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Opportunity Title: Investigation of Strategic and Critical Materials in the Space Infrastructure Supply Chain
Opportunity Reference Code: ICPD-2022-27

Organization Office of the Director of National Intelligence (ODNI)

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How to Apply **Create and release your Profile on Zintellect** – Postdoctoral applicants must create an account and complete a profile in the on-line application system. **Please note: your resume/CV may not exceed 2 pages.**

Complete your application – Enter the rest of the information required for the IC Postdoc Program Research Opportunity. The application itself contains detailed instructions for each one of these components: availability, citizenship, transcripts, dissertation abstract, publication and presentation plan, and information about your Research Advisor co-applicant.

Additional information about the IC Postdoctoral Research Fellowship Program is available on the program website located at: https://orise.orau.gov/icpostdoc/index.html.

If you have questions, send an email to ICPostdoc@orau.org. Please include the reference code for this opportunity in your email.

Application Deadline 2/28/2022 6:00:00 PM Eastern Time Zone

Description **Research Topic Description, including Problem Statement:**

The supply chain for materials critical to space infrastructure is incredibly complex, reflecting the globalized nature of industry and trade. For example, certain metals used in aerospace alloys are mined in one country, smelted or processed in another, and manufactured in a third before making their way to the United States. Additionally, certain countries or regions hold an effective monopoly on one part or all of the supply chain for strategic materials. One notable example of this is China's dominance of the rare earth market. In 2017, China accounted for over 80% of global rare earth element production.[1] Rare earth metals are essential for many modern technologies, including electronics, renewable energy, batteries, and space-grade superalloys. Cases such as this expose the development and maintenance of US space infrastructure to political, environmental, and social risk by not having sufficient alternative sources readily available. Estimating the impact of supply disruptions requires a systematic understanding across the supply chain from mineral extraction to end use application. [2] While the recent supply-chain crises caused by the COVID-19 pandemic have raised awareness to the issue, most studies focus only on the manufacturing risk at the end of the supply chain. There is a need for a full-scope supply chain assessment for critical materials to fully understand the full level of risk to the US aerospace and defense industries.

The proposed study would tackle this problem by:

1. identifying the key critical chemical elements,
2. mapping out the life cycle of each element,
3. identifying the risk exposure at each stage in the life cycle, and
4. Suggesting risk-mitigation strategies and proposing alternatives.

References

1. Gamboji, J. Mineral Commodity Summary – Rare Earths. https://minerals.usgs.gov/minerals/commodity/rare_earths/mcs-2017.raree.pdf
2. Riddle, M. E., Tatara, E., Graziano, D. J., Braeton, S. J., Olson, C., Bennet Irion, A., Argonne's global critical materials agent-based model (GCMat), ANL-20/25, 2020.

Example Approaches:

This project should utilize open-source information and academic literature to establish a baseline for determining which elements are the most critical to space infrastructure. After selection of an initial series of materials, life cycle assessment (LCA) software in conjunction with other sources should be used to map out the "mine-to-mission" pathway of each material, identifying key sources of strategic risk at each step. This research project should also investigate possible effects of disruption to each step. Risks can include direct risks to mining processes (such as labor shortages, infrastructure/transport challenges, environmental disasters) to risks in processing, refining and shipping of product. Outside of specific risks, overarching disruption potentials should be addressed. These would include potential impact on US manufacturing, economic stability, and national security. Publicly available information on stockpile data can be used to estimate how long stockpiles can be utilized in the event of a disruption, which in turn can inform on what are appropriate levels of stockpiling for each material. Finally, the project should advise on risk mitigation strategies for each critical material, evaluating the cost and benefit of each strategy.

Relevance to the Intelligence Community:

It is critical that the US maintains the access to the materials essential for space infrastructure. Extended disruption to their supply chains would compromise readiness and undermine the US's competitive edge in technology. Through identifying the elements most exposed to supply chain risk, mitigation strategies can be developed and implemented to ensure the continued success of US space missions and infrastructure.

Key Words: Risk Management, Supply Chain, Materials Criticality, Globalization, Strategic Materials, Stockpiles, Aerospace Materials, Rare Earth Elements

Qualifications

Postdoc Eligibility

- U.S. citizens only
- Ph.D. in a relevant field must be completed before beginning the appointment and within five years of the application deadline
- Proposal must be associated with an accredited U.S. university, college, or U.S. government laboratory
- Eligible candidates may only receive one award from the IC Postdoctoral Research Fellowship Program

Research Advisor Eligibility

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- Must be an employee of an accredited U.S. university, college or U.S. government laboratory
- Are not required to be U.S. citizens

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Discipline(s):**
  - **Chemistry and Materials Sciences** (12)
  - **Communications and Graphics Design** (2)
  - **Computer, Information, and Data Sciences** (16)
  - **Earth and Geosciences** (21)
  - **Engineering** (27)
  - **Environmental and Marine Sciences** (14)
  - **Life Health and Medical Sciences** (45)
  - **Mathematics and Statistics** (10)
  - **Other Non-Science & Engineering** (2)
  - **Physics** (16)
  - **Science & Engineering-related** (1)
  - **Social and Behavioral Sciences** (27)