III. Arms-producing and military services companies, 2021

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The combined arms sales of the world's 100 largest arms-producing and military services companies in 2021 (the SIPRI Top 100 for 2021) totalled US$592 billion.[1] This represented an annual increase of 1.9 per cent in these companies' arms sales.[2] Arms sales by the Top 100 have been on an upward trajectory since at least 2015 (the first year for which SIPRI included Chinese firms in its ranking) and increased by 19 per cent in real terms between 2015 and 2021 (see table 5.6).

This section reviews developments in the arms production and military services industry in 2021 (the most recent year for which consistent data on arms sales of the Top 100 is available) and 2022. It first outlines regional and national developments in the SIPRI Top 100 for 2021 and notable developments outside the Top 100. It then assesses the compounded effects on the industry and its supply chains of the disruptions caused by the Covid-19 pandemic and the Russian Federation's invasion of Ukraine, and the surge in demand caused by that war. 'Arms sales' are defined as sales of military goods and services to military customers domestically and abroad.[3]

Regional and national developments in the Top 100 for 2021

North America: Mergers, acquisitions and the rise of private equity

North America is the region with the largest presence in the Top 100, accounting for more than half of the total value of arms sales in 2021 (see table 5.7).

Arms sales by US companies in the Top 100 decreased by 0.9 per cent in 2021, but the USA continued to dominate the ranking with 40 companies and total arms sales of $299 billion. Twenty-five of these companies recorded a year-on-year decline in arms sales in 2021.

The world's five largest arms companies in 2021 were all based in the USA, continuing a pattern that dates back to 2018. Despite a decrease in its arms

[1] Unless otherwise stated, all financial figures—including arms sales figures—in this section are presented in nominal (current) 2021 US dollars, while percentage changes and shares are in constant 2021 US dollars (i.e. in real terms). For further detail on the SIPRI Top 100 see the SIPRI Arms Industry Database, Dec. 2022. For a full list of the Top 100 for 2021 as analysed here see Béraud-Sudreau, L. et al., 'The SIPRI Top 100 Arms-producing and Military Services Companies, 2021', SIPRI Fact Sheet, Dec. 2022.

[2] This change of 1.9% refers to the arms sales in 2020 and 2021 of the 100 companies in the Top 100 for 2021. The change of 0.8% in table 8.5 compares the arms sales of the Top 100 for 2021 with the arms sales of the slightly different set of companies in the Top 100 for 2020.

[3] For further details see SIPRI Arms Industry Database, 'Sources and methods'.

Table 5.6. Trends in arms sales of companies in the SIPRI Top 100, 2012–21

Change is the difference (in %) between the total arms sales of the Top 100 of each year and the different set of companies in the Top 100 for the previous year.

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Arms sales in current prices and exchange rates										
Total ($b.)	405	406	398	446	460	477	505	539	557	592
Change (%)		*0.3*	*–2.1*	..	*3.2*	*3.6*	*5.8*	*6.8*	*3.3*	*6.3*
Arms sales in constant (2021) prices and exchange rates										
Total ($b.)	439	429	415	497	518	522	538	575	588	592
Change (%)		*–2.2*	*–3.3*	..	*4.4*	*0.8*	*3.0*	*6.8*	*2.2*	*0.8*

|| = series break.

Note: There is a series break between 2014 and 2015, when Chinese companies were first included in the data set.

Source: SIPRI Arms Industry Database, Dec. 2022.

sales of 0.6 per cent in 2021, Lockheed Martin again topped the ranking with $60.3 billion in arms sales. Raytheon Technologies (ranked 2nd) was the only company in the top five that recorded an increase in arms sales, of 9.1 per cent compared with 2020. The decreases in arms sales reported by Lockheed Martin, Boeing (ranked 3rd) and General Dynamics (ranked 5th) were mainly attributable to inflation, as their arms sales increased in nominal terms between 2020 and 2021.

A continuation of mergers and acquisitions in the US arms industry in 2021 led to the entry of new companies into the Top 100.[4] For example, Peraton (ranked 21st) acquired the information technology (IT) and mission-support services business of Northrop Grumman (ranked 4th) in February 2021 and then in May 2021 it bought Perspecta, another military-related IT services company. In early 2020 Amentum was spun-off from AECOM's management services business, which provided a wide array of services such as consulting, logistics, IT and training to both civilian and military customers. Amentum then bought DynCorp International—an aerospace company—in November 2020. In 2021 Amentum's arms sales reached $5.0 billion and it entered the Top 100 at rank 25.

