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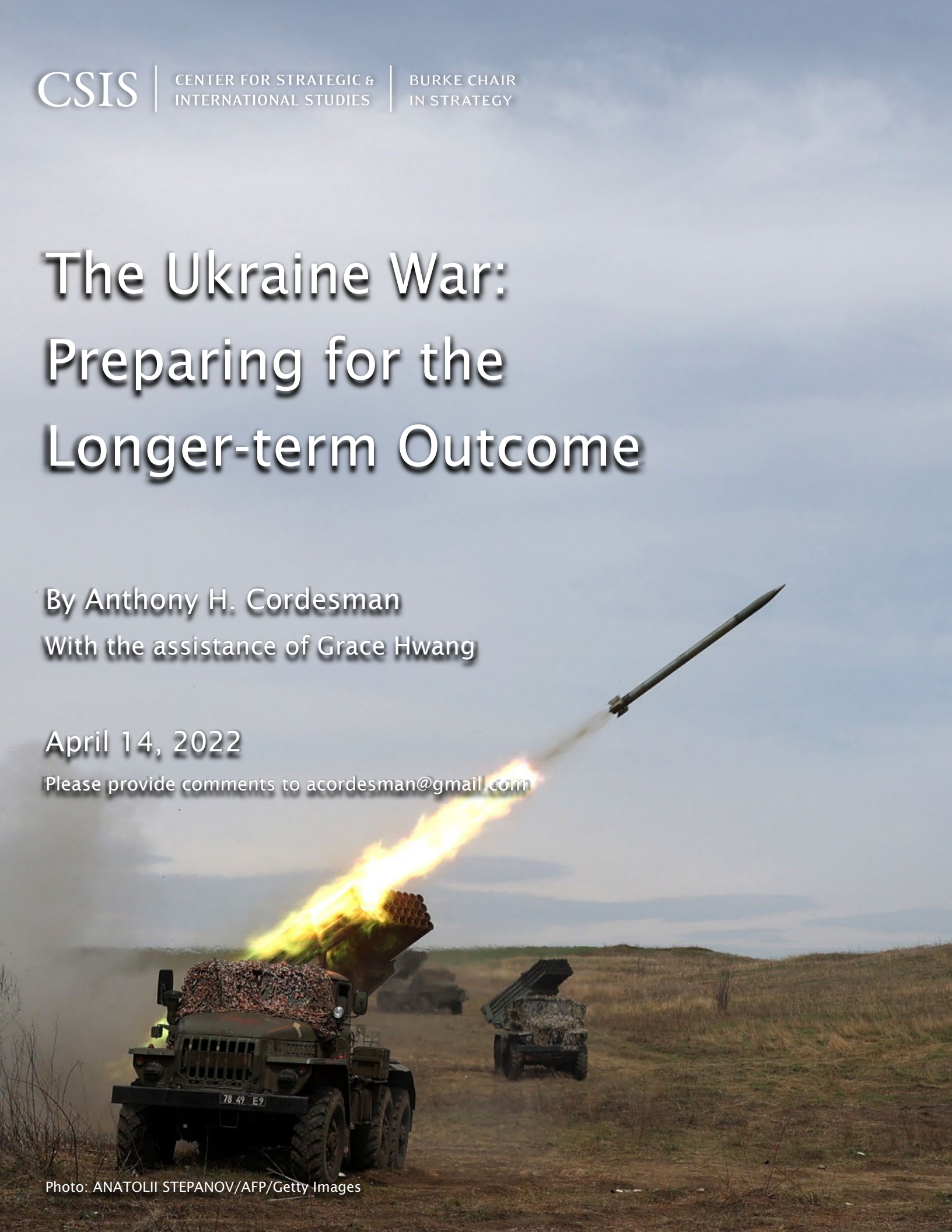

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Anthony H. Cordesman

It is far too early to predict the ultimate outcome of the Ukraine War, but it is all too clear that no peace settlement or ceasefire is likely to eliminate a long period of military tension between the U.S. – including NATO and its allies – and anything approaching President Putin's future version of Russia, nor will any resolution of the current conflict negate the risk of new forms of war. It is equally clear that the U.S. and NATO need to act as quickly as possible to prepare for an intense period of military competition and must create a more secure deterrent and improve their capability to defend against Russia.

In practice, NATO will need to make up for years of underfunding by each member country and for the cuts in force levels, readiness, and modernization that years of a U.S.-driven focus on burden-sharing – rather than funding NATO's real military priorities – did little or nothing to address. NATO will need to find new ways to counter the massive problems in interoperability and differences in comparative warfighting that still exist between NATO's 30 nations.

This will need to be accomplished at a time when emerging and disruptive technologies (EDTs) are constantly changing the nature of deterrence and warfighting, when Russia is actively pursuing nuclear modernization rather than arms control, and when NATO's more advanced forces are struggling to create new approaches to joint all-domain command and control (JADC2) – and all while doing so at a time when most member countries have limited capabilities to support their existing force structure.

