Managing Materials for a 21st Century Military

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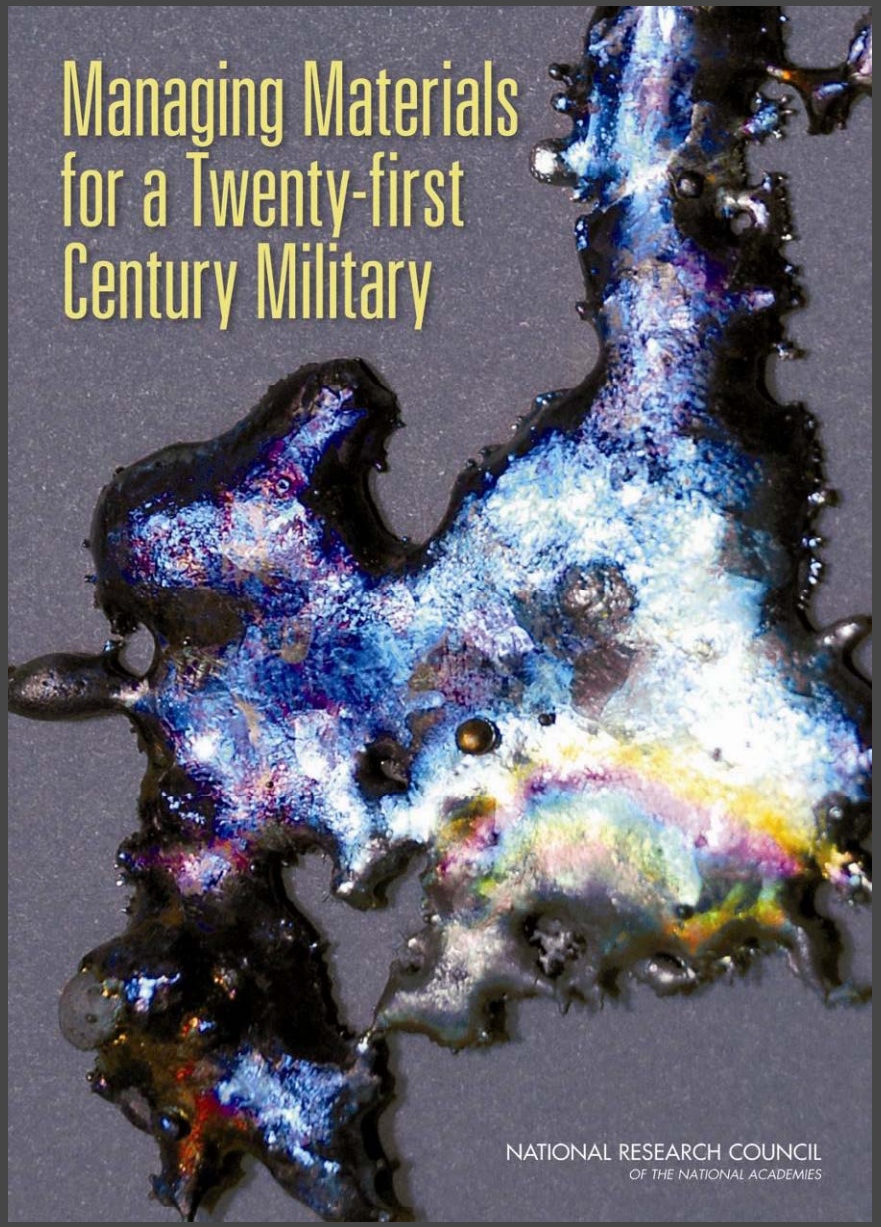
Links to Reports

- Managing Materials for a Twenty First Century Military
  - » http://books.nap.edu/catalog.php?record_id=12028
- DOD Report to Congress on Reconfiguration of the National Defense Stockpile
  - » https://www.dnsc.dla.mil/pdf/NDSReconfigurationReportToCongress.pdf