There will probably be fewer large-scale mergers among the largest US firms in the coming years as a result of an effort by the administration of US President Joe Biden to reduce 'extreme consolidation' within the arms industry.[5] The Biden administration sees the mergers, which reduce competition and leave the USA overly reliant on a small group of suppliers,

[4] Marksteiner, A. et al., 'Arms-producing and military services companies, 2020', *SIPRI Yearbook 2022*, pp. 287–96.

[5] White House, 'Department of Defense releases new report on safeguarding our national security by promoting competition in the defense industrial base', Fact sheet, 15 Feb. 2022. See also US Department of Defense (DOD), Office of the Under Secretary of Defense for Acquisition and Sustainment, *State of Competition within the Defense Industrial Base* (DOD: Washington, DC, Feb. 2022).

Table 5.7. Regional and national shares of arms sales for companies in the SIPRI Top 100, 2020–21

Arms sales figures are in constant (2021) US$ and changes between 2020 and 2021 are in real terms, based on constant (2021) US$. Figures for 2020 refer to the companies in the Top 100 for 2021, not the slightly different set of companies in the Top 100 for 2020. Figures may not add up to the given totals because of the conventions of rounding.

No. of companies	Region/ Country[a]	Arms sales ($m.) 2021	Arms sales ($m.) 2020	Change in arms sales, 2020–21 (%)	Share of Top 100 sales, 2021 (%)
41	*North America*	300 460	302 783	*–0.8*	*51*
40	United States	299 180	301 780	*–0.9*	*51*
1	Canada	1 280	1 003	*28*	*0.2*
27	*Europe*	123 290	118 270	*4.2*	*21*
8	United Kingdom	40 430	41 563	*–2.7*	*6.8*
5	France	28 750	24 908	*15*	*4.9*
4	Germany	9 320	8 826	*5.6*	*1.6*
3	Trans-European[b]	18 840	19 805	*–4.9*	*3.2*
2	Italy	16 850	14 615	*15*	*2.8*
1	Sweden	4 090	3 726	*9.8*	*0.7*
1	Poland	1 430	1 445	*–1.0*	*0.2*
1	Ukraine	1 330	1 447	*–8.1*	*0.2*
1	Norway	1 170	1 013	*15*	*0.2*
1	Spain	1 080	924	*17*	*0.2*
21	*Asia and Oceania*	135 550	128 146	*5.8*	*23*
8	China	109 140	102 634	*6.3*	*18*
4	Japan	9 030	9 161	*–1.4*	*1.5*
4	South Korea	7 180	6 932	*3.6*	*1.2*
2	India	5 130	4 612	*11*	*0.9*
1	Singapore	2 160	1 966	*9.8*	*0.4*
1	Taiwan	1 970	1 811	*8.8*	*0.3*
1	Australia	940	1 029	*–8.6*	*0.2*
6	*Russia*	17 770	17 701	*0.4*	*3.0*
5	*Middle East*	14 990	14 073	*6.5*	*2.5*
3	Israel	11 630	11 294	*3.0*	*2.0*
2	Türkiye	3 360	2 779	*21*	*0.6*
100	**Total**	**592 060**	**580 973**	***1.9***	***100***

[a] Figures for a country or region refer to the arms sales of the Top 100 companies headquartered in that country or region, including those by subsidiaries in another country or region. They do not reflect the sales of arms actually produced in that country or region.

[b] The 3 companies classified as 'trans-European' are Airbus, MBDA and KNDS.

Source: SIPRI Arms Industry Database, Dec. 2022.

as a threat to national security. These mergers could also have knock-on effects on procurement costs and product innovation.[6] This policy is only the latest attempt by a US administration to either encourage or discourage

[6] Lopez, C. T., 'DOD report: Consolidation of defense industrial base poses risks to national security', US Department of Defense, 16 Feb. 2022.

consolidation in the US arms industry, with policy shifts dating back at least to the 'last supper' speech in 1993.[7]

Another important development in the US arms industry is the increasingly visible trend for acquisitions of larger arms companies by private equity firms since 2019–20. In addition to the formation of Peraton and Amentum, other notable private equity acquisitions include Advent International's purchase of two British arms-producing companies, Cobham in January 2020 and Ultra Electronics in July 2022, and the purchase in May 2021 of Cubic Corporation by Veritas Capital and Evergreen Coast Capital. Such acquisitions reduce transparency in financial reporting since US private equity firms are not required to report financial results to the public.[8] This makes it increasingly difficult to establish an accurate picture of the size of the arms industry. The growing trend for private equity acquisitions is likely to continue due to the historically strong financial performance of the arms industry and the expected higher demand for arms in the context of heightening geopolitical tensions.

