

# Rare Earth Metals and U.S. National Security

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## In Brief:

- China owns 97% of the global market in rare earth metals.
- Today, the U.S. is completely reliant on China for the production of some of its most powerful weapons.
- The U.S. has the second-biggest deposit of rare earth metals in the world. North American mines alone could supply U.S. rare earth needs.

Rare earth metals are essential for the United States' military and economic well-being. Yet the U.S. has been particularly lax when it comes to securing the supply of these metals. The U.S. has gone from the world's top producer and supplier of rare earths to being completely dependent on one country – China – for its supply. China's dominance in the rare earths market will have profound implications for U.S. national security in the next couple of years. As it is, some analysts already believe it is too late to avoid a global shortage of rare earth metals, placing the U.S. in greater risk. The U.S. needs to take steps now to remedy this situation.

## Background

There are 17 rare earth metals. Contrary to their name, rare earth metals are not rare at all. In fact, all of them are as common in the earth as silver. Some are even more abundant than lead.<sup>1</sup> Their name stems from the fact that, despite their relative

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1. Seaman, John, *Rare Earths and Clean Energy: Analyzing China's Upper Hand*, Institut français des relations internationales, September 2010, 6, [www.ifri.org/downloads/noteenergieseaman.pdf](http://www.ifri.org/downloads/noteenergieseaman.pdf).

abundance, they are difficult to extract from ore and the extraction process is costly and more environmentally damaging than for other elements.

Rare earth metals have a wide variety of applications. They are used in hybrid car motors, computer hard drives, cell phones, and wind turbines. They are also essential for military equipment. Jet engines, smart bombs and guided missiles, lasers, radar, night vision goggles, and satellites all depend on rare earth metals to function.

The vast majority of these metals are produced by China, which owns approximately 97% of the global market in rare earth metals.<sup>2</sup> China also has 35% of the world's reserves in rare earth metals, and supplies almost all of the world's demand. China's stronghold in the rare earths market is due to strong government support, cheap labor, and relatively loose environmental laws. These factors make it much more economical to mine and produce rare earth metals in China.

The United States has the world's second-biggest deposit of rare earth metals. According to the U.S. Geological Survey, the U.S. has "approximately 13 million metric tons of rare earth elements," mainly located in western states such as California, Alaska, and Wyoming.<sup>3</sup> Until the 1980s, the U.S. was the chief supplier of rare earth metals to the rest of the world, when production and mining facilities began to move to China.<sup>4</sup> Today, the U.S. no longer produces any rare earth metals, having sold off its last domestic producer of rare earth magnets (used in smart bombs) in 2003. The last U.S. rare earth mine, located at Mountain Pass, California, closed in 2002. Before it closed, Mountain Pass was one of the world's largest rare earth mines.

## National Security Risks

Many analysts fear that there will be a shortage of rare earth metals as early as 2012, although most believe the shortage will not occur until 2014. This makes U.S. dependence on China for rare earths extremely problematic. U.S. dependence poses both economic and national security risks.

**Military:** The United States' reliance on technology, particularly for military applications, is the biggest cause for concern. Although the Pentagon claims that the U.S. only uses 5% of the world's supply of rare earth metals for defense purposes,<sup>5</sup> the fact is that the U.S. is completely reliant on China for the production of some of its most powerful weapons. Peter Leiter, a former trade advisor at the Department

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2. Ibid., 11.

3. United States Geological Survey, "Rare Earth Elements in the U.S. Not So Rare," *USGS Newsroom*, November 17, 2010, <http://www.usgs.gov/newsroom/article.asp?ID=2642> (accessed January 21, 2011).