Committee on Assessing the Need for a Defense Stockpile

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Madan M. Singh, Arizona Department of Mines and Mineral Resources
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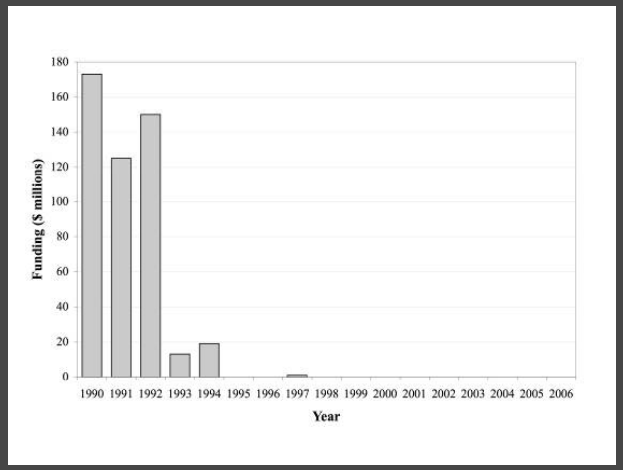
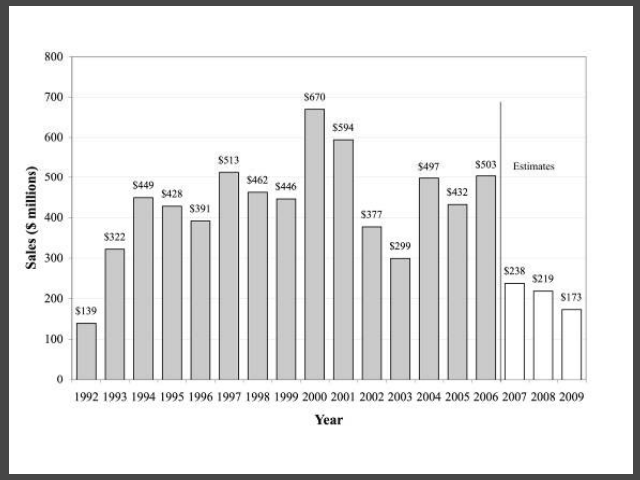
  - Dr. John D. Morgan, U.S. Bureau of Mines (retired)
  - Subhash C. Singhal, Pacific Northwest National Laboratory

