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Rare-Earth Elements Mining and Milling Conflicts

Guy Burgess & Sanda Kaufman

This case study uses the technique of developing "anticipatory" scenarios. It offers students the realistic situation of a think-tank seeking to acquire negotiation and conflict management skills from outside partners, in the context of a project on global strategies regarding the mining and acquisition of rare-earth elements (REEs).

REEs (mostly metals) are key to modern consumer electronics, electric transportation, and military systems. They are not really rare, though known reserves are limited. Current sources are in China (largest), Vietnam, Russia, India, Brazil, and in southern Africa, a place rife with conflicts and international meddling. Considering the stakes, hybrid warfare tactics may be at play to skew the market in favor of certain actors, and against others. Such a possibility presents numerous opportunities for negotiation and conflict prevention.

This case study encourages students to focus on thinking, strategizing and decision skills, as well as imagining an uncertain future using anticipatory scenarios for developing responses to emerging hybrid warfare threats.

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Keywords: Hybrid warfare – Rare-earth elements – Uncertainty – Anticipatory scenarios - Strategic conflict management framework –Simulation – Consultancy – Think-tank

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Some additional elements about how to administer this case are presented in the General Teaching Note on p. 41, particularly starting on p. 47.

RARE-EARTH ELEMENTS MINING AND MILLING CONFLICTS

Guy Burgess & Sanda Kaufman[1]

Introduction

This case study is about an ongoing, real-world challenge: the vulnerability of developed democracies to the disruption of supply of raw materials critically important to their economies. It uses anticipatory scenarios as tools for developing response strategies. As such, this case requires participants to imagine, and deal with, situations that might occur in the future, rather than analyze situations which have already happened and therefore typically have plenty of information available about them.

Anticipatory scenarios are used here to develop necessary skills that complement analytic skills used in traditional case studies. Unlike predictions, anticipatory scenarios require imagining various futures and strategizing about how to obtain favorable outcomes. This is especially useful in dealing with complex situations that are difficult to predict because they are novel in some key respects, change all the time, and/or are plagued by high levels of uncertainty. The anticipatory scenario approach, increasingly used in business, urban planning, medicine, finance, and military contexts, allows exploration of possible developments and preparation of responses to them. This approach helps uncover vulnerabilities in strategies and actions which might not be apparent otherwise. At the very least, it can reveal some of what we do not even know that we do not know.

The rare-earth elements (REEs) pose "wicked" (read "complex") challenges, meaning that any action in pursuit of objectives may have unexpected negative consequences to be considered and weighed against the expected benefits. One characteristic of wicked problems is the fact that information about them is often missing, incomplete, or hard to obtain, and what there is obsolesces rapidly. Therefore, students addressing such problems need creativity and flexibility. They will have to imagine unfamiliar contexts, contingencies, and (intended and unintended) consequences for a changing number of stakeholders. In the process, students will also be called on to identify and consider some moral dilemmas, and to confront parties whose intentions are not what they seem or are outright inimical to democratic values. They will have to surface their assumptions, test them against reality, reject those which do not match, and adopt new ones. Chiefly, students will be asked to produce strategies (expressed in "if-then" statements contin-

[1] Rishi Batra, Heidi Burgess, Calvin Chrustie, Barney Jordaan, Anne Leslie, Leonard Lira, Scott McGregor and I. William Zartman contributed to the discussions that led to this case.

gent on current and new geopolitical and technological considerations)[2] rather than fixed steps toward a solution.

Background information

Rare earths elements (REEs), mostly metals, are key to modern consumer electronics, electric transportation, and military systems. Access to REEs is highly prized by high-tech, industrial powers worldwide. As geopolitical tensions have intensified in recent years, so has competition for access to these minerals. They are not really rare, though known reserves are limited. Current ones[3] are in China (largest deposits known so far), Vietnam, Russia, India, Brazil, and in southern Africa.[4] Considering the stakes, hybrid warfare tactics may be at play to skew the market in favor of certain actors, and against others.

Let's develop an example of an anticipatory scenario regarding southern Africa (SA). This region has potential for increased REE mining above current levels, which could improve the economic situation of its inhabitants and could alleviate the dependence on current sources. However, SA has also seen some of the world's most dangerous and deadly conflicts. We might expect that increasing pressure to secure access to REEs in SA might lead to a global crisis, resulting from a simultaneous increase in social and political tensions in Africa's mineral-rich areas and rapidly accelerating global demand for the region's mineral resources.

