South West
Centre of Excellence in Satellite Applications

CATAPULT
Satellite Applications

SATELLITES SUPPORTING THE SOCIAL IMPACT OF MINING

Social Impact of Mining Spark Session Output Report

V3 MAR 2021

SATELLITE APPLICATIONS CATAPULT

Supported By:

UK SPACE AGENCY

Report complied by Joel Freedman - Regional Innovation & Design Lead, Satellite Applications Catapult

Contents

Executive Summary

On February 10th 2021 a Spark Session was carried out by the Satellite Applications Catapult in partnership South West Centre of Excellence supported by the UK Space Agency.

This workshop explored opportunities for satellite technology to address the social impact of mining on local communities. These areas were:

Illegal, Unreported & Artisanal Mining

Community Engagement

The session was attended by over 40 organisations from a wide range of cross-sector organisations including representatives from South West Centre of Excellence, Small and Medium Enterprises, academia and a range of space technologists.

The list of participating organisations can be found at Annex 1.

Participants brainstormed multiple ideas for new opportunities before choosing two high impact ideas to develop in more detail. These ideas were:

- Identifying and categorising mining automatically through a set of indicators.
- Benefitting local mining communities using satellite data.

Introduction

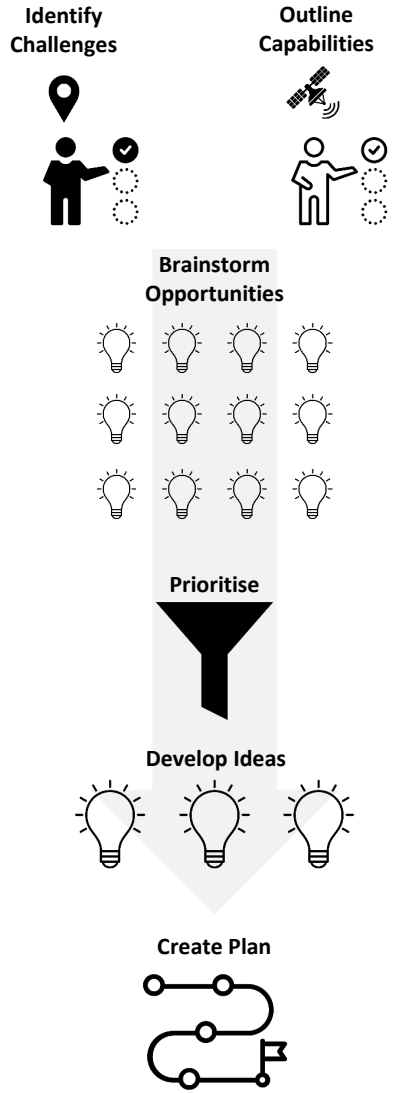
The Spark Programme

The Satellite Applications Catapult (SAC) is a part government funded not-for-profit technology and innovation organisation, created to grow the UK space sector. As part of a programme of work funded by the UK Space Agency, SAC is conducting a series of Spark Sessions across the UK. These sessions are designed to identify high value opportunities for space technology in areas of strategic regional importance.

Sectors and groups of regional priority have been identified through SAC's Regional Centres of Excellence in Satellite Applications, and key stakeholders from these groups have been brought together in order to plan and deliver each spark session.

Before a Spark Session takes place, research is conducted within areas of interest to identify and validate topics that are of most interest. Based on this research the SAC team prepares a series of examples of relevant satellite capability which is presented on the day. Following that presentation, the Spark Session encourages participants to generate ideas for how satellite technology can address key challenges. These ideas are then prioritised, and those that emerge as being of most interest are developed in more detail in order to outline a plan of action to make them happen.

The value of Spark Sessions comes not only from the ideas taken forward on the day, but in the awareness raising of communities around the value that satellite technology can bring, and in building momentum toward a larger programme of future collaboration and long-term innovative solution development.

