SEVENTH FRAMEWORK PROGRAMME
THEME 6
Environment

Grant agreement for: **Small or medium-scale focused research project**

Annex I - "Description of Work"

Project acronym: *EO-MINERS*
Project full title: Earth Observation for Monitoring and Observing Environmental and Societal Impacts of Mineral Resources Exploration and Exploitation
Grant agreement no.: *244242*

Date of preparation of Annex I (latest version): September 30th, 2009
Date of approval of Annex I by Commission: *(to be completed by Commission)*

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Part A

A 1. Budget breakdown and project summary

A 1.1: Overall budget breakdown for the project

Participant number in this project [a]	Participant short name	Estimated eligible costs (whole duration of the project)					Total receipts	Requested EC contribution
		RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D		
1	BRGM	487,361.70	62,700.90	199,063.40	50,584.40	799,710.40	0.00	646,519.53
2	BGS	285,494.00	4,260.00	0.00	44,303.00	334,057.00	0.00	260,552.00
3	TAU	389,600.00	0.00	0.00	0.00	389,600.00	0.00	292,200.00
4	DLR	955,610.35	12,050.85	1,500.00	0.00	969,161.20	0.00	724,233.19
5	WI	259,820.80	14,172.80	11,848.00	105,356.80	391,198.40	0.00	314,713.00
6	GeoZS	106,698.00	0.00	0.00	53,484.00	160,182.00	0.00	133,507.50
7	MIRO	53,071.20	0.00	4,125.60	223,456.80	280,653.60	0.00	267,385.80
8	CGS	343,276.50	13,998.48	0.00	17,949.88	375,224.86	0.00	282,406.50
9	AOL-ATD	67,647.20	6,873.77	0.00	13,747.54	88,268.51	0.00	0.00
10	UVSQ	60,352.00	0.00	0.00	50,736.00	111,088.00	0.00	96,000.00
11	CzechGS	127,704.16	5,027.92	0.00	5,027.92	137,760.00	0.00	103,320.00
12	SU	3,219.30	0.00	0.00	1,254.12	4,473.42	0.00	0.00
14	AACL	18,500.00	0.00	0.00	3,000.00	21,500.00	0.00	0.00
TOTAL		3,158,355.21	119,084.72	216,537.00	568,900.46	4,062,877.39	0.00	3,120,837.52

A 1.2 : Project Summary

Project Number [1]	244242	Project Acronym [2]	EO-MINERS

One form per project

General information

Project title [3]	Earth Observation for Monitoring and Observing Environmental and Societal Impacts of Mineral Resources Exploration and Exploitation		
Starting date [4]	01/02/2010		
Duration in months [5]	36		
Call (part) identifier [6]	FP7-ENV-2009-1		
Activity code(s) most relevant to your topic [7]	ENV.2009.4.1.3.2: Earth observation in support of a sustainable exploitation of mineral resources		
Free keywords [8]		Earth Observation, Extractive Industry, ETP-SMR, environmental & societal footprint, GEO - GEOSS	

Abstract [9] (max. 2000 char.)

European Commission Vice President Günter Verheugen, responsible for enterprise and industry policy declared "European industries need predictability in the flow of raw materials and stable prices to remain competitive. We are committed to improve the conditions of access to raw materials, be it within Europe or by creating a level playing field in accessing such materials from abroad.” The global dimension of access to raw materials was on the agenda of the G8 Summit on June 2007. On that occasion a Declaration on "Responsibility for raw materials: transparency and sustainable growth" was adopted. Several national and international initiatives, both from the private or the institutional sectors, arised to address the sustainable development of the extractive industry and the reduction of its environmental footprint. Meanwhile, the extractive industry is facing increasing environmental and societal pressures, being regulatory or not, during all phases of a project, from exploration to exploitation and closure. The social acceptability of a project is among the major key issues to be dealt with. EO-MINERS scientific and technical objectives are to: - assess policy requirements at macro (public) and micro (mining companies) levels and define environmental, socio-economic, societal and sustainable development criteria and indicators to be possibly dealt using EO - use existing EO knowledge and carry out new developments on demonstration sites to further demonstrate the capabilities of integrated EO-based methods and tools in monitoring, managing and contributing reducing the environmental and societal footprints of the extractive industry during all phases of a mining project, from the exploration to the exploitation and closure stages - contribute making available reliable and objective information about affected ecosystems, populations and societies, to serve as a basis for a sound “trialogue” between industrialists, governmental organisations and stakeholder

A 1.3: list of beneficiaries

Beneficiary Number	Beneficiary name	Beneficiary short name	Country	Date enter project	Date exit project
1 (Coordinator)	Bureau de Recherches Géologiques et Minières	BRGM	France	1	36
2	British Geological Survey	BGS	United Kingdom	1	36
3	Tel-Aviv University	TAU	Israel	1	36
4	Deutsches Zentrum für Luft - und Raumfahrt e.V.	DLR	Germany	1	36
5	Wuppertal Institut für Klima, Umwelt, Energie GmbH	WI	Germany	1	36
6	Geoloski Zavod Slovenije	GeoZS	Slovenia	1	36
7	Mineral Industry Research Organisation	MIRO	United Kingdom	1	36
8	Council for Geoscience	CGS	South Africa	1	36
9	Anglo Operation Ltd – Anglo Technical Division	AOL-ATD	South Africa	1	36
10	Université de Versailles – St Quentin	UVSQ	France	1	36
11	Česká Geologická Služba	CzechGS	Czech Republic	1	36
12	Sokolovská Uhelná a.s.	SU	Czech Republic	1	36
13	Anglo American Chile Ltda	AACL	Chile	1	36

Part B

B1. Concept and objectives, progress beyond state-of-the-art, S/T methodology and work plan

Mining and extractive industry have played a significant role in the development of many countries all over the world. The industry has been, and continues to be an important contributor to both national and regional economies and is critical to national defence. Mining, and the industries it supports, is among the basin building blocks of a modern society.

The world today is facing and increasing mineral resource demand. This has been illustrated by the European Commission Vice President Günter Verheugen, responsible for enterprise and industry policy, who said: "*European industries need predictability in the flow of raw materials and stable prices to remain competitive. We are committed to improve the conditions of access to raw materials, be it within Europe or by creating a level playing field in accessing such materials from abroad*".

In recent years, the EU's total material requirement has remained at a constantly high level – roughly 50 tonnes a year per head of the population since the middle of the 1980s. But in this time the weight of imports and their environmental impacts have considerably increased (EEA 2003). The bulk of this increase is attributable to ores, mineral fuels, metalware and products such as glass, ceramics and precious stones. These four categories account for most of the ecological impact of imports. More than half of these originate in the developing countries, while fewer resources are extracted in Europe itself. Numerous mines have closed in Europe during the last few decades, either because of natural exhaustion or because they were not profitable. With the closure of mines environmental pressure has been reduced in Europe but risen in other regions. The environmental footprint of EU material consumption has shifted from Europe to other regions.

At the same time, the ecological impacts of imports into the EU have increased. One tonne of imports leaves behind an average amount of 5 tonnes in mining waste, emissions and erosion in the exporting country (Schütz/Moll/Bringezu 2003). This ratio has more than doubled over the past twenty-five years, and in the case of ores has quadrupled from 1:4 to 1:16 tonnes. This suggests that the acquisition of raw materials is becoming more and more costly, that more energy has to be used, and that more waste is left behind by mining operations. The analysis of the ecological impacts of imports to the EU reveals that environmental burden are shifted with significant social and economic consequences in other parts of the world.

The global dimension of this problem is being increasingly recognized. Access to raw materials was on the agenda of the G8 Summit on 6-8 June 2007. On that occasion a Declaration on "Responsibility for raw materials: transparency and sustainable growth" was adopted, which addresses the key priorities for a sustainable and transparent approach to this question. In addition the Competitiveness Council meeting on 21 May 2007 has invited the Commission to develop a coherent political approach to the issues arising. As a result, the European Commission launched in autumn 2008 "The Raw Materials Initiative – Meeting our Critical Needs for Growth and Jobs in Europe" (COM(2008)699).

The exploitation of natural resources in many developing countries has been considered as a vital part of economic growth, employment and infrastructure development, but it has come at a cost to the environment. Early mining operations have left a historical legacy of negative environmental impacts that affect our perception of mining. With the emergence of the concept of sustainable development it is now recognised that environmental protection is as fundamental to a healthy economy and society as it is development. The challenge is to simultaneously promote both economic growth and environmental protection.

The responsible management of Earth's environment is one of today's most pressing concerns and a central motivation for the Group on Earth Observations (GEO). Sound environmental management of mining activities can avoid high remediation costs, which frequently might drain public funds. Surface and groundwater pollution, soil contamination, and terrain instability all cause damage that can affect urban and sub-urban areas. Understanding and monitoring pollution processes in mining areas is therefore of concern to a very wide user community, including central government bodies or agencies, local authorities, industry, environmental groups and individual citizens. Facing legal and social pressures also the mining industry is interested to minimize the impacts on environment and society. Formerly due to often accumulating remediation costs, nowadays these activities play an important role at the stock market and an increasing environmental awareness is an essential aspect of modern mining management. But the technology platform to support such critical environmental monitoring is diverse, geographically inconsistent, site specific, lacks integration across technologies and is therefore far from complete. Understandably, it is currently a gap within GEO's Global Earth Observing System of Systems, which concentrates on issues such as Disasters and Climate Change.

The non-energy extractive industry (NEEI) of the EU-25 generated a direct turnover of about €40 billion, and provided employment to about 250,000 people in 16,629 enterprises in 2004 (SEC(2007)771)[1]. Estimated indirect employment provided by NEEI industry is up to 4 times greater than the directly employed, and is clearly a significant contributor to the economy of the EU. The use of these primary raw materials in the products of other branches of EU industry means they have a central role in guaranteeing industrial and economic sustainability. Nevertheless current demand exceeds production, and so the EU is heavily dependent on mineral and metal imports leading to an annual trade deficit of about €11 billion (SEC(2007)771). Metallic minerals accounted for 90% of this deficit (€10 billion), while there were also net trade deficits in construction minerals (€456 million) and industrial minerals (€798 million).

Several national and international initiatives, both from the private or the institutional sectors, have been developed to address the sustainable development of the extractive industry and the reduction of the environmental footprint.

One can cite:

- Both the EU's 2001 Sustainable Development Strategy (SDS) (renewed in 2006) and the 2005 Thematic Strategy for the Sustainable Use of Natural Resources aim at a decoupling of economic activity from environmental impacts by considering the entire life cycle of resource use. This means that environmental impacts are considered at each stage of the life-cycle of the product and the raw materials – during extraction, transport, processing/refining, the use phase of the products made from it, and when a product or raw material becomes waste at the end of its useful life – thus avoiding negative impacts being shifted to other environmental media, to other stages of the life-cycle, or to other countries.

[1] Analysis of the competitiveness of the non-energy extractive industry in the EU: Commission staff working document 201pp 2007

- The ETP-SMR Strategic Research Agenda (SRA). The Implementation Plan (IP) focuses on ways and means to implement the most urgent activities outlined in the SRA. In particular the short Term Research Priority 8 mentions "Helping cities in mining regions secure their strategic land, water and biodiversity resources by the use of modelling and economic tools".

- ICMM (International Council on Mining and Metals) members have committed to the ICMM Sustainable Development Framework. The Sustainable Development Framework comprises three elements and a set of 10 Principles (including a set of supporting position statements), public reporting and independent assurance. The Framework has been developed systematically since the formation of ICMM in 2001, with its foundations in the Mining, Minerals, and Sustainable Development (MMSD) project.

- The SDIMI, an international forum for the Sustainable Development indicators in the Mineral Industry, which objective is to assist the mining and minerals industries in their global transition to sustainable development. SDIMI states that "*Meeting the development needs of the world's growing population without depriving future generations of the means to meet their own needs, better known as Sustainable Development is the key challenge facing the minerals and mining industry. At present a special focus of public perception is placed on environmental and social consequences of mining. Growing environmental and social concerns, supply chain procurement standards as well as public pressure and regulatory measures will profoundly shape the global mining business in the near future. In order to cope with these challenges the mining and minerals companies are forced to integrate sustainable development as well as stakeholders' participation into their business strategies and policies. Up to now there are on-going discussions and projects on the development of sustainability indicators however these different efforts haven't resulted into a common agreement yet*".

- African Mining Vision 2050 is Task Force developed under the auspices of the the United Nations Economic Commission for Africa (ECA). The taskforce, jointly established by the African Union (AU) and ECA, also includes representatives from the African Mining Partnership (the intergovernmental forum of African ministers responsible for mining), the African Development Bank (AfDB), UNCTAD, and UNIDO. Among short term (less than 5 years) objectives are : a) Improve public participation (Consultation and information sharing/ participatory decision making/ dispute resolution mechanism) in the mining sector and b) capacity building

- Sixteen African ministers responsible for mining in their respective countries have launched the African Mining Partnership (AMP), with the aim of championing and coordinating mining and mineral-related initiatives under the auspices of Nepad - the New Partnership for Africa's Development. The ministers have identified mining programmes and projects in six key areas: Artisanal or small-scale mining; harmonisation of mining policies; environment and sustainable development; beneficiation; human resource development; and promoting foreign investment and indigenous participation in mining ventures.

B 1.1 Concept and project objective(s)

EO-MINERS aims at integrating new and existing Earth Observation tools to improve best practice in mining activities and to reduce the mining related environmental and societal footprint by

- introducing innovative remote sensing tools to the mining industry,
- providing accuracy and quality measures for remote sensing products,
- demonstrating the application of Earth Observation in different case studies,

- fostering the dialogue between mining industry and environmental organisations based on EO-derived information and
- generalising the obtained results to be used in operational mining applications in the future.

B 1.1.1: The environmental and societal footprint of mining and the extractive industry

Today, the European extractive industry is facing increasing environmental and societal pressures, being regulatory or not, during all phases of mine and quarry projects, from exploration to exploitation and closure. The social acceptability of a project is among the major key issues to be dealt with.

Mining, active or abandoned, is among the most significantly impacting man-made activities on the environment. Much of the environmental impacts of mining is associated with the release of harmful elements from mine waste. Improper waste disposal practices can cause increased turbidity in receiving waters and the release of polluted drainage and highly acidic waters. The consequences of such pollution can extend to impoverishment or deaths of aquatic flora and fauna, damaging the livelihood of terrestrial animals that feed on aquatic plants and animals, contamination of surrounding land and air, abandonment of public water supply intakes, damage to property and commerce, the disincentive to urban redevelopment posed by visible pollution, damage to society such as e.g. loss of visual amenities. The impact on surrounding farmland is of concern if livestock ingest contaminated grass and soil. In this scenario, food scares affect health and consumer confidence among a much wider community. The reclamation of mine sites which have not fully recovered through soil and plant regeneration is an important issue for local authority planners. These sites are eyesores within regions keen to develop tourism to replace the abandoned mining activity as a major part of their economies. Quality of life is also highly dependent on the surrounding scenery where people live.

The call aims at the reduction of environmental footprints affected by the exploration and exploitation of mineral resources by using new observing, monitoring methods, and providing information about populations and societies. An established methodology of measuring the environmental footprint of resources is the calculation of the total material input. This is defined as the life cycle wide total quantity (in kg) of materials moved (physically displaced) by humans. These are so-called hidden flows behind direct consumption of resources (Best et al. 2008, 239).

Economy wide material flow analysis (EW-MFA) provides a method with which to estimate the resource expenditure of economic areas, and thus of whole economies. The MFA methodology is used by Eurostat (for example as headline indicator for sustainable production and consumption, Eurostat 2007, 102) as well as by the European Environment Agency (EEA 2007, 5) and the Organisation for Economic Co-operation and Development (OECD 2004). It makes it possible to monitor on a macro level where the environmental pressure induced by resource consumption actually takes place (Bringezu/Schütz 1995). For this the indicator 'Total Material Requirement' (TMR) has been developed; it adds up all the primary materials (with the exception of air and water) that an economy extracts from nature in the course of a year. The TMR is measured in tonnes and consists of materials extracted within an economy as well as imported materials. In the latter case it also distinguishes between the weight of the imports themselves and their so-called ecological rucksack, which represents the hidden flows. The ecological rucksack of one tonne of primary aluminum, for example, weighs 7 to 8 tonnes, that of one tonne of copper approximately 500 tonnes, and that of one tonne of gold more than 500,000 tonnes (Schmidt-Bleek 1998, 297). Although this is a very rough assessment it indicates the dimension of the ecological footprint, which is cause by the extraction of different of different mineral resources.

Both the EU Sustainable Development Strategy and the Thematic Strategy for the Sustainable Use of Natural Resources identify a lack of suitable indicators as a key challenge for setting targets and measuring progress on global resource use impacts. Thus, both strategies propose to develop indicators that consider the entire life cycle of resource use in order to achieve the overall objective of decoupling economic activity from environmental impacts. Therefore, Europe needs a long-term strategy that integrates the environmental impacts of using natural resources, including their external dimension (i.e. impacts outside the EU) in policy-making.

In order to bridge the data gaps indicated above, Earth Observation offers a unique opportunity to collect necessary spatial parameter that play a key role for better assessments of mining-related environmental impacts. It could enable the consortium to develop means to identify the site-specific environmental footprint of mineral resource extraction and to determine their respective significance. This understanding of global and cumulative footprint along a causal chain is needed in order to target policy measures so that the aspired reduction of environmental footprints in the mining sector can be most effective for the environment and more cost-efficient for public authorities and economic operators.

Similar environmental and social damage can be equally associated to the flooding of abandoned underground mine workings as result of wrong or absent post closure management strategies.

Major impact of mining on land can occur before, during and after operation, including:

- Exploration – including surveys, field studies, drilling and exploratory excavations. Some land disturbance and waste already occur at this stage.
- Project development – includes roads and buildings, access tunnels, erection of treatment plants, overburden stripping and placing, preparation of disposal areas, construction of service infrastructure, power lines and generating plants, water supplies and sewerage, laboratories and amenities.
- Mine operation – underground or surface mining, hydraulic mining in or near riverbeds. Newer processes may include heap leaching of ore or tailings, and solution mining of buried deposits.
- Beneficiation – on-site processing may include comminution to reduce particle size, flotation using selected chemicals, gravity separation or magnetic, electrical or optical sorting, ore leaching with a variety of chemical solutions.
- Associated transport and storage of ore and concentrates may be a handling risk and can result in localised site contamination.
- Mine closure – rehabilitation is best done progressively rather than at the end of life of the mine. While the closure and rehabilitation is intended to mitigate environmental impact, it is important that it does not itself create secondary effects through excessive fertiliser use, spread of weeds, silting and incompatible landscape features.

B 1.1.2: The EO-MINERS objectives

General objectives

The aim of EO-MINERS is to bring into play EO-based methods and tools to facilitate and improve interaction between the mineral extractive industry and the society in view of its sustainable development while improving its societal acceptability.

Strategic objectives

Mining companies, regulatory bodies and stakeholders need various EO-based tools and methods adequately juxtaposed regarding the local contexts and applications (in compliance with GEO and GMES objectives and tasks).

Forecasting impacts and footprints and relevant remediation measures require developing prospective tools. GIS using EO data will enable to visualise prospective evolution over time (flow modelling), playing on one or several GIS-layer parameter. For instance, population migration flow is often taken into account during the pre-feasibility phase, but not properly monitored further.

Cumulative impacts must be adequately addressed at regional scale (valley, district...), including induced impacts (population migration, livestock impact …) with respect to the concept of heavily exploited area.

As the EU is strongly interested in the establishment of measures for raw material flow analysis, especially for imported mineral resources, this project will contribute to the development of measures that can be used to analyze the mining operations taking the individual potential ecological and social footprint into account. Thus the project directly supports the monitoring of three major EU policies:

- The Sustainable Development Strategy
- The Raw Materials Initiative
- The Thematic Strategy for the Sustainable Use of Natural Resources.

Eventually these developed methods and products should be integrated into Environmental Management systems (ISO 14000) and such integration must be properly addressed.

Scientific and technical objectives

The scientific and technical objectives of EO-MINERS are three fold:

- Assess policy requirements at macro (public) and micro (mining companies) levels and define criteria and indicators to be possibly dealt using EO:
  - Environmental criteria and indicators
  - Socio-economic criteria and indicators
  - Societal criteria and indicators
  - Sustainable development criteria and indicators

- Use existing EO knowledge and carry out new developments on demonstration sites to:
  - further demonstrate the capabilities of integrated EO-based methods and tools in monitoring, managing and contributing reducing the environmental and societal footprints of the extractive industry during all phases of a mining project, from the exploration to the exploitation and closure stages.

- contribute making available reliable and objective information about affected ecosystems, populations and societies, to serve as a basis for a sound "trialogue" between industrialists, governmental organisations and stakeholders.
- summarize and to document the developed models and algorithm, as well as the results of the "trialogue" to establish a baseline for a compendium of best practise approaches that will assist the ongoing and necessary dialogue between society and mining industry.

- Capacity building, communication and dissemination among:
  - ETP-SMR
  - International and national organisations (EU, AU, UNEP, UNECA, etc)
  - Extractive industry associations and individual companies
  - Governmental representations
  - NGO's

B 1.2 Progress beyond the state of the art

Satellite and airborne EO data have been intensively used in the past for mineral exploration. Major mining companies used Landsat MSS, then TM as well as radar images to help finding mineralization and/or favourable structural models. Airborne and ground geophysics provided information on surface and subsurface data, along with deeper structures. Imaging spectroscopy started to be used in the 1980s.

At that time little attention was paid to environmental and social concerns.

From late eighties and in the nineties several programmes started to foster the use of Earth Observation applied to environmental concerns. The Superfund programme in USA, led by US EPA and USGS (Superfund is the federal government's program to clean up the nation's uncontrolled hazardous waste sites) demonstrated the capabilities or EO methods, in particular Hyperspectral AVIRIS Imaging sensor in mapping hazardous wastes. Meanwhile, the development of the HyMap sensor in Australia and the involvement of CSIRO fostered the use of imaging spectroscopy in this domain.

In Europe, the PECOMINES project, using conventional satellite sensors and the FP5 MINEO project, using HyMap hyperspectral images were cornerstone projects focusing on mining-related environmental concerns.

None of these projects however made an integrated use of all available EO tools and techniques and lacked association of satellite, airborne and in situ monitoring technologies.

The use of remote sensing approach in the investigation of environmental impacts caused by mining to address issues like acid mine drainage (AMD), watershed pollution, subsidence and nowadays also the ecological footprint, replaces different methods used so far, like aerial photography and ground based data takes. Until recently, satellite imagery has lacked the spatial, temporal and radiometric resolution to compete especially at small scale and quantification of target materials. However, new satellite and airborne sensor systems offer new opportunities on the bias of data collected both in the optical part of the electromagnetic spectrum and in the microwave wavelength region. The increasing trend to comparable cheaper instrumentation and, therefore, lower costs per square kilometre encourages a thorough evaluation, the development of suitable models for data analysis, time series analysis and data assimilation techniques as well as the development of quality measures and quality standards.

To facilitate the acceptance of multispectral, hyperspectral and radar imagery, quality measures not only have to be defined. The general principles of current senor technologies and their relevant physical parameters, combined with the basics and principles of in collecting and processing data and corresponding quality aspects of the imagery itself have to be described in detail and the improvement have to be demonstrated and documented.

The defined quality measures, the demonstrated ability to improve data processing chains and the different data products are important aspects for the gained acceptance of remote sensing technologies in near future. Therefore those documentations are one of the important outcomes of the project.

B 1.2.1: Imaging Spectroscopy

Traditional sensors from orbit, either passive or active, cannot provide quantitative and exclusive information on the Earth's surface because they are limited by their spectral and spatial resolutions. During the past two decades, a new technology, termed, imaging spectroscopy (IS), has attracted the attention of many users, especially in the field of geology and geomorphology.

Allocating spectral information in a spatial domain provides a new dimension that neither the traditional point spectroscopy nor air photography (or multi-channel sensor) can provide separately. IS can thus be described as an "expert" Geographic Information System (GIS) in which surface layers are built on a pixel-by-pixel basis rather than a selected group of points. This enables spatial recognition of the phenomenon in question more accurately than the traditional GIS interpolation technique does in practice.

Since the spatial-spectral-based view may provide better information than viewing limited spatial or spectral information, IS serves as a powerful and promising tool in the modern remote sensing arena. Soil, as a complex matrix, was not previously used in IS applications, and only recently, when better signal-to-noise sensors have emerged, did soil surface mapping by IS means become more available. Today, it is well-established that the quality of the IS data is very important for quantitative assessment of Earth’s surface properties. Since the IS technology provides a spectrum for every pixel, a high-quality set of data (e.g., a high signal-to-noise ratio) may play a key role in the soil-IS system's quantitative approach. The main advantage of the IS technology is its ability to successfully map quantitative and qualitative information from every pixel from far distances. This ability is based on an intensive laboratory study that proved the physical relation between chemical properties of the matter (chromophores) and the reflectance information. The new spectral approach demonstrated that chemical and physical information about the Earth's crust can be captured quantitatively solely from the reflectance information. The new IS sensors, which will be used in this study, are being followed by progress both in electro optics and in new processing algorithms that enable the extraction of new surface information never before achieved. These capabilities enable adequate assessment of chemical and physical properties on a pixel-by-pixel basis that generates quantitative maps on a temporal basis. This may yield, for the first time, a spatial kinetics representation of chemical and physical reactions and interactions of the environment. This capability paves the road for a new state-of-the-art technology that can be further developed (as suggested in this study) to serve an exclusive tool to monitor the problems of the mining districts of the surrounding environment in a new remote dimension (quantitative, exclusive, rapid. and lone large scale). Properties such as pH, Electrical Conductivity (EC), iron oxide content, organic matter content, specific surface areas, heavy metal content, moisture content, and mineral composition are a few of the properties this technology can (directly and/or Indirectly) capture and will be used in this study. No other EO technology can extract these properties on a pixel-by-pixel basis and more properties, based on the area studied, can be used. Generating quantitative maps of the above attributes (and others as well), may yield a new innovative tool to assess and monitor spatial changes within the mining districts and will provide real spatial information to the decision makers, which cannot be obtained by other EO tool. Based on the above, it is clear that combining the laboratory spectral-based methodology, the IS tool may project the mining monitoring mission into the 21st century as required by the FP7.

B 1.2.2: ALERT monitoring technology

Traditional sampling to monitor the impact of mining on surface waters and groundwater is laborious, expensive and often unrepresentative. In particular, sparse and infrequent borehole sampling may fail to capture the dynamic behaviour associated with important events such as flash flooding, mine-water break-out, and subsurface acid mine drainage. Current monitoring practice is therefore failing to provide the information needed to assess the socio-economic and environmental impact of mining on vulnerable eco-systems, or to give adequate early warning to allow preventative maintenance or containment.

The proposed ALERT monitoring concept aims to provide **automated sampling** using permanent *in-situ* sensors and a “smart” network which will allow the collection of data from multiple sensors “on demand” and hence the **volumetric imaging** of subsurface hydrogeological processes in real-time at a range of scales and depths. Geophysical and geochemical surveys are routinely used to infer hydraulic or hydrogeochemical properties, but current practice is invariably restricted to one-off surveys. Recent research (Kuras *et al* 2006, Daily *et al* 2004, Versteeg *et al*, 2006) suggests that many of these sensors can be adapted for permanent deployment and then interrogated using wireless telemetry (e.g: GSM, low-power radio, internet, and satellite) to facilitate real-time data transmissions. A generalized communication system for multiple, diverse and widely distributed sensors will be a departure from current practice and pose a significant technical challenge. New sensor development is beyond the scope of this proposal but new software, interfaces and communication protocols will be developed based on the BGS-designed ALERT technology (Ogilvy, *et al*, 2008). No commercial system exists, and the prototype ALERT technology has yet to be evaluated in the context of sustainable mining.

B1.3 Science and Technology and associated work plan

B 1.3.1: overall strategy and general description

B 1.3.1.1 - overall strategy and workpackages

The work plan starts with the identification of the needs from industry, regulatory bodies and stakeholders (society, NGOs) to evaluate the indicators and parameters to be taken into account in the assessment of the environmental, socio-economic and societal footprints of the extractive industry at each stage of a project, from exploration to exploitation and closure. Corporate level (extractive industry and relevant associations) as well as public level (regional, national to international) will be considered.

This stage will serve as the basis for:

- Identifying parameters and indicators that can be addressed by Earth Observation methods, and to be used during the EO tools and methods development phase over demonstration sites
- Identifying stakeholders to be addressed during the dissemination phase at the end of the project

A strong RTD component will consist in developing EO-based tools and methodologies to observe and monitor the environmental and societal footprint of extractive industry activities over three demonstration sites located in heavily exploited areas:

- In Europe : the Sokolov lignite open cast in Czech Republic
- In Southern Africa: the Witbank Coalfields, Mpumalanga Province, South Africa
- In Southern America : the Los Bronces mine and the El Soldado mine in Chile

Innovation will consist in the juxtaposition and/or fusion of various EO data through models or data integration schemes which fit at best with i) site specific requirements, and ii) the parameters and indicators to be addressed as defined during the previous stage.

In the perspective of the societal acceptability of extractive industry, one of the major aim of the project being to define tools "opposable" during discussions between the parties involved in a mining project life, a particular attention is paid to the definition and application of protocols and standards to EO data and added value products that guarantee the "quality and objectivity" of data and products.