To a largely unknown degree, this crisis is likely already occurring. Global powers and giant resource corporations commonly resort to "hardball" strategies as they struggle to build and maintain social and political support for their mineral extraction efforts, while undermining support for their rivals' extraction efforts. A country (e.g., China, home to extensive REE deposits) might acquire lands in SA to block other countries' access, to preserve their own position as the largest supplier and to control global REE flows.

In the many cases where ethical competitive strategies do not produce the desired results, it is not uncommon for competitors to resort to "dirty tricks." These range, for example, from various types of espionage, blackmail, or threats against individual decision-makers who are not adequately compliant, to disinformation campaigns, sabotage, and even acts of violence (generally staying just under the threshold that might provoke large-scale, violent countermeasures). Such strategies fall under the umbrella of hybrid warfare (HW).

[2] For example: REEs are necessary for electric vehicles. We can assume this will continue. However, demand is already slackening for such vehicles, which currently have battery and other problems and lack infrastructure. While in the future all these challenges may be resolved and electric vehicles will be in high demand, there is also the possibility of new technologies coming online for non-fossil-fuel-powered vehicles, which will diminish to an extent the demand for REEs and the race to secure them.

[3] Rare earth elements: where in the world are they? https://www.mining.com/web/rare-earth-elements-where-in-the-world-are-they/

[4] Particularly in five countries: Mozambique, Angola, South Africa, Namibia, and Malawi. Bekoe et al, Rare Earth Elements in Africa: Implications for U.S. National and Economic Security (Institute for Defense Analysis, 2022), at https://apps.dtic.mil/sti/trecms/pdf/AD1204908.pdf

What might happen if this HW-backed competition for REEs in SA were to get out of hand and result in large-scale acts of violence targeting mining, processing, and shipping facilities, as well as the area's civilian population? Triggers could be, for example, a few spectacular acts of sabotage (such as, elsewhere, the attack that destroyed the Nord Stream pipeline in 2022 – see scenario #9). There are also well-founded chronic worries about more predictable attacks to global trade, e.g. on shipping in the Strait of Hormuz, already happening as of 2023, and causing expensive rerouting of shipping traffic around the Horn of Africa.

Under this confluence of circumstances, we can expect interruptions of the steady supply of the strategically important REEs on which so much of the global economy depends. The disruptions could escalate into a kind of superpower conflict by proxy which will make it impossible to assure general commercial access to SA minerals. Is there anything REE users can do in this scenario?

While we could focus on efforts to defuse the crises in SA, this case study seeks to explore a secondary crisis – one that would arise within the resource-rich, developed democracies as they embark on an urgent effort to develop more secure (domestic wherever possible) alternative sources of REEs. These democracies are not above acting unilaterally to protect their own REE supply even at the expense of allies, giving rise to fierce conflicts among "friends." This is a space requiring negotiations and conflict management to develop effective strategies against hybrid warfare by unfriendly actors and for sharing the risks and benefits associated with securing access to REEs.

This exercise asks participants to think through how they would navigate this complex environment in the quest for circumventing the obstacles arising in any region with REE deposits, such as southern Africa. A first step is developing a scenario – anticipating what problems might crop up at any selected location, and then globally. The next step is offering a robust[5] strategy that identifies risks and mitigates them to the extent possible. The case is built on publicly available information about ongoing efforts to develop alternative, stable sources for the key REE minerals.

[5] A robust strategy offers steps which are contingent on various possible events and threats and does not depend critically on any condition materializing. One definition by McInerney, D., Lempert, R. & Keller, K. (What are robust strategies in the face of uncertain climate threshold responses? *Climatic Change*, 547–568 (2012). https://doi.org/10.1007/s10584-011-0377-1) is: "trading a small decrease in a strategy's expected performance for a significant increase in a strategy's performance in the worst cases." The wider the range of contingencies for which a strategy is still wise, the more robust it is to surprises. A simple example is taking an umbrella on a walk in the Fall is more *robust* than relying on the weather forecast of low-probability rain.

A crisis is brewing in the developed democracies

Seventeen metallic elements are included in the rare-earth elements group (REEs). They are key components in the production of military equipment, wind turbines, and electric vehicles. They are also essential in the production and functioning of numerous widely used consumer electronics which have become critical to our daily lives. These include cellular phones, computers, and flat screens.[6] The use of such devices is rising rapidly, increasing the demand for REEs around the globe.