Asia and Oceania: Pursuit of self-reliance

The combined arms sales of the 21 companies in Asia and Oceania included in the Top 100 amounted to $136 billion in 2021—an increase of 5.8 per cent compared with 2020.

Amid rising geopolitical tensions and perceived threats in the region, many governments in Asia and Oceania have implemented policies to support the development of domestic arms-industrial capabilities with the aim of enhancing self-reliance in arm production.[9] There are wide disparities within the region in progress towards this goal.[10] There is generally more self-reliance in arms production in East Asia than in South East Asia and South Asia.

China leads the region in terms of the size of its arms companies. It is the only country in the region that has companies that can produce complex weapon systems in all sectors. Arms companies in Australia, India, Japan, the Republic of Korea (South Korea), Singapore and Taiwan have developed advanced production in niche areas and are also represented in the Top 100. While other countries in Asia and Oceania, such as Indonesia, Malaysia, Pakistan, Thailand and Viet Nam, have domestic arms industries, they

[7] See e.g. Dunne, J. P. and Surry, E., 'Arms production', *SIPRI Yearbook 2006*, pp. 399–401; and Jackson, S. T., 'Key developments in the main arms-producing countries', *SIPRI Yearbook 2012*, p. 223.

[8] US Securities and Exchange Commission, 'Private fund', 6 Jan. 2023.

[9] On South East Asia see Bitzinger, R. A., 'Revisiting armaments production in Southeast Asia: New dreams, same challenges', *Contemporary Southeast Asia*, vol. 35, no. 3 (Dec. 2013). On China, India, South Korea and Taiwan see Bitzinger, R. A., *Arming Asia: Technonationalism and its Impact on Local Defense Industries* (Routledge: Abingdon, 2017).

[10] Béraud-Sudreau, L. et al., *Arms-production Capabilities in the Indo-Pacific Region: Measuring Self-reliance* (SIPRI: Stockholm, Oct. 2022), p. 54.

remain limited and are still concentrated in low-technology production and the maintenance, repair and overhaul of foreign systems.[11] None of these countries is represented in the Top 100.

Eight Chinese arms companies appear in the Top 100 for 2021. Their aggregated arms sales reached $109 billion, 6.3 per cent more than in 2020. The growth in arms sales reflects the scale of China's modernization of its military equipment and its objective to become self-reliant in the production of all categories of major arms.[12] Seven of the eight Chinese companies increased their arms sales in 2021. China North Industries Group Corporation (NORINCO, ranked 7th), a land systems specialist, is the largest Chinese arms company. Its arms sales rose by 11 per cent to $21.6 billion in 2021.

There have been signs of consolidation in China's arms industry since the mid 2010s. This marks a reversal of previous structural reforms that aimed to improve productivity and competitiveness by breaking up sector monopolies.[13] In 2021 the two largest shipbuilders in China, China Shipbuilding Industry Corporation (CSIC) and China State Shipbuilding Corporation (CSSC), finalized a merger to form a new entity operating under the name CSSC (ranked 14th). With arms sales of $11.1 billion, CSSC was the largest military shipbuilder in the world in 2021.

The total arms sales of the four companies in the Top 100 based in Japan fell by 1.4 per cent in 2021 to $9.0 billion.[14] Arms sales of Mitsubishi Heavy Industries (ranked 35th), Japan's biggest arms producer, dropped by 5.3 per cent. In contrast, Fujitsu (ranked 77th) recorded strong growth, with an increase in arms sales of 10 per cent in 2021.

