Large rocks containing chromite are crushed before extracting and refining the ore that yields chromium at the Mughulkhil mine in Logar Province, Afghanistan, in September 2022. Chromium is a vital component of stainless steel. (Marcus Yam / Los Angeles Times)

Materiel for Minerals: How the U.S. Can Leverage Security Assistance to Secure Supply Chains

Jahara Matisek, Morgan Bazilian, Gregory Wischer

Introduction

The U.S. Department of Defense's (DoD) inaugural 2023 National Defense Industrial Strategy (NDIS) prioritizes "resilient supply chains," which include those for critical minerals.[1] These minerals are vital for the manufacture of DoD platforms like Virginia-class attack submarines and munitions like 155mm artillery rounds.[2] In 2008, defense production manufacturers used an estimated 275,000 tons of aluminum, over 200,000 tons of copper, and nearly 90,000 tons of lead.[3] Mineral consumption directed by the DoD will likely increase further as efforts to build more naval vessels,[4] munitions,[5] and uncrewed aerial vehicles continue.[6]

However, the limited U.S. mining and refining production capacity has led to heavy reliance on imports to meet demand.[7] The United States imports, largely from China, more than 95% of its demand for rare earth elements, which are used in DDG-51

Aegis destroyers, F-35 Lightning aircraft, and other technologies.[8] This dependence on mineral imports leaves the U.S. defense industrial base vulnerable to supply chain disruptions, such as those created by export controls, civil unrest, and natural disasters. Yet, of the over 22,000 words in the NDIS, "minerals" and "rare earth elements" are mentioned only four times.[9]

In 2024, the DoD released its NDIS Implementation Plan, which recommends stockpiling and investment in mineral projects to build more resilient U.S. mineral supply chains.[10] However, the National Defense Stockpile can only be tapped during national emergencies,[11] and the DoD can only award Defense Production Act (DPA) grants for mineral projects to the four countries deemed a "domestic source" – the United States, Canada, Australia, and the United Kingdom.[12] The DoD can indeed rely largely on domestic and allied mineral supplies, but for a small group of minerals, including bismuth and tin, production in both the United States and its allies is limited, forcing it to rely heavily on non-allied countries.

China is the world's largest producer of bismuth, which is used in defense alloys and machine tooling,[13] and the largest source of U.S. bismuth imports.[14] Similarly, China is the globe's largest producer of tin, used as an alloy in bearings.[15] Peru, Bolivia, and Indonesia are the largest sources of U.S. tin imports.[16] Thus, the DoD needs to source certain minerals from non-allied countries; however, it lacks the mechanisms to do so.

The DoD could seek new authorities and additional appropriations from Congress to award DPA grants to prospective mineral projects in non-allied countries, just as it currently does in Canada.[17] But in non-allied countries, both prospective mineral projects and producing mines face stoppage risks, like civil unrest and government disputes, as seen in Mozambique with graphite mines, New Caledonia with nickel mines, and Panama with a major copper mine.[18] In allied countries, too, like Canada and Australia, prospective mineral projects confront risks in commissioning and ramping up production. Therefore, DoD investment in mineral projects does not guarantee mineral production or sustained access to mineral production. Furthermore, even if Congress deems other countries as domestic sources and hence eligible for DPA grants, the administration of President Donald Trump could prioritize allocating funds to domestic mineral projects.[19]

The DoD could, however, seek offtake agreements for uncontracted mineral production in non-allied countries. Specifically, it could seek right-of-first-refusal (ROFR) offtake agreements, which would give it the right but not the requirement to buy a certain volume of minerals at market prices. The DoD could exercise its right to offtake following supply cutoffs – such as when China imposes mineral export bans[20] – and then sell the minerals at the same prices to U.S. defense firms. The DoD could also procure minerals and distribute them to defense firms responsible for high-priority defense programs facing mineral shortages and, hence, delays.

To secure these ROFR offtake agreements, the DoD could leverage its security assistance by conditioning U.S. security assistance, military cooperation (e.g., exercises and training), and foreign military sales (FMS) to mineral-rich countries on ROFR offtake agreements. Many foreign governments highly desire U.S. military training, cooperation, and arms. From fiscal year 2018 to fiscal year 2022,[21] FMS – which includes U.S.-funded sales – totaled nearly $250 billion.[22] The United States also spent over $68 billion on security assistance from 2018 to 2022,[23] and it provided security training to over 365,000 personnel from 2015 to 2019.[24] These engagements can deepen U.S. global security ties and, when leveraged effectively, secure U.S. mineral supply chains.

Importantly, many governments in countries that possess minerals lacking in the United States and allied countries seek U.S. defense materiel (officially, "defense articles"), and many of these same governments are shareholders in mineral projects in their countries. Thus, the DoD could offer materiel-for-minerals (M4M) deals. In exchange for FMS deals and other forms of security assistance (e.g., military training, education), the DoD can require ROFR offtake agreements for specific volumes of existing mineral production. M4M deals would provide the DoD, and thus the defense industrial base, access to additional mineral supplies in the event of significant demand or limited supply. Given the Trump administration's February 2025 decision to pursue a minerals deal with the Ukrainian government in exchange for continued

U.S. security assistance to Ukraine, this represents the first modern M4M case by the U.S. government.[25]

M4M deals could offer an innovative approach to securing mineral supply chains for the DoD. By leveraging existing security assistance programs and military equipment transfers, the M4M strategy aims to establish mutually beneficial agreements with mineral-rich countries, reducing U.S. dependence on minerals from adversarial countries. While M4M deals may appear overly transactional and at odds with typical norms, such arrangements are no different than past U.S. administrations that worked out de facto deals with Persian Gulf countries to ensure the flow of oil and natural gas out of the region in exchange for American military assistance and a security umbrella.

America's Vulnerable Mineral Supply Chains

Limited domestic mineral supplies constrain the U.S. defense industrial base. The United States no longer mines and refines many minerals despite having significant reserves and a long history of refining. For example, the United States stopped mining tantalum in 1959,[26] niobium in 1960,[27] and tungsten in 2015,[28] and it stopped refining primary gallium in 1987,[29] tin in 1989,[30] and primary bismuth in 1997.[31] Moreover, new mineral projects in the United States face long lead times. S&P Global estimates that the time from first discovery to first production for a mining project in the United States is 29 years.[32] Thus, the United States faces constraints in supplying the defense industrial base's mineral demands.

The United States relies heavily on mineral imports. For 31 of the 50 minerals on the U.S. critical minerals list, imports are used to meet over 50% of U.S. consumption, and for another 12 critical minerals, imports supply 100% of U.S. consumption.[33] China – the United States' "most consequential strategic competitor" – is the largest source of U.S. mineral imports.[34] Notably, imports are vulnerable to export controls, disruption, and delays, both in the country of production and on their shipping routes to the United States.[35]

In the country of production, export-focused mineral projects can face issues including royalty disputes with the host government and protests by the local community.[36] As another example, China has imposed export controls on certain minerals to the United States amid intensifying geopolitical tensions.[37] In December 2024, China outright banned exports of antimony, gallium, and germanium to the United States,[38] which relies heavily on China for these minerals.[39] Other governments – like Indonesia, Tanzania, and Zimbabwe – have imposed export bans on certain mineral ores and concentrates, too, seeking to encourage more processing and refining in their countries.[40]

Mineral imports are also vulnerable to shipping disruptions and delays. For instance, civil unrest in Mozambique has disrupted transport routes for Syrah's graphite mine in Balama, leading Syrah to default on its loans with the U.S. International Development Finance Corporation and the U.S. Department of Energy.[41]

Inadequate DoD Plans and Policies

To build more resilient mineral supply chains, the NDIS Implementation Plan recommends stockpiling and investing in mineral projects.[42] A more robust National Defense Stockpile could indeed support the defense industrial base, but this stockpile can only be tapped during national emergencies like war.[43] It is not meant to "insulate private industry from supply shocks."[44] For example, if priority defense programs face limited commercial supplies of minerals, the National Defense Stockpile could not release minerals to the defense firms executing the program unless a war or national emergency is declared.

The DoD could invest in mineral projects through programs like the DPA and the Industrial Base and Sustainment program.[45] However, the DoD can award grants to mineral projects only in the four countries considered to be domestic sources.[46] Although the DoD can generally depend on the United States and allied countries for most minerals given their collective reserves, recycling, and substitutes, the United States and its allies heavily rely on other countries for a select group of minerals.