Access to REEs is highly prized by high-tech, industrial powers worldwide. Countries with access to REEs have a considerable leg up in developing and/or taking advantage of novel technologies. This access translates into economic benefits as well as enhanced defense capability.

REEs are neither very rare, nor earths. Like other vital resources such as water, they are not equitably located around the world. Moreover, detection of deposits and extraction of REEs are both difficult and environmentally damaging. This gives rise to a serious international competition by fair and unfair means to find, mine, and process REEs, with various degrees of regard (or lack thereof) for environmental and social consequences.

A crisis is looming within wealthy, developed democracies. They are embarking on an urgent effort to develop a steady flow of REEs from secure sources, as an alternative to competing for them in the current places where these minerals are being extracted.[7] This is largely because there are numerous downsides to reliance on REEs found at some of these locations. Chief among these downsides is the potential for unexpected disruptions in supply, which could trigger a worldwide chain reaction in several industries, some of them critical to communications and defense. For example, China or Russia (and countries in their sphere of influence) might cut the flow of supplies to obtain political or economic advantages. One region where mining opportunities might be explored is the southern part of the African continent. However, that region is frequently buffeted by violent ethnic and political conflicts, which also poses risks to the flow of REEs. Other downsides include competition from unfriendly countries which do not shrink from using covert methods to establish their dominance in the REE markets.

In some of the developed democracies – the United States or Australia, for example – attempts to negotiate the agreements necessary to develop major new mineral facilities would need to overcome obstacles such as:

- The negotiation of government subsidies (to make the development of lower quality mineral resources economically feasible).

[6] See *What are rare earth elements, and why are they important?* https://www.americangeosciences.org/critical-issues/faq/what-are-rare-earth-elements-and-why-are-they-important

[7] Top 10 Largest Rare Earth Elements Producing Countries: https://www.geeksforgeeks.org/top-10-largest-rare-earth-elements-producing-countries/

- Opposition from strong environmental movements which seek to block (or at least attach strong environmental safeguards to) any development.
- Widespread public hostility toward multinational mineral extraction companies.
- General distrust of the national security establishment.
- And geopolitical rivals' clandestine efforts to stir up local opposition to projects they think would weaken their strategic position.

These obstacles are likely to be counterbalanced, to a degree, by strong support from those who would benefit economically from proposed projects, and from those working in industries dependent upon the REEs. There is also likely to be intense competition between projects vying for government support.

All these pressures will make it difficult for even the most altruistically motivated negotiators to come up with agreements that wisely and equitably balance the competing interests of the various stakeholders. The focus of this project is on how exactly to do this kind of balancing, while also resisting the efforts of bad-faith actors to undermine this process by using the full array of hybrid warfare tactics.

Two entities searching for solutions to the REEs conflicts

You will play the role of members of the Minerva Group.

The Minerva Group (named after the Greek goddess of wisdom and defensive war) is a consulting consortium made up of professionals and organizations offering to assist in negotiation and conflict management in a broad range of political and security issues. The group provides consulting and conflict management services to clients seeking wise and equitable ways of handling the complexity of today's large-scale problem-solving collaborative efforts.

Minerva's members are individuals whose background and expertise are quite diverse. They specialize in helping clients navigate hostile negotiation environments where a wide range of "bad faith" actors employ a variety of sinister and deceptive tactics, in attempts to subvert negotiation processes in ways that advance their own and/or their employers' (organizations and countries) interests. Of particular concern in this context are some aggressive foreign powers employing modern hybrid warfare tactics. In the United States, recent examples include cyberattacks on critical infrastructure and food supply sources, and use of sophisticated methods (such as balloons and drones, and disruptions of communication means) to test responses to hostile moves, as well as targeted theft of intellectual property in specific areas such as REEs.

Minerva's members seek to encourage others to think strategically about how to apply the ideas which they are developing, should they be given the opportunity to do so.

The Promontory Institute is a low-key, well-funded and well-connected international initiative of leaders of major defense and technology companies, politicians and academics specializing in security and governance issues, as well as a few environmentalists and social justice advocates. Its members come from the major developed democracies and are united in the belief that the destructive politics that has taken over too many liberal democracies is making it impossible for these societies to successfully respond to the many challenges of the early- and mid-21st century including, especially, China's new brand of assertive high-tech authoritarianism. Promontory aims to show that the sophisticated application of state-of-the-art negotiation and conflict management strategies can generate wise, equitable, and politically realistic strategies for meeting these challenges. Since Promontory lacks specific expertise, it commissions, through requests for proposals (RFPs), consultants who bring the necessary skills to the problems Promontory intends to tackle.

