

WAR MACHINE

THE NETWORKS

SUPPLYING & SUSTAINING

RUSSIA'S

PRECISION
MACHINE TOOL
ARSENAL



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EXECUTIVE SUMMARY

Degrading Russia’s ability to wage war is critical to the survival of Ukrainian democracy. Among the Russian defense industry’s greatest vulnerabilities is its reliance on foreign technologies. Few technologies embody this vulnerability better than computer numeric control (CNC) machine tools—devices that employ computer technology to automate the manufacture of critical defense equipment like precision-guided munitions and aircraft parts.

The Russian defense industry has historically sourced foreign-produced CNC machine tools (FPCMTs) from jurisdictions whose governments now support Kyiv, either vocally or through the enforcement of trade restrictions against Russia like sanctions and export controls. This made it possible on paper for Ukraine’s allies to limit Russia’s access to new FPCMTs, and essential components thereof. Yet public reporting suggests that the Russian arms machine remains at full throttle, inviting questions about the efficacy and enforcement of those restrictions practice.

Despite voicing support for Ukraine and agreeing in principle to crack down on

Russia, some jurisdictions have dragged their feet to the point of becoming key points of failure in enforcement regimes. Weakening Russia’s ability to wage war against Ukraine—and potentially other neighbors—requires accounting for Russia’s complex procurement tactics, and closing the enforcement-regime gaps that enable them.

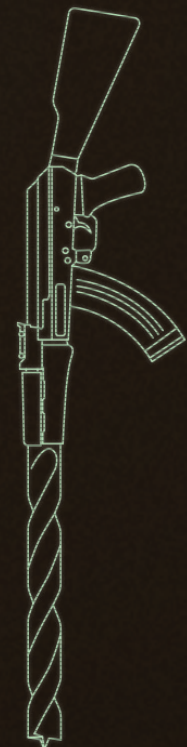
To this end, C4ADS investigated shifts in Russia-oriented FPCMT supply chains after Russia’s reinvasion of Ukraine on February 24, 2022. Key findings include:

- * Despite actions or statements made in support of Ukraine, intermediaries based in “third countries” (jurisdictions that facilitate shipments of goods but are neither the origin nor the destination of those goods)¹ undermine export controls and sanctions. Companies and individuals in these jurisdictions act as brokers, supplying FPCMTs not only to Russian defense industry contractors but also to Russian subsidiaries of foreign machine tool firms that allegedly exited Russia after February 2022. Third-country brokers are uniquely positioned to exploit

supply chain vulnerabilities by supplying Russian customers with previously used FPCMTs from resellers abroad. Key “broker” countries of concern are China and Hong Kong, Turkey, and the United Arab Emirates.

- * Russia appears to practice two key evasion tactics: “subsidiary-oriented evasion,” where Russian subsidiaries of foreign machine tool firms access products made by their parent companies after the latter had allegedly exited the Russian market, and “distributor-oriented evasion,” where Russian machine tool distributors not owned by foreign machine tool manufacturers import FPCMTs and parts, both new and used.
- * Five case studies illustrate these trends. Ten of the companies discussed therein have been sanctioned, the most recent on June 12, 2024, while six remain unsanctioned as of the date of publication. These sums pertain only to the companies involved in procuring FPCMTs and not their likely end-users.

Safeguarding regional security requires policies that frustrate efforts to procure FPCMTs and other dual-use technologies that sustain the Russian defense industry. For these policies to be effective, increased enforcement resources, stiff penalties for noncompliance, and more coordinated cross-jurisdictional collaboration must work in concert. Accordingly, based on our findings, we make a series of public-policy and private-sector recommendations to better curb the trade emanating from third-country brokers.



INTRODUCTION

How can Kyiv’s allies hinder both continued military operations against Ukraine and potential future military operations against Russia’s neighbors? This is perhaps the single most pressing national security question facing Ukraine and its allies today. After two years of large-scale conflict, the Russian war machine has proven more resilient in waging long-term war in Ukraine than many U.S. policymakers anticipated, despite the tremendous amount of damage to its military force, arsenal, and war economy.²

The answer is complex. Since the years of the Soviet Union, Russia has been one of the world’s largest conventional arms producers and has enormous resources to mobilize. However, this defense industrial base is not entirely self-sufficient, and years of corruption and lethargy have further weakened it. In key sectors, the Russian defense industry now relies on foreign goods and services in ways that it cannot easily replicate domestically, which creates distinct vulnerabilities in its wartime supply chains.

Few other items better represent this

vulnerability than Russia’s reliance on foreign-manufactured machine tools. Machine tools—a type of industrial equipment used to process metal and other rigid materials into specific shapes—are an important pillar of modern industrial engineering, lending a degree of precision that would otherwise be impossible to achieve by the human hand alone. Today, defense industries around the world routinely employ machine tools automated by computer numeric control (CNC) technology to manufacture components for military hardware ranging from mortar shells to cruise missiles. Russia lags far behind many of Ukraine’s allies when it comes to producing CNC machine tools and has historically had to source as much as 90% of its machine tools through imports in the mid-2010s.

This dependence on foreign products appears to have only deepened, with Russia evidently prioritizing the import of CNC machine tools and their parts as a core component of its efforts to evade sanctions and export controls. The Russian private sector’s defense and logistics companies have also stepped up to play a vital role in the procurement of foreign-produced CNC machine tools (FPCMTs). Once

an overlooked background feature of many a manufacturing floor, the outsized role of FPCMTs in Russia’s military-industrial complex is now irrefutable. Consequently, constricting Russia’s access to FPCMTs and

their component technologies can limit the Russian military’s ability to rearm its forces in Ukraine as well as sustain potential future military operations.



Sequential excerpts from a promotional video published via Rutube on the page of the Russian arms manufacturer JSC Central Scientific Research Institute, “Burevestnik,” demonstrating the manufacture of fins for a “silent” mortar round using what appears to be a Taiwanese-produced machine tool. The machine tool is likely of Taiwanese origin given the model number visible in image 1, HV415A, which is a proprietary model of Taiwanese Akira Seiki Co., Ltd.³

METHODOLOGY AND SCOPING

This report applies publicly-available information (PAI)—information made accessible to the public either commercially or gratis⁴—to investigate post-February 24, 2022, FPCMT procurement activity, analyzing Russian trade data, corporate records, public procurement records, court filings, news reports, social media, and video streaming platforms. In select cases, we also used leaked Russian tax records to determine whether Russian FPCMT importers of interest transacted business with Russian defense industry entities after February 2022.

We identified investigative leads using two PAI-based targeting techniques:

* The first “active” technique involved reviewing Russian trade data for FPCMT imports made after February 24, 2022⁵ and running the tax identification numbers of recent FPCMT importers against Russian public procurement data to single out, for investigation, those importers with a record of transacting business with Russian defense industry entities.

* The second “passive” technique consisted of reviewing news reports, propaganda materials, and social media for evidence of Russian defense industry actors using FPCMTs to manufacture weapon components. We followed up with trade data and leaked tax records to reconstruct the supply chains through which the FPCMTs of concern reached said actors after February 24, 2022.

This report focuses on Russian imports of CNC machine tools originally made in jurisdictions committed to sanctioning Moscow for its military aggression against Ukraine. Scoped to jurisdictions that have voiced support for Ukraine or whose policy interests align with the intent of current multinational sanctions and export controls on Russia, this report focuses on transfers of FPCMTs originally manufactured in jurisdictions with a demonstrated track record of holding Russia to account. By that same token, even though Russian trade data show that imports of Chinese-manufactured CNC machine tools to Russia surged after February 2022, Russian imports of CNC machine tools made in China are given only cursory attention herein

because of that country’s unwillingness to impose economic penalties on Russia.^{6,7}

C4ADS’ access to trade data is largely restricted to portions of transnational FPCMT supply chains that directly touch Russia. As such, our view of trade networks, writ large, is inherently limited. For example, C4ADS’ analysis identified limited information regarding how FPCMTs arrived in third countries before being reexported to Russia. By definition, PAI can only speak to those instances of Russian FPCMT procurement readily disclosed in official public records. Given that illicit actors

are unlikely to disclose that they are engaged in smuggling or importing counterfeit goods to customs officials, for instance, this report does not address the smuggling of FPCMTs or shipments of counterfeit FPCMTs to Russia.

GLOSSARY OF ENTITIES

ACN: According to trade and corporate records, the Aydın Corporate Network is a group of Turkish companies involved in shipping German-manufactured machine tool-cutting instruments to Russia after February 2022. ACN is named for its owners, Turkish nationals Gürhan Aydın and Recep Çetin Aydın, and includes the following companies:

* **AYT:** AYT CNC Takım Tezgahları Servis

Makina Sanayi ve Ticaret Limited Şirketi.

* Renamed Minyon Kesici Takımlar Makine Sanayi ve Ticaret Limited Şirketi or **Minyon** on September 16, 2022.

* **AYTT:** AYTT CNC Takım Tezgahları Makine Sanayi ve Ticaret Limited Şirketi.

* **Modülsan:** Modülsan Makina Dişli ve Kesici Takımları Sanayi Ticaret Limited Şirketi.

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- * **SSGCTM:** SSGCTM CNC Takım Tezgahları Makine Sanayi ve Ticaret Limited Şirketi.

AEROSCAN: According to news reports, LLC Aeroscan is a U.K.- and U.S.-sanctioned Russian company involved in producing Russian military drones.

AMEGINO: According to trade records, Amegino FZE is a U.S.-sanctioned Emirati company involved in directing shipments of Japanese CNC machine tools from China to Russia.

AMG: According to trade records, LLC Kompaniya AMG is a U.S.-sanctioned Moscow-based CNC machine tool distributor involved in importing Japanese CNC machine tools from China via Amegino.

AVBIS: According to trade records, LLC Avbis is a U.S.-sanctioned Moscow-based company involved in importing German CNC machine tools from Turkey.

DNSOL: DN Solutions Co., Ltd. is a South Korean CNC machine tool manufacturer.

- * **DNSol China:** Based on corporate records, DN Solutions China, Co., Ltd.

is DNSol's Chinese subsidiary.

- * **Doosan MT:** According to news reports, DNSol's name prior to June 2, 2022, was Doosan Machine Tools Co., Ltd.

ELE: According to trade records, ELE Technology Co., Ltd. is a Chinese company involved in shipping Japanese CNC machine tools to AMG at Amegino's direction.

GE FONG: Ge Fong Machinery Co., Ltd. is a Taiwanese CNC machine tool company.

GÜHRING: Gühring KG is a German machine tool-cutting instrument manufacturer with multiple overseas subsidiaries, including:

- * **Gühring TR:** Based on corporate records, Gühring Takım Sanayi ve Ticaret Limited Şirketi is a Turkish company.

GUT: According to procurement records, LLC Tool Company GUT is a Moscow-based defense contractor. Corporate records indicate it is formally owned by German machine tool-cutting instrument manufacturer Gühring.

HERMLE: Maschinenfabrik Berthold

Hermle AG is a German CNC machine tool manufacturer.

IM-RU: According to trade records, LLC I Machine Technology is a U.S.- and Taiwan-sanctioned Moscow-based importer of Taiwanese-origin CNC machine tools.

IM-TW: I Machine Tools Co., Ltd. is a Taiwanese CNC machine tool company that, according to corporate records, is affiliated with IM-RU.

JACBAC: Jacobac Technology Dış Ticaret Limited Şirketi is a U.S.-sanctioned Turkish company that, according to trade records, is involved in shipping German-manufactured CNC machine tools to Russia.

JEIL-M: Jeil Machine, Inc. is a South Korean reseller of previously used CNC machine tools.

MERTEGE: Mertege Makina Sanayi Ve Ticaret Limited Şirketi is a Turkish company that, according to corporate records, is affiliated with Jacobac. Trade records indicate it is involved in importing German CNC machine tools to Turkey.

MICRO DYNAMICS: Micro Dynamics Co., Ltd. is a Taiwanese CNC machine tool company.

MM GLOBAL: MM Global Service, Inc. is a South Korean reseller of previously used CNC machine tools.

SILVERTECH: Silver Technology Limited is a U.S.-sanctioned Hong Kong-based company involved in shipping South Korean CNC machine tools to SFT, including via Jeil-M and MM Global, after February 2022.