Dissemination activities are addressed through:

- Communication, dissemination and capacity building: The target audience will include, but not be limited to, the European Technology Platform on Sustainable Mineral Resources (ETP SMR), national and international organisations (e.g. EU, UNEP, UNECA, etc), the extractive industry and their trade associations, and NGOs.;
- Initiating and developing a sound "trialogue" (definition: "An interchange and discussion of ideas among three groups having different origins, philosophies, principles, etc.") between the three main groups involved, the industry, governmental organisations and other stakeholders (e.g. NGOs) based on reliable and objective information about ecosystems, populations and societies affected by mining activities.

The project is divided into five technical work packages closely related each other and corresponding to the three scientific and technical objectives, as described in table 1-1

Table 0-1: Objectives and relevant work packages and tasks

Objective	WP	Task	Description
Assess policy requirements and define criteria and indicators to be possibly dealt using EO	WP1 : Policy Analysis and Indicator Identification	1.1	Task 1: Policy analysis
		1.2	Identification of information requirements and operational indicators
		1.3	Resonance analysis of selected indicators and EO services

Use existing EO knowledge and carry out new developments on demonstration sites	WP2 : Protocols and standards for EO products	2.1	Mission Planning
		2.2	Data inspection
		2.3	Atmospheric calibration and validation
		2.4	Thematic accuracy and validation
		2.5	Documentation and dissemination
	WP3: EO application and development over demonstration sites	3.1	Site specific available data collection
		3.2	EO data acquisition
		3.3	Quality assessment
		3.4	Data processing, data fusion, algorithm development
		3.5	footprint assessment and risk analysis
		3.6	Interaction with stakeholders and capacity building at site level
	WP4 : EO integration and products	4.1	EO Products
		4.2	Models for Forecasts and Simulations
		4.3	Environmental Observation Systems
		4.4	EO-MINERS and GEO
Capacity building, communication, dissemination and exploitation	WP5 : Communication, dissemination, capacity building and exploitation	5.1	Dissemination and capacity building
		5.2	Communication and promotion
		5.3	Initiating and establishing a sound “trialogue”
		5.4	Exploitation and IPR

The graphical representation of the WPs and their loop-type relationship is displayed in figure 1-1.

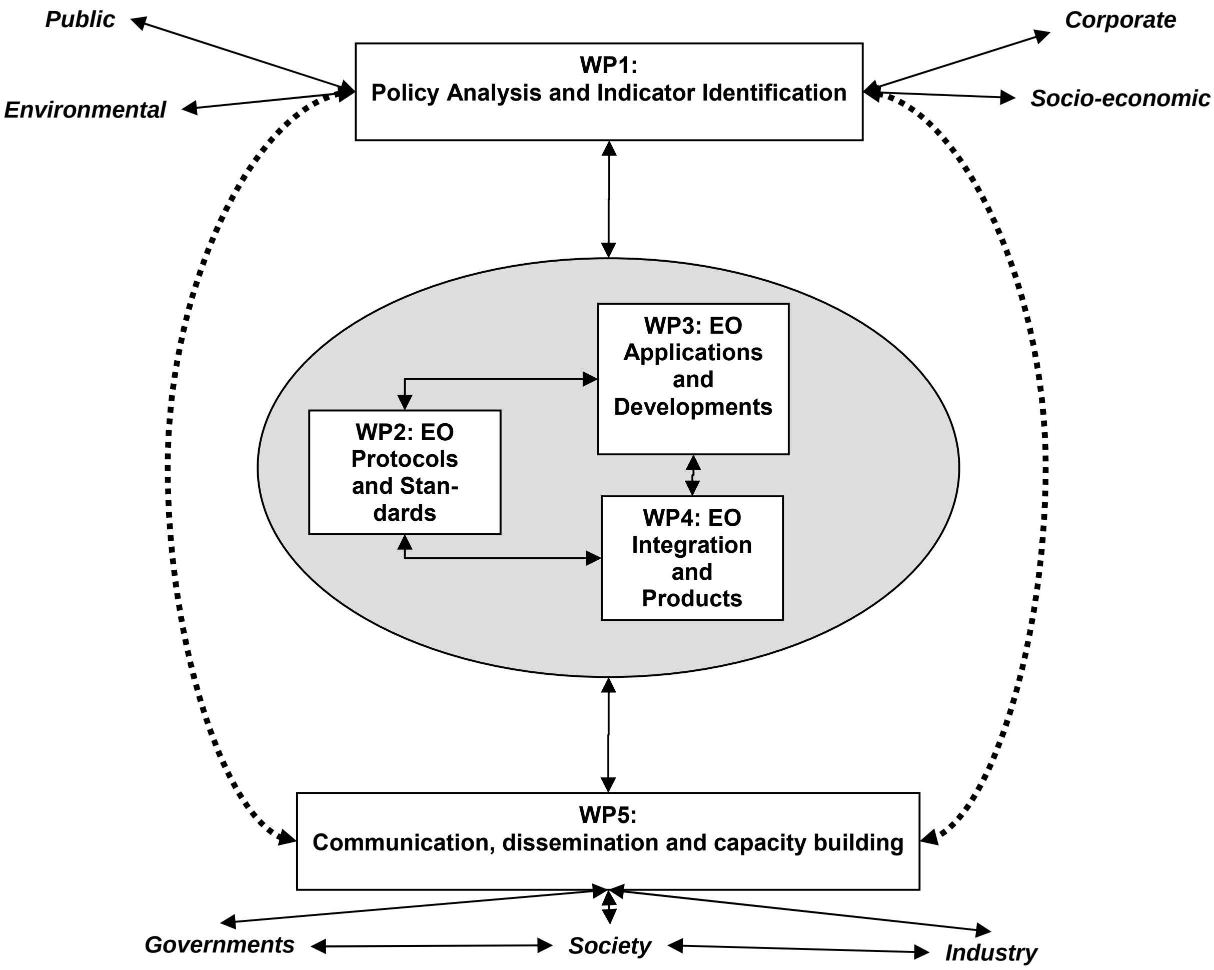

Figure 0-1: WP relationship and input output bodies and organisations

WP1, entitled "Policy Analysis and Indicator Identification", addresses the need to assess policy requirements and define criteria and indicators to be possibly dealt using EO methods and tools. It aims to identify the information requirements from policy for the selection of appropriate Earth Observation techniques and the formulation of protocols and standards in subsequent work packages. WP1 will produce an analysis of policies related to the environmental and social footprint of mineral industries. Policies from three stakeholder categories will be under study: companies, public authorities and civil society. WP1 identifies policies that address the environmental and social footprint of mineral industries of corporations, public authorities and civil society. Based on the policy analysis, WP1 derives specific information demands on the three levels for the development of footprinting indicators for the European Technology Platform on Sustainable Mineral Resources (ETP-SMR).

The core of the project aims at developing EO-based tools for helping monitoring and observing the impact on the environment and on the society of the exploration and exploitation of mineral resources.

To this end, project RTD will primarily focus on the improvement of EO targeted applications and developments over selected demonstration sites over the world. Innovative approaches will be carried out in processing together various EO data sets through different combination of them. Data fusion algorithms and specific processing algorithms will be tested and/or developed at this stage, taking into account site conditions and various thematic requirements defined by the mining companies and geological surveys. GIS thematic map layers issued from these developments will then be used for footprint assessment and risk analysis

WP3 hence will contribute to develop high level EO-based data products applicable to the different stages of mining activities within the life cycle of mining operations. Those products will allow to observe, to monitor and to quantify social and environmental impacts caused by mining activities over the selected demonstration sites and aiming to understand their "footprint". As satellite based remote sensing focuses more on a regional – and sometimes up to a national – scale, airborne remote sensing maintains the opportunity to record mineral extraction sites with high resolution (geometrically and thematically). Based on detailed reference data, quantitative measurements are made possible. This allows the detection of surface covering materials, their spatial pattern and thus the delineation of "hot spots". The definition and the establishment of procedures that allow the repeated generation of reliable and plausible data sets are prerequisites for GIS-based analyses.

Based on the site specific developments carried out in WP3, RTD in **WP4** is intended to contribute to the development of generic EO data integration schemes, EO products and EO-driven environmental modelling scenarios adapted to various situations, whose reliability and objectivity cannot be disputed by all parties involved in any stage of a mining project. Such products aim to characterise affected ecosystems, populations and societies and become an indisputable basis for a sound "trialogue" between industrialists, governmental organisations and stakeholders. WP4 also addresses GEO and GEOSS process and tasks, by using these outputs to define core elements of an environmental observing system and examining how this system fits in GEO and contributes to building GEOSS. Today, there are no GEO observing systems dedicated to this function. EO-MINERS is designed to fill that gap by identifying existing GEO observing systems that are suited to the task, modifying them as required and adding new ones where necessary. To this end, a major GEO Minerals Workshop is a mid-term milestone. A key outcome will be contributions to existing, as well as suggestions for new, GEO Work Plan Tasks and SubTasks.

Developments carried out in WP3 and WP4 rely on data that fully comply with protocols and standards, e.g., data calibration, data validation and data quality assurance, from upstream (data acquisition phase) to downstream (the added-value EO-based product delivery phase) as well as through the processing chain (algorithms). **WP2** will take care of robust and reliable standards and protocols that guarantee the repeatability of the methods deployed.

Eventually **WP5** focuses on dissemination, promotion and capacity building actions in order to provide bodies involved and interested in impact assessment of mining activities as well as all other interested parties with the results of the project work. Further, WP5 will also concentrate on developing means for a sound "trialogue" (definition: "An interchange and discussion of ideas among three groups having different origins, philosophies, principles, etc.") between the three main groups involved, the industry, governmental organisations and other stakeholders (e.g. NGOs). This "trialogue" will assist towards the reconciliation of interests in order to reach common agreement upon actions to deal with environmental and social impacts of mining activities. One individual task will be dedicated to IPR and exploitation. Main emphasis will be put on developing and maintaining an exploitation plan identifying all project results and especially those with commercial potential.

B 1.3.1.2 - Demonstration sites

The goal of EO-MINERS is to provide best practice advice for the use of EO technologies in all stages of mining activities.

Thus several test areas have to be investigated to cover the variety of mineral deposits, environmental issues, and legal constraints. In particular aspects to be covered are

- heavily exploited sites (Mpumalanga, South Africa),
- sites in densely populated areas (Sokolov, Czech Republic) and
- combining exploration and exploitation applications (Los Bronces, Chile).

The three sites described in the following will allow addressing these issues with special focus on reducing the environmental footprint of mining activities from exploration to remediation.

Witbank Coalfields, Mpumalanga Province, South Africa

Coal mines within the Witbank Coalfield are owned and operated by a number of coal mining companies, while many mines are abandoned and may be classified as “derelict and ownerless” in terms of Section 46 of the Minerals and Petroleum Resources Development Act (Act 28 of 2002). This mining district covers a very large area (The catchment feeding the Loskop Dam, the most affected waterbody in the area totals 11 500km²) and includes mines encompassing all stages of mining, from exploration through modern operating mines, mines undergoing closure. A total of 209 abandoned mines have been identified by the Council for Geoscience in this catchment, including 118 coal mines.

The town of Emalahleni was established in 1890 to establish coal deposits located in the vicinity. This became feasible after 1894, with the construction of a railway line to Pretoria. Since then, Emalahleni and its coalfields have contributed a significant proportion of South Africa’s coal production and the area has become an important industrial town with industries including power generation and steel production.

The major direct environmental and societal impacts of mining have been due to land degradation and water pollution. Old underground mine workings have collapsed in places, leaving large areas pockmarked with sinkholes. In some cases these workings have undergone spontaneous combustion, leading to physical hazards as well as contributing to air pollution. Coal discard dumps and abandoned mining infrastructure also render land unfit for productive use.

Water pollution sources in the mining areas include operating, closed and abandoned mines, with acid mine drainage and related metal contamination forming the most important problems. Important sulphide bearing materials which can lead to the formation of acid mine drainage include the coal and discarded material and some of the overburden materials used in the rehabilitation of more modern open-pit operations. In addition, many wetlands and rivers are believed to be clogged with coal dust. Other issues include those common to most mining areas in South Africa, where with the promise or expectation of jobs resulting in the creation of large informal settlements with high levels of poverty and unemployment. The physical and pollution hazards resulting from coal mining exacerbate many of the related societal health problems.

Coal has historically formed the basis of South Africa’s energy economy, often with little attention being paid to the environmental impacts of its mining and use. In recent years this has changed, with more and more commitment to a cleaner industry being shown. In recent times however, the role of coal mining in the pollution of local rivers and streams has been under scrutiny due to increasing pollution levels in the Olifants River Catchment, which has been cited as the cause of large scale deaths of fish and large animals in the Loskop Dam downstream of mining. Coal mining has also been implicated in regional scale pollution both in this catchment and in the adjacent Vaal River Catchment which, some researchers believe, could eventually lead to a shortage of potable water for the downstream areas. In the case of the Olifants River, this would include the Kruger National Park and Moçambique, while in the case of the Vaal, the densely populated and highly industrialised Gauteng Province, including the cities of Johannesburg and Pretoria, could be affected.

For the purposes of this project, a small area of the catchment, including the derelict and ownerless Transvaal and Delagoa Bay (T&DB) Colliery and the riverine environment adjacent to the operating Kromdraai Colliery will be surveyed, to identify their impacts on the local groundwater and surface water systems.

The major expected output is a better understanding of the environmental impacts of coal mines in the Karoo Coalfields of South Africa as well as an EO-based integrating methodology for the assessment of these impacts. Specific outputs will be:

- Optical remote sensing images and interpretations;
- Geophysical images and interpretations
- Ground-based measurements for calibration/validation of remotely sensed data;
- GIS integration of these data to produce thematic maps characterising environmental risk.

The Sokolov lignite open cast, Czech Republic

The Sokolov lignite mining area is located in the north-west of the Bohemia province and west of the town of Karlovy Vary, close to the German border. The area is largely affected by mining activities, including open casts and dump sites.

The Sokolov basin is part of the Eger rift that was strongly rifted into numerous horsts and grabens (Rojík et al., 1998) and gave rise to several brown coal deposits in the Czech Republic, Germany and Poland. The Sokolov Basin, dating from the Oligocene and Miocene eras, is between 8 and 9 km in width and 36 km in length, with a total area of approximately 200 km^2. It is bordered by a complex SW – NE faulting system and is cut by NW – SE faults. The basin is bordered in the north by the Lipniza faulting system. Hydrothermal fluids have been circulating along the faults where silicification and sulphur are to be found, and exposure to the latter can result in acid-mine drainage.

Lignite is found only in the western part of the basin and comprises three coal seams. The lower one (Josef coal seam) is very rich in sulphur (up to 5%) and arsenic (60 – 70 ppm). The Anežka seam is of more recent genesis than the Josef seam, and is only developed in the western part of the basin. The Josef and Anežka seams have been exploited, particularly in the Medard open pit. The Antonin seam is currently being exploited in the Jiří open pit, and contains up to 8% sulphur, together with arsenic.

Thick (130–200 m) overburden is represented by the clays of the Cypris formation (Burdigalian), dominantly kaolinite at the base, moving to illite and montmorillonite (smectite) at the top. The Cypris formation is capped by limestone.

The Lomnice pit was exploited in the early 20th century. The coal contained about 5.5% sulphide. The Medard pit has been exploited over 90 years, with a rate of eight million tonnes of lignite being extracted every year. Most of the overburden from the past has been dumped over the basement rocks, north of the Chodov – Lomnice road. The dump is 36 m thick on average and is mainly made up of clays from the Cypris Fm. Some levels are rich in organic matter, giving rise to brown levels. The clays contain few pyrite and ferro-magnesian minerals, responsible for magnetic anomalies.

In 2007, 10 million tonnes of lignite were extracted and 30 million tonnes of overburden material were removed.
The mining of brown coal is accompanied by several environmental problems, including:

- Local changes in morphology, landscape and drainage as well as degradation of land use due to dumping of material.
- Erosion of bare or thinly-vegetated dump slopes.
- Acid-mine drainage (AMD) and discharge of highly-mineralised water from mine dumps and contamination of surface and subsurface water.
- Vegetation stress due to contamination – air, soil, water.

The area is largely affected by AMD due to the presence of sulphur:

- In the brown coal itself (5 to 8% pyrite in the coal).
- In the hydrothermal deposits along the faulting system that borders the basin and that is affected by the exploitation.

AMD affects the mine water in the former-exploited open pits, with low pH values (pH = 2.2) measured with the presence of Na-Jarosite. Several abandoned pits (Lomnice, Medard, Marie, etc.) present intensive AMD and low-pH water, both on the pit slopes and at the pit lakes. AMD also occurs locally on dump sites.
The former-exploited areas are undergoing various rehabilitation procedures, including overburden backfilling of the open pits, re-vegetation of dumps and the construction of recreational areas such as golf courses. Sokolovská uhelná closure planning includes an artificial lake, filling the former Medard open pit and extending over 500 hectares with a 50-metre depth, for recreational purposes.

The Los Bronces mine and the El Soldado mine, Chile

Anglo American are proposing two of it's operational sites in Chile for the proposed study; the Los Bronces mine and the El Soldado mine.

The Los Bronces Cu mine is part of Anglo American Chile Ltda's operations and is in the metropolitan Region of the country 65 kilometers from Santiago and at 3,500 meters above sea level. Los Bronces is an open pit copper and molybdenum mine and produced 231,200 tonnes of copper in 2007 and 2,582 tons of molybdenum. The ore is extracted and crushed and transported in an ore slurry pipeline 56 kilometers long to Las Tortolas flotation plant where copper and molybdenum concentrates are produced. The mine also produces copper cathodes. The total energy used for the project in 2007 was 4,737 (1000GJ), the land use includes 4,701 hectares, and water used for primary activities is 18,435 (1000m3). Anglo American plc have approved the Los Bronces Expansion project with capex of 1,744 ($m) to increase the production volume by 170 ktpa of Cu by the end of 2011.

El Soldado is also part of Anglo American Chile Ltda's operations which produced 72,800 tonnes of copper in 2007. It is in Region V in Nogales, 132 kilometers from Santiago and at 600 meters above sea level. El Soldado has both an open pit mine and an underground mine, crushing plants and facilities for the treatment of oxide and sulphide Cu ore. The total energy used for the project in 2007 was 1,846 (1000GJ), the land use includes 999 hectares, and water used for primary activities is 3,195 (1000m3). The Chargres Smelter near El Soldado is part of Anglo American Chile's operations. It is in Region V in the municipality of Caternu, 100 kilometeres north of Santiago and at 400 metres above sea level. The smelter's productive process (copper concentrate fusion) is carried out using the modern flash furnace, a technology known for its low emission levels, making the smelter an environmental leader in Chile's mining industry."

B 1.3.1.3 - Earth Observation tools and methods

Optical satellite data

Conventional satellite data such as Landsat Thematic Mapper (TM) and ASTER, very high resolution satellite optical sensors (IKONOS, Quickbird, SPOT 5, etc.) will be used. Very high resolution sensors in particular have proven their invaluable contribution in mapping surface features related to mining areas and their surroundings, in particular mining infrastructures and settlements.

Based on commercially available satellite imagery, mine sites and their individual surroundings will be mapped at different scales. At regional scale relevant land-cover and land-use classes will be mapped. Time series analysis will focus on current and on-going spatial changes, taking changes in infrastructure and settlements into account. This information, in conjunction with census data, generates the basis for further analysis of the environmental and social dynamic within the region under investigation. On a local scale mining related infrastructure (processing infrastructure, tailings dams, waste dumps, drainage pattern, etc.) will be mapped. Spatial information that can be related directly to mining and remediation activities are:

- size of the mine site,
- area of waste dumps, area under direct rehabilitation measures,
- volume of piled material,
- (potential) regional impact caused by direct and/or diffuse pathways of mined or piled materials,
- (potential) affected drainage / groundwater area,
- mined area vs. undisturbed area (risk analysis, "environmental value" of surroundings),
- indices that may describe the efforts the mining company made to protect the environment,
- etc.

Mapping techniques will include image interpretation and classification techniques, using spectral and/or morphology/texture criteria.

To these data sets, a change in detection analysis will be applied. This information will be used as input data toward predicting the spatial change in 2 to 10 years under certain conditions. This approach will be practical for both mining companies and environmental observers to predict possible future damage to the area so that preventive measures may be undertaken.

Radar Satellite data

Up to now the monitoring changes of the topographic surface in mining areas is based on precise levelling and terrestrial measurements, regular GPS measurements, airborne photogrammetric or airborne laser scanning surveys, connected often with long time intervals between the measurements, because of the time consuming and expensive aspects of these methods. Differential SAR interferometry (dInSAR) and Interferometric Point Target Analysis will be used to monitor the topographic surface, analysis the volume of waste piles, to record changes of open pit cast mining activities and to detect subsidence associated to underground mining activities. Due to the different characters of the areas under investigation, satellite data with different wavelengths will be used (C-, L- and X-band).

Airborne imaging spectroscopy

Airborne hyperspectral imagery enables qualitative and quantitative assessment of the spatial composition of natural and man-made materials and thus their spatial pattern. It is intended to implement operational algorithms to extend relevant information products to enable decision makers and stakeholders to initiate mining impact assessment initiatives for active and abandoned mining areas. The latest developments in spectroscopic instruments (high spectral resolution along with high signal to noise ratio) in hyperspectral sensors affords the opportunity to generate quantitative information beyond the capabilities of multispectral data. Indeed, hyperspectral sensors are characterised by their high spectral resolution across a wide range of the electromagnetic spectrum, enabling the identification or characterisation of surface materials at a much finer spatial scale. This is important as the technology affords the ability not only to positively identify contaminations (and hence their potential risks) but also the potential to determine the sources and downstream impacts such as physiological impacts on the vegetation. For example, in an acid contaminated site, hyperspectral technology can measure the different secondary minerals that are produced with acid drainage.

The new Airborne Reflective Emissive Spectrometer ARES is currently being built by Integrated Spectronics, Sydney, Australia, and co-financed by DLR German Aerospace Center and the GFZ GeoResearch Center Potsdam, Germany. This instrument shall feature a high performance over the entire optical wavelength range and will be available to the scientific community from 2008 onwards. The ARES sensor will provide approx. 150 channels in the solar reflective region (0.45-2.45 µm) and the thermal region (8-12 µm). It will consist of five co-registered individual spectrometers, three of them for the reflective and one for the thermal part of the spectrum. The spectral resolution will be between 12 and 15 nm in the solar wavelength range and less then 150 nm in the thermal.

One of the major goals of ARES is to prepare the ground for the future global spaceborne hyperspectral mission EnMAP.

Airborne geophysical methods

Airborne geophysical measurements may be used for the detection, mapping and assessment of anthropogenic effects in mining areas, as well as for the definition of 3D geological structure which has an important influence on the migration of groundwater pollution plumes. Successful past implementations have included the use of the airborne radiometric method for the detection of surface plumes related to uranium mining and localised implementation of the airborne electromagnetic method in areas where saline groundwater plumes are suspected. In both cases these tend to applied on an *ad-hoc* basis, with limited if any integration with other remotely sensed data streams in a GIS context. The project aims:

- To utilise these methods, in conjunction with ground geophysical methods;
- To address the potential applications of radiometric surveying in non-uranium mining environments;
- To assess the applicability of airborne electromagnetic surveying in conjunction with ground-based geophysical methods for the detection and monitoring of groundwater pollution in mining environments;
- To develop a set of standards, indicators and standardised methods, interpretation criteria etc. for geophysical surveys in mining environments; and
- To develop methodologies for environmental risk assessment and risk reduction based on geophysical data.

The aeromagnetic method will be used to map geological structures which could have an influence on the movement of groundwater and the migration of pollution plumes. Existing data collected by the Council for Geoscience with a line spacing of 200m will be used for the purposes of this study over the South African site.

The airborne radiometric method relies on highly sensitive measurement of the radioactivity of surface deposits. In South Africa, while the coal mined in this part of the Mpumalanga Coalfield is not generally associated with highly elevated levels of radioelements, the radiometric method will be used to characterise surface geology and, where possible, map the migration of pollutants on the surface.

The airborne electromagnetic method provides a means to map the conductivity structure of the earth. A time-varying magnetic field is induced by varying the current in a transmitter loop mounted on the survey aircraft and the secondary fields due to electric currents induced in the subsurface measured from the survey aircraft. This makes it possible to produce a 3-dimensional image of the conductivity structure of the area surveyed. A major concern in the study area is the existence of saline plumes within the groundwater. These are likely to be detected as zones of high electrical conductivity, which may be detected using the airborne electromagnetic method. Additional ground-based electrical and electromagnetic surveying can be employed to verify the anomalies detected using the airborne system.

Time-lapse electrical resistivity tomography (ALERT)

An innovative 4D electrical imaging system known as ALERT (Automated time-Lapse Electrical Resistivity Tomography) has been developed by BGS which uses permanent *in-situ* electrode arrays and “smart” microprocessor-controlled instrumentation to remotely monitor temporal changes in subsurface properties. Such changes may be related to changes in fluid flow, hydrogeochemistry, or saturation levels. Complex dynamic processes can now be studied at unprecedented sampling rates without manual intervention. Volumetric images of the shallow subsurface are captured “on demand” by wireless telemetry (GSM/3G, GPRS, satellite and/or internet) from an office PC or laptop anywhere in the world – thereby eliminating the need for expensive repeat surveys. A centrally managed network server and web-portal are used for data capture, processing, modelling, visualisation and databasing. The entire process from data capture to visualisation is automated and seamless. It is proposed to install ALERT technology at a site in the Witbank Coalfield, South Africa to:

- Study the environmental impacts of mine waste, and acid mine drainage on surface waters, groundwaters and vulnerable ecosystems, to depths of tens of metres or more, thereby complementing satellite imagery (hyperspectral imaging, SAR) which has a penetration depth of only a few centimetres.
- Relate the temporal tomographic images (in both space and time) to all components in the hydrologic continuum (climate, soil, surface water, groundwater, salinization and acid mine drainage). A better characterisation of spatial and temporal hydraulic behaviour at depth is essential to assess the impact of anthropogenic or climatic forcings. Specific focus will be given to minewater rebound (in the case closed mines); surface-groundwater interactions and leachate flowpaths from surficial spoil heaps, low permeability backfill, tailings lagoons or underground workings.
- Provide early warning of minewater break-out, subsurface pollution plumes, and potential threats to containment barriers (e.g: tailings dams). It is proposed that ALERT also be assessed as a potential technology for the automated real-time remote monitoring of

mine-related operations to detect these potential problems before visible manifestation. Mine managers or Health & Safety Authorities could be notified of these threats by cell-phone text message, visual alarms on the web-portal, or by email.

To-date, none of the above applications have been tested or demonstrated in areas impacted by mining.

In situ monitoring tools

Ground based measurements on the different test sites include measurements to describe the natural background conditions as well as materials and their composition disseminated by water or wind directly or on diffuse pathways. To describe the local situation, parameters related to vegetation stands to soil properties (pH values, mineral content, etc.) and to weathering processes (spatial mosaic of primary and secondary mineral compositions) have to be measured or analysed in the field and/or in laboratory.

Field spectroradiometric measurements and Spectral Library: Based on the ground measurements libraries of the spectral signatures corresponding to different surface materials have to be set up to archive the measurements properly. This requires not only a correct documentation of the measurements, but also archiving ancillary data (measurement device used, information about calibration, etc.) have to be recorded. The development of well defined metadata concept is essential. DLR already operates a spectra library where all relevant data from flight campaigns and projects are archived. The concept developed so far can easily be enhanced to take the needs and requirements of the different test sites under investigations into account. Spectral library are essential for processing optical imagery and in particular hyperspectral images. At the end of the project the spectral library will become part of the overall documentation of WP 2 and WP 3.

Based on an innovative method developed by Chudnovsky et al (2007) to assess quantitatively very small amounts of dust (from 0. 018-0.45 mg/cm^2) using reflectance measurements, this concept will be applied to demonstration sites. This method will be applied first to the indoor environment that is closed to the mines. At the second stage this approach will be further developed to cover the outdoors environment and track after possible contamination direction and processes. The information will be projected on the high spatial and spectral resolution EO data for finding possible correlation with other spatial information. In this stage a dust spectral model will be developed in order to implement it on both the reflectance image and on a point reflectance domain measured at each building. GIS based methods to interpolate the point measurements into map will allow a precise recognition of small amount of dust in high spatial resolution domain over short time. This information will be also examined under temporal basis.

Chemical Model and 3D Characterization of the contaminated soils: Chemical and spectral information from many samples at selected sites will be used to generate quantitative spectral models to predict contamination. This information will be validated in the field (WP2) and if it will pass the uncertainty threshold, it will be applied to the High Spectral Resolution (HSR) reflectance/emmitance data. The models will be also used to describe the soil contaminated profile using Tel-Aviv University new assembly 3S-HED (Ben-Dor et al, 2008). This electrooptic sensor can be penetrated into very small drilling hole ("soil catheterization") that the traditional needs to open boreholes. This information will be overlain on the surface mineral map generated previously from the HSR sensor enabling a 3D understanding of the contamination. The models and the 3S-HED assembly will be delivered at the end of the project with a written manual on how to use them in the future using similar technology.