The Promontory Institute is currently concerned about the on-ongoing vulnerability of developed democracies to the disruption of supply of critically important rare-earth elements (REEs). In pursuit of strategies to deal with this challenge, the Institute has issued a request for proposals (RFP), which the Minerva Group and its competitors have received, to generate advice. Promontory will fund only a select number of proposals-those which will persuade them of a considerable likelihood of successfully contributing to the securing of a steady supply of REEs to developed democracies.

The rare-earth elements initiative

Rare-earth elements are essential building blocks of modern, high-tech societies. Among the many challenges Promontory is committed to address with respect to REEs is the need to secure a reliable supply of competitively priced rare-earth elements to effectively counterbalance China's near monopoly on these. In pursuing this goal, the Promontory Institute is taking an international approach that seeks to strengthen and bind together developed democracies, rather than dividing them along nationalistic lines and unnecessarily creating a competition among them despite shared interests.

The Institute is calling on leading negotiation and conflict management organizations (including Minerva) to submit proposals detailing how they would structure a broad-based (and possibly ongoing) negotiation effort capable of achieving these desired objectives. Cost is not a major consideration. In soliciting these proposals, the Institute emphasizes that it seeks robust strategies likely to be successful not only in the current international climate but also in the near and even mid-term future. The Institute is also committed to using its considerable influence to help secure any needed cooperation from both public and private sector organizations which the consultants might identify as necessary.

The complex international environment is shifting rapidly. Therefore, an effort such as Promontory is contemplating is unlikely to be one-time. Rather, successful strategies

will have to incorporate recurring reevaluations and negotiations[8] that would respond to new events and technologies – especially those which opponents might deploy to circumvent obstacles to their objectives.

More specifically, the Promontory Institute is looking for an organization capable of managing a comprehensive effort to negotiate approval for a series of rare-earth elements mining, milling, and refining projects that would, in a timely manner, provide a secure, competitively priced supply of these minerals which would be socially responsible and sensitive to environmental concerns.

Overall proposal process

The Institute is asking potential contractors (including Minerva) how they would structure a process that identifies and evaluates proposed projects and then secures the approvals needed to go ahead and implement some combination of projects to provide the secure sources of sought rare earth elements supply.

Part I – Selecting projects for implementation

The first set of questions that the Institute would like to see addressed by those bidding on the contract pertains to the mechanics of the process for selecting the projects to be negotiated. Included are the following:

1) How would you distill the large list of proposed domestic and international projects into a much shorter list of projects worth detailed consideration? Criteria might include, for example, the potential of projects to produce REEs; the likelihood of agreement among stakeholders; risks to the projects at different time horizons; political and economic implementability; and vulnerability to hybrid warfare tactics. How would you organize in-depth technical analyses of the shortlisted projects? The analyses will have to assess economic feasibility (perhaps with government subsidies, price guarantees and other devices requiring international cooperation) and any adverse social and environmental impacts (as well as the feasibility of impact mitigation strategies). Such analyses ought to seriously consider whether expanded rare-earth elements production is, in fact, essential and/or whether alternative technologies and sources might be preferable and expected to come online in the near to middle time range, thereby impacting demand for REEs. Worth considering: the sources, risks, and impacts of possible supply disruptions (through hybrid warfare and other tactics) and the amount of money that is worth spending to reduce the risk of such disruptions.
2) How would you verify that these analyses are drawing on sound, available information, and that they are trustworthy and trusted by key stakeholder groups?

[8] Recurring evaluations and tweaking are standard recommended components of negotiated agreements especially in international, environmental and planning areas, whose effects materialize over years and decades during which much can change.

3) What kind of political assessment / stakeholder analysis would you conduct to identify those likely to support or oppose potential projects and assess their ability to influence the decision? In addition, an assessment is necessary regarding how politically vulnerable these projects are likely to be. For example, are they in the category of activities that might find favor during one administration only to be overturned by the next? Can such risk be mitigated?
4) How would you structure a series of negotiations (and with whom) capable of finding mutually acceptable ways of overcoming sources of "own camp" opposition?