Yet, the DoD currently lacks policies to secure mineral supplies from these non-allied partner countries. It could seek new authority and additional appropriations

U.S. Mineral Reserves

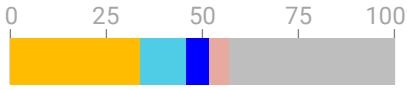
Antimony — **Years of domestic supply:** 2.7 — **U.S. import reliance:** 80%

Import Sources (2019-2022)
China, Belgium, India, Bolivia, Other

Largest Producers (mine production):
China, Tajikistan, Türkiye, Myanmar, Russia

Chromium — **Years of domestic supply:** 1.7 — **U.S. import reliance:** 74%

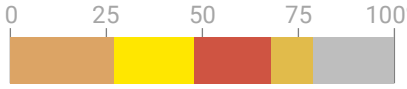
Import Sources (2019-2022)
South Africa, Kazakhstan, Canada, Russia, Other



Largest Producers (mine production):
South Africa, Kazakhstan, Türkiye, India, Finland

Tin — **Years of domestic supply:** 0 — **U.S. import reliance:** 74%

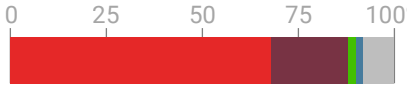
Import Sources (2019-2022)
Peru, Bolivia, Indonesia, Malaysia, Other



Largest Producers (mine production):
China, Myanmar, Indonesia, Peru, Bolivia, Brazil

Bismuth — **Years of domestic supply:** 0 — **U.S. import reliance:** 94%

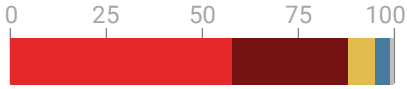
Import Sources (2019-2022)
China, South Korea, Belgium, Mexico, Other



Largest Producers (refinery production):
China, Laos, South Korea, Japan, Kazakhstan

Arsenic — **Years of domestic supply:** 0 — **U.S. import reliance:** 100%

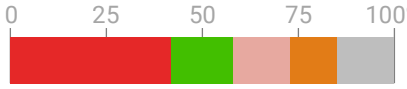
Import Sources (2019-2022)
China, Morocco, Malaysia, Belgium, Other



Largest Producers (arsenic trioxide production):
Peru, China, Morocco, Belgium, Russia

Graphite (natural) — **Years of domestic supply:** 0 — **U.S. import reliance:** 100%

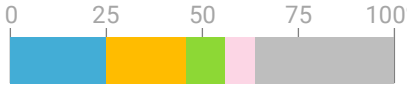
Import Sources (2019-2022)
China, Mexico, Canada, Madagascar, Other



Largest Producers (mine production):
China, Madagascar, Mozambique, Brazil, South Korea

Manganese — **Years of domestic supply:** 0 — **U.S. import reliance:** 100%

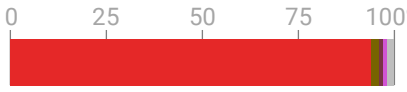
Import Sources (2019-2022)
Gabon, South Africa, Australia, Georgia, Other



Largest Producers (mine production):
South Africa, Gabon, Australia, Ghana, China

Yttrium — **Years of domestic supply:** 0 — **U.S. import reliance:** 100%

Import Sources (2019-2022)
China, Germany, France, South Korea, Other



Largest Producers (mine production):
China, Myanmar

Years of domestic supply is calculated with amount of reserves to annual consumption

Note: The criteria for inclusion on this list are (1) the United States is over 50% import-reliant, (2) the United States has less than 5 years of domestic reserves to meet annual consumption, and (3) non-allies represent more than 50% of U.S. import sources. To calculate America's reserve supply, the U.S. Geological Survey must have data on reserves and annual consumption. Thus, the list excludes minerals—including cesium, rubidium, scandium, and tungsten—for which the U.S. Geological Survey lacks U.S. reserve and/or consumption data, but the United States potentially has reserves of these minerals.

Source: Kateryna Klochko

from Congress to give DPA awards to projects in these countries. For instance, the National Defense Authorization Act for fiscal year 2024 added Australia and the United Kingdom as domestic sources,[47] and the Additional Ukraine Supplemental Appropriations Act of 2022 appropriated $600 million to the DPA, including for strategic and critical materials.[48] However, it's not a given that Congress would add more countries to that list – even allies like New Zealand – and appropriating more DPA money is not assured.

Finally, investment in prospective commercial projects does not ensure production or continued access to production. Projects face production risks, including technical (e.g., ramping up, personnel), financial (e.g., low mineral prices impacting project feasibility), and governmental (e.g., permits, licenses) issues. For example, Australian company Jervois halted the opening of its Idaho Cobalt Operation due to low cobalt prices,[49] which the U.S. government attributed to overproduction by China.[50] Moreover, even if Congress deems other countries as domestic sources eligible for DPA grants, the Trump administration could still prioritize allocating funds to domestic mineral projects, given the president's support for onshoring.[51]

The Rationale for M4M Deals

The DoD could pursue offtake agreements for uncontracted mineral production in non-allied countries. Although some mines in these countries may already have other offtake agreements, it's likely there is uncontracted production capacity the DoD could secure through new agreements. In particular, the DoD could aim to sign ROFR offtake agreements, which would give it the option but not the obligation to purchase a specific volume of minerals before they are offered to other buyers at the same price. ROFR offtake agreements are common with prospective mineral projects, but such projects often face significant risks in achieving actual mineral production. Consequently, the DoD should focus on securing offtake agreements from existing mines to ensure a reliable mineral supply.

With ROFR offtake agreements, the DoD could exercise its right to offtake – for example, following supply cutoffs imposed by China[52] – and then sell the minerals to the defense industrial base. Outside of supply cutoffs, the DoD could exercise its right to offtake minerals and sell the minerals to defense firms executing priority defense programs but lacking access to adequate mineral volumes and facing corresponding delays. Alternatively, when the defense industrial base can access sufficient mineral volumes, the DoD does not have to execute ROFR offtake agreements. Simply put, ROFR offtake agreements effectively act as a buffer mineral supply that the DoD can tap when necessary.

To secure ROFR offtake agreements, the DoD could invest in mineral projects. Many foreign governments want increased investment in their mineral sectors; thus, direct investment may encourage mines with state ownership to sign ROFR offtake agreements. However, the DoD is restricted from issuing grants mineral projects outside of the United States, Canada, Australia, and the United Kingdom. Furthermore, even if investment in other countries was made possible, it would be considered risky given the operational and jurisdictional risks with mineral projects. Consequently, the DoD should avoid directly investing in overseas mineral projects in non-allied countries.

Instead, the DoD could be leveraged to offer arms sales and security training to non-allied countries in exchange for mineral agreements. For example, the DoD in tandem with the Department of State (DoS) can condition certain FMS on securing ROFR offtake agreements. Many governments in non-allied countries want to acquire U.S. defense articles, giving the DoD and DoS leverage to negotiate such agreements, assuming Congress will also consent to such deals. Importantly, many of these governments hold significant shares in mineral projects in their countries; therefore, they can negotiate such offtake agreements.

For instance, the Kazakh government, which has requested to buy U.S. defense articles,[53] has the largest stake in the Eurasian Resources Group (ERG),[54] which is a major producer of chromite in Kazakhstan.[55] Similarly, the Indonesian government is a major U.S. arms purchaser,[56] and Indonesia's state-owned holding mining company, Mining Industry Indonesia (MIND ID), has ownership stakes in several major mineral projects, including for tin.[57] These foreign governments exercise significant influence over their mineral projects. Given the lack of chromite and tin production

in the United States and allied countries, these minerals are targets for ROFR offtake agreements.

Importantly, the foreign government counterparty could hold ownership stakes in mineral projects in not only the home country but also in third-party countries. For example, the Kazakhstan government, through ERG, has ownership stakes not only in Kazakh projects but also in those in Africa and Brazil.[58] A hypothetical ROFR offtake agreement could feature a project with ownership stakes held by a foreign government outside that government's own country, too.

The DoD should negotiate M4M deals with foreign governments as means of providing itself, and thus the defense industrial base, with access to additional mineral supplies as needed. Using the FMS process to secure ROFR offtake agreements also leverages existing role of the DoS – primarily through the respective U.S. embassy's Office of Defense Cooperation – in the FMS process and Minerals Security Partnership.[59] M4M deals would strengthen both U.S. military partnerships and mineral supply chains. These deals could also help limit China's access to overseas mineral supplies by locking up mineral supplies that Chinese companies could previously have tapped.

Considering that the first Trump administration was particularly active in facilitating FMS deals and strengthening U.S. mineral supply chains, the current Trump administration will likely remain open to such deals.[60] Furthermore, the administration may support M4M deals because they are cost-neutral to the U.S. government, as seen with the tentative minerals deal with Ukraine in February 2025.

Using Foreign Military Sales to Secure Minerals

The FMS program involves selling and exporting American-made defense articles to eligible foreign purchasers, and a similar process of direct commercial sales could also be leveraged within the construct of M4M.[61] Defense articles include not only platforms, munitions, and their components but also properties, materials, and equipment that support military assistance, as well as machinery and tools for manufacturing defense articles.[62] The FMS program is governed by the Foreign Assistance Act of 1961,[63] International Security Assistance and Arms Export Control Act of 1976,[64] subsequent amendments, federal regulations like the U.S. Munitions List, and executive branch policies, including the Conventional Arms Transfer (CAT) policy.[65] The Security Assistance Management Manual (SAMM) then provides DoD with guidance on managing and implementing the FMS program.[66]

In the FMS program, the DoD acts as an intermediary by procuring defense articles on behalf of foreign purchasers. While these counterparts ultimately pay for the defense articles, they benefit from the DoD's technical and acquisition expertise. The Defense Security Cooperation Agency (DSCA) within the DoD manages the FMS program, ensuring proper accounting procedures and that all transactions align with U.S. defense and foreign policy objectives.

