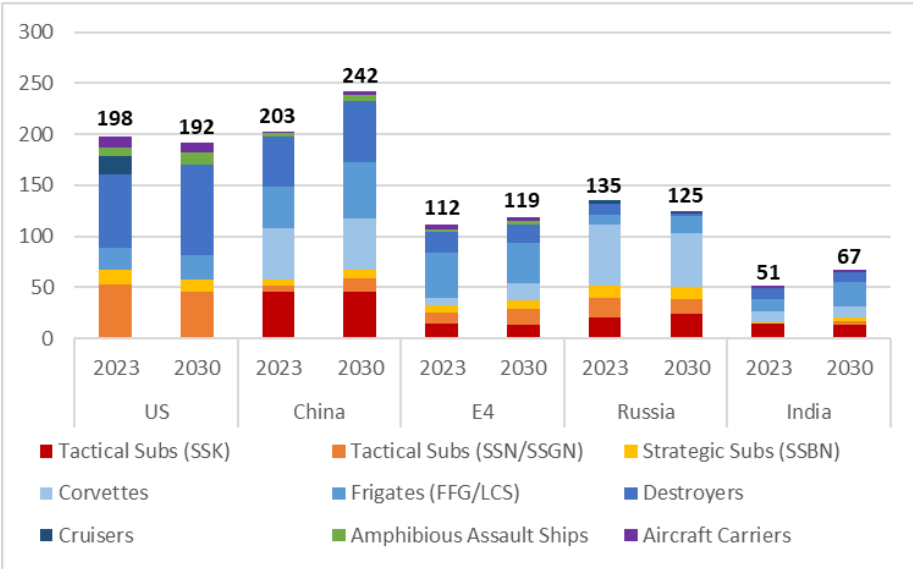

Figure 4.2: Future naval equipment of the major world powers, 2023–2030. Source: FOI

The Chinese PLA Navy is almost certain to continue its expansion until 2030. However, the rate of expansion is likely to slow compared to the previous decade, as maintenance costs for existing platforms will consume a larger share of the naval budget and the growth of military expenditure will likely slow as economic growth decelerates. Nevertheless, China will most likely put increased emphasis on constructing large surface combatants in the coming decade. This study estimates that the PLA Navy will consist of 175 surface combatants and 67 submarines by 2030. Given that the production of the *Type 056* corvettes stopped by 2020, with 22 transferred from the PLA Navy to the Chinese Coast Guard, the shipbuilding focus will likely shift to larger surface combatants. These include the *Fujian*, plus one likely additional, for a total of two new aircraft carriers, additional *Type 75* amphibious assault ships, *Type 055* and *Type 052D* destroyers, and a new batch

[48] Congressional Research Service (2022) *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, December 21, RL32665, p. 8.

of *Type 54A* frigates.[49] China is also likely to increase the number of its nuclear submarines, both strategic and tactical, while the number of its conventional submarines is likely to remain more stable. However, the PLA Navy submarine force is one of the most secretive parts of China's Armed Forces and, as a consequence, estimates of its future size are highly uncertain. Nevertheless, these additions will significantly increase the PLA Navy's ability to project power and strengthen its regional advantage in East Asia.

The navies of the UK, France, Germany and Italy are likely to expand slightly in numbers until 2030. This would mean a reversal of the downward trend from previous decades. It is estimated that the combined navies of the four European powers in 2030 will consist of 82 surface combatants and 37 submarines. However, the expansion will be modest and vary depending on ship type. The number of large surface combatants is assumed to decrease slightly, as older classes of French and Italian destroyers near the end of their life cycles, without any immediate replacements planned before 2030. Meanwhile, the French *Aquitaine*; German *Baden-Württemberg*, and the future *MKS180*, UK *Type 26* and *Type 31*; and Italian frigates commissioned during the period; will not fully replace older classes on a one-to-one basis.[50] Most of the increase is instead attributable to the growing number of German *Braunschweig* and Italian *Paolo Thaon di Revel* corvettes. The quantity of submarines will increase slightly, as 6 new French *Barracuda*, 2 in addition to the 6 existing German *Type 212*, a total of 7 UK *Astute*, and 8 Italian *Todaro* submarines, will replace older vessels.

The Russian Navy is likely to maintain its overall number of vessels. This study estimates that the Russian Navy will have 75 surface combatants and 50 submarines by 2030. This is a downward revision from the estimate in the previous Defence Economic Outlook, from 2020.[51] The reasoning behind this assumption is limited finances and prolonged and delayed maintenance of existing vessels. The decreasing numbers are not evenly distributed among types of vessels. The number of large surface combatants is likely to decrease as the *Sovremenny*- and *Udaloy*-class destroyers reach the end of their life cycles without any clear replacements. Instead, the numbers of Admiral *Gorshkov*- and Admiral *Grigorovich*-class frigates are set to replace both older *Krivak* I and II frigates and take on some of the roles previously filled by destroyers. The stable number of corvettes hides the fact that a large number of these older platforms, such as *Grisha* and *Nanuchka*, will be replaced by new ones, such as *Merkuriy* and *Karakurt*, until 2030. The quantity

[49] The Chinese aircraft carrier, Type 003 *Fujian*, was launched in 2022. This study assumes that it will be commissioned by 2025.

[50] New E4 frigate classes appearing in this study include the French *Frégates de taille intermédiaire* (FTI), the German future MKS 180, the Royal Navy Type 26 and Type 31, as well as the rest of the Italian Bergamini-class (FREMM) frigates. Older ships set to retire between 2020 and 2030 include the French *La Fayette* and *Floréal*, the German *Bremen* and *Brandenburg*, the UK Type 23 and Italian Maestrale frigates.

[51] Olsson, et al. (2020*) Defence Economic Outlooks 2020 – An Assessment of the Global Power Balance 2010-2030*.

of submarines is likely to remain stable, as newer and more capable conventional as well as tactical and strategic nuclear-propelled submarines replace those in the older classes. Newer *Kilo 636.3 Varshavyanka* conventional submarines will continue to gradually replace older *Kilo 877 Paltus*, and *Graney 885M Yasen* are introduced as older nuclear submarines are retired. The number of strategic nuclear *Dolorukiy 955 Borey* submarines is likely to increase to 12 by 2030, from 10 in 2020, replacing older *Delta IV* and *Delta III* submarines.

The Indian Navy is set to expand significantly by 2030, to 46 surface combatants and 21 submarines. This expansion is mainly driven by the introduction of the planned *Nilgiri*-class frigates. India also plans to introduce tactical and strategic nuclear submarines in the coming decade. India is constructing a third aircraft carrier, but this is not planned to be taken into service until after 2030. The estimates of this study rely on the ability of the Indian shipbuilding industry to provide these vessels. This is far from certain, as previous programmes have suffered from significant delays. However, the introduction of new destroyers has been on track, so India is given the benefit of the doubt. Nevertheless, the Indian Navy will remain small compared to those of the US, China and Russia.

Naval Tonnage 2023–2030

In terms of tonnage, relative naval strength will also change in the coming decade; see Figure 4.3. This study estimates that the US Navy surface tonnage will remain relatively stable, growing only slightly from 2,413 to 2,461, between 2023 and 2030. Meanwhile, the number of missiles carried by US surface combatants will decrease, from slightly over 9,400 to just below 8,900, during the same period. This is mostly due to the retirement of the *Ticonderoga*-class cruisers.

Chinese naval tonnage will also increase much faster than the number of vessels, indicating that the average PLA Navy vessel size will continue to increase. PLA Navy tonnage is estimated to more than double and missile capability to increase by about 65 percent. If these estimates hold, then the PLA Navy surface combatants will have reached over half the US naval tonnage and nearly three-fourths of its missile capability in 2030. Nevertheless, the US Navy will still consist of generally larger and more capable vessels than those of its Chinese counterpart, especially regarding large aircraft carriers and advanced nuclear-attack submarines.

It is estimated that the E4's naval tonnage will increase, but only marginally more than the number of ships, indicating no major change in average vessel size. The average E4 naval vessel is much smaller than the average US vessel, but larger than those of the other major powers.

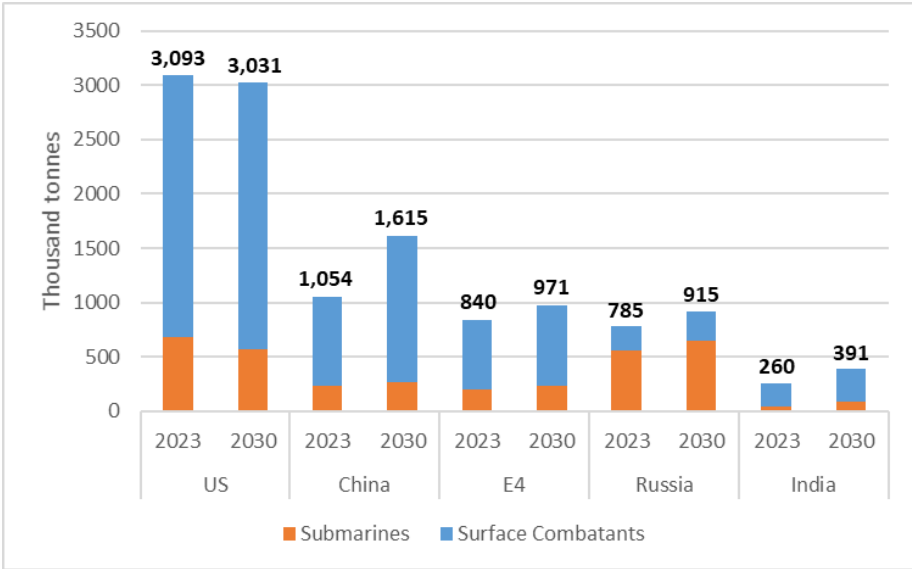

Figure 4.3: Future naval tonnage of the major world powers, 2023–2030. Source: FOI

For Russia, the picture is mixed and highly uncertain, given its current state of war. The sinking of the Russian cruiser, *Moskva*, removed 10,000 tonnes of Russia's naval capacity. The Russian Navy is set to decrease its number of surface combatants marginally by 2030, while its tonnage will grow. However, this assertion relies heavily on the assumption that the aircraft carrier, *Admiral Kuznetsov*, re-enters service by that year. Older nuclear submarines will also be replaced by newer and slightly larger ones, while Russian destroyers will likely be mostly retired and replaced with relatively heavy frigates. With the introduction of a large number of *Admiral Gorshkov* frigates and *Karakurt* corvettes, it is estimated that the Russian surface fleet will have increased its missile capability. Meanwhile, India is set to increase its number of surface combatants by 29 percent, while its surface combatant tonnage will increase by 35 percent and the number of its missiles by 53 percent, indicating an overall larger and more capable surface fleet. It is estimated that India's submarine tonnage will more than double until 2030, provided that the planned large nuclear submarines are introduced during the period.

Future naval strength of the major world powers is not merely a numbers game. Potentially disruptive technologies are constantly being conceived, developed and tested. Developments in unmanned surface and underwater vehicles, and in aircraft, lasers, railguns, hypersonic and anti-ship ballistic missiles, quantum technology, and artificial intelligence, as well as more incremental improvements, such as in new generations of sonars and radars, all have the potential to alter the naval power balance in favour of one nation or the other. Such technologies could also create niche advantages for an individual nation, forcing other countries to develop new technologies, or adapt their naval strategies, in response.

Army Equipment 2023–2030

Estimating future quantities of army equipment is more difficult than for navies, as the quantities involved are generally much larger. Furthermore, planned production is harder to track through open sources and can be more quickly revised compared to the construction of large naval vessels. However, some modernisation efforts seem to be fairly certain. By 2030, the US Army plans to replace its current Bradley IFVs with a new generation of Optionally Manned Fighting Vehicles.[52] Furthermore, it will likely have completed upgrading its Abrams tanks to SEPv3 or SEPv4 standard and possibly beyond.[53] China will likely continue to replace older army equipment, while maintaining relatively large quantities. The PLA could very well complete its army modernisation, replacing its legacy and most of its intermediate systems, by 2030. However, this depends on which priority the army is given. The E4 would have begun to replace some of their infantry fighting vehicles with upgraded versions, as well as some new generations. However, most types of E4 army equipment, including main battle tanks, will largely rely on upgraded versions, as the German-French development of the Main Ground Combat System (MGCS) is not set to enter service until 2040.[54] Russia will need to replace equipment lost in its war against Ukraine. Replacement has so far relied on reintroduction of older stored equipment, which means a short-term deterioration of overall quality. Only the introduction of newly produced or upgraded equipment can help Russia continue its disrupted modernisation efforts, but such a recovery may be hindered by sanctions on key technology by the US and EU.

Emerging technologies, such as unmanned aerial and ground vehicles, as well as artificial intelligence, are also likely to play important roles in future land warfare. Lessons learned from the war in Ukraine will surely inform future development of land warfare. The widespread use of drones will most probably spur not only the use and integration of these systems, but also measures to protect against them. Similarly, the use of anti-tank missiles is certain to spur their introduction, along with various active protection systems to counteract them. High-precision long-range artillery have proven effective, but so have older, sometimes antiquated, pieces of artillery. The war in Ukraine has also highlighted the value of stocks and quantities, especially ammunition, as it has been consumed at enormous rates. The war has also highlighted the importance of robust logistics. The question of which lessons are transferrable and which are not will be the subject of continued analyses as the war in Ukraine continues.

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[52] Judson, Jen (2022) “Industry readies for key US Army Bradley replacement decision“, *DefenseNews,* 22 December 2022. (Accessed 10 February 2023).

[53] Judson, Jen (2022) “What comes after Abrams tanks? The Army is working on possibilities“, *DefenseNews,* 14 October 2022. (Accessed 10 February 2023).

[54] Dean, Sidney E. (2023) “Main Ground Combat System (MGCS): A Status Report”, *European Security and Defence,* 23 January 2023. (Accessed 15 February 2023).

Air Force Equipment 2023-2030

Future quantities of air force equipment are also difficult to estimate, for much the same reason as army equipment. It may be that the declining trends from previous decades could provide some clues. However, should defence spending actually increase as advertised, this downward trend may slow down and in some cases even be reversed. Information regarding modernisation is often more publicly available, at least the information that governments wish to share. The US will continue to acquire and introduce the F-35 throughout the 2020s, gradually replacing F-16s. Meanwhile, the US is also pursuing the development of two sixth-generation projects, one for the air force and one for the navy.[55] China has begun to introduce its J-20 in larger series, although not anywhere near the F-35 in numbers, although it is likely to surpass the number of F-22s. The exact performance of the J-20 is widely debated, but it has been upgraded since its introduction in 2017 and incremental improvements are likely to continue during the next decade. China also seems to be developing a second, smaller, fifth-generation fighter, called J-35. Russia has been slower to introduce its Su-57, which has only entered service in very limited numbers. China has also unveiled a concept of a sixth-generation aircraft.[56] However, these projects are much less public compared to their Western counterparts.

The European picture will likely continue to vary somewhat, with some countries having procured F-35s, while others are aiming to replace fourth-generation fighters with a future sixth generation. European countries are currently developing two competing sixth-generation projects, the Franco-German-Spanish *Système de combat aérien du futur* (SCAF) and the UK-Japanese-Italian Global Combat Air Programme (GCAP).[57] Sixth-generation aircraft are meant to introduce several advantages over previous generations. The exact specifications of these aircraft will vary depending on nation and needs, but often-discussed features include variable-cycle engines, the capability to carry hypersonic and direct energy weapons, unmanned "loyal-wingmen," and AI integration, as well as improvements to existing technology, such as the development of more advanced radar, other sensors and datalink capabilities.

[55] For US Air Force projects, see Osborn, Kris (2023) "Navy & Air Force 6th Gen Come to Life", *Warrior Maven*, 12 April 2023. (Accessed 5 May 2023).

[56] For possible Chinese future aircraft projects, see Saballa, Joe (2022) "China Unveils Rival Sixth-Gen Fighter Concept", *TheDefensePost*, 22 November 2022. (Accessed 5 May 2023).

[57] For the UK-Italian-Japanese project, see BAE Systems (2023) *Delivering future combat air capability through international partnerships*. (Accessed 5 May 2023). For the Franco-German-Spanish project, see Airbus (2023) *Future Combat Air System (FCAS) – Shaping the future of air power*. (Accessed 5 May 2023).

Concluding Remarks on Future Trends

There will always be uncertainties when trying to predict future trends. The ongoing war in Ukraine and the challenging economic environment adds to these uncertainties. It is nevertheless the assessment of this study that the most likely scenario until 2030, save any major upheaval, is a continued shift in economic power from the US towards China.

However, this general assessment comes with a number of caveats. Slowing economic growth, and high levels of local government and corporate debt, as well as an unfavourable demographic outlook, make China's ascent to the position of the world's top economy far from certain. Meanwhile, the US has proven resilient against crises in the past and remains a world leader in innovation and key technologies.

The US will most likely remain the largest military spender until 2030 and maintain its overall military advantage, even though the capability gap towards China may continue to narrow. China's PLA Navy already outnumbers the US Navy and by 2030 this gap will have grown. The average US vessel will still be larger and more capable compared to its PLA counterpart, but China will also narrow the gap in terms of tonnage and number of missiles. Meanwhile, the US advantage in the air and below the surface will likely remain, or even widen, as the F-35 and the Virginia-class submarines continue to be introduced. The army equipment of the US and China will likely be upgraded and to some extent replaced until 2030, while China will likely continue to struggle to fully catch up with the US. Both countries are introducing fifth-generation aircraft capabilities, but the US F-35s are far more numerous and likely more capable overall than the Chinese J-20. The US is also developing the sixth-generation air dominance platform, currently pushing ahead of other major world powers.