SPINNER: SPINNER Werkzeugmaschinenfabrik GmbH, a German CNC machine tool manufacturer.

SFT: LLC SFT is a U.S.-, E.U.-, and Swiss-sanctioned Moscow-based CNC machine tool distributor and Russian defense industry contractor that imported South Korean-origin CNC machine tools from a Hong Kong intermediary after February 2022.

TsST: Based on news reports, LLC TsST is a U.S.-, E.U.-, and Swiss-sanctioned Russian company involved in the production of Russian military drones.

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TSUGAMI : Tsugami Corporation is a Japanese CNC machine tool manufacturer. According to trade data, Amegino directed ELE to ship Tsugami products to AMG after February 2022.

UMAC : LLC Yumak is a U.S.-sanctioned Moscow-based machine tool distributor. Trade data indicates that it was involved in

importing German CNC machine tools from Jacobac after February 2022.

ZIK: Public JSC Kalinin Machine-Building Plant is a Russian surface-to-air missile launch systems manufacturer.

KEY TERMS AND CONCEPTS

Machining Operations and Computer Numeric Control Machine Tools

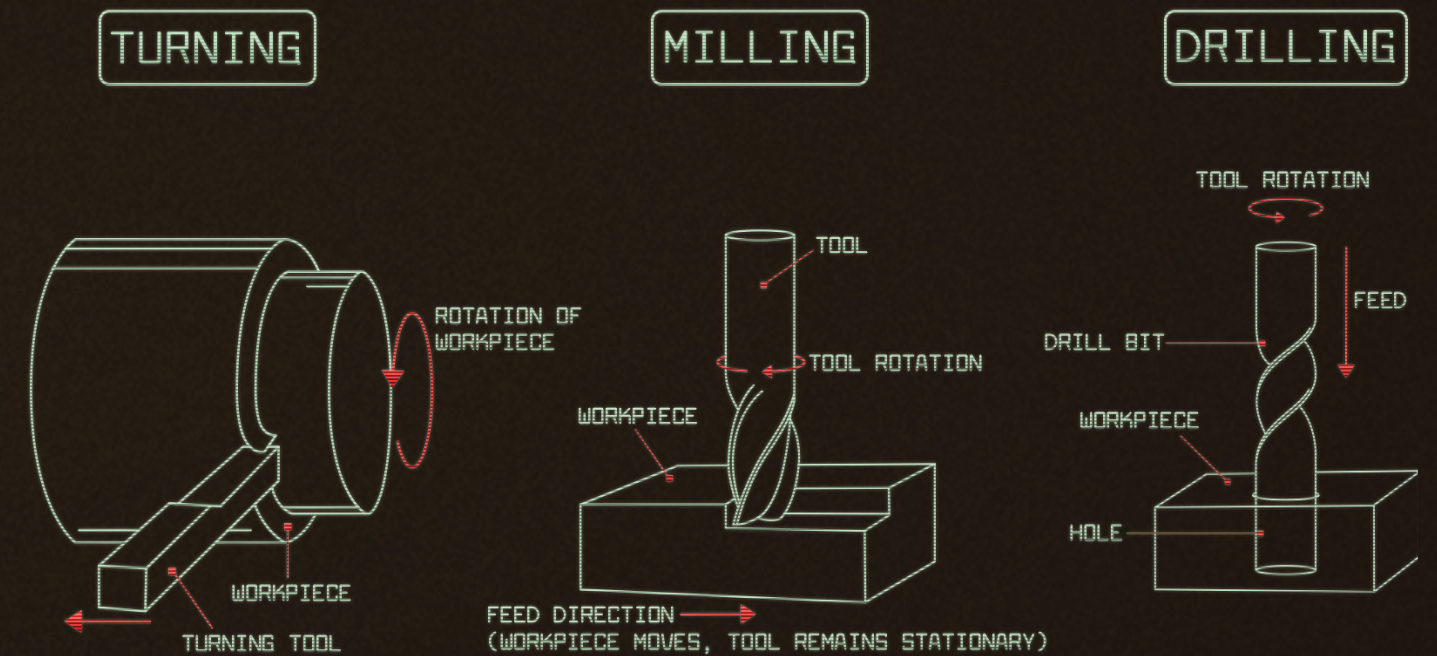
We define the term **machine tool** as a complex mechanical device capable of shaping or **machining** a metallic object or **workpiece** into a desired shape by way of computer numeric control (CNC) technology.⁸ Machine tools can be divided into two categories based on different metalworking processes. **Metal cutting**, or “subtractive” machining, is when a **cutting instrument** made of abrasive or sharpened composite materials or employing

a plasma stream or a laser beam removes metal from an object.⁹ **Metal forming** applies pressure to bend, fold, or shear metal.¹⁰ The present report deals almost exclusively with metal-cutting machine tools, as the demand for such tools in Russia has historically outstripped demand for metal-forming machine tools.¹¹

The most advanced machine tools employ CNC technology that automates different machining operations, the most common of which are turning, milling, and drilling (see diagram below), using programmable computer instructions. CNC machine tools are operated through a machine control unit (MCU) that converts programmed inputs

into electrical signals, which, in turn, drive electric motors and feedback systems that control the relative motion of workpieces and cutting instruments alike according to precise specifications.^{12,13} Machine tools automated by CNC technology can produce complex parts from rigid metal materials with a high degree of control, precision, and efficiency.¹⁴ These

qualities make CNC machine tools a critical technology for modern industrial engineering, including in defense manufacturing.¹⁵ While **turning, milling, or drilling centers** allow the user to perform that specific function, **machining centers** can house multiple machining functions in a single unit.



Three functions of “subtractive” machining, defined as the honing of a workpiece or large piece of material into specific shapes by removing some of that material. Turning removes material from the workpiece by rotating it against a cutting tool, milling is moving a rotating cutting tool against a workpiece, and drilling creates a hole in the workpiece.

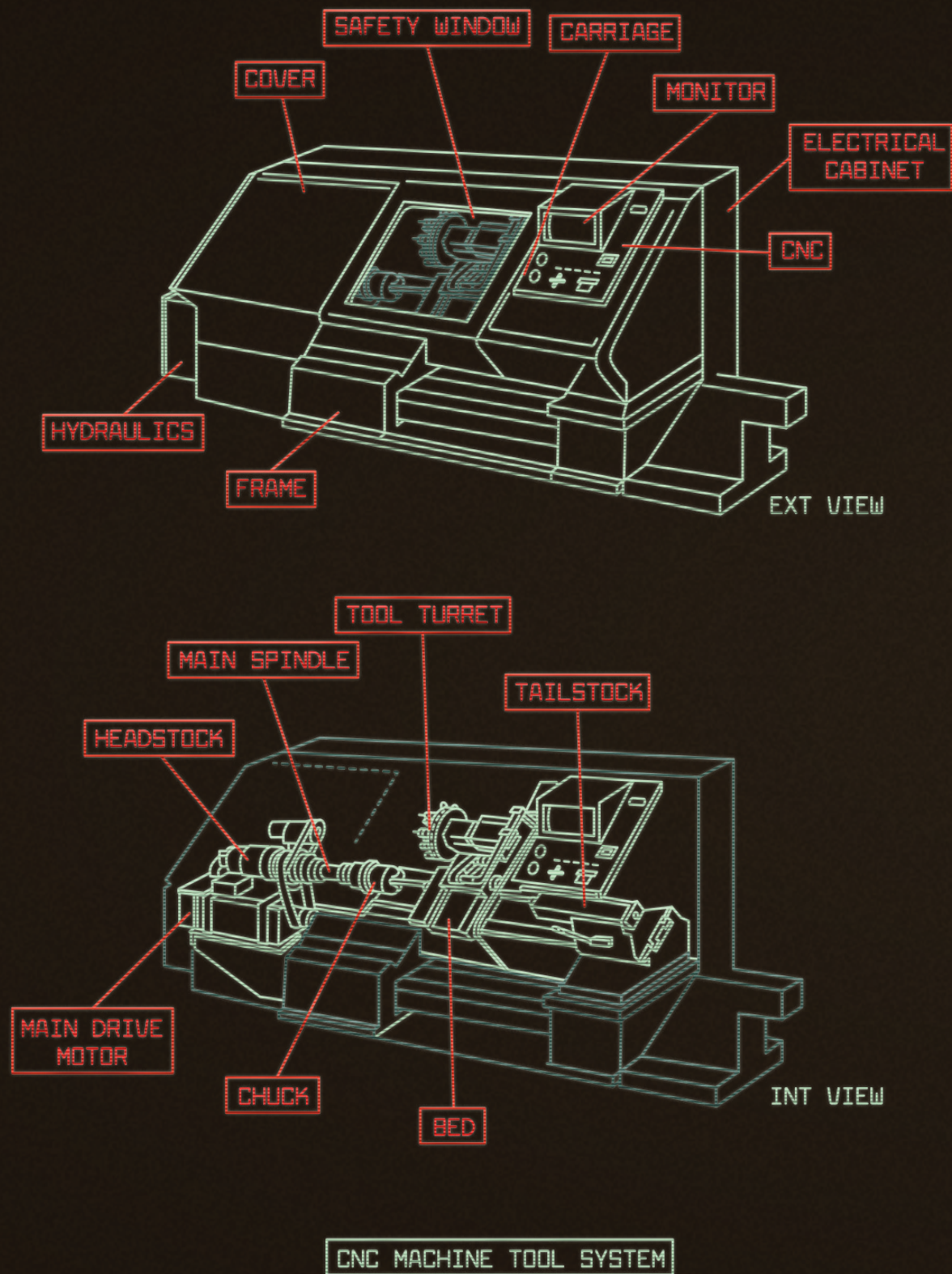


Diagram depicting a machining center. Machining centers house the technology for multiple functions, such as turning and milling.

Dual-Use Goods and Export Controls

CNC machine tools constitute **dual-use goods** in that they have both civilian and defense industrial applications.¹⁶ Trade in dual-use technologies is regulated by **export controls**, which encompass a variety of laws and regulations intended to ensure that strategically valuable technologies are not transferred to potentially hostile foreign end users.¹⁷ Export control regulations generally require shippers to apply for a special permit, known as an **export license**, prior to transferring dual-use technology abroad. Applying for an export license requires shippers to conduct due diligence regarding whether any goods being shipped abroad include dual-use goods and, if so, whether the end user of those goods is a prohibited entity under the origin country's export control regulations.¹⁸

Transshipment or **reexport** happens in cases when cargo is exported to one jurisdiction before being shipped to end users in a different one. While routine practice in international trade, it is sometimes used for obfuscation,

such as in cases of export control evasion. **Export control evasion** occurs when a shipper transfers dual-use goods to a prohibited end user either without an export license or with an export license obtained through the provision of false information regarding the dual-use nature of the goods or the identity of the end user.¹⁹ Export control evasion may be undertaken by commercial actors seeking to profit from new commercial opportunities or at the direction of governments seeking to frustrate economic sanctions.²⁰

Many jurisdictions base their national export control regulations on lists of dual-use goods formulated by multilateral export control regimes such as the **Nuclear Suppliers Group (NSG)** and the **Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies**.²¹ According to Bryan R. Early, professor and associate dean for research at the University at Albany, SUNY, the control lists issued by multilateral control regimes tend to focus on CNC machine tools capable of processing metals, ceramics, and other rigid materials with an exceptionally high degree of precision.^{22,23} However, governments can adopt unilateral

export controls that apply to a broader range of machine tools than the consensus-based lists adopted by the multilateral export control regimes. The Wassenaar Arrangement, for example, controls CNC machine tools based on highly granular technical criteria.²⁴ European Union (E.U.) regulations, by contrast, employ a broader framework that effectively controls the transfer of most, if not all, CNC machine tools to Russia.²⁵

The voluntary nature of membership in multilateral export control regimes makes

their provisions nonbinding.²⁶ While like-minded member governments may agree in principle to enforce the Wassenaar Arrangement's provisions, in practice, those same governments are free to prioritize enforcing the control of certain dual-use goods over others.²⁷ This creates ample opportunity for bad actors to engage in "jurisdictional arbitrage" by exploiting inconsistencies in national export control regulations and enforcement priorities among different jurisdictions.²⁸