At $7.2 billion, the total arms sales of the four South Korean firms in the Top 100 were 3.6 per cent higher in 2021 than in 2020.[15] The growth was largely driven by Hanwha Aerospace (ranked 50th), which saw its arms sales rise by 7.6 per cent to $2.6 billion. Hanwha's arms sales are expected to rise significantly in the coming years, after it signed a major arms deal with Poland in 2022, following the Russian invasion of Ukraine.[16]

The arms sales of the two Indian companies in the Top 100 totalled $5.1 billion in 2021, 11 per cent more than in 2020. The arms sales of Hindustan Aeronautics (ranked 42nd) increased by 6.7 per cent and those of Bharat

[11] Béraud-Sudreau et al. (note 10).

[12] Cheung, T. M., *Fortifying China: The Struggle to Build a Modern Defense Economy* (Cornell University Press: Ithaca, NY, 2009), p. 183; and Cheung, T. M., *Innovate to Dominate: The Rise of the Chinese Techno-security State* (Cornell University Press: Ithaca, NY, 2022).

[13] Tian, N. and Su, F., 'Estimating the arms sales of Chinese companies', SIPRI Insights on Peace and Security no. 2020/2, Jan. 2020.

[14] Data on Japanese companies were provided by the Mitsubishi Research Institute.

[15] Data on South Korean companies were provided by the Korea Institute for Industrial Economics and Trade (KIET).

[16] Reuters, 'South Korea and Poland ink $5.8bn contract for tanks, howitzers', Nikkei Asia, 28 Aug. 2022.

Electronics (ranked 63rd) by 20 per cent. Both companies have benefited from major orders placed by the Indian armed forces in recent years. At the same time, the Indian government has lingering concerns over the productivity of Indian arms companies, their dependence on the domestic market and their reliance on foreign resources.[17] Against this background, Indian companies have started to diversify their business into the civilian market and to set up export offices overseas.[18]

For the first time, a Taiwanese firm appears in the Top 100 for 2021: the National Chung-Shan Institute of Science and Technology (NCSIST). NCSIST, which specializes in missiles and military electronics, recorded arms sales of $2.0 billion in 2021, ranking it 60th. The growth of Taiwan's arms industry can be attributed to its specific geopolitical circumstances and limited access to foreign military equipment.[19]

Europe (other than Russia)

In 2021 Europe (excluding Russia) accounted for 27 of the Top 100 arms companies. Their combined arms sales reached $123 billion, up by 4.2 per cent compared with 2020.

With eight firms in the 2021 ranking, the United Kingdom remained the European country hosting the highest number of Top 100 companies. Six of the eight firms recorded decreases in their arms sales in 2021. The arms sales of the biggest, BAE Systems (ranked 6th), fell by 1.0 per cent to $26.0 billion in 2021.

In contrast, all five companies based in France recorded growth in their arms sales in 2021, reaching a total of $28.8 billion in 2021. Arms sales by Dassault Aviation Group (ranked 19th) rose by 59 per cent and reached $6.3 billion. This was driven by deliveries of 25 Rafale combat aircraft to India and Qatar. Significant increases in arms sales were also recorded for Safran (ranked 24) and Naval Group (ranked 29th). While Rheinmetall (ranked 31st) remained the largest arms company in Germany, its arms sales fell by 1.7 per cent in 2021. In Italy, Leonardo (ranked 12th) increased its arms sales by 18 per cent to $13.9 billion, while Fincantieri (ranked 46th) reported year-on-year growth of 5.9 per cent to reach $3.0 billion.

Among the three trans-European companies, Airbus (ranked 15th) recorded the highest arms sales, $10.9 billion in 2021. This was 15 per cent lower than in 2021, which the firm attributed to lower sales in its military aircraft segment. Arms deliveries by MBDA (ranked 27th) increased significantly, by 15 per

[17] Indian Department of Defence Production, 'Defence Production Policy 2018', 23 Aug. 2018, p. 4. See also Indian Department of Defence Production, 'Strategy for defence exports'.

[18] E.g. Hindustan Aeronautics Ltd (HAL), *58th Annual Report 2020–21* (HAL: Bengaluru, Oct. 2021), p. 76; and Indian Ministry of Defence (MOD), *Annual Report Year 2018–2019* (MOD: New Delhi, [2019]), p. 59.