The E4 have sought to increase military spending in the past decade and Russia's invasion of Ukraine has accelerated those ambitions significantly. This is happening despite economic headwinds due to surging energy prices and supply chain disruptions. The E4 navies will likely expand somewhat until 2030, reversing the stagnant trend of the past decade. Even with modest economic growth rates, the size of the Eurozone economy will make it continue to widen the economic gap towards Russia. This will make it even more difficult for Russia to compete with its neighbours, as it will have to rebuild and modernise its armed forces with relatively modest means. This is made even worse by sanctions, which deny the Russian defence industry of the vital technology and components it needs. Nevertheless, the Russian navy is likely to expand somewhat. Both the E4 and Russia are simultaneously in the process of developing new types of army equipment and new generations of combat aircraft.

The changing global power dynamic observed by this study does not imply that there will be a power shift between the US and China. As described above, the US

still holds several key military advantages over its main near-peer competitor. Furthermore, US power rests not only on its own resources and innovative technological edge, but on its network of alliances and its soft power. Nevertheless, the continued growth of China's economic and military power, even at a slower pace, will likely continue to embolden its leaders and strain the relationship with the US. This relationship will in turn impact the relationships the US and China have with, and between, Europe, India and Russia, as well as the wider global community.

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Appendix A: Military Expenditure

Table A.1: Top 25 Military Spenders in the World, 2021. Source: SIPRI (2023a).

Country	Billion USD (current prices)	Share of the world (%)	Share of GDP (%)	Change 2000–22 (%)	Change 2018–22 (%)
1. US	876.9	39.0	3.5	+61.1	+10.3
2. China	292.0	12.7	1.6	+553.7	+17.4
3. Russia	86.4	3.8	4.1	+215.2	+19.1
4. India	81.4	3.6	2.4	+162.9	+13.5
5. Saudi Arabia	75.0	3.3	7.4	+122.3	-6.2
6. UK	68.5	3.1	2.2	+28.7	+15.4
7. Germany	55.8	2.5	1.4	+24.5	+18.0
8. France	53.6	2.4	1.9	+17.4	+7.2
9. South Korea	46.4	2.1	2.7	+124.0	+15.8
10. Japan	46.0	2.0	1.1	+17.8	+10.3
11. Ukraine	44.0	2.0	33.5	+3,360.2	+764.6
12. Italy	33.5	1.5	1.7	-2.7	+18.8
13. Australia	32.3	1.4	1.9	+108.6	+15.4
14. Canada	26.9	1.2	1.2	+78.9	+4.7
15. Israel	23.4	1.0	4.5	+64.0	+3.4
16. Spain	20.3	0.9	1.5	+5.9	+13.5
17. Brazil	20.2	0.9	1.1	+29.0	-20.1
18. Poland	16.6	0.7	2.4	+191.2	+34.4
19. Netherlands	15.6	0.7	1.6	+39.0	+31.9
20. Qatar	15.4	0.7	7.0	+943.5	N/A
21. Taiwan	12.5	0.6	1.6	+7.4	+11.8
22. Singapore	11.7	0.5	2.8	+49.1	+4.1
23. Türkiye	10.6	0.5	1.2	+6.6	-30.6
24. Pakistan	10.3	0.5	2.6	+134.1	-0.9
25. Colombia	9.9	0.4	3.1	+137.3	+17.1
NATO (excl. US)	**355.4**	**15.8**	**1.7***	**+28.3**	**+14.5**
Top 25	**1,985.2**	**88.3**	**3.8***	**+87.9**	**+13.4**
World Total	**2,248.6**	**100.0**	**2.1***	**+85.6**	**+11.9**

* Average

Military expenditure in 2022 is denoted in current prices, while changes in military spending are denoted in constant 2021 prices. Note that SIPRI's definition of military expenditure includes direct military spending on armed forces, as well as indirect military spending on, e.g., paramilitary forces, defence ministries, military space activities, and also including salaries, pensions, social services, operations, maintenance, procurement, infrastructure and R&D. Meanwhile, expenditure items related to civil defence and veteran benefits are excluded.[58]

[58] SIPRI (2023b) *SIPRI Military Expenditure Database: Sources and Methods*. (Accessed 25 April 2023).

Appendix B: Gross Domestic Product

Table B.1: Top 25 Economies in the World, 2021. Sources: World Bank (2023a, 2023b).

Country	Billion USD (current prices)	Share of the world 2021 (%)	Share of the world 2000 (%)	Average change 2000–21 (%)	Average change 2017–21 (%)
US	23,315	24.2	30.1	+1.9	+2.1
China	17,734	18.4	3.5	+8.7	+6.0
Japan	4,941	5.1	14.6	+0.5	-0.2
Germany	4,260	4.4	5.7	+1.1	+0.7
India	3,176	3.3	1.4	+6.1	+3.8
UK	3,131	3.2	4.9	+1.4	+0.4
France	2,958	3.1	4.0	+1.1	+1.0
Italy	2,108	2.2	3.4	+0.1	+0.2
Canada	1,988	2.1	2.2	+1.8	+1.4
South Korea	1,811	1.9	1.7	+3.7	+2.3
Russia	1,779	1.8	0.8	+3.2	+1.8
Brazil	1,609	1.7	1.9	+2.1	+1.0
Australia	1,553	1.6	1.2	+2.7	+1.9
Spain	1,427	1.5	1.8	+1.2	+0.3
Mexico	1,273	1.3	2.1	+1.6	+0.2
Indonesia	1,186	1.2	0.5	+4.9	+3.4
Netherlands	1,013	1.0	1.2	+1.3	+1.6
Saudi Arabia	834	0.9	0.6	+3.0	+0.2
Türkiye	819	0.8	0.8	+5.0	+4.9
Switzerland	801	0.8	0.8	+1.7	+1.4
Poland	679	0.7	0.5	+3.7	+4.1
Sweden	636	0.7	0.8	+2.1	+1.9
Belgium	594	0.6	0.7	+1.5	+1.3
Thailand	506	0.5	0.4	+3.4	+1.2
Ireland	504	0.5	0.3	+5.2	8.5
Top 25	**80,635**	**83.5**	**85.9**	**+2.8**	**+2.5**
World Total	**96,527**	**100.0**	**100.0**	**+2.8**	**+2.4**

The GDP data for 2021 are indicated in current USD prices, while average changes between 2000 and 2021 as well as 2017 and 2021 are indicated in 2015 constant prices USD.[59] Note that the World Bank excludes Taiwan, which means that its economy is not included among the global top 25.

[59] GDP in constant prices, 2015 USD, are collected from World Bank (2023a) *GDP Constant 2015 US$*, while GDP in current prices are collected from World Bank (2023b) *GDP Current US$*.

Appendix C: Equipment Quantities

This report, including the figures and tables of Appendix C, uses data on equipment quantities that have almost exclusively been compiled from the 2000, 2005, 2010, 2015 and 2023 volumes of IISS's *The Military Balance*. The only exemption is the data for naval tonnage, which have been collected by FOI from various open sources, up until 31 December 2022.

It is important to note that IISS presents quantities of equipment "in active service," which is not the same as equipment available for operational use. The data from IISS feature some inconsistencies concerning the nomenclature and clustering of equipment into types, over time and between countries. Adjustments have been made to standardise nomenclature, but this might create minor inconsistencies with the classifications made by IISS. When IISS indicates that a certain type of equipment is in active service but without specifying a quantity, the quantity is marked as "some" in this report, but is not included in the sum. IISS classifies some equipment as being kept in "storage," or "reserve." This includes equipment that could be everything from near operational to being used only for spare parts, but such variations in status are not specified. These are not included in the assessment of equipment quantities, but are accounted for separately. While IISS data generally do not account for availability, Russian naval vessels kept in reserve, or undergoing long-term overhaul, are excluded. This study has not adjusted for this minor inconsistency, but it is worth noting that this may lead to a slight underestimation of the ships Russia has in active service.

In this report, surface combatants include aircraft carriers, amphibious assault ships, cruisers, destroyers, frigates and corvettes. The main rule of thumb is to include ships capable of carrying combat aircraft, missiles, or both. However, missile boats and fast-attack craft are excluded, due to their limited size and capability.[60] Furthermore, the vast numbers of such vessels possessed by China and Russia would have skewed comparisons of ship quantities. Submarines include nuclear-armed strategic submarines (SSBN), torpedo- and missile-armed tactical submarines with nuclear propulsion (SSN) and tactical submarines with conventional propulsion (SSK). Mini-submarines and special-purpose submarines are excluded. Furthermore, only manned surface vessels and submarines are included.

Also note that there is no internationally accepted classification of surface combatants, i.e., of what actually distinguishes a small destroyer from a large frigate. IISS sometimes attempts to adjust classifications to reflect changes in roles and capabilities. However, this study has kept the original national classifications. The consequences are generally limited, but the use of national classifications means

[60] The distinction between a coastal corvette and a missile attack craft is often not clearly defined. However, this study classifies coastal corvettes displacing less than 500 tonnes as missile attack craft, thereby excluding them from the overall tally.

that the French European multi-mission frigates (FREMM) of the *Aquitaine* class are categorised as destroyers, while the vessels of the Italian FREMM *Bergamini* class are categorised as frigates.

Main battle tanks are heavily armoured vehicles, armed with a powerful main gun for direct fire. There is no universally accepted standard for what constitutes a main battle tank and these can vary considerably in size. However, wheeled tanks are usually not included in the definition and have also been excluded in this study. Infantry fighting vehicles (IFVs) provide infantry with armoured transportation and fire support. Armoured personnel carriers (APCs) perform similar tasks, but are generally more lightly armed. Both IFVs and APCs can be either wheeled or tracked. There is no universally accepted distinction between an IFV and an APC, but this report classifies vehicles armed with 20mm autocannons, or above, as IFVs. Artillery and multiple rocket launch systems (MLRSs) provide ground forces with indirect fire; both can be either towed or self-propelled. No attempt has been made to estimate the quantities of the replacements of Russian IFVs, APCs, artillery pieces or MLRSs. Although Russia, according to IISS, had large reserves of these equipment types in 2023 and would likely have replaced a significant number of these, as it did with tanks.

Combat aircraft can perform both ground attack and air-superiority missions. They generally carry missiles and autocannons. In this study, the category of combat aircraft includes multirole aircraft, as well as more purpose-built fighters and attack aircraft. Meanwhile, purpose-built large bombers have been placed in a separate category. Transport aircraft provide troops the ability to deploy rapidly and over large distances. These vary greatly in size, but all except light personnel transport aircraft and aircraft for VIPs are included.

USA

US Navy Surface Combatants and Submarines

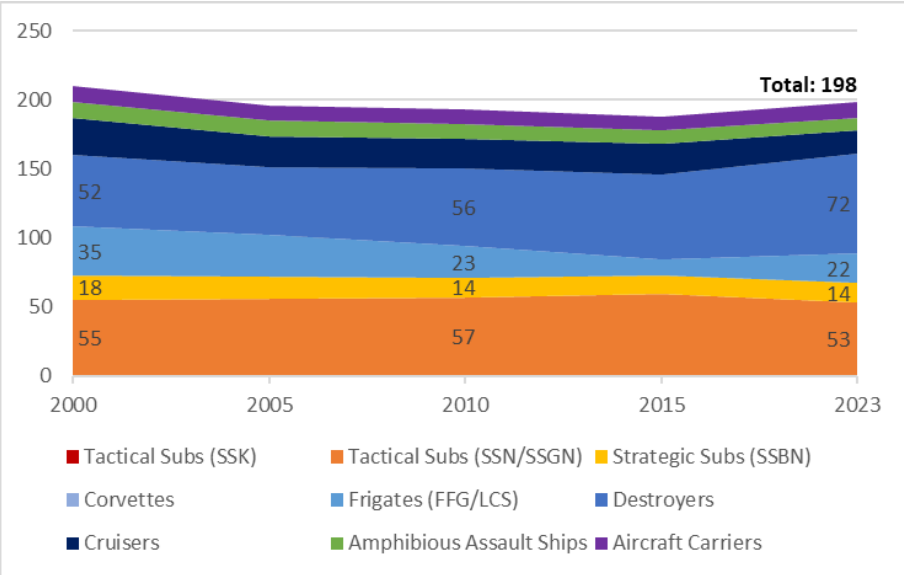

Figure C.1: US Navy surface combatants and submarines, 2000–2023. Sources: IISS

Classes of aircraft carriers: Gerald R. Ford, Nimitz, Enterprise, John F. Kennedy, Kitty Hawk, amphibious assault ships; America, Wasp, Tarawa, cruisers; Ticonderoga, destroyers: Zumwalt, Arleigh Bourke Flight I/II/IIA, Spruance, frigates; Oliver Hazard Perry, littoral combat ships; Freedom, Independence, strategic nuclear submarines; Ohio, tactical nuclear submarines; Virginia Flight I/II/III, Seawolf, Ohio (Mod), Los Angeles (Imp), Los Angeles, Sturgeon.

Table C.1: US Navy surface combatants and submarines, 2000–2023. Sources: IISS.

Type/Year	2000	2005	2010	2015	2023
Aircraft Carriers	12	11	11	10	11
Amphibious Assault Ships	11	12	10	10	9
Cruisers	27	22	22	22	17
Destroyers	52	49	56	62	72
Frigates & LCSs	35	30	23	11	22
Strategic Nuclear Submarines	18	16	14	14	14
Tactical Nuclear Submarines	55	56	57	59	53
Total	**210**	**196**	**193**	**188**	**198**

US Army Equipment

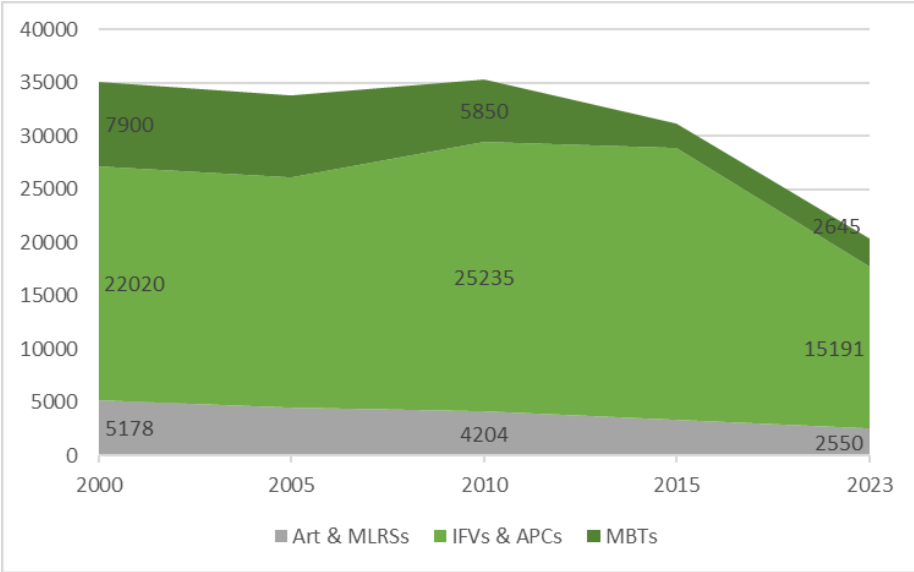

Figure C.2: US Army equipment, 2000–2023. Source: IISS

Types of main battle tanks (MBTs): M1A2/SEPv2/SEPv3 Abrams, M1A1 Abrams, M1 Abrams, infantry fighting vehicles (IFVs); M4/M7A3 Bradley, M2/A Bradley, reconnaissance vehicles; M3A2/A3 Bradley, M7A3 Bradley, M1127 Stryker, Tpz Fuchs, armoured personnel carriers (APCs); MRAP, Stryker, M113, artillery (SP); M109A7, M109A1/A2/A6, artillery (T); M777, M198, M119, M102, multiple launch rocket systems (MLRSs); M142 HIMARS, M270.

Table C.2: US Army equipment, 2000–2023. Source: IISS.