Geographic Information Systems

Weakness which can presently be identified is mostly related to a large variety of techniques and formats for research outputs. In many cases it is difficult to compare the data or to extrapolate them from a specific site to the level of a catchment area, to other sites and to regional cross-border purposes. Comparability of the data is the main prerequisite for application and use of assessment techniques, which are inevitable for appropriate research based protective and remediation measures. Along with a lack of comparability of data, the lack of new monitoring and mapping techniques based on remote sensing is obvious, which can provide quantitative, spatially comprehensive and temporal information on a regional or catchment scale. Earth observation techniques can significantly contribute to impact assessment at catchments level.

The spatial information serves as input for the development of GIS-based models, which will describe the different sites under investigation in terms with respect to their individual ecological footprint. The impacts are caused by the mined materials; their processing and related dissemination pathways represent both quantitatively and qualitatively impacts to the environment.

A modern and competitive mining industry requires - for reasons of environmental protection and due to the legal regulations - to measure and to manage environmental effects, influences on infrastructure and social effects as exactly as possible. This is even necessary to calculate prognoses of arising effects and influences in future as well as for a comprehensive monitoring at regular times. Mining activities depend on the deposits´ structure and on the necessity of an economic management. Therefore the procedures which are needed have to be flexible and economical. The developed methods should represent an economical alternative in comparison to terrestrial measurements and airborne photogrammetric surveys, since data analyses of optical and SAR images will allow an efficient monitoring of the areas as a whole. The development of practical guidelines to use this technology in the future is an integral component of the project. The research topic therefore is product- and procedure-oriented.

EO-MINERS project Risk Analysis

Significant risks associated to the project and contingency plans are provided in B 2.1.4

B 1.3.2: Timing of workpackages and their component

		Year 1												Year 2												Year 3											
Task	**Description**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
WP0	**Project Management**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WP1	**Policy Analysis and Indicator Identification**																																				
1.1	Policy analysis	X	X	X	X	X	X	X	X	X	X	X	X																								
1.2	Identification of information requirements and operational indicators						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
1.3	Resonance analysis of selected indicators and EO services																				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WP2	**Protocols and standards for EO products**																																				
2.1	Mission Planning	X	X	X	X	X	X																														
2.2	Data inspection	X	X	X	X	X	X	X	X	X	X	X	X	X																							
2.3	Atmospheric calibration and validation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																				
2.4	Thematic accuracy and validation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X															
2.5	Documentation and dissemination				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X													
WP3	**EO application and development over demonstration sites**																																				
3.1	Site specific available data collection	X	X	X	X	X	X	X	X																												
3.2	EO data acquisition				X	X	X	X	X	X	X	X	X																								
3.2'	ALERT data acquisitipon				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
3.3	Quality assessment	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X												
3.4	Data processing, data fusion, algorithm development (already avalaible data)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X												
3.4'	Data processing, data fusion, algorithm development (new data)										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X												
3.5	footprint assessment and risk analysis								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
3.6	Interaction with stakeholders and capacity building at site level								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WP4	**EO integration and products**																																				
4.1	EO Products									X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
4.2	Models for Forecasts and Simulations													X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.3	Environmental Observation Systems																			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.4	EO-MINERS and GEO													X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WP5	**Communication, dissemination, capacity building and exploitation**																																				
5.1	Dissemination and capacity building							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.2	Communication and promotion	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X							X
5.3	Initiating and establishing a sound "trialogue"								X	X	X	X	X	X	X						X	X	X	X	X	X	X					X	X	X	X	X	X
5.4	Exploitation and IPR	X	X								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

B 1.3.3: Workpackage List

Work package No[2]	Work package title	Type of activity[3]	Lead participant No[4]	Lead participant short name	Person-months[5]	Start month[6]	End month[6]
WP0	Coordination	MGT	1	BRGM	12.3	0	36
WP1	Policy Analysis and Indicator Identification	RTD	5	WI	55.1	0	33
WP2	Protocols and standards for EO products	RTD	3	TAU	45.3	0	32
WP3	EO application and developments over demonstration sites	RTD	4	DLR	126.4	0	30
WP4	EO integration and products	RTD	2	BGS	62.8	9	36
WP5	Communication, dissemination, capacity building and exploitation	OTH	7	MIRO	64.7	0	36
				TOTAL	366.6		

2 Work package number: WP 1 – WP n.

3 Please indicate one activity per work package:

RTD = Research and technological development (; DEM = Demonstration; MGT = Management of the consortium; OTHER = Other specific activities, if applicable in this call including any activities to prepare for the dissemination and/or exploitation of project results, and coordination activities) According to the description of the funding scheme given previously.

4 Number of the participant leading the work in this work package.

5 The total number of person-months allocated to each work package.

6 Measured in months from the project start date (month 1).

B 1.3.4: Deliverable list

Del. no.	Deliverable name	WP no.	Lead bene-ficiary	*Estimated indicative person-months*	Nature	Dissemina-tion level	Delivery date[7] (proj. month)
D 0.1	Consortium agreement	0	BRGM	1.3	O	CO	Month 1
D 0.2	Periodic report	0	BRGM	5.2	R	CO	Month 18
D 0.3	Final Report	0	BRGM	2.2	R	CO	Month 36
D 0.4	Kick-off meeting min-utes	0	BRGM	0.6	R	CO	Month 1
D 0.5	Annual meeting min-utes	0	BRGM	1.5	R	CO	Month 12, 24, 36
D 0.6	Project meeting min-utes	0	BRGM	1.5	R	CO	Month 6, 18, 24
D 1.1	Corporate policy analysis on mineral extraction, including a preliminary list of stakeholders	1	UVSQ	6.9	R	CO	month 6
D 1.2	Public policy analysis, including a preliminary list of stakeholders	1	WI	9	R	CO	month 6
D 1.3	Report on Corporate and Public policy anaylsis	1	WI	7.8	R	RE	month 12
D 1.4	Draft report on infor-mation requirements and SWOT of opera-tional footprinting methodologies and indicators	1	GeoZS	6.7	R	RE	month 18
D1.5	Final report on infor-mation requirements and SWOT of opera-tional footprinting methodologies and indicators	1	WI	7.6	R	RE	month 30
D 1.6	Resonance analysis of selected Earth Obser-vation specifications	1	WI	10.1	R	CO	month 36
D 1.7	Draft journal article on political response to the footprinting of the mineral industry	1	WI	4.1	R	PU	month 36

[7] Month in which the deliverables will be available. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

D1.8	Status quo of monitoring environmental indicators by EO services	1	TAU	2.9	R	PU	month 6
D 2.1	Protocol to select a sensor for a mission and a guide to the set spectral and spatial configuration of the selected sensor.	2	TAU	7.5	R	RE	Month 6
D 2.2	Raw and radiometric data quality indices pre and post correction	2	TAU	7.5	R	RE	Month 9
D 2.3	Atmospheric correction protocol and validation results	2	DLR	10.7	R	RE	Month 11
D 2.4	Generic (thematic) quality indicators and quality layers	2	TAU	10.4	R	RE	Month 22
D 2.5	CAL/VAL documentation – a check list for all of the above stages + threshold values+ Questionnaires to mining companies, environmental bodies and the EO data interpreter regarding the quality of the data, its usage, and remarks.	2	TAU	9.2	R	RE	Month 30
D 3.1	Report on site description and site conceptual model (one per site)	3	BGS	16	R	RE	month 6
D 3.2	Report on data acquisition and validation	3	DLR	26.2	R	RE	month 10
D 3.3	Presentation of algorithms (regression, unmixing, data fusion, etc.) and novel tools for the characterisation, mapping and monitoring of mining activities using combination of EO data	3	DLR	36.5	R	RE	month 24, 32
D 3.4	Report on methodological developments for site footprint and risk analysis, considering possible "generic"	3	DLR	36.6	R	RE	month 30

	aspects						
D3.5	Feedback on interaction with stakeholders and capacity building at site level	3	BGS	11.1	R	RE	month 12, 24
D 4.1	EO Product Review	4	BGS	23.5	R	RE	Month 30
D 4.2	Mine Site Simulation Platform	4	BRGM	11.8	P	RE	Month 36
D 4.3	Mining and Environmental EO Systems Report	4	BGS	14.8	R	RE	Month 36
D 4.4	GEO Minerals Workshop	4	BGS	4.6	O	PU	Month 18
D 4.5	GEO Minerals Workshop Proceedings	4	BGS	3.7	R	PU	Month 24
D 4.6	EO-MINERS to GEOSS Mapping Database and Report	4	BGS	4.4	R	PP	Month 36
D 5.1	Project web site	5	MIRO	7.3	O	PU/RE	2
D 5.2	General promotion material for the project	5	BGS	13.2	O	PU	3
D 5.3	Final plan for the use and dissemination of foreground	5	MIRO	1.5	R	PU	6
D 5.4	Workshop proceedings	5	GeoZS	14.1	O	PU	after each workshop, probably months 13, 25, 36
D 5.5	Book summarising the project achievements (“Guide for Good Practice”)	5	MIRO	11.8	R	PU	36
D 5.6	Report summarising “trialogue” activities and results	5	WI	6.8	R	PU	36
D 5.7	Exploitation Plan	5	MIRO	7.5	O	PP	12, 24, 36
D 5.8	Report on awareness an wider societal implications	5	WI	2.5	R	PU	36
			TOTAL	366.6			

B 1.3.5: Work package description

Work package number	0	**Start date or starting event:**		0			
Work package title	Consortium management						
Activity Type[8]	MGT						
Participant number	**1**	5	7				
Participant short name	**BRGM**	WI	MIRO				
Person-months per participant:	**10.8**	1	0.5				

Objectives

Project co-ordination (technical and financial) and management activities : project management, EU relation
Achievement of working group activities
Achievement of Consortium and Data Use Agreement
Control of final editing activities
Cooperation with the ImpactMin project

Description of work : project Coordination

Activities will consist in day to day project technical follow-up and financial control of the different activities, liaising with the project partners and EU, including periodic reporting.

The Co-ordinator will:

– Organise and chair meetings, workshops and conference, prepare minutes and circulate project information;
– direct all research activities conducted during the project;
– liaise with the Commission, in particular with respect to any problem arising during the project course
– submit documents and technical reports
- undertake all financial and administrative responsibility for the project

The advancement of the technical programme will be assessed internally between the partners and actions will be taken to rectify any delay in the programme progress.

Because the project is going to deal with a lot of data coming from various institutions, access, copyrights, ownership will have to carefully dealt with via strong managerial control and properly designed data access and utilisation agreements (review of data ownership, definition of Intellectual Property Rights, definition of data accessibility process, drafting of data use agreement).

In the beginning of the project, a “Project Handbook” will be elaborated that will carefully describe all project tasks and the corresponding schedule. A copy of this handbook will be provided to each individual intervening in the project that will return a signed “return of receipt” to the project Co-ordinator.

Contacts with the ImpactMin project, run in parallel with EO-MINERS, will make part of the EO-MINERS management process and common EO-MINERS – ImpactMin workshop(s) are foreseen.

Deliverables

D 0.1 : Consortium agreement

D 0.2 : Periodic reporting

D 0.3 : Final report

D 0.4 : Kick-off meeting minutes

[8] RTD = Research and technological development.

D 0.5 : annual meetings (General Assembly, Advisory Board) minutes D 0.6 : project meetings minutes

Work package number	1	**Start date or starting event:**		0		
Work package title	Policy Analysis and Indicator Identification					
Activity Type[9]	RTD					
Participant number	1	2	3	4	**5**	6	7
Participant short name	BRGM	BGS	TAU	DLR	**WI**	GeoZS	MIRO
Person-months per participant:	3.7	1.4	1	3	**22**	5	3
Participant number	8	9	10	11	12	13	
Participant short name	CGS	AOL-ATD	UVSQ	Czech GS	SU	AACL	
Person-months per participant:	3.5	1	6	5	0.3	0.2	-

Objectives

The overarching objective of WP1 is to identify information requirements derived from policy to inform the selection of appropriate Earth Observation techniques. Specifically, WP1 will identify policies that address the environmental and social footprint of mineral industries with respect to corporations, public authorities and civil society. Based on the policy analysis, WP1 will derive specific information demands on the three levels for the development of footprinting indicators for the European Technology Platform on Sustainable Mineral Resources (ETP-SMR). For quality assurance of the EO services, which are going to be developed in WP2-WP4, resonance analysis will test their potential usefulness for corporate and public stakeholders.

Description of work, and role of participants

WP1 proposes to identify, evaluate and select different types of indicators that support the analysis of environmental and social impacts related to mineral extraction. For the selection of applicable Earth Observation techniques, WP1 will identify and analyse policies related to the footprint of mining industries, at corporate, authority and civil society level (task 1). Information requirements will be derived and appropriate indicators assessed and selected for all three levels, covering both social and environmental indicators of corporate sustainability reporting and macro-economic indicators for governmental policy-making (task 2). These tasks will on the one hand be undertaken so as to directly feed into the "trialogue" in task 5.3, on the other hand they are also fed by results of the "trialogue". The results of the analyses in task 1 and 2 will define the demand for the development and application of Earth Observation services by the European Technology Platform on Sustainable Mineral Resources and thus frame the work in WP 2, 3 and 4. In a final iteration loop, the response to the tested Earth Observation services will be analysed (Task 3).

<u>Task 1.1: Policy analysis</u>

Task Leader : WI

With regard to sustainable mineral resource use, there are several stakeholders on different governance levels (from local to global level). Their policies aim at different objectives which can be supported by EO services. The first step will entail a literature review on the policies related to mining activities on three different levels, in order to identify relevant policies and core concerns. The information will be enriched by the early results of the "European Trialogue" (task 5.3). The three levels will be addressed in three subtasks

[9] RTD = Research and technological development.

Subtask 1.1-1: Corporate policies

The first level will relate to policies of mining companies and associations (e.g. in the context of Corporate Social Responsibility, CSR). The analysis will be limited to aspects of exploration, exploitation and processing of raw materials. The industry Codes and their external verification tackling the issues of credibility and accountability will be evaluated and their synergies with ISO 14001 standards state of implementation will be considered.

Subtask leader : UVSQ, participants WI, GeoZS, MIRO, CGS, BRGM, BGS, AOL-ATD, SU, AACL

Subtask 1.1-2: Public policies

The second level will relate to governmental policies from supranational to national, regional and local levels at the test sites. The reference points are EU policies such as EU Sustainable Development Strategy, EU Thematic Strategy on the Sustainable Management of Natural Resources, EU Action Plan for Sustainable Consumption and Production, Sustainable Industry Policy, and EU Raw Materials Initiative**.**

Task leader : WI, participants GeoZS, UVSQ, MIRO, CGS, BRGM, BGS, AOL-ATD

Subtask 1.1-3: Policies in civil society

The third level will include civil society organisations that address mining footprints primarily from a social and environmental perspective, such as Mines and Communities (MAC).

Subtask leader : UVSQ, participants GeoZS, MIRO, CGS, BRGM, BGS, WI

Subtask 1.1-4: Identification of stakeholders

In the course of the policy analysis, the most relevant stakeholders will be identified and listed, including scientific institutions like RWTH Aachen (project on sustainability indicators of the mining industry) or public institutions like European Platform for Life Cycle Analysis, EU Data Centre on Resources, the International Panel for Sustainable Resource Management, the European Topic Centre on Resource and Waste Management/SCP. This list will be successively updated with information generated in task 1.1 and 1.2. Subtask 1.1-4 will continuously communicate information about stakeholders to WP5 for the preparation of the trialogue in task 5.3. Stakeholders to be covered are:

- corporate stakeholders (management, workers, customers, extractive industry associations, including the European Technology Platform on Sustainable Mineral Resources)
- local or societal stakeholders (e.g. civil society organisations, local community, local and regional governments)
- national stakeholders (e.g. governments, geological surveys)
- EU stakeholders (e.g. Commission, European Environment Agency, ETP-SMR)
- International stakeholders (e.g. UN, UNEP, UNECA, Resource Panel, AU)

Subtask leader : GeoZS, participants UVSQ, MIRO, CGS, BRGM, BGS, WI

<u>Task 1.2: Information Requirements and Indicators (all three levels)</u>

The information requirements are derived by results from task 1 and by iterative exchange with the European Trialogue and Local Trialogue, i.e. communications with selected stakeholders (task 5.3). This means that current results are input for discussions in the trialogue, while the results of the trialogue are used to guide the work in defining the information requirements. In order to provide efficient exchange and dialogue between WP1 and WP5, the “Deliberation Matrix” will be used, a multimedia evaluation tool developed by C3ED.

Task leader: GeoZS

Subtask 1.2.1: Identification of information requirements

This subtask will define the scope of the environmental footprint of mineral industries, as well as its social implications (e.g. burden shifting). From the policies identified in task 1, this subtask will identify information requirements for all three levels related to the footprint of mineral industries, both globally and locally (matrix 3x2). For the local stakeholders, this will be supported by an on-site mapping of information demand with interviews and discussion workshops (1 week on each mining area). The local level is coordinated with the footprint assssment in task 3.5. Specific information requirements on the global level will be documented in collaboration with the ETP-SMR.

Subask leader : GeoZS, participants UVSQ CzechGS, MIRO, CGS, BRGM, BGS, WI

Subtask 1.2.2: Identification of operational indicators

This subtask will define the scope of the quantification of footprints. It will outline strengths, weaknesses, opportunities and threats (SWOT) of existing footprinting methodologies and indicators and thus is based on the review of indicators (subtask 2.3). Major data gaps and uncertainties will be identified. The SWOT reports will be provided for successive EO parameter selection and development and testing of EO services (in WP2, 3 and 4).

Subtask leader : WI, participants, GeoZS, UVSQ, CzechGS, MIRO, CGS, BRGM, BGS

Subtask 1.2.3: Status quo of monitoring environmental indicators by EO services

EO services had increasingly addressed environmental indicators in former projects. The aim of this subtask is summarising what has been achieved in this field up to now in order to learn from these lessons. For this purpose, finished and ongoing EO activities and projects are screened worldwide by a literature review and their grade of success is assessed, if possible, based on results of preceding Sustainable Development Indicator for Mineral Industry (SDIMI) conferences. The result is a table with indicators and EO products (or the underlying technical methods) indicating where methods are already developed. This information supports the developments within other work packages, especially it is a good basis for WP2 and WP3.

Subtask leader: TAU. Contributors: CSR, BGS, WI, DLR.

<u>Task 3: Resonance analysis of selected indicators and EO services</u>

This task will use the resonance analysis methodology, which has been dedicated specifically to match policies with indicators. It has been further developed for Earth Observation purposes and tested in the FP6 project Global Monitoring for Environment and Security (GMES) network of users (GNU). Resonance analysis collects empirical evidence on whether and how specific Earth Observation services can be related to phases of the policy cycle (e.g. agenda setting, implementation, evaluation). By means of documentation and stakeholder interviews WP1 will find out whether and how the Earth Observation services developed and tested in WP3 and 4 can be used in corporate and public policy-making. The results of this task will form the basis for the quality control of the project and for raising awareness on the potential contribution of EO services for the mineral industry and for non-governmental stakeholders with regard to environmental and social footprinting. Moreover, the results will provide core elements for the “Guide for Good Practice” (see task 5.1).

Task leader : WI, participants GeoZS, DLR, MIRO, BRGM, BGS

Deliverables

D 1.1: Corporate policy analysis on mineral extraction, including a preliminary list of stakeholders (month 6)

D 1.2: Public policy analysis, including a preliminary list of stakeholders (month 6)

D 1.3: Report on Corporate and Public policy analysis (month 12)

D 1.4: Draft Report on information requirements and SWOT of operational footprinting methodologies and indicators (month 18)

D 1.5: Final report on information requirements and SWOT of operational footprinting methodologies and indicators (month 30)

D 1.6: Resonance analysis of selected Earth Observation specifications (month 36)

D 1.7: Draft journal article on political response to the footprinting of the mineral industry (month 36)

D 1.8: Status quo of monitoring environmental indicators by EO services (month 6)

Work package number	2	**Start date or starting event:**		0		
Work package title	Protocols and standards for EO products					
Activity Type[10]	RTD					
Participant number	2	**3**	4	5	6	7	8
Participant short name	BGS	**TAU**	DLR	WI	GeoZS	MIRO	CGS
Person-months per participant:	2.8	**18**	18	2	1	1	1.5
Participant short name	AOL-ATD						
Person-months per participant:	1						

Objectives: To deal with all aspects relevant to EO protocols and standards, e.g., data calibration, data validation and data quality assurance, from upstream (data acquisition phase) to downstream (the added-value EO-based product delivery phase) as well as through the processing chain (algorithms).

Description of work:
Using state-of-the-art EO remote sensing means (either optical or SAR) requires data quality assurance at all levels as well as protocols and standards for both operation and processing stages (CAL/VAL = Calibration/validation). For precise mapping and high-quality products, the acquired data must be physically reliable, consist of a favorable signal-to-noise ratio and possess robustness for all potential users. Since this project is aimed at developing new concepts to assess and monitor the potential environmental impact of mining activity, the developing of technical stages, protocols and standards for using EO data is crucial and significantly required. Assuming that this project might trigger future research in this field, and that the final stage of this initiative may be commercially operated, the major role of this WP is not only to assure the success of this project, but also to facilitate future projects in this direction, with technical steps and protocols on how to apply calibration / validation examinations to assure high-quality EO products.
This need strongly requires a specific WP that will deal with all aspects of data quality, corrections, utilization, as well as data inspection and assimilation. The stages we have proposed are as follows: mission planning (sensor selection, spectral configuration, spatial resolution, area coverage), raw data quality assurance (functioning of the sensors during data acquisition), radiometry quality assurance (sensor calibration performances), atmospheric correction quality (reflectance and emissivity extraction), field data quality (reliable and reproducible measurements), standards for field and laboratory measurement (for high validation levels), thematic assurance (ground validation), uncertainty estimation (possible errors at each stage plus estimation of the final error), follow-up feedback from end-users during the project (for fine tuning the process), and dissemination of the protocols to relevant groups. The last task will initially be used by the EO-MINERS participants in this project and in the future by all interested in the world wide community. The report will contribute to the "trialogue" in WP5 and is essential for achieving WP3. The suggested tasks are:

Task 2.1: Mission planning: In this stage the relevant sensor for a thematic demand will be selected along with its spectral-spatial settings. This stage is crucial for the ensuing tasks in WP3. It will composed of the sensor's spectral and spatial configuration, targets, background, physical-chemical characterization, and will set the ground truth arrangement for the specific mission. The information anticipated to be obtained is concerned with the working scheme with respect to the mining companies, mining products, weather conditions, problems and complaints regarding the surrounding environment and possible requests for deliverables from the project. Based on this information and on the targets and background characteristics plus the capabilities of the EO systems at hand, we will issue a standard form termed "mission order" for each EO mission.

Task leader : TAU, participants DLR, BGS, CGS, WI, AOL-ATD

Task 2.2: Data inspection: This task will be led by the DLR and TAU to set a protocol to accept or reject the EO data at hand based on its quality. This will be done for both raw and radiance (physical based) data For the raw data , technical parameters such as electronic and mechanical sensor's stability , , navigation system conditions as well physical parameters such as quantum efficiency, Detector malfunction (dead pixels) and problems at certain frequencies will be evaluated. Passing this stage the radiometric quality will be evaluated. t by examining the radiometric information of the acquired data against a simulated data base. This will be done by applying the calibration gain and offset values extracted prior to the mission to the raw data and then comparing selected pixels' response to a simulated radiance response as modeled by MODTRAN. temporal evaluation of the radiometric stability and accuracy will be performed as well. In the case of HSR data te radiance information will be further spectrally evaluated by checking the position of the gases' absorption (sensor's spectral calibration status) and the curvature malfunction will be evaluated (Satenz 2004). In this stage, possible correction steps will be carried out such as de-striping. In addition, a post evaluation stage will be performed to the corrected data. If this stage will pass a specific score's threshold, then Task 4 above can proceed. This task is important for WP3

Task leader : TAU, participants DLR, CGS

Task 2.3: Atmospheric calibration and validation – This stage is extremely important and crucial for the success of this project because it provides physical-chemical meanings to the surface signals as well as to the problems under investigation. This is the first time in the processing chain that physical-chemical meanings are more important than cognitive visualization. These spectral meanings enable one to objectively and quantitatively assess phenomena important for the project, which are sometimes invisible to the naked eye. In practice, every data set acquired by the EO system (orbital, air, and field) consists of a mixture of signals of both the atmospheric and terrestrial spheres (litho, hydro, bio, and crio). It is then essential to isolate the targeted sphere. Using hyperspectral technology, this problem is more pronounced since data are acquired over highly attenuated spectral regions. It is then essential to remove the atmosphere attenuation and to focus on the ground targets if this is requested. In this stage, we attempt to remove atmospheric attenuation by using model-based approaches and software developed at DLR (ATCOR) + PARGE. We will emphasize validating the atmospheric correction procedure by comparing several targets on the ground, utilizing both reflectance and emittance measurements, by using field spectrometers This stage will be scored according to the validation results by using the ASDS technique developed by Ben-Dor et al., 2005. If the evaluation stage will pass a requested threshold, then it is possible to proceed to Task 2.4 below. If not, then a second correction round should be implemented using ground information and fusion between the model-based and empirical methods. This task is connected to WP3.

Task leader : DLR, participants TAU, BGS

Task 2. 4: Thematic accuracy and validation: After generating the thematic maps (e.g., mineral contamination and vegetation stress), we will conduct a field study to validate the results. In this stage, we will apply a commission omission test while generating a confusion matrix in several polygons extracted from the classification stage. Since we also intend to generate from the state-of-the-art sensors quantitative information on a pixel-by-pixel basis, we will also implement a validation stage. In this validation process, we will sample the attributes and check them in the laboratory. This information will be compared to the thematic map results and the accuracy of the thematic results will be evaluated. An accuracy map will be delivered with the thematic maps. Further, a previous stage where the geometric performance of the EO sensor will be evaluated will be applied prior to the thematic accuracy examination. We will apply the GPS IMU information recorded onboard to the data and will validate the results by measuring on the ground several well-observed targets such as road junctions.

Task leader : TAU, participants DLR, GeoZS, CGS, BGS, WI, AOL-ATD

Task 2.5: Documentation and dissemination: All of the steps described in this WP will be documented in a guide book and will be forwarded to other WPs for optimal implementation. This is essential especially for WP3 where data acquisition and processing will be done. This guideline book will technically summarize each step and will provide the users with an operational manual for routine usage to judge their data, models, and the final product. As the final product from this WP, the guide book could be disseminated to those members of the entire EO community who are willing to use this technology and approach. . Data assimilation refers to the ability of the community to repeat and use the technology developed in EO-MINERS. This will be done by submitting questionnaires to mining companies, environmental bodies, and EO-based companies after obtaining the final products to understand the project's impact and to enable possible improvement in the future.

Task leader : TAU, participants DLR, MIRO, CGS, BGS, AOL-ATD

Deliverables:

No	Name
D 2.1	Protocol to select a sensor for a mission and a guide to the set spectral and spatial configuration of the selected sensor (month 6).
D 2.2	Raw and radiometric data quality indices pre and post correction (month 9)
D 2.3	Atmospheric correction protocol and validation results (month 11)
D 2.4	Generic (thematic) quality indicators and quality layers(month 22)
D 2.5	CAL/VAL documentation – a check list for all of the above stages + threshold values + Questionnaires to mining companies, environmental bodies and the EO data interpreter regarding the quality of the data, its usage, and remarks (month 30)

Work package number	3	**Start date or starting event:**		0			
Work package title	EO application and development over demonstration sites						
Activity Type[11]	RTD						
Participant number	1	2	3	**4**	5	6	7
Participant short name	BRGM	BGS	TAU	**DLR**	WI	GeoZS	MIRO
Person-months per participant:	11.3	16.3	18	**36**	2	6	1
Participant number	8	9	11	12	13		
Participant short name	CGS	AOL-ATD	Czech GS	SU	AACL		
Person-months per participant:	11.7	1	22	0.6	0.5	-	

Objectives

To develop high level EO-based data products applicable to the different stages of mining activities within the life cycle of mining operations. Those products will allow to observe, to monitor and to quantify social and environmental impacts caused by mining activities over the selected demonstration sites and aim to understand their "footprint". Research is closely connected to the data quality aspects treated in WP 2 and results will be linked to WP 4, to develop EO-based tools to improve mining operations in future.

Description of work (possibly broken down into tasks), and role of participants

Task 3.1: site specific available data collection

A precursor of any environmental impact risk assessment is the development of an understanding of the risk paradigm within the context of the site under consideration. This is achieved by developing conceptual site models of the source –pathway-receptor interactions. Conceptual site models are intended to assist in the integration of technical information from various sources, identify possible knowledge gaps and support the selection of EO tools for gaining further understanding of the impact of mining on the environmental and human receptors.

For the purpose of the selection of EO methodologies to use at the selected demonstration sites, for each of the selected demonstration site, this task will consist in a review and the collation, with the help of the operating company responsible for the site, of all available data relevant to:

- Mining activities (mined area, technical infrastructure on site, ratio of assessed and already remediated land, etc.)
- Environmental aspects (natural environment, direct or diffuse path ways for solid materials, water flows, dust, weathering processes and spatial pattern of weathered material and secondary minerals, etc.)
- Socio-economic aspects (local opportunities for water and agricultural supply, economical dependencies of mining and other industrial branches, etc.)