4. Seaman, 14.

5. Helmore, Edward, "China's Stranglehold on Rare Earth Metals 'No Threat to US Security,'" *The Guardian*, October 31, 2010, <http://www.guardian.co.uk/business/2010/oct/31/china-monopoly-rare-earth-metals-no-threat-pentagon-security> (accessed January 21, 2011).

of Defense, echoed this concern when he stated, “The Pentagon has been incredibly negligent...there are plenty of early warning signs that China will use its leverage over these materials as a weapon.”<sup>6</sup>

Even commercial uses of rare earth metals, such as cell phones and laptops, have military applications and are critical to operating current military platforms. Yet top U.S. defense officials are unaware of just how dependent they are on rare earths. According to a U.S. National Defense Stockpile report, “[U.S.] defense leaders do not necessarily know exactly which minerals they use in which systems in what amounts, [and] where the minerals came from...”<sup>7</sup> Likewise, the U.S. does not track rare earth metals in its weapons systems or platforms.<sup>8</sup> A shortage of rare earths will affect the strength and readiness of the U.S. military until current systems are no longer in operation. However, it will also affect future production: newer systems rely just as much, if not more, on computers and other electronic equipment. The U.S. is developing itself into greater dependence on rare earth metals.

**Economic:** The U.S. helped guarantee China’s position at the top of the rare earths market when it removed American mining and production capabilities. With the closure of the Mountain Pass mine and the sale of domestic production facilities, the U.S. became almost completely import-dependent for its supply of rare earth metals.

China’s near-monopoly of the rare earths market has allowed it to manipulate this market by restricting production, using export quotas to limit global supply, and increasing taxes on rare earth metals. Recently, China blocked exports of rare earths to Japan in retaliation for the Japanese detainment of a Chinese fishing vessel and its captain. The embargo was rumored to have expanded to the U.S. and EU.<sup>9</sup> The Organization for Economic Cooperation and Development has estimated that non-Chinese producers pay at least 31% more for raw rare earth metals than Chinese producers.<sup>10</sup> As a result, a black market in rare earths has developed. Fully one-third of all rare earths leaving China are smuggled out.<sup>11</sup> Such market distortions cause the U.S. to pay more for weapons systems and platforms – a big concern during the current economic crisis and tightening defense budgets.

6. Ricks, Thomas E, “China’s Minerals Diplomacy and You,” *Foreign Policy*, September 30, 2010, [http://ricks.foreignpolicy.com/posts/2010/09/30/china\\_s\\_minerals\\_diplomacy\\_and\\_you](http://ricks.foreignpolicy.com/posts/2010/09/30/china_s_minerals_diplomacy_and_you) (accessed January 21, 2011).

7. Burke, Sharon E, “China is Calling for Your Cell Phone,” *Center for a New American Security*, October 12, 2010, <http://www.cnas.org/node/3513>, (accessed January 21, 2011).

8. Ratnam, Gopal, “Pentagon Sees No Rare-Earths Crisis; May Aid U.S. Producers,” *BusinessWeek*, October 31, 2010, <http://www.businessweek.com/news/2010-10-31/pentagon-sees-no-rare-earths-crisis-may-aid-u-s-producers.html> (accessed January 21, 2011).

9. Bradsher, Keith, “China Said to Widen Its Embargo of Minerals,” *The New York Times*, October 19, 2010, [http://www.nytimes.com/2010/10/20/business/global/20rare.html?\\_r=1](http://www.nytimes.com/2010/10/20/business/global/20rare.html?_r=1) (accessed January 27, 2011).

10. Korinek, Jane, and Jeonghoi Kim, *Export Restrictions on Strategic Raw Materials and Their Impact on Trade*, OECD Trade Policy Working Paper, 2010, 21, [http://www.oecd-ilibrary.org/trade/export-restrictions-on-strategic-raw-materials-and-their-impact-on-trade\\_5kmh8pk441g8-en](http://www.oecd-ilibrary.org/trade/export-restrictions-on-strategic-raw-materials-and-their-impact-on-trade_5kmh8pk441g8-en).

11. Hurst, *China’s Rare Earth Elements Industry: What Can the West Learn?* Institute for the Analysis of Global Security, March 2010, 15, <http://fmso.leavenworth.army.mil/documents/rareearth.pdf>.

## Recommendations

With shortages likely sometime in the next two to three years, the U.S. needs to act quickly to reduce its reliance on Chinese rare earth metals. There are several actions the U.S. can take.