Type/Year	2000	2005	2010	2015	2023
Main Battle Tanks	7,900	7,620	5,850	2,338	2,645
Infantry Fighting Vehicles	6,710	6,719	6,452	4,559	2,855
Reconnaissance Vehicles	110	96	96	1,435	1,745
Armoured Personnel Carriers	15,200	14,900	18,687	19,450	10,591
Artillery (Self-Propelled)	2,512	2,087	1,594	969	689
Artillery (Towed)	1,591	1,547	1,780	1,242	1,267
Multiple Launch Rocket Systems	1,075	830	830	1,205	594
MBTs (Reserve)	-	-	-	3,500	2,000
IFVs (Reserve)	-	-	-	2,000	2,000
Rec (Reserve)	-	-	-	800	800
APCs (Reserve)	-	-	-	8,000	8,000
Artillery (Reserve)	-	-	-	500	850

US Air Force, Navy and Marine Corps Aircraft

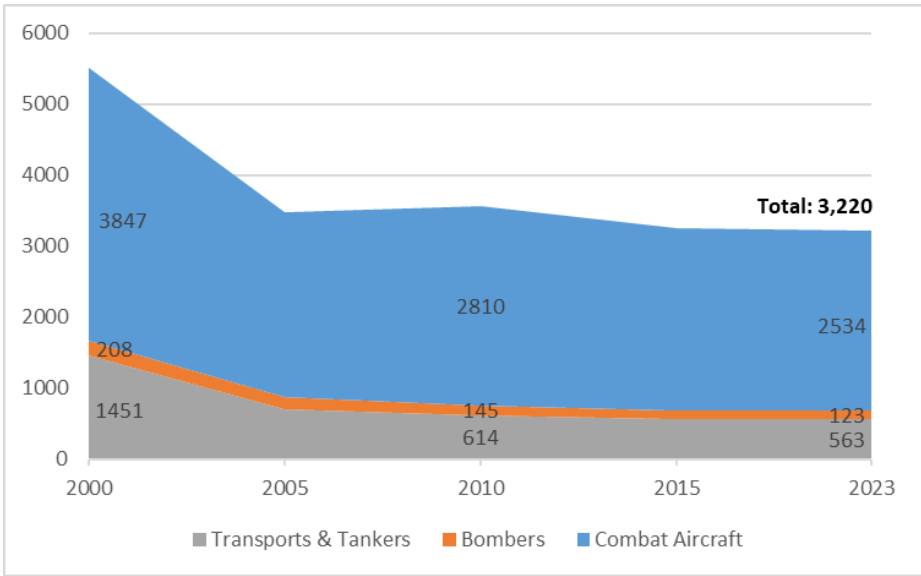

Figure C.3: US Air Force, Navy and Marine Corps aircraft, 2000–2023. Source: IISS

Types of combat aircraft: F-35A/B/C, F-22, F-18E/F, F-18A/B/C/D, F-111, F-16A/B/C/D, F-15E, F-15A/B/C/D, F-14A/B/D, OA-10A/A-10C, AV/TAV-8, A-10A, bombers; B-2, B-1B, B-52, transports; C-5, C-17A, C-130, C-141, C-135, tankers; KC-46A, KC-10A, KC-135.

Table C.3: US Air Force, Navy and Marine Corps aircraft, 2000–2023. Source: IISS.

Type/Year	**2000**	**2005**	**2010**	**2015**	**2023**
Combat Aircraft	3,847	2,611	2,810	2,557	2,534
Bombers	208	174	145	137	123
Transports	846	383	373	327	229
Tankers	605	314	241	226	334
Total	**5,506**	**3,482**	**3,569**	**3,247**	**3,220**

China

PLA Navy Surface Combatants and Submarines

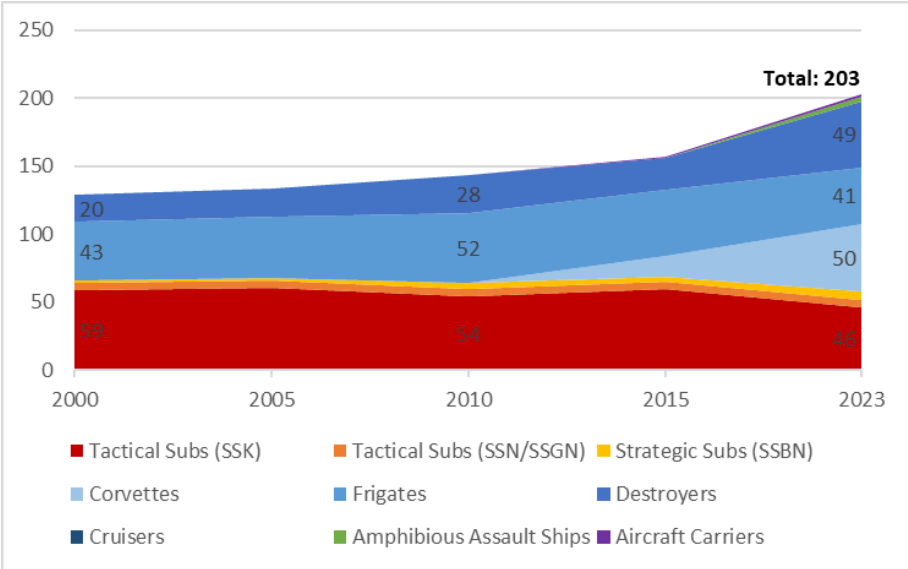

Figure C.4: PLA Navy surface combatants and submarines, 2000–2023. Sources: IISS

Classes of aircraft carriers: Type 002, Type 001, amphibious assault ships; Type 075, destroyers; Type 055, Type 052D/DL, Type 052C, Type 052B, Type 051C, Type 051B, Sovremenny, Type 052, Type 051/D/G, frigates; Type 054A, Type 054, Type 053H, corvettes; Type 056/A, strategic submarines; Type 094, Type 092, Golf, tactical nuclear submarines; Type 093A, Type 93, Type 091, tactical conventional submarines; Type 039A, Type 039, Kilo 636.3, Kilo 877, Type 035, Type 033.

Table C.4: PLA Navy surface combatants and submarines, 2000–2023. Sources: IISS.

Type/Year	**2000**	**2005**	**2010**	**2015**	**2023**
Aircraft Carriers	-	-	-	1	2
Amphibious Assault Ships	-	-	-	-	3
Destroyers	20	21	28	23	49
Frigates	43	45	52	49	41
Corvettes	-	-	-	15	50
Strategic Submarines	2	2	4	4	6
Tactical Nuclear Submarines	5	5	6	5	6
Tactical Conventional Subs	59	61	54	60	46
Total	**129**	**134**	**144**	**157**	**203**

PLA Army Equipment

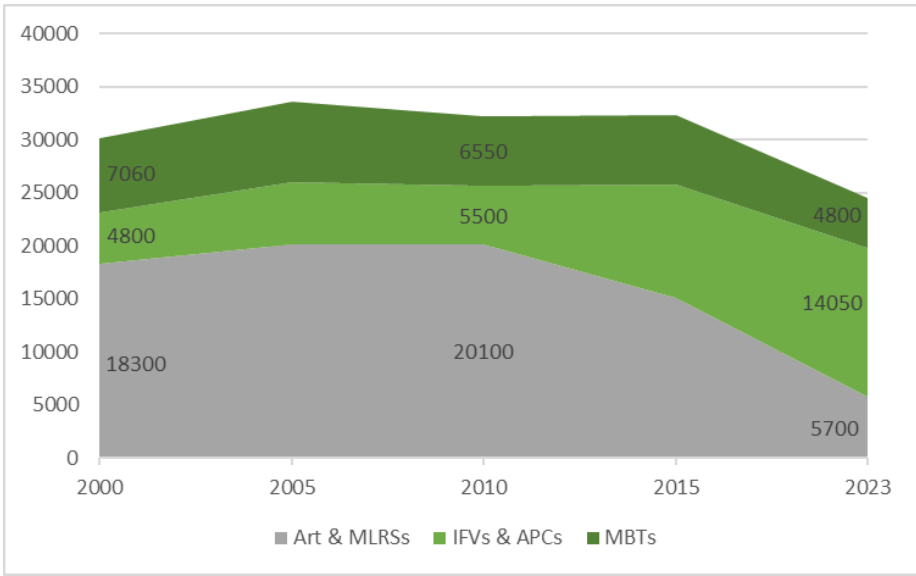

Figure C.5: PLA Army equipment, 2000–2023. Source: IISS

Types of main battle tanks (MBTs): ZTZ-99/A, ZTZ-96/A, ZTZ-88, ZTZ-79, ZTZ-69, ZTZ-59, infantry fighting vehicles (IFVs); ZTL-11, ZTS-63A, ZTD-05, ZBD-04/A, ZDB-86/A, BTR-50, armoured personnel carriers (APCs); ZSL-10, ZBL-08, ZSL-93, ZSL-92, ZSD-89, ZSD-63, artillery (SP); PLZ-07/A/B, PLZ-05, PCL-181, PCL-171, PCL-161, PCL-09, PLL-09, PLZ-89, PLZ-83, PLZ-45, artillery (T); PL-96, PL-54/-59/-66, multiple launch rocket systems (MLRSs); PHL-19/-20, PHL-03, PHL-161, PHL-21, PHL-20, PHZ-10/-11, PHL-11, PHZ-89, PHZ-81/-90.

Table C.5: PLA Army equipment, 2000–2023. Source: IISS.

Type/Year	2000	2005	2010	2015	2023
Main Battle Tanks	7,060	7,580	6,550	6,540	4,800
Infantry Fighting Vehicles	some	1,200	1,100	2,120	6,000
Armoured Personnel Carriers	4,800	3,500	3,300	6,450	8,050
Artillery (Self-propelled)	300	1,150	1,200	2,280	3,480
Artillery (Towed)	15,500	16,550	16,500	10,898	900
Multiple Launch Rocket Systems	2,500	2,400	2,400	1,872	1,320

PLA Air Force and Navy Aircraft

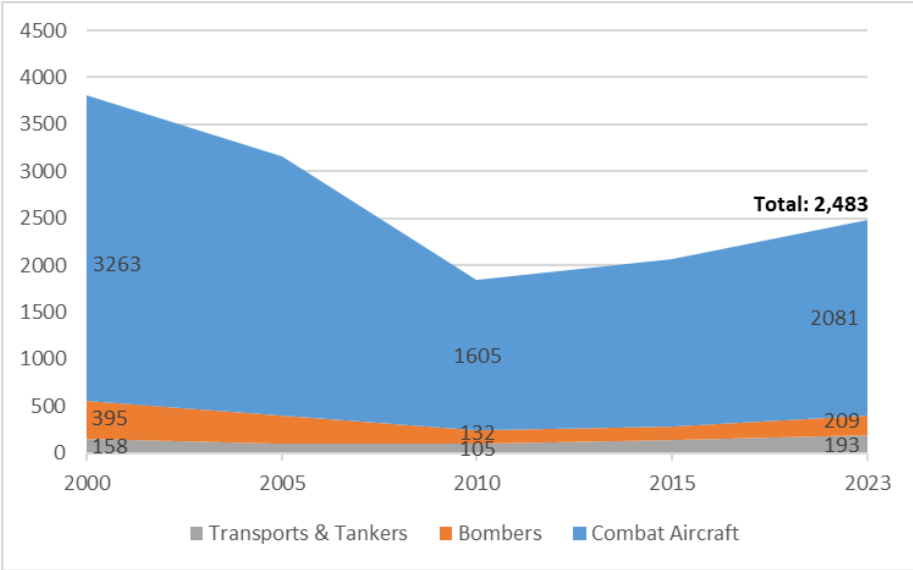

Figure C.6: PLA Air Force and Navy aircraft, 2000–2023. Source: IISS

Types of combat aircraft: J-20, J-16, J-15, J-10A/B/C, Su-35, Su-30MKK/MK2, J-11B/BS, J-11/Su-27, JH-7/A, J-8A/B/E, J-7, Q-5, J-6, bombers; H-6, H-5, transports & tankers; Y-20, Il-76, Y-9, Y-8, Y-12, Y-11, Y-7, Y-5, Il-18, Yak-48.

Table C.6: PLA Air Force and Navy aircraft, 2000–2023. Source: IISS.

Type/Year	**2000**	**2005**	**2010**	**2015**	**2023**
Combat Aircraft	3,263	2,769	1,605	1,787	2,081
Bombers	395	290	132	136	209
Transports & Tankers	158	104	105	142	193
Total	**3,816**	**3,164**	**1,842**	**2,065**	**2,483**

European Four

UK, French, German and Italian Navy Surface Combatants and Submarines

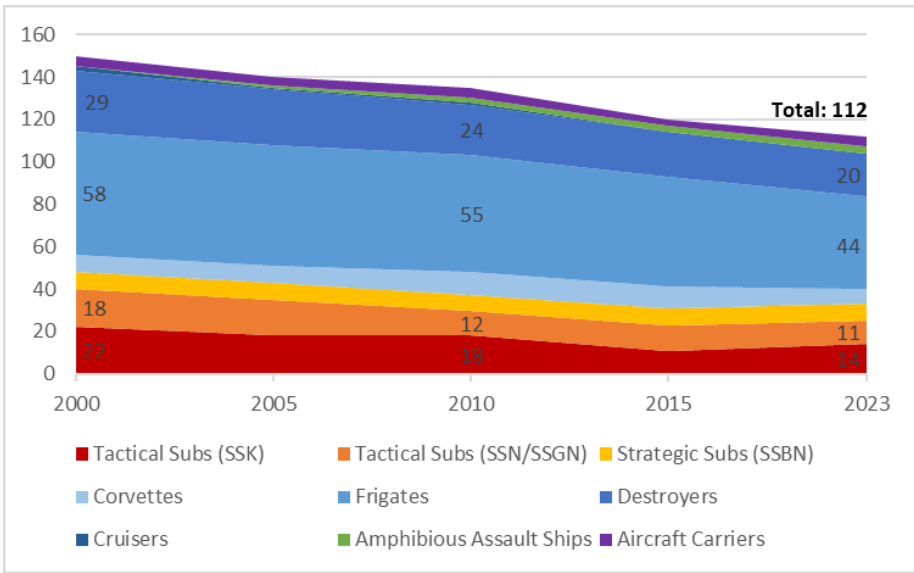

Figure C.7: E4 Navy surface combatants and submarines, 2000–2023. Source: IISS

Classes of aircraft carriers: Queen Elizabeth, Invincible (mod.), Charles de Gaulle, Clémenceau, Invincible, Cavour, Guiseppe Garabaldi, amphibious assault ship; Mistral, cruisers; Jeanne d'Arc, Vittorio Veneto, destroyers; Type 45, Type 42, Aquitaine, Forbin, Cassard, Georges Leygues, Tourville, Lütjens, Andrea Doria, Durand de la Penne, Audace, frigates; Type 23, Type 22 Batch 2/3, La Fayette, Floreal, Sachsen, Brandenburg, Bremen, Bergamini, Maestrale, Artiglieri, Lupo. Corvettes: Braunschweig, Paolo di Revel, Minerva, strategic nuclear submarines; Vanguard, Le Triumphant, Redoutable, tactical nuclear submarines; Astute, Trafalgar, Swiftsure, Barracuda, Rubis, tactical conventional submarines; Agosta, Type 212A, Type 206/206A, Type 205, Todaro, Pelosi, Sauro.

Table C.7: E4 Navy surface combatants and submarines, 2000–2023. Source: IISS.

Class/Year	2000	2005	2010	2015	2023
Aircraft Carriers	5	4	5	3	5
Amphibious Assault Ships	-	1	2	3	3
Cruisers	2	1	1	-	-
Destroyers	29	26	24	21	20
Frigates	58	57	55	52	45
Corvettes	8	8	11	10	7
Strategic Nuclear Submarines	8	8	7	8	8
Tactical Nuclear Submarines	18	17	12	12	11
Tactical Conventional Subs	22	18	18	11	14
Total	**150**	**140**	**135**	**120**	**113**

UK, French, German and Italian Army Equipment

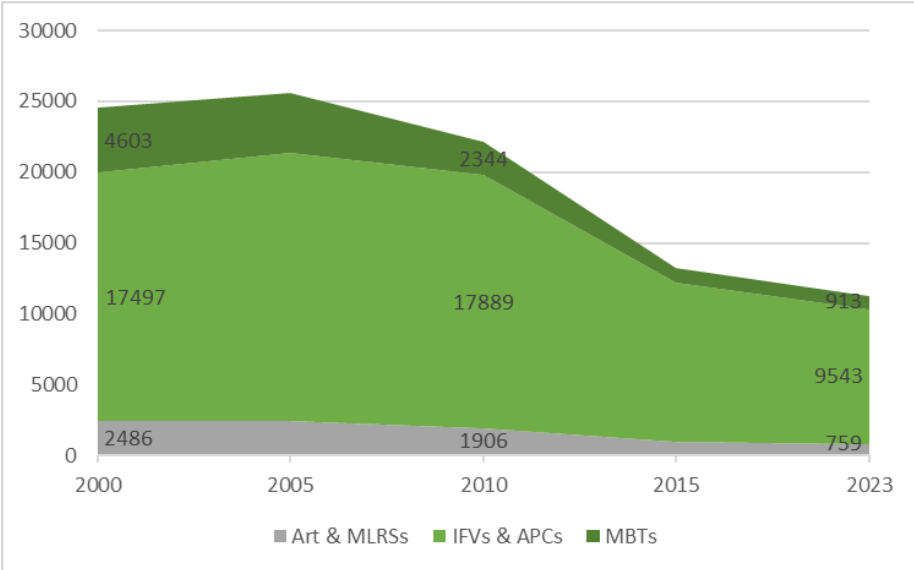

Figure D.8: E4 Army equipment, 2000–2023. Source: IISS

Types of main battle tanks (MBTs): Challenger 2, Challenger 1, Chieftain,Leclerc, AMX-30, Leopard 2A7/A6/A4, Leopard 1, C1 Ariete, infantry fighting vehicles (IFVs); Warrior, Rarden, VBCI, AMX-10, Puma, Marder, Wiesel, Centauro, Dardo, Freccia, reconnaissance vehicles; Ajax, Jackal, Sabre, FV 101, VBL, AMX-10RC, AML-60/90, Wiesel, Fennek, Tpz-1, SPz-2, armoured personnel carriers (APCs); Ares, Athena, Panther, Warthog, Stormer, Bulldog, Spartan, Ridgeback, Mastiff, Foxhound, Saxon, Saracen, BvS-10, VAB, VBMR, Bv-206, M-113, Boxer, TpZ-1, Eagle, Dingo, VCC-1, Fiat 6614, Cougar, VBR NBC, artillery; AS-90, FV 433, M-109, M-107, M-110, L-118/-119, Mod 56, CAESAR, AU-F-1, TR-F-1, PzH-2000, M110, FH-70, M-101, M-56, multiple launch rocket systems (MLRSs); M270, MLRS 227, LARS.