The FMS program is overseen by the DoS, which has the responsibility to notify Congress about certain deals. This process provides transparency and allows Congress to review the terms of significant FMS transactions.[67] Although Congress has the authority to review, block, and restrict these deals, these legislative actions are subject to presidential veto, highlighting the executive branch's ultimate control over arms transfers. Other arms transfer programs, including Foreign Military Financing and Excess Defense Articles, are also classified under the FMS program.[68]

Demand has increased for FMS since Russia invaded Ukraine in 2022.[69] In the government's fiscal year 2023, the FMS program totaled $66.2 billion in sales, with over $80 billion in 2024.[70] In the first two weeks of October 2024, for example, the DSCA approved selling MK 54 MOD 0 lightweight torpedoes to India;[71] the Electronic Attack Mission System to Italy;[72] Sentinel radar systems to Romania;[73] AIM-9X Block II Sidewinder missiles, AGM-114R3 Hellfire II missiles, ammunition for artillery systems, machine guns, and tanks to Saudi Arabia;[74] and munitions for the Guided Multiple Launch Rocket System and Army Tactical Missile System to the United Arab Emirates.[75]

The FMS process begins with a letter of request sent by the eligible foreign purchaser to a U.S. security cooperation organization, usually the Office of Defense

A general view of granite being mined on Feb. 26, 2025, in the Zhytomyr region of Ukraine. (Kostiantyn Libero v / Libkos / Getty Images)

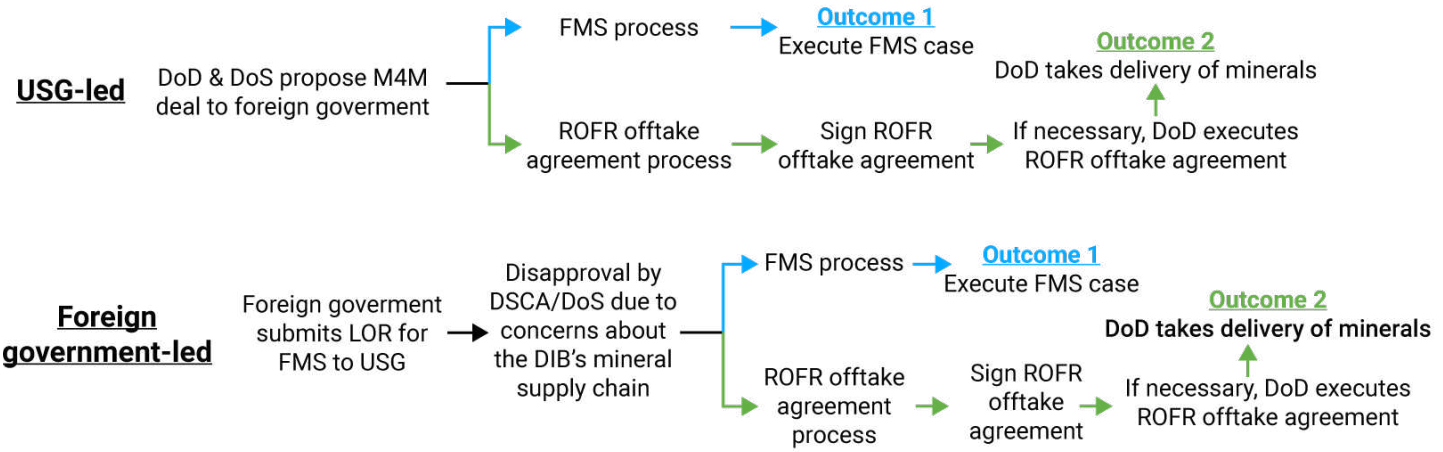
Cooperation, or directly to the DCSA or other relevant U.S. government agency.[76] The letter includes the foreign purchaser's desired defense articles. While the FMS process begins there, the U.S. government can indeed signal its support for FMS deals, effectively encouraging foreign purchasers to pursue them.[77] For instance, Trump, in his first administration, was vocal in his support of selling defense articles to foreign governments, such as Saudi Arabia.[78]

Upon receipt of the letter of request, the requisite U.S. government agency, usually the DCSA, evaluates the proposed deal for compliance with stated U.S. national security goals, the ability of the purchasing nation to pay for the acquisition, and other criteria, including the purchasing nation's military interoperability with the U.S. military. The FMS case is then sent to the State Department, which evaluates the deal based on overall policy objectives and handles the requisite notification to Congress. Generally, DCSA handles the execution of FMS, while the State Department focuses on interagency cooperation and overall alignment with U.S. foreign policy goals.

For most FMS cases, the State Department must notify Congress before approving an FMS deal. As previously stated, Congress can block or restrict an FMS deal through a joint resolution. However, the president can veto the resolution. Additionally, the president (or the secretary of state with delegated authority) can issue a declaration of emergency and bypass congressional input. This action occurred in late 2023 when then-Secretary of State Antony Blinken utilized emergency authorities on a sale of 155mm artillery rounds to Israel "given the urgency of Israel's defensive needs."[79]

When the FMS case clears all approval processes, the U.S. government will acquire the defense articles on behalf of the foreign purchaser, which covers the full cost associated with the deal.[80] The DoD will sometimes pair FMS with other military assistance and training to further enhance the defense relationship and improve interoperability.

The Process of M4M Deals



Sources: Jahara Matisek, Gregory Wischer, Morgan Bazilian

M4M Deal Structure

The DoD could pursue M4M deals by linking ROFR mineral offtake agreements with FMS deals and other security assistance arrangements. The FMS process would remain unchanged, and the ROFR offtake agreement negotiation would run concurrently. Due to the DoD's discretion to approve FMS deals on a case-by-case basis, the DoD could condition specific FMS transactions on securing ROFR mineral offtake agreements.

Just as the DoD is an intermediary for the foreign eligible purchaser in FMS deals, it would also act as such in executing offtake agreements. A defense firm would request that the DoD execute a mineral offtake, and it would then determine whether it should and for what volume. The DoD could then use DPA funds to execute the purchase of minerals from non-domestic sources.[81] Under a DPA exemption, the DoD can purchase industrial resources – including minerals – "necessary to assure the availability to the United States of overseas supplies."[82] This exemption exempts the DoD from other laws, such as restricting contract solicitations to domestic sources.[83]

Defense firms would be responsible for paying the resulting costs, including duties; therefore, both FMS deals and ROFR offtake agreements would be cost-neutral, meaning no additional expenditures are incurred by the U.S. government. After taking delivery of the minerals, the DoD would resell them to the requesting defense firm. The DoD would have to develop corresponding procedures for considering offtake requests, including how to adjudicate multiple bids for limited mineral volumes.[84]

Notably, then-President Joe Biden signed a waiver of DPA purchase requirements for critical and strategic materials, suspending purchase requirements such as a presidential determination, spending limitations, and congressional notifications.[85] The current administration could now sign and, if necessary, execute ROFR mineral offtake agreements.

To discourage foreign counterparts from reneging on mineral offtake agreements after receiving defense articles, the DoD could withhold spare parts. Under the current CAT policy, the DoD can at any time "cease the transfer of or future support for a transferred defense article or service."[86] The DoD could condition security assistance and training programs, too, on the foreign government upholding ROFR offtake agreements. Additionally, if foreign governments seek to circumvent ROFR offtake agreements by procuring defense articles directly from U.S. arms manufacturers via Direct Commercial Sales licenses, the State Department can determine that those sales must "be required to proceed through the FMS process."[87]

The proposed M4M deal structure complies in principle with existing statutes. The Foreign Assistance Act says

that U.S. policy for security assistance is "based upon the principle of effective self-help and mutual aid,"[88] while the AECA states that FMS should "be approved only when they are consistent with the foreign policy of the United States,"[89] which includes strengthening U.S. supply chains for minerals.[90] The AECA adds that the deals should consider "the impact of the sales on programs of social and economic development,"[91] and mineral offtake agreements would indeed be economically beneficial to the foreign counterpart.

The M4M deal structure also aligns with the CAT policies of both Biden and the first Trump administration. Biden's CAT Policy supported U.S. efforts to "strengthen the United States manufacturing and defense industrial base and ensure resiliency in global supply chains."[92] The first Trump administration's CAT Policy was also explicit: arms transfers should "strengthen the manufacturing and defense industrial base."[93] Given the first Trump administration's CAT Policy, the current Trump administration could issue a CAT policy that emphasizes the importance of arms transfers in strengthening the defense industrial base – which M4M deals would do.

The security assistance portion of the M4M deal structure aligns with U.S. policy, too. Providing arms, training, and military equipment to a foreign government makes them more militarily effective, a core rationale for U.S. security assistance.[94] Such security assistance also increases U.S. military influence in increasingly important non-allied countries like Indonesia vis-à-vis China.[95]

Example M4M Deal: Indonesia

The DoD consumes an estimated 2,600 metric tons of tin annually.[96] Yet, the United States has not mined tin since 1993, and it has not smelted it since 1989.[97] The National Defense Stockpile contains 3,578 metric tons of tin as of September 30, 2022.[98] Consequently, the United States writ large relies on imports to meet 74% of its domestic demand for refined tin, with the other 26% of consumption being met by recycled tin.[99] Non-allied countries like Peru, Bolivia, and Indonesia are the largest sources of U.S. imports.[100]

Indonesia specifically is a major producer of tin,[101] and PT Timah Tbk, the country's largest tin producer, is majority-owned by the government of Indonesia.[102] Indonesia is also a major buyer of U.S. defense articles through the FMS program. In February 2022, the DSCA certified a nearly $14 billion deal for 36 F-15ID aircraft and related equipment.[103] DSCA has previously approved other Indonesian FMS deals involving MV-22 Osprey aircraft,[104] AIM-120C-7 missiles,[105] and AIM-9X-2 Sidewinder missiles.[106] The DoD could condition and entice future FMS deals with Indonesia based on the DoD signing a ROFR tin offtake agreement with PT Timah Tbk.

Other governments that the U.S. government could target with M4M deals are Arabian Gulf countries like Saudi Arabia and the United Arab Emirates. Traditionally, these countries are major purchases of U.S. defense articles, and while these countries are not major mineral producers, their state-owned enterprises – including state investment firms like Saudi Arabia's Manara Minerals – are taking significant stakes in mineral projects and companies in other countries. Therefore, the DoD could condition future FMS deals with these governments on them signing ROFR mineral offtake agreements. The DoD and State Department could identify other potential target governments that both produce minerals and want to purchase U.S. defense articles.