At best, developing and sustaining any coherent effort to deal with these issues will take at least five years to implement. It then will require constant updating on an annual basis as new types of technology, tactics, and command and control continue to reshape military needs and force plans. This, in turn, requires sustained political and popular support in the face of inflation and civil needs during a time when the momentum for military change created by the current fighting in Ukraine may have faded. In some ways, the only thing harder than crisis management is the lack of crisis management.

Transforming NATO after Decades of Peace Dividends and Burden-sharing

At a minimum, NATO must begin with a new approach to force planning, assessing the threat, and making real progress. The emphasis on burden-sharing before the current war in Ukraine did little or nothing to prepare NATO or member countries for these challenges. In fact, burden-sharing was little more than a stupid mathematical farce.

Put simply, the basic math used to set goals like spending 2% of every member's GDP on defense was ridiculous, considering it was during a period when both official and think tank estimates of total Russian military spending were only $62 to $100 billion a year. Calling for fixed percentage of increased spending as a percent of GDP made no sense under these conditions. Such estimates of the Russian effort were already consistently under one-third of the more than $300 billion a year being spent by NATO Europe alone. They were only a small fraction of the combined total for U.S., Canada, and NATO Europe – which exceeded $1 trillion in a year.

The focus on generic spending goals also failed to provide any public incentive for higher spending that was based on a convincing analysis of the threat, and it also did little in political terms to focus on the areas where spending was most needed: for true interoperability and coordinated

modernization. The erratic national efforts to meet the 2% and 20% goals often ignored both the steady reduction in, and aging of, key aspects of the major weapons and military systems in many countries, as well as the continued dependence of many Eastern European members on weapons and systems that they had inherited from the Former Soviet Union (FSU) and where they no longer had access to, or purchased, the necessary upgrades, modernization, and updated weapons and C4/ISR systems for such weapons.

Above all, calls for the same generic increase in levels of effort relative to the national economy never addressed the fact that even the simplest comparisons of NATO's force structure and modernization efforts by country show that they need to be based on a serious examination of how to meet radically different national goals for a given country's forces. Focusing on NATO-wide percentage of GDP did far too little to correct this situation and even less to examine what level of national spending was actually needed to correct the deficiencies in any given country's force posture, modernization, readiness, and training and sustainability. It did even less to examine whether current spending levels or meeting the 2% would ever be adequate to meet NATO's needs or to estimate when a given country could meet the necessary goals.

Furthermore, any real-world moves toward actually reaching 2% of GDP were erratic at best. NATO did report some increases in member country's spending as a percent of GDP in constant 2015 dollars after 2014, but NATO's most recent estimate of actual spending levels – issued in June 2021 – found that 19 of its 30 members were still spending under 2%. This included only 1.5% of GDP for a key nation like Germany that had let its military forces go hollow. Moreover, another 10 out of its 30 countries were spending under 1.5%.[1]

Even a quick glance at the weapons holdings; overall levels of technology; and command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4/ISR) as well as battle management systems of many member countries – based on unclassified reporting by sources like the IISS and commercial sources like IHS Janes – shows that even countries that did meet the 2% goal usually needed to spend something like 3% or more of their GDP to offset the aging of their existing major weapons and technology and to avoid slow but steady cuts in force size. While fewer reliable unclassified data are available on the "soft" trends in NATO country forces like training and readiness, electronics, and software, it is clear that many national forces suffered from a lack of readiness, failure to train at adequate and realistic levels, major problems in interoperability, and failures to modernize C4/ISR.

Moving toward a More Effective Alliance

Fortunately, NATO's military and civilian staffs as well as the military and force planners in many member countries did focus on NATO's actual needs rather than burden-sharing. Their work on strategy and force improvement priorities often identified real problems and possible solutions. The problem was not the competence or lack of imagination on the part of NATO and national professionals, rather it was the lack of political support and the prioritization of funding civil programs in a time when the risk of war seemed remote.

Many of NATO's ongoing efforts to revise its strategy and improve its forces have laid the groundwork for immediate efforts to rebuild and restructure the alliance. So have the efforts of military and civilian planners in several NATO states. In many cases, the need is not one for new options, force plans, or strategies, but rather the need to focus on key priorities and plans which can actually fund and deploy the forces they already propose.

There are, however, a number of areas where the U.S. and its strategic partners need to recognize that further changer are required. Some also require a new institutional approach to force planning; information warfare; arms control; and programming, planning, and budgeting (PPB).

Transparency, Democracy, Communication, and Information "Warfare"

One key area of improvement is the need to properly communicate the importance of NATO at a public and unclassified level. NATO and member countries need to understand that "information warfare" in a democracy means communicating in depth and in unclassified terms when the public is asking about the need to fund deterrence and defense, showing that there really is a threat, that there are adequate plans to meet it, and that there is value in partnerships and alliances.