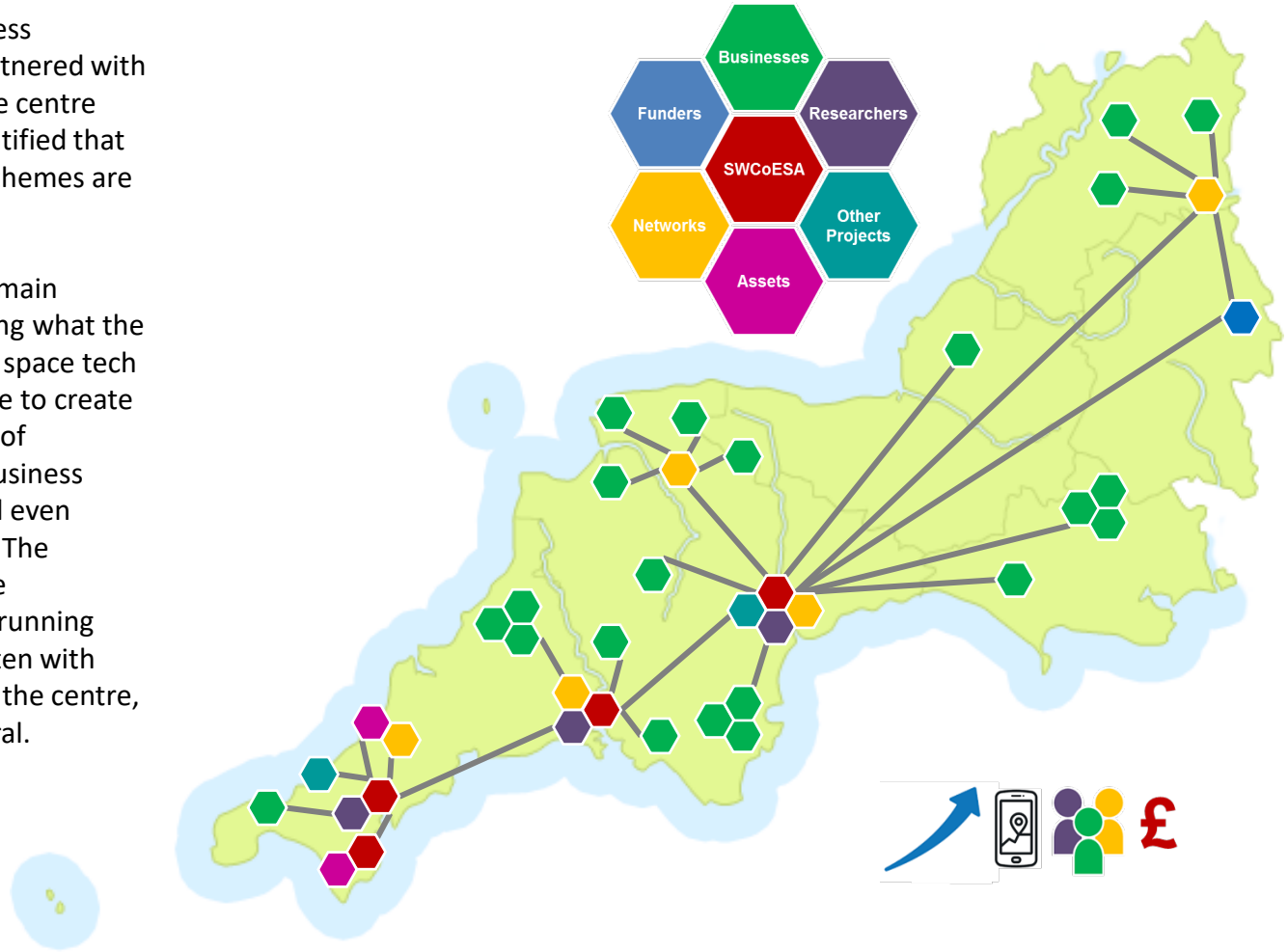


Introduction

South West Centre of Excellence in Satellite Applications

The South West Centre of Excellence is a regional team of business development and support staff based across the south west. Partnered with three major SW universities, Plymouth, Exeter and Falmouth, the centre provides thematic leads/experts on several of the key areas identified that are particularly relevant and of interest to the local area. These themes are health, marine and cyber security.

The SWCoESA engages businesses, largely in line with the three main themes, to offer support and exchange knowledge while assessing what the opportunities are for the SW based businesses to use and adopt space tech to optimise and improve their products and services, or of course to create new products and services entirely. This could come in the form of signposting to other UK based space tech companies, offering business design sprints, offering desk space at one of our space hubs, and even helping or leading in funding bids to get projects off the ground. The SWCoESA also raises awareness for space tech and what satellite applications, funding and general opportunities are available by running events, currently mostly online, such as workshops and talks, often with guest speakers, to help spread the word and increase interest in the centre, the Satellite Applications Catapult and space innovation in general.