M4M Implementation

U.S. policymakers should consider the M4M approach as part of a broader strategy to secure America's mineral supply chains. This includes investing in domestic mineral production and processing capabilities, supporting research into alternative materials and recycling technologies, strengthening partnerships with allied nations to diversify supply chains, and developing comprehensive risk assessment and mitigation strategies for mineral supply disruptions. M4M deals simply offer another tool for addressing U.S. mineral supply chain vulnerabilities. However, its implementation must be carefully integrated into a comprehensive approach to mineral security and balanced against potential negative consequences.

Implementing the M4M strategy will require coordination among various U.S. government agencies, namely the DoD and DoS. Successful execution will

U.S. Secretary of State Antony Blinken and Norwegian Foreign Minister Espen Barth Eide sign a memorandum of cooperation on "High-Standard, Market-Oriented Trade of Critical Minerals," strengthening their partnership on clean energy, on Sept. 30, 2024, in Washington, D.C. (Kevin Dietsch / Getty Images)

depend on identifying suitable partner countries with both access to mineral resources and interest in obtaining U.S. military equipment and/or assistance. Negotiating agreements that balance mineral access with appropriate levels of military support will be crucial, as will ensuring compliance with existing laws and regulations governing arms sales and technology transfers. Developing mechanisms to monitor and enforce M4M agreements over time will also be essential for long-term success.

If the U.S. government indeed pursues M4M deals, it must be responsive to changing global conditions. Regular reassessment of the M4M approach, its impacts, and its alignment with broader U.S. foreign policy and national security objectives will be important. These reassessments could involve adjusting the terms of agreements, exploring new partnerships, or developing alternative strategies as geopolitical and economic landscapes evolve. The U.S. government should establish clear metrics for evaluating the effectiveness of M4M agreements and be prepared to modify or terminate arrangements that do not meet established goals or that generate negative consequences.

Lastly, the success of an M4M strategy will depend on robust oversight and accountability mechanisms. Transparent reporting on the outcomes of these agreements, including their impact on mineral supply chains, partner nation development, and regional stability will be essential for maintaining domestic and international support for the program.

Benefits and Risks

The M4M approach presents several benefits. It provides a mechanism for securing mineral access without requiring new legislative authorities or appropriations. It capitalizes on existing relationships and programs such as the FMS program to create mutually beneficial arrangements with mineral-rich countries. Furthermore, it offers flexibility through ROFR offtake agreements, allowing the DoD to access minerals without committing to unnecessary

purchases. Critically, M4M deals could reduce reliance on adversarial countries, namely China, for critical minerals.

The M4M strategy has the potential to reshape global mineral supply chains and influence geopolitical relationships to the United States' benefit. The DoD would not only strengthen its position in mineral-rich countries but also offer a demand alternative to China, helping diversify global mineral supply networks. U.S. allies could also adopt the M4M strategy and further lock out adversaries like China and Russia from accessing some mineral supplies.

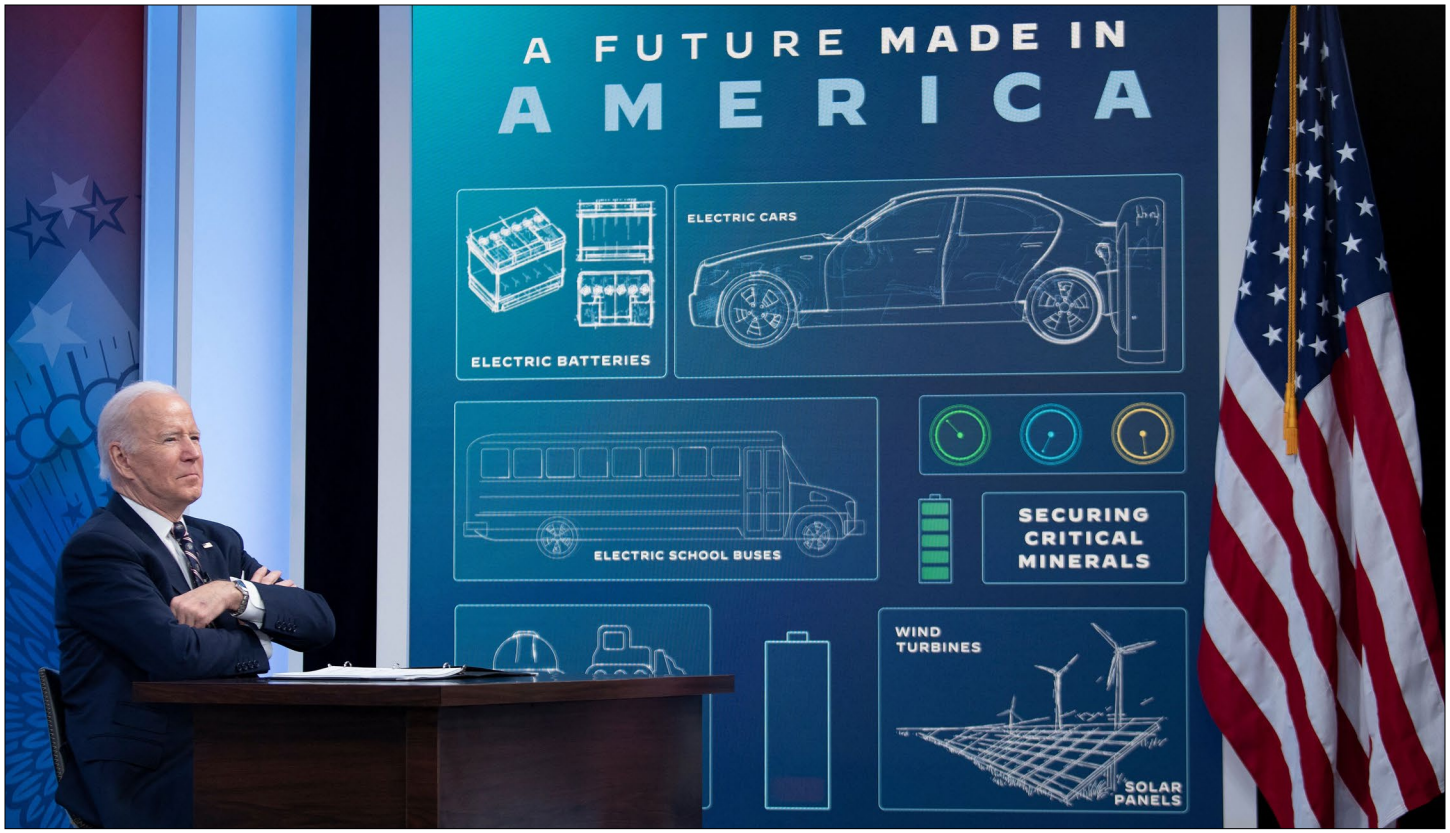
However, the M4M approach also poses risks. First, M4M deals for minerals lacking in the United States could dissuade investment in domestic stockpiling, recycling, and substitutes for those minerals. Domestic sources of minerals would be less prone to disruption than those from M4M deals, and they could also be transported to domestic defense firms more quickly, which is why domestic mineral production and stockpiling should be prioritized. The U.S. government, therefore, should view M4M deals as part of a broader strategy that includes developing domestic capabilities and fostering innovation in mineral extraction and processing technologies.

Second, exchanging military equipment for mineral access could exacerbate regional tensions and contribute to arms proliferation. Governments receiving advanced weaponry might use it to repress domestic populations or engage in armed conflict with neighboring countries; however, these very same governments may be dissuaded from acting in such a manner in order to maintain access to U.S. defense materiel. These actions could lead to increased violence and humanitarian crises, which contradict broader U.S. foreign policy goals of promoting peace and stability. Given the exchange of arms for minerals, other governments and international institutions may also view M4M deals as unethical and exploitative, harming U.S. diplomatic standing. Thus, the U.S. government must engage in careful diplomacy and transparent communication about the mutual benefits of M4M agreements.

Third, increased mineral extraction activities could harm the environment by contributing to deforestation, water pollution, and habitat destruction, among other effects. Moreover, local communities might face displacement as governments prioritize mineral production to secure military deals. These impacts could damage the United States' reputation and contravene its commitments to environmental protection and human rights. To mitigate these risks, ROFR mineral offtake agreements could include provisions that require environmental protection and community engagement.

Policy Recommendations

1. **The White House should update its CAT policy to emphasize that one of the objectives of its arms transfers policy is to strengthen the defense industrial base's supply chains, including for critical minerals.** The Trump administration could be amenable to such an update since during the president's first term, CAT policy noted that the arms transfer action plan "should account for the competitive environment in which the United States must operate and the need to protect and expand our technological advantages and our defense industrial base."[107] The mineral supply chains of the defense industrial base are vulnerable; therefore, the U.S. government's arms transfer policy could help protect these supply chains and, hence, the defense industrial base.
2. **State Department leadership should direct its chiefs of mission and their requisite country teams to prepare Integrated Country Strategies (ICSs) that explicitly include M4M deals.**[108] An ICS is the four-year strategy that articulates priorities in a given country, including mission goals and objectives for arms transfers and other cooperation.[109] Drafting the ICS is led by the chief of mission and includes input from other relevant government agencies, including the DoD. By including M4M deals in an ICS, U.S. embassies around the world would have direct tasking to pursue those deals. Embassy teams would also be responsible for favorably framing these deals as mutually beneficial with the foreign counterparts.
3. **DoD's Manufacturing Capability Expansion & Investment Prioritization Office should develop a list of target minerals and corresponding target countries for M4M deals.** This list of minerals



U.S. President Joe Biden speaks during a virtual meeting on securing critical mineral supply chains in Washington, D.C., on Feb. 22, 2022. (Brendan Smialowski / AFP via Getty Images)

lacking in both the United States and allied countries would be distributed to the U.S. embassy teams in target countries. Additionally, the office oversees the DPA Title III program, which would be used to execute the ROFR mineral offtake agreements. Consequently, the office would be responsible for drafting procedures for receiving and reviewing requests to execute these offtake agreements, as well as determining mineral allocations to requesting defense firms.