Table D.8: E4 Army equipment, 2000–2023. Source: IISS.

Type/Year	2000	2005	2010	2015	2023
Main Battle Tanks	4,603	4,187	2,344	997	913
Infantry Fighting Vehicles	3,887	3,853	3,882	2,200	2,470
Reconnaissance Vehicles	1,533	1,527	1,285	1,145	1,238
Armoured Personnel Carriers	12,077	13,546	12,722	7,908	5,835
Artillery (Self-propelled)	1,266	1369	1125	533	355
Artillery (Towed)	842	749	505	297	299
Multiple Launch Rocket Systems	378	340	276	139	105

UK, French, German and Italian Air Force and Navy Aircraft

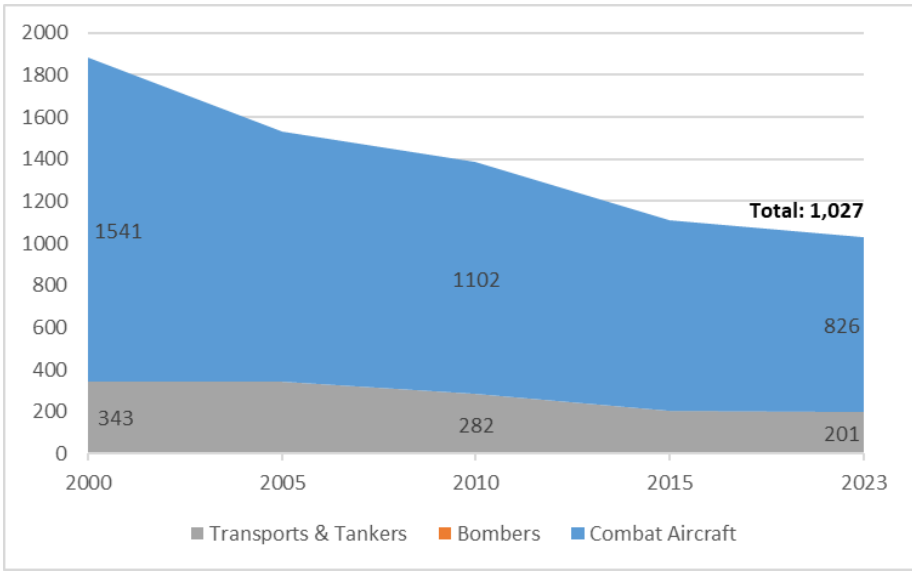

Figure C.9: E4 Air Force and Navy aircraft, 2000–2023. Source: IISS

Types of combat aircraft: F-35, Eurofighter, Rafale, Mirage 2000, Mirage F-1, F-16, Super Etard, Tornado, Harrier, Jaguar, Ghibli, F-4, Su-22, F-104, MiG-29, MiG-23, MiG-21, bombers; none, transports; A310, A400M, C-17A, C-130, C-160, CN-235, DHC-6-300, B-707-320C, TBM-700, C-27J, A-319, G-222, MB-339, tankers; A330, KC-135, KC-767A, KC-130J, C-135FR, C-160R, VC-10, TriStar.

Table C.9: E4 Air Force and Navy aircraft, 2000–2023. Source: IISS.

Type/Year	**2000**	**2005**	**2010**	**2015**	**2023**
Combat Aircraft	1,541	1,188	1,102	905	826
Transports & Tankers	343	340	282	206	201
Total	**1,923**	**1,556**	**1,406**	**1,111**	**1,027**

Russia

Russian Navy Surface and Submarines Combatants

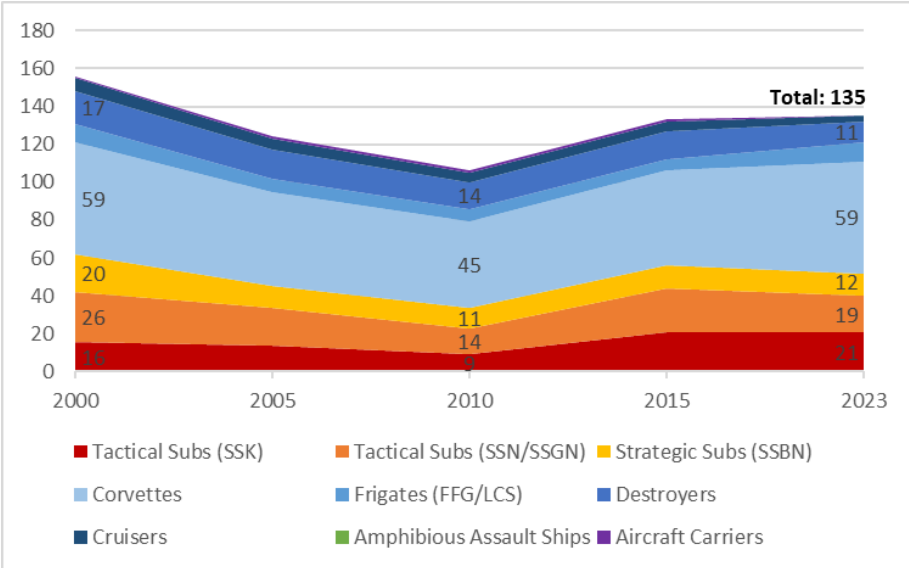

Figure C.13: Russian Navy surface combatants and submarines, 2000–2023. Sources: IISS

Classes of aircraft carriers: Kuznetsov, cruisers; Kirov, Slava, Kara, Kynda. Destroyers: Udaloy I/II, Sovremenny, Kashin (Mod.), Kashin, frigates; Gorshkov, Krivak V, Gepard, Neustrashimyy, Krivak I/II, corvettes; Karakurt, Steregushchiy, Buyan/M, Parchim II, Grisha I/III/IV/V, Nanuchka III/IV, strategic nuclear submarines; Borey/-A, Typhoon, Delta I/III/IV, Yankee I/II, tactical nuclear submarines; Graney, Victory III, Sierra I/II, Akula I/II, Oscar II, tactical conventional submarines; Lada, Kilo 636.3, Kilo 877, Tango, Foxtrot.

Table C.13: Russian Navy surface combatants and submarines, 2000–2023. Sources: IISS.

Class/Year	**2000**	**2005**	**2010**	**2015**	**2023**
Aircraft Carriers	1	1	1	1	-
Cruisers	7	6	5	5	3
Destroyers	17	15	14	15	11
Frigates	10	7	7	6	10
Corvettes	59	50	45	50	59
Strategic Nuclear Submarines	20	11	11	11	12
Tactical Nuclear Submarines	26	20	14	23	19
Tactical Conventional Subs	16	14	9	21	21
Total	**156**	**124**	**106**	**132**	**135**

Russian Army Equipment

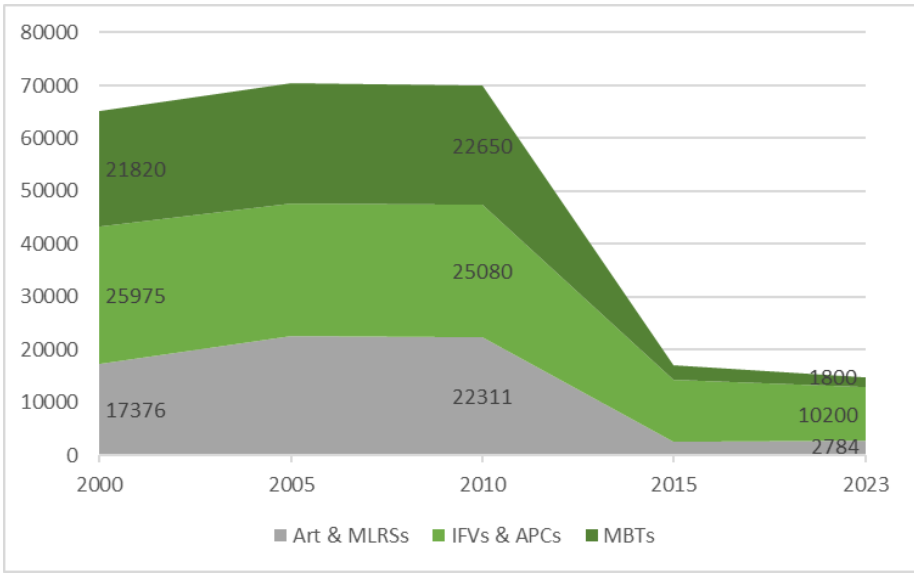

Figure C.14: Russian Army equipment, 2000–2023. Source: IISS

Types of main battle tanks (MBTs): T-90M, T-90/A, T-80BVM, T-80BV/U, T-80/U/UD/UM, T-72B3/B3M, T-72B/BA, T-72/L/M, T-64A/B, T-62, T-55, infantry fighting vehicles (IFVs); BMP-3/M, BMP-2, BMP-1, BRM-1K, BMD, BDRM-2, armoured personnel carriers (APCs); BMO-T, MT-LB, BPM-97, BTR-D/82/82A, BTR-80A, BTR-80/70/60, BTR-50, artillery; Koalitsiya-SV, Msta-SM, Msta-S, Malka, Pion, Giatsint-S, Akatsiya, Gvozdika, Msta-B, Giatsint-B, D-30, D-20, D-1, BS-3, M-46, M-30, M-20, multiple launch rocket systems (MLRSs); Tornado-S, Smerch, Uragan-1M, Uragan, BM-24, Grad, TOS-1, BM-16, BM-13.

Table C.14: Russian Army equipment, 2000–2023. Source: IISS

Type/Year	**2000**	**2005**	**2010**	**2015**	**2023**
Main Battle Tanks	21,820	22,800	22,650	2,600	1,800
Infantry Fighting Vehicles	14,700	15,090	15,180	4,700	3,950
Armoured Personnel Carriers	11,275	9,900	9,900	7,225	6,250
Artillery	14,770	18,735	18,735	1,650	1,898
Multiple Launch Rocket Systems	2,606	3,926	3,576	850	886
MBTs (Reserve)	8,900	-	350	17,500	5,000
IFVs (Reserve)	-	-	-	8,500	8,500
APCs (Reserve)	-	-	-	6,000	6,000
Artillery (Reserve)	-	-	-	16,695	11,400
MLRSs (Reserve)	-	-	-	3,220	3,220

Russian Air Force and Navy Aircraft

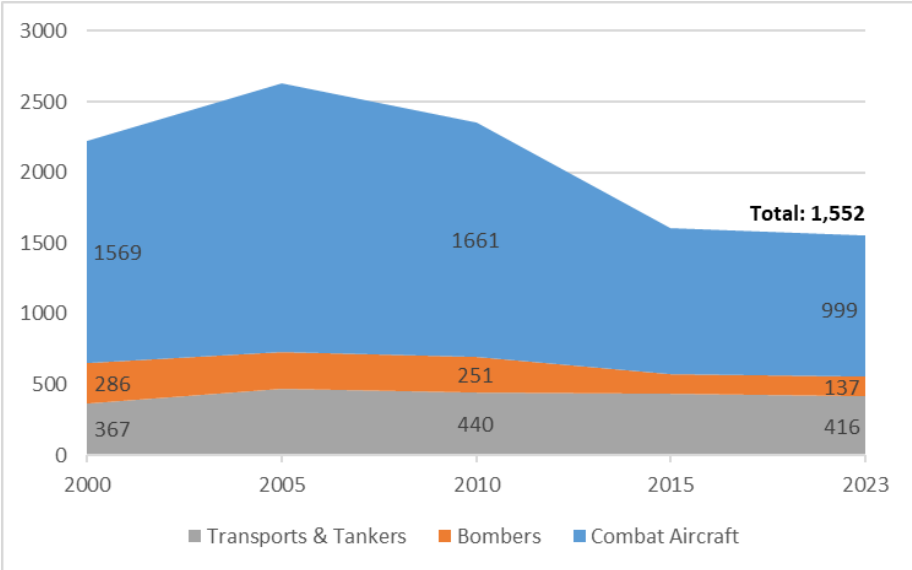

Figure C.15: Russian Air Force and Navy aircraft, 2000–2023. Source: IISS

Types of combat aircraft: Su-57, Su-35S, Su-34, Su-30/M2/SM, Su-27/UB/SM2/SM3, MiG-29, Su-25A/SM/UB, Su-24, MiG-31, MiG-25A/E, bombers; Tu-160, Tu-95, Tu-22, transports & tankers; An-124, An-22, Il-76, An-12BK, An-26, An-72, An-140, L-410, Tu-134, Il-78.

Table C.15: Russian Air Force and Navy aircraft, 2000–2023. Source: IISS.

Type/Year	**2000**	**2005**	**2010**	**2015**	**2023**
Combat Aircraft	1,569	1,902	1,661	1,031	999
Bombers	286	261	251	141	137
Transports & Tankers	367	468	440	431	416
Total	**2,222**	**2,631**	**2,352**	**1,603**	**1,552**

India

Indian Navy Surface Combatants and Submarines

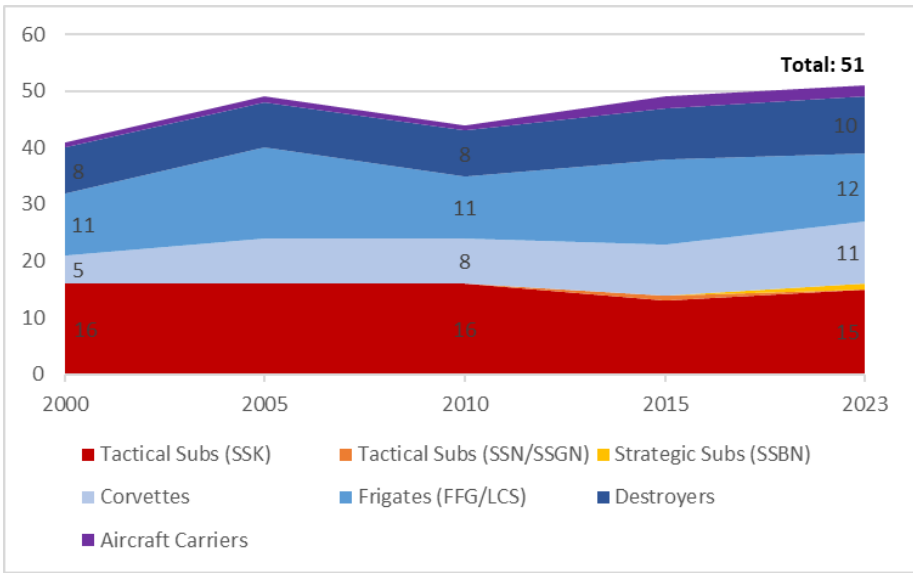

Figure C.10: Indian Navy surface combatants and submarines, 2000–2023. Source: IISS

Classes of aircraft carriers: Vikrant, Vikramaditya, Viraat, destroyers; Visakhapatnam, Kolkata, Delhi, Rajput, frigates; Shivalik, Talwar, Brahmaputra, Godavari, Arnala, Nilgiri, corvettes; Kamorta, Kora, Khukri, strategic submarines; Arihant, tactical nuclear submarines; Chakra, tactical conventional submarines; Kalvari, Sindhugosh, Shishumar, Kursurat.

Table C.10: Indian Navy surface combatants and submarines, 2000–2023. Source: IISS.

Type/Year	2000	2005	2010	2015	2023
Aircraft Carriers	1	1	1	2	2
Destroyers	8	8	8	9	11
Frigates	11	16	11	15	12
Corvettes	5	8	8	9	10
Strategic Submarines	-	-	-	-	1
Tactical Nuclear Submarines	-	-	-	1	-
Tactical Conventional Subs	16	16	16	13	15
Total	**41**	**49**	**44**	**49**	**51**

Indian Army Equipment

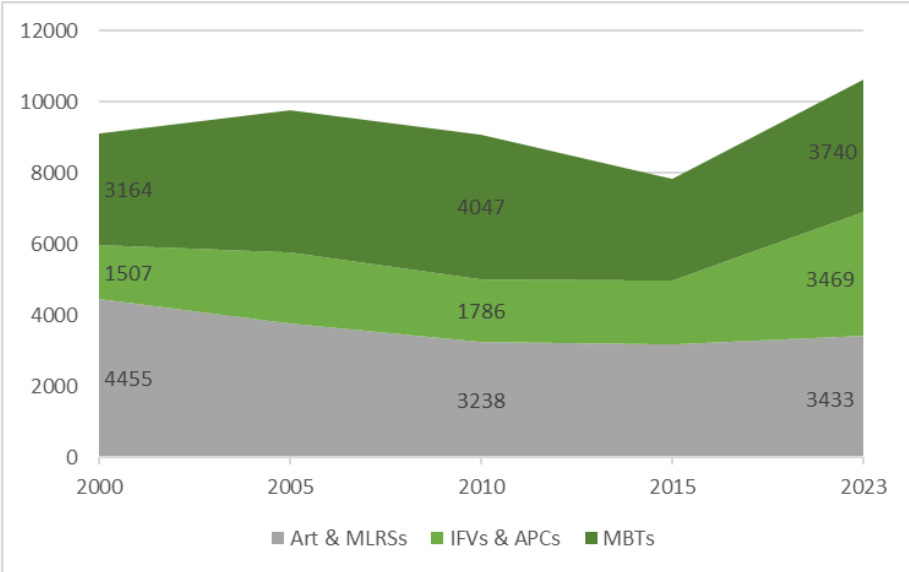

Figure C.11: Indian Army equipment, 2000–2023. Source: IISS

Types of main battle tanks (MBTs): T-90S Bhishma, Arjun Mk1, T-72/-M1 Ajeya, Viyanta, T-54/-55, infantry fighting vehicles (IFVs); BMP-2K, BMP-2 Sarath, BMP-1, armoured personnel carriers (APCs); Yukthirath, Casspir, Ot-62/-64, artillery (SP): K9 Varja, M-46 Catapult, artillery (T); M777A2, FH-77B, Abbott, D-30, M-46, M-56, LFG, IFG, Yug-48, 75/24 mtn, multiple launch rocket systems (MLRSs); 9A52 Smerch, Pinaka, BM-21.