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Overview

Session Aims

At the beginning of the session participants were invited to share what they aimed to achieve from the session. These aims are summarised below. Although some very specific aims were identified, consistently the session attendees were focusing on the sharing of information to help understand how satellite technology can support the two key opportunities for the social impact of mining

- Develop at least 3 ideas which can be developed further with mining companies & funders
- Engage with others to share knowledge, problems and solutions
- Increase interest in an innovative project in social challenges
- Understand new ideas of how satellite technology can aid managing mining operations
- Increase understanding of satellite technology for community engagement
- Explore the technical opportunities & limitations of EO
- Refine the social challenges use case & understand how we can make scalable satellite solutions with sustainable business model(s)
- Understand other ideas and share thoughts on how satellite technology can monitor mining activities
- Understanding more about the prevalence of artisanal mining and associate issues
- Create opportunities for collaborative consortia tackling key mining challenges

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Overview

Technological Context

The satellite sector is undergoing transformational changes, leading to a greater amount of accessible data, higher spatial resolutions, lower latency communications, automated analytics and diversified business models.

Huge investment by satellite operators in communication systems are seeing the growth of new satellite mega-constellations promising high bandwidth, low latency, secure communications that will rival current fibre options and disrupt the communications market. The UK Government has recently acquired OneWeb, which promises to deliver a UK sovereign communication and navigation capability expected to begin supporting service delivery within the next five years.

As 5G rolls out across the UK, developments are being made on the hardware and software with the capability to seamlessly switch between modes of communication, from cellular, to satellite, to low power wide area networks such as those used for the Internet of Things.

The Sentinel missions, part of the EU's Copernicus Programme, are striving toward continuous global earth observation coverage which, though coarse in resolution, is open and available to all, and capable of generating valuable insights. Meanwhile an increase in commercial satellites and constellations are delivering new medium and high-resolution satellite images across the planet multiple times per day.

In parallel with more data, improvements in cloud storage and processing are reducing the hardware requirements necessary to utilise satellite imagery and increasing accessibility. Developments in AI and Machine Learning are enabling data processing and analysis on unprecedented scales and speeds, leading to rapid insights from imagery, along with a significant evolution of autonomous system's capability to make quick decisions in place of human operators. This provides an opportunity for reduced risk, reduced cost, increased efficiency in operations across numerous sectors.

As the cost of new hardware goes down and available data and connectivity coverage goes up, we find ourselves entering a new era of ubiquitous connectivity and geospatial insights enabling new autonomous, connected, and smart systems monitoring and operational systems never-before possible.

There are a broad range of sectors poised to take advantage of these developments, however the key to successful technology development is early identification of the challenges it helps us address.
Whilst the Satellite Applications Catapult is working at the forefront of these technologies, it is the end user communities who will drive innovation.

Overview

Structure of the Day

The Spark Session was conducted fully virtually using a combination of Zoom and Miro. Miro is an online collaborative whiteboard tool that enables multiple users to contribute to shared virtual space.

The day was structured in order to remind participants about the aims and objectives, review the challenges that had been identified, present satellite capabilities, and then develop ideas for new opportunities.

The approach taken has ben developed and delivered by SAC over several years to enable and encourage a collaborative approach to innovation across wide groups of stakeholders. Participants are split into groups based on shared areas of interest, given an opportunity to brainstorm individually based on the capability presentation they will have just seen, and then encouraged to discuss and cluster their ideas into groups and themes. Once discussed, these ideas are then voted on based on agreed prioritisation criteria, such as:

- *Highest value*
- *Biggest impact*
- *Quick wins*
- *Links to ongoing initiatives*

Once ideas have been prioritised, groups then focused their attention on refining the top one or two ideas in order to better understand the opportunity, the requirements, and develop high level actions as next steps. Co-creating strategies for idea development can build commitment between participants and a shared sense of ownership which can be a driver for implementation.

In order to further develop prioritised ideas, groups were asked to answer the following questions:

1. **Describe the current context** (what is happening right now and why is this a problem?)
2. **Describe the opportunity** (what would you like to happen? What value would this bring?)
3. **Outline the technical solution** (what is required and how might it be used?)
4. **How do we go from today to a solution?** (what steps are required and who needs to be involved?)
5. **How might this be funded?** (are there any ongoing initiatives that this could link into?)
6. **What are the next steps?** (who should take them?