4. **State Department leadership should assign responsibilities for drafting preliminary M4M deals to the economic sections and Offices of Defense Cooperation at U.S. embassies.** The economic sections at U.S. embassies understand the mining industries in the host countries, while the security cooperation offices understand the host countries' interests in U.S. defense articles. The draft deals would then be sent to State Department and Defense Department headquarters for final drafting before being presented to the foreign counterparts. The embassy teams would then be responsible for negotiating the M4M deal, subject to final approval by DoD and State Department leadership.
5. **The DSCA should issue a policy memo on minerals, noting that letters of request for FMS deals can be denied due to concerns about the mineral supply chains of the U.S. defense industrial base.** This policy memo can be used as a predicate for the DSCA and State Department to deny FMS letters from foreign governments with whom the DoD seeks ROFR mineral offtake agreements. The disapproval notice would effectively notify the foreign government that the U.S. government would reconsider the request if the foreign government signed an ROFR offtake agreement.

Conclusion

The DoD faces significant challenges in securing its mineral supply chains, which are crucial in both defense platforms and munitions. The DoD's reliance on foreign mineral sources poses substantial risks to the defense industrial base and, by extension, U.S.

national security. The proposed M4M deal framework offers an option for mitigating these risks.

By carefully implementing and continuously refining the M4M deal structure over time, the DoD has the potential to strengthen its global partnerships and secure its mineral supplies in an increasingly competitive world. However, success will require sustained commitment, careful diplomacy, and a willingness to address the ethical and practical challenges that arise from linking military assistance to mineral extraction.

Future research on M4M deals could focus on assessing the legal and regulatory frameworks necessary to support M4M deals, to include expanding direct commercial sales within the same construct, analyzing the potential economic impacts on both the defense industrial base and partner nations, evaluating the environmental and social impacts of increased mineral extraction in partner countries, and exploring alternative strategies for securing mineral supplies, including increased domestic production and recycling initiatives

As U.S.-China competition intensifies and the defense industrial base's mineral demand grows, M4M deals could provide the DoD with another tool to strengthen the supply chains of the defense industrial base.

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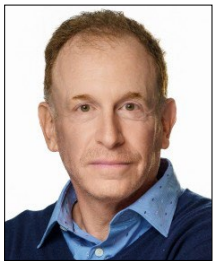

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Endnotes

1 U.S. Department of Defense, "National Defense Industrial Strategy," 2023, https://www.businessdefense.gov/docs/ndis/2023-NDIS.pdf.

2 Valerie Bailey Grasso, "Rare Earth Elements in National Defense: Background, Oversight Issues, and Options for Congress," R41744, Congressional Research Service, September 17, 2013, https://www.everycrsreport.com/files/20130917_R41744_f524dd012737e617d9a79c8bf3a62ad071a52904.pdf; and James McKeigue, "Russia's War in Ukraine Boosts Copper Demand," Fastmarkets, July 8, 2024, https://www.fastmarkets.com/insights/russias-war-in-ukraine-boosts-copper-demand/.

3 Institute for Defense Analyses, "Key Materials for High-Priority Weapon Systems, and Assessing Risks to Their Supply: A Report for the U.S. Defense National Stockpile Center," July 31, 2008, in U.S. Department of Defense, "Reconfiguration of the National Defense Stockpile Report to Congress," April 2009, B-2, https://www.scribd.com/document/16483302/Reconfiguration-of-the-National-Defense-Stockpile-Report-to-Congress.

4 Paul McLeary and Connor O'Brien, "Exclusive: Navy Projects Fleet Will Expand to nearly 400 Ships," POLITICOPro, March 19, 2024, https://subscriber.politicopro.com/article/2024/03/navy-projects-fleet-will-expand-to-nearly-400-ships-00147840.

5 Josh Luckenbaugh, "Just in: Army Modernizing, Expanding Munitions Production Facilities," National Defense Magazine, February 5, 2024, https://www.nationaldefensemagazine.org/articles/2024/2/5/army-modernizing-expanding-munitions-production-facilities.

6 Jen Judson, "Army Picks Two Companies to Get Small Drones to Brigade Combat Teams," DefenseNews, September 12, 2024, https://www.defensenews.com/land/2024/09/12/army-picks-two-companies-to-get-small-drones-to-brigade-combat-teams/.

7 Nedal T. Nassar, Elisa Alonso, and Jamie L. Brainard, "Investigation of U.S. Foreign Reliance on Critical Minerals—U.S. Geological Survey Technical Input Document in Response to Executive Order No. 13953 Signed September 30, 2020," Report 2020–1127, U.S. Geological Survey, revised December 7, 2020, 2, https://pubs.usgs.gov/of/2020/1127/ofr20201127.pdf.

8 Daniel J. Cordier, "Rare Earths," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 144, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-rare-earths.pdf; and Valerie Bailey Grasso, "Rare Earth Elements in National Defense: Background, Oversight Issues, and Options for Congress," R41744, Congressional Research Service, September 17, 2013, https://www.everycrsreport.com/files/20130917_R41744_f524dd012737e617d9a79c8bf3a62ad071a52904.pdf.

9 The Nationa Defense Industrial Strategy—with over 22,000 words—only mentions "minerals" and "rare earth elements" four times. See U.S. Department of Defense, "National Defense Industrial Strategy," 2023, 8, 17–18, 43, https://www.businessdefense.gov/docs/ndis/2023-NDIS.pdf.

10 U.S. Department of Defense, "National Defense Industrial Strategy: Implementation Plan for FY2025," 2024, 19, 25, 30–32, 69, 80, https://www.businessdefense.gov/docs/ndis/NDIS-Implementation-Plan-FY2025.pdf.

11 50 U.S.C. §98a(b), https://uscode.house.gov/view.xhtml?hl=false&edition=prelim&req=granuleid%3AU.S. C-prelim-title50-section98a&num=0&saved=%7CKHRpdGxlOjUwIHNlY3Rpb246OTggZWRpdGlvbjpwcmVsaW0p%7C%7C%7C0%7Cfalse%7Cprelim.

12 50 U.S.C. §4552(7), https://uscode.house.gov/view.xhtml?path=/prelim@title50/chapter55&edition=prelim.

13 Under Secretary of Defense for Acquisition, Technology and Logistics, "Strategic and Critical Materials 2015 Report on Stockpile Requirements," U.S. Department of Defense, January 2015, appendix 6-9, https://www.hsdl.org/?view&did=764766.

14 Amy C. Tolcin, "Bismuth," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 46–47, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-bismuth.pdf.

15 Under Secretary of Defense for Acquisition, Technology and Logistics, "Strategic and Critical Materials 2015 Report on Stockpile Requirements," U.S. Department of Defense, January 2015, appendix 6-85, https://www.hsdl.org/?view&did=764766.

16 Chad A. Friedline, "Tin," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 184–185, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-tin.pdf.

17 The U.S. Department of Defense has committed approximately $65 million in Defense Production Act grants to Canadian mineral projects. See "Department of Defense Awards $14.7 Million to Enhance North American Cobalt and Graphite Supply Chain," U.S. Department of Defense, May 16, 2024, https://www.defense.gov/News/Releases/Release/Article/3777044/department-of-defense-awards-147-million-to-enhance-north-american-cobalt-and-g/; "Department of Defense Awards $20 Million to Establish Sustainable Cobalt Sulfate Production for Large Capacity Battery Supply Chain," U.S. Department of Defense, August 19, 2024, https://www.defense.gov/News/Releases/Release/Article/3877791/department-of-defense-awards-20-million-to-establish-sustainable-cobalt-sulfate/; "Department of Defense Awards $12.9 Million to Increase Production of Active Materials for Lithium Iron Phosphate Cathodes," U.S. Department of Defense, September 26, 2024, https://www.defense.gov/News/Releases/Release/Article/3917579/department-of-defense-awards-129-million-to-increase-production-of-active-mater/; and "Department of Defense Makes Investment to Strengthen the Tungsten Supply Chain," U.S. Department of Defense, December 13, 2024, https://www.defense.gov/News/Releases/Release/Article/4000947/department-of-defense-makes-investment-to-strengthen-the-tungsten-supply-chain/.

18 Paul-Alain Hunt and Amy Bainbridge, "Syrah Declares Force Majeure for Its Graphite Mine in Mozambique," Bloomberg, December 11, 2024, https://www.bloomberg.com/news/articles/2024-12-11/syrah-declares-force-majeure-for-its-graphite-mine-in-mozambique; Gus Trompiz, "Explainer: What New Caledonia Riots Mean for the Nickel industry," Reuters, May 22, 2024, https://www.reuters.com/markets/commodities/what-new-caledonia-riots-mean-nickel-industry-2024-05-22/; and Valentine Hilaire and Divya Rajagopal, "Explainer: What Happens Next after Panama's Top Court Strikes Down First Quantum Contract?" Reuters, November 28, 2023, https://www.reuters.com/markets/commodities/what-happens-next-after-panamas-top-court-strikes-down-first-quantum-contract-2023-11-28/.

19 Caroline Peachey, "Explainer: What Trump 2.0 Means for the Mining Industry," Mining Technology, November 7, 2024, https://www.mining-technology.com/features/explainer-what-trump-2-0-means-for-the-mining-industry/.