"Information warfare" is not simply manipulating communications and data to counter an enemy or win diplomatic and economic gains. It means that the U.S. and its partners must explain and justify the need for military spending and modernization, the nature of the threat, and what and how NATO and member country forces are acting to meet it. It means fully and *openly* communicating why NATO merits the budgets and resources needed to make the alliance effective.

In fairness, NATO's military and international staffs often do communicate effectively when they are authorized to do so, but NATO as an organization and its member countries do far little to explain strategy in detail. There are almost no open-source data on the Russian and other threats or net assessments of NATO and threat capabilities. Unclassified strategy documents and statements are little more than hollow rhetoric, plans and budgets are never explained or justified, and no real effort is made to publicly address most national problems in force development and interoperability. The same is true of virtually all member country defense reporting.

NATO and national unclassified efforts to communicate the nature of the threat – or the shifting balance in net assessment terms – are virtually lacking. The U.S. is the only country to have published a serious report like *Soviet Military Power* and *Russian Military Power*, and the U.S. has not done this with any consistency since the break-up of the FSU. In some areas, Sweden may have published more semi-official unclassified reporting on Russia than NATO.

Countries like the UK and the U.S. talk about net assessments, but there have been no public net assessments. NATO does not publish unclassified reports on what its budget buys and its success in force modernization by country. Reporting on NATO member countries' force developments and budgets have been left to erratic national white papers filled with the equivalent of slogans and strategic goals with little data on how they can ever really be implemented.

It is time that NATO and member countries addressed the fact that they all have a long history of gross over-classification in a world where much or most of this over-classification serve no useful purpose. Modern intelligence activity and technology give Russia access to all of the data that NATO needs to fully justify its existence, but NATO and most member countries still fail to broadly communicate what they do to meet the threat, show what budget is really needed, and describe the need for a far more integrated and interoperable alliance in depth.

Democracy requires transparency, particularly in a world with so many competing needs and programs. Competing for resources cannot rest simply on the fact that a threat exists – it must be justified in detail. This justification must also deal with hard issues and should put them in an honest context. National sensitivities are important, and all member countries are scarcely equal in what they can afford and their rate of modernization and force improvement. The fact remains,

however, that national weaknesses need to be openly addressed along with the priorities for action and the risks inherent in the failure to act.

Member countries also need to honestly explain and justify the proper level of national and alliance defense expenditures. Quietly taking a peace dividend was one thing before 2014 – and possibly even before the new Russian invasion of Ukraine in 2022. NATO cannot, however, rely on a one-time surge of support coming out of the worst phases of the Ukraine War.

NATO will need to compete for national support in the same way that civil programs compete in democracies, and while it may be an exaggeration to call this "information warfare," competing in valid ways for popular and political support may well be more important in practice than competing in actual information warfare with a threat like Russia. This is particularly true when the U.S. and several other members of NATO must deal with the potential threat from China, and especially in the case when the entire alliance must deal with terrorism, extremism, and challenges from humanitarian crises and fragile states.

Making Effective Use of Net Assessments

As **Figure One** shows, NATO scarcely helped itself from 2015 onwards by conducting a failed burden-sharing effort with little or no net assessment or any appraisal of its real world-impact on military effectiveness. Furthermore, NATO never openly examined or reported how its capabilities and strategy could create an effective alliance, and it failed to conduct even the simplest net assessment of comparative spending, military effort, and defense industrial base with Russia.

The NATO data in **Figure One** for 2021 are typical of NATO versus Russian military spending for the entire period since 2014, and they show that NATO Europe has consistently been spending over five times the total official annual spending figure for Russia. If one adds in U.S. and Canadian spending (which does involve a dishonest U.S. claim that its entire $754 billion defense budget should be counted as dedicated to NATO), the total is over $1.1 trillion – and nearly 18 times Russia's official figure. Even if the U.S. did provide a credible estimate of the portion of its forces whose primary mission is to support NATO – rather than perpetuating the lie that all U.S. defense spending should be counted as supporting NATO and amount to 70% of the total for the alliance – the annual total for NATO Europe, Canada, and the U.S. would still probably be over $700 billion.

As Figure One also shows, many analysts do feel Russia's official figure sharply understates its real spending, but even if it is the high estimate of $178 billion, this would still make Russia only 53% of NATO Europe and 16% of NATO's total of $1.113 trillion. In contrast, China spent $207 billion officially – 3.3 times the Russian official figure – with the highest figure estimating $322 billion – 1.9 times the Russian figure. (It is striking that Ukraine's defense budget was only $118 to $131 billion.)[2]