[11] Please indicate one activity per work package:
RTD = Research and technological development; DEM = Demonstration; MGT = Management of the consortium; OTHER = Other specific activities, if applicable (including any activities to prepare for the dissemination and/or exploitation of project results, and coordination activities).

- Societal aspects (housing, infrastructure, development strategies, etc.)

Based on the mining related footprint definition, elaborated conjointly with stakeholders from the different groups, attracted in WP 1 and WP 5, all this information are the basic requirements for the development of site conceptual models. Based on those models, the necessary parameters will be identified that can be delineated by EO and GIS-based analysis.

Task leader : BGS, participants AOL-ATD, CGS, AACL, SU, CzechGS, GeoZS, BRGM, DLR, WI

Task 3.2: EO data acquisition

EO data will be acquired (or collected if already existing) over the demonstration sites. Data set can vary according to site specificity. This will include:

- Satellite data
    - Conventional optical sensors : Landsat Thematic Mapper, ASTER, Hyperion, etc.
    - Very high resolution optical sensors, such as Ikonos, Quickbird, SPOT 5, etc.
    - Radar sensors , in particular for INSAR applications
- Airborne data
    - Airborne imaging spectroscopy (hyperspectral) survey
    - Airborne geophysics : radiometric, electromagnetic, aeromagnetic
- In situ monitoring methods
    - Time-lapse electrical resistivity tomography (ALERT)
    - Ground monitoring networks
    - In situ point measurements
    - Field spectroradiometry campaigns
    - Information and/or measurements about vegetation, soil, groundwater and dust
    - Chemical Model and 3D Characterization of the contaminated soils

The planned airborne hyperspectral surveys of the Czech and the Chilean demonstration sites are corner stones of the project. Together with the comprehensive field campaigns, the data sets are the basis for the detailed and quantitative analysis approaches. As the demonstrations side in South Africa has been flown already, data evaluation procedures are of key importance.

Task leader : DLR, participants TAU, BGS, BRGM, GeoZS, CGS, WI, CzechGS

Task 3.3: Quality assessment

To ensure comparable data products over the different test sites and to make sure that different RTD tasks can be addressed properly, the data sets will be evaluated in terms of quality and accuracy under consideration of techniques and instruments used. This includes data pre-processing. and validating procedures. Special focus will lie on geometric and atmospheric pre-processing routines for the different data sets. These aspects will base on the models DLR uses as a standard software tools (PARGE, ATCOR-2, ATCOR-3). Validation of the data sets will be done based on the comprehensive GIS data sets available and especially based on the field measurements by field spectroscopic measurement devices. This task is closely related to data calibration and validation tasks for various instruments and techniques carried out in WP2.

Task leader : DLR, participant TAU

Task 3.4: data processing, data fusion, algorithm development

EO-based products related to the life cycle of mining operations will be developed. It is expected to map site environment status at different scales, with respect to the environmental and/or social parameters assessed and relevant requirements.

Innovative approaches will be carried out in processing together various EO data sets through different combination of them. Data fusion algorithms and specific processing algorithms will be tested and/or developed at this stage, taking into account site conditions and various thematic requirements jointly defined by the mining companies and geological surveys.

Research will focus on the development of routines that will allow the synergetic analysis of satellite based and airborne imagery by up-scaling and down-scaling procedures. Another important aspects are the development and evaluation of spectral unmixing routines to bridge the gap between the different spatial resolution of the data sets as well as a necessary step for the aspired quantification of land use classes and land cover materials. At present most unmixing routines are based on the assumption of a linear mixture to be analysed. Unfortunately dominant materials do not necessarily produce the most dominant spectral feature of the reflectance curves; dominant spectral patterns produced by minor components with strong absorption features can significantly assist to the spectral signature. Advances focus on multivariate data analysis techniques that commences with linear mixtures of unknown independent sources using higher order statistics.

Image classification by using non-parametric classifiers has bee advocated since these do not depend on specific data distribution assumptions. Recent developments of these classifiers are based on support vector machines and related optimization strategies.

Task leader : DLR, participants TAU, BRGM, CzechGS, CGS, BGS,

Task 3.5: footprint assessment and risk analysis

Using map layers achieved from methods and tools developed in task 3.4, GIS-based analysis will be used to perform environmental and societal footprint assessment and risk analysis. Enhanced GIS-based methods and integrated approaches for modelling footprint and associated risk will be developed at this stage.

The aim is to develop procedures, as automated as possible, based on different data sets (e.g. reference data, mapped information from the field, classification and “hot spot” detection results) to synthesize mining related parameter that can be mapped considering spatial and temporal changes. The accuracy of the obtained results has to be analysed to ensure, that different information can be combined to develop reliable map products. This approach hast to take the inherent uncertainty of the different data sets into account. One important point is the transferability of the approach to different sites under investigation in future. The GIS-based models will be developed in tight cooperation with WP 4.

Task leader : BRGM, participants GeoZS, CGS, BGS, CzechGS, TAU, DLR, WI, AOL-ATD

Task 3.6: Interaction with stakeholders and capacity building at site level

Results of the previous task will be presented and discussed with interested parties (mining companies, local to national authorities, local communities and NGOs) for each of the test sites. Strong feedback is expected to judge the pertinence of the developed tools and methods.

Results will be used in WP1, WP4 and WP5.

Task leader : BGS, participants CzechGS, DLR, MIRO, CGS, GeoZS, WI, AOL-ATD, SU, AACL

Deliverables (brief description and month of delivery)

D 3.1 : report on site description and site conceptual model (one per site)

D 3.2 : report on data acquisition and validation

D 3.3 : presentation of algorithms (regression, unmixing, data fusion, etc.) and novel tools for the characterisation, mapping and monitoring of mining activities using combination of EO data

D 3.4 : report on methodological developments for site footprint and risk analysis, considering possible “generic” aspects

D3.5 : feedback on interaction with stakeholders and capacity building at site level

Work package number	4	**Start date or starting event:**			6	
Work package title	EO Integration, Products and Systems						
Activity Type[12]	RTD						
Participant number	1	**2**	3	4	5	6	7
Participant short name	BRGM	**BGS**	TAU	DLR	WI	GeoZS	MIRO
Person-months per participant:	17.4	**6**	5	12	3	1	1
Participant number	8	9	11	12	13		
Participant short name	CGS	AOL-ATD	Czech GS	SU	AACL		
Person-months per participant:	8	1	8	-	0.4	-,	

Objectives

The primary objectives of WP4 are threefold: i) to translate the individual EO datasets developed in WP3 into more generic, integrated EO products that address the needs for indicators identified in WP1; ii) to integrate these EO products into the systems of work that are already in use in the mining and environmental management sectors; and iii) to organise these products so that they can form part of the Global Earth Observing System of Systems (GEOSS) being developed by the Group on Earth Observations (GEO). This will ensure that the project's outcomes form a contribution to GEO from the minerals sector, filling a strategic gap in GEO, an initiative which does not address minerals to any meaningful extent at present.

Description of work (possibly broken down into tasks), and role of participants

In order to achieve the above goals, four main sub-activities will be necessary: i) the integration of different spaceborne, airborne and ground-based EO datasets into mature, EO products; ii) the development forecast and simulation models describing the various stages of the mining life cycle that take advantage of EO products for mining applications; iii) the development of mining and environmental observation systems through the application of EO products within appropriate models and existing environmental and geoscience workflows; and iii) the preparation of such products for longer term delivery as part of the GEOSS, through the definition of new GEO Tasks for inclusion in future annual updates of the GEO Work Plan.

Task 4.1 EO Products

Single EO datasets rarely meet a particular need for environmental information in isolation. In most cases, several different types of measurement coming from space, airborne ground based systems need to be integrated into one product to meet a specific need. This task is designed to examine how EO datasets resulting from WP3 can be integrated to address environmental indicators identified in WP1. Examples to be investigated and documented as deliverables will include:

- Ground motion measurements using satellite radar interferometry, which gives a relative

[12] Please indicate one activity per work package:
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measure per pixel but over a wide area, integrated with techniques such as GPS and levelling, which are better understood by the industry and give well-characterised measurements but only at a number of discrete points, to give absolute measurements of ground motion over wide areas that can fit into existing systems of work in the mining and environmental sector.

- Airborne hyperspectral measurements of reflectance and emission that can be used to make mineral maps per pixel, integrated with ground based spectral measurements that identify specific minerals exposed on the ground through their reflectance and emission spectra, other geochemical sampling techniques (e.g. pH, Electrical Conductivity, iron oxide content, organic matter content, heavy metal content, moisture content) better integrated into current best practice in the industry, and spaceborne systems that will support wider application of this approach in the future.
- Space based and airborne EO systems that provide a regional identification of hotspots, which can then be instrumented with ground-based geophysical monitoring technology like BGS's ALERT system that can provide long-term, remote monitoring of the behaviour of groundwater and pollutants at those hotspots and hydro-geochemical sampling techniques that can characterise the water and materials at the sites being monitored.

This task will be led by BGS and will involve BRGM, CzechGS, DLR, TAU, CGS ,WI, AOL-ATD, AACL.

Task 4.2 Models for Forecasts and Simulations

This Task will use BRGM integrated modeling and simulation techniques as a possible methodological approach to study the functioning / impacts / possible foreseeable evolutions of systems representing mineral resource exploitation activities. This integrated approach takes simultaneously into account several thematic aspects, e.g. hydrogeology (linked to the nature of the exploited resource), socio-economy (linked to the actors involved) and geography (linked to the position of actors and resources in a geo-referenced area). It is proposed to develop a simulation platform, linked to a GIS for importing data and exporting results in the form of maps, enabling:

- Dynamic display of the evolution of a given area, either in real time (simulation) or in offline time (post simulation),
- Scenarios management used for understanding evolution over time of the interaction between social and environmental dynamics over a given mining area,
- Prospective simulation to help decision-makers evaluating and identifying actions for sustainable management of resources while contributing to local community development.

This will include the integrated modeling of socio-economic, environmental and geographical data focusing of flow representation. A **pilot** model will be constructed with the ultimate aim of enabling:

- Understanding, through a dynamical representation of curves and maps, the current flow system relevant of a mining site, integrating all environmental aspects including for instance related CO2 emissions (if available)
- Assessing foreseen impact of mine closure on local employment and consumption.

This Task will be led by BRGM and involve BGS, CzechGS, DLR, WI, CGS, AOL-ATD.

Task 4.3 Environmental Observation Systems

This Task is a crucial stage in the process of developing observation systems that have wider application in the mining and environmental management process. There are existing models that describe the behaviour of earth systems and processes, such as the expected movement of water within an aquifer below a mine site, for example, and these will be developed further in Task 4.2. Models are widely used in the industry, but they are often data poor and make many assumptions about specific model parameters. EO data offer one way of ensuring that such models are based on real observations about these parameters and thus provide a way to calibrate such models, improving their utility and the accuracy of any forecasts based upon them. Global Earth observation systems are typically characterised by well-integrated EO data that are combined with well-calibrated models; classic examples include the Global Climate Observing System and the Global Ocean Observing System. There is no such Observing System for the shallow subsurface today. This Task will integrate the modelling component developed in Task 4.2 with the EO products from Task 4.1, in order to identify the main elements of a shallow subsurface observing system for the minerals sector. Such as system will consider both the practical elements that would be required by the mining and environmental industry and also how such elements would feed into an observing system in the sense that GEO intends, as a contribution to the GEOSS in this sector. The outcome will be documented in a report.

This Task will be led by BGS and will involve DLR, BRGM, CGS, WI, AOL-ATD, CGS.

Task 4.4 EO-MINERS and GEO

This Task is designed to embed the outcomes of this project firmly in the GEO process. The Task group will review the existing GEO Tasks covering the 9 societal benefit and 5 transverse areas defined by GEO work plan 2007-2009. It will also analyse the databases of the four GEO standing committees. This analysis will be used to identify synergies and gaps between EO-MINERS and GEO, with the aim of mapping mining and environmental observation systems into the 9 GEOSS Societal Benefit Areas, identifying EO-MINERS contributions to existing GEOSS targets and defining new, EO-MINERS activities in support of GEOSS, based on the output of WP3. Throughout this process, working group members will maintain a dialogue with GEO, visiting GEO members and participating organisations in ACP countries and Europe as necessary. Emphasis will be put on active National Contact Points. Web links will be developed. EO-MINERS project team representatives will participate in GEOSS conferences and workshops, making presentations on the contribution of mining and environmental observations to specific societal benefit and transverse areas, and vice versa. EO-MINERS will also run a minerals workshop with GEO members and/or the GEO Secretariat. The expected deliverable is an ‘EO-MINERS to GEOSS Mapping Database and Report’ including (1) a proposal for the update of the GEO Work Plan, (2) proposals for follow-on projects to deliver against common EO-MINERS and GEO targets; and (3) proceedings of EO-MINERS presentations at GEO Workshops and Conferences.

This Task will be led by BGS and will involve BRGM, CGS, GeoZS, DLR, MIRO.

Deliverables (brief description and month of delivery)

D 4.1: EO Product Review (month 24)
D 4.2: Mine Site Simulation Platform (month 36)
D 4.3: Mining and Environmental EO Systems Report (month 36)
D 4.4: GEO Minerals Workshop (month 18)
D 4.5: GEO Minerals Workshop Proceedings (month 21)
D 4.6: EO-MINERS to GEOSS Mapping Database and Report (month 36)

Work package number	5	**Start date or starting event:**		0		
Work package title	Communication, dissemination, capacity building and exploitation					
Activity Type[13]	OTH					
Participant number	1	2	4	5	6	**7**	8
Participant short name	BRGM	BGS	DLR	WI	GeoZS	**MIRO**	CGS
Person-months per participant:	3.7	5	3	6	9	**24,5**	4
Participant number	9	10	11	12	13		
Participant short name	AOL-ATD	UVSQ	Czech GS	SU	AACL		
Person-months per participant:	1	6	2	0.3	0.2		

Objectives

The primary objective of WP5 is to disseminate and communicate the results of the work within the project by suitable means (press releases, oral and written presentations, leaflets, illustrations, videos, seminars and workshops, publishing of a book, etc) to the scientific community, mining industry, society, regulators and other stakeholders. It will also initiate and establish communication channels between all parties involved in the impact assessment of mining activities in order to keep everybody informed about latest information related to the test sites.

The most important objective is to initiate and develop a sound "trialogue" (definition: "An interchange and discussion of ideas among three groups having different origins, philosophies, principles, etc.") between the three main groups involved, the industry, governmental organisations and other stakeholders (e.g. NGOs). This "trialogue" should be based on reliable and objective information about ecosystems, populations and societies affected by mining activities.

Last but not least WP5 will look after IPR and exploitation of results. WP5 will address the potential exploitation of any products derived from the research. An exploitation plan will be developed and maintained. It will identify the ownership of background IPR and address the issue of foreground intellectual property developed by consortium partners.

Description of work and role of participants

The focus of WP5 is dissemination, promotion and capacity building actions in order to provide everybody involved and interested in impact assessment of mining activities as well as all other interested parties with the results of the project work. In order to effectively fulfil this task, a detailed communication strategy will be established identifying target groups and selecting the most effective ways of effectively engaging and communicating with them. The target audience will include, but not be limited to, the European Technology Platform on Sustainable Mineral Resources (ETP SMR), national and international organisations (e.g. EU, UNEP, UNECA, etc), local communities, the extractive industry and their trade associations and NGOs. Close contacts need especially be established with the ETP SMR as the European Technology Platform dealing with all matters related to mineral resources. The project will contribute to the implementation of parts of their Strategic Research Agenda.

It is envisaged that all actions will result in a sound "trialogue" between the three main groups involved, the industry, governmental organisations and other stakeholders (e.g. NGOs). This "trialogue" will assist towards the reconciliation of interests in order to reach common agreement upon

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need to mitigate environmental and social impacts of mining activities.

One individual task will be dedicated to IPR and exploitation. Main emphasis will be put on developing and maintaining an exploitation plan. The plan will identify all project results and especially those with commercial potential. The plan will further identify the ownership of background IPR and any foreground IP developed by consortium partners in the frame of the project.

MIRO will be responsible for coordinating and supervising the activities in WP5.

The work of WP5 will comprise of 4 tasks:

Task 5.1: Dissemination and capacity building

The results of the work undertaken in WP1 to 4 needs to be made known to related and also other interested parties. To this effect, a wide variety of dissemination mediums is proposed including written, oral and visual presentations in order to inform and actively involve governmental organisations, industry and societal groups during the project as well as in its aftermath. It is foreseen to give at least 2 presentations per year at related external events or conferences or at special events at the test sites especially organised for this purpose. The events mentioned are for the purpose of informing the public about general project achievements. They are not meant as capacity building and/or "trialogue" event but may however run in combination with such events. Targeted audience will be the industry and their trade organisations and governmental organisation. Society organisations may participate as well but are not in the main focus due to the more technical content of the presentations. These groups are addressed by other means.

Specifically, towards the end of project, the results of the project and its achievements and consequences will be collated and presented in a book. This book will be edited within the frame of the project and published using an established publishing house. The book may solve as kind of "Guide for Good Practice".

Capacity building activities will comprise workshops and/or seminars mainly on local level preferably at the same time as the foreseen annual meetings and a final conference. This means that we envisage one workshop per test site. The capacity building activities are mainly dedicated to the related local authorities and local communities including NGOs. Depending on the success of the activities a second workshop/seminar per site might be planned if necessary. Another possibility could be to continue discussion if necessary via discussion forums included in the project web site on the Internet. It must in any case be ensured that all messages about possibilities and consequences of impact assessment (based on the project achievements and common good practice) can be brought across.

The capacity building activities will be combined with mobilisation or awareness campaigns in order to ensure that all interested and affected groups are aware of and can take part in the discussions at the events. As the events will be organised jointly with project meetings double travelling of the project partners will be avoided so that all partners may participate.

In addition to the abovementioned actions a set of multimedia material will be produced for use by the consortium and the EC especially designed for dissemination and promotion purposes. It will comprise of leaflets, reusable illustrations, brochures and videos or slideshows containing information about the project and its achievements. Clear reference will be made to FP7 Environmental Theme. The material will be produced whenever appropriate during the lifetime of the project, especially at the beginning and towards the end. It will at least be available for download on the project web site. Other distributions channels will be explored as well.

Role of partners:

Task leader: GeoZS

Geo-ZS: Facilitator at capacity building activities, support with editing, designing/ preparing page – break for materials / book

MIRO: Contribute to capacity building activities, organisation of events, editing all kinds of publications, editing the envisaged book

BGS: Contribute to organisation and content of capacity building activities, contributing to presentations, editing of publications (in English)

BRGM, DLR, WI, CGS, UVSQ: Contribute to content of presentations and other material, workshops, seminars and/or capacity building events

<u>Task 5.2: Communication and promotion</u>

The publication and dissemination of realistic, interactive and objective information on the social and environmental issues relating to mineral extraction and new methodologies in managing and reducing such effects in the future is core to the success of the project. In order to ensure that information about the project outputs reach all related and interested parties, a detailed communication strategy will be established identifying target groups and ways of reaching them appropriately. Such a strategy ensures that the envisaged “trialogue” will include the right partners from all involved parties.

An effective and wide reaching promotion campaign is proposed focused around the development of a project website, publication of a series of non-technical factsheets/illustrations/leaflets, a project brochure, a few short stand-alone videos or slideshows and a poster series. All promotional material will be tailored to the target stakeholder community and be prepared to a common format and standard. A logo will be included to ensure distinctiveness and recognition of all project outputs. Furthermore, press conferences will be organised and press releases issues upon reaching project milestones. All multimedia material mentioned will clearly make reference to FP7 Environmental Theme and be at least available for download on the project web site. Other distributions channels will be explored as well.

Communication and promotion activities will be at two levels: 1. Non-technical level targeting the interaction between society, regulators and industry, and 2. technical level targeting industry, researchers and policy makers. This two levels approach should ensure to provide every interested party with factual information in an understandable manner.

<u>Non-technical leaflet series:</u>

Reaching societies affected by mining activities can be challenging and access to the internet can be extremely restricted, in particular in remote areas where mining activities are, more often than not, located. On this basis, promotional material will be predominantly analogue based and will focus around the a series of about 6 short (4 page glossy) non-technical leaflets designed to provide a non-specialist audiences with key factual information on a wide range of issues relating to mineral extraction, in particular those issues core to this project. Each leaflet will focus on a different stage of mining, the potential impacts associated with that particular stage, mitigation options with direct reference to the use of EO for this purpose. The objective of these leaflets is for industry to use them as an effective tool for communicating that they are committed to the local communities peripheral to their operations and are using the most advanced and best technologies for monitoring and minimising the impacts of their operations. If necessary the leaflets will be published in the local language of the related test sites as well. This should ensure that local communities are reached adequately. The leaflets will be accompanied by a short stand-alone video illustrating the activities performed in the frame of the project.

<u>Videos/slideshows:</u>

A set of short stand-alone videos and slideshows will be produced for dissemination and promotion purposes. It will illustrate the general scope and the activities performed in the frame of the project as well as achievements. This material may be used accompanying printed information or as stand-alone audio-visual promotion and information source. A first video and/or slideshow will be produced at the start of the project containing the basic information about it, the work to be carried out and envisaged achievements. Whenever appropriate during the lifetime of the project additional material will be produced and made available for use by the consortium and the EC.

<u>Website:</u>

A website will be developed to disseminate the results of the project and to provide a directory of information to all stakeholders. All published multimedia material will be made available for download here. The website will have three separate areas targeting three audiences: society, industry & technology and policy makers & regulators. The website will provide up-to-date factual information on EO technology and its use in managing and minimising the footprint of mining and also present a series of case studies of the test sites. The possibility of having real time monitoring on the web will be explored. A web-based discussion forum will be established in order to facilitate and support discussion among the project partners about the technical work and results. Further, the discussion forum will be a tool encouraging the "trialogue" as it allows the external participants of the trialogue to get in contact easily with each other and to contribute to and profit from the project activities at an early project stage. Once established and distributed, that forum may be moderated by the WP leaders.

Technical brochures and posters:

Brochures and posters are dedicated to technical audiences. Brochures will be designed upon project milestones describing the project and technical achievements as well as project status and planning. This material will be complementary to the project web site content and refer to it for more detailed information. A series of 5 posters will be designed, one showing the project basics as a whole and one each dedicated to the "technical" workpackages 1 to 4.

Special communication channels will be established and maintained with the ETP SMR and the Raw Materials Supply Group (RMSG). It is expected that the project will contribute to the ETP SMR in the domain of environmental footprint reduction by using new observing, monitoring methods, and providing information about populations and societies affected by the exploration and exploitation of raw material. The RMSG as being a stakeholder group comprising extractive and user industries, Member States, environmental NGOs, trade unions and the Commission is supposed to be the right group in order to initiate the envisaged "trialogue" on European level affecting also the related discussions in ICPC countries.

Role of partners:

Task leader: BGS

BGS: Preparation of content and design of non-technical leaflet series ready for printing with contribution from all partners as appropriate, design and compilation of text and images for the website with technical material supplied by the relevant partners.

conceptual design of multimedia material.

MIRO: Contribute to establishment of communication strategy, provide communication channel to ETP SMR, contribute to creation of promotion material, hosting project web site

Geo-ZS: Contribute to preparation of communication strategy, provide and maintain communication channel to RMSG

BRGM, DLR, WI, CGS, UVSQ, CzechGS, SU, AACL: Contribute to content of technical promotion material and non-technical leaflet series as well as multimedia material

Task 5.3: Initiating and establishing a sound "trialogue"

Exploration as well as exploitation activities related to winning of mineral resources will always cause some impact to the environment and the society in the affected region. The project will make available reliable and objective information about affected ecosystems, populations and societies, to serve as a basis for a sound "trialogue" between industrialists, governmental organisations and stakeholders. Using the communication strategy established in Task 5.2, Task 5.3 will initiate and develop this "trialogue", which is meant to contribute to reconciliation of interests in order to reach common agreement upon actions to deal with environmental and social impacts of mining activities. Apart from this the "trialogue" would in a way also confirm the project idea and outcomes and confirm its usefulness.

In the context of structuring the "trialogue" a Deliberation Matrix, a multimedia evaluation tool developed by C3ED, may be applied. This tool confronts the diversity of stakeholders views on the different issues (eg. biodiversity preservation), using indicators. This should represent an opportunity to build a common representation and language of the exploitation and to structure the dialogue between the different actors.

Similar to the capacity building events (see Task 5.1) "trialogue" events will be organised on local level in connection with the annual project meetings (at test sites) and the final meeting. Additionally, one event will take place in Brussels in the second half of the project involving lobbying organisations like Euromines or IMA and other EU stakeholders together with members of the RMSG. Correspondingly, the "trialogue" is split up into so-called "local trialogue" and "European trialogue". "Trialogue" activities will be accompanied by related web-based discussions via the discussion forum at the project web site.

Apart from summarising the results of the "trialogue" in a proper report (Deliverable D 5.6) the wider social implications of this activity and the general awareness will be assessed and reported (Deliverable D 5.8)

Role of partners:

Task leader: WI

WI: Establish the framework for a balanced trialogue, facilitate the communication, preparation of both the intermediate results and information requirements regarding the work packages 1-4, support the exchange with the discussion forum in task 5.1.

MIRO: Provide and facilitate industry contacts, contribute to coordination of "trialogue" activities

BGS: Assist in identifying stakeholders, providing contacts.

Geo-ZS: Providing contacts of stakeholders, the main role would be as (one of) facilitator of "trialogue", interacting among stakeholders, and description of "trialogue" outcomes.

UVSQ: Contribute to facilitate and structure dialogue by providing C3ED tool

BRGM, DLR, CGS, CzechGS, AOL-ATD: Contribute to "trialogue" activities

Task 5.4: Exploitation and IPR

WP5 will also address the issue of foreground intellectual property and the potential exploitation of any products derived from the research. An exploitation plan will be developed and maintained to:

- Identify any technologies, software, methodologies or datasets with commercial potential.
- Initiate IPR protection (e.g. patent filing, trademark registration, copyright) with a view to post-project exploitation
- Identify the most appropriate mechanism for commercial knowledge transfer (e.g. by direct licensing, spin-out, or innovation relay centre)

The plan will identify the ownership of background IPR and any foreground IP developed by the consortium partners. This plan will be updated with each periodic report to the EC and maintained as an evolving document. IPR with commercial potential will not be disclosed in the public domain. For example, it is anticipated that the adaptation of the BGS ALERT prototype technology for the long-term monitoring of mines (during extraction and post-closure) could result in a near-market prototype system with a high potential for global sales, job creation and exports. It is possible that some other EO techniques or products may have generic components that could be adapted for other cross-cutting market sectors, including: geohazard prediction, flood and landslide warning, monitoring water degradation and scarcity, contaminated land remediation, the monitoring of safety-critical plant, civil infrastructure (e.g. nuclear waste repositories, earthworks) and not least, heritage conservation.

Besides the exploitation plan dealing with the project achievements and IPR issues in detail the work in this task will start with drafting a plan about use and dissemination of the foreground.