THE HISTORY OF THE RUSSIAN MACHINE TOOL INDUSTRY

The roots of Russia's contemporary reliance on foreign machine tools run deep. British, German, and U.S. technology and expertise predominated the machine tool market of the late Russian empire.²⁹ Imports of U.S. and European-manufactured machine tools during the 1930s helped Soviet industry weather World War II, thereby indirectly contributing to the post-war rise of Soviet machine

tool manufacturing.³⁰ Amid trade policies hardened by the Cold War, Soviet advances in the development of CNC technologies during the 1970s and 1980s³¹ likely depended on illicit procurement of FPCMTs and related technologies.³² Meanwhile, Soviet CNC machine tool products remained of such relatively low quality that the Soviet government felt compelled to embrace "large-scale imports" of Western CNC machine tools to aid defense production, according to a May 1983 U.S. Central Intelligence Agency assessment.³³

The 1991 dissolution of the Soviet Union critically hindered the development of Russia's CNC machine tool manufacturing capabilities. Russian machine tool manufacturers previously accustomed to the closed Soviet economic model struggled to adapt to free market reforms that placed them in direct competition with foreign companies who already enjoyed access to easy credit and cutting-edge technologies.^{34,35} By the end of the 1990s, the Russian machine tool industry had all but cratered as domestic manufacturers converted to the production of less sophisticated industrial products or shut down production altogether.³⁶

The national security ramifications of this

RECENT DEVELOPMENTS IN THE RUSSIAN MACHINE TOOL INDUSTRY

Sanctions and export controls expanded since February 2022 have had a mixed effect on Russian governmental efforts to end the country's dependence on FPCMTs and revive

situation were not lost on the Kremlin. Between 2010 and 2014, the Russian government adopted several measures intended to stimulate domestic machine tool production and reduce the Russian defense industry's reliance on FPCMTs.³⁷ These measures appear to have had some success, as Russian statistical data indicates that domestic production of CNC turning centers and machining centers grew from 147 units in 2013 to 1,022 units in 2021. This overall upward trend has continued to the present day, despite a fall in output amid the first year of Russia's "Special Military Operation" against Ukraine in 2022.³⁸

domestic machine tool manufacturing.^{39,40} On the one hand, Russian government officials assert that sanctions against the country's defense industry have stimulated rather than hindered the machine tool sector's development,⁴¹ a claim bolstered by reports of strides made in the production of a variety of new CNC machine tool products based on Russian technology.⁴² Yet knowledgeable officials

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admit that Russian machine tool manufacturers are struggling to improve their technological capacities and meet defense industry demand under foreign sanctions and export controls.⁴³ U.S. sanctions targeting several Russian machine tool manufacturers may further complicate the sector's ability to grow.⁴⁴

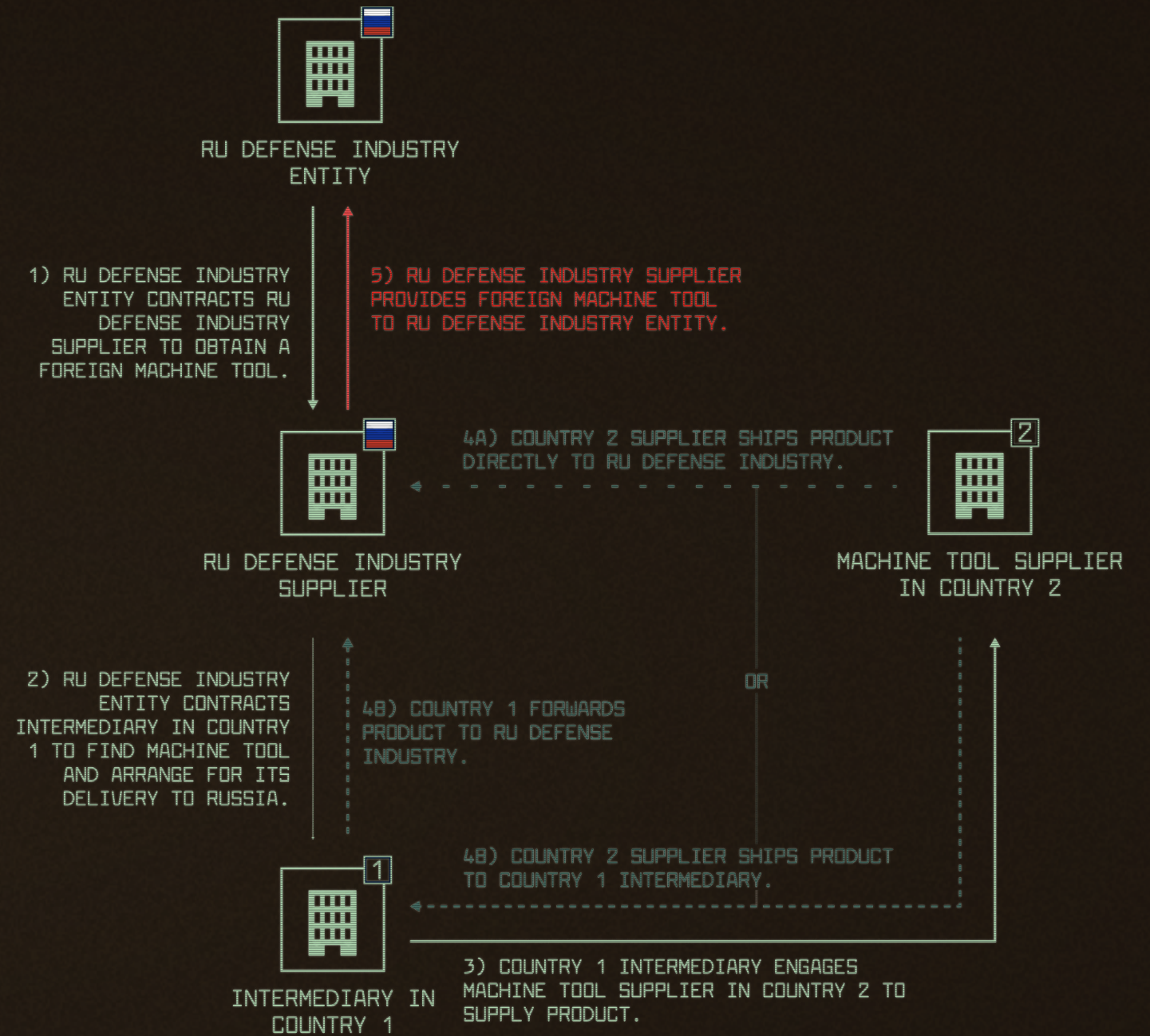
The Russian machine tool industry thus stands at a crossroads. While Russian manufacturers of CNC machine tools and related technologies have evidently achieved

some breakthroughs, Russia is unlikely to attain self-sufficiency in machine tool manufacturing in the near future. The Russian government has repeatedly barred exports of FPCMTs and certain machine tool parts since February 2022,⁴⁵ potentially indicating a desire to stockpile these tools. Under such conditions, limiting the Russian defense industry's access to FPCMTs may erode its ability to sustain the Kremlin's military aims.

THE SHIFTING LANDSCAPE OF RUSSIAN FPCMT PROCUREMENT

The expansion of sanctions and export controls against Russia since February 2022 has discernably altered the configuration of Russian FPCMT procurement networks and the overseas markets that supply them. Analysis of Russian trade data suggests that export controls have greatly reduced the number of jurisdictions through which Russian customers can still import FPCMTs.

The bulk of FPCMTs imported to Russia since February 2022 were shipped by brokers based in jurisdictions uncommitted to enforcing economic penalties against Russia. Research indicates that these brokers occasionally supplied Russian customers with previously used FPCMTs from resellers based in countries vocally supportive of Ukraine—suggesting that Russian defense industry suppliers face complications in obtaining newly manufactured CNC machine tool products.



Some Russian FPCMT procurement networks are using third-country brokers to source previously used CNC machine tools first made in pro-Ukraine jurisdictions from resellers in China, South Korea, and Turkey. Nick Pinkston, a manufacturing technology entrepreneur

familiar with operating and building machine tools, observes that previously used CNC machine tools are easily purchased from dealers or at auction.⁴⁶ A lack of trade data from pro-Ukraine jurisdictions, such as South Korea and Taiwan, limits visibility as

to whether manufacturers in those countries might be using secondhand markets abroad to disguise transfers of their products to Russia.

AN OVERVIEW OF POST-FEBRUARY 2022 RUSSIAN FPCMT PROCUREMENT TYPOLOGIES

Analysis of Russian trade data indicates that sanctions and export controls introduced in response to the Kremlin’s reinvasion of Ukraine on February 24, 2022, have compelled Russian defense industry suppliers to source FPCMTs from intermediaries in third countries whose governments have not committed to enforcing economic penalties on Russia. This finding is consistent with studies of illicit Russian technology procurement efforts conducted by the U.S. government⁴⁷ and Ukrainian nongovernmental organizations.^{48,49}

Third-country brokers constitute a departure point for examining how transnational networks involved in supplying FPCMTs to Russia have adapted to economic penalties

introduced against that country after February 24, 2022. The case studies in this report demonstrate how these networks increasingly evade sanctions and export controls in service of two similar but distinct categories of Russian importers:

- * **Subsidiary-oriented evasion**, helping Russian subsidiaries of foreign machine tool firms access products made by their parent companies after the latter had allegedly exited the Russian market.
- * **Distributor-oriented evasion**, helping Russian machine tool distributors not owned by foreign machine tool manufacturers import FPCMTs and parts, both new and used.

The following case studies do not encompass the totality of possible ways in which third-country brokers might facilitate the circumvention of Russian sanctions and

export controls. Further research and analysis of third-country actors would likely obtain insight into similar post-February 2022 scenarios in which Russian actors employed third-country brokers for both licit and illicit ends. Nonetheless, the hope is that these examples will stimulate further examination of how third-country brokers satisfy illicit demand for dual-use goods.

SUBSIDIARY-ORIENTED EVASION

The Aydın Corporate Network

Gürhan Aydın (G. Aydın) and Recep Çetin Aydın (R. Aydın) are a pair of Turkish national ID card holders who own multiple companies engaged in the export of German-origin machine tool-cutting instruments to Russia. The companies in question—hereafter referred to collectively as ACN—include:

- * AYT CNC Takım Tezgahları Servis Makina Sanayi ve Ticaret Limited Şirketi (hereafter AYT).⁵⁰

- * Renamed Minyon Kesici Takımlar Makine Sanayi ve Ticaret Limited Şirketi (hereafter Minyon) on September 15, 2022.⁵¹

- * AYT CNC Takım Tezgahları Makine Sanayi ve Ticaret Limited Şirketi (hereafter AYT).⁵²

- * Modül-san Makina Dişli ve Kesici Takımları Sanayi Ticaret Limited Şirketi (hereafter Modül-san).⁵³

- * SSGCTM CNC Takım Tezgahları Makine Sanayi ve Ticaret Limited Şirketi (hereafter SSGCTM).⁵⁴

Minyon and SSGCTM came under U.S. sanctions on June 12, 2024.⁵⁵

Of note, AYT is a resident of the Mersin Free Zone (Mersin FZ),⁵⁶ a special economic zone offering various tax and customs duty exemptions.⁵⁷ The Mersin FZ is located next to the Port of Mersin,⁵⁸ a major cargo terminal that reportedly became a major Russian transshipment hub after February 2022.⁵⁹

C4ADS’ analysis found that ACN entities helped two Russian subsidiaries of separate foreign machine tool companies overcome sanctions and export controls through the provision of products made by the Russian subsidiaries’ parent companies.

* Records indicate that ACN entities supplied LLC Tool Company GUT (hereafter GUT)—the Moscow-based subsidiary of Gühring KG (hereafter Gühring), a German machine tool-cutting instrument manufacturer—with Gühring products after Gühring announced its exit from the Russian market.

* ACN entities also appear to have enabled LLC I Machine Technology

(hereafter IM-RU), a Russian company affiliated with Taiwanese machine tool company I Machine Tools Co., Ltd. (hereafter IM-TW), access IM-TW products after Taiwan tightened export controls on transfers of CNC machine tools to Russia.