Part II – Responding to Hybrid Warfare Tactics

The focus of a second set of questions the Promontory Institute wants to see addressed in proposals regards how the recommended process above will be defended from "bad faith" actors. These individuals, organizations or even inimical government entities might use clandestine and deceptive hybrid warfare tactics, either to prevent the process from reaching a successful conclusion or to distort the process in ways that result in undermining rather than advancing the interests of the Promontory Institute and other stakeholders.

This will require conducting a broad "threat assessment" that looks beyond traditional negotiation and litigation arenas at the many ways in which public and private sector actors from both open and closed societies might try to undermine the ability of the Institute to achieve its primary objectives. In other words, the Institute wants potential contractors to think about all that could go wrong with a proposed project ("pre-mortem")[9] besides everything that could go right.

More specifically, the Institute seeks to know which of the following tactics potential contractors are prepared to identify and counter, and which tactics they believe fall outside of their ability to reasonably defend against. Applicants should avoid generalities and, to the extent possible, be very specific regarding the situations to which their proposed remedies should apply, as well as where they might not be relevant.

1) Deliberate distortions of the technical assessment process: Given the role that the various technical assessments play in determining which REE projects are going to be pursued, there will be considerable incentives for parties to oversell their projects and downplay (or even sabotage) competitors. What strategies might preempt or correct these assessments?
2) The influence of corrupt officials: There is a real danger that key decision makers will attempt to capitalize on their position by demanding some type of "payoff"

[9] See Kahneman, Daniel. 2011. Thinking Fast and Slow. New York: Farrar, Straus, and Giroux. A pre-mortem entails imagining what could go wrong and embedding mitigation in the proposed strategies. This will not prevent something going wrong anyway. It will, however, diminish the ways in which we can be surprised by unintended side-effects of decisions (bound to occur in complex systems), and for some surprises we will be prepared, leaving time and resources to be devoted to other, unanticipated surprises.

which, while legally prohibited, can be hard to resist. A bigger threat, however, is likely to come from officials who take advantage of clever legal maneuverings to achieve the same basic result. These and other threats also derive from the space some decision makers might discover, within which they can promote agendas and pursue individual or group interests at the expense of those sought by the Institute and by other stakeholders. What measures might prevent such corrupt moves?

3) Anti-competitive business practices: Some countries might try to undermine the financial viability of a project by dumping REEs on the market at extremely low prices or by threatening near-term access to REES to businesses considering a longer-term switch to Promontory-affiliated sources. For example, in the past, China improved its economic position in various markets by such tactics and may try to do so again by cornering the REEs market. How can REE projects be protected from such actions?

4) Sensationalistic media: As part of a broad effort to attract an audience, media outlets have been known to inflate and distort modest disagreements, framing them as major social controversies that undermine a prudent consideration of the issues. What strategies might counteract such tendencies?

5) The project becoming a pawn in larger political struggles: Inevitable conflicts surrounding REE projects could easily be amplified as part of routine, "hardball" politics, or as part of a clandestine campaign in which provocateurs would seek to drive, and then benefit from, increased political polarization. This could include "mobilize the base" hate-mongering politicians across the political spectrum from left to right, and foreign powers who seek to destabilize Western democracies. Here, the concern goes far beyond legitimate substantive issues that deserve serious consideration. Flashpoints could erupt around the rights of indigenous peoples, environmental risks, jobs and wages, unionization, increased use of advanced technologies (such as AI and robotics), etc. and be exploited for their own ends by nefarious actors. What steps might lessen the impacts of such activities?

6) Information security breaches and espionage: What steps would you propose to take to prevent unauthorized and inappropriate disclosure of information as well as clandestine efforts to obtain confidential information? This will require ability to navigate today's increasingly dangerous cybersecurity environment, where hybrid warfare tactics are often used.

7) Disinformation warfare: What steps would you propose to take to anticipate, identify, and counter sophisticated disinformation strategies designed to influence decision-makers and the general public by generating and amplifying deceptive and inflammatory narratives through marketing, social media, and other strategies?

