NRC·CNRC

# MINING INNOVATION

**Technologies to increase productivity and sustainability**

National Research Council Canada
Conseil national de recherches Canada

Canada

**The massive scale, cost and complexity of mining — from exploration to operations to closure — makes the development and introduction of disruptive technology both risky and expensive.**

**Faced with declining ore grades and increasing production costs, the mining industry is confronting an unprecedented challenge that may only be solved by new models of innovation. As the country's premiere research and technology organization, the National Research Council of Canada (NRC) is uniquely positioned to help companies manage the risks of new technology development and deployment while capturing the benefits for Canadian industry and society.**

### STRATEGY: BRINGING THE SUPPLY CHAIN INTO THE INNOVATION ECOSYSTEM

Incremental improvements to existing equipment, technology and engineering practices can yield important marginal benefits but fail to deliver the meaningful productivity and environmental gains needed to keep the industry competitive.

The NRC's multi-year R&D approach connects technology developers, suppliers, integrators and producers in collaborative projects defined with a deeper understanding of end-user requirements, challenges and pathways toward commercialization. Involving the entire supply chain in technology conception and development leads to faster scale-up and adoption. This de-risks the process while giving all partners a meaningful stake in the innovation ecosystem.

### CONSORTIUM APPROACH TO MATERIALS INNOVATION SAVES INDUSTRY MILLIONS

Equipment wear and corrosion are leading contributors to skyrocketing maintenance, repair and operations (MRO) costs in Canada's mining sector. For over two decades the NRC has been managing a Mining Materials Wear and Corrosion Consortium that brings leading mining companies, material developers and original equipment suppliers together to identify equipment durability solutions that have saved industry millions in production loss avoidance and material costs.

## OUR PRIORITIES

The NRC works closely with the industry and other government partners to strengthen the innovation capacity of the supply chain, channelling a critical mass of expertise towards industry-defined priorities.

### Advanced mining technology

- Real-time analysis and intelligent process control improves mining system efficiency throughout the entire mining life cycle.
- Innovative separation technologies apply advanced mineral characterization to increase extraction and refining productivity.
- Material wear and corrosion management technologies, advanced manufacturing, and integrated predictive maintenance approaches improve equipment durability.

### Environmentally sustainable processes and practices

- Better prediction and prevention of acid rock drainage (ARD) and metal leaching (ML), waste valorization and greener processing results in lower impact extraction.
- System improvements, targeted contaminant removal and novel water reuse and recycling solutions reduce mine effluent treatment and monitoring costs.
- Application of physical, chemical and biological techniques to remediation and reclamation to create "walk-away" mine closure scenarios.

### Cleaner energy systems and markets

- Locally sourced energy from biomass or other renewable sources can reduce GHG emissions and power costs at remote mining operations.
- Producers of battery-grade minerals can create new competitive advantage by benchmarking, transforming and testing raw materials for energy storage.

Across all these areas of impact, the NRC's techno-economic expertise helps evaluate the feasibility of investments. This supports better decision-making and calculated risk-taking through all stages of R&D.

## THE NRC ADVANTAGE

For over 100 years the NRC has built a reputation as a results-focused R&D performer, adapting to meet the world's most pressing challenges. By reducing the R&D risk for Canadian businesses, we help them compete with some of the world's most innovative companies.

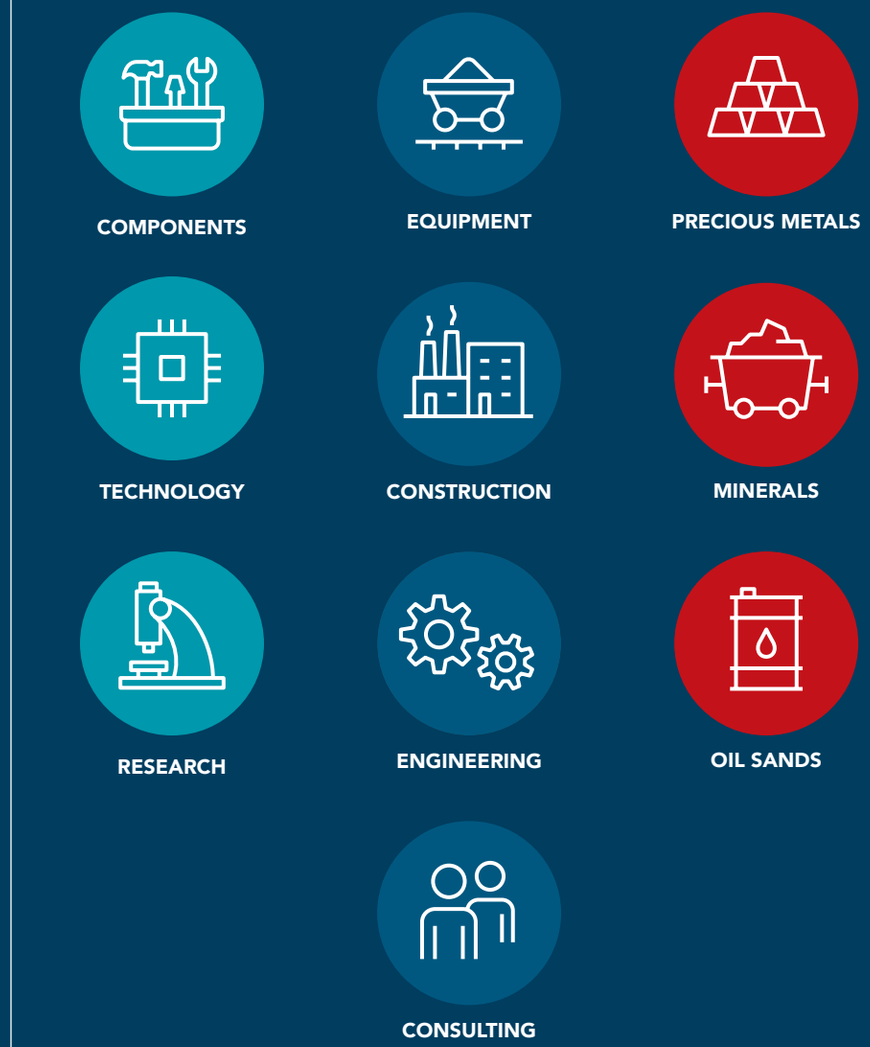
Our multidisciplinary capabilities, unbiased view, world-class facilities, national network and cross-sector relationships make us uniquely positioned to help introduce transformative innovation into complex mining systems.