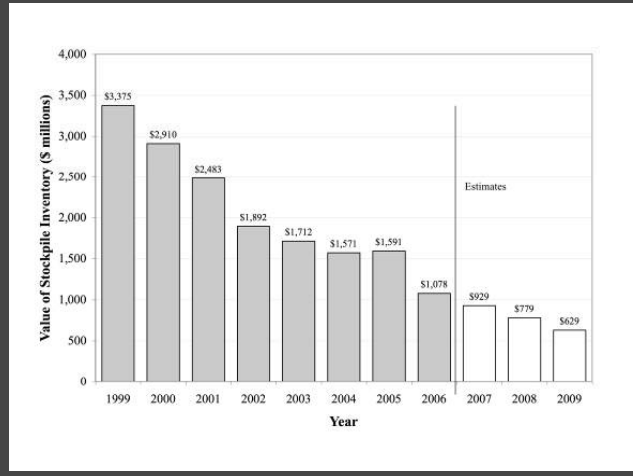
Rationale:
Congressional Concerns



Purchases



Sales



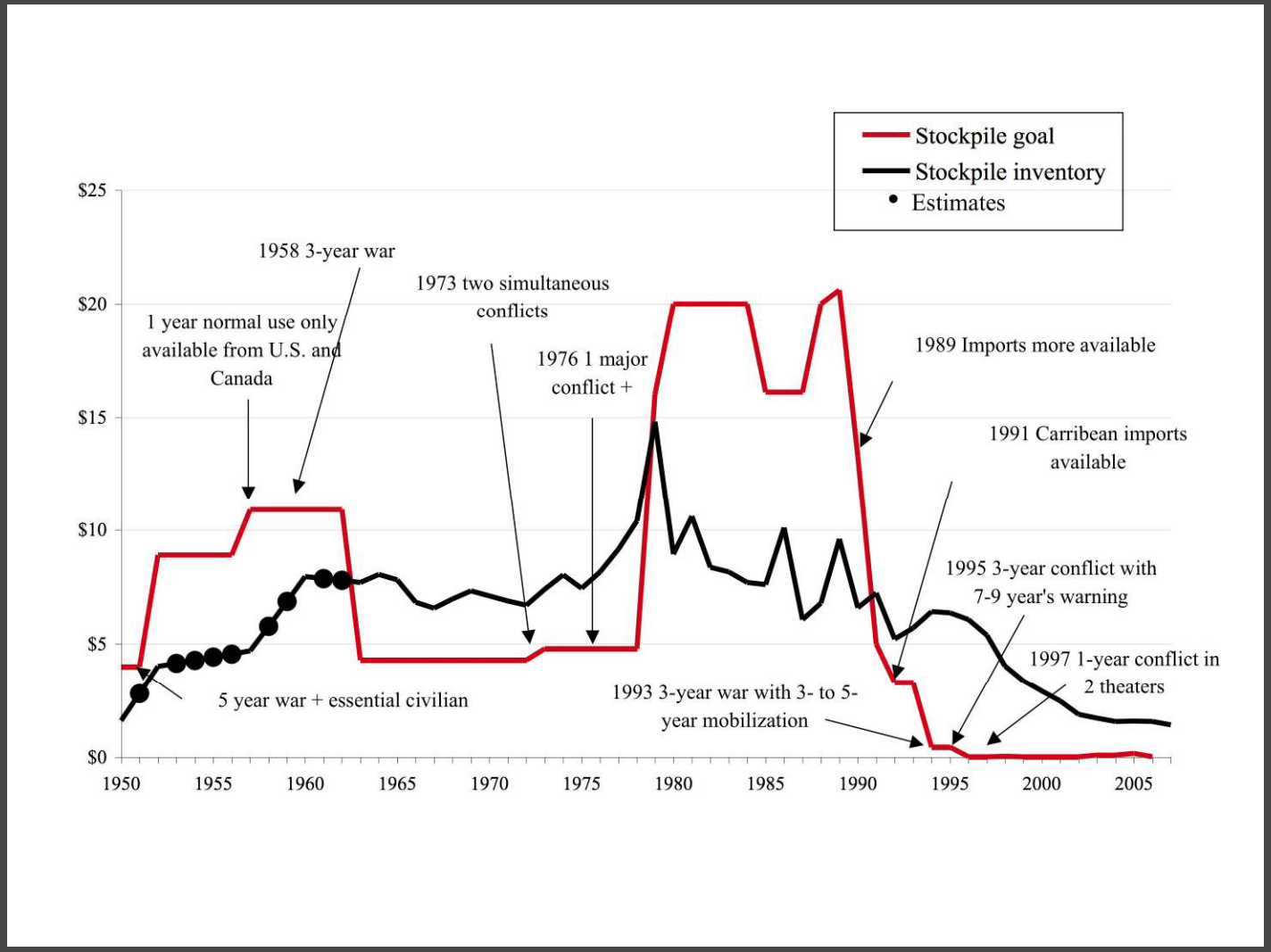
Value

HOUSE ARMED SERVICES COMMITTEE: “Review the policy to dispose of materials in the National Defense Stockpile and determine whether the NDS should be reconfigured to adapt to current world market conditions to ensure future availability of materials required for defense needs” (2006 National Defense Authorization Act)

TABLE 4-1 Comparison of Changes in DoD Strategy, its Approach to Stockpiling (if any), and the Impact on the Assumptions Made in the Stockpiles Requirements Analysis and the Number of Requirements Reported to Congress. The table shows NDS assumptions lag significantly changes in DoD strategy and that requirements have been reduced to near zero. Table 6-4 gives more details on the requirements reported.

	DoD Strategy		DoD Stockpile Reports to Congress	
	Elements	*Stockpile Approach*	*Stockpile Assumptions*	*Number of Reported Stockpile Requirements*
Base Force (1989-1992)	○ Strategic Deterrence & Defense ○ Forward Presence ○ Crisis Response ○ Reconstitution	Reconstitution included as an explicit part of strategy to hedge against potential resurgence of Soviet Union	○ Indefinite duration conflict ○ Requirements modeled for first 3 years ○ 1 year warning time (1989-91) ○ 3 year mobilization (1993-) after non-nuclear, conventional conflict	1989: 48 1992: 20
Bottom-Up Review (1993-1997)	○ 2 MRCs ○ Prepositioning of military supplies overseas	Not addressed	○ 7-9 years warning (1995-) ○ 2-4 years mobilization ○ 3 year conflict (3-4 months intense; 2 years+ stalemate; 3-4 months wrap up)	1993: 7 1995: 3
QDR (1997-2001)	○ 2 MTWs	Not addressed	○ Little warning ○ 1 year conflict (1999-) ○ 3 year regeneration period	1997: 6 1999: 3
2001 QDR (2001-2005)	○ 1-Defend the Homeland ○ 4-Deter forward in 4 critical regions ○ 2-Swiftly defeat 2 adversaries nearly simultaneously ○ 1-Win 1 decisively ○ CBP	Not addressed	○ Little warning ○ 1 year conflict (1999-) ○ 3 year regeneration period ○ Catastrophic US incident added	2001: 4 2003: 3 2005: 3
2006 QDR (2006-2010)	○ 1-Defend the Homeland ○ 4-Respond to the spectrum of conflict ○ 2-Swiftly defeat 2 adversaries nearly simultaneously ○ 1-Win 1 decisively ○ CBP ○ Prepositioned stocks ○ "Stockpile routine defense articles such as helmets, body armor and night vision devices for use by coalition partners."	Not addressed		