It is also important to stress that none of these data attempt to compare military effectiveness, levels of deterrence, and levels of risk. Russia has also scarcely demonstrated high effectiveness in its capabilities during the invasion of Ukraine. Other data show, however, that Russia has a global manufacturing output that could be as low as only 1% of the world's output versus 5.3% for Germany alone, and somewhere nearly half the size of either the UK or France. The U.S. has some 16.8% and China has 28.7%. No one can doubt the size of Russia's nuclear and conventional forces, but asking NATO to spend more without openly examining its comparative manufacturing

capability or defense industrial base makes as little sense as asking every member state to spend 2% without examining the size of Russian efforts and comparative efficiency in defense spending.[3]

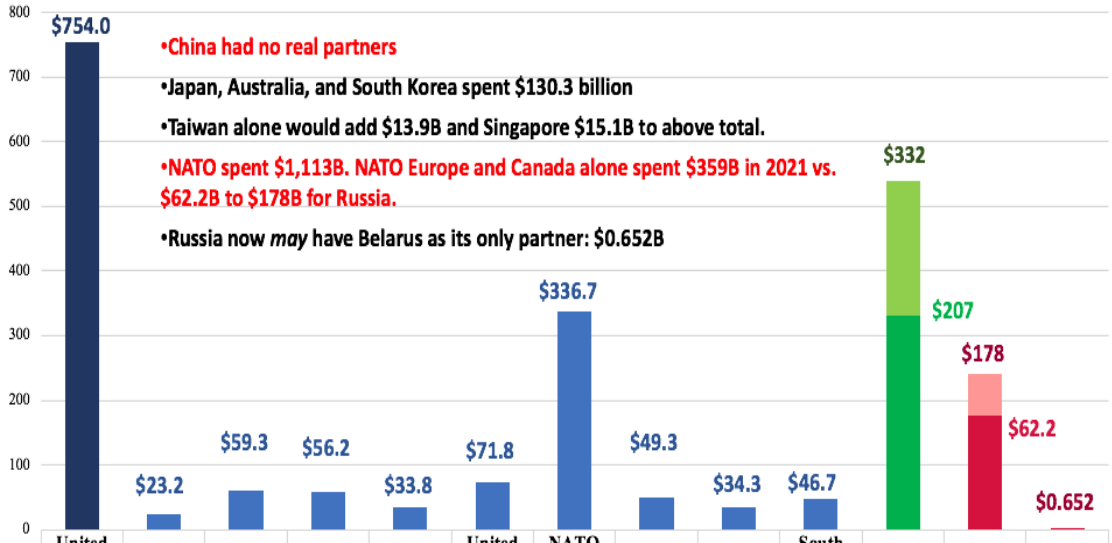
NATO clearly needs to examine these issues in a net assessment context to make the best comparisons of military effort and the efficiency of military spending as possible. Its failure to do this effectively during the Cold War was one of the key reasons that NATO's intelligence efforts grossly over-exaggerated some aspects of Russian military capability through the 1960s, while it sharply underestimated Russian spending through 1990.

These spending data, however, are only part of NATO's need to develop both classified and open-source net assessments. Deterrence is ultimately dependent on warfighting capability, and net assessments that touch upon any aspect of battle plans in detail or on sensitive areas of operations, technology, and modernization do need to be classified. In broad terms, however, many key comparisons of force size by mission and location – and on the rates of training, readiness, and modernization – cannot be kept secret from a threat with intelligence assets like those of Russia.

Moreover, such net assessments are critical if the various members of NATO are to understand their comparative strengths and weaknesses, develop various levels of modernization, and set effective goals for joint and all-domain operations (JADO). They also provide a valid way of measuring national progress and demonstrate the need for effective levels of spending and effort. A 30-country alliance cannot be revitalized by setting broad strategic goals that are not based on some form of net assessment and that do not measure current and projected capability by country in terms of mission and threat. Moreover, both understanding the threat and tracking the progress to meet a given threat must also be measured and broadly understood at a public level. It is one thing to classify and another thing to conceal.

Figure One: NATO, Russian, Chinese, and Key Country Military Spending

(In Current 2021 $US Billions)



	United States	Canada	France	Germany	Italy	United Kingdom	NATO Europe	Japan	Australia	South Korea	China	Russia	Belarus
Official Estimate	754	23.2	59.3	56.2	33.8	71.8	336.7	49.3	34.3	46.7	207	62.2	0.652
PPP Estimate											332	178	

Source: NATO; and IISS, *Military Balance 2021*.

Strategy: Posturing or Planning, Programming, and Budgeting (PPB)

More broadly, strategic rhetoric – and describing broad goals without providing real-world plans and resources to implement them – is far more dishonest than exaggerating the share of a nation's defense spending that goes to NATO; it is destructive. In the real-world, strategy and capability are also what a country can actually buy and deploy, not the plans, intentions, and ministerial communiques. Despite what some defense ministers and senior military officers seem to think, the actual strategy is the budget and how well it is executed, not some document or plan. It also is all too common to have a major strategy-reality gap. In fact, there does not seem to be a single NATO country where this is not the case – although some countries do much better than others.