[19] Béraud-Sudreau et al. (note 10), pp. 34–36.

cent to $5.0 billion in 2021, as it began the process of catching up on deliveries that had been delayed by the effects of the pandemic. Having merged in 2015, Nexter of France and Krauss-Maffei Wegmann (KMW) of Germany furthered their integration in 2020 and were thus replaced in the Top 100 by KMW+Nexter Defense Systems (KNDS), which ranked 44 in 2021.[20]

The growth in the total arms sales of the European arms industry is likely to continue in 2022 as the demand for arms grows in Europe due to Russia's invasion of Ukraine. To meet this demand and in response to ongoing supply chain challenges and depleting stockpiles (due to military aid to Ukraine), in 2022 the European Union (EU) strengthened existing initiatives and established new ones to boost the arms industry. In February 2022 the European Commission proposed the European Chips Act, which included more than €43 billion ($45 billion) in investment to address semiconductor shortages exacerbated by the Covid-19 pandemic and to increase the EU's share of global production of semiconductors.[21] In an effort to address the fragmentation of the EU arms industry, in May the Commission allocated additional financial incentives to the European Defence Fund (EDF) to support closer cooperation between EU member states and between their national arms industries.[22] In the same month the Commission published a plan aimed at bolstering the EU arms industry through joint procurement to meet the demand arising from the war in Ukraine.[23] In December the European Council agreed a general approach to the proposed European Defence Industry Reinforcement through Common Procurement Act (EDIRPA) for consideration by the European Parliament.[24] EDIRPA is intended to further incentivize joint arms procurement and arms-industrial cooperation within the EU.[25]

Several leading EU arms companies in the Top 100, such as Thales (ranked 6th), Leonardo and Airbus, are expected to benefit from these financial instruments. For example, Thales participated in 41 of the 60 EDF-funded projects in 2021 and Leonardo in 23.[26]

[20] French Ministry of Armed Forces, 'Communiqué: Évolution de la gouvernance et poursuite de l'intégration de KNDS, champion européen de l'armement terrestre' [Communiqué: Development of governance and further integration of KNDS, European land armament champion], Press release, 14 Dec. 2020.

[21] European Commission, 'European Chips Act', 8 Feb. 2022.

[22] European Commission, 'European Defence Fund: €1 billion to boost the EU's defence capabilities and new tools for defence innovation', Press release, 25 May 2022.

[23] European Commission, High Representative of the Union for Foreign Affairs and Security Policy, 'Defence investment gaps and measures to address them', Joint Communication to the European Parliament, the European Council and others, JOIN(2022) 24 final, 23 May 2022.

[24] Council of the EU, 'EU defence industry: Council reaches general approach on boosting common procurement', Press release, 1 Dec. 2022.

[25] European Commission, 'Defence industry: EU to reinforce the European defence industry through common procurement with a €500 million instrument', Press release, 19 July 2022.

[26] Foundation for Strategic Research (FRS), 'European Defence Fund (EDF)—Results of the 2021 EDF calls for proposals: A first review', 3 Oct. 2022.

Russia

Six Russian companies appear in the SIPRI Top 100 for 2021. This is three fewer than in 2020 because no data is available for Almaz-Antey, KRET and Russian Electronics. The combined arms sales of the six companies that are included reached $17.8 billion in 2021, which was 0.4 per cent higher than in 2020.

Three of the Russian companies—United Aircraft Corporation (UAC), United Engine Corporation (UEC) and Russian Helicopters—recorded decreases in their arms sales, while the other three—United Shipbuilding Corporation (USC), Tactical Missiles Corporation and UralVagonZavod—recorded increases. The 18 per cent increase registered by Tactical Missiles Corporation (ranked 37th) can be partly attributed to growth in its foreign sales, most likely to India.[27] The estimated arms sales of UAC (ranked 30th) fell to $4.5 billion in 2021, and arms sales as a proportion of its total sales decreased from 82 per cent in 2020 to 70 per cent in 2021. The change most likely stems from the Russian government's 2016 instruction to the arms industry to increase civilian production.[28]

Four of the Russian companies in the Top 100 for 2021—UAC, UEC, Russian Helicopters and UralVagonZavod—belong to the Rostec holding group, which owns numerous Russian arms companies. SIPRI's ranking excludes holding entities with no direct operational activities and therefore does not include Rostec. However, it is worth noting that Rostec's arms sales decreased by 13 per cent between 2020 and 2021 to $15.5 billion.