20 Gregory Wischer, Morgan Bazilian, and Jahara Matisek, "China's Mineral Export Ban Strikes at the U.S. Defense Industrial Base," The Diplomat, December 6, 2024, https://thediplomat.com/2024/12/chinas-mineral-export-ban-strikes-at-the-us-defense-industrial-base/.

21 The U.S. government's fiscal year is October 1–September 30.

22 Christina L. Arabia, Nathan J. Lucas, and Michael J. Vassalotti, "Transfer of Defense Articles: U.S. Sale and Export of U.S.-Made Arms to Foreign Entities," R46337, Congressional Research Service, updated March 23, 2023, 3, https://crsreports.congress.gov/product/pdf/R/R46337/4.

23 Center for International Policy, "Security Sector Assistance Database," accessed December 31, 2024, https://internationalpolicy.org/programs/sam/security-sector-assistance-database/.

24 Center for International Policy, "Foreign Military Training Database," accessed December 31, 2024, https://internationalpolicy.org/programs/sam/foreign-military-training-database/.

25 Jane Lytvynenko, Ian Lovett, and Alan Cullison, "U.S. and Ukraine Prepare to Sign Minerals Deal—with Critical Details Unresolved," Wall Street Journal, February 26, 2025, https://www.wsj.com/world/zelensky-says-details-of-u-s-deal-for-resources-still-need-to-be-worked-out-aa763dab.

26 Chad A. Friedline, "Tantalum," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 178, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-tantalum.pdf.

27 Chad A. Friedline, "Niobium (Columbium)," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 126, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-niobium.pdf.

28 Kim B. Shedd, "Tungsten," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 190, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-tungsten.pdf.

29 Brian W. Jaskula, "Gallium," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 74, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-gallium.pdf.

30 Chad A. Friedline, "Tin," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 184, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-tin.pdf.

31 Amy C. Tolcin, "Bismuth," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 46, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-bismuth.pdf.

32 Mohsen Bonakdarpour, Frank Hoffman, and Keerti Rajan, "Mine Development Times: The U.S. in Perspective," S&P Global, June 2024, 8, https://cdn.ihsmarkit.com/www/pdf/0724/SPGlobal_NMA_DevelopmentTimesU.S. inPerspective_June_2024.pdf.

33 U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 6, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024.pdf.

34 U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 6–7, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024.pdf; and U.S. Department of Defense, "2022 National Defense Strategy," October 27, 2022, iii, https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.pdf.

35 Gregory Wischer, Morgan Bazilian, and Jahara Matisek, "China's Mineral Export Ban Strikes at the U.S. Defense Industrial Base," The Diplomat, December 6, 2024, https://thediplomat.com/2024/12/chinas-mineral-export-ban-strikes-at-the-us-defense-industrial-base/.

36 Oliver Griffin and Steve Orlofsky, "Miner South32 Files Request for Arbitration in Colombia Royalty Dispute," Reuters, March 31, 2020, https://www.reuters.com/article/world/miner-south32-files-request-for-arbitration-in-colombia-royalty-dispute-idU.S. KBN21I33U/; and Marco Aquino and Elaine Hardcastle, "Protesters Blockade Peru's Las Bambas Mine after Talks Fall through," Reuters, April 10, 2024, https://www.reuters.com/world/americas/protesters-blockade-perus-las-bambas-mine-after-talks-fall-through-2024-04-10/.

37 For a list of minerals subject to China's export controls, see Gregory Wischer, "On November 15, 2024, China Ministry of Commerce...." LinkedIn, November 21, 2024, https://www.linkedin.com/posts/gregory-wischer-009887142_prc-export-control-lists-of-dual-use-items-activity-7265359130301710339-nkAJ?utm_source=share&utm_medium=member_desktop.

38 China's Ministry of Commerce, "Announcement No. 46 of 2024 of the Ministry of Commerce on Strengthening Export Control of Relevant Dual-Use Items to the United States," December 3, 2024, https://www.mofcom.gov.cn/zwgk/zcfb/art/2024/art_3d5e990b43424e60828030f58a547b60.html.

39 Kateryna Klochko, "Antimony," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 34, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-antimony.pdf; Brian W. Jaskula, "Gallium," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 74, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-gallium.pdf; and Amy C. Tolcin, "Germanium," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 80, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-germanium.pdf.

40 International Energy Agency, "Prohibition of the Export of Nickel Ore," updated March 19, 2024, https://www.iea.org/policies/16084-prohibition-of-the-export-of-nickel-ore; David Whitehouse, "Exclusive: Tanzania to Ban Unrefined Lithium Exports from May 2024," The Africa Report, November 2, 2023, https://www.theafricareport.com/326733/exclusive-tanzania-to-ban-unrefined-lithium-exports-from-may-2024/; and "Zimbabwe's Lithium Ore Export Ban Highlights Africa's Lithium Potential," Benchmark Source, December 23, 2022, "https://source.benchmarkminerals.com/article/zimbabwes-lithium-ore-export-ban-highlights-africas-lithium-potential.

41 Syrah Resources, "Balama Force Majeure," ASX announcement/media release, December 12, 2024, https://company-announcements.afr.com/asx/syr/76380d8f-b80e-11ef-8ebe-de7546lb6fbc.pdf.

42 U.S. Department of Defense, "National Defense Industrial Strategy: Implementation Plan for FY2025," 2024, 19, 25, 30–32, 69, 80, https://www.businessdefense.gov/docs/ndis/NDIS-Implementation-Plan-FY2025.pdf.

43 50 U.S.C. §98a(b)–(c), https://uscode.house.gov/view.xhtml?hl=false&edition=prelim&req=granuleid%3AU.S. C-prelim-title50-section98a&num=0&saved=%7CKHRpdGxlOjUwIHNlY3Rpb246OTggZWRpdGlvbjpwcmVsaW0p%7C%7C%7C0%7Cfalse%7Cprelim.

44 Bureau of Industry and Security, U.S. Department of Commerce, "Request for Public Comments on the Potential Market Impact of the Proposed Fiscal Year 2026 Annual Materials Plan From the National Defense Stockpile Market Impact Committee," Federal Register 89, no. 168 (August 29, 2024): 70167, https://www.govinfo.gov/content/pkg/FR-2024-08-29/pdf/2024-19422.pdf.

45 Wes Shinego, "DOD Leverages Defense Production Act to Galvanize Critical Supply Chains," U.S. Department of Defense, December 4, 2024, https://www.defense.gov/News/News-Stories/Article/Article/3985393/dod-leverages-defense-production-act-to-galvanize-critical-supply-chains/.

46 50 U.S.C. §4552(7), https://uscode.house.gov/view.xhtml?path=/prelim@title50/chapter55&edition=prelim. Even mineral production in allied countries is not totally secure. but Canada in December 2024 appeared to threaten export controls on minerals to the United States amid a U.S.–Canada tariff row. Then Deputy Canadian Prime Minister Chrystia Freeland said, "Some premiers proactively identified products that their provinces produce and export to the United States and which the U.S. relies on and should be considered as part of the Canadian response. This included some critical minerals and metals." See CTV News, "Premiers Pushed for 'Robust Canadian Response' to Trump Tariffs Threat in Meeting with PM: Freeland," YouTube, December 11, 2024, https://www.youtube.com/watch?v=gI7G2lxKxLc&feature=youtu.be.

47 An Act to Authorize Appropriations for Fiscal Year 2024 for Military Activities of the Department of Defense and for Military Construction, and for Defense Activities of the Department of Energy, to Prescribe Military Personnel Strengths for Such Fiscal Year, and for other Purposes, Public Law 118–31, U.S. Statutes at Large 137 (2023): 415, https://www.congress.gov/118/plaws/publ31/PLAW-118publ31.pdf.

48 An Act Making Emergency Supplemental Appropriations for Assistance for the Situation in Ukraine for the Fiscal Year Ending September 30, 2022, and for Other Purposes, Public Law 117–128, U.S. Statutes at Large 136 (2022): 12114, https://www.congress.gov/117/plaws/publ128/PLAW-117publ128.pdf.

49 Jervois Global Limited, "Jervois Global Suspends Final Construction at Idaho Cobalt Operations," Junior Mining Network, March 29, 2023, https://www.juniorminingnetwork.com/junior-miner-news/press-releases/2313-tsx-venture/jrv/138634-jervois-suspends-final-construction-at-idaho-cobalt-operations.html.

50 Michael J. Kavanagh, "U.S. Blames China's CMOC for Predatory Tactics Behind Cobalt Glut," Bloomberg, May 14, 2024, https://www.bloomberg.com/news/articles/2024-05-14/us-blames-china-s-cmoc-for-predatory-tactics-behind-cobalt-glut.

51 Caroline Peachey, "Explainer: What Trump 2.0 Means for the Mining Industry," Mining Technology, November 7, 2024, https://www.mining-technology.com/features/explainer-what-trump-2-0-means-for-the-mining-industry/.

52 Gregory Wischer, Morgan Bazilian, and Jahara Matisek, "China's Mineral Export Ban Strikes at the U.S. Defense Industrial Base," The Diplomat, December 6, 2024, https://thediplomat.com/2024/12/chinas-mineral-export-ban-strikes-at-the-us-defense-industrial-base/.

53 Defense Security Cooperation Agency, "Kazakhstan – King Air B300ER Scorpion Aircraft with Intelligence, Surveillance, Reconnaissance (ISR) Mission Systems," transmittal no. 21-09, December 23, 2020, https://www.dsca.mil/sites/default/files/mas/Press_Release-Kazakhstan_21-09_CN.pdf.

54 Eurasian Resources Group, "Group at a Glance," accessed December 29, 2024, https://www.eurasianresources.lu/en/pages/group-at-a-glance/group-at-a-glance.