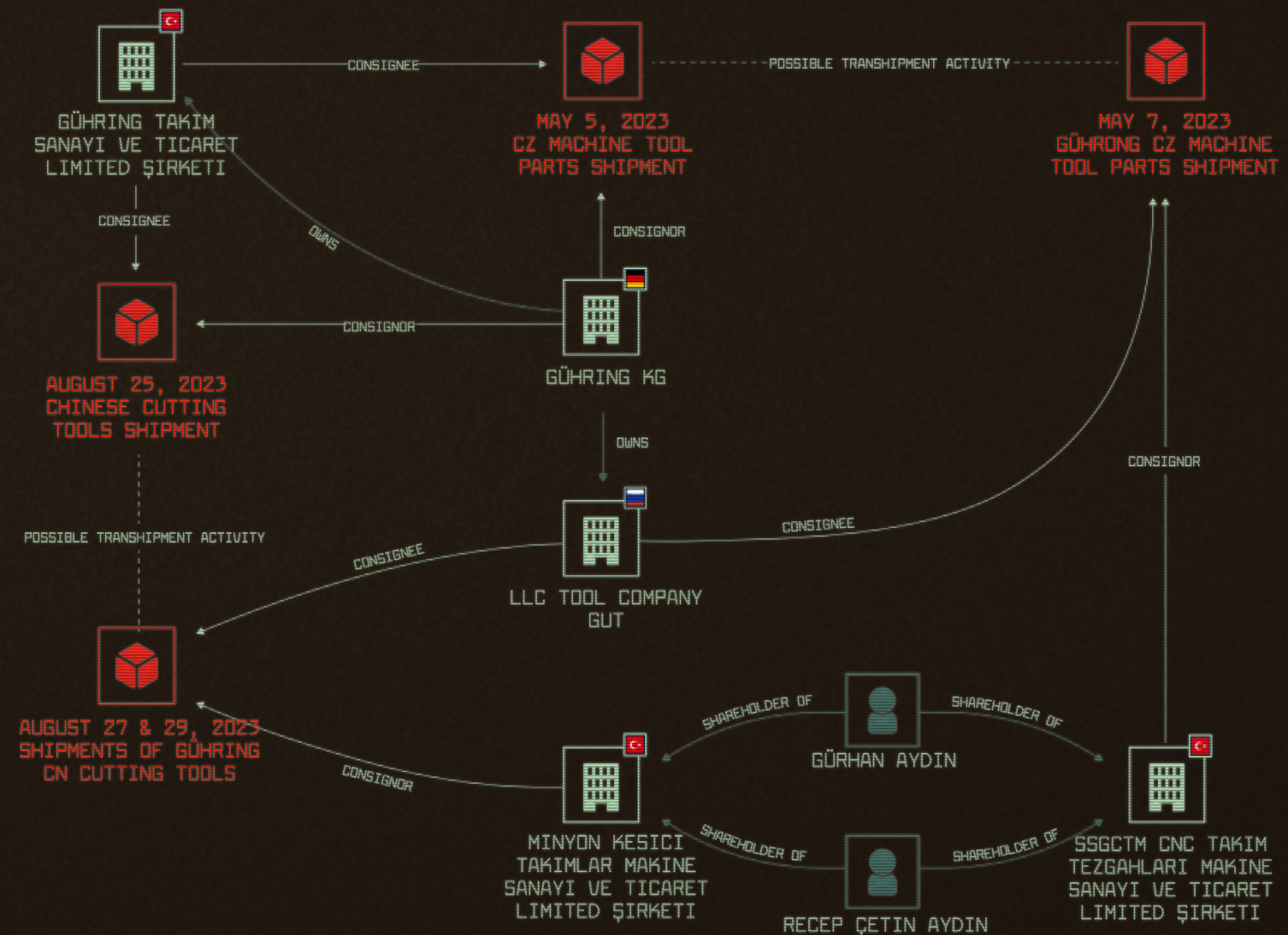
ACN, GUT, and Gühring

GUT is a Moscow-based company wholly owned by Gühring, a German company specializing in the manufacture of cutting tools, tool holders, and other machine tool consumables.⁶⁰ On May 24, 2022, Gühring issued a statement announcing that it would close its Russian branch and cease all business with Russian companies.⁶¹ However, Russian corporate records indicate that Gühring remained GUT’s sole shareholder when this paper was published.⁶² According to Gühring, the Russian government will not permit the divestment of its stake in GUT. Moreover, Gühring purports to no longer exercise influence over GUT’s operations.⁶³

GUT, a documented Russian defense industry contractor,^{64,65} first began importing Gühring products from ACN entities on May 31, 2022.⁶⁶

However, Russian trade data indicates that GUT continued to import Gühring products directly from Gühring itself and from its Chinese and South Korean subsidiaries until October 2022.⁶⁷ Russian trade data also indicates that GUT imported at least 979 shipments containing Gühring-manufactured products from ACN entities between February

24, 2022, and July 20, 2023.⁶⁸ Of note, Turkish trade data shows that AYT, AYT, and Minyon imported 11 shipments containing machine tool instruments for cutting, boring, and drilling, as well as unspecified articles of iron and steel, from Gühring itself in March 2022, June 2022, September 2022, November 2022, January 2023, and April 2023.⁶⁹



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ACN Entities May Have Supplied GUT with Products Imported by Gühring's Turkish Subsidiary.

Analysis of Russian and Turkish trade data identified multiple instances in which ACN entities exported Gühring products to GUT days after Gühring exported nearly identical products to its Turkish subsidiary,^{70 71} Gühring Takım Sanayi ve Ticaret Limited Şirketi (hereafter Gühring TR).

* According to Turkish trade data, on August 25, 2023, Gühring shipped a cargo containing four Chinese-origin milling cutters to Gühring TR.⁷² GUT subsequently imported two shipments from AYT containing milling cutters made by a Chinese Gühring subsidiary, Gühring (Changzhou) Cutting Tools Co., Ltd., on August 27 and 29, 2023.⁷³

* Additional Turkish trade data reveals that on May 05, 2023, Gühring shipped five cargoes containing Czech-origin tool holders, drill bits, and boring heads to Gühring TR.⁷⁴ Two days later, per Russian trade data, GUT imported five cargoes from SSGCTM containing

tool holders, boring heads, threaded steel bars, and unspecified steel articles made by Gühring's Czech branch, Gühring s.r.o.^{75,76}

* Further Russian trade data indicates that on March 27, 2023, Gühring TR imported a cargo containing Romanian-origin unwrought cermets—a composite of ceramic and metal material commonly used to make machine tool-cutting instruments⁷⁷—from Gühring. Three days later, according to that same Russian trade data set, GUT imported a cargo from SSGCTM containing unwrought cermets made by Gühring's Romanian branch, Gühring S.R.L.^{78,79}

These examples suggest that GUT may have used ACN entities to conceal its acquisition of Gühring-made machine tool consumables.

GUT Won Supply Contracts from a U.S.-Sanctioned Russian Missile Manufacturer in February and April 2023.

Russian court records indicate that Public JSC Kalinin Machine-Building Plant (hereafter

ZiK)—a surface-to-air missile launch systems manufacturer^{80,81} subject to U.S. sanctions since September 12, 2014,⁸² and direct E.U. sanctions since February 23, 2024,⁸³ awarded GUT two procurement contracts on February 28, 2023 and April 04, 2023.⁸⁴ Both contracts required GUT to deliver certain unspecified goods no later than June 05, 2023.⁸⁵ ZiK subsequently sued GUT on December 23, 2023, for breaching the terms of both contracts.⁸⁶

GUT may have failed to fulfill the aforementioned contracts with ZiK on time because of disruptions to GUT's trade relationship with ACN entities. Russian trade data indicates GUT last imported Gühring products from an ACN entity—namely, SSGCTM—on August 15, 2023, whereafter GUT began exclusively sourcing Gühring products from various Chinese companies.⁸⁷ This shift occurred as the E.U. gradually tightened export restrictions to Russia, although limited information is available to assess whether exports or sanctions contributed to GUT's shift from Turkish to Chinese suppliers.⁸⁸

GUT is not subject to any sanctions at the time of this writing.

ACN, IM-TW, and IM-RU

Taiwan-based CNC machine tool company IM-TW that appears to be affiliated with IM-RU, a Moscow-based firm.⁸⁹ Russian and Taiwanese corporate records indicate that IM-RU and IM-TW were founded on April 21, 2008, and February 08, 2011, respectively.^{90,91} According to publicly-available records and reporting, IM-TW's sole shareholder, Yu Ming Je (hereafter Yu),⁹² cofounded IM-RU with two Russian nationals, Alexander Gennad'yevich Blok and Alexey Viktorovich Bredikhin.⁹³ Bredikhin was IM-RU's sole shareholder when this paper was published.⁹⁴ Although Russian and Taiwanese corporate records do not indicate that IM-RU and IM-TW are currently affiliated with each other formally, Taiwanese intellectual property records show that the companies' logos are owned by Yu and a Russian national residing in Taiwan.⁹⁵

Documented Russian defense industry and security services contractor IM-RU⁹⁶ came under U.S. sanctions on November 02, 2023.⁹⁷ The government of Taiwan sanctioned IM-RU on February 02, 2024.⁹⁸ IM-TW was not subject to any sanctions when this paper was published.

WAR MACHINE

IM-RU Began Importing IM-TW Products from Turkish ACN Entities After Taiwan Tightened Export Controls.

Russian trade data indicates that between March 15, 2023, and December 18, 2023, IM-RU imported at least 16 shipments of IM-TW-manufactured CNC machine tools from ACN entities AYTT and SSGCTM.^{99,100} Analysis did not identify any evidence that AYTT, SSGCTM, or any other Turkish companies have ever imported IM-TW products to Turkey.¹⁰¹ These shipments coincided with IM-TW's direct shipments of its products to IM-RU. Limited information is available to determine why IM-RU imported IM-TW products from ACN entities when IM-TW was concurrently supplying its products directly to IM-RU.

IM-TW May Have Shipped CNC Machine Tools to IM-RU in Violation of Taiwanese Export Controls.

Russian trade data reveals that IM-RU imported at least 123 shipments containing CNC machine tools from IM-TW between February 24, 2022, and December 28, 2023.¹⁰²

Thirty-six of the aforementioned 123 cargoes were imported after January 04, 2023, when the government of Taiwan tightened export controls on transfers of CNC machine tools to Russia.¹⁰³ Seventeen of those 35 shipments contained CNC machine tools made by IM-TW, while the remaining 18 shipments contained products bearing the branding of various other Taiwanese CNC machine tool companies, including:

- * Ge Fong Machinery Co., Ltd. (hereafter Ge Fong);
- * Micro Dynamics Co., Ltd. (hereafter Micro Dynamics); and
- * Ming Yang Machinery Co., Ltd. (hereafter Ming Yang).

9	1	4	1	4
1	5	2	2	1
2	0	5	6	1
5	1	8	1	6
5	1	3	5	.

IM-TW APPEARS TO ENJOY ACCESS TO TAIWANESE MACHINE TOOL INDUSTRY'S SUPPLY CHAINS

IM-TW likely assembles its products from components manufactured by other firms rather than manufacturing them itself. Such arrangements are common in the Taiwanese machine tool industry, wherein companies assemble CNC machine tools from parts manufactured by specialized contractors.¹⁰⁴ Although IM-TW's website claims the company makes its products,¹⁰⁵ it has not registered any manufacturing facilities with the Taiwanese government as required under Taiwanese law.¹⁰⁶ IM-TW's website asserts that the company "has excellent relationships with many of Taiwanese manufactures [sic] and always ready to provide a large variety of top quality machines at competitive prices for different kinds of customers' needs."¹⁰⁷

IM-TW's website lists a CNC five-axis machining center with the model number 30VT.¹⁰⁸ The photo provided for the 30VT model on IM-TW's website, apart from the

logo, appears virtually identical to the Micro Dynamic website's image for the latter company's model MEGA 30VT CNC five-axis machining center¹⁰⁹ (the former appears to superimpose IM-TW's logo over Micro Dynamics' branding). Similarly, the photo used on IM-TW's website for that company's G-42HA-DET model CNC turning center¹¹⁰ closely resembles the photo for an identically named CNC turning center advertised on Ge Fong's website.¹¹¹

IM-TW has also exported Ge Fong- and Micro Dynamics-branded CNC machine tools to IM-RU.¹¹² IM-TW's products appear to use Ge Fong-designed software, further suggesting that Ge Fong has or had licensing agreements with IM-TW.¹¹³ Taken together, this information indicates that IM-TW—and IM-RU by extension—has access to the same supply chains as Ge Fong and Micro Dynamics. Of note, IM-RU imported seven shipments of Micro Dynamics CNC machine tools from ACN entity SSGCTM between April 13, 2023 and November 02, 2023.¹¹⁴



Photos of the MEGA30VT from Micro Dynamics' website (left) and the IM-RU-branded 30VT from IM-TW's website (right).