Table C.11: Indian Army equipment, 2000–2023. Source: IISS.

Type/Year	2000	2005	2010	2015	2023
Main Battle Tanks	3,164	3,992	4,047	2,874	3,740
Infantry Fighting Vehicles	1,350	1,700	1,455	1,455	3,100
Armoured Personnel Carriers	157	317	331	336	369
Artillery (Self-propelled)	100	70	20	20	100
Artillery (Towed)	4,255	3,505	3,010	2,970	3,095
Multiple Launch Rocket Systems	100	180	208	192	238

Indian Air Force and Navy Aircraft

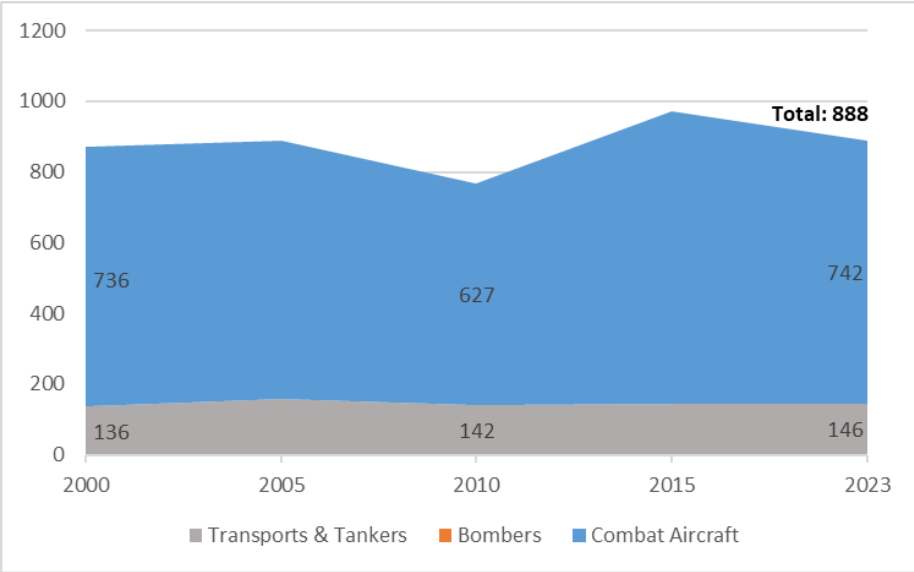

Figure C.12: Indian Air Force and Navy aircraft, 2000–2023. Source: IISS

Types of combat aircraft: Rafale EH/DH, Tejas, Su-30MKI, Mirage 2000, Mig-29, Sea Harrier, MiG-27, Mig-21, MiG-21, Jaguar, bombers; none, transports & tankers; Il-78, C-17A, Il-76, C-130J, An-32, B737, B-707, BAe-748, Do-228, EMB-135BJ.

Table C.12: Indian Air Force and Navy aircraft, 2000–2023. Source: IISS.

Type/Year	**2000**	**2005**	**2010**	**2015**	**2023**
Combat Aircraft	736	730	627	825	742
Bombers	-	-	-	-	-
Transports & Tankers	136	158	142	146	146
Total	**872**	**888**	**769**	**971**	**865**

Appendix D: Equipment Quality

This report's assessment of equipment quality, including the figures and tables in Appendix D, are based on two methods. First, in order to assess the overall modernity of the equipment of the major global powers, the quantity data collected from numerous editions (2000, 2005, 2010, 2015 and 2023) of *The Military Balance*, published by the IISS, was sorted into three broad categories: Modern, Intermediate and Legacy equipment. Secondly, in order to compare the performance of the modern equipment used by the major global powers, performance indicators for new equipment are presented.

Categorisation by Generation

The categorisation of surface combatants and submarines according to their degree of modernity is based on the decade in which the lead ship of a given class was commissioned into active service. Naval classes commissioned in the 1950s and 1960s are categorised as Legacy. Classes taken into service in the 1970s and 1980s are categorised as Intermediate. Classes where the lead ship was commissioned after 1990 are categorised as Modern, or New. There are some exceptions to this general rule. The two most notable are the surface combatants and submarines of China's PLA Navy and the Indian Navy. During the 1980s and 1990s, China mainly copied, or adapted, older Soviet designs and it was only during the 2000s that it began to produce more modern vessels. Similarly, India relied on updated British, or imported older Soviet designs, up until 2000. Therefore, the classification of Chinese and Indian naval vessels lags a decade behind that of the US, E4 and Russia. The identification of age has been done by referring to a wide variety of open sources.

It is also worth noting that naval vessels are usually upgraded during their long life cycles. However, upgrades have not been taken into account in this classification. This may underestimate the overall modernity of Russia's, and to a lesser extent China's, navy. A conscious inconsistency is the *Sovremenny*-class destroyers, which were bought by China in the early 2000s, but for the PLA Navy are classified as Intermediate, as they were of older design and the Russian navy had classified them as Intermediate. Another conscious inconsistency is the Russian aircraft carrier, *Kuznetsov*, which is classified as Intermediate, while its Chinese sister ship, *Liaoning*, is classified as New. The reason is that the *Liaoning* was upgraded by China prior to being commissioned in 2012.

This report's categorisation of main battle tanks corresponds with the generally accepted division into generations. Third-generation main battle tanks are classified as New, while second-generation tanks are classified as Intermediate, and first-generation tanks as Legacy. Exactly which tank belongs to which generation can be a matter of debate, but there are some general commonalities. For the pur-

pose of this report, third-generation tanks often feature composite armour, computer-stabilised fire control, networked communications and have entered service from the 1980s onwards. Second-generation tanks often feature NBC (nuclear, biological, chemical) protection and some thermal imagery and were introduced in the 1960s and 1970s. The first-generation main battle tanks were introduced just after World War II. The identification of generations has been done by referring to a wide variety of open sources.

In this study, the category of combat aircraft includes multirole, fighter and attack aircraft, but excludes bombers. Similarly to tanks, the categorisation corresponds to the classification into generations. Fifth- and fourth-generation combat aircraft are classified as Modern, while those of the third generation are classified as Intermediate, and second-generation aircraft are classified as Legacy. Exactly which aircraft belongs to which generation can be a matter of debate, but there are some general commonalities. For the purpose of this report, fifth generation aircraft feature stealth capabilities and sensor-fusion advanced communications, while entering service after 2000. Fourth-generation combat aircraft feature advanced avionics and high manoeuvrability, and mainly entered into service from the 1970s. The third-generation combat aircraft were introduced in the 1960s and the second generation were commissioned from the 1950s. The identification of age has been conducted using a wide variety of open sources.

Quality Indicators for Modern Equipment

While the categorisation according to modernity can offer broader insights, there may be quite significant differences in quality between the modern equipment of one country compared to another's. In order to address this issue, the broad categorisation presented above is complemented by a number of performance indicators that are relevant for the selected modern surface combatants, main battle tanks and combat aircraft of the major global powers.

Surface combatant performance is assessed by the following indicators: number of missiles, maximum range (indicated in km) and top speed (indicated in Mach)[61] of surface-to-air missiles (SAMs) and anti-ship missiles (ASMs). The number of missiles gives a broad sense of the lethality and endurance of a given warship. Note that short-range point-defence missiles are not included in this tally. Maximum missile range is a highly theoretical measure. A missile that can fly 200 km, but can only hit targets at 100 km, will have a shorter effective range than a missile that can both fly and hit targets at 150 km. However, exact efficiency is difficult to obtain and even harder to verify using open sources. So, keeping this caveat in mind, maximum range should provide some understanding of relative performance. Top speed, denoted in terms of Mach, is relevant, as higher speed makes

[61] Mach is a measure indicating the speed of sound, sonic speed is defined as 1 Mach = 1225 km/h. Speeds under 1 Mach are defined as subsonic and speeds over 1 Mach are defined as supersonic. Note that the speed of sound, and therefore 1 Mach, varies depending on air temperature and flight altitude.

avoiding, or intercepting, an incoming missile more difficult. Nonetheless, there are several other factors at play for missile performance besides range and speed, such as size of warhead, manoeuvrability and the available countermeasures, which are not included in this study. To estimate ASW capabilities, the number of helicopters and number of torpedo tubes are also indicated. Finally the number of ships in active service, by class, in 2000 and 2023, is presented, in order to provide an idea of the trends and prevalence of the assessed capabilities. This report excludes several important quality parameters for surface combatants, such as the performance of radars, sonars and communications. The precision of weaponry is also excluded. The main reason for these delimitations is the lack of open-source data. Also not included are the data for vessel speed, range, or endurance. While top speeds are fairly similar for large surface combatants, around 30 knots, their range and endurance varies. However, since these factors often vary with ship size, they were not prioritised here.

Main battle tank performance is assessed through the indicators of firepower, protection and mobility. Firepower is indicated as the penetration depth of the best available kinetic penetrator, or armour-piercing fin-stabilised discarding sabot (APFSDS) round from a distance of 2,000 metres, measured in millimetres of rolled-homogenous-armour equivalents (RHAe).[62] Similarly, protection is indicated by maximum armour depth against APFSDS at the front of the turret, usually the strongest protected section of a tank, also measured in millimetres of RHAe. Mobility is measured by engine horsepower (HP) through the weight of the tank, in tonnes. Based on these indicators, modern third-generation classification is then nuanced by adding a plus or minus.[63] The quantities of tanks in active service in 2000 and 2020 are also presented, in order to give a picture of the trends and prevalence of the assessed capabilities. Several quality parameters not included in this report are the precision of the main gun, quality of sensors, communications, and tank maintainability. The main reason for this delimitation is the lack of open-source data. However, if made available, these metrics could be included in future editions of this report.

Combat aircraft performance is assessed through the number of hard points, i.e. stations for missiles, bombs or additional fuel tanks, carried. Although the performance of each individual missile is not indicated, the number of hard points does give a broad sense of the lethality and combat endurance of a given aircraft. Combat range (indicated in km) and maximum speed (indicated in km/h) are also presented as quality indicators, as they give some broad sense of the endurance and manoeuvrability of an aircraft. The generation of the aircraft, fifth or fourth, is also

[62] Note that this is a simplification, as APFSDS projectiles are often designed to defeat specific types of armour and that the generalised RHAe values should therefore be interpreted as rough approximations.

[63] The original sources of tank performance data are the US Training and Doctrine Command (2014) *Worldwide Equipment Guide 2014* and *Steelbeast.com*.

presented as a proxy performance indicator. Fifth-generation combat aircraft combine stealth, i.e. minimised radar cross-section and radar absorbent materials, with high manoeuvrability and advanced avionics. Meanwhile, late fourth-generation combat aircraft lack minimised radar cross-section, but often share other stealth features with those of the fifth generation, such as radar absorbent materials and reduced infra-red signature. As is done for ships and tanks, the number of combat aircraft in active service is also presented, in order to give a picture of the trends and prevalence of the assessed capabilities. Important performance features, such as data on radar-cross section, performance of radar, IR sensors, manoeuvrability and performance of weaponry are not included in this report. The main reason for this is the lack of both open data as and the proper methodological tools to account for these variables. However, given that such data and tools can be provided, future editions of this report series may very well include these metrics.

Data on performance indicators have been collected from a wide range of open sources, such as government departments and agencies, international institutes and online news outlets with a military focus. These data are referred to collectively in the tables below as “FOI”; see Section 2.1 for details. Note that open-source data should be treated with a degree of caution and viewed as publicly available estimates, rather than absolute truths.

USA

US Navy Surface Combatants

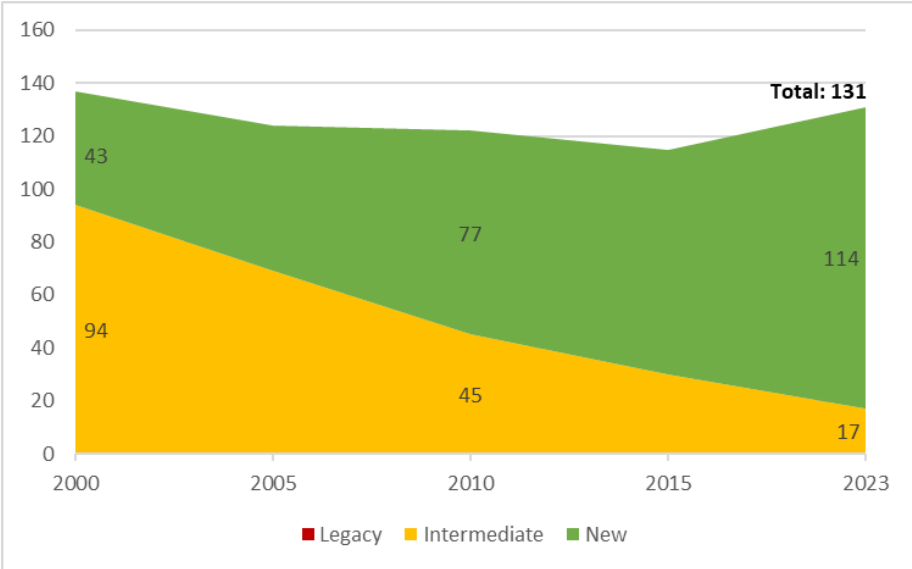

Figure D.1: US Navy surface combatants by modernity, 2000–2023. Source: IISS, FOI

"New" includes the classes of aircraft carriers; Gerald R. Ford, Nimitz, Enterprise, amphibious assault ships; America, Wasp, destroyers; Zumwalt, Arleigh Bourke Flight IIA, Arleigh Bourke Flight I/II, littoral combat ships; Freedom and Independence. "Intermediate" includes aircraft carriers; John F. Kennedy, Kitty Hawk, amphibious assault ships; Tarawa, cruisers; Ticonderoga, destroyers; Spruance, frigates; Oliver Hazard Perry. "Legacy" includes; none.

Table D.1: US Navy modern surface combatant performance, 2023. Sources: IISS, FOI.

Class	No. Mis-siles	SAM Range/ Speed	ASM Range/ Speed	ASW TT/ Hel.	Quant. 2000	Quant. 2023
Zumwalt	80	240/3.5	240/3.5	-/1	0	2
Arleigh Bourke IIA	96	240/3.5	240/3.5	6/2	0	42
Arleigh Bourke II	104	240/3.5	240/3.5	6/1	7	7
Arleigh Bourke I	104	240/3.5	240/3.5	6/-	21	21
Freedom	-	-/-	-/-	-/2	0	10
Independence	8	-/-	250/0.9	-/1	0	12
Total (Modern)	**7,200**	**N/A**	**N/A**	**N/A**	**43**	**114**
Total (All)	**9,410**	**N/A**	**N/A**	**N/A**	**137**	**131**

All US destroyers are capable of carrying the SM-6 ERAM dual-use surface-to-air missile (SAM) and anti-ship missile (ASM).

US Army Main Battle Tanks

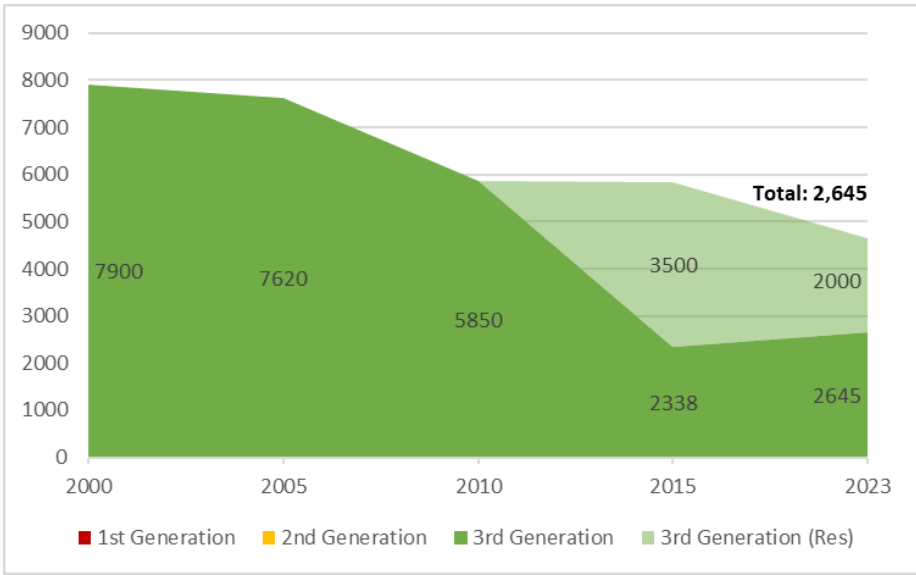

Figure D.2: US Army main battle tanks by generation, 2000-2023. Source: IISS

3rd generation includes types M1A2SEPv3 Abrams, M1A2SEPv2 Abrams, M1A2 Abrams, M1A1 Abrams, M1 Abrams. 2nd generation includes none. 1st generation includes none. 3rd generation, in reserve, includes M1A2 Abrams, M1A1 Abrams.

Table D.2: US Army modern main battle tank performance, 2023. Sources: IISS, FOI.