55 Elena Safirova "The Mineral Industry of Kazakhstan," U.S. Geological Survey, December 2019, 24.2, https://pubs.usgs.gov/myb/vol3/2019/myb3-2019-kazakhstan.pdf.

56 U.S. Department of State, "U.S. Security Cooperation With Indonesia," March 23, 2021, https://www.state.gov/u-s-security-cooperation-with-indonesia.

57 MIND ID, "About U.S. ," accessed December 29, 2024, https://mind.id/en/pages/tentang-kami.

58 Eurasian Resources Group, "Group at a Glance," accessed December 29, 2024, https://www.eurasianresources.lu/en/pages/group-at-a-glance/group-at-a-glance.

59 U.S. Department of State, "Minerals Security Partnership (MSP): Principles for Responsible Critical Mineral Supply Chains," February 2023, https://www.state.gov/wp-content/uploads/2023/02/MSP-Principles-for-Responsible-Critical-Mineral-Supply-Chains-Accessible.pdf.

60 "Fiscal Year 2018 Sales Total $55.66 Billion," Defense Security Cooperation Agency, October 9, 2018, https://www.dsca.mil/news-media/news-archive/fiscal-year-2018-sales-total-5566-billion; and The President, "Executive Order 13817 of December 20, 2017: A Federal Strategy To Ensure Secure and Reliable Supplies of Critical Minerals," Federal Register 82, no. 246 (December 26, 2017): 60835–60837, https://www.govinfo.gov/content/pkg/FR-2017-12-26/pdf/2017-27899.pdf.

61 For the criteria list to assess eligibility for foreign military sales, see Defense Security Cooperation Agency, Security Assistance Management Manual, C4.1. - Who May Purchase Using the FMS Program, https://samm.dsca.mil/chapter/chapter-4#C4.1. For a list of potential purchasers and their eligibility for foreign military sales, see Defense Security Cooperation Agency, Security Cooperation Customer and Regional Codes and FMS Eligibility Tables, Table C4. 1. 2. All Entries, https://samm.dsca.mil/table/table-c4t2all.

62 22 U.S.C. §2403(d)(1)–(4), https://uscode.house.gov/view.xhtml?req=(title:22%20section:2403%20edition:prelim). "Defense article" is defined as
"(1) any weapon, weapons system, munition, aircraft, vessel, boat or other implement of war;
(2) any property, installation, commodity, material, equipment, supply, or goods used for the purposes of furnishing military assistance;
(3) any machinery, facility, tool, material supply, or other item necessary for the manufacture, production, processing repair, servicing, storage, construction, transportation, operation, or use of any article listed in this subsection; or

(4) any component or part of any article listed in this subsection; but shall not include merchant vessels or, as defined by the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011), source material (except uranium depleted in the isotope 235 which is incorporated in defense articles solely to take advantage of high density or pyrophoric characteristics unrelated to radioactivity), by-product material, special nuclear material, production facilities, utilization facilities, or atomic weapons or articles involving Restricted Data."

63 Foreign Assistance Act of 1961, Public Law 118–83 (1961): 1–275, https://www.govinfo.gov/content/pkg/COMPS-1071/pdf/COMPS-1071.pdf.

64 An Act to Amend the Foreign Assistance Act of 1961 and the Foreign Military Sales Act, and for Other Purposes, Public Law 94–329, U.S. Statutes at Large 90 (1976): 729–769, https://www.govinfo.gov/content/pkg/STATUTE-90/pdf/STATUTE-90-Pg729.pdf.

65 Christina L. Arabia, Nathan J. Lucas, and Michael J. Vassalotti, "Transfer of Defense Articles: U.S. Sale and Export of U.S.-Made Arms to Foreign Entities," R46337, Congressional Research Service, updated March 23, 2023, 1, https://crsreports.congress.gov/product/pdf/R/R46337/4.

66 William E. Landay III, "Reissuance of the Security Assistance Management Manual (SAMM) as Defense Security Cooperation Agency (DSCA) Manual 5105.38-M, DSCA Policy 12-20," Defense Security Cooperation Agency, April 30, 2012, https://samm.dsca.mil/listing/authorization-letter.

67 Under the Arms Export Control Act (AECA), Congress requires notification for significant FMS transactions. Specifically, the President must formally notify Congress 30 calendar days before concluding a government-to-government foreign military sale if the transaction involves: Major defense equipment valued at $14 million or more; defense articles or services valued at $50 million or more; and design and construction services valued at $200 million or more. See

68 Christina L. Arabia, Nathan J. Lucas, and Michael J. Vassalotti, "Transfer of Defense Articles: U.S. Sale and Export of U.S.-Made Arms to Foreign Entities," R46337, Congressional Research Service, updated March 23, 2023, 4, https://crsreports.congress.gov/product/pdf/R/R46337/4.

69 C. Todd Lopez, "A Year in, DOD Racks Up Wins for Foreign Military Sales," U.S. Department of Defense, August 8, 2024, https://www.defense.gov/News/News-Stories/Article/Article/3866263/a-year-in-dod-racks-up-wins-for-foreign-military-sales/.

70 C. Todd Lopez, "A Year in, DOD Racks Up Wins for Foreign Military Sales," U.S. Department of Defense, August 8, 2024, https://www.defense.gov/News/News-Stories/Article/Article/3866263/a-year-in-dod-racks-up-wins-for-foreign-military-sales/.

71 Defense Security Cooperation Agency, "India – MK 54 MOD 0 Lightweight Torpedoes," transmittal no. 24-101, October 7, 2024, https://www.dsca.mil/sites/default/files/mas/Press%20Release%20-%20India%2024-101%20CN.pdf.

72 Defense Security Cooperation Agency, "Italy – Electronic Attack Mission System," transmittal no. 24-98, October 7, 2024, https://www.dsca.mil/sites/default/files/mas/Press%20Release%20-%20Italy%2024-98%20CN.pdf.

73 Defense Security Cooperation Agency, "Romania – Sentinel Radar Systems," transmittal no. 24-109, October 7, 2024, https://www.dsca.mil/sites/default/files/mas/Press%20Release%20-%20Romania%2024-109%20CN.pdf.

74 Defense Security Cooperation Agency, "Kingdom of Saudi Arabia – AGM-114R3 Hellfire II Missiles," transmittal no. 20-62, October 11, 2024, https://www.dsca.mil/sites/default/files/mas/Press%20Release%20-%20Kingdom%20of%20Saudi%20Arabia%2020-62%20CN.pdf; Defense Security Cooperation Agency, "Kingdom of Saudi Arabia – AIM-9X Block II Sidewinder Missiles," transmittal no. 24-46, October 11, 2024, https://www.dsca.mil/sites/default/files/mas/Press%20Release%20-%20Kingdom%20of%20Saudi%20Arabia%2024-46.pdf; and Defense Security Cooperation Agency, "Kingdom of Saudi Arabia – Ammunition for Artillery Systems, Machine Guns, and Tanks," transmittal no. 21-15, October 11, 2024, https://www.dsca.mil/sites/default/files/mas/Press%20Release%20-%20Kingdom%20of%20Saudi%20Arabia%2021-15%20CN.pdf.

75 Defense Security Cooperation Agency, "United Arab Emirates – GMLRS and ATACMS Munitions," transmittal no. 20-79, October 11, 2024, https://www.dsca.mil/sites/default/files/mas/Press%20Release%20-%20UAE%2020-79%20CN.pdf.

76 Defense Security Cooperation Agency, Security Assistance Management Manual, Table C5.T2. IAs Authorized to Receive Letters of Request, https://samm.dsca.mil/table/table-c5t2.

77 For example, the first Trump Administration's Conventional Arms Transfer policy stated, "When a proposed transfer is in the national security interest, which includes our economic security, and in our foreign policy interest, the executive branch will advocate strongly on behalf of United States companies." See Donald J. Trump, "National Security Presidential Memorandum Regarding U.S. Conventional Arms Transfer Policy," April 19, 2018, https://trumpwhitehouse.archives.gov/presidential-actions/national-security-presidential-memorandum-regarding-u-s-conventional-arms-transfer-policy/.

78 White House, "Remarks by President Trump and Crown Prince Mohammed Bin Salman of the Kingdom of Saudi Arabia Before Bilateral Meeting," March 20, 2018, https://trumpwhitehouse.archives.gov/briefings-statements/remarks-president-trump-crown-prince-mohammed-bin-salman-kingdom-saudi-arabia-bilateral-meeting/.

79 Defense Security Cooperation Agency, "Israel – 155mm Artillery Ammunition," transmittal no. 24-16, December 29, 2023, https://www.dsca.mil/sites/default/files/mas/Press%20Release%20-%20Israel%2024-16%20CN.pdf; and John Hudson and Mikhail Klimentov, "U.S. Approves $147.5 Million Sale of Artillery Ammunition and Gear to Israel," Washington Post, December 30, 2023, https://www.washingtonpost.com/national-security/2023/12/30/us-weapons-sale-israel-blinken/.

80 "Security Cooperation Overview," Defense Security Cooperation Agency, accessed December 31, 2024, https://www.dsca.mil/foreign-customer-guide/security-cooperation-overview.

81 According to 50 U.S.C. §4533, "To create, maintain, protect, expand, or restore domestic industrial base capabilities essential for the national defense, the President may make provision or purchases of or commitments to purchase an industrial resource or a critical technology item, for Government use or resale. See 50 U.S.C. §4533(a)(1)(A), https://uscode.house.gov/view.xhtml?hl=false&edition=prelim&req=granuleid%3AU.S. C-prelim-title50-section4533&num=0&saved=%7CKHRpdGxlOjUwIHNlY3Rpb246NDUzMyBlZGl0aW9uOnByZWxpbSk%3D%7C%7C%7C0%7Cfalse%7Cprelim.