DISTRIBUTOR-ORIENTED EVASION

Jacbac Technology Dış Ticaret Limited Şirketi

Jacbac Technology Dış Ticaret Limited Şirketi (hereafter Jacbac) and Mertege Makina Sanayi Ve Ticaret Limited Şirketi (hereafter Mertege) are Turkish companies with an overlapping ownership structure. On February 21, 2019, Swedish national John Victor Jacobson Backman, aka Victor Backman,¹¹⁵ hereafter V. Backman,¹¹⁶ incorporated Jacbac.¹¹⁷ Mertege was cofounded on May 18, 2022, by V. Backman

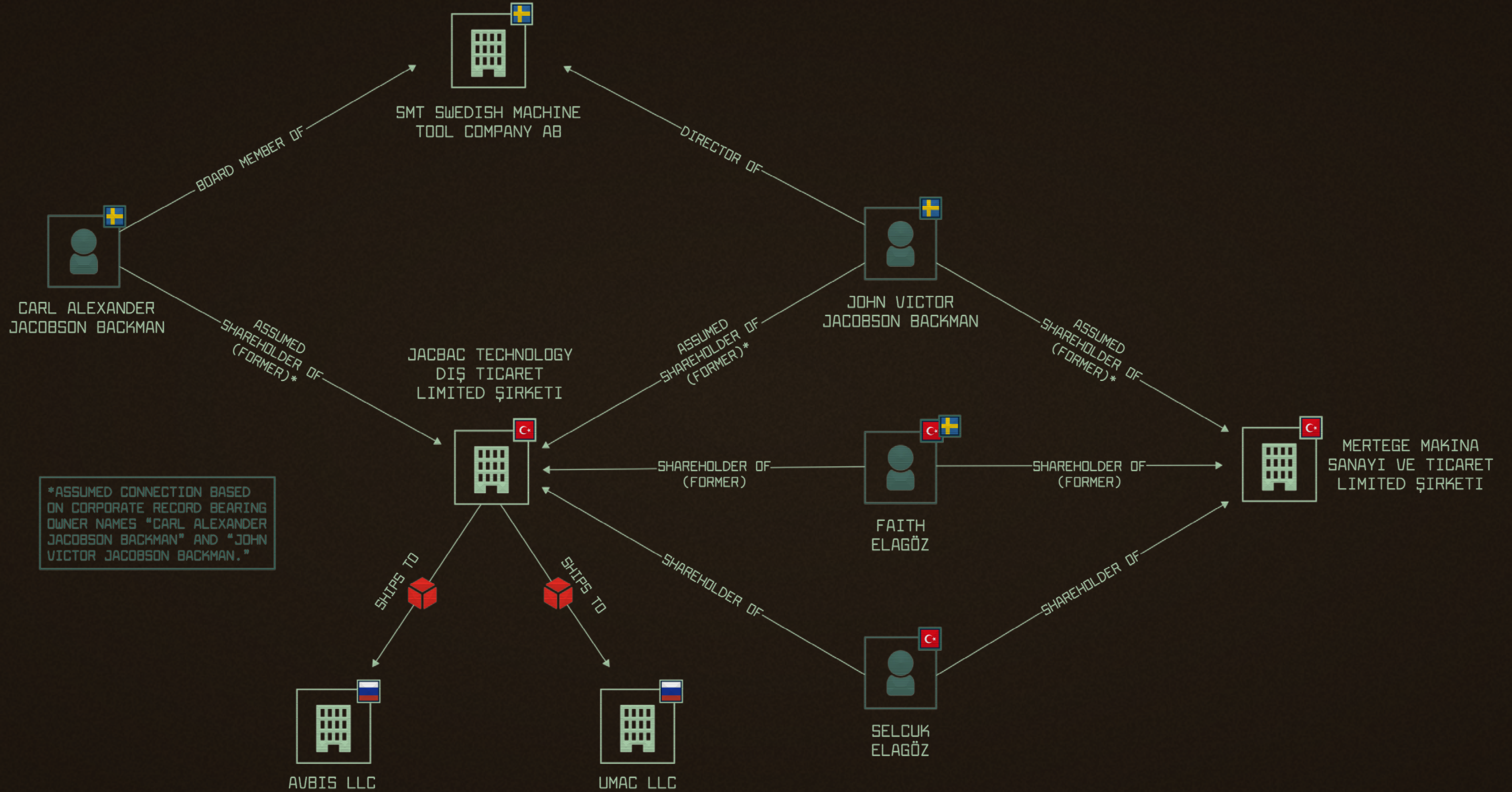
and Fatih Elagöz (hereafter F. Elagöz), a Turkish national residing in Sweden.¹¹⁸

On or about May 11, 2022, V. Backman transferred 330 shares in Jacbac to Elagöz and another 330 shares to Swedish national Carl Alexander Jacobson Backman (hereafter C. Backman).¹¹⁹ V. Backman and C. Backman, who are reported to be twin brothers,¹²⁰ cofounded a company that acted as a dealer for products made by German machine tool manufacturer SPINNER Werkzeugmaschinenfabrik GmbH (hereafter SPINNER).¹²¹

According to Turkish corporate records, Turkish national Selçuk Elagöz acted as the manager and sole shareholder of Jacbac since February 2023.¹²² As occurred with Jacbac, Selçuk Elagöz also became Mertege's sole shareholder in February 2023.¹²³

The United States sanctioned Jacbac on November 02, 2023.¹²⁴





WAR MACHINE

Jacbac Exported a New German CNC Machining Center to a Russian Defense Contractor in May 2023.

Russian trade data reveals that on May 27, 2023, LLC Yumak (hereafter Umac),¹²⁵ a Moscow-based machine tool distributor,¹²⁶ whose past clientele includes numerous Russian defense industry entities,¹²⁷ imported a new vertical machining center made by German machine tool company Maschinenfabrik Berthold Hermle AG (hereafter Hermle) from Jacbac.¹²⁸ Analysis of Turkish trade data did not identify any information as to what entity supplied the Hermle product in question to Jacbac.¹²⁹

The United States sanctioned Umac on December 12, 2023.¹³⁰

Avbis Likely Imported E.U.-origin FPCMTs from Jacbac on Umac's Behalf.

Russian trade data shows that between August 30, 2022, and September 11, 2023, LLC Avbis, a low-profile Moscow-based firm with no discernable public procurement history,¹³¹ imported at least 19 shipments from Jacbac containing CNC machine tools manufactured by Hermle and SPINNER's Bulgarian and

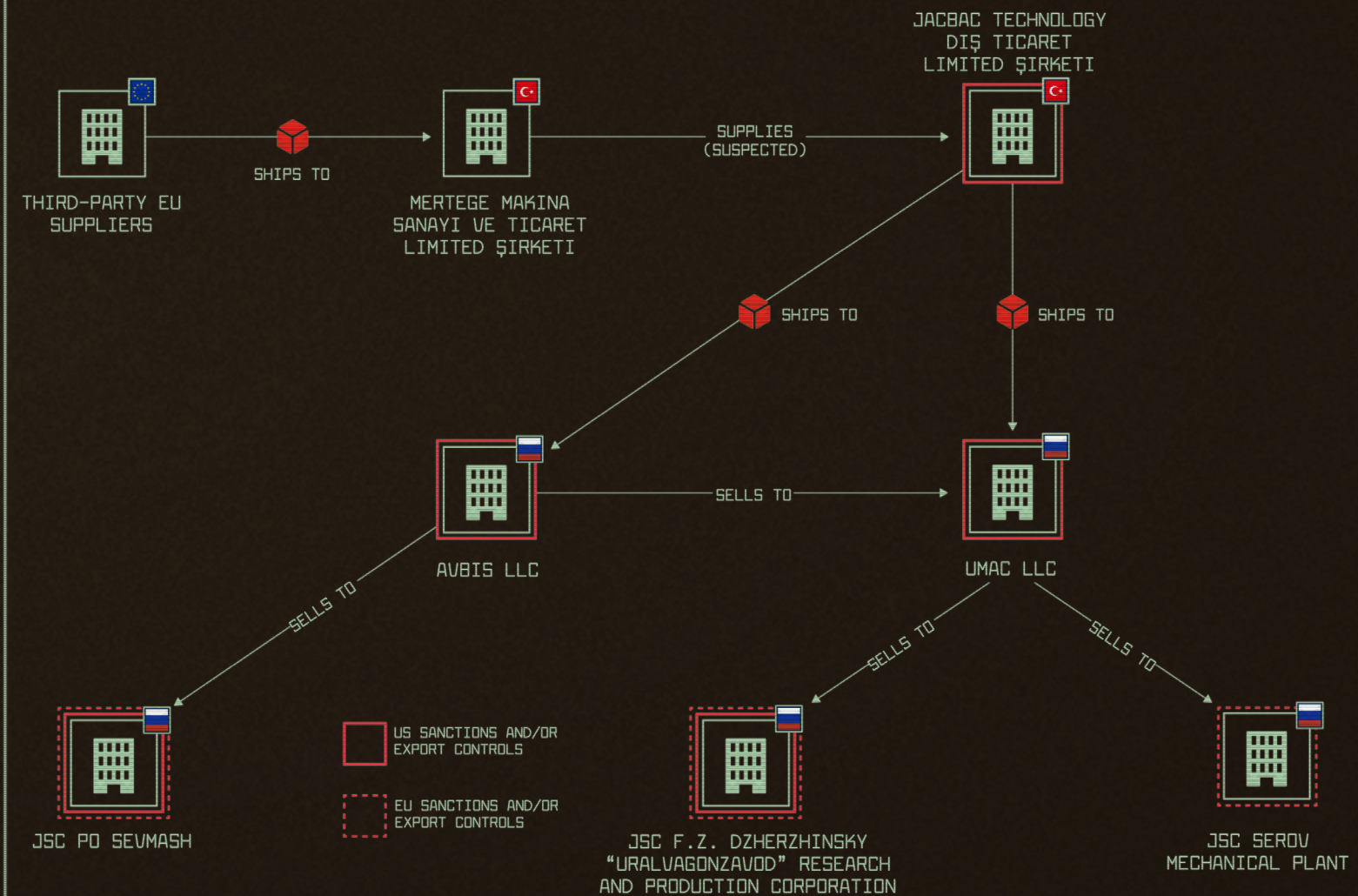
Turkish subsidiaries—SPINNER Bulgaria Ltd. and SPINNER Takim Tezgaahlari Sanayi Ve Ticaret Limited Sirketi,¹³² respectively.¹³³ Originally incorporated in Moscow on June 06, 2009, Avbis does not appear to have any formal corporate affiliation with Umac.¹³⁴

Some of the E.U.-origin FPCMTs that Jacbac reportedly shipped to Avbis after February 2022 may have ended up in Umac's possession. Russian financial records provided by the Economic Security Council of Ukraine indicate that Avbis regularly conducted business with Umac in 2023, recording more than RUB2.4 billion (approximately US\$26.9 million as of December 31, 2023)¹³⁵ from 51 transactions between January 20 and September 19, 2023.¹³⁶ Although these records do not specify the goods or services that Avbis provided to Umac, a handful of the transactions of concern took place shortly after Avbis appears to have imported FPCMTs from Jacbac.

For example, Russian trade records show that on May 25, 2023, Avbis imported a 2022 model Hermle CNC vertical machining center with a declared value of RUB67,759,016 (approximately US\$845,200 per contemporary

exchange rates)¹³⁷ from Jacbac.¹³⁸ According to Russian financial records, four days later, on May 29, 2023, Umac paid Avbis RUB75,729,900 (approximately US\$942,000 per contemporary exchange rates)¹³⁹ for goods or services not specified.¹⁴⁰ This indicates that Avbis may have imported FPCMTs from Jacbac on Umac's behalf.

