European Innovation Partnership on Raw Materials

Application for a Raw Materials Commitment

**Sustainable Intelligent Mining Systems**

Acronym:
SIMS

Abstract / executive summary:

In order to realize the vision of a sustainable intelligent mine with safe working conditions, high efficiency and low environmental impact, several new technologies, processes and methods must be implemented in today’s mining operations. Some parts of the mining system are more developed than others, and challenges are identified in all operations throughout the mining system. SIMS Raw Material Commitment (RMC) aims to test and demonstrate relevant technologies all supporting the realization of the vision of the sustainable intelligent mining system which will strengthen European competitiveness by contributing to lower production cost, minimized environmental impact and minimized mining waste, safer and more attractive working conditions, and a highly automated and flexible mining operation. The actions will lead to unlocking of potential mineral reserves and securing the supply of raw materials for Europe. Further, SIMS aims also at increasing the acceptance and understanding for mining in Europe, focusing on the social license to operate through communication with society and relevant stakeholders.

SIMS aspires to create a long lasting impact on the way we test and demonstrate new technology and solutions for the mining industry. Within the SIMS RMC, well-developed mining operations, selected due to their maturity regarding innovative technologies, world-leading equipment and system suppliers, highly specialized SMEs and top-class universities will join hands to test and demonstrate new innovative technologies throughout Europe. The SIMS RMC origins from the EIT RawMaterials partnership, and has joined for this RMC due to the common challenges and needs. SIMS aims at boosting innovations by joining relevant actors and shortening the time to market for new technologies and processes by utilizing partner synergies, thus helping keeping European equipment manufacturers, system providers and mining companies to maintain a leading position in the global market.

Links to the Strategic Implementation Plan:

- **I. Technology Pillar**
  - **I.B Priority Area: Technologies for primary and secondary raw materials’ production**
    - **Action area n° I.2: Exploration**
    - **1) New exploration technologies**
    - **Action area n° I.3: Innovative extraction of raw materials**
1) Automated mining
2) Mining of small deposits
3) Alternative mining
4) Action area n° I.4: Processing and refining of raw materials
5) 1) Innovative and flexible processing

Coverage of the Action Areas referred to above:

This RMC is addressing actions and objectives stated in the EIP-SIP Raw Materials Technology pillar 1B (technology area for primary and secondary raw materials production). The proposal is addressing the specific challenge Raw materials “Innovative pilot actions”, “Intelligent mining on land” and the main idea of the project is that the consortium will collaborate on test and demonstration of new technologies, processes and methods in various selected test sites located in existing mines, combined with a virtual platform. For example:

Human interaction: This area focuses on trust and acceptance for mining (social license to operate), acceptance for new technologies and related organizational changes, safety in mining operations and mining in symbiosis with the society. An example of a planned pilot action within this impact area is the development and demonstration of virtual safety and operations training related to new intelligent mining systems.

Intelligent Process Control: This impact area focuses on innovative new communication technologies, enhanced positioning and integrated process control of mining systems. An example of a planned pilot action within this impact area is the 5G tests in a Boliden mine. Another example is a pilot to test an integration of mobile production systems into a superior system.

Mining Solutions and Technologies: This impact area focuses on the mines, the various parts of the mining process and the mining equipment. In order to apply and benefit from the new communication and process control technologies, the mines needs to adapt both their mining operations but also system integration, infrastructure and organization. Further, in order to meet the objectives critical parts of the mining process and methods needs to be developed, with innovative mining equipment but also by applying intelligent tools and methods to the various unit operations and for resource characterization.

Objectives of the commitment:

SIMS Raw Material Commitment (RMC) aims to test and demonstrate relevant technologies all supporting the realization of the vision of the sustainable intelligent mining system which will strengthen European competitiveness by contributing to lower production cost, minimized environmental impact and minimized mining waste, safer and more attractive working conditions, and a highly automated and flexible mining operation. The actions will lead to unlocking of potential mineral reserves and securing the supply of raw materials for Europe. Further, SIMS aims also at increasing the acceptance and understanding for mining in Europe, focusing on the social license to operate through communication with society and relevant stakeholders.