Worse, real-world success means real-world planning on an alliance-wide level to deal with the host of problems and differences that are unique to individual NATO countries. A good part of the existing gaps in NATO, however, are driven by the failure to focus on interoperability, to properly execute modernization plans, and to create effective alliance-wide capabilities. Some of these problems have been reduced by better cooperation is several key areas since 2014, but others have only been made worse by executing national plans that do not serve the broader needs of the alliance.

The Ukraine War has now created a window of opportunity where NATO may find that the money and cooperation it needs to become more effective are easier to obtain, but exploiting this time window requires as integrated and effective of an effort as possible. One possible way would be

to build on the lessons of the NATO Force Planning Exercise that began in the 1960s, but this version will need to be far more public and allow for far stronger review of national efforts.

The original NATO Force Planning Exercise was one intended to help member countries develop integrated planning, programming, and budget (PPB) systems and report on plans and progress in the form of annual replies to a defense planning questionnaire that showed a force plan and budget that extended five years into the future. This effort had some successes, but efforts to link it to a net assessment of the threat had only limited success.

Many countries found they could not afford to execute the military plans and budgets they submitted to NATO as they had to assume full responsibility for funding their forces and as the U.S. had ceased to provide the postwar-U.S. aid which they had previously depended upon. Competing defense industries often created barriers to true interoperability, and member countries strongly resisted outside review and criticism of their defense plans and budgets. The U.S., which had sponsored the effort as part of a shift in strategy that would reduce NATO's reliance on theater nuclear forces, found that it too faced major problems in executing such plans for NATO because of the competing need to fund the Vietnam War.

Some elements of the process did survive, however, and other NATO planning activities, such as the deployment of Pershing II and BGM-109G ground-launched cruise missiles in response to the Russian deployment of S-20 intermediate-range ballistic missiles (IRBMs) in the 1980s, led to the negotiation of the Conventional Armed Forces in Europe (CFE) Treaty in 1990, demonstrating that NATO could add some elements of net assessment, advanced modeling, and wargaming to the process.

NATO never, however, succeeded in creating effective internal review and debates over most aspects of national plans and budgets. Moreover, the break-up of the FSU, gradual integration of East European states into the alliance, and emphasis on cutting budgets and taking peace dividends after 1992, all combined to reduce any support for such efforts.

Once again, even a casual scan of reporting by the IISS on member countries' forces in its *Military Balance* for 2022 immediately shows just how serious NATO's current planning and budgeting problems are when they are reviewed by country, and these problems are immediately reinforced when one looks at the scale of force cuts since 1991 and the lack of progress since 2014.

The same is true when one reviews NATO reporting on EDTs and when one considers what they will mean in terms of changes in reaction times, the need for JADO, and the need to redefine interoperability and integration. Living with a revolution in military affairs is hard at the best of times. Living with such a revolution and having to revitalize an alliance after two decades of substituting rhetoric for results between 1991 and 2022, is far from the best of times.

What is clearly needed is as transparent of a force PPB process as possible. It should be focused on tying together country-by-country improvements, and it should give NATO command – as well as senior NATO and member country officials – the full opportunity to carry out detailed reviews. It should provide enough unclassified details to allow outside expert review and comments to create expanded forms of dialogue or future membership with countries like Sweden and Finland (and possibly Switzerland, Austria, and the surviving parts of Ukraine). The end result might well be substantially more costly, but as the Ukraine War has all too grimly demonstrated, the failure of deterrence can become far more costly all too quickly.

Public Transparency and *Russian Military Power*

These are demanding calls for change, although they require shifts in operating method rather than basic changes in the institutions necessary to implement them. In fact, NATO has already shown a striking capability to react in dealing with the invasion of Ukraine at both the institutional and national levels. At the same time, NATO needs to react quickly to carry out assessments of whatever Russian approach to military forces emerges out of its mixed performance in the Ukraine War. Member countries have long avoided detailed public reporting on the Russian threat, and the U.S. and the UK have both found it easier to talk about net assessments than to actually execute them

One immediate step that could bypass some of the present bureaucratic barriers to NATO reform in this aspect of the NATO planning cycle, which is also one of the difficulties in providing the necessary agreed NATO intelligence support, would be for the U.S. to begin immediately developing and issuing new annual editions of *Russia Military Power*, which the U.S. Defense Intelligence Agency (DIA) last issued in 2017.[4] This report – like its matching *China Military Power* – provides most of the unclassified data needed to support a net assessment, and it also provides media, reporters, researchers, and think tankers outside government with a clear picture of the potential threat.[5]

Some at DIA and elsewhere in the intelligence community evidently believed it was not necessary to issue annual editions of *Russia Military Power* on the grounds that Russia did not change its forces often and that the internal bureaucratic cost and time were too high. In practice, however, any document seeking to influence expert opinion on a global level virtually needs to be annual in order to be consistently used and quoted, and the cost and time are negligible compared to its impact – as was demonstrated by the *Soviet Military Power* while the FSU still existed and by the impact of *China Military Power* today. One does not win at information warfare by shooting oneself in the word processor.