Type	Gen	Firepower (mm RHAe)	Armour (mm RHAe)	Mobility (HP/ tonne)	Quantity 2000	Quantity 2023
M1A2 SEPv3	+3	-	>950	-	0	500
M1A2 SEPv2	+3	840	950	23.1	some	1,605
M1A1 Abrams	3	750	600	25.9	some	540
M1 Abrams	-3	-	-	-	7,900	0
M1A1/A2 (Res)	3	-	-	-	0	2,000
Total (Active)	**N/A**	**N/A**	**N/A**	**N/A**	**7,900**	**2,645**

US Air Force, Navy and Marine Corps Combat Aircraft

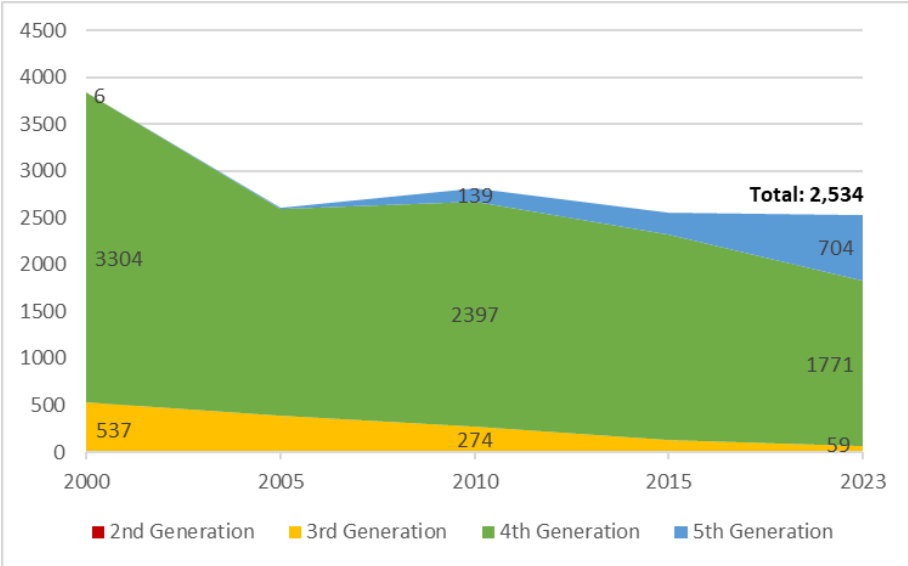

Figure D.3: US Air Force, Navy and Marine Corps combat aircraft by generation, 2000–2023. Source: IISS

5th generation includes the types, F-35A/B/C, F-22. 4th generation includes F-18E/F, F-18A/B/C/D, F-111, F-16A/B/C/D, F-15E, F-15A/B/C/D, OA-10A/A-10C. 3rd generation includes F-14A/B/D, AV/TAV-8, A-10A. 2nd generation includes none.

Table D.3: US Air Force, Navy and Marine Corps modern combat aircraft performance, 2000–2023. Sources: IISS, FOI.

Type	Gen	No. Hard-points*	Range (Km)	Speed (Km/h)	Quant. 2000	Quant. 2023
F-35 Lightning II	5	10(4)	2,200	1,960	0	539
F-22 Raptor	5	12(8)	>3,000	2,470	6	165
F/A-18 Super Hornet	+4	11	3,333	2,205	14	613
F/A-18 Hornet	4	11	3,333	2,205	1,005	239
F-16 Fighting Falcon	4	9	3,222	2,470	1,420	515
F-15E Strike Eagle	+4	11	3,840	3,018	210	220
F-15 Eagle	4	11	**5,745	2,470	494	49
OA-10A Thunderbolt	4	9	1,287	676	109	135
Total (Modern)	**N/A**	**N/A**	**N/A**	**N/A**	**3,310**	**2,475**
Total (All)	**N/A**	**N/A**	**N/A**	**N/A**	**3,847**	**2,534**

* Number of missiles carried internally is marked in parentheses.
** Range of F-15 Eagle with external fuel tank.

China

PLA Navy Surface Combatants

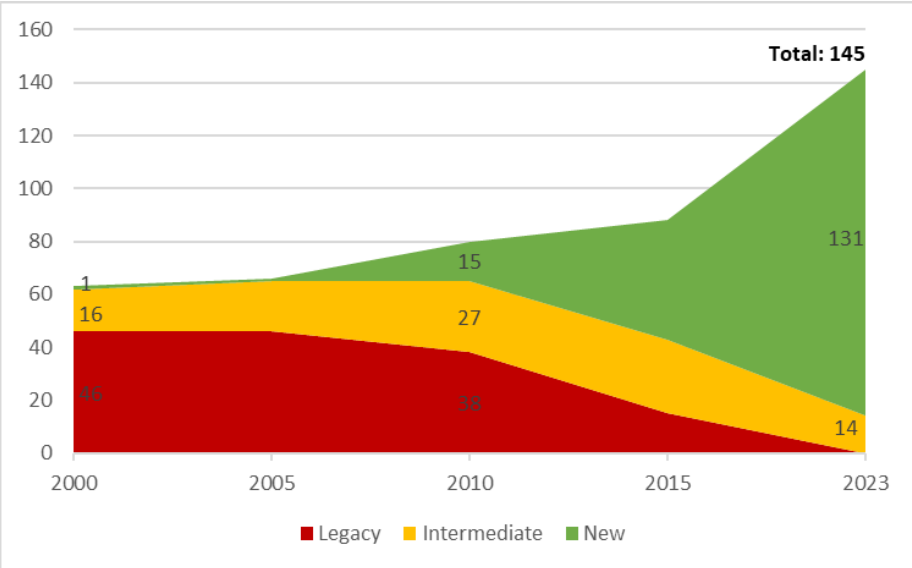

Figure D.4: PLA Navy surface combatants by modernity, 2000–2023. Sources: IISS, FOI

"New" includes the classes of aircraft carriers, Type 002, Type 001, amphibious assault ships; Type 075, destroyers; Type 055, Type 052D, Type 052C, Type 052B, Type 051C, Type 051B, frigates; Type 054A, Type 054, corvettes; Type 056/A. "Intermediate" includes destroyers; Sovremenny, Type 052, frigates; Type 053H3, Type 053H2G, Type 053H1G/H1Q. "Legacy" includes destroyers; Type 051/D/G, frigates; Type 053H/H1/H2.

Table D.4: PLA Navy modern surface combatant performance, 2023. Sources: IISS, FOI.

Class	No. Mis-siles	SAM Range/ Speed	ASM Range/ Speed	ASW TT/ Hel.	Quant. 2000	Quant. 2023
Type 055	112	200/4.0	540/*3.0	6/2	0	7
Type 052D	64	200/4.0	540/*3.0	6/1	0	25
Type 052C	56	120/4.0	200/0.9	6/1	0	6
Type 052B	64	40/3.0	200/0.9	6/1	0	2
Type 051C	56	90/4.0	200/0.9	6/1	0	2
Type 051B	48	40/3.0	200/0.9	6/2	1	1
Type 054A	40	40/3.0	200/0.9	6/1	0	31
Type 054	8	-/-	200/0.9	6/1	0	2
Type 056A	4	-/-	200/0.9	6/-	0	50
Total (New)	**4,480**	**N/A**	**N/A**	**N/A**	**1**	**131**
Total (All)	**4,880**	**N/A**	**N/A**	**N/A**	**63**	**145**

* The YJ-18 ASM has a flight speed of Mach 0.8 and terminal attack speed of Mach 3.0.

Type 055 and Type 052D are equipped with the HHQ-9ER surface-to-air missile (SAM) and YJ-18A anti-ship missile (ASM); all other surface combatants have YJ-62 ASM. Type 052C has HHQ-9 SAM. Type 051C has S-300F. Type 52B, Type 51B and Type 054A have HHQ-16 SAM. Type 054 has HHQ-7 SAM.

PLA Army Main Battle Tanks

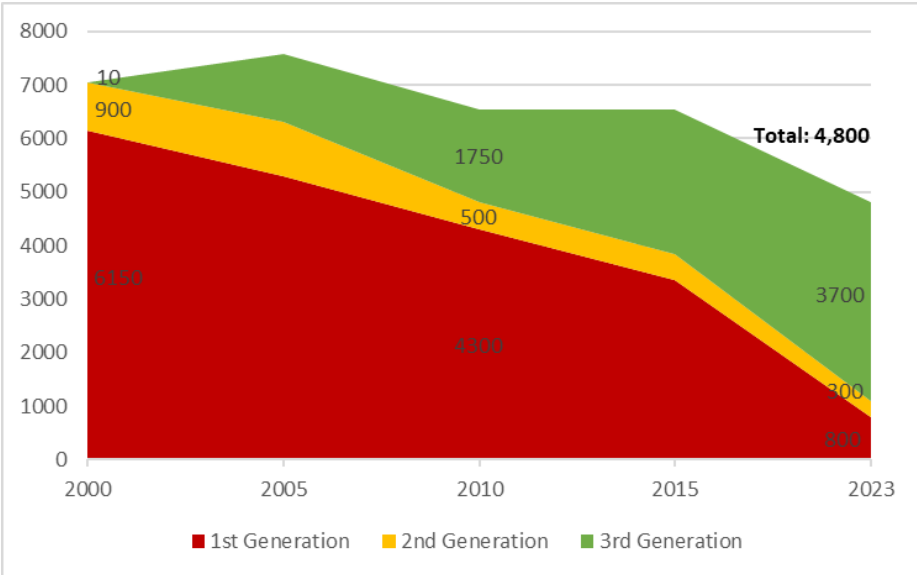

Figure D.5: PLA Army main battle tanks by generation, 2000–2023. Source: IISS

3rd generation includes the types, ZTZ-99A, ZTZ-99, ZTZ-96/A. 2nd generation includes ZTZ-88A/B/C. 1st generation includes ZTZ-79, ZTZ-69-I, ZTZ-59/-I/-II/-D.

Table D.5: PLA Army modern main battle tank performance, 2000–2023. Sources: IISS, FOI.

Type	Gen	Firepower (mm RHAe)	Armour (mm RHAe)	Mobility (HP/ tonne)	Quantity 2000	Quantity 2023
ZTZ-99A	+3	800	990	25.9	0	600
ZTZ-99	3	660	840	22.6	10	600
ZTZ-96A	-3	660	780	18.6	0	1,500
ZTZ-96	-3	660	-	18.1	Some	1,000
Total (3rd Gen)	**N/A**	**N/A**	**N/A**	**N/A**	**10**	**3,700**
Total (All)	**N/A**	**N/A**	**N/A**	**N/A**	**7,060**	**4,800**

For reference, the slightly upgraded legacy main battle tank, ZTZ-59-II, has a fire-power of 460 mm RHAe, protection of 203 mm RHAe and a mobility value of 14 horsepower per tonne, far less than modern third-generation tanks.

PLA Air Force and Navy Combat Aircraft

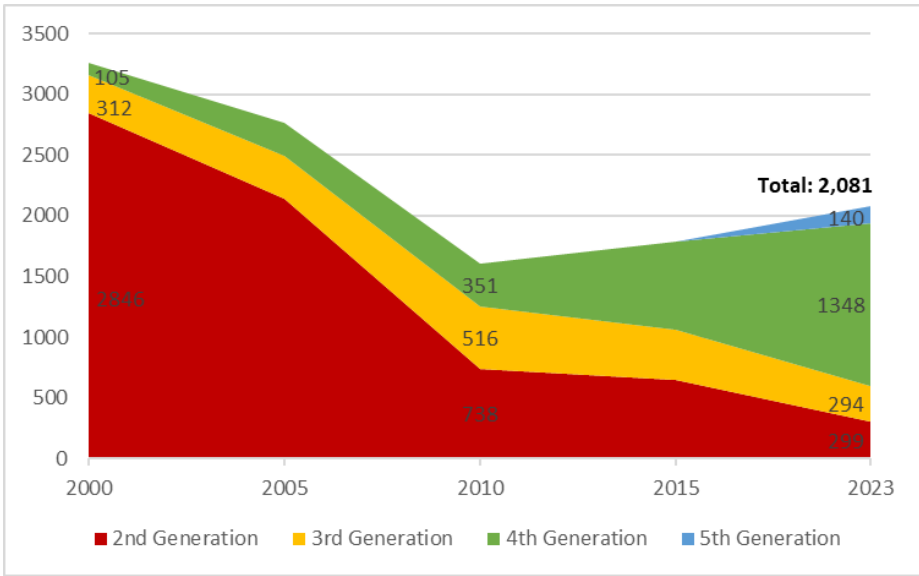

Figure D.6: PLA Air Force and Navy combat aircraft by generation, 2000–2023. Source: IISS.

5th generation includes type J-20. 4th generation includes J-16, J-15, J-10S/B/C, J-10/A, Su-35, Su-30MKK/MK2, J-11B/BS, J-11/Su-27. 3rd generation includes JH-7/A J-8A/B/E. 1st generation includes J-7/II/III/E, Q-5/C/D/E, J-6/B/C/D/E.

Table D.6: PLA Air Force and Navy modern combat aircraft performance, 2000–2023. Sources: IISS, FOI.

Type	Gen	No. Hard-points*	Range (Km)	Speed (Km/h)	Quant. 2000	Quant. 2023
J-20 Mighty Dragon	5	10(6)	3,400	2,100	0	140
J-16	+4	12	3,000	2,450	0	250
J-15 Flying Shark	4	12	3,500	2,100	0	60
J-10 Vigorous Dragon	4	11	1,850	2,327	0	588
Su-35	+4	12	3,600	2,390	0	24
Su-30	4	12	3,000	2,150	40	97
J-11B/BS	4	10	3,530	2,100	0	202
J-11/Su-27	4	10	3,530	2,100	65	127
Total (Modern)	**N/A**	**N/A**	**N/A**	**N/A**	**105**	**1,488**
Total (All)	**N/A**	**N/A**	**N/A**	**N/A**	**3,263**	**2,081**

* Number of missiles carried internally is marked in parentheses.

European Four

UK, French, German and Italian Navy Surface Combatants

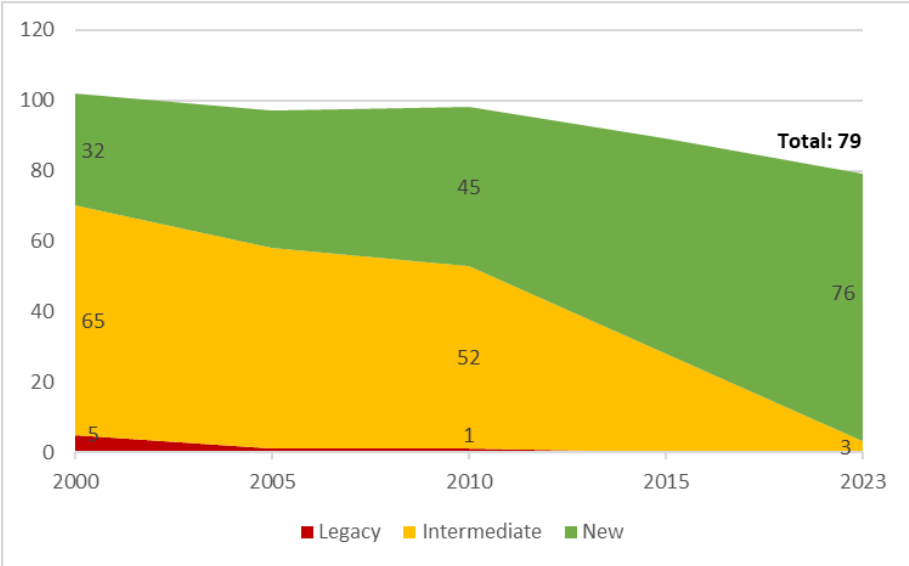

Figure D.7: E4 Navy surface combatants by modernity, 2000–2023. Sources: IISS, FOI

"New" includes the classes of aircraft carrier, Queen Elizabeth, Charles de Gaulle, Cavour, amphibious assault ship; Mistral, destroyers; Type 45, Aquitaine, Forbin, Andrea Doria, Durand de la Penne, frigates; Type 23, La Fayette, Floreal, Sachsen, Brandenburg, Bergamini, corvettes; Braunschweig. "Intermediate" includes aircraft carrier; Invincible, Guiseppe Garabaldi, destroyers; Type 42, Cassard, Georges Leygues, Tourville, Audace, frigates; Type 22, Bremen, Maestrale, Artiglieri, Lupo, corvettes; Minerva. "Legacy" includes aircraft carrier; Clémenceau, cruisers; Jeanne d'Arc, Vittorio Veneto, destroyers; Lütjens.

Table D.7: E4 Navy modern surface combatant performance, 2023. Sources: IISS, FOI.