The session conducted on the 10th of February 2021 had roughly 50 attendees and was conducted from 9:30-13:00.

What follows in the report is a summary of the ideas that were developed as part of the brainstorming, and a write-up of the ideas that were developed in more detail.

Annex 3 of this document contains a list of all ideas developed, and Annex 4 contains screenshots of the Miro boards created on the day.

Illegal, Unreported & Artisanal Mining

Summary of Top Ideas

Identification & categorisation of illegal, unregulated & regulated mining using satellite technology

Top voted idea

Creation of a list of applications & companies monitoring illegal mining using satellite technology

Top voted idea

Prevent reoccurrence of illegal mining and identify alternative sources of income for displaced workers

Creating a list of knonw artisanal operations from remote sensing and local data.

Identify pain points for organisation in the supply chain and how satellite technology can support them

Top voted idea

Idea Taken Forward:

Identifying and categorising mining automatically through a set of indicators derived from remote sensing data

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Idea Development

Identifying and categorising mining automatically through a set of indicators

The Context

In many parts of the world where mining activity is happening, it is spread over vast and remote areas. This means that mapping to build an up-to-date picture of activities often requires on the ground data capture, which is costly, logistically complex, and often has high associated risk.

Across these vast regions, the mining activity occurring may fall into a number of categories, from legal large scale industrial mining, to Artisinal Small Scale Mining (ASM), to illegal and criminal mining activities. Monitoring these activities can enable a number of critical services, from auditing, to compliance monitoring, environmental monitoring, and law enforcement.

However, as the activities being monitored are often extremely dynamic, where monitoring is not happening on a regular basis (sometimes in the region of every two years), data can often be too out of date to be useful when required.

Current remote sensing capabilities can be harnessed to monitor wide areas of land on a regular basis, both using freely available lower resolution data, and higher resolution paid for data. However, with such vast amounts of data coming in, and such a variety of changes being looked for, there is too much work for it to be done at any meaningful scale by human capacity alone.

The Proposed Solution

By utilising the latest data analysis tools, machine learning algorithms can be trained to look for specific indicators in remote sensing data that are indicative of specific types of activities.

This enables a birds-eye view of vast regions to be rapidly analysed in order to identify trends and changes that require attention. Though there are geographical challenges which may dictate the data type chosen, the range of available datasets is generally able to overcome these. For example, Synthetic Aperture Radar (SAR) imagery is able to see through clouds and at night, easily identifying man made machinery and changes to water courses.

A baseline map of activities and indicators could then form the basis of a number of services for both government, industry, and academia.

In order to further this concept, an integrated working group of key stakeholders and technologists should be assembled in order to carry our research onto available solutions. Following this, key areas of interest should be identified as case studies to help train initial indicator sets, before a demonstrator is created to prove the value of the concept.

This can be used to identify the most suitable customers in different locations in order to develop a commercial MVP.

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Community Engagement

Summary of Top Ideas

- **Development & designing mining sites using satellite technology** — *Top voted idea*
- **Using satellite technology to establish an environmental baseline** — *Top voted idea*
- **How satellite technology can provide opportunities to tackle mine site & mining crime**
- **Engaging with local stakeholders and communicating benefits of mining** — *Top voted idea*
- **Monitoring the compliance of mining companies** — *Top voted idea*
- **Fusing satellite data with other complementary geospatial datasets**
- **Communicating geotechnical data with stakeholders**
- **Creating reliable satellite solutions for many geographic locations**

Idea Taken Forward:

Benefitting local mining communities using satellite data to provide key services

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Idea Development

Benefitting local mining communities using satellite data

The Challenges

Communities around which mining activities are planned will often protest and attempt to prevent said activity taking place. This is mainly due to the negative associations of having a mining site in the local area. They are known to damage the local environment and create health and safety hazards, whilst taking the wealth of the land away to another place. All this, with little perceived upside to the local community, and little information that can be easily digested.

By neglecting to consider the benefits that a mine could bring to local communities, and developing strategies to deliver long-term benefits, it is no surprise that there are often violent protests to this activity taking place. Where there are benefits funded by a mining operation, those benefits (whether they be schools or community centres) may then lose funding as soon as the activity has stopped.