Description of the activities:

Pilot action test sites: Our concept is to create geographically distributed projects where a number of excellent test sites located in existing operating mines are utilized, and where different parts of the intelligent mining system is tested and demonstrated. The physical test sites will be complemented and connected by a virtual test site which also will be a part of the SIMS platform and will be a support tool for demonstration, dissemination, communication and outreach activities.
to all relevant stakeholders, including the society and general public. The concept of combining several physical test sites through virtual platform instead of aiming for “one single European test site” will meet the various needs related to the various parts of the mining system. Using several test sites, including a virtual test site will increase the accessibility and enable parallel tests and pilots, combined through the virtual platform.

Virtual test sites: The VR test site will act as a both training and a test facility for the mining industry. The virtual test site will be co-funded by partner- and regional funding, and the cooperation with local science centers will enable an improved communication and public dialogue. The VR test sites are also a test site for the virtual pilot actions, for instance simulations, which will be performed within the RMC. The physical test sites and the virtual test sites will be connected so that for instance augmented reality can be used to combine actions in the different physical test sites.

Physical test sites: The mines acting as pilot test sites have been selected in order to support the infrastructure or special needs addressed by the pilot action tests. All mines are selected due to their specific conditions and their high degree of maturity with regards to intelligent systems, automation and sustainability. The physical test sites are:

- Boliden mines that are among the most productive in the world. The Boliden mines operate with a high degree of technological refinement and the underground mines have more than 2000 access point for underground Wi-Fi.
- LKAB Underground Mines in Kiruna and Malmberget. The Kiirunavaara Iron ore mine is one of the world’s largest underground mines. Both the Kiirunavaara and the Malmberget mine are now operating at more than 1000m depth. LKAB has for many years been in the forefront of the development of automation in underground mining.
- K+S mines (Zielitz, Hattorf-Wintershall, Neuhof-Ellers) are potash mines with an output of roughly 31 million tons per year. The mines have a history of being pilot sites for various projects. Current focus is digitized production planning, increasing production efficiency and streamlining production activities.

Description of the expected impacts:

Target of EIP raw materials Innovative pilot actions: We will establish a test environment consisting of test sites located in various operating mines and a virtual environment that together with the SIMS platform will enable SME/OEM/Mining companies to more rapidly learn and understand requirements, give early feedback to tests in real mining environment and provide a more open test environment.

Market potential and competitive technology: Many of the consortium partners are world leading suppliers and producers and the identified pilot action tests also reflects this. We believe that we have a good selection of very promising tests and that we will test and demonstrate new technology and solutions with a world market potential. Through our university partners we foresee an opportunity to identify new research challenges and to generate know how by joint public-private publications.

Unlocking potential reserves: The new technologies and solutions that will be tested and demonstrated has the potential of increasing effectiveness and productivity, thus decreasing the cost per ton. This, together with the increased safety obtained with the new technologies and solutions will contribute to unlocking unexploited reserves, both due to lowered production costs but also by making it possible to avoid human presence at potentially dangerous situations and environments.

Public acceptance & Trust: The SIMS project will focus on human interaction, both human
interaction related to the demonstrated technologies and solutions but also interaction regarding public acceptance and trust of society. We will allow for public interaction, and we will perform all activities in a transparent fashion while encouraging an open dialogue with the public.

Expected innovation outcomes:
New products to the market
New services
New technologies
New ideas to the market

Name of the coordinating organisation:
ATLAS COPCO ROCK DRILLS AB

Country:
Sweden

Entity profile:
Multi-national organization

Role within the commitment:

Atlas Copco Rock Drills AB provides equipment for drilling and rock excavation through a global network. Atlas Copco is a core partner to EIT RawMaterials, high level steering group member to the European Innovation Partnership (EIP) on Raw Materials, partner to the Swedish Strategic innovation program for the Swedish mining and metal producing industry (SIP STRIM) and many more national and international programs and projects.