Task leader: MIRO

MIRO: Contribute to drafting of exploitation plan, identification of exploitable results and IPR

BGS: Contribute to drafting of exploitation plan, identification of exploitable results and IPR

BRGM, DLR, WI, GeoZS, CGS, UVSQ, CzechGS: Providing relevant information about exploitable results and IPR issues

Deliverables (brief description and month of delivery)
D 5.1: Project web site (month 2)
D 5.2: General promotion material for the project (month 3)
D 5.3: Final plan for the use and dissemination of foreground (month 6)
D 5.4: Workshop proceedings (after each workshop, probably months 13, 25, 36)
D 5.5: Book summarising the project achievements ("Guide for Good Practice") (month 36)
D 5.6: Report summarising "trialogue" activities and results (month 36)
D 5.7: Exploitation plan (months 12, 24, 36)
D 5.8: Report on awareness and wider societal implications (month 36)

B 1.3.6: Efforts for the full duration of the project

Project Effort Form 1 - Indicative efforts per beneficiary per WP

Project number (acronym) : 244242 (EO-MINERS)

Workpackage	WP0	WP1	WP2	WP3	WP4	WP5	TOTAL per Beneficiary
BRGM	**10.8**	3.7	-	11.3	17.4	3.7	46.9
BGS	-	1.4	2.8	16.3	**6.0**	5.0	31.5
TAU	-	1.0	**18.0**	18.0	5.0	-	42.0
DLR	-	3.0	18.0	**36.0**	12.0	3.0	72.0
WI	1.0	**22.0**	2.0	2.0	3.0	6.0	36.0
GeoZS	-	5.0	1.0	6.0	1.0	9.0	22.0
MIRO	0.5	3.0	1.0	1.0	1.0	**24.5**	31.0
CGS	-	3.5	1.5	11.7	8.0	4.0	28.7
AOL-ATD	-	1	1	1	1	1	5
UVSQ	-	6.0	-	-	-	6.0	12.0
CzechGS	-	5.0	-	22.0	8.0	2.0	37.0
SU	-	0.3	-	0.6	-	0.3	1.2
AACL		0.2		0.5	0.4	0.2	1.3
TOTAL	12.3	55.1	45.3	126.4	62.8	64.7	366.6

Project Effort Form 2 - indicative efforts per activity type per beneficiary14

Project number (acronym) : 244242 (EO-MINERS)

Activity Type	BRGM	BGS	TAU	DLR	WI	GeoZS	MIRO	CGS	AOL-ATD	UVSQ	CzechGS	SU	AACL	TOTAL AC-TIVITIES
RTD/Innovation activities														
WP 1	3.7	1.4	1.0	3.0	22.0	5.0	3.0	3.5	1	6.0	5.0	0.3	0.2	55.1
WP 2		2.8	18.0	18.0	2.0	1.0	1.0	1.5	1					45.3
WP3	11.3	16.3	18.0	36.0	2.0	6.0	1.0	11.7	1		22.0	0.6	0.5	126.4
WP4	11.3	5.5	5.0	12.0	1.5	1.0	1.0	8.0	0.5		6.0		0.4	52.1
Total 'research'	**26.3**	**26.0**	**42.0**	**69.0**	**27.5**	**13.0**	**6.0**	**24.7**	**3.5**	**6.0**	**33.0**	**0.9**	**1**	**278.9**
Demonstration activities														
WP 1														0.0
WP 2														0.0
WP3														0.0
WP4	6.1	0.5			1.5				0.5		2.0			10.6
WP5														0.0
Total 'demonstration'	**6.1**	**0.5**	**0.0**	**0.0**	**1.5**	**0.0**	**0.0**	**0.0**	**0.5**	**0.0**	**2.0**	**0.0**	**0.0**	10.6
Consortium management activities														
WP 0	10.8				1.0		0.5							12.3
Total ' management'	**10.8**	**0.0**	**0.0**	**0.0**	**1.0**	**0.0**	**0.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**12.3**
Other activities														
WP5	3.7	5.0		3.0	6.0	9.0	24.5	4.0	1	6.0	2.0	0.3	0.2	64.7
Total 'other'	**3.7**	**5.0**	**0.0**	**3.0**	**6.0**	**9.0**	**24.5**	**4.0**	**1**	**6.0**	**2.0**	**0.3**	**0.2**	**64.7**
TOTAL BENEFICIARIES	**46.9**	**31.5**	**42.0**	**72.0**	**36.0**	**22.0**	**31.0**	**28.7**	**5**	**12.0**	**37.0**	**1.2**	**1.3**	**366.6**

14 Please indicate in the table the number of person months over the whole duration for the planned work , for each work package, for each activity type by each benefici-ary

B 1.3.7: List of milestones and planned reviews

List and schedule of milestones					
Milestone no.	**Milestone name**	**WPs no's.**	**Lead benefici-ary**	**Delivery date from Annex I** [15]	***Comments***
M 0-1	kick-off meeting and Consortium agreement	WP0	BRGM	1	Consortium agreement signed, minutes
M 0-2	first annual meeting	WP0	BRGM	12	minutes
M 0-3	second an-nual meeting	WP0	BRGM	24	minutes
M 0-4	Final meet-ing	WP0	BRGM	36	minutes
M 1.1	Policy Analysis	WP1, WP5	WI	Month 12	Report
M 1.2	Policy De-mand	WP1, WP4, WP5	GeoZS	Month 30	Report
M 2.1	Mission Planning	WP1, WP2, WP3	DLR	Month 4	List of targets, scientific questions, and sensors at hand
M 2.2	Data Acqui-sition	WP2, WP3		Month 6	List of data quality
M 2.3	Thematic Mapping	WP2, WP3		Month 14	Maps (thematic, verification, and uncertainties)
M 2.4	Guide Book	WP2, WP3, WP5		Month 26	A Guide Book
M 2.5	Data assimi-lation	WP4	BGS	Month 32	Report
M 3.1	airborne data sets	WP2, WP3	DLR	Month 12	pre-processed data sets

15 Month in which the milestone will be achieved. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

M 3.2	site specific model development	WP2, WP3, WP4	BRGM	Month 24, 32	Maps (exemplary footprint of mining activities for each demonstration site)
M 3.3.	draft design of a generic toolbox	WP2, WP3, WP4, WP 5	DLR	Month 32	definition of a hierarchic concept of different data levels and data products
M 4.1	GEO Mineral workshop	WP4	BGS	Month 18	Workshop
M 4.2	Modifications to GEO Work Plan	WP4	BGS	Month 36	Integration in GEO work plan

NB: WP5 has not defined any milestones as WP5 depends on the results obtained in the other WPs and does not include any action critical for the project progress.

Tentative schedule of project reviews

Review no.	**Tentative timing, i.e. after month X = end of a reporting period** [16]	***planned venue of review***	***Comments , if any***
1	After project month: 12	**Brussels**	**Reporting period month 1 - 12**
2	After project month: 24	**Brussels**	**Reporting period month 13 - 24**
3	After project month: 36	**Brussels**	**Reporting period month 25 - 36**

[16] Month after which the review will take place. Month 1 marking the start date of the project, and all dates being relative to this start date.

B 2. Implementation

B 2.1 Management structure and procedures

B 2.1.1: Objectives and organisation

Management objectives within EO-MINERS are:

- To coordinate the scientific and technical activities of the project at the consortium level;
- To ensure the smooth day to day running of the project:
- To provide timely and efficient financial and administrative co-ordination of the project;
- To provide decision making, quality control and conflict resolution mechanisms to support the project's consortium and its evolution;
- To facilitate exchange of information in between partners;
- To support implementation of changes in the activities and in the consortium.

The principles of project management, including IPR issues and decision making procedure, has been agreed by the EO-MINERS partners to implement all issues not covered by the Grant Agreement and indispensable to make the project operational and viable. These principles will be formalised in the Consortium Agreement (CA) drafted by the Coordinator. All partners will sign the final CA prior to the signature of the Grant Agreement. The proposed management structure will allow decisions to be taken in a structurally coherent manner, while avoiding the potentially biased view of a single coordinating institution (Figure 2-1). The structure makes decisions transparent as it assures information flow bottom-up as well as top-down.

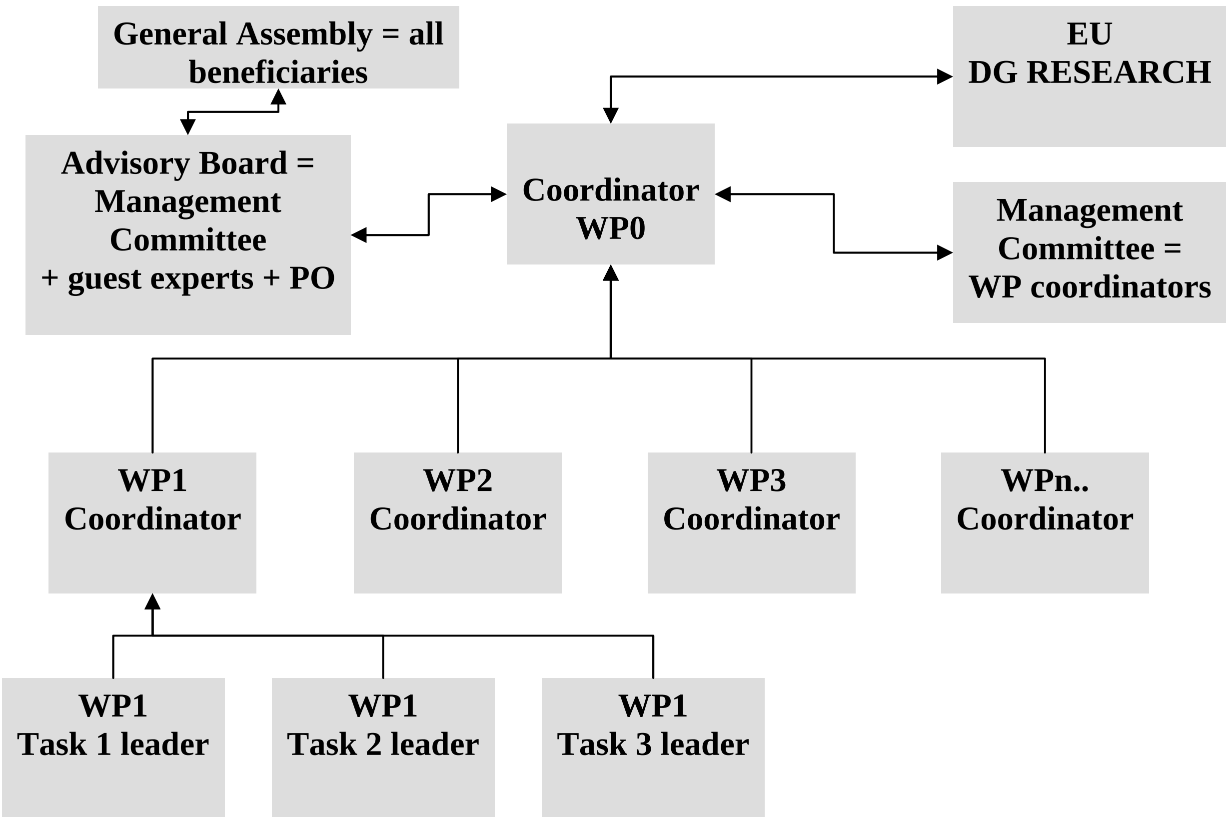

Figure 2-1: Organisational and decision making structure of the EO-MINERS project.

The General Assembly consists of one representative of each partner. It provides the forum which is attended by all partners and discusses strategic questions on scientific issues of EO-MINERS and eventual problems related to the project management. The Coordinator reports the observations and recommendations of the General Assembly to the Advisory Board and the decisions and plans of the Advisory Board to the General Assembly. The chairman of the General Assembly will be elected at the EO-MINERS kick-off meeting. The General Assembly will meet once a year.

The Management Committee comprises the work packages leaders and the Coordinator. The Management Committee will be in charge of taking operational decisions regarding the day-to-day project management, including arbitrating on deadlock situations occurring in work packages. It will be in charge of preparing the programme of activities, making preparations for decisions and recommendations to be taken by both the Advisory Board (see below) and the General Assembly and will ensure that these decisions are properly implemented. It will meet in principle once every six months or more often as required. Reports of the meetings are sent to members of the General Assembly and posted on Project Website (private domain pages).

The Management Committee is responsible for the identification of the general specific risks of the project and the definition of remedial actions. In the monthly progress confirmations to the project coordinator and the activity coordinator, the activity leaders give an update of the activity specific risks.

The Advisory Board participates in policy and decision making. The Advisory Board is chaired by a representative of the ETP-SMR and is composed of the Management Committee and six invited experts. The EC Programme Officer in charge is likely to attend the Advisory Board meetings. The Advisory Board meets once a year, during the same period as the General Assembly.

The Advisory Board takes the strategic decisions. It meets once a year at a minimum or on request of other partners. It will be responsible for decision making by:

- Deciding upon the allocation of the Project's budget by Work Packages in accordance with the Contract, including the Project Plan, and reviewing and agreeing budget transfers to partners if necessary;
- Deciding on scientific and technical adjustment in accordance with the industry needs and the ETP-SMR advices;
- Checking the consistency of the work, the interdependency in between WP and with other EU programme;
- Overseeing and implementing all issues to do with the Grant Agreement and consortium agreement;
- Proposing and leading the communication policy.

The Coordinator is the legal entity acting as the intermediary between the Parties and the European Commission. The Coordinator shall, in addition to its responsibilities as a Party, perform the tasks assigned to it as described in the Grant Agreement and the tasks to be agreed in the Consortium Agreement.

The coordinator's responsibilities are:

- To monitor compliance by the Parties with their obligations as described in the Grant Agreement and in this Consortium Agreement
- To manage the EC contract, handle and distribute the funds according to the rules of the Grant Agreement;

- To collect and to submit financial and technical reports and other deliverables to the European Commission
- To maintain the interface with the Programme Officer assigned by the EC;
- To maintain regular contact with the partner organisations;
- To organise meetings of the General Assembly, of the Advisory Board and of the Management Committee;
- To ensure global project coordination with the aim to meet the project schedule and objectives.
- To promote and maintain scientific links between partners within and between work-packages, in order to ensure project deliverables;
- To analyse scientific results from all workpackages and make recommendations to the Advisory Board for new scientific tasks and collaborations and for best exploitation of results inside and outside the Project.
- To organise the Management of the consortium activities including implementation of competitive calls by the consortium for the participation of new partners, in accordance with the provisions of the contract; maintenance of the consortium agreement, ensuring the transfer of information from the EC to the partners and reciprocally and other management activities at the consortium level.

The Work Package Leaders are responsible for the technical activities of the WP with respect to the timetable of the project relative to the succession of the technical and reporting tasks, and of the deliverables. One of their main responsibilities is the Quality Control of the work of their WP.

Table 2-1: Meeting frequency and participants

Meetings	Management Committee	Advisory Board	General Assembly
Kick-off	Y		Y
Month 6 (progress)	Y		
Month 12 (annual)	Y	Y	Y
Month 18 (progress)	Y		
Month 24 (annual)	Y	Y	Y
Month 30 (progress)	Y		
Month 36 (final)	Y	Y	Y

Annual meetings and either kick-off or final meetings will take place in demonstration site countries.

The Demonstration Site Managers are assigned to each demonstration site attached to WP3

- Ms. Veronika Kopačková for the Czech site
- Mrs. Fatima Ferraz for the South African site
- Mr. Dan Taranik for the Chilean site

Tasks of the Demonstration Site Managers include:

- Collection of inputs, including available EO data;
- Collection of inputs on the socio-economic situation;
- Collection of data on the environmental, economic and social situation;
- Identifying the relevant local stakeholders and hosting participatory workshops.

B 2.1.2: Management of communication

One of the pitfalls of working with a large consortium is the communication and the flow of information. EO-MINERS proposes to alleviate this problem by creating centralized project management tools, inducing a document management system to hold all project reports and documentation: an archived mailing list to manage e-mail communication inside the project team: and a task tracking system that will provide both project manager and researchers with an up-to-the-minute overview of project progress.

It is also proposed to hold bimonthly exchanges between the Management Committee and the Program Officer to monitor progress and management of the project, and meetings every six months in person for an in-depth review. There will also be annual meetings with the General Assembly and the Advisory Board, where any participant may raise issues for discussion and resolution. As the work package leaders are together in the WPs, additional communication and joint ownership of technical issues will be achieved. Finally, the leaders of each work package will ensure the regular communication among the partners in each workpackage.

B 2.1.3: Quality Management

The Coordinator will be responsible for elaborating a "Project Manual" according to the BRGM's ISO 9001:2000 quality procedures. The Project Manual will carefully describe all project tasks and corresponding schedule. A copy of this handbook will be provided to each individual intervening in the project that will return a signed "return of receipt" to the project Coordinator.

The "Project Manual" is a summary of rules, methods and tools that fixes:

- the project objectives and their analysis in terms of products, tasks and necessary resources (personnel, financial and material);
- a related reliable time and financial schedule;
- the specific project procedures in accordance with FP7 programme requirements;
- the measures to reach cost and delay objectives of the project.

The Project Manual will be presented and discussed with all participants during the Project kick-off meeting to be held at the very beginning of the project. The coordinator will ensure the responsibility for technical management and administrative support. He will circulate and archive all correspondence related to the project, internal as well as external, using a specific project numbering. He will carefully follow up the project progress and point out every possible problem or improper functioning. He will take care of the communication flow inside the project. He will report scientific, technical and financial matters in progress reports. Where necessary, after consultation and in accordance with the Management Committee and /or the Advisory Board and the Commission, he will immediately propose the best-adapted remediation measures. The Project Manual will be revised accordingly.

B 2.1.4: Risk analysis and management

General and specific risks are inherent in the organization and execution of a project such as EO-MINERS. The following general risks, impact and remedial actions are identified, which could influence the success of the project

Managerial and technical risks have been separately identified and treated

Managerial risks

Risk	Impact	Rank before remediation	Remedial action
Large number of partners	Inadequate communication; difficulties to manage; unclear responsibilities; insufficient participation; insufficient integration	low	Use of project website: specified leaders for each work package; clear consortium agreement, clear quality procedures and plan for Quality Control and Quality Assessment, clear description of responsibilities in working plans, Consortium meetings every six months, video conferencing and/or Skype as required; performance monitoring by Management Committee
Start up time of project too short	Organization not ready; personnel net vet employed: activities not synchronized	medium	Time delay between end of negotiation and the start of the project to enable possible recruitment
Deliverables not on time	Delay of correlated deliverables integration cannot start on time	High for correlated deliverables	Clear working plan; strict management of milestones; definition of critical deliverables
Lack of quality control	Undetected errors	low	Quality assurance plan prepared by the Coordinator as part of the BRGM'S ISO 9009 quality certification. Quality Plans to be prepared by each partner based on institutional QA protocols (e.g: Prince 2, ISO 140001; 2004. Plans will also include Disaster Recovery strategies, to prevent data loss or corruption..
Costs deviation: EO-MINERS project addresses a very challenging topic, with demonstration sites in three countries, including two ICPCs.	Deviations in the work plan and deviation in mission costs. Missions are obviously necessary to perform field measurements and surveys, to coordinate the project and for dissemination.	medium	Budget expenditure will be monitored on a regular basis by each partner. Spend to be recorded in periodic EC reports. Management Committee to monitor significant over-spend and/or under-spend, and take remedial action if required. All deviations from work plan to be recorded in Periodic Reports and agreed by Management Committee. WP Leaders to provide 3-month summary financial reports for website for oversight by all partners. Open reporting and audits each year

Technical risks

Risk	Impact	Rank before remediation	Remedial action
Unexpected (or lack of) technical developments	Requirements cannot be met or can be exceeded or superseded	high	If barriers are technical, timely redefinition of requirements, and design of alternative solutions and deliverables in consultation with Management Committee and EC. If delays related to poor partner performance formal warning to defaulting partner to be given. If not acted on, ultimate sanction would be expulsion from consortium in accordance with EC contract rules.
Insufficient participation of experts from institutes and stakeholders not participating directly in EO-MINERS	Insufficient technical and societal inputs from local and thematic experts and stakeholders	high	Regional meetings with comprehensive involvement and commitment of national and thematic experts and stakeholders, role of site managers
Inability to communicate and find common ground among "technologists" and "social scientists" and establish jointly accepted methodologies	Failure in reaching expected output documents.	low	the partners are known to each other from previous contracts. Good communication and working relationships already established , The risk y of total failure is considered to be very low A glossary for key terms is built up to support a seamless communication
Data conflicts: as a consequence of the high number of partners and the variety of data sources, there will be a risk associated to non interoperability between data from different sources.	Delays in deliverables	medium	The initial definition of a (Web)GIS structure will define expected formats at a very early stage of the project and ensure the global interoperability. The data will remain owned by the organisation from which it originates. Furthermore, a web master based at MIRO will assume the reliability and updating of common data within the project.

Missing, or poor quality, airborne hyperspectral survey data acquisition	Lack of data and/or reliable data	high	Good quality data acquisition is strongly weather-dependant. Data acquisition periods and schedule will be carefully taken into consideration by DLR Annual performance of a radiometric calibration measurement. QA and QC procedures to be rigorously enforced by WP Leaders and Coordinator and deviations or non-compliances noted
Inappropriate satellite data ordered by the different partners (different sensor systems, different time slots, different ideas/strategies about preprocessing, algorithms to be used, etc.)	lack of defined strategies, variety of pre-processing steps and data level definitions, intermediate results are not comparable,		Setup of a useful data catalogue and definition of pre-processing steps, strict definition of cal/val procedures, definition of results – critical checked at regular times during the project life cycle.
ALERT monitoring station may be subject to vandalism or theft	Gap or lack of monitoring data	medium	BGS has several back-up ALERT systems. Data gaps unlikely or minimal. Possibility of theft is minimised by locating ALERT in high-security metal enclosures within existing buildings, plant and/or fenced security compounds. Instrumentation in tamper-proof boxes and not visible to public. System under responsibility of the South African site manager, and subject to regular inspection and overview by CGS.

B 2.2 Beneficiaries

B 2.2.1: BRGM

Organisation activities:
BRGM is France's leading public institution in the Earth Science field for the sustainable management of natural resources (including mineral resources) and surface and subsurface risks. The various roles of BRGM can be described as follows: technological research and development and innovation; support for public policies and citizen information; international cooperation and development aid; safety and monitoring of former mining sites.
The Mineral Resources Division (coordinator of the project) activity covers the whole spectrum of the management of mineral resources, from fundamental research (e.g. ore forming processes, metallogenic syntheses, predictive mapping, etc.), including exploration, expertise, development of geological and mining infrastructures, management of after mine problems, to raw material economy.

The Environmental and Process Division will be involved in the project too. For a better management of water, polluted sites and soils, and waste, this division draws up methodological guides and technical standards, develops decision-aid tools, develops "clean technologies" for treating soil, water and waste, and offers professional training to those responsible for managing polluted sites in France.

Status:
Public institution with industrial and commercial interests (EPIC). Under the joint supervision of the ministries responsible for Research, for Industry and for Environment. Staff: 1008 (more than 75 specialities), 2007 turnover: €112.60 million

Role in the project:
BRGM will be the coordinator of the project. It will actively participate in WP3 and WP4. It will in particular provide expertise in Remote Sensing and GIS-based integrated approach of environmental assessment. It will develop tools for modeling the evolution over time of the interaction between social and environmental dynamics over a given mining area. BRGM will also be research partner in WP1 and WP5

Relevant Experience: BRGM is coordinating six FP7 projects and participant in eight. It coordinates in particular the GEOSS dedicated projects AEGOS and EUROGEOSS. It coordinated fourteen FP6 projects (including BioMinE, BIOSHALE and EO-LANDEG) and participated in twenty seven FP6 projects (including HOLIWAST). The coordinator was the Coordinator of the FP5 MINEO project (Monitoring and assessing the environmental Impact of mining in Europe using advanced Earth Observation Techniques) and of the FP6 EO-LANDEG (Earth Observation initiative in a former homeland of South Africa in support of EU activities in land degradation and integrated catchment management) Specific Support Action.

Key persons involved:

Stéphane CHEVREL, Mr. Diploma of engineer in Mineral Resources and Industrial Minerals, University of Orleans, France. Post-graduate certificate in Analysis and Management of Geological Risks, University of Geneva, Switzerland. 24 years of experience in remote sensing applied to Earth Sciences, with particular focus on land use planning and development of applications of remote sensing and geographic information systems to environmental impacts of mining activities, mostly in South Africa and Europe. Co-ordinated the EU FP5 project MINEO (Assessing an Monitoring the Environmental Impact of Mining in Europe using advanced Earth Observation Techniques, contract IST-1999-10337) and the FP6 Specific Support Action EO-LANDEG (Earth Observation Initiative in former homeland of South Africa in support to EU activities on land degradation and integrated catchment management). Currently manages a BRGM RTD project on application of spectroradiometry to the environmental impact of the Sokolov lignite mine (Czech Republic). Member of the national “hyperspectral group” initiated by the French Space Agency (CNES).

Ms. Anne Bourguignon
Anne Bourguignon is a geochemist with 8 years of experience in remote sensing with particular focus on land use and coastal planning and environmental concerns. She worked in methodological developments in processing of hyperspectral imagery (EU FP5 project MINEO) and in the application of very high resolution remote sensing tools (BRGM RTD project in S. Africa). She was co-ordinating (2001-2004) multidisciplinary project of the NATO Science for Peace Programme. A. Bourguignon obtained a PhD in 1988 from the University of Lyon I (France). She is currently working on spectroradiometry over the lignite mine of Sokolov with CzechGS.

Mrs. Carnec Claudie

After receiving an M.Sc. in fundamental physics, Claudie Carnec specialised in radar remote sensing. She received the doctoral degree in physics from University of Paris VII with a thesis on differential radar interferometry. Her main research interest concerns image processing applied to synthetic aperture radar, and particularly the derivation of surface movement information through interferometry.
She is now Research and Development project leader on radar and interferometry applications. Principal investigator of pilot projects from ESA and NASA, Mrs Carnec participates in radar applications in Natural Risks problematic with industrial partnerships and international research collaborations. Member of the scientific committees CNES/ TOSCA (Terre - Océan - Surfaces Continentales - Atmosphère) and CNES/ORFEO, she is also evaluator of ERS Announcement of Opportunity for the European Space Agency. Since 2005, she spent part of her time between BRGM where she is in charge of research and development of geophysical and remote sensing projects, and French ministry of Research as the French representative of GMES European program

Mr. **Fenintsoa Andriamasinoro** is currently a research scientist at the French Geological Survey (BRGM). His general research interests are in agent-based systems modelling and simulation, applied to mineral resources management, and at a territory scale. His first application in BRGM was on developing models to understand and to prospect the social and economical impact of artisanal mining activities to population in Madagascar and Burkina Faso.
Currently, he is developing a computer framework called Is@Tem (Integrated System applied to Territory and Environment Management) to better simulate such a system by allowing the user to monitor the dynamic of the spatial evolution of the modelled application. The first application of Is@Tem is the analysis of the aggregate resources flow situation in Seine-Normandie region (France): the current and the future trend of that situation within the next 20 years.
Mr. Fenintsoa Andriamasinoro holds a Ph-D in Computer Science (2003) from the Applied Mathematics and Computer Science Research Institute (IREMIA) of the University of Reunion Island, a MS-degree in Computer Sciences (1999) and a Master Degree in Computer-Engineering (1998) from the National Computer School of Madagascar.

Dr François Blanchard has over 28 years experience in Environment and associated fields (energy, chemistry, hydrogeology, etc.). He has worked, in the BRGM group as a consultant on agriculture, industrial and mining projects, and he specialises in EIA, environmental audits, environmental protection and management of water resources. He has been responsible for environmental studies in Europe, Africa, Middle East, South America and Asia for both the public and private sectors including a broad spectrum of multilateral development Agencies.
François spent five years in the Normandy industrial and mining Group, holding the position of Manager Environment and Community for the Europe and Africa time zone, working on all the environmental aspects of new mining projects and existing plants and mines, and he implemented the Environmental Management System in all the mines of the Group. Since 2002 he is back in BRGM and he is now the head of the polluted sites and soils Unit with management of a team in charge of developing the French methodology regarding polluted sites and soils, training of the administration, expertise on mining and post mining studies in France and overseas.

B 2.2.2: BGS

Founded in 1835, the British Geological Survey (BGS) is the world's oldest national geological survey. A public sector organisation and the UK's premier earth science centre, it provides impartial geologic advice to governments, industry, academia and the public. BGS is part of the Natural Environment Research Council (NERC), the UK's leading body for research and monitoring in environmental science. Founded in 1965 by Royal Charter, NERC reports to the UK Government's Department of Innovation, Universities and Skills. BGS undertakes an extensive programme of overseas research, surveying and monitoring, including major institutional strengthening programmes in the developing world. BGS International has worked extensively for the key development agencies including the UK Department for International Development (DFID), World Bank, European Union, Development Banks, World Health Organisation and United Nations agencies. All BGS's International scientific activities are directed toward development issues such as sustainable resource development, the protection of people and the natural environment from geological hazards, quality of life and poverty alleviation.

BGS has a long history of involvement in the application of Earth Observation technologies to mining. BGS was one of the core partners in the EC FP5 project MINEO, developing the application of hyperspectral data to mine waste characterisation and monitoring. The two key MINEO personnel will be involved in EU-MINERS. BGS has also been involved in the European Space Agency (ESA) GMES Service Element Terrafirma, developing ground motion monitoring for a range of environments, including mine sites. For the past three years it has led efforts by participating geological surveys and engineering organisations to understand geologic causes of motion at all Terrafirma study sites, as well as operating two sites itself and overseeing a major activity on the validation of PSInSAR data. GMES projects are the mainstay of Europe's contribution to the Group on Earth Observations and the building of the Global Earth Observing System of Systems. BGS are active in GMES in other ways, too; for example, participating in and leading a work package for the EC FP6 GMES Network of Users, GNU. Within FP7, they lead the GEOSS work package within the African EU Georesource Observing System (AEGOS).

Professor Stuart Marsh will oversee BGS's contribution to EO-MINERS. His PhD is on geologic remote sensing from the University of Durham. Since 1991 he has developed BGS EO applications to mine waste characterisation, environmental geoscience, geohazards and geologic mapping. On the Expert Group that wrote the NERC's EO Strategy, he Chairs their EO Director's Advisory Board and represents the UK on Group on Earth Observation's Science and Technology Committee. He Co-Chairs the Integrated Global Observing Strategy for Geohazards, endorsed by an international group of space and UN agencies and published by ESA. He ran the UK test site in MINEO. Within Terrafirma, he Chairs the project's Product Validation Workgroup that coordinates all geological inputs to the project. He runs the International Stakeholders Group in GNU and the GEO work package in AEGOS.

Dr Colm Jordan BA. MSc PhD is the BGS Earth Observation Principal Researcher and is Team Leader of the Earth and Planetary Observation and Mapping Programme in BGS (NERC). With experience as a geological consultant and university lecturer prior to BGS, he now leads technology development and mapping projects at the BGS and has over 15 years of professional experience. Currently he manages an EU MSSP Airborne Geophysics Project in Ghana and a BGS project developing and implementing digital mapping techniques. PSInSAR and EO for geohazards, as well as 3D visualisation and developing publishing techniques are coordinated by Colm in his role as Team Leader. As Chair of the BGS (NERC) Information Futures Team, he leads horizon scanning of technologies and systems for geoscience applications. He is also an elected member of the Remote Sensing and Photogrammetry Society, of which is also a Fellow.