However, by utilising satellite technology (that will need to be integrated by mining companies for operational purposes out with the local community), and working with communities to understand their needs, there is an opportunity to create services that will enable lasting benefits to communities, which may tip the balance in such a way that communities actively seek the opportunity to have mining activity near them.

The Proposed Solution

The creation of a set of underlying e-learning, e-health, and other community services enabled by satellite communication, which can form part of a package of support available to local communities. By coordinating with NGOs and local government, these tools can be customised to suit community specific needs.

Remote sensing data can also be used to create visualisations of activity that are digestible and meaningful to communities so they stay informed and educated about the activity happening around them. This could be all be delivered through an existing community centre, or involve the creation of a new location for the delivery of these services. However it is positioned physically, it should be available for all community members to access appropriately.

In order to take this forward, a pilot project should be developed with a location where existing relationships with communities and local government can be leveraged. Communication also must be made with the mining companies to make them aware of the opportunity, along with an overview of relevant socio-economic policy and regulations that this activity would support them to meet.

A working group should be formed in order to take this idea forward, finding funding to develop the MVP, and running key stakeholder engagements in parallel.

Relevant Regional Activities

Camborne School of Mines / Deep Digital Cornwall

Camborne School of Mines is a critical friend and associate of the South West Centre of Excellence and is a department within the University of Exeter which is one of the Centre's partners. The school is based at the Penryn Campus in Cornwall but it's impact is felt world wide.

The school is well known for its research and practical mining and geoscience capabilities and facilities that include chemical and mechanical labs. It is, headed by Prof Kip Jeffrey, is part of the larger College of Engineering, Maths and Physical Sciences at the University and produces great research outputs through its many senior academics.

CSM has been partners on several SWCoESA/Catapult projects including the recent Satellites For Batteries project and the ARISE autonomous robot project. They continue to be a great source of expertise in mining and geoscience for the mining themed activities of the SWCoESA and are normally the first port of call for academic partners in any project not only in Cornwall but nationally and globally.

The **Deep Digital Cornwall** project is recently ERDF funded £4million project won by Prof Frances Wall at CSM, University of Exeter. The project now has several full-time members of staff including professional services staff and academic fellows. The project aims to offer support to SME's in the county of Cornwall whose projects and businesses specialise or operate in underground environments which could include mining, geoscience, civils, constructions, geotechnics, agriculture and more.

There are small pots of funding available to eligible companies and projects ranging from £5-100k to develop ideas empowered by various key technologies such as AI, VR, remote sensing, machine learning, big data and more.

The project is partnered with the SWCoESA such that a member of staff on Deep Digital Cornwall is considered part of the SWCoESA, an academic research fellow focussing on EO and remote sensing for the SME's that may go through DDC or the SWCoESA.

On 1st December 2020 the South West Centre of Excellence and Satellite Applications Catapult Extractives Team hosted an online webinar event called "Space Tech to Solve Social Challenges in Mining". Speakers included Wardell Armstrong, University of Oxford and CSM.

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Relevant Catapult Activities

Extractive Industries Value Stream

The Satellite Applications Catapult Extractive Industries Value Stream has previously worked on projects that have explored the use of remote sensing to identify indicators of mining activity that can be cross referenced against known mining sites.

By analysing features such as deforestation, building of new roads, changes in river shapes, and new buildings or machinery, machine learning systems can be designed to give a probability certainty of mining activity. Whilst this technology has been explored, the Catapult is keen to discuss further opportunities to develop commercial services with suitable partners.

The Catapult has also developed and deployed immersive 2D and 3D visualisations to successfully communicate the socio-environmental impacts of mining operations to local communities, even in remote areas.

The data interpreted by the satellite imagery could be correlated by terrestrial IoT checkpoints – for e.g. to see where pollution originates and where potentially it can end up (measuring chemical makeup of water for e.g at different water catchment locations in the area – satellite enabled IoT).

Regarding to communication capability, the Catapult is involved in numerous projects exploring the delivery of satellite communication enabled services in remote locations, which could support the provision of community support materials. The Catapult also has strong links to service providers who could support delivery of such materials today.

Specifically, expertise gathered from projects focusing on providing Education for communities around mines in **Mexico**, healthcare along the **Amazon** river, and remote healthcare services in **Scotland** may have key insights that can be utilised.

