

# Defence and military analysis

## Re-baselining the defence industry

Russia's war in Ukraine has harshly exposed the inventory reductions within many NATO members that took place after the end of the Cold War. Traditionally, rectifying this would have been achieved through simply buying far larger volumes of equipment, such as missiles, uninhabited aerial vehicles (UAVs) or munitions, and stockpiling these in case of war. This was because procurement and production cycles, measured in years and not months, were unable to accommodate surges in demand to more quickly meet a deteriorating security environment, or even the outbreak of hostilities. This, however, is changing as novel production techniques and technologies emerge in combination with disruptive new entrants offering to reshape parts of the defence-industrial landscape.

Several factors contribute to what is unfolding. A cadre of defence start-ups are embracing new ways of manufacturing to reduce costs and act with increased agility. There is also recognition among some senior military and political circles that the old models of defence acquisition and production are no longer fully fit for purpose. The existing defence-industrial base is being oriented more toward a war footing, while emerging players are encouraged to offer different and more rapid responses to meet defence-materiel needs.

In 2024, then US Deputy Defense Secretary Kathleen Hicks said that 'America's defence industrial base is at a pivotal moment', with the COVID-19 pandemic revealing the fragility of supply chains, along with Russia's war in Ukraine, Israel's invasion of Gaza and its incursion into Lebanon underscoring the importance of, and sometimes the lack of, production capacity.

Israel's MAFAT, the country's Directorate of Defense Research and Development, hosted an advanced-manufacturing seminar as the country was juggling the competing demands of fighting in Gaza and Lebanon while all along supporting national missile defence. These demands have strained Israel's industrial output, from ammunition

to air-defence missiles. At the gathering, MAFAT head Daniel Gold urged industry to embrace mass production and automation and argued further for domestic innovation. The seminar focused on topics including 3D printing, the use of automation and robotics in production, and innovative manufacturing methods.

In the United States, a flag bearer for a disruptive approach to defence manufacturing is defence start-up Anduril Industries. In August 2024, the company unveiled plans for a large defence production facility able to produce thousands of uninhabited vehicles annually. With more than 460,000 square metres of space, the facility would almost approach the size of the Pentagon itself and be one of the world's largest production facilities. The start-up disclosed the ambition soon after completing a USD1.5 billion 'Series F' investment round that valued the seven-year-old business at USD14bn.

Anduril's chief strategy officer, Chris Brose, said that the goal is to use a common set of manufacturing tools and processes to easily scale production. The company has for some time rather grandiosely called for 'rebooting the arsenal of democracy', invoking the United States' ability during the Second World War to surge production on a vast scale, and said the new facility would be called Arsenal-1. The company has suggested it may not be too long before it moves forward with another facility, Arsenal-2, either in the US or abroad. Anduril said it would rely on modularity to build equipment quickly and to avoid dependence on bespoke components. It added that 'Arsenal dismantles the traditional defence production preference for complexity by designing products that are as simple as possible, eliminating requiring unnecessary materials, parts, and specialized processes', adding that around 90% of production at Arsenal-1 will rely on commercially sourced items.

The start-up had previously made other production commitments, including building 200 autonomous underwater vehicles in Rhode Island, in part

to meet the requirements of a US Navy contract. Anduril said it made the investment decision to have sufficient capacity to satisfy anticipated demand for its Dive-LD family of underwater systems. Another company goal is to meet orders at pace, signalling how industry recognises that during a time of growing security concerns, military customers are less able to wait for years for equipment. The facility, which is due to open in 2025, should allow Anduril to produce more than 200 hulls per year.

It is not just the new entrants that are innovating to simplify equipment manufacture for military users. Pratt & Whitney is among those that have been working on additive-layer manufacturing, also called 3D printing, to become more efficient. The RTX unit says it has been able to slash the parts count on its TJ-150 small turbojet engine, used on missiles and UAVs, using a process called unitisation, without compromising performance. Rather than using outsourced casting and machining, Pratt & Whitney says it can print the component in-house. The supplier has said that the potential savings on castings and mouldings alone could approach USD1bn. Rolls-Royce is also exploring the use of 3D printing for some of its defence-related activities. The company, for instance, is looking at additive-layer manufacturing as part of its *Orpheus* rapid-development demonstrator-engine effort aimed in part at the United Kingdom's Future Combat Air System Technology Initiative. *Orpheus*, funded jointly by Rolls-Royce and the UK Ministry of Defence, is intended to lead to a family of new small engines to power systems such as cruise missiles and autonomous collaborative platforms, the UK equivalent of the US collaborative combat aircraft. 3D printing of metals as well as plastics is being tested and integrated increasingly by armed services as well as defence industries. For armed forces, using 3D printers holds the promise of shortening supply chains and increasing equipment availability through more flexible spare-parts supply, while also possibly increasing the pace of equipment adaptation and innovation. However, as both industry and the armed forces pursue these

technologies, ensuring cyber security will remain a key focus.