The United States sanctioned Avbis on February 23, 2024.¹⁴¹



WAR MACHINE

Mertege and Jacobac May Have Transshipped E.U.-origin FPCMTs to Avbis.

Russian and Turkish trade data suggest that Mertege may have imported and funneled new and previously used E.U.-origin FPCMTs to Jacobac for transshipment to Russia at a markup of tens of thousands of euros.

Russian trade records show that on June 19, 2023, Mertege imported an 8,735-kilogram (kg) Hermle model C250 U five-axis machining center worth EUR124,500 (approximately US\$135,000 per contemporary exchange rates) from a German packaging machine manufacturer.¹⁴² One week later, on June 26, 2023, Jacobac reportedly exported an unspecified 8,500 kg five-axis CNC machining center with a declared value of EUR142,000 (approximately US\$155,000 per contemporary exchange rates) to Moscow-based Avbis;¹⁴³ however, Turkish trade records identify this shipment's destination as Kazakhstan¹⁴⁴—suggesting the cargo was diverted to Russia. Russian trade records indicate that on July 07, 2023, Avbis imported an unspecified model of a Hermle-made five-axis CNC machining center weighing 8,240 kg with a declared

value of RUB61,565,539 (approximately US\$673,000 per contemporary exchange rates) from Jacobac.¹⁴⁵

Mertege was not subject to any sanctions when this paper was published.

ELE Technology Co., Ltd.

ELE Technology Co., Ltd. (hereafter **ELE**) is a Shenzhen, China-based reseller of previously used CNC machine tools.¹⁴⁶ ELE's website registered on April 14, 2022, shortly after Russia's reinvasion of Ukraine,¹⁴⁷ indicates the company sells previously-used CNC machine tools made by more than 45 manufacturers, including Japanese **Tsugami Corporation** (hereafter **Tsugami**).¹⁴⁸

ELE shares a common phone number and building address with a similarly named company that sells Tsugami CNC machine tools on the Chinese business-to-business commerce platform Alibaba, although limited information is available to determine whether that company and ELE are related.¹⁴⁹ Both companies are located in Shenzhen's Futian District, which is home to a major electronics wholesale market.¹⁵⁰ ELE's ownership appears

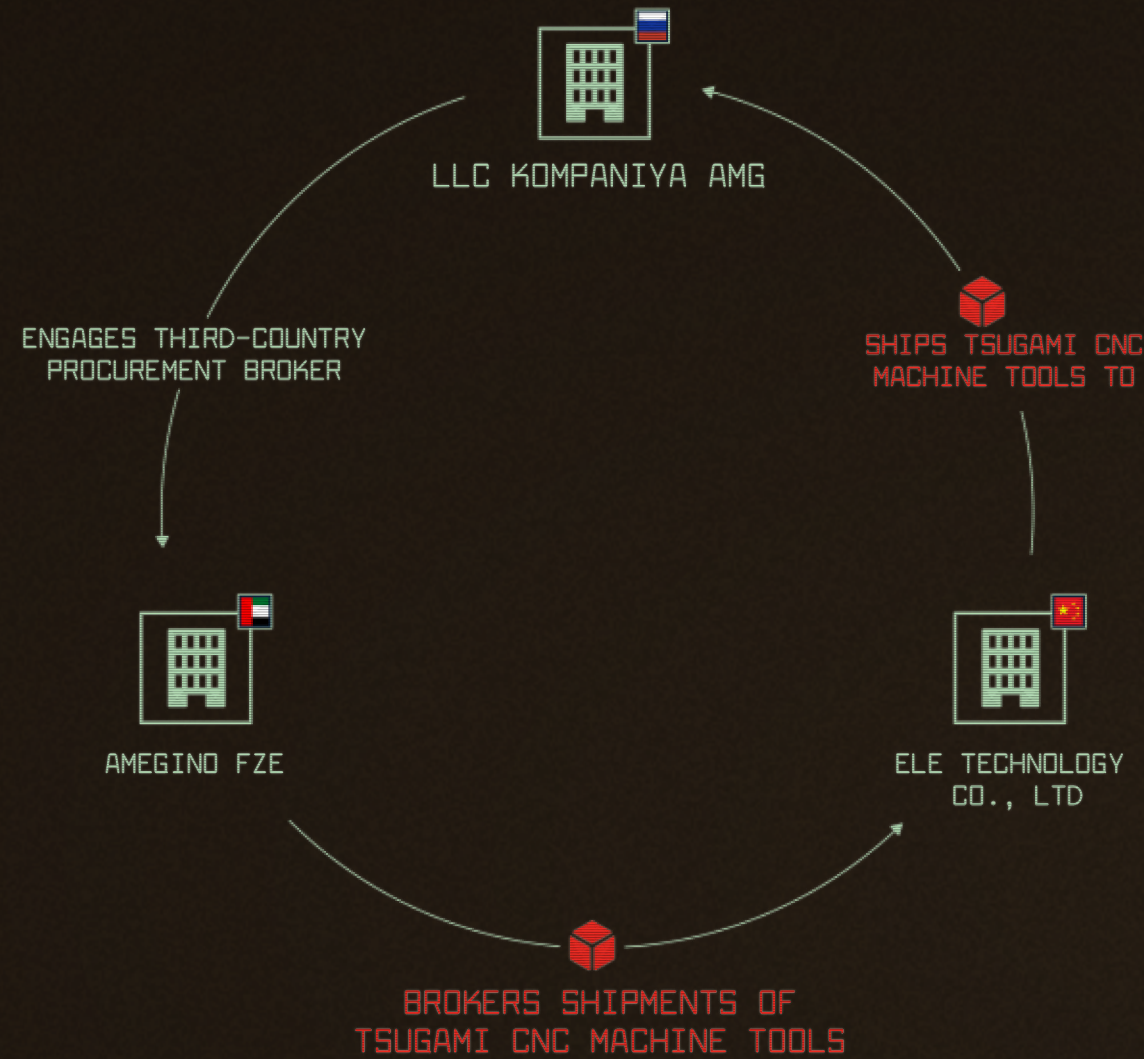
to consist of Chinese nationals, although ELE's website claims that the company is affiliated with a U.S. CNC machine tool reseller.¹⁵¹

ELE was not subject to any sanctions when this paper was published.

ELE Made Nearly 100 Shipments of Tsugami CNC Machine Tools to a Russian Defense Industry Contractor After February 2022 in Possible Violation of Japanese Export Controls and U.S. Sanctions.

According to Russian trade data, Moscow-based CNC machine tool importer and distributor **LLC Kompaniya AMG** (hereafter **AMG**) imported at least 96 shipments containing Tsugami-manufactured CNC machine tools from ELE between February 24, 2022, and December 12, 2023.¹⁵² AMG has previously won public procurement contracts from various Russian defense industry entities.¹⁵³ Russian trade data does not specify whether ELE has supplied new or previously used Tsugami products to AMG, although ELE's website indicates that the company specializes in the resale of previously used CNC machine tools.¹⁵⁴

On March 18, 2022, the Japanese government adopted regulations aimed at prohibiting transfers of CNC machine tools and other dual-use goods to Russia by requiring exporting parties to apply for relevant export licenses.¹⁵⁵ The United States sanctioned AMG on November 02, 2023.¹⁵⁶ As a result, ELE may have violated U.S. sanctions and Japanese export controls by shipping Tsugami products to AMG.¹⁵⁷



ELE Appears to Have Shipped Tsugami Products to AMG on Behalf of a United Arab Emirates (U.A.E.) Firm Subject to U.S. Sanctions for Supplying Microelectronics to Russia.

AMG appears to have imported five cargoes containing Tsugami CNC turning centers and

spare parts from ELE between March 15 and 21, 2023. Russian trade data indicates that ELE shipped these cargoes to AMG at the direction of U.A.E.-based Amegino FZE (hereafter Amegino).¹⁵⁸ Separately, the United States sanctioned Amegino on July 20, 2023, for its illicit shipments of other dual-use goods to Russia, namely microelectronics.¹⁵⁹

Amegino and ELE Replaced a Major Japanese Trading Company as AMG’s Principal Sources of Tsugami Products After Japan Tightened Export Controls.

As noted above, Japan restricted exports to Russia of Japanese-origin CNC machine tools on March 18, 2022.¹⁶⁰ Prior to the rollout of these controls, AMG imported Tsugami products almost exclusively from Kanematsu KGK Corporation (hereafter KGK), a Japanese trading company¹⁶¹ that supplies products made by Tsugami and other Japanese machine tool manufacturers.¹⁶² While KGK was the consignor for 74% of all Tsugami CNC machine tool products imported by AMG before March 18, 2022, Russian trade records show that by the end of 2023, more than 80% of AMG’s Tsugami imports—including products made by a Chinese Tsugami subsidiary)¹⁶³—came from ELE and Amegino.¹⁶⁴ This shift suggests that AMG turned to ELE and Tsugami because expanded Japanese export controls made continued trade with KGK untenable.

Silver Technology Ltd.

Silver Technology Ltd. (hereafter SilverTech)¹⁶⁵

is a Hong Kong-based company that advertises itself as a provider of “engineering and industrial consulting services.”¹⁶⁶ Incorporated on June 26, 2016, SilverTech’s ownership has consisted of apparent Hong Kong residents throughout the company’s existence.¹⁶⁷ SilverTech claims to represent various Japanese, South Korean, and Taiwanese CNC machine tool manufacturers in the Russian, Azerbaijani, and Kazakhstani markets,¹⁶⁸ although research did not identify any evidence to corroborate this claim. Among the CNC machine tool manufacturers that SilverTech claims to represent is South Korea’s Doosan Machine Tools Co., Ltd. (hereafter Doosan MT),¹⁶⁹ which rebranded as DN Solutions Co., Ltd. (hereafter DNSol) on June 02, 2022.¹⁷⁰

The United States sanctioned SilverTech on May 01, 2024.¹⁷¹

SilverTech Exported More Than 250 Shipments of DNSol Products to a Likely Former DNSol Russian Sales Agent After February 2022.

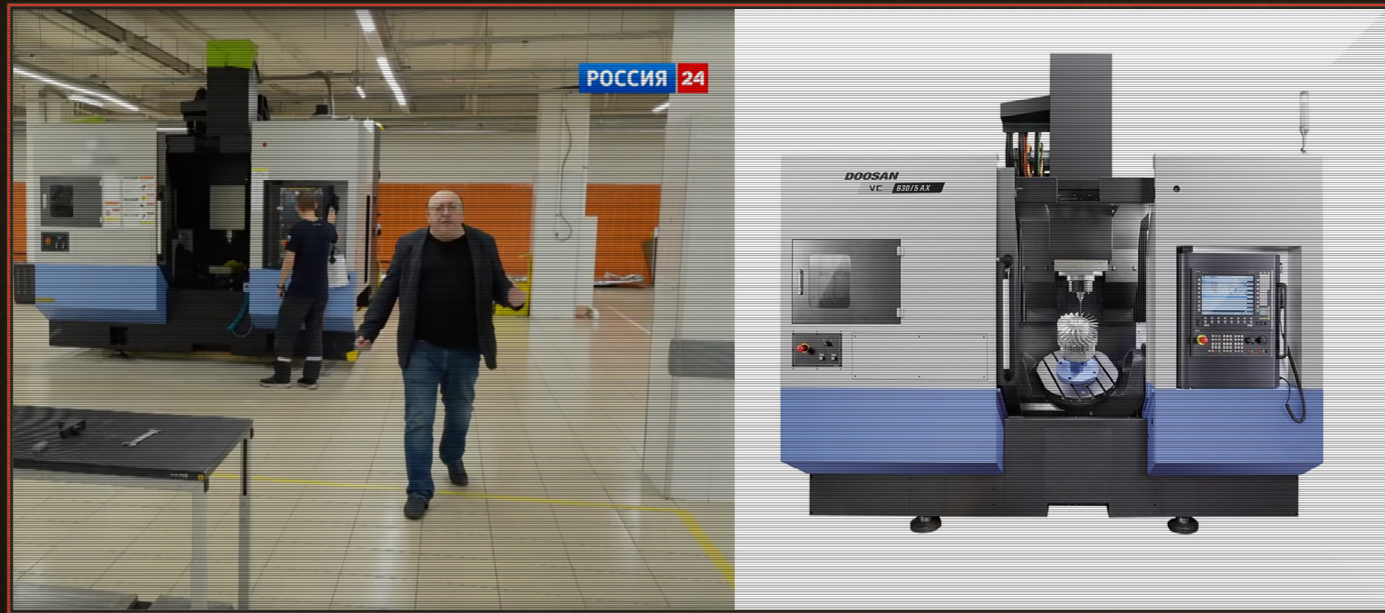
Between February 24, 2022, and November 15, 2023, Doosan MT’s apparent former Russian sales agent and related companies imported

at least 259 shipments from SilverTech of Doosan MT- and DNSol-made CNC machine tools.¹⁷² The principal consignee in question, Moscow-based LLC SFT (a/k/a LLC CFT,¹⁷³ hereafter SFT), advertises itself as DNSol’s exclusive distributor on the Russian market.¹⁷⁴ Archived versions of DNSol’s corporate website list a Moscow-based entity identified as “CFTechnologies” as Doosan MT’s sole authorized sales and service representative in Russia.¹⁷⁵ The archived DNSol website lists CFT’s website under the contact section for CFTechnologies, suggesting that SFT and CFTechnologies may be the same entity.¹⁷⁶

DNSol’s website did not list “CFTechnologies” or SFT as a sales agent when this paper was published.¹⁷⁷ SFT appears to belong to a group of companies with interrelated ownership.¹⁷⁸

The United States, Switzerland, and the European Union sanctioned SFT on November 02, 2023, January 13, 2024, and February 24, 2024, respectively.^{179 180 181}

Doosan MT and DNSol CNC Machine Tools Supplied by SilverTech to SFT May Have Ended Up in the Possession of Russian Military Drone Manufacturers.