There are some specific organisations, such as Ubuntu Power, who provide solutions to communities using renewable energy resources that can be enabled by satellite communications, which the Catapult has worked with in the past, and as such can facilitate introductions.

If you are interested in finding out more about technological capabilities, or discussing future collaborations, please contact one of our experts:

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Head of Communication Systems Engineering
Ashweeni.beeharee@sa.catapult.org.uk

Anastasia Bolton
Business Development Manager for Extractive Industries
Anastasia.bolton@sa.catapult.org.uk

Alice Bird
Extractive Industries Lead for South-West UK
A.P.Bird@exeter.ac.uk

Recommendations

The ideas outlined in detail represent one part of the broader opportunity highlighted in the workshop to utilise advanced satellite technology to support high impact applications to reduce the negative social impacts of mining and increase positives.

That they were voted on by workshop participants to be explored in more detail indicates a willingness from the community to pursue and engage in next steps. While each concept has its own set of specific next steps to follow, there are some cross cutting approaches to continued engagement that this report recommends.

- Primarily this report should be fed back to participants in order to capture any further feedback or input.
- Participants should be asked explicitly which ideas they would be interested in being involved with, as well as any other stakeholders who should be included in the creation of primary working groups.
- Working group meetings should then be set in order to capture further detail on how ideas outlined link to ongoing initiatives and determine development routes.
- Technology demonstrations supported by the SAC should occur across working groups based on underpinning capabilities outlined in this report.
- Initial opportunity prioritisation based on:
    - Stakeholder engagement
    - Funding landscape / opportunities
    - Perceived impact
- Conduct deeper dive study to understand key requirements for idea and map technology landscape in order to create clear use cases.
- Use cases should have
    - Real-world scenarios of use with an understanding of how key stakeholders currently operate
    - Identification and understanding of challenges faced by current approaches
    - Information on impact of challenges (economic, environmental, or social)
    - Proposed service journey of how technological solutions could address key challenges
    - Assessment of impact of proposed interventions.
- Utilise use cases to run cost benefit analysis on ideas
- Secondary prioritisation can then be based one:
    - Outputs of the cost benefit analysis
    - Resource availability
    - Continued stakeholder engagement
- Utilise research to create a proposal that can be shared with academic institutions and industry in order to find delivery partners for project opportunities and unlock funding (either industry or grant funded).
- In parallel with this work, a review should be carried out of the broad list of ideas generated to identify opportunities for development that aligns with other ongoing initiatives and activities.

Annex 1: Attendee List

Organisations Registered

Accenture
AeroSpace Cornwall
Alcis Holdings Limited
Altus Strategies
AssetAssurance Monitoring
Camborne School of Mines - University of Exeter
CGG
EO Consultant
Famas Integrated Geoservices Ltd
GlobalTrust
Godrej Aerospace
Insta Associates
Institute of Physics
Levin Sources Limited
Masae Analytics
Mining & Sustainable Development Ltd
NanoAvionics (UK)
Nebula 42
North Coast Consulting Ltd
Novojy
Pixalytics
PRI
Principles for Responsible Investment
Queens Belfast
Rock Solve
Rosacom Ltd
Satellite Applications Catapult
SJK
South West Centre of Excellence in Satellite Applications
Spatial Business Integration GmbH
STFC
The Signal Group
Universidad Tenologica Nacional
University of Leicester
University of Nottingham
University of Oxford
University of Portsmouth
Veritas Imagery Services Ltd.
WAI
Wardell Armstrong International
Wegrowgreentech.com
Xylene GmbH
Zimble Analytica LLC

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Annex 2: Miro Boards

Filled out on the day – See Attached Doc

Challenge Area 1:

Illegal, Unregulated, Artisinal Mining

Need to create a warning system when sensitive areas might be impacted, this way intervention can be prioritised.

Monitor dumps at closed mine workings to identify illegal activity. (This is a problem in South Africa where illegal mining in closed shafts often results in death).

Need to quantify the impact on environment and communities that these activities have

Need to estimate the amount of mercury dumped in the environment based on the historical activities. Can we identify hotspots?

Human rights violations and child labour - bad for obvious reasons

Covering large areas on foot/in person searching for illegal mining activity is labour intensive and therefore expensive for gov bodies and mining operations to stay on top of

Currently often using aeroplane surveys for monitoring activity which is £££ & time consuming & labour intensive

Can we calculate volume of Earth removed /extracted by artisanal miners at these unregulated sites?