The start-up world is thinking even more aggressively. Divergent Technologies, for example, sees a future where some platforms are 3D-made. The company, which is already working with General Atomics, has plans to develop 3D-printed UAV structures and is eyeing the Pentagon's Replicator initiative to produce systems at scale. Divergent supported General Atomics' November 2023 release of an Advanced Air-Launched Effects from the internal weapons bay of an MQ-20 *Avenger*. Ukraine, which has made considerable use of UAVs, has been pursuing 3D-printing technologies rapidly to put systems into the field more quickly and at scale. In late 2023, the country began operating some long-range printed UAVs, demonstrating the utility of such systems.

Interest in greater flexibility and responsiveness is not restricted to the realm of military hardware. Many modern weapons systems are dependent on software for their performance, though this too comes with multiple challenges. Coding, software verification, ensuring new software releases are reliable, and that performance patches do not have an inadvertent effect on existing software, all have to be considered. The Lockheed Martin F-35 *Lightning* II, for example, is a software-intensive platform, and updating the software has been one source of the problems with the aircraft.

The ever-increasing importance of and reliance on software-based systems was apparent in the March 2024 decision by the US Army Contracting Command to award a software-focused contractor, Palantir Technologies, a USD178.4 million major systems integration prime contract. Palantir will develop and deliver the Tactical Intelligence Targeting Access Node (TITAN). TITAN is intended to be the US Army's next-generation intelligence, surveillance and reconnaissance ground station to process data gathered from ground, airborne and space sensors and to employ machine learning. Palantir will oversee the team that also includes more traditional contractors such as Northrop Grumman and L3Harris.

Anduril, a member of Palantir's team, has also stressed that software is key to its approach to defence production. It described its Arsenal platform as 'software-defined' and said that for all Anduril products the software 'serves as a unified system to integrate the design, development, and mass production stages'. Core to its effort is a proprietary manufacturing-execution software system, it said, that spans modelling and simulation, testing, threat-based operational analysis and other functions. Proprietary, however, is not necessarily a positive in the software realm.

More traditional defence companies are also embracing that mindset. In October 2024, Saab chief executive Micael Johansson said 'the way we develop software is incredibly important and that needs to be transformed'. The company, he said, would try to move to more of a 'software factory type of setup' where code can support different programmes. Governments are also adapting to embrace the new approaches to doing business. The US Department

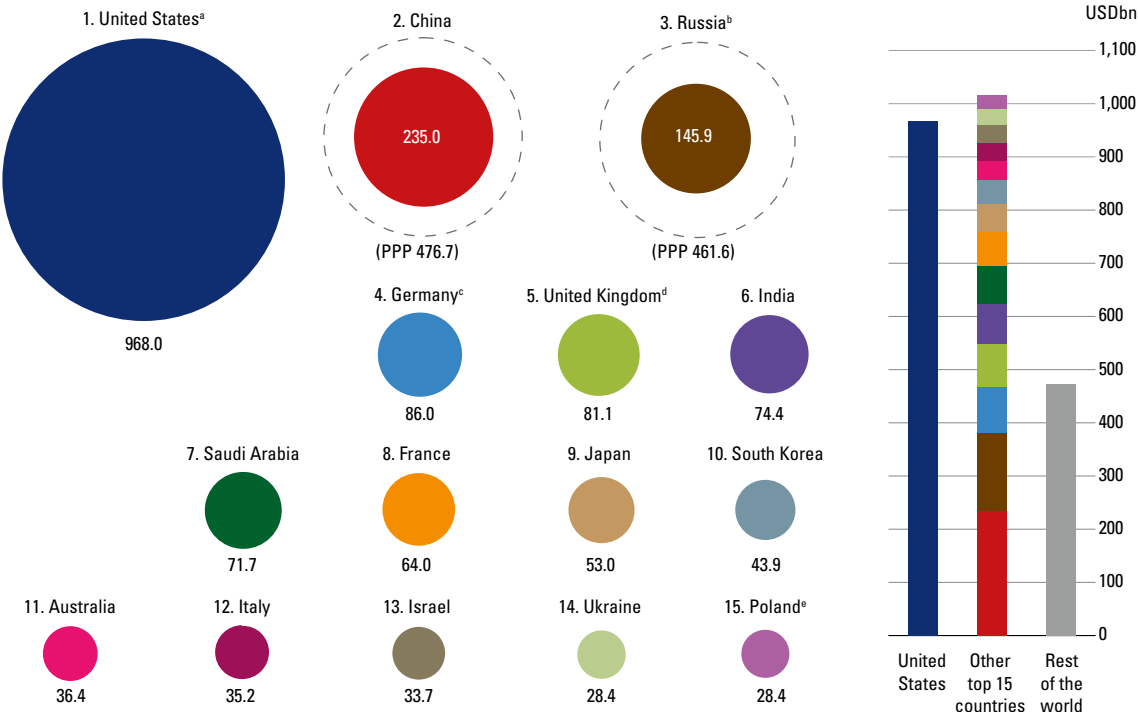
of Defense, in October 2024, laid out implementation measures for the Defense Industrial Strategy unveiled in January that year, aimed at strengthening its supply chain and core manufacturing capabilities. The implementation plan then urged the department to adopt 'more flexible pathways to field new capability in a timely fashion'. In some cases, that just requires institutions using newly created acquisition tools to move with greater pace for rapid prototyping and fielding of equipment.

