IDA | Research Summary

Assessing Strategic and Critical Materials National Security Risks

The United States is increasingly dependent on foreign supplies of strategic and critical materials, and assured sources of supply are vital to U.S. economic security and military readiness. IDA's ability to assess risks to the supply of these materials has led to robust support to the Department of Defense (DoD), including the National Defense Stockpile (NDS) Program, whose mission is to decrease or preclude a dangerous and costly reliance on foreign sources and single-point-of-failure producers of strategic and critical materials during a major national security emergency.

The NDS Program estimates material supply shortfalls that could occur across the Nation's entire economy and the Future Years Defense Program, and threaten U.S. economic security and military readiness, including defense acquisition programs, current military operations, and future contingencies. Material shortfalls associated with the provision of essential civilian goods and services (e.g., medical, energy, transportation, and other critical infrastructure) are also estimated. Whether mitigating supply disruption risks posed by strategic competitor countries such as China, or preparing the Nation to respond to supply disruptions resulting from global events such as COVID-19, the ability to identify, assess, and mitigate risks in advance of supply disruptions is a national imperative.

To help DoD estimate shortfall risks and inform U.S. Government mitigation options, IDA developed the Risk Assessment and Mitigation Framework for Strategic Materials (RAMF-SM). RAMF-SM is a comprehensive means for estimating total U.S. civilian and military material demand and the sources of their supply. For these purposes—and for estimating wartime shortfalls and evaluating the cost-effectiveness of mitigation options—RAMF-SM makes extensive use of economic modeling, simulation, and forecasting tools as well as other unique research techniques. There are two approaches to RAMF-SM material shortfall assessments.

August 2021
NS D-10899

Macro Approach: *This approach estimates total U.S. consumption of a material across 352 industry sectors—including the fraction consumed for the U.S. military—and it compares U.S. material demand with global supply, including foreign supply disruptions from postulated wartime scenarios. This approach accounts for the Nation's entire consumption, over multiple years, for each material assessed. As a practical matter, the process aggregates supply and demand of variations of similar materials. In these cases—and because defense demands typically (1) represent a small fraction of total U.S. demand and (2) are satisfied before civilian needs during national emergencies—RAMF-SM's macro approach does not often detect U.S. defense shortfalls even in the context of major conflict scenarios. Nonetheless, RAMF-SM's macro approach is an effective means to comprehensively estimate total U.S. material demand, sources of global supply, and postulated wartime shortfalls.*

Industry users of a particular material may often use similar but sufficiently different materials that are not readily substitutable. Moreover, materials can be differentiated by unique, and often proprietary, approaches to their production and downstream manufacturing uses, and therefore are not readily interchangeable. In some cases, such as for highly engineered and proprietary materials, there may be only a single factory in the world capable of production. These supply risks can be especially serious during wartime, when a sole producer may be unable to surge production to meet unanticipated and urgent U.S. military needs, or when a sole foreign producer may be located in an adversary country or conflict region where wartime supply disruptions may occur. Disaggregating these demands, and their supply, from more commodity-like materials can be important to uncovering U.S. military-specific supply risks.

Micro Approach: *To identify U.S. military-specific supply shortfalls of high-risk materials, and for weapon-specific applications in particular, IDA developed a micro approach within RAMF-SM. For this purpose, RAMF-SM's framework has been applied to newly developed research techniques for assessing specific materials, targeted defense industrial base sectors, and individual weapon system supply chains. Known as "deep dive" or "downstream supply chain weak link" assessments, this approach helps address a growing U.S. national security concern for highly distributed and often opaque, global supply chains of critical materials that may be unique to a dominant foreign producer country (including future adversaries) or represent a single-point-of-failure producer. This approach relies less on economic modeling as the macro approach and more on highly targeted and detailed investigations into specific defense industrial base sectors, individual weapon system requirements, and company-level supply chains. These assessments have identified important defense shortfall supply risks and led to mitigation actions for diverse defense sectors and weapon system supply chains, including rare earth materials for defense electronics, ceramics for body armor, and carbon fiber composite materials for space and missile systems.*

RAMF-SM has contributed to other strategic and critical material assessments, including Office of the Secretary of Defense (OSD) reports to Congress and OSD's response to key White House Executive Orders (EOs), including EO 13806, *Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States*, EO 13817, *A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals*; and EO 14017, *America's Supply Chains*.

For these project activities, **James S. Thomason** (jthomaso@ida.org), Deputy Director of IDA's Strategy, Forces and Resources Division (SFRD) led a team that included SFRD Research Staff Members **Nicholas S. J. Karvonides** (nkarvonides@ida.org) and **Julie C. Kelly** (jkelly@ida.org). Nick led the development and implementation of SFRD's "deep dive" defense supply chain research work.

Research was sponsored by the Defense Logistics Agency's Office of Strategic Materials.