What alternative economy can be derived from the local area if mining activities are stopped?

Volume change mapping can certainly be used to make estimates for this. However especially for small scale mining, high resolution stereo data would be required which is not cheap. - Ed Sage

Challenge Area 2:
Community Engagement

Recent monitoring of site activities viewable by local stakeholders

Rehousing and displacement of residents for construction of mine is always a challenge, new communication tools might go a long way

Some studies have shown that increased use of technology (e.g. autonomous trucks) can lead to decreased trust with communities - Could this be a problem with satellite use? Especially where understanding of satellite technology is low. How can we get these communities to trust satellites and associated data?

Safe placement of community homes and buildings / safe placement of tailings. Do communities grow close to the tailings because the land is already cleared? Analyse risk areas from topography.

Sending large exploration teams in early stages often creates a bad atmosphere with local communities straight away

Local infrastructure and road systems. Are the current roads sufficient to use for large concentrate trucks etc. Will this be a source of noise and dust pollution to local communities. Analyse road network systems and surface types.

Water resources and security. If the project is going to alter the water course this can have a massive impact on local communities that are dependent on the water source. Analyse existing water courses and groundwater levels.

Community Engagement
Alice, Anastasia, Electra, Conrad, John

GROUP 1 - IDEAS BOARD - *30 minutes*

INSTRUCTIONS:

1. **INTRODUCTION** (5MINS)
2. **INDIVIDUAL BRAINSTORM** (5MINS)
3. **DISCUSSION & CLUSTERING** (15 MINS)
4. **VOTING** (5MINS)

Create a trusted forum in which end users can engage with the mining companies

often companies are reluctant to do full/extensive community engagement, can satellite imagery aid in their understanding as well as the communities themselves

How to get satellite application solutions into the hands of those that need it

Showing local communities how they will benefit from the mine/mining operation - how can satellites help?

Using satellite communication technologies to improve local social infrastructure such as health services and education

Provide a public tool to create situational awareness of the mining activity to encourage best practise in and around the mine

Refine the biggest challenges facing local communities (e.g. Employment, health , education, mistrust in the mining companies, pollution, environmental degradation etc0>

How can satellites help the "design" of a mine in order to take local community concerns into account?

Establishing an environmental baseline for the local area before mining operation starts.

Using satellite data to help with the EIA and SIA (planning stages)

how to meaningfully engage with local communities

How can Space data/3D modelling/immersive tech be used to help Mining companies engage with local communities to obtain buy-in as soon as possible?

Live environmental monitoring available to stakeholders

Allowing local communities to better shape the development of a mine site and the future closure plan

Follow remediation activities

Creating satellite solutions which can be repeatable over many geographies with minimal ground base and human intervention

Can we create visual tool with EO to support understanding of changes in the area. Community can see social benefits (schools, hospitals, other - before and after?)

Use satellite technologies for governments to monitor regulatory compliance

Governments need to introduce country/region specific ESG targets as part of the licencing regime

To re-assure the investment community that their mining portfolio is carrying out appropriate ESG measures

Can we use satellite technology to detect, deter and investigate conflict minerals?

Challenge: Completing InSAR over mine closure sites is already somewhat a challenge given the encouraged vegetation growth. So deployment of Corner Reflectors (Artificial radar reflectors) is sometimes required. Closed sites are not always staffed and trespassing and vandalism can be a problem.

Geotechnical stability of open pit/ underground/ tailings facilities open data to stakeholders

What are the opportunities for satellite technology to verify responsible sourcing and determination of geological and geographic provenance.

What do we do with the satellite data when it suggests illegal mining takes place?

Fusion of satellite and other complimentary geospatial datasets

Use geospatial information to produce 3D model of what the infrastructure would look like, in order to get local buy-in.

TOP IDEA SUMMARY:

Using satellite communication technologies to improve local social infrastructure such as health services and education

Using satellite communications and earth observations tools to benefit local stakeholders and mining companies/workers by improving, introducing and providing innovative infrastructure such as facilities for health, education and cultural understanding

This has to be accessible to all affected communities, that might be very remote and with high levels of illiteracy.

IDEA DEVELOPMENT BOARD 1 - *30 minutes*

WHAT CHALLENGE ARE YOU SOLVING?

WHAT'S HAPPENING RIGHT NOW? WHY IS THIS A PROBLEM?