Operating nationally with close to 4,000 employees working from over 20 state-of-the-art research facilities from coast to coast, the NRC can leverage its expertise to speed up innovation development and deployment in various industry sectors.

Applying the NRC's recognized experience and technology leadership in adjacent sectors — including automotive, construction, defence and information communication technologies — we bring a fresh perspective to resolve mining industry challenges. The NRC's leadership and ongoing investment in emerging and platform technologies keeps us ahead in the innovation game.

# THE NRC'S MULTI-YEAR R&D APPROACH

## CONNECTING TECHNOLOGY DEVELOPERS, SUPPLIERS, INTEGRATORS + PRODUCERS



## WORKING WITH US

The NRC supports technology development, deployment and integration from lab prototype to pilot stage demonstrations in the field. Flexible business models let us engage clients on an individual basis or through other collaborative arrangements:

### Strategic R&D

Our research projects span a broad spectrum of activities and business models, from consortia to single and other multi-party collaborations. As technology risks are shared, new commercial arrangements including supply chain technology alliances and systems integration programs may be developed.

### Licensing opportunities

The NRC looks for industry partners to fully exploit commercialization-ready R&D solutions. Qualified partners may access the NRC's intellectual property rights, technology and supply chain relationships to understand end-user needs and technical requirements to attract investment and quickly advance to commercialization.

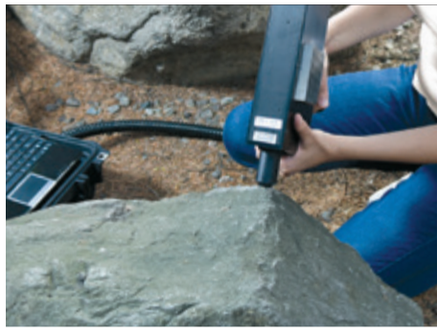
### Technical services

We provide clients with testing and validation, calibration, prototyping, codes and standards advice, demonstrations and scale-up support as part of larger collaborations or as targeted fee-for-service offerings.

### Business support and funding

The Industrial Research Assistance Program (NRC IRAP) provides small and medium-sized enterprises in Canada the advisory services and financial support they need to build their innovation capability to succeed in the global marketplace.

### BREAKTHROUGH PORTABLE SENSOR TECHNOLOGY FOR REAL-TIME ELEMENTAL ANALYSIS IN THE FIELD



Current analytical systems fail to deliver reliable results for instantaneous and on-site operation decisions. Working with a consortium of mining companies and a leading equipment supplier, the NRC is poised to transfer breakthrough real-time, in-the-mine sensing technology to industry. This technology will help geologists identify and follow lode orientation in the field, saving costs and increasing accuracy of exploration.

### PIONEERING PLANTS USED TO ACCELERATE MINE SITE REVEGETATION

Revegetation of mining sites minimizes erosion, accelerates degradation and immobilization of pollutants, and is required for site closure. The NRC's deep understanding of the relationship between plants and their microbiome is helping to accelerate this revegetation process. Exploiting the symbiotic relationship between alders and nitrogen-fixing bacteria, these pioneering plants are thriving in former oil sands and hard rock tailing sites.

# JOIN CANADA'S MINING INNOVATION ECOSYSTEM!

Find out how the NRC and its supply chain partners can help increase the productivity and sustainability of your mining interests.

## CONTACT

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