Stockpile Over Time



Structure of the Study

- History of the stockpile
- What has changed
- Identifying requirements
- Insuring Supply

History of the Stockpile

- WWII – Korea
  - Created 1939 in response to threat of war
  - Modified 1946 (materials storage, refining/processing)
  - 1947 National Security Act created Civilian Mobilization Agency
  - 1953, Office of Defense Mobilization
- Cold War
  - Quantities reduced, numerous disposal initiatives
  - 1965 Stockpile Act combined all Federal stockpiles and reserves
  - 1973, Defense purposes only
  - 1976, reinstated essential civilian needs
  - 1979 Stockpile Act, transferred responsibility to FEMA
  - 1980, Reagan National Security Council – stockpiles unnecessary
- Fall of Soviet Union to Present
  - 1988, EO12626 directs SECDEF as Stockpile Manager, IDA performs analysis
  - 1991, GAO, DoD/IG call process deficient
  - 1992, Congress authorizes sell-off at SECDEF request
  - 1992 to present: $1.6B sold

President authorizes materials and quantities to be held, and only
President may authorize release in war or national emergency

Previous Studies

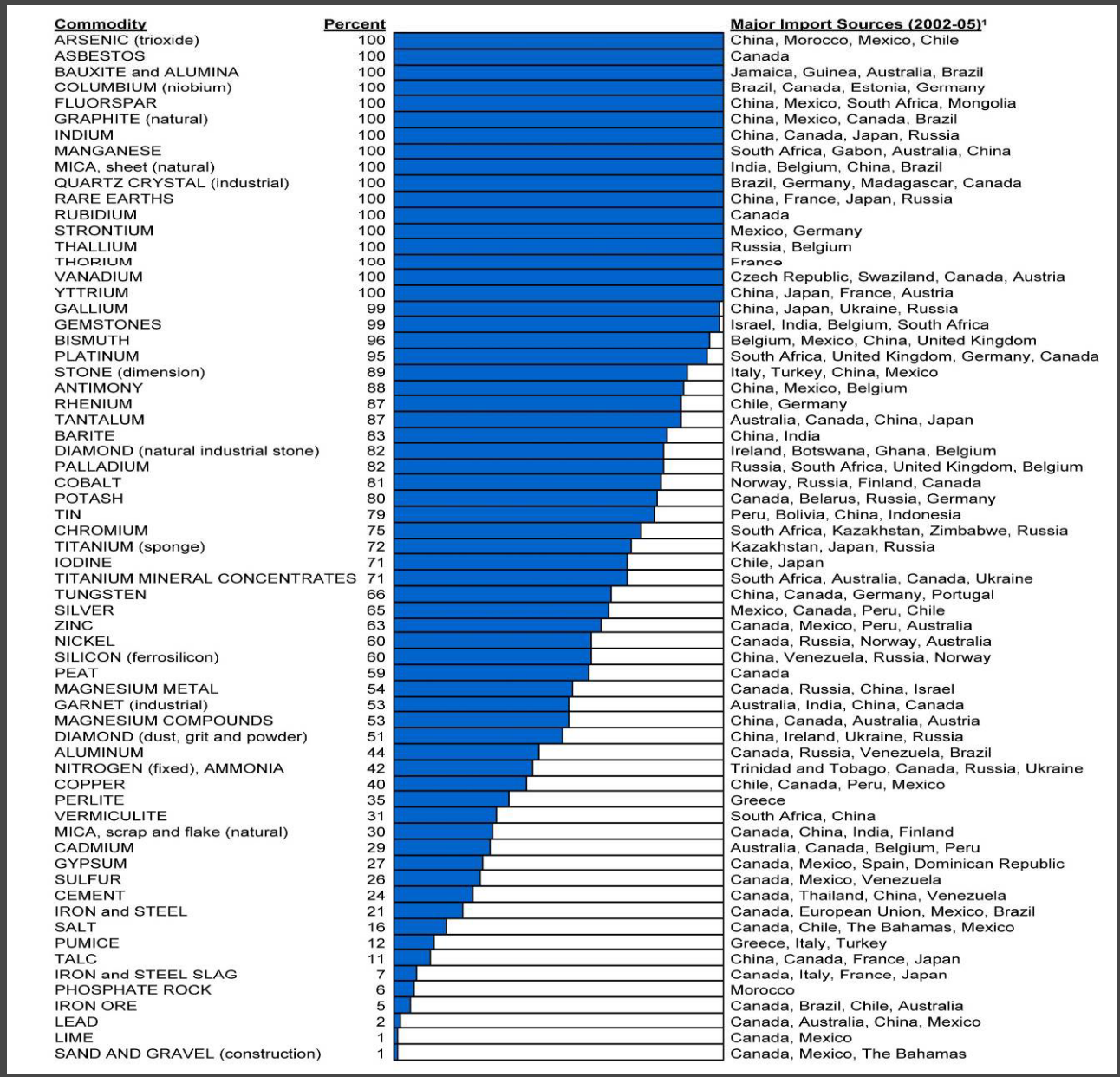
- GAO (1975) – Stockpile Objectives of Strategic and Critical Materials Should Be Reconsidered Because of Shortages. Recommended SECDEF and NSC re-evaluate stockpile assumptions
- CBO (1983) – Strategic and Critical Non-Fuel Materials: Problems and Policy Alternatives. Noted that NDS was not an economic stockpile. Suggested policy options to diversify sources of supply
- DoD/IG (1991) – Audit Report of the Inspector General: Requirements for the National Defense Stockpile. "The process for determining the types, quantities, and qualities of the materials to be acquired for and retained in the stockpile needs improvement"
- GAO (1992) – Comments On DoD's 1992 Report to the Congress and Proposed Legislation. Of the 40 materials identified as stockpile goals in 1989, the stockpile was deficient in all but one, and had been so since 1980.