8) Delaying tactics: Competing suppliers and, especially, competing geopolitical actors are likely to take advantage of the many opportunities that democratic systems offer to anyone who wants to prevent a new project from going forward (the effect is sometimes called "sticky status quo[10]"). The large number of permits that all major projects require, along with extensive opportunities for public participation and the opportunity to appeal adverse decisions, can allow some interest groups to cause indefinite postponement of decisions that, based on the merits of their arguments, would almost certainly go against them. Here the issue is the bad-faith perversion of otherwise reasonable decision-making processes. What means do you propose for diminishing the effect of the sticky status quo?
9) Threats and intimidation: The stakes involved in this issue are high enough that it is not impossible to imagine parties willing to resort to violence and intimidation to advance their interests. It is, for example, quite possible that those involved in the negotiations envisioned above will be at risk of being kidnapped (especially in violence-prone areas). How can such actions be anticipated/prevented?
10) Other tactics: The 9 items above are but an incomplete list of tactics to be used to defeat REE projects. What other impediments can you imagine/anticipate that should be added to this list, and how would you propose to deal with them?

Potential contractors should also outline the legal and ethical obligations and constraints that will guide their efforts (especially in cases where difficult trade-offs between competing priorities are required).

Part III – Social System-Level Recommendations

In addition to measures that the Minerva Group is seeking to recommend in the context of specific REE project negotiations, the Institute would also like to know what larger, more systemic steps Minerva might propose to help society as a whole address the hybrid warfare problem. These steps might include, for example, possible changes to international laws and trade agreements, legislative or regulatory steps which could be taken by national governments, changes to the formal standards of practice which could be promoted by professional associations, education campaigns for helping the public understand the nature of the hybrid warfare problem, and public disclosure of the actions of those who chronically violate generally accepted norms. Beyond this, the Institute would like to know what training programs Minerva (and its competitors) might recommend for informing participants in negotiation efforts about possible threats to the integrity of their work, and about the best currently available options for limiting those threats. Besides skills directly related to securing the REEs supply, such training could include, for example, robust decision making, risk assessment, negotiations, consensus building, communicating across cultures and languages and others.

[10] This is the effect of being "stuck" with the status quo because of lack of consensus on change. The status quo is considered to have inertia.

Conclusion

The Institute considers the above to be just a preliminary list of questions that deserve consideration. They invite potential contractors to suggest other topics that they ought to consider, both regarding REEs and, more generally, ways to counteract hybrid warfare.

The Institute also recognizes that the success of this overall effort will require involving organizations with expertise in several areas including, for example, mineral engineering, market analysis, environmental impact assessment and remediation, social impact assessment and remediation, media relations, security, and permitting (and other legal issues). Potential contractors are asked to highlight areas of expertise that they think Promontory should be sure to include and specify how that expertise would interface with their conflict management strategy.

The bottom line is that the Institute recognizes that business-as-usual approaches to complex negotiations – such as those involved with expanding access to REEs – are ill-suited for today's complex and quite hostile negotiating environments. The Institute is looking for a novel approach to negotiation – one that begins with a solid grounding in negotiation theory and practice, which then adapts and extends these ideas to meet contemporary challenges.

Background readings[11]

This is an initial collection of background readings on the Rare-Earth Elements problem and decision-making in complex contexts. Note that in the complex environment of competition over an increasingly valuable resource, information changes and obsolesces rapidly, requiring constant updates and quality verification.

About rare earth elements:

- What are rare-earth elements, and why are they important? https://www.americangeosciences.org/critical-issues/faq/what-are-rare-earth-elements-and-why-are-they-important
- What are Rare Earth Elements (REEs), where are they found and how are they mined? https://etech-resources.com/what-are-rare-earth-elements-rees-where-are-they-found-and-how-are-they-mined/
- We Don't Mine Enough Rare-Earth Metals to Replace Fossil Fuels With Renewable Energy – https://www.vice.com/en/article/a3mavb/we-don't-mine-enough-rare-earth-metals-to-replace-fossil-fuels-with-renewable-energy
- The collapse of American rare earth mining - and lessons learned –

[11] These are some suggestions. A comprehensive literature and data search will eventually be needed for the project. Contractors are advised to propose ways to collect necessary information without getting bogged down in the vast literature available.

https://www.defensenews.com/opinion/commentary/2019/11/12/the-collapse-of-american-rare-earth-mining-and-lessons-learned/