The Middle East

Taken together, the five companies in the Top 100 based in the Middle East generated $15.0 billion in arms sales in 2021. This was a 6.5 per cent increase compared with 2020 and the highest rate of growth of all regions represented in the Top 100. All five increased their arms sales in 2021. Turkish Aerospace (ranked 84th) recorded the largest increase, at 62 per cent, and Israel Aerospace Industries (IAI, ranked 38th) the lowest, at 1.9 per cent. Most of the five Middle Eastern firms display a relatively high level of specialization in military products: on average, arms sales accounted for 91 per cent of their total sales in 2021.

Edge, a conglomerate based in the United Arab Emirates (UAE) that was among the top 25 arms companies in 2020, has not disclosed any arms sales figures for 2021 and therefore could not be included in the 2021 ranking. However, Edge reported $5.0 billion of orders in 2022, which indicates that

[27] 'Tactical Missiles Corporation's export to be over $1 bln in 2021—CEO', TASS, 21 July 2021; and 'Tactical Missiles Corporation to make over 40 aftersales service contracts by 2025', TASS, 14 Feb. 2023.

[28] President of Russia, [Meeting on diversification of civilian production by defence industry organizations], 24 Jan. 2018 (in Russian).

it would almost certainly be in the Top 100 if figures for its arms sales were available.[29]

The aggregated arms sales of the three Israeli companies in the Top 100 were $11.6 billion in 2021, which was 3.0 per cent higher than in 2020. Elbit Systems (ranked 28th) increased its arms sales by 3.6 per cent to $4.8 billion in 2021. Israeli arms companies have taken advantage of the normalization of diplomatic relations with the UAE following the 2020 Abraham Accords.[30] For example, in 2021 Elbit established a subsidiary in the UAE, and IAI and Edge agreed to cooperate in the design of uncrewed weapon systems.[31]

The two Turkish companies in the Top 100 in 2021—Aselsan and Turkish Aerospace—had combined arms sales of $3.4 billion. Aselsan (ranked 56th) recorded a 6.0 per cent increase in its arms sales to reach $2.2 billion. The substantial year-on-year growth by Turkish Aerospace was partly due to the delivery of several Anka-S uncrewed aerial vehicles (UAVs) to the Turkish armed forces. It meant that the company re-entered the ranking in 2021 having been outside the Top 100 in 2020.

Notable developments outside the Top 100

The ongoing growth of arms sales of the Top 100 also means that even companies outside the ranking can be substantial in size and can have profound impact on international and regional security. For example, Brazil, Saudi Arabia and Türkiye all have notable arms companies with significant arms sales that do not rank in the Top 100. These companies are helping their respective states develop indigenous arms-production capabilities through developing niche weapon systems and partnering with leading international firms.

Despite not being in the Top 100, the UAV specialist Baykar is Türkiye's top arms exporter.[32] It recorded arms sales of $789 million in 2021. Its Bayraktar TB2 armed UAV has been used extensively by Ukraine during the war there and Baykar is in the process of building a production facility in Ukraine.[33] Baykar's UAVs have also been deployed in other conflicts, including Türkiye's military operations in Syria, the 2020 Nagorno-Karabakh conflict and the

[29] Edge, 'UAE's Edge marks three year anniversary as major global force in advanced technology and defence', Press release, 29 Nov. 2022.

[30] Davis, I., 'The Israeli–Palestinian conflict and peace process', *SIPRI Yearbook 2021*, pp. 162–64.

[31] Elbit Systems, 'Elbit Systems establishes a company in the United Arab Emirates', Press release, 14 Nov. 2021; and Naval News, 'UAE's Edge and Israel's IAI team up for USV development', 20 Nov. 2021.

[32] 'Baykar becomes top exporter in Turkey's defense, aerospace sector', *Daily Sabah*, 15 June 2022.

[33] Sezer, C., 'Turkey's Baykar to complete plant in Ukraine in two years—CEO', Reuters, 28 Oct. 2022.

armed conflict in Tigray.[34] Another Turkish company, Roketsan, produces munitions for the Bayraktar TB2 UAVs. It reported an almost 50 per cent increase in its arms sales in 2021.[35] However, Roketsan could not be included in the final ranking due to a lack of verifiable data.