Dr R D Ogilvy B.Sc. M.Sc. Ph.D is Team Leader of the Geophysical Tomography Programme in BGS (NERC). He has over 30 years research experience in developing applied geophysical technologies and methodologies for near-surface environmental, engineering, mining and hydrogeological problems. He is a recognised international authority on electrical tomography with over 118 papers in high-impact ISI journals and Conference Proceedings. He has coordinated and led 9 EU-funded transnational research projects, including a recently completed EU FP6 contract to develop Automated time-Lapse Electrical Resistivity Tomography (ALERT) to remotely monitor saltwater intrusion in coastal aquifers. He is former Editor-in-Chief of the *European Journal of Engineering & Environmental Geophysics* (the forerunner of the *Near Surface Geophysics Journal*). He holds a US patent on non-intrusive Capacitive Resistivity Imaging. Dr Ogilvy has co-supervised 14 PhD students at 10 UK universities. He is an active member of EAGE, SEG, EEGS, and ASEG.

Fiona McEvoy is a senior economic and planning geologist and is the Team Leader for Minerals Policy Analysis within the Minerals Area of Science. Although primarily a research scientist, she has led a number of high-profile commissioned research projects for clients such as the Department for Communities and Local Government and the Scottish Executive Government. Recent research investigating the sterilisation of mineral resources has resulted in the revision of national minerals policy to include an obligatory protection of mineral resources within the land-use planning system in England. Current research includes modelling the environmental and socio-economic impact of different supply options for aggregate minerals into the 2012 Olympic Park in London (with the University of Leeds) and undertaking an assessment of the socio- economic and environmental costs and benefits of producing aggregate indigenously, providing recommendations for current UK policy.

Dr Barbara Palumbo-Roe is a senior process geochemist and is the Team Leader for Abandoned Mine and Contaminated Land within the Environment & Health Area of Science. She leads research on the environmental impact of surface contamination especially related to past-mining activities, delivering several studies on the dispersal of metal and metalloids and their bioaccessibility in abandoned mine-contaminated sites. Particular relevance is given to the characterisation of mine wastes through lab-based studies and geochemical modelling, evaluating contaminant movement and pollution potential within a risk-based framework. She has been UK Member of the EU technical committee for the development of technical implementation measures of the EU Directive on “the Management of Waste from the Extractive Industry” and provided consultancy support on the nature of waste produced by active mineral workings in UK for the Department for Communities and Local Government (DCLG) in UK.

B 2.2.3: TAU

Organisation activities:

TAU is the leading university in Israel for imaging spectroscopy remote sensing (ISRS), with specific emphasis on soil and mineral mapping for environmental monitoring. The TAU laboratory is situated in the Department of Geography and Human Environment at Tel-Aviv University, which is the biggest university in Israel. More than 200 peer-reviewed, proceedings papers, chapters from books, and technical reports have been published by the ISRS, covering issues mostly dealing with new methods to integrate and assimilate remote sensing data of the soil, water, atmosphere, rocks, and the living environment from afar by using spectral information. Recently ISRS has established an imaging spectrometry (IS) group composed of several leading scientists in Israel. The core for this activity is supported by the Ministry of Science under a project entitled: "*Establishing a National Infrastructure for Imaging Spectroscopy Remote Sensing (IS) Processing: Quantitative Novel Approaches to Map the Earth's Surface* ". The lab is divided into three parts, (a) a soil laboratory (for soil analysis), (b) a dark spectroscopy laboratory furnished with BRDF assembly and 3 spectrometers, and (c) a processing computing center that comprises 15 working stations. The TAU-IRSL lab consists of a large soil spectral library (more than 200 soils + 74 attributes for each soil) and additional libraries of man-made materials, urban targets, organic matter, and sediment dust.

Status:
TAU is the largest state university in Israel, consisting of more than 1200 professors in 7 faculties and with 30,000 students. The 2009 turnover is around €300 million.

Role in project:
TAU is an academia partner that is involved in WP1,3,4 and leading WP2, providing experience and know-how regarding the hyperspectral activity (standards and protocols plus thematic mapping).

Relevant Experience:
TAU's laboratory has been a pioneering laboratory worldwide. It has studied the contribution of IS technology to monitor the soil and the urban environments. To that end, it has developed many applications that are based on reflectance spectroscopy. Its research focuses on both quantitative and qualitative analyses of field and laboratory reflectance data and on processing of airborne and orbital hyper spectroscopy information for precise and advanced surface and atmosphere mapping and pattern recognition. A recent overview paper of TAU-ISRS entitled "imaging spectrometry for soil applications", which was published in 2008 in *Agronomy Journal,* is considered to be a key article for remote sensing of soil attributes and mineralogy using the hyperspectral (IS) technology. The TAU-ISRS personnel have a strong background and experience in soil science, spectroscopy, and quantitative remote sensing applications. The TAU-ISRS received an award by the President of Tel Aviv University for its excellence as a scientific center and it is known today for its excellence country-wide in both education and research activities. TAU-ISRD is participating in the EUFAR project under the FP7 framework (EUFAR) and is serving as a steering committee member of the DIGISOIL (FP7) project. In TAU-ISRS, international and national projects are being carried out for both governmental and private sectors in Israel. TAU–ISRS also has proven experience in management and execution of both international and national projects of large partners such as GIF and BARD.

Key persons involved:

Eyal Ben-Dor Prof. is a full professor at Tel Aviv University (TAU) and has served as the chair of the Geography and Human Environment Department at Tel-Aviv University from 2005-2009. Currently he is serving as the head of the Image Spectroscopy Remote Sensing Laboratory (ISRL) within this department. He received his PhD from the Hebrew University of Jerusalem, Faculty of Agriculture in Soil Science in 1992 and from 1992-1994 he had a post doc fellowship in CSES (Center of Study the Earth from Space) the University of Colorado at Boulder under the supervision of Prof. Goetz and Dr. Kruse. The fellowship he earned came from the Baron-de-Hirsh, Rothschild, and NOAA foundations. He was a pioneer in studying the contribution of IS technology to the soil and urban environments and has developed many applications to that end. His studies focus on both quantitative and qualitative analyses of field and laboratory reflectance data and on processing of airborne and orbital hyper spectroscopy data for precise and advanced surface and atmosphere mapping within the environment. He has a strong background in soil science, soil mineralogy, spectroscopy, and remote sensing processing and is the author of more than 200 papers, book chapters, and technical reports. Prof. Ben Dor has a proven ability to conduct, manage, and lead international scientific collaborations and projects. Recently he, among the 1200 professors at the university, received an award from the President of Tel Aviv University for his excellent research and was appointed by the Ministry of Science to be the founder and the leader of the Israeli Hyper spectral Group: Center of Excellence (IHSR-CE).

Dr. Gila Notesco is a hyperspectral researcher in the Remote Sensing and GIS Laboratories, at the Department of Geography and Human Environment of Tel-Aviv University. She collaborates in different projects that relate space- and airborne multi- and hyperspectral images with applications to water quality, soils, and surface mapping. Previously she was a researcher in the Cometary and Atmospheric Chemistry Laboratory in the Department of Geophysics and Planetary Sciences of Tel-Aviv University, where she also completed her PhD work in physics and chemistry of comets. She has been a lecturer in Chemistry and Atmospheric Chemistry at Tel-Aviv University for seven years and has published more than 10 articles in international *peer-reviewed* journals.

Dr. Agustin Pimstein is an Agricultural Engineer who began his professional career in Chile working on different projects. He served as a consultant on soil management, irrigation, and crop management for greenhouse crops, orchards, vineyards, and field crops. During his PhD work (2004 – 2008), he studied the spectral response of wheat and corn field crops to nutritional and water stress, and developed monitoring algorithms that can be applied from both hyper and multispectral platforms. During this period, he coordinated the acquisition of satellite images and their ground truth campaigns, and performed all the necessary image preprocessing (registration and atmospheric correction) needed for their analytical interpretation. After completing his PhD, he has worked as a post-doctorate fellow at the Remote Sensing and GIS Laboratories at Tel Aviv University, and is responsible for the EUFAR-FP7 duties, processing and analyzing airborne hyperspectral images, and leading a soil spectroscopy study.

PhD student (not yet appointed)

This position will be filled by either a PhD student or a Post Doc candidate. As soon as the project will be officially approved, a global search for a suitable candidate will be initiated. The credentials for this position will be a strong background in remote sensing (preferably hyperspectroscopy and environmental aspects, with emphasis on mineralogy).

B 2.2.4: DLR

The German Aerospace Center (DLR) is Germany's national research center for aeronautics and space and responsible for the forward planning and the implementation of the German space program by the German federal government as well as for the international representation of German interests. Approximately 5,300 people are employed in DLR's 28 institutes and facilities at eight locations and thereby it is the largest research establishment for engineering sciences in Germany. Its scientific-technical expertise is in four main research areas: aerospace, aeronautics, energy and transport.

The Remote Sensing Technology Institute (MF) and the German Remote Sensing Data Center (DFD) are at the focal point of the remote sensing activities of the DLR. DFD develops products and system solutions for applications related to the environment, security and geoinformation (GIS), with an emphasis on agriculture, soil science, forestry, land degradation, planning, mega cities and ecological cartography.

The Imaging Spectrocopy (IS) team of the DFD DLR located at Oberpfaffenhofen will be actively involved. This group disposes of different hyperspectral airborne sensors, access to a fleet of research aircraft, sensor calibration facilities and complete data processing chains. For the last 10 years, DLR has been using these facilities to carry out successful hyperspectral flight campaigns all over Europe, e.g., in the frame of the EU-funded project HySens or the ESA-funded DAISEX campaigns. From 2010 onwards, a new advanced reflective and thermal hyperspectral instrument (ARES) will be operated by DLR. As a future perspective, the German spaceborne hyperspectral EnMAP mission is currently in project phase B. Form the planned launch in 2011 onwards, the joint GFZ and DLR initiative will provide high quality spectroscopic data on a global scale.

Base for application oriented projects carried out in the group are the profound knowledge of the spectral signatures of natural and man-made surfaces, which have been continuously broadened by laboratory and field spectroradiometric measurements.

Key persons involved

Name	**Fischer, Christian**	
Born	1965	
Nationality	German	
Degree	Diploma in Physical Geography, Hydrology and Soil Science	
Education	1982 to 1985	Technical Secondary School, Kassel
	1986 to 1995	Leibnitz University of Hannover
Professional Experience	2006 to date	DLR, German Remote Sensing Data Center; Senior Scientist and Project Coordinator of the Sino-German Research Initiative on Spontaneous Coal Fires in China
	2001 to 2006	Assistance Professor, Institute for Geotechnical Engineering and Mine Surveying, Clausthal University of Technology
	1995 to 2001	Researcher with Deutsche Steinkohle AG, Dept. of Geoinformation / Engineering Surveying in Bottrop (appointed at Clausthal University of Technology)

- more than 10 years of experience in projects related to of environmental monitoring using especially hyperspectral remote sensing data and GIS.
- Working and managing national and international projects within the framework of hyperspectral flight campaigns (EU-project MINEO, HySens 2002)
- Senior Researcher within projects from the German mining industry (RAG Deutsche Steinkohle, German Federation of Industrial Research Associations (AiF))
- Project leader and responsible Scientist in basic research projects founded by the German Research Foundation (DFG)
- PI within the current ESA/MOST-Initiative DRAGON 2
- Head of a working group for Technical Documentation of Imaging Spectroscopy Applications within the Association of German Engineers (VDI)

Languages	German, English

Name	**Müller, Andreas**
Born	1963
Nationality	German
Degree	Diploma in Geology

Education	1973 to 1983	Gymnasium (Munich and Pfaffenhofen/Ilm, Germany)
	1984 to 1989	Ludwig-Maximilian University Munich: Geology
Professional Experience	2000 to date	DLR, German Remote Sensing Data Center; Head of team 'Imaging Spectroscopy'
	1996 to 2000	DLR, Institute of Optoelectronics; Head of working group 'Spectroscopy and Modelling' and project group 'Imaging Spectroscopy'
	1989 to 1996	DLR, Institute of Optoelectronics, Project Scientist in the working group 'Spectroscopy and Modelling'

- 15 years of experience in processing and evaluation of airborne hyperspectral and multispectral scanner data (GERIS, DAIS 7915, DAEDALUS), atmospheric / geometric correction, and digital filtering
- Managing national and international hyperspectral flight campaigns (DAIS LSF, HySens, ProSmart 1998/1999, DAISEX 1999/2000, HyEurope 2000-2005) using several imaging spectrometers (ROSIS, DAIS, HyMap).
- Coordintaing DLR contribution to the EU Project Application and Development of New Techniques Based on Remote Sensing, Data Integration and Multivariate Analysis for Mineral Exploration. Contract No. MA2M-CT90-0010.
- Coordintaing DLR contribution to the BMBF Project "Application of Hhyperspectral Remote Sensing in the Central German Lignite Mining District"
- Co-investigator on two proposals to the ESA-EEOM program (SIMSA, 1998 and SAND, 2002) headed by the GeoResearchCenter Potsdam
- Chairman of the Special Interest Group 'Imaging Spectroscopy' at the European Association of Remote Sensing Laboratories (EARSeL)

Languages German, English

Name	**Bachmann, Martin**	
Born	1976	
Nationality	German	
Degree	PhD in Natural Sciences, Diploma in Physical Geography	
Education	1996 – 2002	Study of Physical Geography (Diploma) at University of Trier and Technical University of Dresden, Germany
	2003 – 2005	PhD student at DLR-DFD, working group 'Imaging Spectroscopy', delegated to Würzburg University, Remote Sensing Unit
Professional Experience	2005 - present	Research Scientist at DLR-DFD, working group 'Imaging Spectroscopy'

- More than 6 years of experience in the fields of hyperspectral data analysis and data processing (system correction, ortho-recitification, atmospheric correction)
- Coordination and participation in multiple ground campaigns for validation / calibration of airborne hyperspectral data
- Teaching / training experience focusing on optical remote sensing data analysis (University of Würzburg, within DLR capacity building activities, within FP6 Marie Curie Project "Hyper-I-Net" and as freelancer)

Languages German, English

Name **Holzwarth, Stefanie**

Born	1974	
Nationality	German	
Degree	Dipl.-Ing. Geodesy and Geoinformatics	
Education	1985 to 1994	Gymnasium (Murrhardt, Germany)
	1995 to 2002	University Stuttgart: Geodesy and Geoinformatics
Professional Experience	2002 to date	Scientific employee – German Aerospace Center (DLR), German Remote Sensing Data Center (DFD)

- Coordination of all activities related to data acquisition and data processing of airborne hyperspectral remote sensing.
- Research activities are carried out within the field of improving the geometric accuracy of hyperspectral image data.
- Project manager of the procurement of the new airborne sensor system "ARES".
- Coordinating DLR contribution to the EU FP6 Project "HYRESSA".
- Coordinating DLR contribution to the Networking Activity "Standards and Protocols" within the EU FP7 Project "EUFAR".

Languages German, English

Name	**Weide, Sebastian**	
Born	1981	
Nationality	German	
Degree	Diploma in Survey & Geoinformatic (March 2009)	
Education	1994 to 1998	Realschule Vaterstetten, Germany
	1998 to 2000	Fachoberschule Wasserburg, Germany
	2004 - 2009	University of Applied Science Munich, Survey & Geoinformatic
Professional Experience	2008 to present	Scientific staff at DLR, DFD Workinggroup 'Imaging Spectroscopy'
	2006 to 2008	Parttime Job IAGB mbH, Remote Sensing & GIS, FFH Classification Internship AED-Sicad, Development GIS Intership Wagner + Partner, Survey
	2004 to 2006	O2 Germany, Support Specialist, parttime-job during studies
	2000 to 2003	Job Training, Fachinformatiker / Sytemintegration, Hörmann Industrietechnik GmbH

- Field of studies Survey & Geoinformatic with focus on Remote Sensing and GIS
  Diploma thesis: Airborne Laserscanning on Hintereisferner (Ötztal)

Languages German, English, French (basics)

B 2.2 5: WI

Wuppertal Institute explores and develops models, strategies and instruments to support a sustainable development at local, national and international levels. It employs about 120 people. Sustainability science at the WI focuses on ecology and its relation to economy and society. The Research Group on Material Flows and Resource Management develops (i) Integrated analysis and assessment of the industrial metabolism and land use; (ii) Resource use scenarios; (iii) Policy relevant indicators and targets; (iv) Guidelines and evaluation schemes of resource policies. The group has developed methods for analysis and assessment of the industrial metabolism, with a focus on options to increase resource efficiency, considering systems-wide, trans-boundary resource requirements at different levels of the economy. The research group has initiated and supported scientific networks such as the International Society for Industrial Ecology. It has contributed to official reporting of the EU on material flows, resource use and efficiency through EUROSTAT and the European Environment Agency (EEA). It is consortium member of the EEA Environmental Topic Centre on Sustainable Consumption and Production (ETC-SCP). Scientists of the research group are involved in several research projects for the European Commission and the European Parliament. For more information: www.wupperinst.org

The research group is involved in a number of EU Framework Programme projects relevant for the project, such as Sustainability A-Test (Advanced Techniques for Evaluation of Sustainability Assessment Tools), MATISSE (Methods and Tools for Integrated Sustainability Assessment), CALCAS (Co-ordination Action for Innovation in Life-Cycle Analysis for Sustainability) and FORESCENE (Indicator-Based Evaluation of Interlinkages between Different Sustainable Development Objectives) on the latter it is consortium leader. Relevant to earth observation is the FP6 project "Global Monitoring for Environmental and Security (GMES) Network of Users" (GNU). In GNU the Wuppertal Institute is further developing a methodology for connecting Earth Observation with policies, which will also be applied in this project. In addition, the research group had developed footprinting indicators within the context of EU resource use accounting.

Dr. Stefan Bringezu (PhD, m) Director of the Research Group on Material Flows and Resource Management; biologist by training, PhD in ecosystems analysis; Habilitation (Professorial degree) at Faculty of Environment and Society, Technical University Berlin. Prior affiliations with University Bayreuth, German Federal Environment Agency (Chemicals Assessment department), University of Dortmund (Visiting Professor and Acting Head of the Department of Supply Systems and Environmental Planning); he lectured at several universities, initiated scientific networks (ConAccount, cofounder of ISIE), and pioneered on methods such as MFA and derived indicators; Member of various advisory boards, Member of the International Panel on Sustainable Resource Management; his main subject is the analysis of the socio-industrial metabolism and the instruments to sustain the resource supply, use and waste management.

Philipp Schepelmann (PhD, m) project coordinator in the Research Group on Material Flows and Resource Management; born in 1966, PhD in environmental planning at the Technical University of Berlin, with a thesis about the use of sustainability indicators in EU Regional Policy. Philipp Schepelmann joined the Wuppertal Institute in 1998. He is visiting lecturer for European Political Science at the Jean Monnet European Centre of Excellence at the University of Wuppertal, the University of Kassel and the University of Applied Science Trier and the Asian Pacific University, Japan. He has specialized on EU sustainability policies, environmental policy integration, indicators and impact assessment.

Dominic Wittmer (PhD, m) project coordinator in the Research Group on Material Flows and Resource Management; born in 1972, geologist by training (University of Mainz), PhD in environmental engineering at the Federal Institute of Technology (ETH Zurich, Switzerland) and the Federal Institute of Aquatic Science and Technology (Eawag Dübendorf, Switzerland) with a thesis about the development of the anthropogenic copper stocks. Experience in material flow analysis on national and regional level, including uncertainty analysis, and in model and scenario building and calibration.

B 2.2.6: GeoZS

Geological Survey of Slovenia (GeoZS) is a public research institute established by the Government of the Republic of Slovenia. GeoZS is central geological organization in the country.

Its main objective is to provide and store geoscientific information of the Republic of Slovenia. The organizational units of GeoZS are following departments: Sedimentology & Mineralogy & Petrology, Paleontology & Stratigraphy, Mineral Resources, GIS, Geological Maps, Geochemistry & Environmental Geology and Hydrogeology, where research and expertise are carried out. Geoscientific information is a basis for the solution of nation's major issues, such as health and environmental protection, drinking water supply, protection against natural hazards, urban planning, exploration and assessment of natural resources as well as planning of their use. Geological Survey of Slovenia collects and stores geological data within a modern geological information system, but mostly in more than 30.000 expert reports and research projects stored in its archive.

Concerning activities of proposed project GeoZS has an important role in the decision making process for mining rights and monitoring of impacts of exploitation (environmental and social footprints of mineral extraction), furthermore in maintaining mineral resources databases, setting ground for sound minerals management, and carrying out different expertise for mineral planning. In addition the GIS department manages GIS related databases and maps such as hydrogeological, geochemical, geological, minerals and others. It also focuses on satellite images manipulation and interpretation and developing risk assessment methods (geohazard) by combining satellite imagery with related geological data.

GeoZS has experience in areas described above, in particular in sustainable mineral resource management and indicators, environmental impact assessment, GIS and remote sensing. GeoZS is involved in international and national projects. Among international projects following should be mentioned: (a) Interreg IIIB Alpine space: ClimChAlp - Climate Change, Impacts and Adaptation Strategies in the Alpine Space, Mar 06-Mar 08; (b) Alpine Space: AdaptAlp, Dec 07-Avg 11; (c) OneGeology - geological surveys of the world creating dynamic geological map data of the world; Aug 08-Sep 10, (d) Terrafirma - ESA GMES project aimed at improving safety and reducing economic loss by measuring terrain motion from satellite radar data, and (e) eContent plus project: eWater – creation of a ground water information system in several European countries, Sep 06-Sep 08;

Among national programs two research programs (Sedimentology & Mineral resources, and - Environmental Geology & Hydrogeology) and expert program (Mineral Resources) should be exposed. The expert program deals with mineral resource policy, management and monitoring (indicators) issues for the ministry in charge of mining.

Dr. Slavko V. Solar (born in 1959) is a Mineral Resource Geologist in rank of senior associate researcher. He is specialist in non-metals and construction raw materials and deposits, and works in the field of sustainable development based mineral resource management. Dr. Solar is an adviser to Slovenian government (on national and EU level) and industry. He is the author of the Strategy of the mineral resources management of the Republic of Slovenia. He will contribute mostly to WP1&5: micro level indicators, trialogue, communication.

Dr. Gorazd Zibret (born in 1977) works as a researcher. His scientific work is focused on the research of soils and urban sediments (dusts) contamination, mainly with heavy metals. In this topic he has published several scientific articles in international journals. In the field of mineral resources research he is involved in the geological investigations of non-metallic raw material deposits, such as aggregate pits and quarries, clay deposits (Wienerberger brick producer), calcite quarry (Lafarge cement group) etc. His work will be mainly focused in WP3, but he will also participate in WP2&4.

Ms. Ana Burger (born in 1980) is involved in different tasks, relating to the management of mineral resources, manages the databases and produce different statistics for the needs of the government. She is an expert in mining waste and aggregate recycling. Moreover she is in the editor's board for the slovenian Mineral magazine. Moreover she manages the preparation of different promotional materials and in the organizing of different events for promotional activities. Her work will be focused in WP 1 and 5.

B 2.2.7: MIRO

Organisation activities:

The Mineral Industry Research Organisation (MIRO) is a leading international collaborative research and technological development (RTD) facilitator and provider of project management services to the minerals and related industries.

MIRO works in partnership with industry, government, research and service providers to identify, influence, fund, transfer, deliver and communicate information and technology development to address the needs of stakeholders in the sector.

MIRO is governed by a Council of senior industry executives and directed with the support of a number of Research Advisory Panels, Executive Committees and experienced industry professionals. As an independent body MIRO is a company limited by guarantee and operates on a 'not-for profit' basis.

Through its UK Head Office and its network of Project Managers, MIRO provides its Members with extensive resources aimed at delivering experience and capability in RTD project development, funding and project management, technology transfer, information dissemination, technical publications, technical enquiry services and industry networking

MIRO works closely with multinational businesses and SMEs located throughout the world. Through extensive networking and co-ordination activities, MIRO has established a key role in supporting future technological development throughout the minerals industry.

Role in project:

MIRO will lead WP5 and will be significantly involved in dissemination, communication and capacity building activities. MIRO will take care of linkages between WP2 to 4 with WP5.

Relevant Experience:

Since its formation in 1974, MIRO has established and managed more than 200 major technical RTD projects with a combined value of over £50M. MIRO has demonstrated specific experience in RTD related to mineral exploration, mining and mineral extraction, mineral processing, environmental technologies, waste management, new materials, land reclamation and information technology. MIRO managed research activities delivering industrially relevant, sustainable, technological solutions worldwide.

MIRO is funding member of the European Technology Platform on Sustainable Mineral Resources (ETP SMR) and Dr Horst Hejny was coordinator of the EU funded NESMI network, which formed the nucleus for the ETP SMR.

Key persons involved:

Dr Horst Hejny

Dr Hejny studied chemical process engineering at the University of Dortmund, Germany. He received his doctorate from the University of Essen, Germany for work on the field of coal gasification. For 25 years he worked for DMT (Deutsche Montan Technologie GmbH) and predecessor organisations in different fields related to health and safety in coal mines. The last couple of years of his employment there was dedicated to company's innovation management. Since May 2004 Dr Hejny acts as independent consultant in the field of mining and tunnel safety.

Amongst others he was coordinator the European Thematic Network NESMI (Network of the European Sustainable Minerals Industries), which provided the basis for the establishment of the European Technology Platform on Sustainable Mineral Resources. Today he also represents MIRO, the Mineral Industry Research Organisation in the UK, for which he works as project manager on contract basis.

Alan Gibbon

A Minerals Engineering graduate, Alan Gibbon spent the first twenty four years of his career in research and development, focussed on the platinum group metals, at Johnson Matthey in the UK, Canada and South Africa. He was active in mining in South Africa and in the recovery of the platinum group metals from catalytic converters in motor vehicles in the UK.

He formed his own consultancy in 1992 and joined MIRO as a Project Manager in 1993 where he was responsible for project development in mineral extraction and processing including (1) mining, (2) mineral processing and (3) chemical and pyrometallurgical processing, (4) recycling and waste minimisation and (5) process modelling.

He is a member of The Institute of Materials, Minerals and Mining (IOM3) editorial board and serves on their Material Chemistry Committee.

He became MIRO's Development Director in 2006 and has overseen MIRO's growth in difficult trading conditions. MIRO now manages part of the UK government's Aggregate Levy Sustainability Fund and is active in National and European competitions for co-funding of important and industrially relevant projects on behalf of its members.

Ian G Martin

Ian Martin a Certified Electrical Engineer who has specialises in IT systems, network infrastructure, together with hardware, software and internet support.

He formed his own company in 1985 providing electrical and IT systems infrastructure and network installation to small and medium sized businesses. By the 1995 he found himself heavily involved in business IT systems integration and later providing internet services in the form of domain registration and hosting, mail systems and website design.

He joined the Mineral Industry Research Organisation (MIRO) in 1999 to provide IT systems support services and in 2000 became their ICT manager. His wide ranging IT knowledge, skills and hands on approach are regularly put to the test, as he is responsible for the design, creation and installation of numerous project based web sites as well as the management of all other MIRO IT systems both on and off their head office site.

Sadie Ferriday

Sadie Ferriday joined the Mineral Industry Research Organisation (MIRO) in 2005 to provide Graphic Design services.

She is qualified to HND level, having attained a Higher National Diploma in Art and Design and a National Diploma in Graphic Design (for print). Prior to joining MIRO, Sadie gained considerable knowledge whilst employed within the design and print industry working for a small agency and an award winning printers. She is highly proficient in all the design industry standard software, including: Photoshop, Illustrator, InDesign, Quark Xpress and Acrobat.

At MIRO, Sadie is responsible for the design and execution of all MIRO publications, corporate identity development and implementation, proofing, sourcing printers and supplying print ready artwork, and alongside Ian Martin, designing and providing graphics for all MIRO websites. Including "Sustainable Aggregates" on behalf of Defra (www.sustainableaggreagates.com), this brief included designing and setting numerous reviews and all publicity materials, working with MIRO personnel alongside those from English Heritage to tight deadlines.

B 2.2.8: CGS

The CGS is one of the National Science Councils of South Africa and is the legal successor of the Geological Survey of South Africa. The strategic context within which the CGS operates has been defined by a number of key factors, including its legislative mandate and any changes thereof, the need to contribute towards Government's efforts to deal with the multitude of challenges it faces and strategies it needs to implement, as well as the need for the CGS to contribute towards broader regional and continental objectives in relation to geoscience.

The Geoscience Act, Act 100 of 1993, established the CGS in its present form. Today, the CGS is a modern institution, boasting excellent facilities and expertise, ranking among the best in Africa. The CGS is tasked with establishing a national investigative and application capacity which seeks to understand and produce knowledge about earth systems so as to bolster the nation's ability to: manage its marine, land, water, energy and mineral resources; generate wealth through the identification and safeguarding of new mineral deposits, thereby contributing to the economic development of South Africa; contribute to the provision of comprehensive knowledge about the natural resource environments, their condition and hazard potential; and promote the efficient and effective use of the environment and its natural resources.