There is also no reason why such a document could not be circulated to some key European intelligence agencies for comment – British, French, and German intelligence are just a few examples. A classified version could also be circulated to NATO – setting the precedent for both NATO classified and unclassified versions. In any case, a reliable official source is needed. No matter how good academic, commercial, and think tank studies may be, NATO needs an official and up-to-date reference on the threat.

Interoperability, Exchange, and Joint All-Domain Warfare

A second area where immediate efforts are needed – some of which are evidently underway – is setting clear priorities for improving interoperability and the capability to exchange actual combat units and forces with other countries in joint all-domain warfare. Today, NATO has an excellent list of EDTs. The U.S. has issued at least four such lists in the last year – by the Defense Advanced Research Projects Agency (DARPA), the Directorate of Defense Research and Engineering (DDR&E), the Department of Homeland Security (DHS), and the White House. The UK has addressed the issue in its white papers, and so have other NATO countries.[6]

The practical problem is that NATO needs some agreed focus on how to improve interoperability over time, create realistic exchange options for forward deployment and other operations outside a country's standard theater of operation, and create effective joint operations that not only cut across each member nation's military services but also involve space, cyber, information, artificial

intelligence, autonomous operations, and unconventional warfare. Furthermore, to the extent possible, these efforts too must be interoperable and support exchanges in combat.

It is far easier to describe these goals in terms of broad alliance-wide rhetoric than make any real progress in achieving them, especially since the larger and wealthier members of NATO – particularly the U.S. – can afford far more capable assets in many areas than most members of the alliance because there are so many constantly changing EDTs and because some priorities for adopting them change on an annual basis. Change almost always comes at a higher cost – at least initially – and with higher risk. It also risks occurring with nations pursuing different priorities in the equivalent of parallel lines – efforts that never meet in some interoperable form.

Here, NATO and each member state need to build on their current technology base and integrate the development of NATO-wide interoperability, exchange capability, and joint all-domain warfare capability into individual country force plans and budgets. NATO needs to provide far better guidance for force planning in all of these areas, and it must do so as quickly as possible.

This presents major challenges to an alliance that has not met these challenges in the past with any efficiency and limited risk. The most advanced states must commit themselves to serious amounts of risk in terms of cost, estimated timelines and progress, and mass challenges in constantly adaptive systems of integration to implement JADO and JADC2 effectively – and so far their performance has rarely gone above low to mediocre. They must also seek interoperability while keeping pace or surpassing Russia (and China), and they must be able to work with the poorer and less advanced members of NATO – many of which are the powers nearest to Russia or former East European satellites with an inheritance that is still an FSU legacy. A great deal more of realism, planning, and risk analysis – tied to an emphasis on advanced levels of jointness and interoperability – is critical. Far too little pre-Ukraine War national efforts adequately met any of the goals.

Airpower, Unmanned Systems, Missiles, Missile Defense, Nuclear, and Conventional Long-Range Strike

Finally, NATO and a number of member states have already begun to consider how to strengthen the states nearest to Russia, and they are preparing for its potential future targets from the aftermath of the current fighting over Ukraine as well as to the Baltic or Russian "spoiler" and other out-of-area operations. They are reacting to the fact that Russia has made actual use of long-range conventional cruise missiles, ballistic missiles, and missiles equipped on strike aircraft, as well as surface-to-air missiles. Russia also has made at least indirect threats of using theater nuclear weapons.

These same threats have long-ranges and often theater-wide consequences, and they can be used to strike deep into NATO territory – even against states that are as far from the Russian border, such as the UK. As Ukraine has shown, they cannot be met by deploying shorter-range air defense systems, anti-tank missiles, and unmanned combat vehicles like drones.

Far too few NATO countries near Russia now have advanced air and missile defense systems or are protected by survivable combat aircraft and longer-range missile strike systems that can deter or counter Russian strikes. Many European member states of NATO have let their combat aircraft and surface-to-air missile systems fall behind in technical terms, and they have seriously cut their force strength. Most have no long-range conventionally-armed, precision guided missile strike

systems – including ones that could help deter Russian strikes on NATO countries near or on Russia's border.

It will take at least half a decade to correct these problems at a time when Russia's forces are anything but static. Russia is placing a major emphasis on advanced, layered air and missile defense systems on both sides, alongside a mixtures of cruise, ballistic, and hypersonic "smart" conventional precision strike weapons. These efforts are tied to modern strike aircraft and heavily defended bases, advanced deep strike targeting systems, and a growing ability to strike new military target complexes throughout Europe as well as critical civilian targets with major counter-value impact on civil society and national economies. In some cases, Russian offensive "conventional" missiles may prove to be dual use as both nuclear – and possibly chemical biological weapons (CBW) – and conventional strike systems. So far, there has also been largely negative real-world progress in maintaining – much less increasing – arms control as an alternative.