Class	No. Missiles	SAM Range/ Speed	ASM Range/ Speed	ASW TT/ Hel.	Quant. 2000	Quant. 2023
Aquitaine (FREMM)	40	120/4.5	180/0.9	4/1	0	8
Forbin	56	120/4.5	180.0.9	4/1	2	2
Type 45 Daring	56	120/4.5	240/0.9	4/1	0	6
Andrea Doria	56	120/4.5	180/0.9	2/1	0	2
Durand de la Penne	16	25/3.5	180/0.9	6/2	2	2
La Fayette	12	-/3.5	180/0.9	-/1	4	5
Floreal	4	-/2.6	40/0.9	-/1	6	6
Baden-Württemberg	8	-/-	124/0.7	-/2	0	4
Sachsen	40	170/3.5	124/0.7	6/2	0	3

Brandenburg	20	50/4.0	40/0.9	4/2	4	4
Type 23 Duke	40	10/2.0	240/0.9	4/2	14	12
Bergamini (FREMM)	20	120/4.5	180/0.9	6/2	0	8
Paolo di Revel	24	120/4.5	180/0.9	6/2	0	2
Braunschweig	4	-/-	200/0.9	-/-	0	5
Total (Modern)	**1,920**	**N/A**	**N/A**	**N/A**	**32**	**76**
Total (All)	**1,952**	**N/A**	**N/A**	**N/A**	**102**	**79**

Surface-to-air missiles (SAMs): Aquitaine, Forbin, Daring, Andrea Doria, Bergamini and Paolo Thaon di Revel have the Aster 30. Durand de la Penne has Aspide. Sachsen has SM-2 Block III. Brandenburg has Sea Sparrow. Anti-ship missiles (ASMs): Aquitaine, Forbin and La Fayette have MM40 Exocet. Sachsen has Harpoon Block IB. Floreal and Brandenburg have MM38 Exocet. Daring and Duke have Harpoon Block IC. Andrea Doria, Durand de la Penne, Bergamini and Paolo Thaon di Revel have Otomat Mk2. Braunschweig has RBS15 Mk3.

UK, French, German and Italian Army Main Battle Tanks

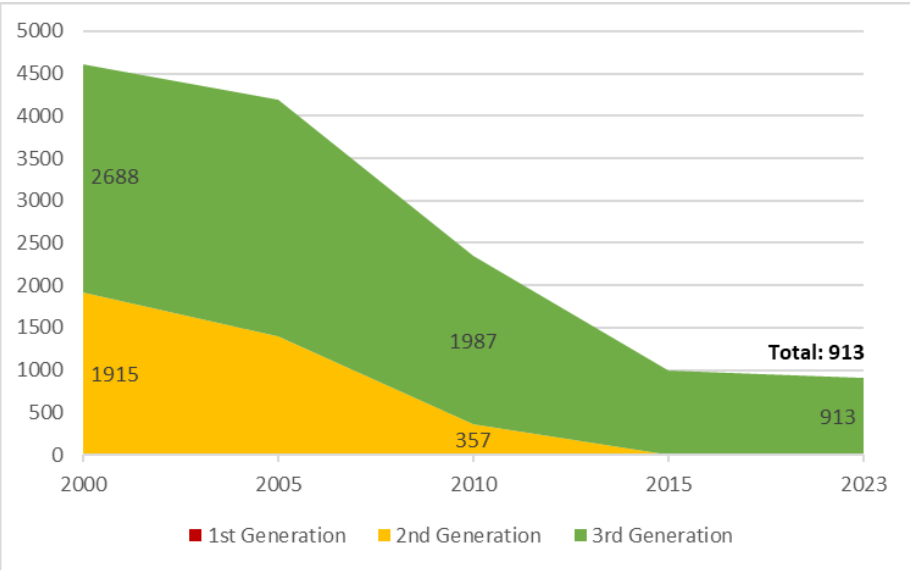

Figure D.8: E4 Army main battle tanks by generation, 2000–2023. Source: IISS.

3rd generation includes the types, Leclerc, Leopard 2A7/A6/A4, Challenger 2, Challenger 1, C1 Ariete. 2nd generation includes AMX-30, Leopard 1, Chieftain.

Table D.8: E4 Army modern main battle tank performance, 2023. Sources: IISS, FOI.

Type	Gen	Firepower (mm RHAe)	Armour (mm RHAe)	Mobility (HP/ tonne)	Quantity 2000	Quantity 2023
Challenger 2	+3	610	1,250	19.2	192	227
Challenger 1	3	-	-	-	410	0

Leclerc	+3	690	890	26.6	199	215
Leopard 2A7	+3	-	-	-	0	98
*Leopard 2A6**	+3	750	970	24.0	0	223
Leopard 2A4	3	600	700	27.2	1,782	0
C1 Ariete	3	-	-	-	105	150
Total	**N/A**	**N/A**	**N/A**	**N/A**	**4,603**	**913**

* The data actually represent the older Leopard 2A5 version, exported to, e.g., Denmark and Sweden.

UK, French, German and Italian Air Force and Navy Combat Aircraft

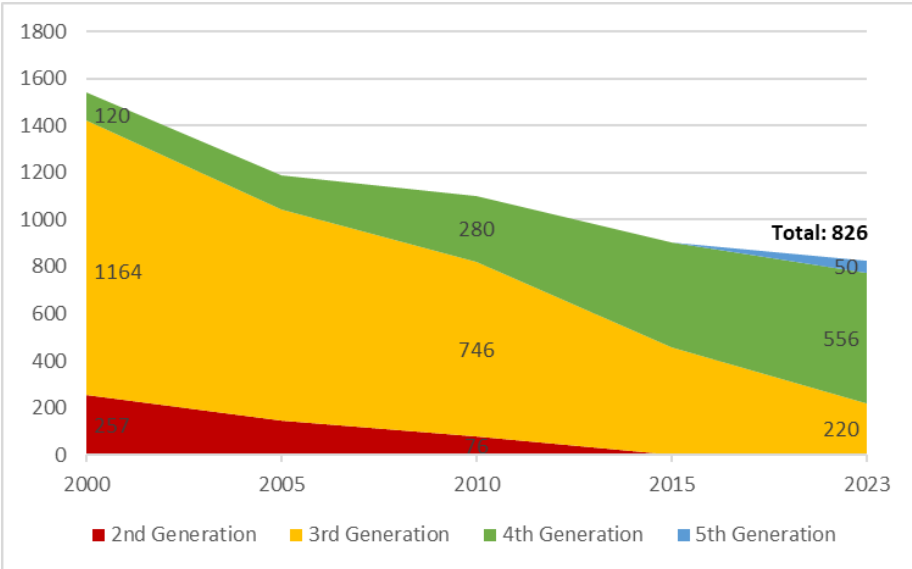

Figure D.9: E4 Air Force and Navy combat aircraft by generation, 2000–2023. Source: IISS.

5th generation includes the type, F-35B. 4th generation includes Eurofighter, Rafale B/C, Rafale M, Mirage 2000D/N, F-16. 3rd generation includes Harrier, Jaguar, Mirage 2000B/C, Mirage F-1, Super Etard, Tornado, MiG-29, Ghibli. 2nd generation includes F-4, Su-22, F-104, MiG-23, MiG-21.

Table D.9: E4 Air Force and Navy modern combat aircraft performance, 2023. Sources: IISS, FOI.

Type	**Gen.**	**No. Hard-points***	**Range (Km)**	**Speed (Km/h)**	**Quant. 2000**	**Quant. 2023**
F-35 Lightning II	5	10(4)	1,667	1,960	0	50
Eurofighter Typhoon	+4	13	3,790	2,470	0	359
Rafale B/C/M	+4	14	3,125	2,205	0	132
Mirage 2000 D/N	4	9	3,335	2,530	120	65
Total (Modern)	**N/A**	**N/A**	**N/A**	**N/A**	**120**	**606**
Total (All)	**N/A**	**N/A**	**N/A**	**N/A**	**1,543**	**826**

* Number of missiles carried internally is marked in parentheses.

Russia

Russian Navy Surface Combatants

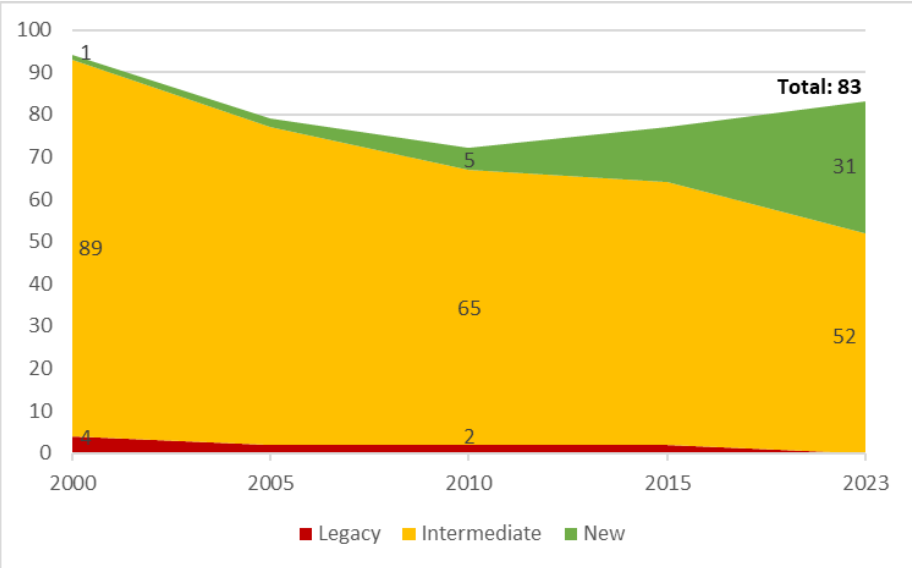

Figure D.13: Russian Navy surface combatants by modernity, 2000–2023. Sources: IISS, FOI

"New" includes the classes of frigates, Gorshkov, Krivak V, Gepard, Neustrashimyy, corvettes; Steregushchiy, Buyan/M. "Intermediate" includes aircraft carrier; Kuznetsov, cruisers; Kirov, Slava, destroyers; Udaloy I/II, Sovremenny, frigates; Krivak II, Krivak I, corvettes; Parchim II, Grisha I/III/IV/V, Nanuchka III/IV. "Legacy" includes cruisers; Kara, Kynda, destroyers; Kashin mod., Kashin.

Table D.13: Russian Navy new surface combatant performance, 2023. Sources: IISS, FOI.

Class	No. Mis-siles	SAM Range/ Speed	ASM Range/ Speed	ASW TT/ Hel.	Quant. 2000	Quant. 2023
Gorshkov	48	150/6.0	300/2.4	8/1	0	2
Krivak V	32	50/4.0	300/2.4	4/1	0	3
Gepard	18	-/-	300/3.0	4/1	0	2
Neustrashimiy	40	12/2.0	130/0.8	6/1	1	1
Kurakurt	8	-/-	-/-	-/-	0	3
Steregushchiy	20	50/2.6	130/0.8	8/1	0	8
Buyan/-M	20	-/-	300/3.0	-/-	0	12
Total (Modern)	**588**	**N/A**	**N/A**	**N/A**	**1**	**31**
Total (All)	**1,880**	**N/A**	**N/A**	**N/A**	**94**	**83**

Surface-to-air missiles (SAMs): Gorshkov has 9M96 Poliment-Redut. Krivak V has 9M317E Shtil-1. Neustrashimiy has 3K95 Kinzhal. Steregushchiy has 9M96M Poliment-Redut. Anti-ship missiles (ASMs): Gorshkov and Grigorivich have P-800 Onyx. Gepard and Buyan-M have 3M54 Sizzler. Neustrashimiy and Steregushchiy have 3M24 Uran. Karakurt corvettes carry land-attack Klub cruise missiles, which so far are not verified as ASM-capable.

Russian Army Main Battle Tanks

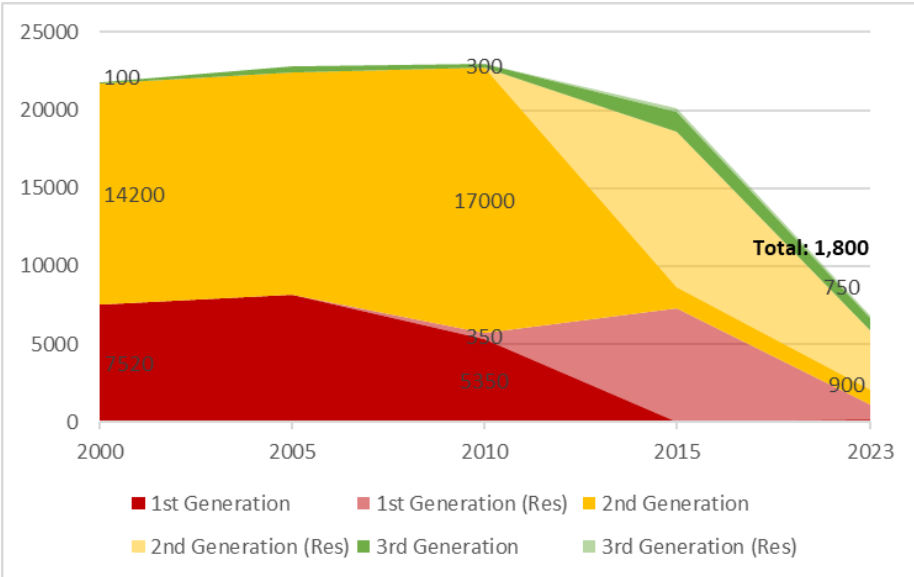

Figure D.14: Russian Army main battle tanks by generation, 2000–-2023. Source: IISS

3rd generation includes types T-90M, T-90/A, T-80BVM, T-72B3/B3 mod. 2nd generation includes T-80BV/U, T-80/U/UD/UM, T-72B/BA, T-72/L/M. 1st generation includes T-64A/B, T-62, T-55. A large share of Russian main battle tanks are currently held in reserve. 3rd generation in reserve includes T-90/A. 2nd generation in reserve includes various versions of T-80 various versions of T-72. 1st generation in reserve includes T-64A/B, T-62, T-55.

Table D.14: Russian Army modern main battle tank performance, 2023. Sources: IISS, FOI.

Type	Gen	Firepower (mm RHAe)	Armour (mm RHAe)	Mobility (HP/ tonne)	Quantity 2000	Quantity 2023
T-90M	+3	-	-	-	0	100
T-90A	3	660	840	23.7	100	200
T-80BVM	3	-	-	-	0	100
T-72B3/B3 mod.	-3	660	780	18.9	0	250
Total (Modern)	**N/A**	**N/A**	**N/A**	**N/A**	**100**	**750**
Total (All active)	**N/A**	**N/A**	**N/A**	**N/A**	**21,820**	**1,800**

Russian Air Force and Navy Combat Aircraft

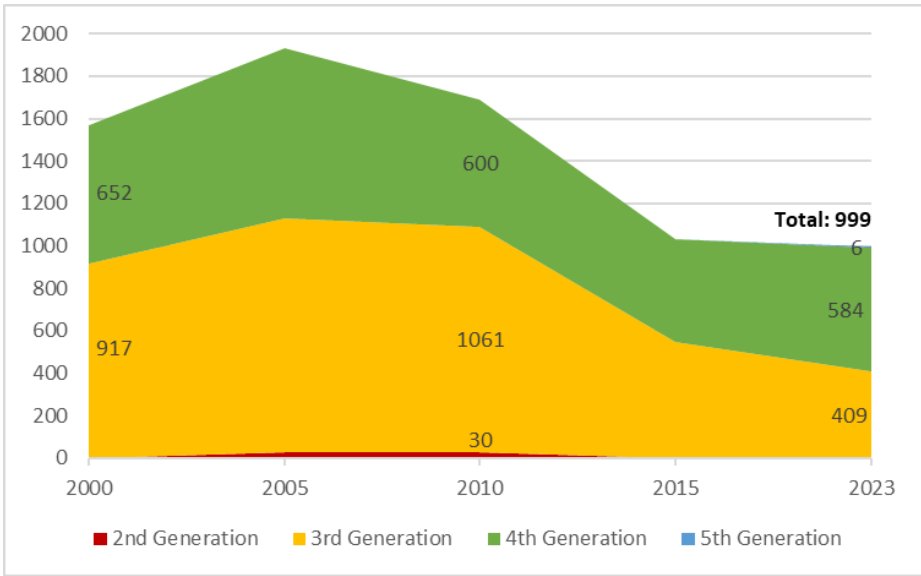

Figure D.15: Russian Air Force and Navy combat aircraft by generation, 2000–2023.
Source: IISS

5th generation include types: none. 4th generation includes Su-35S, Su-34, Su-30/M2/SM, Su-27/UB/SM2/SM3, and MiG-29. 3rd generation includes Su-25A/SM/UB, Su-24, MiG-31. 2nd generation includes MiG-25A/E.

Table D.15: Russian Air Force and Navy modern combat aircraft performance, 2023.
Source: IISS.

Type	Gen.	No. Hard-points	Range (Km)	Speed (Km/h)	Quant. 2000	Quant. 2023
Su-57 Felon	5	12(6)	3,500	2,100	0	6
Su-35S Flanker-E	+4	12	3,600	2,390	0	99
Su-34 Fullback	+4	10	*4,500	1,900	0	112
Su-33 Flanker-D	4	12	3,000	2,300	0	17
Su-30/M2/SM	4	12	3,000	2,150	0	120
Su-27/UB/SM2/SM3	4	10	3,680	2,879	392	122
MiG-35	+4	9	3,000	2,100	0	6
MiG-29	4	7	2,100	2,400	260	109
Total (Modern)	**N/A**	**N/A**	**N/A**	**N/A**	**652**	**590**
Total (All)	**N/A**	**N/A**	**N/A**	**N/A**	**1,569**	**999**

* Range of Su-34 Fullback with external fuel tank.