Embraer is Brazil's largest arms company, with arms sales of $590 million in 2021. It is developing military aircraft in collaboration with foreign companies such as L3Harris (ranked 13th) of the USA and BAE Systems of the UK.[36] In the maritime sector, Embraer works with Germany's Thyssenkrupp (ranked 55th) to deliver frigates for the Brazilian Navy, while Itaguaí Construções Navais (ICN) leads the construction of submarines with technology transfer from France's Naval Group.[37]

Saudi Arabian Military Industries (SAMI) is a state-owned arms company. Its arms sales increased 25-fold between 2020 and 2021 to reach $624 million due to the acquisition in late 2020 of another Saudi Arabian company, Advanced Electronics Company (AEC). It has established joint programmes with many US and European companies, including Lockheed Martin, Boeing and Thales.[38]

Supply chain disruptions, the war in Ukraine and demand for arms

Many arms companies in the SIPRI Top 100 rely on extensive and complex supply chains to function efficiently. For example, Airbus (ranked 15th) and Leonardo (ranked 12th) both rely on vast global supply chains involving, respectively, 21 000 and 11 000 companies.[39] Many thus faced a high risk of disruption from the public health measures implemented worldwide from 2020 to curb the spread of Covid-19. The ripple effects of the pandemic included disruption to international shipping, labour shortages and a lack of semiconductors—a key component of major weapon systems.

The significant regional disparities in the Top 100 in 2021 reflected the impact of the pandemic-related disruptions. Collectively, the arms sales

[34] Fazil, S., 'Armed conflict and peace processes in Iraq, Syria and Turkey', *SIPRI Yearbook 2022*, pp. 168–74; Davis, I., 'The interstate armed conflict between Armenia and Azerbaijan', *SIPRI Yearbook 2021*, pp. 127–32; and Davis, I., 'Armed conflict and peace processes in East Africa', *SIPRI Yearbook 2022*, pp. 225–29.

[35] Istanbul Chamber of Commerce, 'Roketsan Roket San. ve Tic. A.Ş.: İSO 500—2021 yili sonuçlari' [Roketsan Rocket Industries and Trade plc: İSO 500—Results for 2021], Istanbul Chamber of Industry (İSO), 2022.

[36] 'Planemaker Embraer, BAE agree on defense partnership; Eve gets order', Reuters, 19 July 2022.

[37] Naval Group, 'Key milestones for the Brazilian submarine program celebrated in Itaguaí', Press release, 11 Dec. 2020.

[38] Saudi Arabian Military Industries (SAMI), 'SAMI Composites LLC signs agreement with Lockheed Martin to develop composites manufacturing center of excellence in Riyadh', 19 July 2022; Saudi Arabian Military Industries (SAMI), 'SAMI announces joint venture agreement with Boeing', 6 Apr. 2022; and Thales, 'Thales in the Kingdom of Saudi Arabia'.

[39] Leonardo, *Annual Report 2021* (Leonardo: Rome, Jan. 2022), p. 132; and Airbus, *Universal Registration Document 2021* (Airbus: Leiden, Apr. 2022), p. 95.

of North American companies fell by 0.8 per cent, largely due to supply chain problems and inflation. Similarly, most of the European companies that specialize in military aerospace reported losses for 2021, which they attributed to supply chain disruption.[40] However, this was offset by strong growth in other regions, particularly in Asia and Oceania, where arms sales rose by 5.8 per cent in 2021.

Russia's invasion of Ukraine in February 2022 added to supply chain problems for arms producers, as Russia is an exporter of raw materials such as aluminium, copper, steel and titanium that are used in the manufacturing of military equipment.[41] With the implementation of Western sanctions on Russia, including the ban by the EU on imports of Russian steel products, and the broader severing of Western countries' economic ties with Russia, European and North American arms companies have had to reorganize their supply chains to procure raw materials from other producers.[42]

At the same time, war in Ukraine has prompted a surge in the demand for arms in Europe and the USA. Following Russia's invasion in February 2022, Western countries supplied Ukraine with large quantities of military equipment from the existing stocks of their armed forces and financial assistance. However, as the war continued, stockpiles diminished.[43] The Ukraine Defense Contact Group (also known as the Ramstein group) is a USA-led group of more than 50 countries and international organizations that have pledged to assist Ukraine. It has been coordinating efforts to boost arms production and replenish stockpiles.[44] For example, as of January 2023 the US government had awarded several contracts to arms companies to replenish the USA's stockpiles.[45] These included a $624 million order with Raytheon Technologies for Stinger missiles; a $663 million order for Javelin anti-tank missiles placed with a joint venture partnership between Lockheed Martin and Raytheon Technologies; and a $624 million order with Lockheed Martin for HIMARS light multiple rocket launchers.