Even though software and additive-layer manufacturing are becoming more critical to equipping armed forces, more traditional concerns have not disappeared. In late September, the Pentagon placed a USD15m Defense Production Act Investment to bolster heavy-forging capacity, with potential use in the manufacture of *Virginia*- and *Columbia*-class submarines, perhaps the clearest sign that industrial-era considerations remain as fundamental to the modern defence-industrial base as new technology concerns.

# Global defence spending

- Global defence spending reached USD2.46 trillion in 2024, up from USD2.24 trillion in 2023. Real-terms growth rose to 7.4% in 2024 compared to 6.5% in 2023 and 3.5% in 2022. All regions, bar Sub-Saharan Africa, grew in real terms in 2024.
- As a proportion of GDP, global spending increased from an average of 1.59% in 2022 to 1.80% in 2023 and 1.94% in 2024.
- Between 2023 and 2024, Russian total military expenditure grew by 41.9% in real terms to USD145.9 billion.
- European defence spending growth surged to 11.7% in real terms in 2024. Significant 23.2% real growth in the German budget, between 2023 and 2024, made it the world's 4th largest defence budget, while Poland became the 15th largest defence spender globally, up from 20th place in 2022.
- Overall, regional spending in Europe was more than 50% higher in nominal terms compared to 2014.
- China's defence budget grew by 7.4% in real terms, outpacing the wider regional average of 3.9% despite significant uplifts in the Japanese and Indonesian budgets. However, stronger uplifts in other regions meant that Asia's share of global spending fell to 21.7% in 2024 from 25.9% in 2021.

## Top 15 defence budgets (USDbn), 2024\*\*



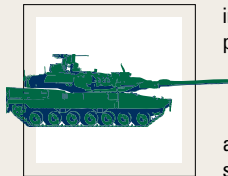
<sup>a</sup>OMB adjusted figure. <sup>b</sup>National Defence budget plus military R&D funding, military pensions, paramilitary forces' budgets, and other MoD-related expenses such as housing. <sup>c</sup>Includes 'Sondervermögen' (special fund) allocation, military pensions and military aid to Ukraine. <sup>d</sup>Includes Armed Forces Pension Scheme and military aid to Ukraine. <sup>e</sup>Excludes Armed Forces Support Fund. <sup>f</sup>At current prices and exchange rates. <sup>g</sup>Analysis only includes countries for which sufficient comparable data is available. Notable exceptions include Cuba, Eritrea, Libya, North Korea and Syria.

Notes: Unless otherwise indicated, US dollar totals are calculated using average market exchange rates for 2024, derived using IMF data. The relative position of countries will vary not only as a result of actual adjustments in defence spending levels, but also due to exchange-rate fluctuations between domestic currencies and the US dollar. The use of average exchange rates reduces these fluctuations, but the effects of such movements can be significant in a number of cases. US Foreign Military Financing not included in figures. Dashed line reflects an estimate for the value of the Chinese and Russian defence budget in PPP (purchasing power parity) terms to take into account the lower input costs in these countries. These PPP figures are not used in any regional or global totals in this publication and should not be used in comparison with other international data.