**Stockpile Rare Earths.** While stockpiling rare earths is not a long-term solution (eventually stockpiles will run out), it is a good stop-gap measure until new technologies or mines are available. A few countries, such as Japan and South Korea, already have strategic stockpiles of rare earth metals.<sup>12</sup> China will begin stockpiling rare earths this year.<sup>13</sup> Even in the U.S., such stockpiles are not unprecedented. The U.S. currently stocks petroleum, helium, and medical supplies in case of an emergency.<sup>14</sup> In fact, at one point the U.S. did stock rare earth metals in its National Defense Stockpile, but these were all sold by 1998.<sup>15</sup>

**Develop New Mines.** Experts estimate that it would take anywhere from 10-15 years to have a new mine up and running efficiently, assuming everything goes according to plan and there are no unforeseen setbacks.<sup>16</sup> There are several places where mining would be a worthwhile venture, including Thor Lake in Canada, which possibly contains one of the world's largest deposits of rare earth metals.<sup>17</sup> The U.S. is currently working on reopening the mine at Mountain Pass, California, and expects it to be fully operational by the end of 2012.<sup>18</sup> Experts believe that North American mines alone could produce as much as 40,000 metric tons of rare earth metals per year, or double what the U.S. currently uses.<sup>19</sup> If the U.S. could fully develop these mines, it would have sufficient rare earths to supply its domestic needs, as well as enough to satisfy future growth in demand.

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12. Hounshell, Blake, "Is China Making a Rare Earth Power Play?" *Foreign Policy*, September 23, 2010, [http://blog.foreignpolicy.com/posts/2010/09/23/is\\_china\\_making\\_a\\_rare\\_earth\\_power\\_play](http://blog.foreignpolicy.com/posts/2010/09/23/is_china_making_a_rare_earth_power_play) (accessed January 21, 2011).

13. "China to Start Stockpiling Rare Earths, Caijing Says," *Bloomberg News*, January 25, 2011, <http://www.bloomberg.com/news/2011-01-25/china-to-start-stockpiling-rare-earth-s-caijing-says-update1.html> (accessed January 27, 2011).

14. Defense-Industrial Initiatives Group, *Rare Earth Elements: A Wrench in the Supply Chain?* Center for Strategic and International Studies, October 2010, 2, [http://csis.org/files/publication/101005\\_DIIG\\_Current\\_Issues\\_no22\\_Rare\\_earth\\_elements.pdf](http://csis.org/files/publication/101005_DIIG_Current_Issues_no22_Rare_earth_elements.pdf).

15. Humphries, Marc, *Rare Earth Elements: The Global Supply Chain*, Congressional Research Service, September 30, 2010, 14, <http://www.fas.org/sgp/crs/natsec/R41347.pdf>.

16. Government Accountability Office, *Rare Earth Metals in the Defense Supply Chain*, April 2010, 13, <http://www.gao.gov/new.items/d10617r.pdf>.

17. Humphries, 7.

18. O'Reiley, Tim, "Molycorp Will Double Capacity at Mine in Mountain pass, Calif.," *Las Vegas Review-Journal*, January 25, 2011, <http://www.lvrj.com/business/molycorp-will-double-capacity-at-mine-in-mountain-pass-calif-114536749.html> (accessed January 25, 2011).

19. Green, Jeffrey A, "Defense, Energy Markets Should Brace for Shortages of Key Materials," *National Defense* 94, no. 671, October 2009, 18 <http://www.nationaldefensemagazine.org/archive/2009/October/Pages/Defense,EnergyMarketsShouldBraceforShortagesofKeyMaterials.aspx>.