Russian television personality Alexander Rogatkin walks in front of an apparent Doosan MT-manufactured CNC machining center for a July 2023 televised tour of drone manufacturer Aeroscan’s Izhevsk plant (left). Compare to the photo of a Doosan MT VC 630.

Russian financial records indicate that between February 24, 2022, and May 25, 2023, SFT completed 192 commercial transactions with LLC TsST (a/k/a CST) and LLC Aeroscan, a pair of apparently interrelated¹⁸² companies involved in the design and manufacture of the Lancet loitering munition (hereafter Lancet drone).¹⁸³ The Russian military regularly deploys Lancet drones to attack Ukrainian military targets.^{184,185} The United States sanctioned TsST and Aeroscan on November 02, 2023, while the European Union and the United Kingdom sanctioned Aeroscan on December 18, 2023 and December 06, 2023, respectively.^{186 187} Switzerland sanctioned Aeroscan and TsST on January 31, 2024 and December 20, 2023, respectively.^{188 189}

A July 2023 Russian news broadcast shows what appear to be several DNSol or Doosan MT-manufactured CNC machine tools on the floor of the Izhevsk, a Russia-based plant where Aeroscan reputedly assembles Lancet drones.^{190,191} Given the scale of Aeroscan and TsST’s transactions with SFT and the latter’s routine import of DNSol and Doosan MT products after February 2022, the available evidence strongly suggests that SFT might

have sold Aeroscan and TsST some of the DNSol and Doosan MT CNC machine tools that SFT and its affiliates had imported from SilverTech.

Certain SilverTech¹⁹² Shipments to SFT May Have Violated South Korean Export Controls.

South Korea introduced export controls restricting transfers of CNC machine tools to Russia on April 28, 2023.^{193,194,195} Russian trade data shows that SilverTech made at least 126 shipments of Doosan MT- and DNSol-made CNC machine tools to SFT and affiliated entities after that date through November 15, 2023.¹⁹⁶ Russian trade data indicates that at least 52 of those 126 shipments to SFT and its affiliates were shipped directly from South Korea to Russia,¹⁹⁷—a possible violation of the April 28, 2023 export control amendment. SilverTech is identified as the sole consignor for 44 of those 52 shipments; the remaining eight shipments—all imported on May 31, 2023—were dispatched by South Korean shipping agency Tongjin Shipping Service Co., Ltd.,¹⁹⁸ reportedly at SilverTech’s direction.¹⁹⁹

WAR MACHINE

SilverTech Supplied SFT with Previously Used CNC Machine Tools Sourced from South Korean Resellers.

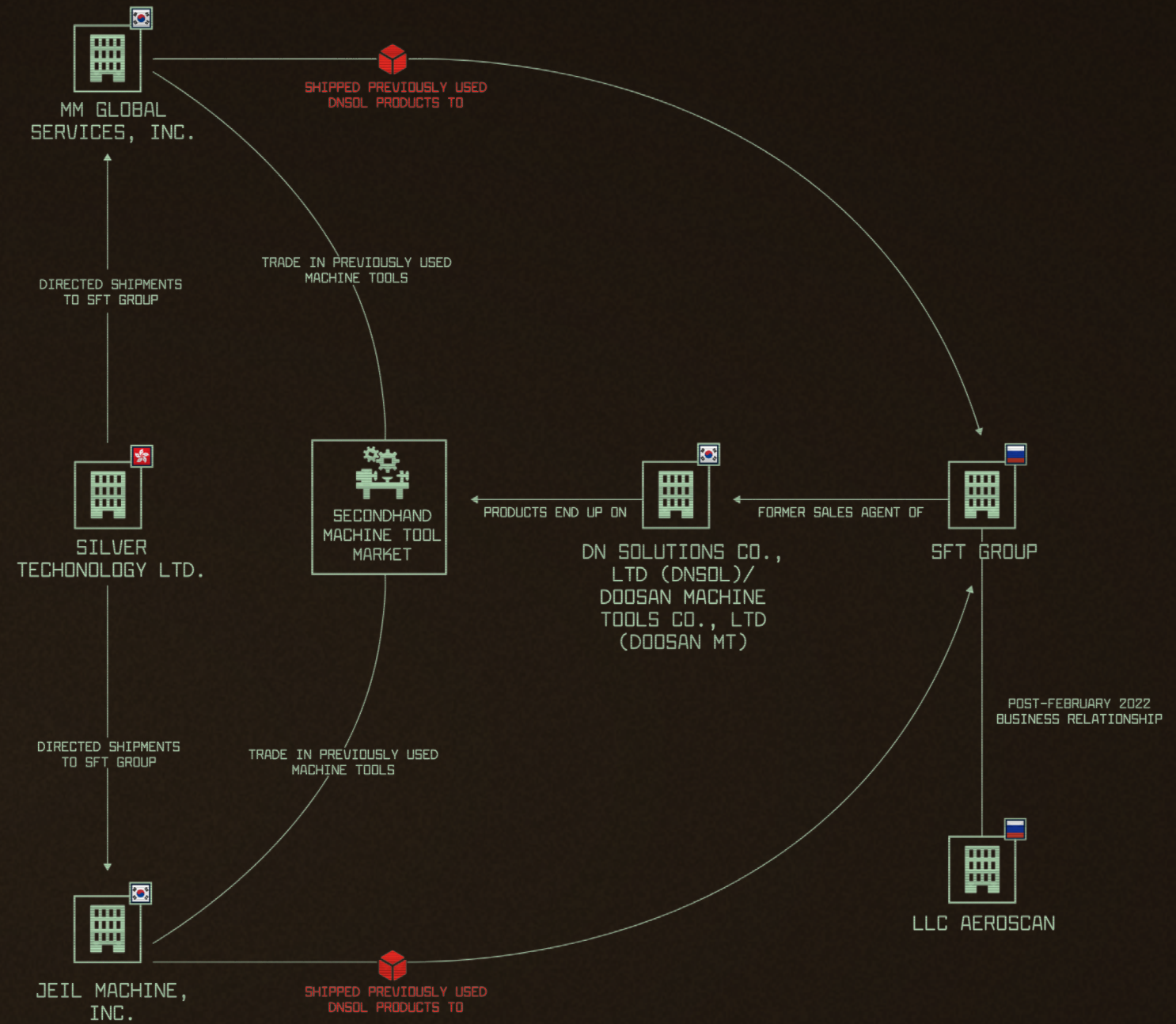
Russian trade data indicates that 242 of the 259 shipments of Doosan MT- and DNSol-made CNC machine tools imported by SFT and its affiliates from SilverTech between February 24, 2022, and November 15, 2023, contained previously used products.²⁰⁰ Cargo descriptions provided in Russian trade data indicate that SilverTech began almost exclusively exporting previously used Doosan MT and DNSol CNC machine tools to SFT and its affiliates on or around late October 2022.²⁰¹ This suggests SilverTech began having trouble sourcing newly manufactured products around that time.

SilverTech appears to have directed two South Korean companies specializing in the resale of previously used CNC machine tools, Jeil Machine, Inc. (hereafter Jeil-M)²⁰² and MM Global Service, Inc. (aka Machinemon, hereafter MM Global),²⁰³ to ship at least 12 of those 242 shipments to SFT and its affiliated companies.²⁰⁴ Russian trade data indicates that Jeil-M and MM Global exported

these shipments in the months before South Korea restricted CNC machine tool exports to Russia.^{205,206} As such, neither Jeil-M nor MM Global appears to have violated South Korean export controls with their documented shipments to SFT and its affiliates, although Russian trade data may not capture the actual number of shipments made by Jeil-M and MM Global to SFT and its affiliates at SilverTech's direction.

Jeil-M sells previously used CNC machine tools on daara.co.kr, a South Korean website offering business-to-business commerce services.²⁰⁷ A YouTube user associated with MM Global posted videos advertising used Doosan MT products for sale via a now-defunct website, machinemon.com.^{208,209} Insufficient information is available to determine whether SilverTech purchased products on SFT's behalf through these websites.

SilverTech Supplied SFT with CNC Machine Tools Made by DNSol's Chinese Subsidiary



DNSol's corporate website indicates that the company operates a manufacturing plant in the eastern Chinese city of Yantai.²¹⁰ Chinese corporate records reveal that this facility serves as the registered address for DN Solutions China Co., Ltd. (hereafter DNSol China), of which DNSol is the sole shareholder.²¹¹ Russian trade data indicates that Russian

customs released 23 cargoes of DNSol China-manufactured CNC machine tools transferred at SilverTech's behest to SFT and its affiliates between March 06, 2023, and July 21, 2023.²¹² Limited information is available to determine whether SFT or its affiliates sold DNSol China-manufactured products to TsST or Aeroscan.

RUSSIAN IMPORTS OF CHINESE CNC MACHINE TOOLS AFTER FEBRUARY 2022

Exports of Chinese-made CNC machine tools to Russia surged after February 2022 as sanctions and export controls compelled manufacturers based in Ukraine-aligned jurisdictions to withdraw from the Russian FPCMT market. While China has occupied a considerable portion of the Russian FPCMT market since the late 2000s,²¹³ imports of Chinese CNC machine tools soared after the expansion of sanctions and export controls following Russia's February 24, 2022, reinvasion of Ukraine.^{214,215} The United States assesses that the Russian defense industry is already using Chinese CNC machine tools to manufacture ballistic missiles.²¹⁶

Media reports suggest that Russian manufacturers have reservations regarding the reliability of high-technology industrial goods made in China. Russian industrial automation experts claim that Chinese industrial robotic technologies lag “two to three generations” behind those of Europe and Japan in

technological sophistication and are less accurate, precise, and durable than comparable European and Japanese manufactured products.^{217,218} Experts interviewed by Russian business daily *Kommersant* believe that China generally has not become an alternative source of technologically advanced machine tools.²¹⁹

Sanctions and export controls, however, are likely forcing Russian defense industry entities to reassess their aversion to using Chinese CNC machine tools. Analysis identified multiple instances of Russian defense manufacturers apparently employing Chinese CNC laser cutting machines,^{220,221} including Aeroscan—the Izhevsk-based drone manufacturer that appears to have obtained previously used South Korean CNC machine tools.^{222,223,224} Commentary on Russian media reports suggest that Russian drone manufacturer LLC Izhevsk Unmanned Systems Research and Production Association uses CNC machining centers made by Chinese machine tool manufacturer Dalian Machine Tool Group Co., Ltd.^{225,226,227}

China may also serve as a base from which Russian machine tool manufacturers

can access foreign components that are unavailable in Russia. On August 14, 2023, Penza, Russia-based machine tool manufacturer and U.S. sanctions target²²⁸ JSC StankoMashStroy (hereafter SMS) signed an agreement to develop a plant for the production of five-axis CNC machining centers on the grounds of the Xianyang National Hi-Tech Industrial Development

Zone, an industrial park located in China's Shaanxi Province.²²⁹ Industry sources believe that the deal was driven primarily by SMS's need to “borrow” tools and technologies unavailable in Russia from Chinese sources, with one expert claiming that “one cannot call China a technological leader in the machine tool construction field.”²³⁰

CONCLUSION

Restricting the Russian defense industry's access to FPCMTs and other foreign-origin dual-use industrial technologies is essential to degrading the Kremlin's ability to wage war against Ukraine. Despite exhibiting some technological progress over the past two years, domestic Russian machine tool manufacturers are unlikely to meet the Russian defense industry's needs in the short-to-medium term. Russian defense industry contractors, meanwhile, continue to source advanced FPCMTs originally made in Ukraine-aligned jurisdictions with help from third-country brokers based in jurisdictions

not inclined to enforce sanctions or export controls against Russia.