The CGS is also committed to helping eradicate poverty by providing assistance to small-scale mining projects, and plays a strategic role in the generation of geoscience knowledge in the Southern African Development Community (SADC) and on the African continent via the African Mining Partnership and proposed and a contribution towards the establishment of the Organisation of African Geological Surveys in order to foster partnership amongst geoscience institutions. The CGS also undertakes international projects and cooperates with a range of international geological and other organisations

Henk COETZEE, Dr: Ph.D. in geophysics from the University of the Witwatersrand, Johannesburg. 21 years of experience in the application of various geophysical methods to a range of exploration, geotechnical and environmental questions. Major focus on the acquisition, processing and interpretation of radiometric data, as well as most conventional ground and airborne geophysical methods. Some experience in remote sensing and image processing, with a focus on environmental issues related to mining, with a special focus on the combination of remotely sensed and geophysical information via geographical information systems (GIS). The interpretation of environmental radioactivity data has also allowed him to gain some expertise in environmental geochemistry, with a focus on laboratory simulations of environmental processes and the use of naturally occurring isotopes as tracers. He has also managed a number of large projects, including the South African Department of Minerals and Energy's Sustainable Development through Mining programme, looking in particular at regional strategies for the closure of gold mines in the Witwatersrand and the management of abandoned mines in South Africa.

Ms Danél van Tonder: Environmental assessment of South African study area.
Holds a BSc Honours degree in geology from the University of Potchefstroom (now North West University). Has experience in geological mapping in granitic terranes, followed up by a

strong background in mineralogy. She currently works in the Environmental Geoscience Unit at the Council for Geoscience where she is specialising in the environmental impact of mining with a specific focus on ecotoxicology. She also has skills and experience in project management, having recently managed a project to develop regional mine closure strategies for the goldfields of the Witwatersrand on behalf of South Africa's Department of Mineral Resources.

Mr Daniel Sebake: Remote sensing and GIS analysis
Holds an M. Env. & Dev in Land Information Management, with 9 years experience in GIS and Remote Sensing applications. In GIS he specialises in spatial databases, modelling and general data management. In Remote Sensing, he is experienced in image preparation and processing, feature extraction, and image interpretations. He took part as a researcher in national projects such as National Land Cover Project, Water usage estimation using remote sensing, and lately Sustainable Development through Mining as a field researcher and data analyst. He has participated in international EO forums as a member of South African chapter of the Group on Earth Observation, Science and Technology thrust.

Detlef Eberle Dr: Dr. rer. nat. in geophysics from Ludwig-Maximilian University, Munich and Dr. habil. from Berlin University of technology. 38 years of experience in geophysical data acquisition, processing, data management and interpretation. He has worked extensively in Africa and South America, with a strong focus on ground-based and airborne geophysics and technology transfer and is currently employed at the Council for Geoscience as a Specialist Geophysicist. Dr Eberle's work experience includes work at the BGR in Hannover, Germany, the University of Pretoria, South Africa, The Geological Survey of Namibia and MADINI in Dodoma, Tanzania. He has also lectured at the Applied Geophysics Institute of Berlin University since 1982.

Mr Bantu Hanise: Socio-economic and societal impact assessment. Scientific Officer at Environmental Geoscience Unit (CGS) with a MPhil in Sustainable Development, Planning and Management from the University of Stellenbosch and have 7 years of experience in multidisciplinary research towards sustainability on resource management and development impacts. Prior, he was involved with the South African National Antarctic Programs (SANAP) where he did two over-wintering expeditions on Marion Island in Sub-Antarctic Convergence. He was part of the SANAP long-term monitoring biological/penguin and Climate Change Research. Subsequently, He got involved in Water Resource Management research project of the Water Research Commission of South Africa. His research explores sustainability and sustainable development methodologies through tools such as the Microsoft SuperCross program, participatory and systems thinking research approach towards Environmental Impact Assessment, Environmental Management Planning for the Small Scale Mining Program and urban development projects.

B 2.2.9: AOL-ATD

Anglo American started operation in South Africa in 1917 and now every business unit within the Group (apart from Industrial Minerals) is present in the country. We have more operation in South Africa than in any other country in which we operate. Our corporate office campus, built for the company in 1938 is located in JNB. JNB is also home to the Anglo Technical Division and Anglo Research.

Anglo operation Ltd includes Anglo Coal South Africa and Anglo Technical

Anglo operation Ltd will be the demonstration site Manager for the South African demonstration sites. It will provide technical and logistical support to the project and actively participate in the work carried out over South African demonstration site during WP3. the company will also express its needs and expectation from EO-MINERS, hence actively participating in the definition of the EO-based products and tools expected by mining companies.

Anglo operation Ltd has a large experience in using remote sensing and GIS tools for mineral exploration as well as environmental studies. It is also experienced in imaging spectroscopy and filed spectroradiometry applied to mining-related environmental surveys

Main persons involved:
Mrs. Fatima Ferraz is Environmental Project Manager at the Geosciences Resource Group. She is experience in EO techniques and in particular in hyperspectral imagery. She will be the Demonstration site Manager for the South African demonstration site.

B 2.2.10: UVSQ

The Centre d'Economie et d'Ethique pour l'Environnement et le Développement (C3ED) is a multi-disciplinary centre established as a joint research unit (Unité Mixte de Recherche) through the cooperation of the Université de Versailles Saint-Quentin-en-Yvelines (UVSQ) and the French Institut de Recherche pour le Développement (IRD). Its main centre of activities is located at the Department of Economics of the University Versailles Saint-Quentin-en-Yvelines (Guyancourt, in the western suburbs of the Paris region), with permanent poles of activity also in Madagascar and West Africa. It is currently structured in five major teams (IACA, MGDD, EDSD, TRDD et G-SERR), each of which is sub-divided into a number of Operations around defined themes. The five teams are:

- IACA (uncertainty, Analyses, Concertation and Management) : Production and mediation of knowledge for Sustainable Development
- MGDD (Globalisation, Governance and Sustainable Development)
- EDSD (Ethics and Social Sustainable Development)
- TRDD (Territory, Resource and Sustainable Development)
- G-SERR (Governance and Resources Exploitation Systems).

In recent years C3ED has been involved in many projects (some of them European) dealing with multi-criteria and multi-stakeholder evaluation, sustainable development, mineral resources

Main persons involved:

Martin O'CONNOR, Professor in Economic Science at the UVSQ, is university-trained in physics and in social sciences and specialist in inter-disciplinary research on problems of the environment. With the C3ED since 1995, he has led research in integrated energy-economy-environment modelling and scenario studies, social science methodology for environmental valuation, indicators for sustainable development, water resources and many other domains, including expert works in the fields of risk analysis, water resources governance and climate change. He was Coordinator of the VIRTUALIS project funded by the EC's IST Programme, of the GOUVERNe Project (1999-2003) and the VALSE Project (1996-1998).

Aurélie Chamaret, researcher in C3ED, completed a Phd in Economics in partnership between UVSQ and the French geo-survey, BRGM, about mining project assessment towards sustainable development with an application on Arlit's Uranium mines (Niger) with the French company AREVA. Her research fields notably comprise sustainability assessment methods and indicators, corporate social responsibility, territorial governance, participatory approaches and the extractive industry. Graduated in international business and in economical analysis and risk management, she also worked on crisis communication and media analysis in public relations agencies.

Franck LEGRAND is a specialist in software services and information management systems, currently working as Technical Coordinator of the 'Environment & Communication' section of the C3ED, including contributions on the EU Projects VIRTUALIS, ALARM and SDRTOOLS

B 2.2.11: CzechGS

Organisation activities:

The Czech Geological Survey (CzechGS), founded in 1919, has evolved into an internationally recognized research institute covering a wide range of geo-scientific topics and services at both levels, national and international as well. It is a state budget organization, the resort research institute of the Ministry of the Environment. The CzechGS is the only institution the mission of which is the systematic research of the geological composition in the extent of the entire territory of the Czech Republic focusing on basic research and applied geological research as well. The main fields of expertise include geological mapping and research, study of mineral resources and their economic potential, mining impact assessment, geochemistry, environmental studies, applied geology, hydrogeology and natural hazards.

The main activities of the CzechGS can be briefly described as follows:

- Research, utilization and protection of natural mineral resources considering the preservation of an ecological balance between the environment and human activity
- Research and expert operation in the area of geohazards and environmental loads
- Collecting, management, evaluation and dissemination of geological information
- Maintaining of accredited laboratories and developing new analytical methods of organic and inorganic geochemistry
- Cooperation with universities and other research institutes
- Education and promotion of natural sciences and environmental protection
- Expert support for decision-making in the state and public interest affairs

The CzechGS is a member of such international bodies as EuroGeoSurveys, FOREGS (Forum of European Geological Surveys) and ICOGS (International Consortium of Geological Surveys).

Role in project:

A representative of the CzechGS will be a Demonstration Site Manager for the Sokolov site, Czech Rep. Furthermore, Remote Sensing&GIS experts will actively participate in WP1, WP3, WP4 and WP5.In particular, the activities will include: Socio-economical data analysis (definition of required data sources, relationship between mining activities and consequent social and economic impacts for the Sokolov region (WP1); Site specific data collecting, EO data acquisition planning and processing (with focuses on detection and analysis of absorption features (field and image spectroscopy) to identify and quantify mineral mixtures), GIS modeling (hydrological analysis, 3D geological model construction), applying analytical methods for a close discrimination among organic and inorganic components of the collected field samples (ground truth) (WP3); EO data integration and creation of final products (WP4); promotion and presentation of the results at a national level, preparation of presentation materials (WP5).

Relevant experience:

Besides regional geological projects, Czech Geological Survey has been carried research under numerous geoecological projects focusing on acidification of the environment (BIO-GEOMON), geological hazards in terms of slope instability (ISPROFIN), mining and processing ore risks (PECOMINES, JRC Ispra), mining impacts (Sokolov&Karlovy Vary Agglomeration, the Territory Affected by Mining and Fabrication of Mineral Material - Affection and Recovery of Essentials Functions of the Environment, R&D project of the Czech Ministry of the Environment, 2004-2006). The CzechGS has been administrating successful projects under the auspices of the national program of foreign development aid (the so called CzechAid) while aiming at assessment and evaluation of mining risks and geological hazards in such countries as Zambia, Burkina Faso, Namibia, Nicaragua, El Salvador and Peru.

Key persons involved:
Veronika Kopačková (female), Sokolov Demonstration Site Manager, Remote Sensing and GIS-based environmental risk assessment: She has been a coordinator of the Remote Sensing Unit, Czech Geological Survey, since its establishment in 2005. In her research she focuses on mineral spectroscopy and slope instability modeling. Since 2007 the collaborative study (CzechGS, BRGM) over the Sokolov open pit mine has been carried out focusing on application of field spectroscopy methods and their further utilization using ASTER satellite data to identify AMD hotspots and to discriminate main mineralogical composition.

Kateřina Fárová (female): Socio-economical data analysis, GIS-based environmental risk assessment: Experienced in cartography, GIS and remote sensing. Participated on sociological and human geographic survey during her bachelor studies. She obtained MSc. Degree at the Faculty of Science, Masaryk University, Brno, in 2004. Since then she is a postgraduate student at the same faculty. In 2008 she joint the Remote Sensing Unit, Czech GS, Prague.

František Laufek (male) analytical inorganic chemistry: His research interests cover such fields as mineralogy and crystallography of tellurides, powder X-ray diffraction (Rietveld refinement, solution of crystal structures from powder diffraction data), experimental mineralogy (sillica glass tube technique) and material science (thermoelectric materials). His team will provide Powder Xray-diffraction (XRD) analysis and patterns of < 2 μm fraction (oriented specimens) will be studied in detail. The acquired X-ray diffraction patterns will be evaluated by means of BedeZDS program and by comparing with modelled patterns (program NEWMOD), especially the expandability of mixed-layered minerals and their ordering (R - reichweite).

Eva Franců (female) analytical organic chemistry: She is a head of the laboratories of organic geochemistry and petrology (CzechGS, Brno). In Her studies she has been focused on heavy metals distribution, non-polar organic compounds such as polyaromatic hydrocarbons, polychlorinated biphenyls in relation to the geogenic and anthropogenic inputs to the fluvial and sedimentary systems. Experience has been built up with application of isotopic and molecular techniques to characterize the patterns and shallow transformations of natural and industrially affected soils and rocks.

B 2.2.12: SU

Sokolovská uhelná, a.s. was established by the National Property Fund and first recorded in the Commercial Register on 1 January 1994. Privatization of the Company was completed in 2004 with the sale of the State's equity share. Today, the successor company – Sokolovská uhelná, právní nástupce, a.s. – is fully privately owned. The Company's core products are electricity and heat, sorted and power generation coal, brown coal briquettes, and carbo-chemical products from the gasification of coal.

The Group's principal activity is the production of lignite for factories and power suppliers, sorted coal for factories and households, briquets, generator gas, technical gases (oxygen and nitrogen), crushed and sorted stone, clay and chemical products (tar, fennol concentrate, liquid ammonia, sulfuric acid and other). The Company exploits about 10 million tons of lignite per year, of which 6 million tons is sold. The rest is used to produce 3.4 TWh of electricity and 300,000 tons of briquets. The Company also distributes power to the nearby agglomeration including the city of Karlovy Vary. It is the largest independent producer of electricity in the country.

The Company reclaims land affected by surface mining activity, and processes and disposes of waste generated by industrial operations.

Dr. Petr Rojík

B 2.2.13: AACL

In Chile, Anglo American mines, develops, processes and markets copper cathodes, anodes and blister, copper and molybdenum concentrates, and sulphuric acid. Operating as part of our Base Metals business, Anglo American Chile Ltda has five productive divisions in four regions of the country and a separate office in Santiago for administration and central services. A team responsible for the group's exploration activities in South America is also based in the Santiago office. Also in Chile, Anglo American holds 44% interest in the Compania Minera Dona Ines de Collahuasi mining company while Ferrous Metals subsidiary Scaw International also has operations in Chile.

Main person involved:
Mr. Dan Taranik, Geoscience Information Manager

B 2.3 Consortium as a whole

Consortium added value and contribution to the European Research Area (ERA)

The project will co-ordinate the expertise and multidisciplinary skills of 10 EU partners, from 6 EU states, 1 partner from Associate Country and 2 ICPC countries. This will ensure a critical mass approach to problem solving that cannot be achieved by individual nations or single high-calibre scientists working in isolation. In the past, many of these centres have undertaken independent and similar research, resulting in unnecessary duplication of effort; often with sub-optimal resourcing by national governments.

In effect, the consortium will constitute a “virtual” European group, allowing the interchange of equipment, expertise, knowledge and staff. In the past, individual national EU governments have not been able to compete with very large government-funded R&D programmes in the USA and elsewhere. This project will help a) to redress this imbalance, b) to take a significant technical lead and c) to consolidate the European Research Area (ERA) as a world-class competitive force in this important sector.

The EO-MINERS Consortium is composed of 14 partners spanning and overlapping the various domains and expertise relevant to the call topic addressed: Geosciences and environmental geosciences, Earth Observation and GIS integrated approaches, mining industry and linked research organisation, EO data providers, sustainable development mining indicators, socio-economics sustainability assessment methods and indicators, corporate social responsibility, territorial governance, participatory approaches and the extractive industry.

The Consortium includes:

- five geological Surveys: Czech Republic, France, South Africa, Slovenia, United Kingdom; of which four are members of EuroGeoSurveys, the Association of the Geological Surveys of the European Union.
- Two mining companies: Multi-national corporation - Anglo American plc (UK) with case studies in mining districts in South Africa (Anglo American Operation) and in Chile (Anglo American Chile Ltda), Sokolovská uhelná a.s (Czech Republic)
- One research organisation representing the mining industry: MIRO (based in UK)
- Two universities: Tel-Aviv University (Israel), University of Versailles – St Quentin (France)
- One aerospace agency: DLR (Germany)
- One research institute on environment: Wuppertal Institute for Climate, Energy and Environment (Germany).

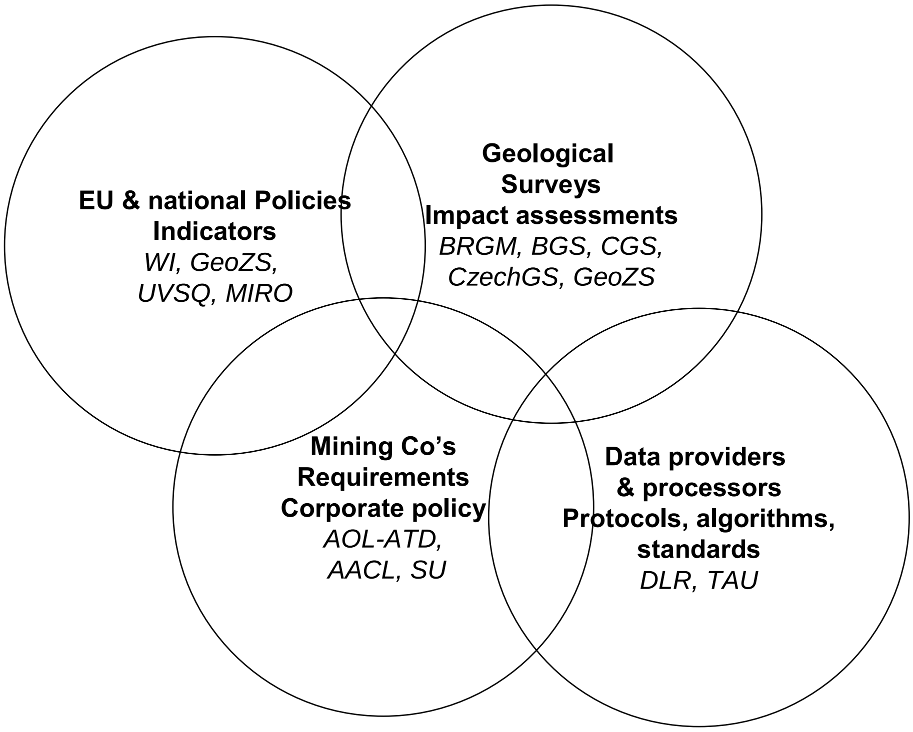

Figure 2: graphical presentation of the Consortium spanning and overlapping domains and expertise

The British, Czech, French, and South African geological surveys all have a longstanding experience in using Earth Observation in mining-related environmental impact and have developed close twinning scientific collaboration on mining-related environmental studies in the past.

BRGM (as coordinator) and BGS were both involved in the FP5 MINEO project (contract IST-1999-10337, www.brgm.fr/mineo): Assessing and Monitoring the environmental Impact of Mining in Europe using advanced Earth Observation Techniques. The project was dedicated to developing the application of airborne hyperspectral data to mine waste characterisation and monitoring.

Since 1996, BRGM and CGS (South African Geological Survey) have been collaborating in the development of Remote Sensing and GIS-based integrated approaches of mining environments in one of the most heavily exploited area in the world, i.e. the Witwatersrand gold field in South Africa. In this frame, they have tested and used together various EO techniques, including conventional sensors (Landsat TM), high spectral resolution satellite sensors (ASTER, Hyperion) very high resolution satellite sensors (IKONOS) and airborne radiometrics with in situ measurements (pH, Eh, Conductivity, portable Niton XRF analysis…). Furthermore, BRGM (as coordinator) and CGS were leading partners in the FP6 EO-LANDEG Specific Support Action (contract INCO-CT2005-015099, www.eolandeg.com): Earth Observation Initiative in former homeland of South Africa in support to EU activities on land degradation and integrated catchment management), where a strong dissemination and capacity building component was developed.

The Czech Geological Survey (CzechGS) and BRGM started collaborating two years ago and have carried out comprehensive field spectroradiometry campaigns to spectrally characterise and map lithologies and Acid Mine Drainage minerals in and around lignite open casts in NW Bohemia.

This solid know-how developed by these four surveys in a comprehensive use of EO techniques (satellite, airborne and in situ) for mining environment impact assessment is strongly backed by the GeoZS international experience in the definition of Indicators of Sustainability for the Minerals Extraction Industries.

The University of Versailles – St Quentin (UVSQ) brings the social and societal dimension of sustainable development of mining to the project. UVSQ already worked together with GeoZS on sustainability indicators.

The Wuppertal Institute for Climate, Energy and Environment develops resource use scenarios and policy relevant indicators and participates in the GNU project where it develops methodology to connect Earth Observation with policies.

DLR, the German Aerospace Agency, has been a leading organisation in imaging spectroscopy in Europe and has a very longstanding experience in acquisition, pre-processing and evaluation of hyper-spectral imagery using different sensor systems, e.g. DAIS 9715, ROSIS, HyMAP and APEX within different national and EU-wide flight campaigns. DLR hosts the necessary calibration facilities and has developed numerous world-class software packages for pre-processing, validating and analyzing hyperspectral imagery for different thematic applications. Besides the capabilities to operate the different sensor systems, DLR will own and operate the new airborne system ARES and has been started, conjointly with the leading industry, to develop the hyperspectral satellite sensor system EnMAP. Besides these activities, image processing standards are currently under development on national (VDI, German Assoc. of Engineers) and EU-level (EUFAR, European Fleet for Airborne Research). DLR's experience is backed by Tel-Aviv University experience in the contribution of imaging spectroscopy to the soils and urban environments, which will be of use in EO-MINERS application developments.

TAU is the leading laboratory in Israel for imaging spectroscopy remote sensing (RSGL), experts in soil mapping, environmental monitoring and hyperspectral remote sensing applications. The laboratory is situated in the Department of Geography and Human Environment at Tel-Aviv University which consider to be one of the largest university in Israel

The mining companies involved in the project either have a solid experience of Earth Observation technologies (AOL-ATD) or have been involved in projects using these methods (SU). AOL-ATD in particular has a longstanding experience in very high spectral resolution (field spectroradiometry, imaging spectroscopy) data processing as well as in thermal infrared data use.

The Mineral Industry Research Organisation (MIRO) is a leading international collaborative research and technological development (RTD) facilitator and provider of project management services to the minerals and related industries. MIRO works in partnership with industry, government, research and service providers to identify, influence, fund, transfer, deliver and communicate information and technology development to address the needs of stakeholders in the sector. Since its formation in 1974, MIRO has established and managed more than 200 major technical RTD projects with a combined value of over £50M. MIRO has demonstrated specific experience in RTD related to mineral exploration, mining and mineral extraction, mineral processing, environmental technologies, waste management, new materials, land reclamation and information technology. MIRO managed research activities delivering industrially relevant, sustainable, technological solutions worldwide. MIRO is funding member of the European Technology Platform on Sustainable Mineral Resources (ETP SMR) and Dr Horst Hejny was coordinator of the EU funded NESMI network, which formed the nucleus for the ETP SMR.

As the project is dealing with assessment of environmental and social impacts resulting from activities of the extractive industries this industry branch should be represented to a significant extent in the project consortium. Anglo American as one of the biggest mining companies in the world and Sokolov Lignite Mining Company from Czech Republic are direct members of the consortium and manage the demonstration sites addressed in the project. Others are intended to be involved during the trialogue activities, because industry in general is seen as one party in the trialogue and is a "must have" or "must participate" there. Further to that the project partner MIRO represents quite a lot of companies and organisations from the minerals industry. MIRO as a non-profit membership organisation has a number of mining companies (including some of the "big" ones) as members and thus can provide short and easy access to them in order to discuss things or providing contacts for further actions.

The project works to the benefit of the European Technology Platform on Sustainable Mineral Resources (ETP-SMR) hence contacts to the ETP-SMR are essential. Both BRGM and MIRO are members of the ETP SMR High Level Group. BRGM as coordinator and MIRO as WP leader dealing with all the communication actions guarantee sufficient relations to the ETP-SMR.

The Consortium includes several partners who have a long experience in GEO in other application areas and are active participants in developing and implementing its workplan. BGS co-authored the Disasters Societal Benefit area at the initiation of GEO and currently represent the UK on GEO's Science and Technology Committee. BRGM lead several GEO Tasks, particularly in the Disasters SBA, and CGS is also active in this global initiative, with South Africa being one of the GEO Co-Chairs and hosting the most recent Ministerial. From the space agency side, DLR is a key German and European player in GEO.

B 2.4 Resources to be committed

B 2.4.1: personnel and general information

Tables in B 1.3.6 section show manpower resources dispatching per partner and per work package. It clearly shows that a large part of the effort concentrates on the development of innovative EO-based tools and methods over the demonstration sites (WP3), to be generalised and promoted during the subsequent work packages.

Significant man/month amount dedicated to dissemination, capacity building and IPR issues (WP5) reflects the importance of these issues as per the topic ENV.2009.4.1.3.2 call requirement.

Policy analysis and indicator identification, protocols and standards for EO products, EO integration products and systems are equally balanced, respective of their equal importance in the project course.

EO-MINERS is a Specific International Cooperation Action collaborative project and, as such, includes two ICPC partners (South Africa and Chile) as well as three demonstration sites, of which one in Europe (Czech Republic).

A significant part of the project budget is dedicated to international travelling that includes:

- At coordination level: travel and accommodation to each of the three countries (plus the kick-off meeting) mentioned above for the coordinator and six guest experts member or the Advisory Board
- For technical work packages: travels to demonstration sites and for participation in project meetings and annual meetings.

Best attention has been paid to avoid travel duplication and most of the travels to demonstration sites for RTD purpose will take place, whenever possible, at same dates as project meetings.

Hyperspectral airborne data acquisition with state of the art sensors is foreseen over the test area Sokolov, CZ. The necessary budget for flight operations (approx. 30,000 €) is included in the cost estimates of DLR. DLR will cover the remaining open costs by its base funding.

Eventually the innovative ALERT automated monitoring technology that will be tested over the demonstration sites will also represent a cost of importance, however justified by its invaluable contribution to site monitoring. Total cost for ALERT is estimated 160,000 €, including in the BGS costs.

A 65,000 € provision has been made by BRGM for the acquisition of very-high spatial resolution data if requested.

MIRO applies for 25,000 € dedicated to editing of multimedia promotion material (leaflets, posters, videos, slideshows, etc) and the final book as kind of “Guide for Good Practice”. The costs are necessary in order to inform all dedicated parties involved in the scope of the project objectives and to properly disseminate the project results.

Subcontracting : an amount of 60,000 € has been provisioned by CGS for subcontracting. The subcontracting is needed to pay local subcontractors to help us with the installation of the ALERT technology at the test site. This may include engineering works such as hiring a JCB operator to do shallow trenching (to bury our cables), getting a local electrician to provide a spur to a local mains supply, buying plastic piping from a local supplier, installing a telephone line, buying and installing secure housing for the ALERT instrument. Clearly these local subcontractors would not qualify as consortium partners.
The subcontracting procurement procedure will follow the official CGS’s Procurement Policy.