India

Indian Navy Surface Combatants

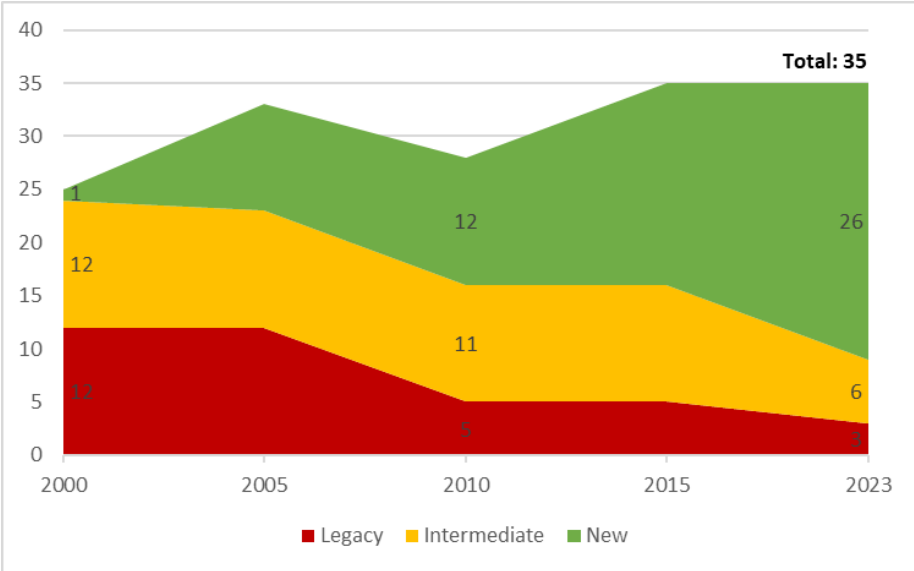

Figure D.10: Indian Navy surface combatants by modernity, 2000–2023. Sources: IISS, FOI

"New" includes the classes of aircraft carrier, Vikrant, Vikramaditya, destroyers; Visakhapatnam, Kolkata, frigates; Shivalik, Talwar II, Talwar I, Brahmaputra, corvettes; Kamorta, Kora. "Intermediate" includes classes of aircraft carrier; Viraat, destroyers; Delhi, frigates; Godavari, corvettes; Khukri. "Legacy" includes destroyers; Rajput, frigates; Arnala, Nilgiri.

Table D.10: Indian Navy modern surface combatant performance, 2023. Sources: IISS, FOI.

Class	No. Missiles	SAM Range/ Speed	ASM Range/ Speed	ASW TT/ Hel.	Quant. 2000	Quant. 2023
Visakhapatnam	48	150/2.0	500/3.0	4/2	0	1
Kolkata	48	150/2.0	500/3.0	4/2	0	3
Shivalik	48	-/-	500/3.0	4/2	0	3
Talwar I/II	30	40/3.0	300/3.0	4/1	0	6
Brahmaputra	40	-/-	500/3.0	6/2	1	3
Kamorta	-	-/-	-/-	-/1	0	4
Total (New)	**716**	**N/A**	**N/A**	**N/A**	**1**	**26**
Total (All)	**950**	**N/A**	**N/A**	**N/A**	**25**	**35**

Visakhapatnam and Kolkata are equipped with Barak 8 SAM. All modern Indian surface combatants have Brahmos ASM, except Talwar I/II, which have Kh-35 Klub. Brahmaputra only has point-defence Barak 1 SAM.

Indian Army Main Battle Tanks

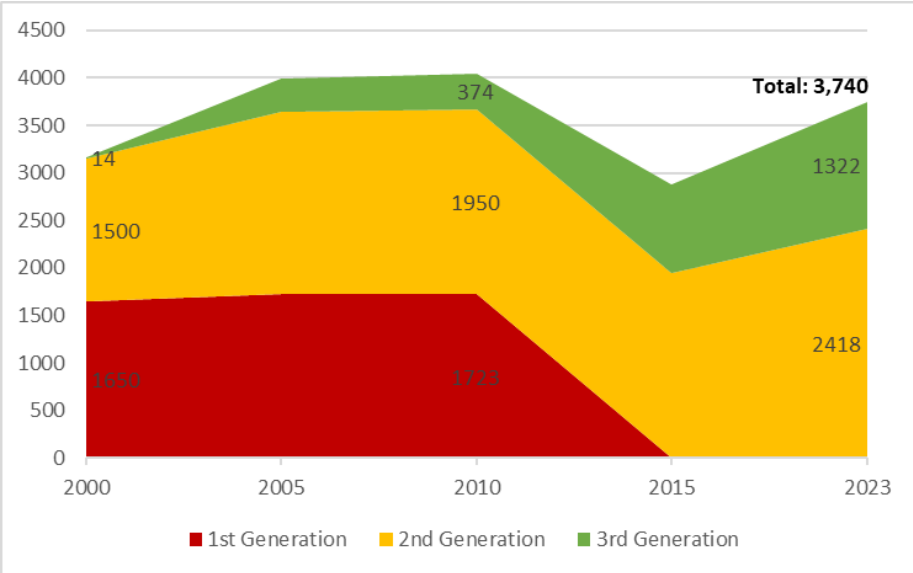

Figure D.11: Indian Army main battle tanks by generation, 2000–2023. Source: IISS

3rd generation includes the types, T-90S Arjun Mk1. 2nd generation includes T-72 T-72M1 Ajeya. 1st generation includes Vijayanta T-54/-55.

Table D.11: Indian Army modern main battle tank performance, 2000–2023. Sources: IISS, FOI.

Type	Gen	Firepower (mm RHAe)	Armour (mm RHAe)	Mobility (HP/ tonne)	Quantity 2000	Quantity 2023
T-90S	3	-	-	-	0	1,200
Arjun Mk1	3	~660	~840	~23.7	14	122
Total (3rd Gen)	**N/A**	**N/A**	**N/A**	**N/A**	**14**	**1,322**
Total (All)	**N/A**	**N/A**	**N/A**	**N/A**	**3,164**	**3,740**

Indian Air Force and Navy Combat Aircraft

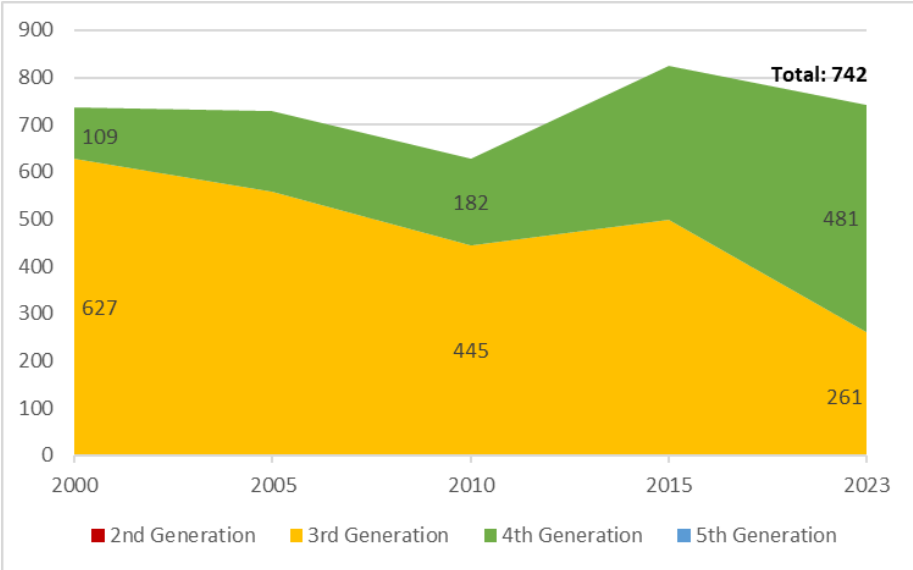

Figure D.12: Indian Air Force and Navy combat aircraft by generation, 2000–2023.
Source: IISS.

5th generation includes the type: none. 4th generation includes Rafale, DH/EH, Tejas, Su-30K/MKI, Mirage 2000 ED/IT, Mirage 2000 E/I, MiG-29UB, MiG-29K/KUB. 3rd generation includes Sea Harrier, MiG-27, MiG-23, MiG-21, Jaguar IB/IS/IM. 1st generation includes: none.

Table D.12: Indian Air Force and Navy modern combat aircraft performance, 2000–2023.
Sources: IISS, FOI.

Type	Gen	No. Hard-points*	Range (Km)	Speed (Km/h)	Quant. 2000	Quant. 2023
Rafale DH/EH	+4	14	~3,125	~2,205	0	36
Tejas	4	8	1,850	1,960	0	30
Su-30K/MKI	+4	12	3,000	2,120	10	263
Mirage 2000 E/I/ED/IT	4	9	~3,335	~2,530	35	48
MiG29 Fulcrum	4	7	~2,100	~2,400	64	104
Total (Modern)	**N/A**	**N/A**	**N/A**	**N/A**	**109**	**481**
Total (All)	**N/A**	**N/A**	**N/A**	**N/A**	**736**	**742**

* Number of missiles carried internally are marked in parentheses.

Appendix E: Future Trends

Estimates of present and future trends, between 2023 and 2030, that are presented in the tables of Appendix E include GDP trends and equipment quantities for the major world power navies. The methods, assumptions and data that form the basis for these estimates are described in detail in this appendix. Assessments of future military expenditure, quantities of army and air force equipment and military equipment quality are not quantified. Instead, these trends are discussed in terms of the developments and factors that are likely to impact the direction of these developments between 2023 and 2030.

GDP Estimates

GDP figures for 2021 were collected from the World Bank (2023a), presented in constant 2015 USD. Meanwhile, estimates for 2023 to 2024 were collected from the latest IMF WEO projections from January 2023 and, for 2025 to 2028, from the IMF database; see Table E.1

Table E.1: Future GDP and growth estimates, constant 2015 USD. Sources: World Bank (2023a), IMF (2023a, 2023b).

Country	GDP 2021 (Billion USD)	Average Growth 2022–24 (%)	Average Growth 2025–28 (%)	Average Growth 2029–35 (%)	GDP 2030 (Billion USD)
US	20,529	+1.5	+2.0	+1.8	24,175
Eurozone	12,475	+1.9	+1.6	+1.5	14,501
China	15,802	+4.2	+3.8	+4.2	22,617
Russia	1,490	+0.1	+1.0	+1.5	1,602
India	2,726	+6.6	+6.1	+7.0	4,751
World	**86,860**	**+3.1**	**+3.3**	**-**	**-**

The growth rates for 2029 to 2035 are rough estimates based on the growth rates of the previous ten year period, i.e. 2019–2028, which have been prolonged with minor adjustments to serve as rough estimates of future trends.

Discussion of Military Expenditure

Future military expenditure of major global powers depends on two factors, the future GDP of each country and the priority each country gives to military expenditure as share of GDP. No estimates of future military expenditure are presented in this report, but Chapter 4 discusses how future military spending for major global powers would look if military expenditure as share of GDP would remain the same in 2030 as in 2023.

Naval Vessel Estimates

Estimates of future quantities of military equipment are limited to the navies of major global powers. Hulls of ships and submarines are usually constructed several years before being commissioned into service. Consequently, the method of estimating quantities of future naval vessels in active service is relatively straightforward. This study assumes that ships and submarines launched by the beginning of 2023 will have been taken into active service by 2025. Similarly, it is assumed that the ships and submarines laid down, or officially planned, but not yet launched, will be commissioned by 2030. The data on the number of launched ships is often made available in open sources, such as the publications of international institutes, navy home pages, press releases, and news outlets. Similarly, FOI has collected data on naval tonnage and missiles from a wide range of open sources. These data are referred to collectively as "FOI". Such open-source data should be treated with a reasonable degree of caution and viewed as broad assessments, rather than as exact predictions.

Table E.2: US Navy future surface combatants and submarines, 2023–2030.
Sources: IISS (2023), FOI.

Class/Year	**2023**	**2025**	**2030**
Aircraft Carriers	11	11	10
Amphibious Assault Ships	9	11	12
Cruisers	17	9	0
Destroyers	72	79	88
LCSs/Frigates	22	20	25
Strategic Nuclear Submarines	14	14	12
Tactical Nuclear Submarines	53	51	45
Total	**198**	**195**	**192**

The US is expected to have 135 surface combatants and 57 submarines by 2030; see Table E.2.

Table E.3: PLA Navy future surface combatants and submarines, 2023–2030.
Sources: IISS (2023), FOI.

Class/Year	**2023**	**2025**	**2030**
Aircraft Carriers	2	3	4
Amphibious Assault Ships	3	3	6
Destroyers	49	48	59
Frigates	41	48	56
Corvettes	50	50	50
Strategic Nuclear Submarines	6	6	8
Tactical Nuclear Submarines	6	10	13
Tactical Conventional Subs	46	46	46
Total	**203**	**214**	**242**

The Chinese PLA Navy seems set to continue its expansion of previous decades, although at a somewhat slower pace after 2025; see Table E.3.

Table E.4: E4 Navy future surface combatants and submarines, 2023–2030.
Sources: IISS (2023), FOI.

Class/Year	2023	2025	2030
Aircraft Carriers	5	4	4
Amphibious Assault Ships	3	4	4
Destroyers	19	18	18
Frigates	46	40	39
Corvettes	7	11	17
Strategic Nuclear Submarines	8	8	8
Tactical Nuclear Submarines	11	12	13
Tactical Conventional Subs	14	14	16
Total	**113**	**111**	**119**

This study estimates that the combined navies of the French, German, UK and Italian navies will consist of 82 surface combatants and 37 submarines by 2030; see Table E.4.

Table E.5: Russian Navy future surface combatants and submarines, 2023–2030.
Sources: IISS (2023), FOI.

Class/Year	2023	2025	2030
Aircraft Carriers	0	0	1
Cruisers	3	3	2
Destroyers	11	6	2
Frigates	10	12	17
Corvettes	59	55	53
Strategic Nuclear Submarines	10	12	12
Tactical Nuclear Submarines	19	16	14
Tactical Conventional Subs	21	23	24
Total	**135**	**127**	**125**

It is estimated that the Russian navy will increase its overall number of vessels; see Table E.5. This study estimates that in 2030 the Russian Navy will have 75 surface combatants and 50 submarines.

Table E.6: Indian Navy future surface combatants and submarines, 2023–2030.
Sources: IISS (2023), FOI.

Class/Year	2023	2025	2030
Aircraft Carriers	2	2	2
Destroyers	10	12	10
Frigates	12	18	24
Corvettes	11	8	10
Strategic Nuclear Submarines	1	2	4
Tactical Nuclear Submarines	0	2	4
Tactical Conventional Subs	15	14	13
Total	**51**	**63**	**67**

It is estimated that the Indian navy will increase its number of vessels until 2030; see Table E.6. This study estimates that in 2030 the Indian Navy will have 46 surface combatants and 21 submarines.

Future navy tonnage and missiles capabilities may also shed additional light on comparative naval strengths by 2030; see Table E.7. Assessments for 2025 and 2030 have been compiled by FOI. Note that aircraft carriers are not included in the overall missile count, as their missile capabilities almost exclusively rest with the number of combat aircraft carried.

Table E.7: Future naval tonnage and missile capabilities among major world powers, 2023–2030. Source: FOI.

Country	Factor	2023	2025	2030
US	Total tonnage (1000 tonnes)	3,093	3,165	3,031
	Surface tonnage (1000 tonnes)	2,413	2,487	2,461
	Surface missiles (number of)	9,410	9,018	8,896
	Submarine tonnage (1000 tonnes)	680	678	570
China	Total tonnage (1000 tonnes)	1,054	1,218	1,615
	Surface tonnage (1000 tonnes)	818	978	1,349
	Surface missiles (number of)	4,880	5,272	6,536
	Submarine tonnage (1000 tonnes)	236	241	266
E4	Total tonnage (1000 tonnes)	840	852	971
	Surface tonnage (1000 tonnes)	640	638	735
	Surface missiles (number of)	1,952	1,872	2,144
	Submarine tonnage (1000 tonnes)	201	214	236
Russia	Total tonnage (1000 tonnes)	785	787	915
	Surface tonnage (1000 tonnes)	232	214	273
	Surface missiles (number of)	1,616	1,888	1,960
	Submarine tonnage (1000 tonnes)	553	573	642
India	Total tonnage (1000 tonnes)	260	338	391
	Surface tonnage (1000 tonnes)	224	272	303
	Surface missiles (number of)	950	1,270	1,450
	Submarine tonnage (1000 tonnes)	36	67	88

Assumptions about future armies and air forces are more difficult to address than those about navies, as ground equipment and aircraft quantities can shift more quickly compared to naval platforms. No exact estimates of the latter are provided in this study; instead, a qualitative discussion about plausible future trends is found in Chapter 4.

Defence Economic Outlook 2023 assesses and compares the military strength of major global powers, in terms of military expenditure, military equipment and economic resources between 2000 and 2022. The report also provides a broad assessment of future trends with regards to the same aspects from 2023 and 2030.

Currently, in 2022, the US has a clear military advantage over near peer rivals and invests significant resources to maintain its lead. However, during the past two decades, China has steadily narrowed the military gap. Since 2000, China's military spending has more than quadrupled, enabling a rapid and comprehensive modernisation of its armed forces. Russia also invested heavily towards military modernisation during this period, but has incurred heavy losses during its invasion of Ukraine. India has increased its military spending during the past two decades, becoming the world's fourth-largest spender. Military expenditure in Western Europe has also increased markedly in recent years.

The US will continue to enjoy an overall military advantage in 2030. However, China seems to be on track to become the world's largest economy around the same time, which will likely further decrease the US-China gap in military strength. European countries plan to strengthen their militaries, but it remains to be seen whether the ambitious goals can be realised. Meanwhile, Russia will likely need to replace much of its lost equipment, while facing severe sanctions.

Although far from providing a complete comparative analysis of global military strengths, taken together the included aspects should provide a nuanced assessment of general international trends in defence economic strengths, currently and in the near future.

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