No significant reports on this subject for over a decade and no actions on recommendations

Shift in Global Supply and Demand

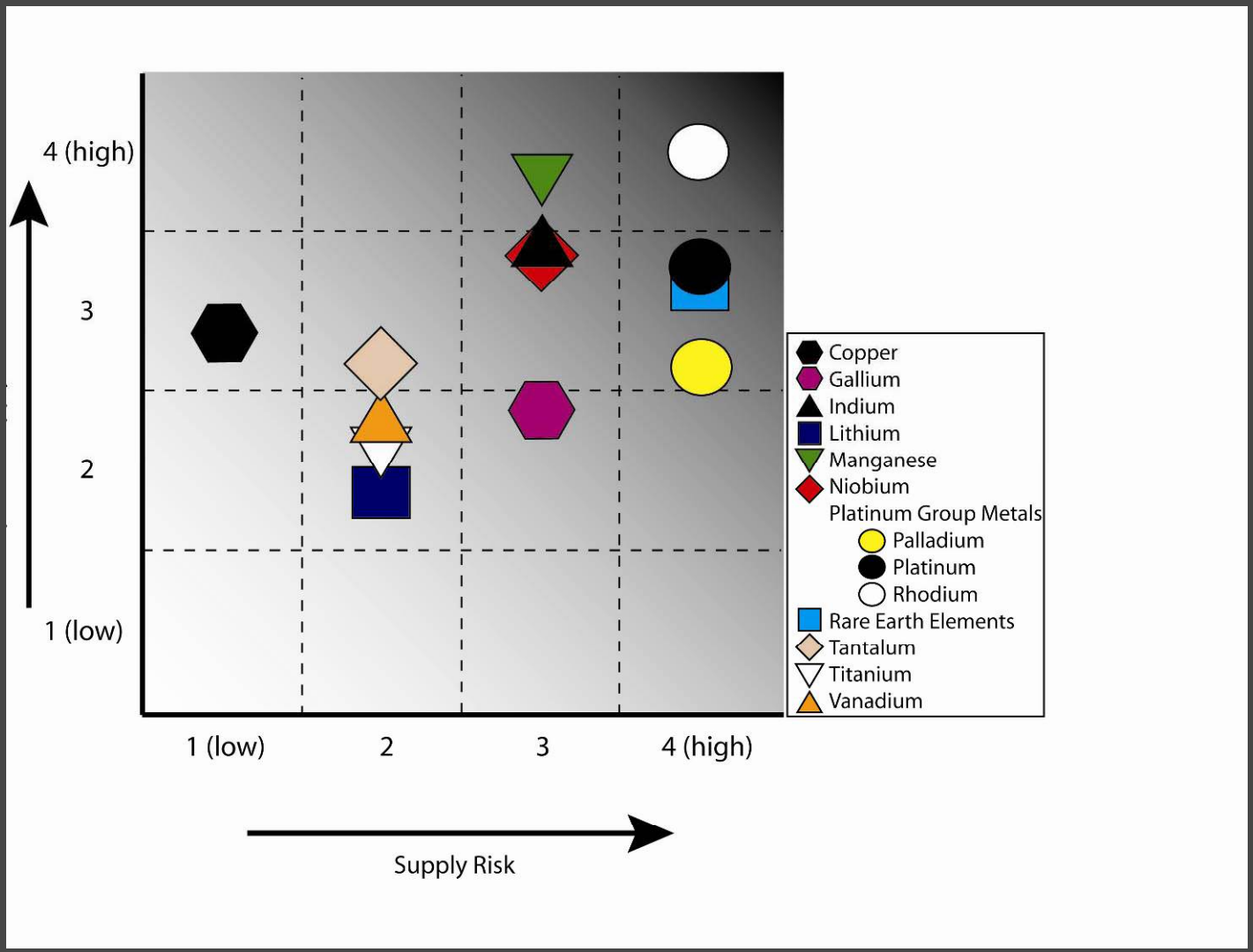
- Increasing global demand
- Dramatic changes in source of supply
  - Diminished US influence on markets
- Volatile markets and pricing
- Corporate consolidation
- Diminished US processing