82 According to 50 U.S.C. §4533(b), "Subject to the limitations in subsection (a), purchases and commitments to purchase and sales under subsection (a) may be made without regard to the limitations of existing law (other than section 1341 of title 31), for such quantities, and on such terms and conditions, including advance payments, and for such periods, but not extending beyond a date that is not more than 10 years from the date on which such purchase, purchase commitment, or sale was initially made, as the President deems necessary, except that purchases or commitments to purchase involving higher than established ceiling prices (or if no such established ceiling prices exist, currently prevailing market prices) or anticipated loss on resale shall not be made, unless it is determined that supply of the materials could not be effectively increased at lower prices or on terms more favorable to the Government, or that such purchases are necessary to assure the availability to the United States of overseas supplies." See 50 U.S.C. §4533(b), https://uscode.house.gov/view.xhtml?hl=false&edition=prelim&req=granuleid%3AU.S. C-prelim-title50-section4533&num=0&saved=%7CKHRpdGxlOjUwIHNlY3Rpb246NDUzMyBlZGl0aW9uOnByZWxpbSk%3D%7C%7C%7C0%7Cfalse%7Cprelim.

83 50 U.S.C. §4517(b)(2), https://uscode.house.gov/view.xhtml?req=(title:50%20section:4517%20edition:prelim).

84 For example, if the Department of Defense has right-of-first-refusal for 5,000 metric tons of antimony metal and oxide, and Defense Firms A, B, and C collectively request 7,000 metric tons, the Department of Defense needs a process to allocate these minerals.

85 Joseph R. Biden, Jr., "Memorandum on Presidential Waiver of Statutory Requirements Pursuant to Section 303 of the Defense Production Act of 1950, as amended, on Department of Defense Supply Chains Resilience," February 27, 2023, https://www.whitehouse.gov/briefing-room/presidential-actions/2023/02/27/memorandum-on-presidential-waiver-of-statutory-requirements-pursuant-to-section-303-of-the-defense-production-act-of-1950-as-amended-on-department-of-defense-supply-chains-resilience/; and 50 U.S.C. §4533, https://uscode.house.gov/view.xhtml?req=(title:50%20section:4533%20edition:prelim).

86 Joseph R. Biden, Jr., "Memorandum on United States Conventional Arms Transfer Policy," February 23, 2023, https://www.whitehouse.gov/briefing-room/presidential-actions/2023/02/23/memorandum-on-united-states-conventional-arms-transfer-policy/.

87 Defense Security Cooperation Agency, Security Assistance Management Manual, C4.3.5.3., https://samm.dsca.mil/chapter/chapter-4#C4.3. The State Department could make this determination based on the criterion of considering the "United States Political-Military Relationship with the End User." Additionally, some defense articles are already designated as FMS-Only, so FMS may already be required for the requested defense articles. See Defense Security Cooperation Agency, Security Assistance Management Manual, C4.3.5.4.1., C4.3.5.2, https://samm.dsca.mil/chapter/chapter-4#C4.3; and J. W. Rixey, "Revision of Security Assistance Management Manual Chapter 4 Regarding Foreign Military Sales-Only Designations, DSCA Policy 16-51 [SAMM E- Change 325]," Defense Security Cooperation Agency, December 5, 2016, https://samm.dsca.mil/sites/default/files/DSCA%2016-51.pdf.

88 22 U.S.C. §2301, https://uscode.house.gov/view.xhtml?path=/prelim@title22/chapter32/subchapter2&edition=prelim.

89 22 U.S.C. §2751, https://uscode.house.gov/view.xhtml?req=42+u.s.c.+2751-.

90 Evidence that strengthening U.S. mineral supply chains is now part of U.S. foreign policy includes executive orders from both President Donald Trump and President Joseph Biden. See The President, "A Federal Strategy To Ensure Secure and Reliable Supplies of Critical Minerals," Executive Order 13817, Federal Register 82, no. 246 (December 26, 2017): 60835–60837, https://www.govinfo.gov/content/pkg/FR-2017-12-26/pdf/2017-27899.pdf; and The President, "America's Supply Chains," Federal Register 86, no. 38 (March 1, 2021): 11849–11854, https://www.govinfo.gov/content/pkg/FR-2021-03-01/pdf/2021-04280.pdf.

91 22 U.S.C. §2751, https://uscode.house.gov/view.xhtml?req=42+u.s.c.+2751-.

92 Joseph R. Biden, Jr., "Memorandum on United States Conventional Arms Transfer Policy," February 23, 2023, https://www.whitehouse.gov/briefing-room/presidential-actions/2023/02/23/memorandum-on-united-states-conventional-arms-transfer-policy/.

93 Donald J. Trump, "National Security Presidential Memorandum Regarding U.S. Conventional Arms Transfer Policy," April 19, 2018, https://trumpwhitehouse.archives.gov/presidential-actions/national-security-presidential-memorandum-regarding-u-s-conventional-arms-transfer-policy/.

94 Jahara Matisek and Ivor Wiltenburg, "Security Force Assistance as a Preferred Form of 21st Century Warfare: The Unconventional Becomes the Conventional," in The Conduct of War in the 21st Century, ed. Rob Johnson, Martijn Kitzen, and Tim Sweijs (New York: Routledge, 2021): 173–188, https://www.taylorfrancis.com/chapters/edit/10.4324/9781003054269-16/security-force-assistance-preferred-form-21st-century-warfare-jahara-matisek-ivor-wiltenburg.

95 Jahara Matisek, "International Competition to Provide Security Force Assistance in Africa: Civil-Military Relations Matter," PRISM 9, no. 1 (2020): 103–113, https://ndupress.ndu.edu/Portals/68/Documents/prism/prism_9-1/prism_9-1_103-113_Matisek%203.pdf?ver=v4ykp2L-6tGx1-DrkQcrAQ%3d%3d.

96 Institute for Defense Analyses, "Key Materials for High-Priority Weapon Systems, and Assessing Risks to Their Supply: A Report for the U.S. Defense National Stockpile Center," July 31, 2008, in U.S. Department of Defense, "Reconfiguration of the National Defense Stockpile Report to Congress," April 2009, B-2, https://www.scribd.com/document/16483302/Reconfiguration-of-the-National-Defense-Stockpile-Report-to-Congress.

97 Chad A. Friedline, "Tin," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 184, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-tin.pdf.

98 Cameron M. Keys, "Emergency Access to Strategic and Critical Materials: The National Defense Stockpile," R47833, Congressional Research Service, November 14, 2023, 44, https://crsreports.congress.gov/product/pdf/R/R47833.

99 Chad A. Friedline, "Tin," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 184, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-tin.pdf.

100 Chad A. Friedline, "Tin," in U.S. Geological Survey, Mineral Commodity Summaries 2024 (Reston, VA: U.S. Geological Survey, 2024), 184, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-tin.pdf.

101 In 2021, Indonesia mined and smelted an estimated 70,000 metric tons of tin. See U.S. Geological Survey, "Advance Data Release of the 2020–21 Annual Tables," Indonesia, Table 1, accessed December 29, 2024, https://www.usgs.gov/centers/national-minerals-information-center/asia-and-pacific.

102 In 2023, PT Timah Tbk produced an estimated 15,340 metric tons of tin. The Indonesian government (MIND ID) has 65% ownership in PT Timah Tbk, while the public has 35% ownership. See PT Timah Tbk, "Annual Report," 2023, 52, 139, https://timah.com/userfiles/post/240429662F51E4380C3.pdf.

103 Defense Security Cooperation Agency, "Indonesia – F-15ID Aircraft," transmittal no. 22-13, February 10, 2022, https://www.dsca.mil/sites/default/files/mas/Press%20Release%20-%20Indonesia%2022-13%20CN.pdf.

104 Defense Security Cooperation Agency, "Indonesia – MV-22 Block C Osprey Aircraft," transmittal no. 20-27, July 6, 2020, https://www.dsca.mil/sites/default/files/mas/indonesia_20-27.pdf.

105 Defense Security Cooperation Agency, "Indonesia–AIM-120C-7 Advanced Medium-Range Air-to-Air Missiles (AMRAAMs)," transmittal no. 15-81, March 10, 2016, https://www.dsca.mil/sites/default/files/mas/indonesia_15-81.pdf.

106 Defense Security Cooperation Agency, "Indonesia – AIM-9X-2 Sidewinder Missiles," transmittal no. 15-28, May 5, 2015, https://www.dsca.mil/sites/default/files/mas/indonesia_15-28_0.pdf.

107 Donald J. Trump, "National Security Presidential Memorandum Regarding U.S. Conventional Arms Transfer Policy," April 19, 2018, https://trumpwhitehouse.archives.gov/presidential-actions/national-security-presidential-memorandum-regarding-u-s-conventional-arms-transfer-policy/.

108 For an example of an Integrated Country Strategy, see U.S. Department of State, "Integrated Country Strategy: India," approved May 27, 2022, https://www.state.gov/wp-content/uploads/2022/07/ICS_SCA_India_Public.pdf.

109 U.S. Department of State, "Integrated Country Strategies," accessed December 29, 2024, https://www.state.gov/integrated-country-strategies/; and Christina L. Arabia, Nathan J. Lucas, and Michael J. Vassalotti, "Transfer of Defense Articles: U.S. Sale and Export of U.S.-Made Arms to Foreign Entities," R46337, Congressional Research Service, updated March 23, 2023, 21, https://crsreports.congress.gov/product/pdf/R/R46337/4.