However, increasing arms-production output takes time, especially in the face of supply chain disruptions, and it could be several years before

[40] BAE Systems, *Annual Report 2021* (BAE Systems plc: London, 2022), p. 25; Muravska, J. et al., 'Challenges and barriers that limit the productivity and competitiveness of UK defence supply chains', RAND Corp., July 2021; Melrose Industries, *Annual Report 2021* (Melrose Industries plc: Birmingham, 31 Mar. 2022), p. 14; Meggit, *Enabling the Extraordinary: To Fly To Power To Live—Annual Report and Accounts 2021* (Meggit plc: Coventry, 2 Mar. 2022), pp. 6, 9; and Carey, N., 'Analysis: Supply chain snags threaten to slow air industry take-off', Reuters, 21 July 2022.

[41] Pavel, C. C. and Tzimas, E., *Raw Materials in the European Defence Industry* (European Commission, Joint Research Centre: Petten, 2016).

[42] Calhoun, D. L., President and chief executive officer, '2022 address to shareholders', Boeing, 29 Apr. 2022.

[43] Pietralunga, C., 'War in Ukraine is putting Western arms stocks under pressure', *Le Monde*, 23 Nov. 2022.

[44] Garamone, J., 'Momentum builds for Ukraine Defense Contact Group', US Department of Defense, 8 Sep. 2022.

[45] US Department of Defense, 'Ukraine contracting action', 13 Jan. 2023.

arms companies are able to adjust to the new demand created by the war in Ukraine. For example, the joint venture to produce Javelin missiles plans to increase its annual output from 2100 missiles to nearly 4000. However, almost doubling the pace of production could take two years to implement.[46]

Artillery rounds for 155-millimetre howitzers are also among Ukraine's key requirements. By the end of 2022 the USA had supplied over 1 million standard and 4700 precision-guided 155-mm artillery rounds to Ukraine.[47] In September 2022 the pace of production was 14 400 rounds per month; at this rate, it would take more than five years to replenish US stocks to previous levels. The US Department of Defense (DOD) has put plans in place with manufacturers to increase the pace of production to 36 000 rounds per month, which will take three years to implement.[48]

Arms producers in Europe are also anticipating a substantial increase in demand for military equipment because of the war. For example, orders for Rheinmetall's defence division more than doubled between 2021 and 2022 as the result of the need to replenish stockpiles of armoured vehicles sent to Ukraine and of Germany's plans to increase military expenditure (see section II).[49] Similarly, the intake of orders by Swedish arms producer Saab surged in 2022 and the company anticipated further growth based on a projected rise in global military spending.[50]

The need to support Russia's war effort in Ukraine has created growing production pressure for Russian arms companies. Western sanctions have also affected the operations and supply chains of Russian companies. Almaz-Antey, for example, stated in March 2022 that it could not receive payments for some of its arms export deliveries.[51] Some Russian companies are also reported to be facing production difficulties due to reduced access to imported components such as semiconductors.[52]

The war in Ukraine and other violent conflicts, accompanied by rising geopolitical tensions, have thus resulted in surging demand for arms production. At the same time, the supply chain challenges exacerbated by these conflicts and tensions might pose significant hurdles to the industry in meeting this demand. These two major forces could characterize development of the global arms industry in the coming years.

[46] Taiclet, J., CEO of Lockheed Martin, Transcript, *Face the Nation*, CBS News, 8 May 2022.

[47] US Department of State, 'US security cooperation with Ukraine', 21 Dec. 2022.

[48] LaPlante, W. A., Under secretary of defense for acquisition and sustainment, and Baker, S. N., Deputy under secretary of defense for policy, Press briefing, US Department of Defense, 9 Sep. 2022.

[49] Rheinmetall, 'Interim report after nine months of 2022', Press release, 10 Nov. 2022.

[50] Saab, *Interim Report Q3* (Saab AB: Stockholm, Oct. 2022), p. 2.

[51] ['Almaz-Antey' reports $1 billion pending for export deliveries], *Kommersant*, 22 Mar. 2022 (in Russian).

[52] US Department of State, 'The impact of sanctions and export controls on the Russian Federation', Fact sheet, 20 Oct. 2022.