The cost and sophistication of the new systems NATO countries must prepare to encounter may well limit them to the wealthier and more advanced members of NATO unless NATO begins to plan now for some collective effort. The Ukraine War has also exposed the fact that the less wealthy NATO states in the forward area will need major intelligence, targeting, and battle management support in using even shorter-range fire and unmanned strike systems.

So far, the UK and France still address their nuclear strike systems largely in terms of national strike objectives where retaliation might take the form of counter-value strikes in response to nuclear strikes on their soil, while Russia may be returning to a more overt mix of theater nuclear weapons.

NATO also needs to act collectively to ensure that countries in the rear can provide deterrent and defensive coverage of nations on the Russian border. Here, it is important to point out that the UK is credited with 225 national strategic nuclear weapons (105 stored) with 120 active weapons on ballistic missile submarine (SSBNs), which in practice seem limited to use against Russia as theater nuclear weapons. France has 290 weapons (10 stored), which in theory are "all azimuth," but they seem restricted in practice to strike roles against Russia.[7]

The U.S. also has hard choices to make about both deploying long-range precision conventional strike systems forward and providing some form of nuclear extended deterrence. U.S. declarations about U.S. nuclear holdings now center around arms control and the 1,458 strategic warheads deployed on 527 intercontinental ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs), and strategic bombers under the New Start agreement. However, total U.S. holdings are estimated to be 3,750 "active" and "inactive" warheads as of September 2020 – not counting retired warheads and those awaiting dismantlement. [8] There seem to have been some 1,750 retired warheads awaiting dismantlement.

Some reports indicate that the total number of U.S. "active" and "inactive" warheads is 3,750 as of September 2020.[9] The stockpile figures do not include retired warheads and those awaiting dismantlement. The Federation of American Scientists (FAS) estimates that there are 1,750 retired warheads awaiting dismantlement, for a total of 5,550 warheads as of early 2021.[10] Other reports indicate that the U.S. still had 100 B-61 nuclear gravity bombs that are forward-deployed in six NATO bases: Aviano and Ghedi in Italy; Büchel in Germany; Incirlik in Turkey; Kleine Brogel in Belgium; and Volkel in the Netherlands in 2021. The total estimated U.S. B-61 stockpile amounted to 230. (Some B-83s may not have been fully decommissioned.)

In contrast, Russia had 1,458 strategic warheads deployed on 527 intercontinental ballistic missiles, submarine-launched ballistic missiles, and strategic bombers in late 2021.[11] The Federation of American Scientists (FAS) indicates that Russia's military stockpile consists of approximately 4,497 nuclear warheads, with 1,760 additional retired warheads awaiting dismantlement, as of January 2021.[12] As is the case with the U.S., none of the reports describing these Russian forces address their possible reactivation for uses in theater or tactical nuclear warfare – or modification for use in dual capable strike systems.

All four powers (the UK, the U.S., France, and Russia) have nuclear modernization plans of a kind. All, however, no longer exist in a world where arms control seems likely to stabilize the arms race and sharply reduce any future risk of war. All face a future in which even conventional medium to long-range precision strike systems can have serious countervalue and counterstrike impacts, and it is far harder to characterize a given major strike weapon as a non-nuclear weapon and to assess the impact of actual precision conventional and low-yield nuclear strikes.

The key question is what can and should NATO do? What level of extended conventional and nuclear deterrence by the full mix of NATO powers – if any – can protect the smaller states and those nearest Russia? What mix of shorter or other offensive systems needs to be in place in large numbers in the forward areas? Can long-range systems in a country to the rear play a major deterrent role? What defensive mixes can have the highest deterrent value and either replace facing systems like the S-300 or be affordable? What – over the next ten to twenty years of life cycle – is the future of manned combat aircraft? How does this interact with the growing threat posed by China and other proliferating powers? Can arms control be revived, and if so, what kind and how?

Up until the Russian invasion of Ukraine the answers were needed, but now they are urgent. Given the time required to act with any coherence, this no longer is the case. Arms control would still be the best option, but paving the road to hell with good intentions seems extremely unlikely to succeed as a strategy. Moreover, the U.S. and all its NATO allies must consider the uncertain impact that China's sharply increasing nuclear forces will have on the global balance, as well as the impact of nuclear proliferation. Creating effective NATO deterrence not only must develop and deploy a fundamentally different mix of conventional defense and strike systems, it must deal with the strong possibility that the nuclear future will change at least as much and almost certainly at the same time.

[1] See NATO, *Defence Expenditure of NATO Countries (2014-2021),* Communique PR/CP(2021)094, June 11, 2021; and Anthony H. Cordesman and Grace Hwang, *NATO and Ukraine: Reshaping NATO to Meet the Russian and Chinese Challenge*, CSIS, February 16, 2022, https://www.csis.org/analysis/nato-and-ukraine-reshaping-nato-meet-russian-and-chinese-challenge.