Import Dependence



Commodity	Percent	Major Import Sources (2002-05)[1]
ARSENIC (trioxide)	100	China, Morocco, Mexico, Chile
ASBESTOS	100	Canada
BAUXITE and ALUMINA	100	Jamaica, Guinea, Australia, Brazil
COLUMBIUM (niobium)	100	Brazil, Canada, Estonia, Germany
FLUORSPAR	100	China, Mexico, South Africa, Mongolia
GRAPHITE (natural)	100	China, Mexico, Canada, Brazil
INDIUM	100	China, Canada, Japan, Russia
MANGANESE	100	South Africa, Gabon, Australia, China
MICA, sheet (natural)	100	India, Belgium, China, Brazil
QUARTZ CRYSTAL (industrial)	100	Brazil, Germany, Madagascar, Canada
RARE EARTHS	100	China, France, Japan, Russia
RUBIDIUM	100	Canada
STRONTIUM	100	Mexico, Germany
THALLIUM	100	Russia, Belgium
THORIUM	100	France
VANADIUM	100	Czech Republic, Swaziland, Canada, Austria
YTTRIUM	100	China, Japan, France, Austria
GALLIUM	99	China, Japan, Ukraine, Russia
GEMSTONES	99	Israel, India, Belgium, South Africa
BISMUTH	96	Belgium, Mexico, China, United Kingdom
PLATINUM	95	South Africa, United Kingdom, Germany, Canada
STONE (dimension)	89	Italy, Turkey, China, Mexico
ANTIMONY	88	China, Mexico, Belgium
RHENIUM	87	Chile, Germany
TANTALUM	87	Australia, Canada, China, Japan
BARITE	83	China, India
DIAMOND (natural industrial stone)	82	Ireland, Botswana, Ghana, Belgium
PALLADIUM	82	Russia, South Africa, United Kingdom, Belgium
COBALT	81	Norway, Russia, Finland, Canada
POTASH	80	Canada, Belarus, Russia, Germany
TIN	79	Peru, Bolivia, China, Indonesia
CHROMIUM	75	South Africa, Kazakhstan, Zimbabwe, Russia
TITANIUM (sponge)	72	Kazakhstan, Japan, Russia
IODINE	71	Chile, Japan
TITANIUM MINERAL CONCENTRATES	71	South Africa, Australia, Canada, Ukraine
TUNGSTEN	66	China, Canada, Germany, Portugal
SILVER	65	Mexico, Canada, Peru, Chile
ZINC	63	Canada, Mexico, Peru, Australia
NICKEL	60	Canada, Russia, Norway, Australia
SILICON (ferrosilicon)	60	China, Venezuela, Russia, Norway
PEAT	59	Canada
MAGNESIUM METAL	54	Canada, Russia, China, Israel
GARNET (industrial)	53	Australia, India, China, Canada
MAGNESIUM COMPOUNDS	53	China, Canada, Australia, Austria
DIAMOND (dust, grit and powder)	51	China, Ireland, Ukraine, Russia
ALUMINUM	44	Canada, Russia, Venezuela, Brazil
NITROGEN (fixed), AMMONIA	42	Trinidad and Tobago, Canada, Russia, Ukraine
COPPER	40	Chile, Canada, Peru, Mexico
PERLITE	35	Greece
VERMICULITE	31	South Africa, China
MICA, scrap and flake (natural)	30	Canada, China, India, Finland
CADMIUM	29	Australia, Canada, Belgium, Peru
GYPSUM	27	Canada, Mexico, Spain, Dominican Republic
SULFUR	26	Canada, Mexico, Venezuela
CEMENT	24	Canada, Thailand, China, Venezuela
IRON and STEEL	21	Canada, European Union, Mexico, Brazil
SALT	16	Canada, Chile, The Bahamas, Mexico
PUMICE	12	Greece, Italy, Turkey
TALC	11	China, Canada, France, Japan
IRON and STEEL SLAG	7	Canada, Italy, France, Japan
PHOSPHATE ROCK	6	Morocco
IRON ORE	5	Canada, Brazil, Chile, Australia
LEAD	2	Canada, Australia, China, Mexico
LIME	1	Canada, Mexico
SAND AND GRAVEL (construction)	1	Canada, Mexico, The Bahamas