Other partners:

Name of partner:
LULEÅ UNIVERSITY OF TECHNOLOGY

Country:
Sweden

Entity profile:
Academia

Role within the commitment:
Luleå University of Technology (LTU) is one of the leading European Mining universities with a strong tradition of applied research and research in collaboration with industrial partners. Provides world leading expertise knowledge on mining and intelligent industrial processes. Core partner EIT Raw Materials, member EIP RM OGs, Partner/manager the national Strategic innovation program for the Swedish mining and metal producing industry

Name of partner:
LUOSSAVAARA-KIIRUNAVAARA AB

Country:
Sweden

Entity profile:
Private sector - large company

Role within the commitment:
LKAB is an international high-tech minerals group that mines and upgrades iron ore for the global steel market. Sustainability is core and the ambition is to be one of the industry’s most innovative, resource-efficient and responsible companies. LKAB is a leading company in applying automation underground and has a well-developed mine infrastructure. LKAB will
provide expert knowledge and will also provide an ambitious physical test site.

Name of partner:
BOLIDEN MINERAL AB
Country:
Sweden
Entity profile:
Multi-national organization
Role within the commitment:
Boliden is an international metals company with focus on sustainable development. Boliden extracts ores from open-pit mines as well as underground mines. Boliden is running an ambitious automation program and will provide expert knowledge in mine design, mining methods and automation as well as a physical test site.

Name of partner:
KGHM CUPRUM sp. z o.o.
Country:
Poland
Entity profile:
Private sector - large company
Role within the commitment:
KGHM-CUPRUM provides an engineering and research consulting service for the mining industry. It operates in all service areas linked with mining activity, from project evaluation, through research and development, to project management and supervision of the implementation stage.

Name of partner:
ABB AB
Country:
Sweden
Entity profile:
Multi-national organization
Role within the commitment:
ABB is a global leader in power and automation technologies. ABB Mining offers comprehensive market-leading packages of ABB competencies, products and services for the complete production chain in mining and mineral processing industries. ABB will provide expert knowledge in mine production optimization and real time scheduling. ABB will also provide expert knowledge in mobile robot applications to move people away from hazardous locations.

Name of partner:
ERICSSON AB
Country:
Sweden
Entity profile:
Multi-national organization
Role within the


commitment:
Ericsson is a world leader in communications technology, providing equipment, software and services to enable industry transformation through mobile communication and digitalization of information. Ericsson would assess 5G solutions for heavy industry applications and environments, for example NX radio, network slicing, Industrial IoT and Data Analytics.

Name of partner: MOBILARIS AB
Country: Sweden
Entity profile: Private sector - SME
Role within the commitment: Mobilaris is a world leading high-tech company focusing on the value of positioning people, vehicles and equipment with multiple technologies to obtain the best possible decision support for improved productivity and increased safety. Mobilaris solutions with real-time 3D visualization and integration with other applications provides an open and proven platform for different use cases in the described project.

Name of partner: RWTH AACHEN
Country: Germany
Entity profile: Academia
Role within the commitment: RWTH Aachen one of Europe’s leading technical Universities and partner of EIT raw materials. Joint research with industry and large collaborative research centers are a particular strength. The Institute for Mineral Resources Machine Technology (IMR) is part of the Division of Mining Engineering and focuses on the research areas sensors and automation, diagnostics and maintenance and rock cutting.

Name of partner: K+S Kali GmbH
Country: Germany
Entity profile: Private sector - large company
Role within the commitment: K+S is an international resources company which has been mining and processing mineral raw materials for more than 125 years. K+S currently operate facilities for rock salt, potash and magnesium in Europe, North and South America. Its mining operations with a long production history are currently in focus of a multitude of projects targeting efficiency by implementing digitization and automation into numerous steps of the production process.

Existing EU contribution:
Period to implement the commitment:
Sunday, 1 January, 2017 to Thursday, 31 December, 2020