Where Russian defense industry suppliers previously imported FPCMTs directly from manufacturers, after February 2022, they increasingly turned to third-country brokers in China and Turkey to exploit vulnerabilities in global CNC machine tool markets. These vulnerabilities appear especially pronounced in secondhand markets populated by entrepreneurs who purchase and resell previously used CNC machine tools. Although secondhand CNC machine tools may be less sophisticated than newer models, they may satisfy the current needs of the Russian

defense industry. This report only scratches the surface of Russian defense industry FPCMT procurement activities. Future research efforts should concentrate on Russian imports of Chinese CNC machine

tools, focusing, in particular, on the financial institutions involved in facilitating this trade. Networks involved in procuring foreign-origin dual-use technologies for Russian machine tool manufacturers also merit specific attention.

RECOMMENDATIONS

The preceding case studies demonstrate the central role that third-country brokers increasingly play in supplying Russian defense industry contractors—including contractors formally owned by or informally affiliated with companies based in Ukraine-aligned jurisdictions. Governments and machine tool industry stakeholders both have important roles to play in preventing third-country brokers from diverting FPCMTs and other dual-use technologies to Russia. For their part, policymakers should provide relevant enforcement agencies with resources to help them deter third-country brokers from violating export controls and sanctions. Sanctions and export control evasion networks often span multiple jurisdictions; allied governments are thus obliged to cooperate in investigating suspected violations.

However, such efforts will likely fall short without the cooperation of private sector actors. Policymakers can provide CNC machine tool market participants with resources and incentives to promote compliance with relevant sanctions and export controls. Private companies involved in the production and distribution of CNC machine tools should also invest in developing compliance competencies of their own. Financial institutions that already boast robust sanctions compliance programs must develop new practices for monitoring clients whose business activity might trigger secondary sanctions that prohibit transfers of CNC machine tools and other dual-use goods to Russia.

Public Policy

Governments should act more aggressively in enforcing export controls and sanctions.

Both the United States and allied governments must allocate additional resources to export control enforcement to keep up with the workload created by sanctions and export controls following Russia's reinvasion of Ukraine. Policymakers need to raise the enforcement risks associated with noncompliance so that manufacturers and distributors of CNC machine tools and other dual-use goods treat export controls and sanctions violations with the same seriousness given to foreign and other white-collar crimes.²³¹ The United States and other coalition partners must provide their respective export controls and sanctions enforcement control agencies with sufficient resources to proactively detect and disrupt illicit Russian dual-use technology procurement networks.

Sanctions enforcement agencies must target third-country brokers and their financial enablers. Third-country brokers play a subtle yet key role in enabling export control evasion. While sanctioning these brokers can seem like a game of whack-a-mole given the ease of setting up shell companies,²³² such measures may create financial strains for Russian end

users and their middlemen.^{233,234} Enforcement agencies need to concentrate their efforts on investigating possible violations of recently activated U.S. secondary sanctions that hold financial institutions liable for facilitating transfers of CNC machine tools and other dual-use goods to Russia.

Governments need to coordinate export control enforcement efforts. Illicit Russian procurement networks seeking to acquire FPCMTs and other dual-use goods are a transnational phenomenon that requires a transnational response. Policymakers should support export controls and sanctions enforcement coordination through investigative cooperation and by assisting other governments in closing regulatory loopholes. Jurisdictions that manufacture CNC machine tools and other dual-use goods should work together further to publicly disseminate information about the conditions under which their export controls apply to overseas markets.

Export control enforcement agencies should investigate and disrupt efforts by Russian defense industry suppliers to source previously used CNC machine tools

from secondhand markets. As the ELE and SilverTech cases demonstrate, Russian defense industry suppliers may use third-country brokers to source previously used FPCMTs from secondhand markets overseas. Export control enforcement agencies must scrutinize e-commerce platforms that allow anyone to purchase previously used CNC machine tools and parts from resellers in other countries. Governments should follow the E.U.’s example by mandating that manufacturers and resellers alike require their customers to sign contracts including a “no reexport to Russia” clause.²³⁵

Governments must empower CNC machine tool manufacturers and their sales agents to mitigate their exposure to export control enforcement-related risks. Policymakers and enforcement agencies need to provide resources that help CNC machine tool market participants navigate complex export control regulations. These resources might range from advice on how manufacturers and suppliers can develop export control compliance programs to databases that provide detailed corporate data for potential business partners, thereby reducing due diligence costs for smaller companies. Policymakers should incentivize

CNC machine tool market participants to develop rigorous compliance policies and due diligence capacities by awarding bonuses to whistleblowers and rewarding self-disclosure of potential violations with mitigated penalties. Governments should also generate lists of authorized counterparties with which CNC machine tool manufacturers and distributors can safely transact business. Alternatively, policymakers may provide financial incentives to manufacturers that preinstall their products with anti-tampering systems.

Private Sector

CNC machine tool manufacturers should adopt due diligence practices to minimize the risk of their products being diverted to Russia. The Russian defense industry’s continued reliance on FPCMTs obliges CNC machine tool manufacturers to ensure their products are not used to sustain Kremlin military aggression. CNC machine tool manufacturers can minimize their exposure to export control-related risks by assessing whether customers or potential sales representatives might divert their products to Russia or ship them to a third country

known to tolerate export control evasion. CNC machine tool manufacturers should conduct due diligence of existing and potential counterparties using know-your-client best practices as articulated by export control enforcement agencies. Manufacturers should further monitor how their products circulate in secondhand markets and require foreign distributors to certify that their customers will not resell their products in the secondhand market without the manufacturers’ consent.

Financial institutions need to develop new procedures to determine whether clients are involved in diverting CNC machine tools to Russia. Financial institutions familiar with conducting know-your-client due diligence investigations for sanctions-related risk may have less experience screening their customers for export control evasion-related risk. New U.S. sanctions authorities oblige foreign banks to develop new due diligence procedures for assessing whether their customers are violating trade-based sanctions targeting the Russian defense industry’s access to CNC machine tools and other dual-use goods. These methodologies could include reviewing trade data and other

PAI to determine whether a client is shipping CNC machine tools to jurisdictions known for diverting dual-use goods to Russia. Know-your-client investigators should then compare this data to bills of lading submitted to banks as security for trade financing.

CNC machine tool manufacturers should install devices to ensure unauthorized parties do not use their products. The German-Japanese CNC machine tool conglomerate DMG Mori announced in May 2023 that it would request its clients to install a “remote management system” capable of turning the company’s products off if “removed or dismantled.”²³⁶ DMG Mori’s example should prompt other CNC machine tool manufacturers to install their products with similar systems lest they end up in the possession of Russian defense industry actors. Anti-tampering mechanisms are apparently common enough to merit discussion in online forums devoted to CNC machine tools.^{237,238} However, continued imports to Russia of previously used CNC machine tools suggest that many manufacturers do not sell their products with such systems preinstalled.

APPENDIX: COMMODITY CODES USED FOR TRADE DATA RESEARCH

For this analysis, we used the following codes from the Commodity Nomenclature of Foreign Economic Activity (Товарная Номенклатура Внешнеэкономической Деятельности, or TNVED).

845961	845941000	846242000	846290001	8459510000	8462320001
846012	846130100	846251000	8457101002	8460401000	8462330000
846022	846140110	846261001	8457109002	8461200001	8537109100
846023	846223000	846262001	8457301000	8461403100	
846024	846224000	846263001	8459210000	8461407100	
846031	846226000	846269001	8459310000	8462250000	

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WAR MACHINE

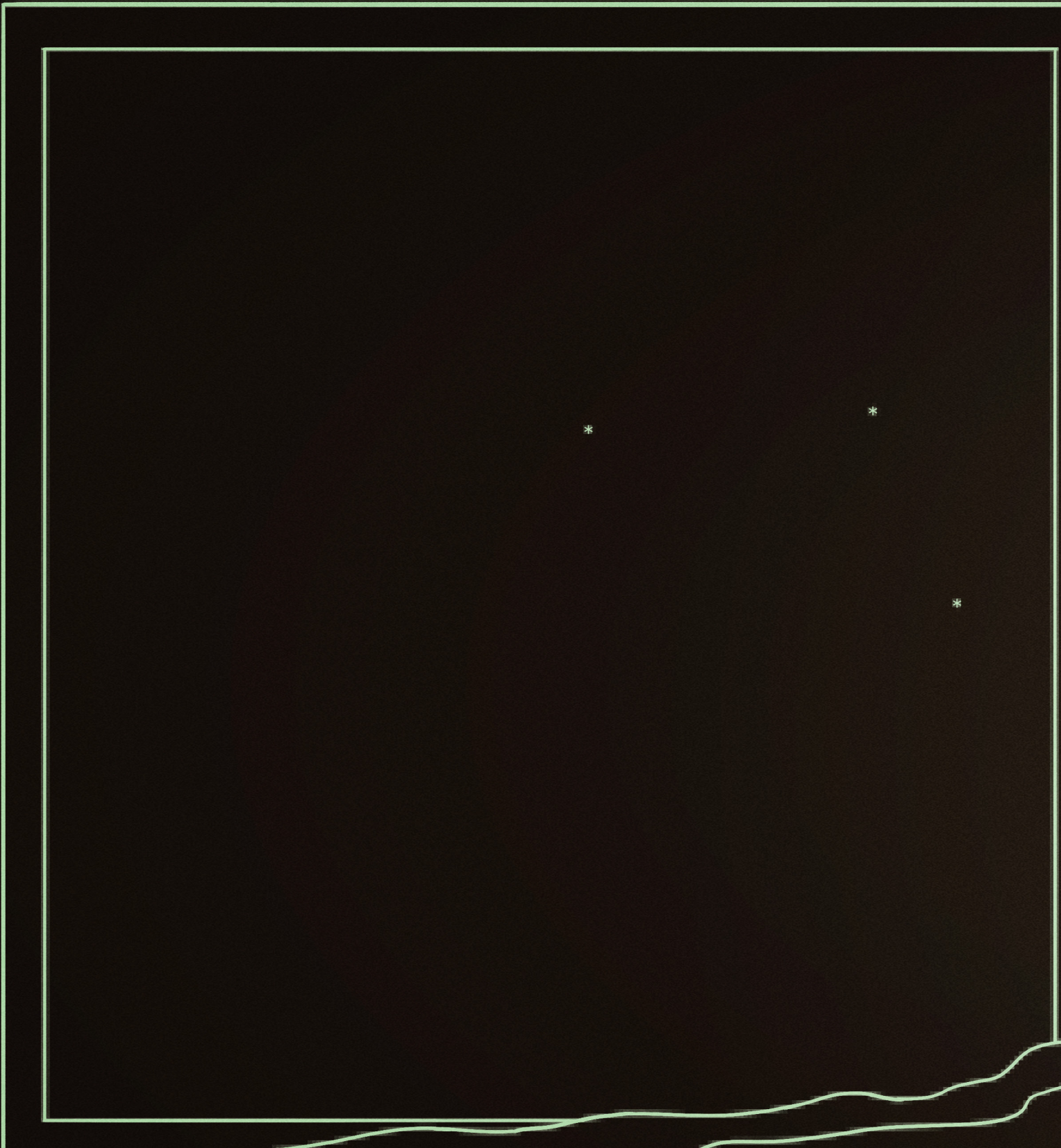
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