Figure 12 Europe: arms procurement and defence-industrial trends, 2024

### GREATER INVESTMENTS IN ARMoured AND MECHANISED FLEETS

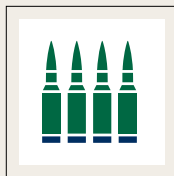
During operations in Afghanistan and Iraq, European armed forces deprioritised armoured and mechanised capabilities. However, over the last three years, European states have advanced plans to recapitalise their fleets, with some even announcing ambitions to establish these capabilities from scratch. The Netherlands retired its KNDS *Leopard 2A6* main battle tanks (MBTs) in 2011 due to budget cuts. However, in late 2024, the country's defence ministry requested approval to acquire up to 52 *Leopard 2A8s* to establish an armoured battalion by 2030. More ambitiously, Lithuania announced that it would also procure a battalion of *Leopard 2A8s*, as well as two battalions of BAE Systems Hägglunds CV90 infantry fighting vehicles (IFVs) and additional ARTEC *Vilkas* wheeled IFVs. Italy is also seeking to expand its armoured fleets. A mid-life upgrade of the CIO *Ariete* is under



way, with plans to double the number of MBTs by acquiring a second type. Talks between KNDS and Leonardo to produce an Italian version of the *Leopard 2A8* collapsed in mid-2024. Since then, Leonardo has established a joint venture (JV) with Rheinmetall to offer the KF51 *Panther* instead. The JV will also offer the KF41 *Lynx* for the Italian army's ambitious programme to acquire over 1,000 vehicles, a significant expansion of its fleet size. Elsewhere, Poland's acquisition of South Korean and US tanks will soon be followed by the production of its indigenous HSW *Borsuk* tracked IFV, with further plans to acquire a heavier platform as well. Efforts across Europe to regenerate capability will not be quick, however, with companies highlighting difficulties in the supply of electronics and armour steel and thus in speeding up delivery of systems to customers.

### EUROPE'S MUNITION PRODUCTION RAMP-UP MAKES PROGRESS

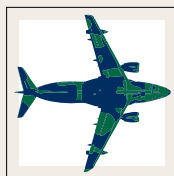
European states, defence companies and multinational organisations are racing to increase defence-industrial capacity and production rates as quickly as possible. This is driven by the need to support Ukraine's war effort and to meet European armed forces' own requirements, including deeper ammunition stocks. Particular efforts have been made in artillery-ammunition production, an area where Ukraine has a great need. Rheinmetall, Europe's largest such producer, has increased its global annual production of 155mm artillery rounds by a factor of ten from its pre-2022 capacity to 700,000 rounds, and is planning to reach one million by 2026. The company has achieved this partly through the acquisition of Spanish company EXPAL Systems in 2023 as well as through investing in existing facilities both before and after the signing of long-term production orders. Other producers, such as Franco-German KNDS, are investing in sites in Belgium, France and Italy to achieve an annual rate



of 100,000 rounds by 2025, which will be up from 60,000 at the start of 2022. Similarly, Scandinavian company Nammo and the UK's BAE Systems have both received contracts from national governments to increase production. However, a range of factors hamper the speed at which this can take place, including competition for energy and chemicals with the commercial sector and difficulties receiving approval to build new factories. There is also concern over the origin of certain materials, with European states relying heavily on China for the supply of nitrocellulose, for example. In addition to national governments funding production increases, the EU has also provided funds to increase supply, most notably through its 2023 Act in Support of Ammunition Production which allocated funds to sustain the industrial ramp-up and production of the ammunition and missile sector. The EU aims for member states' total annual production capacity to reach two million rounds by the end of 2025.

### EUROPEAN STATES DIVERSIFY SUPPLIERS

Since Russia's full-scale invasion of Ukraine began in February 2022, European states have accelerated their modernisation efforts. This has created opportunities for companies outside of Europe, as well as traditional US suppliers, which can either supply equipment more quickly than their European competitors or produce equipment that few or no European companies currently can, such as multiple rocket launchers (MRLs). From February 2022 to the end of October 2024, South Korean companies secured production contracts worth USD18.03 billion from European states. The vast majority of this sum, USD16.88bn, has been contracted by Poland, which is seeking to rapidly modernise and expand the size of its armed forces. This includes the acquisition of large numbers of the Hanwha K9 *Thunder* tracked howitzers now ordered or operated by seven European countries. Israeli firms have also enjoyed



success, signing USD6.85bn+ worth of contracts during this time frame. Although the sale of the IAI *Arrow 3* ballistic-missile-defence system to Germany (USD3.89bn) accounts for most of this, it also includes the sale of Elbit Systems PULS MRLs to Denmark, the Netherlands and Spain. Similarly, since 2019, Brazil's Embraer has signed contracts with five European states for its KC-390 medium airlifter: worth a total of USD4.18bn, of which USD2.96bn has come since February 2022. Some politicians and industrialists in Europe have criticised such acquisitions, arguing that European states should procure from one another or collaborate to develop systems to build up the continent's 'strategic autonomy'. However, other countries, while supporting the overall ambition in the long term, have preferred to acquire non-European systems to achieve capability objectives more quickly.