- Mapping rare earths projects outside China – https://www.mining-technology.com/features/mapping-rare-earths-projects-outside-china/
- Factbox: Miners gear up global rare earth projects as prices surge – https://www.reuters.com/article/us-rareearths-mining-factbox/factbox-miners-gear-up-global-rare-earth-projects-as-prices-surge-idUSKBN2AU0FX
- Factbox: Rare earths projects under development in U.S. – https://www.reuters.com/article/us-usa-rareearths-projects-factbox-idUSKCN2241L6
- Northeast Wyoming Rare Earth Resources – https://www.wyoming-mining.org/minerals/rare-earths/
- Mountain Pass California - Mining Company Determined to Restore U.S. Rare Earth Supply Chain (Updated) – https://www.nationaldefensemagazine.org/articles/2020/11/20/mining-company-determined-to-restore-us-rare-earth-supply-chain
- The Top 5 Rare Earths Companies for 2021 - https://investorintel.com/markets/technology-metals/technology-metals-intel/kozaks-top-5-rare-earths-companies-for-2021/
- Lynas Assessment Report, looking at conflicts surrounding the Lynas Advanced Materials Project (LAMP) - https://lynasrareearths.com/wp-content/uploads/2024/04/2024-Lynas-Kalgoorlie-Compliance-Assessment-Report.pdf

About decision making and negotiations in complex contexts:

- Alkon, C. & Kaufman, S. (2023). A Theory of Interests in the Context of Hybrid Warfare: It's Complex. *Cardozo Journal of Conflict Resolution*, Special Melnick Symposium Issue, *24*(3) 101-135. Listed on SSRN's Top Ten download list, LSN: Dispute Resolution (Oct. 2023).
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Possible topics for discussion (non-exhaustive list)

Complex systems constantly shift over time. Therefore, instead of plans – with objectives and sequences of actions to attain them – complexity requires strategies that also shift over time, to adapt to swiftly changing circumstances. Given the situation described, the Rare Earth Elements (REEs) challenge asks students who should respond, when, how, and what they would advise responders to do strategically.

For example:

- How to recognize hybrid warfare actions.
- How to gather and evaluate information with respect to a specific situation.
- How to debias/depoliticize response strategies and preemptive ones.
- How to imagine (anticipate) what else might happen and what responders should do, including who needs to negotiate with whom, how to evaluate the reliability of agreements, how to build in periodic reviews to change course when necessary, and how to build in recourse measures for breech of agreements.
- How time, scale, and context affect the layers of hybrid warfare, and the information needed to counter it.
- Who needs to do what when some form of hybrid warfare hits (emergency situations).
- How to test proposed responses and strategies for robustness at different time horizons (short-, middle- and long-run); how to explore possibilities that strategies might fail, not just succeed ("pre-mortem") – and how to prevent failures discovered, or negative side effects identified which might diminish the value of proposals.
- Obstacles to acting to defend own interests, structures, etc.

Possible additional questions for discussion (non-exhaustive list)

Questions about the proposal process

1) Can you formulate objectives based on the Promontory Institute initial information? What are they?
2) What additional clarifications, if any, might you ask of the Institute?

Questions focusing on REEs:

1) What types of information do you need to begin work on the proposal?
2) What criteria do you propose for evaluating information sources and their trustworthiness?
3) How to tell when you know enough about REEs?[12] What are some aspects which might be key for the proposal? What information might be shifting over time?[13]
4) What information is missing, if any? Can you proceed without it? If not, what can you do?
5) How sensitive is the proposal to errors in (specific classes of) information?

Questions focusing on stakeholders in the case:

1) The proposal requires a careful assessment of stakeholders – those who may affect or be affected by decisions to secure the supply of REEs – and their stakes.
    - What are the main categories of stakeholders currently?
    - Might the list change in the future?
    - Can their stakes be identified with associated degrees of confidence?
    - Are some stakeholders likely to subvert decision processes to take advantage of current political and economic winds?

[12] Hint: one way to test that is for students to pretend to already know some information they are seeking, and then ask themselves whether, now that they know, they would do anything differently. If the answer is "no," the information may not be necessary.

[13] Since we began working on the case, some of the references may have aged. For example, new sources of REEs are being discovered, and new regulatory action makes it possible for them to be mined at those locations.

Questions focusing on hybrid warfare and negotiations:

1) What kinds of hybrid warfare might be operative in the REEs case?
2) What kinds of mitigation have already been used in other contexts? Are they applicable to the REEs situation?
3) Which types of hybrid warfare activities have opportunities to be countered by negotiating joint strategies with partners? By other means (e.g., technology)?
4) Who should be involved in negotiations? (Public/private entities? At what level?)

Beyond these suggestions, discussions with participants should proceed based on their ideas, encouraging broad participation and challenges.