Minerals Risk Matrix



Example Defense Applications of Rare Earth Elements

- Jet fighter engines and other aircraft components
- Missile guidance systems
- Electronic countermeasure systems
- Underwater mine detection systems
- Anti-missile defense systems
- Range finders
- Satellite power systems
- Satellite communications systems

Source: US Geological Survey Fact Sheet 087-02

NDS Modeling

- **Joint Staff War Planning Scenario**
  - Time phased weapon and materiel production requirements
  - Current inventories, consumption, attrition, other variables
- **Translator aggregates military needs** into demands on US industry
  - Added to Non-defense demands
- **Shortfall in supply** stimulates investment
- Total industry demand by sector multiplied by **material input coefficients** (based on historical data)
- Results are **compared to available** and projected imports and US production
- **Shortfalls are candidates** for National Defense Stockpile

Modeling Weaknesses

- Materials list considered for NDS does not adequately address new and emerging military needs
- Significant time lags occur between 1) military planning and scenario development 2) identified requirements and legislated goals and 3) legislated goals and actual inventory levels
- Those goals which do exist are not a result of the approved modeling process
- Goals have not responded to changes in military scenarios

The process is based on ideas of defense mobilization and on large scale economic modeling which, while sophisticated, are inconsistent with the current and actual practice

Findings and Conclusions of the Study

Conclusion: The design, structure, and operation of the National Defense Stockpile render it ineffective in responding to modern needs and threats.

There is a **lack of specific defense demands data** for particular materials and the **process is episodic** as opposed to being dynamic.

Conclusion: The Department of Defense appears not to fully understand its needs for specific materials nor have adequate information on their supply.

Conclusion: A lack of good data and information—both domestic and offshore—on the availability of materials impedes the effective management of defense-critical supply chains.

Recommendations

Conclusion: Committee believes there is a need for a new approach in the form of a national defense-materials management system.

Recommendation: The Secretary of Defense should establish a new system for managing the supply of these materials.

Holding a materials inventory would be one of the many tools available.

The operation of a new system will depend critically on the conduct of **analyses that will identify defense-specific materials needs**.

The operation of a system for managing materials needed for national defense should be guided by the following general principles:

- **Establish an ongoing analytical process**
- **Provide the option of partnering with private industry** as well as options for outsourcing
- **Provide an appropriate and robust information system** and forecasting tools.
- **Solicit advisory input** from industry, academia, and other stakeholders
- **Evaluate recycling and substitution** as additional sources of key materials.

Recommendation: The federal government should improve and secure the systems for gathering data and information, both at home and abroad, on the availability of materials for defense needs.

Managing Materials for a 21st Century Military

- ***The committee believes that The National Defense Stockpile has not been a priority for the Department of Defense and is hopeful that this report will be the catalyst for long awaited and much needed action.***

DOD Report To Congress
Reconfiguration of the National Defense Stockpile
April 2009

- In Response To
  - HR 1815, NDAA, FY06
  - HR 5122, NDAA, FY07, (HR Rep 109-89)
  - DOD Appropriations Bill 2008 (HR Rep109-452, S. Rep 110-155)
- Concluded
  - No longer rely on US buying power
  - Need greater latitude to react to markets
  - Must better align materials with military needs
  - Suspend sales of thirteen commodities
    - Monitor, strategize thirty nine others

Department of Defense Recommended Changes

- Create integrated, interagency approach
- Give DOD more programmatic flexibility
- Use strategic sourcing, international partnering
- Create repeatable system to identify military needs
  - Strong focus on technologically advanced materials
  - Radically new modeling technique