[2] IISS, *Military Balance 2022*, p. 211.

[3] Source: Felix Richter, "China Is the World's Manufacturing Superpower," May 4, 2021, Statista, https://cdn.statcdn.com/Infographic/images/normal/20858.jpeg.

[4] Defense Intelligence Agency (DIA), *Russia Military Power: Building a Military to Support Great Power Aspirations,* 2017, https://www.dia.mil/Portals/110/Images/News/Military_Powers_Publications/Russia_Military_Power_Report_2017.pdf.

[5] For political reasons, it has been retitled *Military and Security Developments Involving the People's Republic of China 2021, Annual Report to Congress*, and is shown as issued by the Office of the Secretary of Defense, https://media.defense.gov/2021/Nov/03/2002885874/-1/-1/0/2021-CMPR-FINAL.PDF.

[6] For example, see NATO, *Science & Technology Trends 2020-2040: Exploring the S&T Edge NATO Science & Technology Organization*, March 2020, https://www.nato.int/nato_static_fl2014/assets/pdf/2020/4/pdf/190422-ST_Tech_Trends_Report_2020-2040.pdf; Under Secretary of Defense, *USD(R&E) Technology Vision for an Era of Competition*, February 1, 2022, https://www.cto.mil/wp-content/uploads/2022/02/usdre_strategic_vision_critical_tech_areas.pdf?utm_source=EGov%20Welcome%20Email&utm_medium=email&utm_campaign=ExecutiveGov%20Daily%2002.03.2022%20%28X4gXzs%29&kla_id=01EP4ECWBPZCHENPJ31W4B1R2A&_kx=zE9LstVbwmHyuF-Rji_78OQd7SKPzHQ-OhuSk62ySL8%3D.TBKKxP; aWhite House, *Critical and Emerging Technologies List Update: A report by the Fast Track Action Subcommittee on Critical and Emerging Technologies of the National Science and Technology Council*, February 2022, https://www.whitehouse.gov/wp-content/uploads/2022/02/02-2022-Critical-and-Emerging-Technologies-List-Update.pdf; and the various lists of emerging technologies for the Department of Homeland Securitt in Emerging Technologies Subcommittee, https://www.dhs.gov/publication/emerging-technologies-subcommittee.

[7] Estimate adapted from Kelsey Davenport, *Director for Nonproliferation Policy*, (202) 463-8270 x102; Daryl G. Kimball; *Nuclear Weapons: Who Has What at a Glance, Fact Sheet and Briefs*, January 2022, Arms Control Association; and work by Hans M. Kristensen, Shannon Kyle, Robert S. Norris, and Matt Korda.

Also see *SIPRI Year Book, 2021*, "World Nuclear Forces, pp. 333-407, https://sipri.org/sites/default/files/2021-06/yb21_10_wnf_210613.pdf.

[8] Estimate adapted from Kelsey Davenport, *Director for Nonproliferation Policy*, (202) 463-8270 x102; Daryl G. Kimball; *Nuclear Weapons: Who Has What at a Glance, Fact Sheet and Briefs*, January 2022, Arms Control Association; and work by Hans M. Kristensen, Shannon Kyle, Robert S. Norris, and Matt Korda.

Also see *SIPRI Year Book, 2021*, "World Nuclear Forces, pp. 333-407, https://sipri.org/sites/default/files/2021-06/yb21_10_wnf_210613.pdf.

[9] Estimate adapted from Kelsey Davenport, *Director for Nonproliferation Policy*, (202) 463-8270 x102; Daryl G. Kimball; *Nuclear Weapons: Who Has What at a Glance, Fact Sheet and Briefs*, January 2022, Arms Control Association; and work by Hans M. Kristensen, Shannon Kyle, Robert S. Norris, and Matt Korda.

Also see *SIPRI Year Book, 2021*, "World Nuclear Forces, pp. 333-407, https://sipri.org/sites/default/files/2021-06/yb21_10_wnf_210613.pdf.

[10] *SIPRI Year Book, 2021*, "World Nuclear Forces, pp. 333-407, https://sipri.org/sites/default/files/2021-06/yb21_10_wnf_210613.pdf.

[11] Estimate adapted from Kelsey Davenport, *Director for Nonproliferation Policy*, (202) 463-8270 x102; Daryl G. Kimball; *Nuclear Weapons: Who Has What at a Glance, Fact Sheet and Briefs*, January 2022, Arms Control Association; and work by Hans M. Kristensen, Shannon Kyle, Robert S. Norris, and Matt Korda.

Also see *SIPRI Year Book, 2021*, "World Nuclear Forces, pp. 333-407, https://sipri.org/sites/default/files/2021-06/yb21_10_wnf_210613.pdf.

[12] *SIPRI Year Book, 2021*, "World Nuclear Forces, pp. 333-407, https://sipri.org/sites/default/files/2021-06/yb21_10_wnf_210613.pdf.