**Increase International Cooperation.** Increased international cooperation and dialogue should go a long way towards alleviating the shortage of rare earth metals. Countries can work together by jointly investing in new mines, signing a formal “rare earth treaty,” or even making informal agreements to reduce dependence on China. The Pentagon’s rare earth metals report discussed the benefits of international cooperation, recommending greater cooperation among those who use rare earth metals, notably governments, mine operators, and magnet producers.<sup>20</sup>

**File a World Trade Organization Dispute.** Filing a case against China in the World Trade Organization (WTO) would be one way to prevent China from using illegal export quotas and manipulating the rare earths market. Unfortunately, filing a dispute with the WTO can take several years from start to finish, and therefore this recommendation would not solve the impending shortage. If the WTO rules in favor of the U.S, it would eliminate market distortions caused by Chinese policies and make it easier for others to enter the market.

**Develop Effective Substitutes for Rare Earth Metals.** The biggest difficulty concerning substitutes is that most of the rare earths used in defense systems are not able to be substituted without a loss in performance. This, of course, is unacceptable for national security reasons. Although U.S. scientists are working on a solution to this problem, much of the scientific and technical knowledge on rare earths is now in China. The Chinese government has spent millions on rare earth metal research and development. It currently has two state-owned laboratories dedicated solely for rare earth metal research and the only two scientific journals in the world that are devoted to rare earth metals.<sup>21</sup> Although the U.S. government is looking into giving small grants and loans for domestic firms,<sup>22</sup> the U.S. needs to invest more resources into R&D in order to catch up.

**Develop new technologies.** Developing new technologies that increase the efficiency of rare earth metals and that allow for better recycling of rare earths is another way for the U.S. to decrease its dependence on China. Again, this will be difficult since the bulk of the scientific and technical knowledge surrounding rare earths is in China. However, the U.S. Department of Energy (DOE) is currently working on new recycling techniques for rare earths. According to DOE, recycling rare earth metals could “significantly lower world demand for newly extracted materials.”<sup>23</sup>

## Conclusion

Although the United States has taken some steps to reduce its reliance on China for rare earth metals, it has not done enough to secure its supply chain from the shortage expected in the next couple of years.

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20. Ratnam.

21. Hurst, *China’s Rare Earth Elements Industry*, 8-10.

22. Ratnam.

23. U.S. Department of Energy, “Critical Materials Strategy,” December 2010, 6, <http://www.energy.gov/news/documents/criticalmaterialsstrategy.pdf>.

The U.S. needs a coherent, long-term strategy to reduce its reliance on Chinese rare earth metals. The above recommendations should all be a part of this strategy. The U.S. will need to develop new technologies and invest in mining operations to solve the long-term supply problem. In the short-term, stockpiling rare earth metals is one of the best ways to prepare for a future shortage until these new mines and technologies become available.

The first country (or defense company) that is able to develop an effective and reliable substitute for rare earths or that is able to develop new and more efficient technologies will gain a competitive advantage over its peers. This is one area where the U.S. has a significant advantage, having the most robust defense industry in the world. The U.S. needs to capitalize on this advantage and regain its position as a producer and supplier of rare earth metals.

## Building a New American Arsenal

The American Security Project (ASP) is a bipartisan initiative to educate the American public about the changing nature of national security in the 21st century.

Gone are the days when a nation's strength could be measured by bombers and battleships. Security in this new era requires a New American Arsenal harnessing all of America's strengths: the force of our diplomacy; the might of our military; the vigor of our economy; and the power of our ideals.

We believe that America must lead other nations in the pursuit of our common goals and shared security. We must confront international challenges with all the tools at our disposal. We must address emerging problems before they become security crises. And to do this, we must forge a new bipartisan consensus at home.

ASP brings together prominent American leaders, current and former members of Congress, retired military officers, and former government officials. Staff direct research on a broad range of issues and engages and empowers the American public by taking its findings directly to them.

We live in a time when the threats to our security are as complex and diverse as terrorism, the spread of weapons of mass destruction, climate change, failed and failing states, disease, and pandemics. The same-old solutions and partisan bickering won't do. America needs an honest dialogue about security that is as robust as it is realistic.

ASP exists to promote that dialogue, to forge consensus, and to spur constructive action so that America meets the challenges to its security while seizing the opportunities the new century offers.



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