DOD Re-Look At Selected Materials

Table 1. Risk Review of Selected Strategic Materials

	NSE Shortage*	PSD1 Shortage**	PSD1 Near-Shortage***	OSD Survey 2008 Identified a Problem	Recommen-dation****
Materials DoD Recommended for Reserve					
Beryllium Metal	X	X		X	Hold/Goal Material
Chromium Metal		X		X	Hold/Study
Cobalt		X		X	Hold/Study
Columbium (Niobium)				X	Hold/Study
Ferro Chromium			X		Hold/Study
Ferro Manganese			X		Hold/Study
Germanium			X	X	Hold/Study
Iridium			X		Hold/Study
Platinum			X	X	Hold/Study
Tantalum		X			Hold/Study
Tin		X		X	Hold/Study
Tungsten	X	X		X	Hold/Study
Zinc		X		X	Hold/Study
# of materials in group with shortage, near shortage, or problem (of 13)	2	7	5	9	
Other Systematically Analyzed Materials					
Aluminum Metal		X		X	Study/PB
Aluminum Oxide Fused Crude		X			Study/PB
Antimony	X	X			Study/PB
Bauxite Refractory		X			Study/PB
Beryl Ore		X			Study/PB
Beryllium Master Copper Alloy			X	X	Study
Bismuth		X			Study/PB
Boron					Monitor
Boron Composite Filaments			X		Study
Boron Nitride		X			Study/PB
Cadmium				X	Study
Chromite Ore (all grades)					Monitor
Copper		X		X	Study/PB
Fluorspar Acid Grade		X			Study/PB
Fluorspar Metallurgical Grade					Monitor
Gallium		X		X	Study/PB
Hafnium			X	X	Study
Indium		X		X	Study/PB
Lead		X			Study/PB

Table 1. Risk Review of Selected Strategic Materials (continued)

	NSE Shortage*	PSD1 Shortage**	PSD1 Near-Shortage***	OSD Survey 2008 Identified a Problem	Recommen-dation****
Manganese Dioxide Battery Grade--Natural					Monitor
Manganese Dioxide Battery Grade--Synthetic		X			Study/PB
Manganese Metal--Electrolytic		X			Study/PB
Manganese Ore Chem/Metal Grade					Monitor
Mercury		X			Hold/Study
Molybdenum			X	X	Study/PB
Nickel		X		X	Study/PB
Palladium (Platinum Group)		X			Study/PB
Quartz	X	TBD	TBD		Goal Material
Rhenium		X			Study/PB
Rhodium			X		Study
Rubber (natural)		X			Study/PB
Ruthenium			X		Study
Silicon Carbide		X			Study/PB
Silver		X			Study/PB
Tellurium			X	X	Study
Titanium (sponge)		X		X	Study/PB
Vanadium				X	Study
Yttrium		X		X	Study/PB
Zirconium Metal			X		Study
Zirconium Ores and Concentrates					Monitor
# of materials in group with shortage, near shortage, or problem (of 40)	2	23	8	13	
Total # of materials with shortage, near shortage, or problem (of 63)	1	30	13	22	

Table 2. OSD Survey 2008: Other Materials Causing Production Delays (19 Materials)

Material	Recommendation
Aluminum-Lithium (AL - 2.8 Cu - 1.5 Li)	Study
Carbon Fiber	Study
Ceramic/Al Nitride/Copper	Study
Cerium	Study
Deuterium	Study
Europium	Study
Gadolinium	Study
Helium	Study
Image Intensification Tubes	Study
Kevlar	Study
Lanthanum	Study
Lithium	Study
Nomex	Study
PWA 1484	Study
Rene N5	Study
Selenium	Study
Steel (Specialty)	Study
Tritium	Study
Xenon	Study

National Academies
Government-University-Industry Research Roundtable

- "Diminishing Natural Resources: Recognizing Limitations, Responding to the Challenges"
  - Will consider rare earth metals as well as more common
  - Examine
    - Availability
    - Potential global tensions
    - Flow of materials in industrial sector
    - Means of sustainability
    - Innovative R&D
  - Speakers from OSTP, USGS, DOD, Army War College, GE, Universities
    - National Materials Advisory Board participation

Current Congressional Activity

- House Defense Appropriations (HR 3326)
  - Earmark to reopen a California rare earth mine (Molycorp)
  - (Awaiting conference committee a/o 11/10/009)
- National Defense Authorization Act (HR 2647)
  - Enacted
  - Requires Defense Science Board Study
    - Military capabilities impacted by supply or shortage of rare earth materials
- American Medical Isotopes Production Act (HR 3276)
  - Promotes US production of Mo-99