B 2.4.2: Detailed budget

See next pages

Beneficiary 1: BRGM	**Management**		**RTD**		**Demo**		**Other**	
Personnel								
category	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*
Expert/project Manager	117	62 607.20	220	117 726.00			40	21 407.30
Senior scientist/researcher			212	88 752.10			20	8 373.90
Junior scientist/researcher					100	31 713.20		
Project assistant	60	16 058.20						
Total personnel (days)	**177**	**78 665.40**	**432**	**206 478.10**	**100**	**31 713.20**	**60**	**29 781.20**
Travel and accommodation								
Type	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Travels In Europe (CZ)			8	24 720.00				
Travels outside Europe (ZA, CHL)			9	36 810.00	2	8 180.00		
Coordinator	3	6 600.00						
Project meetings	3	1 500.00						
GEO- GEOSS meetings	6	7 500.00						
Guest experts (6 experts)	18	45 000.00						
Total travels	**30.00**	**60 600.00**	**17.00**	**61 530.00**	**2.00**	**8 180.00**	**0.00**	**0.00**
Other costs								
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Purchase of satellite imagery			provision	65 000.00				
Total other costs		**0.00**		**65 000.00**		**0.00**		**0.00**
Grand Total direct costs		***139 265.40***		***333 008.10***		***39 893.20***		***29 781.20***
Direct costs		**139 265.40**		**333 008.10**		**39 893.20**		**29 781.20**
Indirect costs		**59 798.00**		**154 353.60**		**22 807.70**		**20 803.20**
Total		**199 063.40**		**487 361.70**		**62 700.90**		**50 584.40**
Requested EC contribution		**199 063.40**		**365 521.28**		**31 350.45**		**50 584.40**

Beneficiary 2: NERC (BGS) Personnel	Management		RTD		Demo		Other	
category	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*
Personnel: MGMT							85	20 046,26
Expert/project Manager: RTD			56	21 773,68				
Senior scientist/researcher: RTD			215	59 924,26				
Junior scientist/researcher: RTD			170	36 311,58	10	2 130,00		
Total personnel (days)			**441**	**118 009,53**	**10**	**2 130,00**	**85**	**20 046,26**
Travels								
Type	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Details: MGMT				28 421,00				*4 211,00*
Total travels	**0,00**		**0,00**	**28 421,00**	**0,00**	**0,00**	**0,00**	**4 211,00**
Equipment								
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Details				21 053,00				
Total equipment		**0,00**		**21 053,00**		**0,00**	**0**	**0,00**
Subcontracting								
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Total Subcontracting		**0,00**		**00**		**0,00**		**0,00**
Grand Total direct costs				***227 483,53***		***2 130,00***		***24 257,00***
Direct costs				**167 483,21**		**2 130,00**		**24 257,00**
Indirect costs				**118 009,53**		**2 130,00**		**20 046,26**
Total				**285 492,74**		**4 260,00**		**44 303,05**
Requested EC contribution				**214 118,55**		**2 129,00**		**44 302,05**

Beneficiary 3:TAU	**Management**		**RTD**		**Demo**		**Other**	
Personnel								
category	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*
Senior scientist/researcher			12	117 000.00				
Junior scientist/researcher			18	45 000.00				
Technician			12	25 000.00				
Total personnel (days)	**0**	**0.00**	**42**	**187 000.00**	**0**	**0.00**	**0**	**0.00**
Travel and accommodation								
Type	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Travels In Europe (CZ)			8	12 000.00				
Travels outside Europe (ZA, CHL)			6	15 000.00				
Total travels	**0.00**	**0.00**	**14.00**	**27 000.00**	**0.00**	**0.00**	**0.00**	**0.00**
Other costs								
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Spectral Measurements (X-RAY,Ref)			40	3 080.00				
Chemical Analyses			100	4 000.00				
Software upgrade			3	3 000.00				
Total other costs		**0.00**		**10 080.00**		**0.00**		**0.00**
Equipment								
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
computer			*2*	4 000.00				
storage system			1	5 000.00				
server			1	8 420.00				
Total equipment		**0.00**		**17 420.00**		**0.00**		**0.00**
Consumables								
Item	Number	Cost	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Paper Ink			10	1 000.00				
Magnetic Media			10	1 000.00				
Total Consumables		**0.00**		**2 000.00**		**0.00**		**0.00**
Grand Total direct costs		***0.00***		***243 500.00***		***0.00***		***0.00***
Direct costs		**0.00**		**243 500.00**		**0.00**		**0.00**
Indirect costs		**0.00**		**146 100.00**		**0.00**		**0.00**
Total		**0.00**		**389 600.00**		**0.00**		**0.00**
Requested EC contribution		**0.00**		**292 200.00**		**0.00**		**0.00**

Beneficiary 4: DLR	RTD		Demo		Management	
Personnel						
category	*p/h*	*Cost*	*p/h*	*Cost*	*p/h*	*Cost*
Expert/project Manager						
Senior scientist/researcher	9940	477 368.50	140	6 723.50		
Junior scientist/researcher						
Project assistant						
Total personnel (hours)	**9940**	**477 368.50**	**140**	**6 723.50**	**0**	**0.00**
Travel and accommodation						
Type	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Travels In Europe (CZ)	5	17 168.00				
Travels outside Europe (ZA, CHL)	4	32 832.00				
Total travels	**9.00**	**50 000.00**	**0.00**	**0.00**	**0.00**	**0.00**
Other costs						
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
		50 000.00				
Total other costs		**50 000.00**		**0.00**		**0.00**
Subcontracting						
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Audit						1 500.00
Total Subcontracting		**0.00**		**0.00**		**1 500.00**
Grand Total direct costs		***577 368.50***		***6 723.50***		***1 500.00***
Direct costs		**577 368.50**		**6 723.50**		**1 500.00**
Indirect costs		**378 241.85**		**5 327.35**		**0.00**
Total		**955 610.35**		**12 050.85**		**1 500.00**
Requested EC contribution		**716 707.76**		**6 025.43**		**1 500.00**

Beneficiary 5:WI Personnel	**Management**		**RTD**		**Demo**		**Other**	
category	*Months*	*Cost*	*Months*	*Cost*	*Months*	*Cost*	*Months*	*Cost*
Senior scientist/researcher	1	5905.00	27.5	162388.00	1.5	8858.00	6	35430.00
Total personnel (days)	**1**	**5905.00**	**27.5**	**162388.00**	**1.5**	**8858.00**	**6**	**35430.00**
Travel and accommodation								
Type	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Kick-off							2	1280.00
Trialogue/dissemination							12	8800.00
Travels outside Europe (ZA)							2	6136.00
Travels outside Europe (CL)							2	7904.00
Travels In Europe (CZ)							2	5083.00
Total travels	**0.00**	**0.00**			**0.00**	**0.00**	**20.00**	**29418.00**
Other costs								
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
fees							1	1000.00
Total other costs		**0.00**				**0.00**	**1**	**1000.00**
Subcontracting								
Item	Number	Cost	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
audit	1	1500.00						
Total Subcontracting	**1**	**1500.00**				**0.00**		**0.00**
Grand Total direct costs		***7405.00***		***162388.00***		***8858.00***		***65848.00***
Direct costs		**7405.00**		**162388.00**		**8858.00**		**65848.00**
Indirect costs		**4443.00**		**97432.00**		**5314.00**		**39508.80**
Total		**11848.00**		**259820.80**		**14172.80**		**105356.80**
Requested EC contribution		**7 405.00**[17]		**194865.60**		**7086.40**		**105356.80**

[17] WI applies for only 50% funding of management cost to stay inside the EC contribution.

Beneficiary 6: Geo-ZS Personnel	**Management**		**RTD**		**Demo**		**Other**	
category	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*
Expert/project Manager			70	11 340.00			100	16 200.00
Senior scientist/researcher			159	18 342.24			0	0.00
Junior scientist/researcher			41	3 676.88			80	7 174.40
Technician			10	836.00			10	836.00
Total personnel (days)	**0**	**0.00**	**280**	**34 195.12**	**0**	**0.00**	**190**	**24 210.40**
Travel and accommodation								
Type	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Travels In Europe (CZ)			4	8 000.00			2	*4 000.00*
Travels outside Europe (ZA, CHL)			8	32 720.00			4	*16 360.00*
Project meetings			10	14 000.00				
Total travels	**0.00**	**0.00**	**22.00**	**54 720.00**	**0.00**	**0.00**	**6.00**	**20 360.00**
Grand Total direct costs		***0.00***		***88 915.12***		***0.00***		***44 570.40***
Direct costs		**0.00**		**88 915.12**		**0.00**		**44 570.40**
Indirect costs		**0.00**		**17 783.02**		**0.00**		**8 914.08**
Total		**0.00**		**106 698.14**		**0.00**		**53 484.48**
Requested EC contribution		**0.00**		**80 023.61**		**0.00**		**53 484.48**

Beneficiary 7: MIRO	**Management**		**RTD**		**Demo**		**Other**	
Personnel								
category	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*
Expert/project Manager	11	3 438.00	132	36 726.00			253	70 233.00
Senior scientist/researcher							132	36 799.00
Technician							154	42 932.00
Total personnel (days)	**11**	**3 438.00**	**132**	**36 726.00**	**0**	**0.00**	**539**	**149 964.00**
Travel and accommodation								
Type	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Travels In Europe (CZ)			4	3 500.00			5	3 250.00
Travels outside Europe (ZA, CHL)			2	4 000.00			4	8 000.00
Total travels	**0.00**	**0.00**	**6.00**	**7 500.00**	**0.00**	**0.00**	**9.00**	**11 250.00**
Other costs								
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Printing, layouting, PR material, etc)							provision	25 000.00
Total other costs		**0.00**		**0.00**		**0.00**		**25 000.00**
Grand Total direct costs		***3 438.00***		***44 226.00***		***0.00***		***186 214.00***
Direct costs		**3 438.00**		**44 226.00**		**0.00**		**186 214.00**
Indirect costs		**687.60**		**8 845.20**		**0.00**		**37 242.80**
Total		**4 125.60**		**53 071.20**		**0.00**		**223 456.80**
Requested EC contribution		**4 125.60**		**39 803.40**		**0.00**		**223 456.80**

Beneficiary 8: CGS	**Management**		**RTD**		**Demo**		**Other**	
Personnel								
category	Days	Cost	Days	Cost	Days	Cost	Days	Cost
Expert/project Manager			170	51 266.40	10	3 015.67	10	3 015.67
Senior scientist/researcher			200	40 995.91	15	3 071.69	15	3 071.69
Junior scientist/researcher			120	18429.76	20	3 071.63	40	
Total personnel (days)	**0**	**0.00**	**490**	**110 652.07**	**45**	**9 958.99**	**65**	**12 230.62**
Travel and accommodation								
Type	Number	Cost	Number	Cost	Number	Cost	Number	Cost
Travels In ZA			9	3 600	2	800.00		
Travels outside ZA (Europe, CHL)			13	40 500.00				
Total travels	**0.00**	**0.00**	**22.00**	**44 100.00**	**2**	**800.00**	**0.00**	**0.00**
Subcontracting								
Item	Number	Cost	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
ALERT installation			1	60 000				
Total Subcontracting			**1**	**60 000**		**0.00**		**0.00**
Other costs								
Item	Number	Cost	Number	Cost	Number	Cost	Number	Cost
EM Survey			1	75 000.00				
Total other costs		**0.00**		**75 000.00**		**0.00**		**0.00**
Grand Total direct costs		***0.00***		***229 752.07***		***9 9158.99***		***12 230.62***
Direct costs		**0.00**		**289 752.07**		**9 958.99**		**12 230.62**
Indirect costs		**0.00**		**53 524.43**		**4039.49**		**5 719.26**
Total		**0.00**		**343 276.50**		**13 998.48**		**17 949.88**
Requested EC contribution		**0.00**		**257 457.38**		**6 999.24**		**17 949.88**

Beneficiary 9: AOL-ATD	**Management**		**RTD**		**Demo**		**Other**	
Personnel								
category	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*
Senior scientist/researcher			70	40 096.97	10	5 728.14	20	11 456.28
Total personnel (days)	**0**	**0.00**	**70**	**40 096.97**	**10**	**5 728.14**	**20**	**11 456.28**
Travel and accommodation								
Type	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Travels In Europe			1	3 728.00				
Travels in ZA			12	979.72				
Total travels	**0.00**	**0.00**	**13.00**	**4 707.72**	**0.00**	**0.00**	**0.00**	**0.00**
Other costs								
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
general data management, student monitoring			1	11 567.98				
Total other costs		**0.00**		**11 567.98**		**0.00**		**0.00**
Tota other direct costs		0.00		16 275.70	0.00	0.00	0.00	0.00
Grand Total direct costs		***0.00***		***56 372.67***		***5 728.14***		***11 456.28***
Personnel costs		**0.00**		**40 096.97**		**5 728.14**		**11 456.28**
other direct costs		**0.00**		**16 275.70**	**0.00**	**0.00**	**0.00**	**0.00**
Indirect costs		**0.00**		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total		**0.00**		**56 373.67**	**0.00**	**5 728.14**	**0.00**	**11 456.28**
Requested EC contribution		**0.00**		**0.00**		**0.00**		**0.00**

Beneficiary 10: UVSQ	**Manage-ment**		**RTD**		**Demo**		**Other**	
Personnel								
category	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*
Expert/project Manager			22	**7 000.00**			0	0.00
Senior scientist/researcher			22	**5 000.00**	0	0.00	10	**2 272.73**
Junior scientist/researcher			88	1 6720.00			16	3 040.00
Project assistant			0	0.00			105	20 399.00
Total personnel (days)	**0**	**0.00**	**132**	**28 720.00**	**0**	**0.00**	**131**	**25 711.73**
Travel and accommodation								
Type	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Travels In Europe (CZ)			2	3 000.00			1	1 700.00
Travels outside Europe (ZA, CHL)			4	6 000.00			3	4 300.00
Total travels	**0.00**	**0.00**	**6.00**	**9 000.00**	**0.00**	**0.00**	**0.00**	**6 000.00**
Grand Total direct costs		***0.00***		***37 720.00***		***0.00***		***31 711.73***
Direct costs		**0.00**		**37 720.00**		**0.00**		**31 711.73**
Indirect costs		**0.00**		**22 632.00**		**0.00**		**19 027.04**
Total		**0.00**		**60 352.00**		**0.00**		**50 738.77**
Requested EC contribution		**0.00**		**45 264.00**		**0.00**		**50 738.77**

Beneficiary 11: CzechGS	Management		RTD		Demo		Other	
Personnel								
category	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*
Expert/project Manager								
Senior scientist/researcher			615	48 315.11	40	3 142.45	40	3 142.45
Total personnel (days)	**0**	**0.00**	**615**	**48 315.11**	**40**	**3 142.45**	**40**	**3 142.45**
Travel and accommodation								
Type	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Travels In Europe (CZ)			4	3 500.00				
Travels outside Europe (ZA, CHL)			3	9 000.00				
Total travels	**0.00**	**0.00**	**7.00**	**12 500.00**	**0.00**	**0.00**	**0.00**	**0.00**
Consumables								
Item	Number	Cost	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Purchase of HW and SW			3	12 000.00				
Total Consumables		**0.00**		**12 000.00**		**0.00**		**0.00**
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
			4	7 000.00				
Total Subcontracting		**0.00**		**7 000.00**		**0.00**		**0.00**
Grand Total direct costs		***0.00***		***79 815.11***		***3 142.45***		***3 142.45***
Direct costs		**0.00**		**79 815.11**		**3 142.45**		**3 142.45**
Indirect costs		**0.00**		**47 889.06**		**1 885.47**		**1 885.47**
Total		**0.00**		**127 704.17**		**5 027.91**		**5 027.91**

Requested EC contribution	**0.00**	**95 778.13**	**2 513.96**	**5 027.91**

Beneficiary 12 : SU Personnel	**Management**		**RTD**		**Demo**		**Other**	
category	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*
Senior scientist/researcher			12	1 266.12			6	603.06
Total personnel (days)	**0**	**0.00**	**12**	**1 266.12**	**0**	**0.00**	**6**	**603.06**
Grand Total direct costs		***0.00***		***1 266.12***		***0.00***		***603.06***
Personnel costs		**0.00**		**1 266.12**		**0.00**		**603.06**
other direct costs		**0.00**						
Indirect costs		**0.00**		**1 953.18**		**0.00**		**651.06**
Total		**0.00**		**3 219.30**		**0.00**		**1 254.12**
Requested EC contribution		**0.00**		**0.00**		**0.00**		**0.00**

Beneficiary 13: AACL	**Management**		**RTD**		**Demo**		**Other**	
Personnel								
category	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*	*Days*	*Cost*
Senior scientist/researcher			10	6 000.00			5	3 000.00
Junior scientist/researcher			10	3 000.00				
Total personnel (days)	**0**	**0.00**	**20**	**9 000.00**	**0**	**0.00**	**5**	**3 000.00**
Travel and accommodation								
Type	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
Travel In South America			2	6 000.00				
Travels in Europe			4	3 000.00				
Total travels	**0.00**	**0.00**	**6.00**	**9 000.00**	**0.00**	**0.00**	**0.00**	**0.00**
Equipement								
Item	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*	*Number*	*Cost*
general data management			1	500.00				
Total equipment		**0.00**		**500.00**		**0.00**		**0.00**
Total other direct costs		0.00		9 500.00	0.00	0.00	0.00	0.00
Grand Total direct costs		***0.00***		***18 500.00***		***0.00***		***3 000.00***
Personnel costs		**0.00**		**9 000.00**		**0.00**		**3 000.00**
other direct costs		**0.00**		**9 500.00**	**0.00**	**0.00**	**0.00**	**0.00**
Indirect costs		**0.00**			**0.00**	**0.00**	**0.00**	**0.00**
Total		**0.00**		**18 500.00**	**0.00**	**0.00**	**0.00**	**3 000.00**
Requested EC contribution		**0.00**		**0.00**		**0.00**		**0.00**

B 3. Impact

B 3.1: Strategic Impact

General

The development of new calibration standards for satellite Earth Observation images and hyperspectral images will provide the scientific basis to help monitoring and observing the environmental impact of mining industry as well as the impacts of mining operations to the society.

The EO-MINERS consortium includes partners from the whole raw materials supply chain, from the exploration level to the end phase of extraction levels as well as partners from heavily exploited areas from developing countries.

The project proposal and consortium hence is able to address priority D (reducing environmental footprint) of the European Technology Platform on Sustainable Mineral Resources (ETP SMR). Thus it is also addressing central objectives of the Sustainable Development Strategy and the Thematic Strategy for the Sustainable Use of Natural Resources. It is expected that results will give valuable insights on the usefulness of EO services for improving the monitoring of these strategies by Eurostat, the Joint Research Centre and the envisages Data Centre on Resources.

As European Commission recognises ETP SMR objectives and secure supply of raw materials as key factor for competitive European industry, the key impact of the project is to improve competitiveness and sustainability of EU raw materials supply sector.

EO-MINERS will do this by providing new tools, methods and standards for observing and monitoring the environmental and social footprints of extractive industry. That should participate in reducing expenditures for environmental monitoring the mining companies have to perform on the basis of EU and national legislations. On the other hand the project will address new ways to lower (decrease) the social impact of EU mining industry. EO-MINERS hence will contribute to better quality of life of population affected by environmental and social impacts of mining sector.

Furthermore, disseminating new EO-based monitoring and observing tools and methods will contribute to minimise external and internal costs of EU mining sector (end users).

The dissemination will be done with manuals, web pages and seminars, organized for stakeholders. As some project partners are key players inside The European Technology Platform on Sustainable Mineral Resources, which also includes important EU raw materials supply companies, the outcomes of the project will address wider mining industrial community.
The mining and raw materials supply chain being very internationally oriented (needs are dispersed throughout whole Europe, supply is geologically conditioned), environmental and social impacts can extend national boundaries (Baia Mare cyanide spill accident for example). EC recognised that securing raw materials supply chain as a fundamental pillar for securing EU industrial competitiveness. Among other FP7 project, EO-MINERS enables a critical mass to be mobilised, addressing raw material supply international issues.

New knowledge will improve sustainability of the EU mining sector and improve the quality of life of the EU citizens which are affected by negative environmental impacts of mineral extraction.

Contributions to GEO WP tasks

The project will strengthen the Earth Science contribution to GEO, filling a significant gap in the GEOSS by identifying critical elements of a shallow subsurface observing system designed for mining and environmental monitoring. It will lead to a revision of the GEO Work Plan and Tasks that fills a significant gap in GEO/GEOSS.

The GEO Work Plan defines Tasks in 9 Societal Benefit Areas and on 4 cross-cutting themes. None of these explicitly address minerals as an issue, but there are many ways in which it is implicit that EO-MINERS will contribute to GEO Tasks. Therefore, it is helpful to make explicit some of the key links from EO-MINERS to the GEO Work Plan. Most of these links will be managed through WP 4.4, which is designed to take the outputs of EO-MINERS and interface them with GEO. But there will also be more direct links, especially in the area of capacity building on which the EO-MINERS project has a dedicated Work Package activity WP5.1.

In terms of an SBA, the most natural home for EO-MINERS is perhaps the Disaster SBA. This contains not only natural disasters but is also intended to cover the impacts of pollution, an area in which EO-MINERS will make a significant contribution. EO-MINERS is designed to apply EO technologies of various kinds to mining's full life cycle, from exploration through development and exploitation to restoration. The mines being studied all have significant potential to pollute the atmosphere, through dust, and especially groundwater, via acid mine drainage, leading to pollution disasters. Observation technologies will help to manage the mining process better by monitoring mine operations, helping to assess the risk of pollution occurring and mitigating the potential for harmful impacts, contributing to DI-09-01 and DI-09-02.

When pollution does occur, it has a significant impact on water, ecosystems and health, all GEO SBAs in their own rights. In the water SBA, the main contribution will be to integrated products for water resource management (WA-08-01), especially the sub-Tasks on groundwater and water quality monitoring, In the ecosystems SBA, there is the potential to contribute from a pollutant perspective to EC-09-01 on ecosystem observation and monitoring, perhaps via a new sub-Task. Similarly, in the health SBA, EO-MINERS could spawn a new sub-Task under HE-09-02 Monitoring and Prediction Systems for Health to look at mine pollution impacts on health and the environment. It could also contribute from the particulate perspective to the existing HE-09-02 sub-Tasks on aerosols and air quality.

EO-MINERS has study sites in two developing countries and so GEO's cross-cutting Capacity Building Tasks are highly relevant to the project. Links can be foreseen to all main CB Tasks, but will be strongest to the sub-Task on Geo-resources Services for Africa, CB-09-05d, otherwise known as the AEGOS project. Several of the main players in EO-MINERS are also partners in AEGOS. Similarly in Architecture, there are many possible contributions but the most likely is perhaps to AR-09-02c, because EO-MINERS will utilise world leading in-situ sensor networks to monitor mine sites and can provide significant technical input to the development of in-situ sensor webs. The project is likely to make use of the Global Data Sets from DA-09-03 and will provide feedback. In promoting GEO to the minerals industry, it will contribute to ST-09-02. And by engaging the mining end-users in the project, it will contribute to US-09-01 and potentially help GEO to develop a new theme on Resources.

B 3.2: Plan for the use and dissemination of foreground

The results of the work need to be made known to related and also other interested parties. To this effect, the use of a wide variety of dissemination media is proposed including written, oral and visual presentations in order to inform and actively involve governmental organisations, industry and societal groups during the project as well as in its aftermath. The target audience will be the industry and their trade organisations and governmental organisations. Other social stakeholders may participate as well but are not in the main focus due to the more technical content of the presentations. These groups are addressed by other means. Specifically, towards the end of project, the results of the project and its achievements and consequences will be collated and presented in a book.

Capacity building activities will comprise workshops and/or seminars mainly on local level at the same time as the foreseen annual meetings and a final conference. This means that we envisage one workshop per test site. The capacity building activities are mainly dedicated to the related local authorities and local communities including NGOs. Depending on the success of the activities a second workshop/seminar might be planned if necessary. It must be ensured that all messages about possibilities and consequences of impact assessment (based on the project achievements and common good practice) can be brought across.

The capacity building activities will be combined with mobilisation or awareness campaigns in order to ensure that all interested and affected groups are aware of and can take part in the discussions at the events. As the events will be organised jointly with project meetings double travelling of the project partners will be avoided so that all partners may participate.

An effective and wide reaching promotion campaign is proposed focused around the development of a project website, publication of a series of non-technical fact-sheets/illustrations/leaflets, a project brochure and a poster series, a few standalone videos or slideshows. All promotional material will be tailored to the target stakeholder community and be prepared to a common format and standard. All multimedia material mentioned will clearly make reference to FP7 Environmental Theme and be at least available for download on the project web site. Other distribution channels will be explored as well. A logo will be included to ensure distinctiveness and recognition of all project outputs. Furthermore, press conferences will be organised and press releases issues upon reaching project milestones.

Communication and promotion activities will be at two levels: 1. Non-technical level targeting the interaction between society, regulators and industry, and 2. technical level targeting industry, researchers and policy makers. This two levels approach should ensure to provide every interested party with factual information in an understandable manner.

The publication and dissemination of realistic, interactive and objective information on the social and environmental issues relating to mineral extraction and new methodologies in managing and reducing such effects in the future is core to the success of the project. In order to ensure that information about the project outputs reach all related and interested parties, a detailed communication strategy will be established identifying target groups and ways of reaching them appropriately. Such a strategy ensures that the envisaged “trialogue” will include the right partners from all involved parties.

Special communication channels will be established and maintained with the ETP-SMR and the Raw Materials Supply Group (RMSG). It is expected that the project will contribute to the ETP-SMR in the domain of environmental footprint reduction by using new observing, monitoring methods, and providing information about populations and societies affected by the exploration and exploitation of raw material. The RMSG as being a stakeholder group comprising extractive and user industries, Member States, environmental NGOs, trade unions and the Commission is supposed to be the right group in order to initiate the envisaged “trialogue” on European level affecting also the related discussions in ICPC countries.

The project will make available reliable and objective information about affected ecosystems, populations and societies, to serve as a basis for a sound "trialogue" between industrialists, governmental organisations and stakeholders. Using the communication strategy established will initiate and develop this "trialogue", which is meant to contribute to reconciliation of interests in order to reach common agreement upon actions to deal with environmental and social impacts of mining activities. Apart from this the "trialogue" would in a way also confirm the project idea and outcomes and confirm its usefulness.

Similar to the capacity building events "trialogue" events will be organised in connection with the annual project meetings (at test sites) and the final meeting. Additionally, one event will take place in Brussels in the second half of the project involving lobbying organisations like Euromines or IMA and other EU stakeholders together with members of the RMSG. "Trialogue" activities will be accompanied by related web-based discussions via the discussion forum at the project web site.

The issue of foreground intellectual property and the potential exploitation of any products derived from the research will of course also be addressed. An exploitation plan will be developed and maintained to identify any technologies, software, methodologies or datasets with commercial potential, to initiate IPR protection (e.g. patent filing, trademark registration, copyright) with a view to post-project exploitation and to identify the most appropriate mechanism for commercial knowledge transfer (e.g. by direct licensing, spin-out, or innovation relay centre).

The plan will identify the ownership of background IPR and any foreground IP developed by the consortium partners. This plan will be updated with each periodic report to the EC and maintained as an evolving document. IPR with commercial potential will not be disclosed in the public domain. It is possible that some EO techniques or products may have generic components that could be adapted for other cross-cutting market sectors, including: geohazard prediction, flood and landslide warning, monitoring water degradation and scarcity, contaminated land remediation, the monitoring of safety-critical plant, civil infrastructure (e.g. nuclear waste repositories, earthworks) and not least, heritage conservation.

In order to assure coherence of the work supported within the 7th Framework Programme, as well as with initiatives such as the Group on Earth Observations (GEO), the INSPIRE Directive, Global Monitoring for Environment and Security (GMES), representatives of the Consortium will - upon request by the European Commission - participate in meetings where the project objectives and outcomes (of a public nature) will be presented in the perspective of contributing to common approaches and sharing of best practices.

The beneficiaries will adhere to the GEOSS data sharing principle, in particular that principle which states that "all data, metadata, and products for use in education and research will be encouraged to be made available free of charge or at no more than the cost of reproduction" (GEOSS 10-Year Implementation Plan Reference Document, February 2005, www.earthobservations.org,). Beneficiaries will also undertake to register components resulting from work undertaken within the scope of the project in the GEOSS Components registry.

Special attention will be paid to produce and communicate environmental policy-related results. The Clause 29[18] on access to data and results relevant for policy will be taken into

[18] General Clause 29*29. ACCESS RIGHTS TO FOREGROUND FOR POLICY PURPOSES AND TRANSFER OF OWNERSHIP OF FOREGROUND (specific to environment research)*
1. The Project should ensure that protocols and plans for data collection and storage are in line with Community Data Policy.

consideration. Foreground includes the tangible (e.g. prototypes, source code and processed earth observation images) and intangible (IPR) results of the project. Results generated outside the project (i.e. before, after or in parallell with the project) do not constitute foreground.

A clause on "Open Access" to publication on research results will be included in the contract with the Commission.

2. The Community Institutions and Bodies shall enjoy access rights to foreground for the purpose of developing, implementing and monitoring environmental policies. Such access rights shall be granted by the beneficiary concerned on a royalty-free basis.
3. Where foreground will no longer be used by the beneficiary nor transferred, the beneficiary concerned will inform the Commission. In such case, the Commission may request the transfer of ownership of such foreground to the Community. Such transfer shall be made free of charge and without restrictions on use and dissemination.

Glossary

3S-HED	sub-surface spectral head device
AACL	Anglo American Chile Ltda
AfDB	African Development Bank
ALERT	Automated time-Lapse Electrical Resistivity Tomography
AMD	Acid Mine Drainage
AMP	African Mining Partnership
AOL-ATD	Anglo Operation Ltd – Anglo Technical Division
ARES	Airborne Reflective Emissive Spectrometer
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
AU	African Union
AVIRIS	Airborne Visible/Infrared Imaging Spectrometer
BGS	British Geological Survey
BRGM	Bureau de Recherches Géologiques et Minières, French Geological Survey
CAL/VAL	Calibration – Validation,
CGS	Council for Geoscience, South African Geological Survey
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CzechGS	Česká Geologická Služba, Czech Geological Survey
dInSAR	Differential SAR interferometry
DLR	Deutsches Zentrum für Luft - und Raumfahrt e.V.
ECA	Economic Commission for Africa
EEA	European Environment Agency
EnMAP	Environmental Mapping and Analysing Program
EO	Earth Observation
ETP-SMR	European Technological Platform on Sustainable Mineral Resources
EU	European Union
GEO	Group on Earth Observation
GEOSS	*Global Earth Observation System of Systems*
GeoZS	Geoloski Zavod Slovenije, Slovenian Geological Survey
GIS	Geographic Information System
GMES	*Global Monitoring for Environment and Security*
HSR	High Spectral Resolution
ICMM	International Council on Mining and Metals
IMA	Industrial Minerals Association
IPR	Intellectual Property Rights
IS	Imaging Spectroscopy
ISO	International Standard Organisation
Landsat MSS	Landsat Multi Spectral Scanner

Landsat TM	Landsat Thematic Mapper
MINEO	Monitoring and assessing the environmental Impact of mining in Europe using advanced Earth Observation Techniques
MIRO	Mineral Industry Research Organisation
NEEI	Non-Energy Extractive Industry
NERC	National Environment Research Council (UK)
NGO	Non Governmental Organisation
NESMI	Network on European Sustainable Mining and processing Industries
OECD	Organisation for Economic Co-operation and Development
PECOMINES	Inventory, Regulations and Environmental Impact of Toxic Mining Waste in Pre-Accession Countries
RMSG	Raw Materials Supply Group
SAR	Synthetic Aperture Radar
SDIMI	Sustainable Development Indicators in the Mineral Industry
SU	Sokolovská Uhelná a.s.
SWOT	Strengths, Weaknesses, Opportunities and Threats
TAU	Tel-Aviv University
TMR	Total Material Requirement
UNCTAD	United Nations Conference on Trade and Development
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
US-EPA	United States Environment Protection Agency
USGS	United States Geological Survey
UVSQ	Université de Versailles – St Quentin
WI	Wuppertal Institut für Klima, Umwelt, Energie GmbH