Local communities against the planning & building of a new mine.

The management of geohazards and mining hazards

Angry / violent protests against new / expanding mines.

Local communities concerned about the danger's and H&S impact of local mines (e.g. tailings dams etc.).

Local communities concerned about the enviornmental impact of local mines.

How do we get to "I wish we had a mine near us!"

Local concerns about the long term impact of the mining site

Local communities misunderstand the benefits, not seeing any profit.

No benefits being planned for local communities, they see the mine as a negative thing.

How can you ensure long term benefits that do not turn negative, if these are funded by the mine, what happens to the schools/centres when the big stops and the money stops.

It is the communities land prior to the mine, so why not get them more involved in the closure and remediation. Make them part of the process.

Relationship between mining, community, government not established clearly who should, must do what.

language barrier

Overseas mining staff brought in have little understanding of local customs and culture

The plans for the mine and related activities are presented to local communities in such a way that it is difficult for them to understand.

Local people may not have education on geology or mining which only mystifies the mine more

Effective communication using satellite imagery will enable the local context, relevance and opportunities of the mining investment to become better understood.

WHAT SOLUTION ARE YOU PROPOSING?

HOW MIGHT TECHNOLOGY BE USED? WHO MIGHT THE USER BE?

Work with local communities to understand whether the mining company can easily offer other supporting community services, and what these would be.

Work with (local) gov't to create e-learning, e-health and other satcoms-enabled services that would greatly benefit local communities.

Satcoms is an enabling technology - need also to work with local authorities, administrations and/or NGOs to integrate satcoms capabilities with education, health or other social needs/services.

Use these immersive visualisations to keep relevant stakeholders up-to-date with mine developments, and use these as a way of local input/feedback.

Use of satellite technologies to develop immersive visualisations of the mine/mining area so that local communities can understand the mine impacts and benefits.

creation of a physical entity/ location within the community where locals can come and interact with the information etc.

Create virtual tracking of changes with EO's help

Integrate and/or piggy-back community broadband access with mining operational satcoms infrastructure

Tool created could be accessed by all stakeholders: mining, community, local govs.

Clarify policies on future comms: how mining shares, what are responsibilities, its embedded into future comms (space) policies.

Use of 3D digital models to show the development of infrastructure, mine and environmental changes.

This could be very expensive to run

Fusion of Space-enabled data/geospatial data (drones)/3D modelling/immersive tech used within stakeholder 'hubs', to educate, improve engagement, generate local community 'buy-in' and empowerment (local communities to become part of the process).

Development of real-time updates on exploration and mining, using visual imagery.

HOW COULD THIS BE TAKEN FORWARD?

HOW COULD THIS BE FUNDED? WHAT ARE THE NEXT STEPS?

Establish if any regulatory frameworks need to be set up or if they exist and need to be followed.

Pilot project where the engagement with local communities begins right at the start of the mining activity.

Need buy-in from (local) gov't and a local community to participate, as well as a mining company.

Funding opportunities & join forces with other networks/initiatives (immersive tech, digital twins, 3d modeeling, drone data etc.) to develop a fusion of Space-enabled data/geospatial intelligence/3D modelling/immersive tech to be used within stakeholder 'hubs', to educate, improve engagement, generate local community 'buy-in' and empowerment (local communities to become part of the process).

We need buy-in from governments to implement policies, reccomendations, tax nelifs (other tools) for mining to be able to implement new TECH.

Need to engage with national administrations and/or NGOs to understand what satcoms capabilities are needed to support education, health or other social needs/services.

Need to engage with mining companies to make them aware of the possibilities of satcoms for social engagement and buy-in

First and foremost create a business model. Really identify the end users as well as who is paying

Need to ensure that the comm.system and plan to these new community services continue beyond the end of the mining activity (e.g. the schools don't close). Engage with NGOs and gov't and tech companies to create a viable business/service plan.

Leverage government innovation funding to create feasibility

This is not just about governments! It is also about the investment community and ESG metrics

Once proved gov't keen to pay for more of development

Engage at both Government and the local level.

Appoint a single contact throughout the project.

We need buy-in in mining as well - they need to see benefits for them! So talk to mining and invite to pilot projects which could be funded by gov money at first.

We need to pitch mining to space! Comms must cover this angle from the beggining! So satellites developed to include those capabilities.

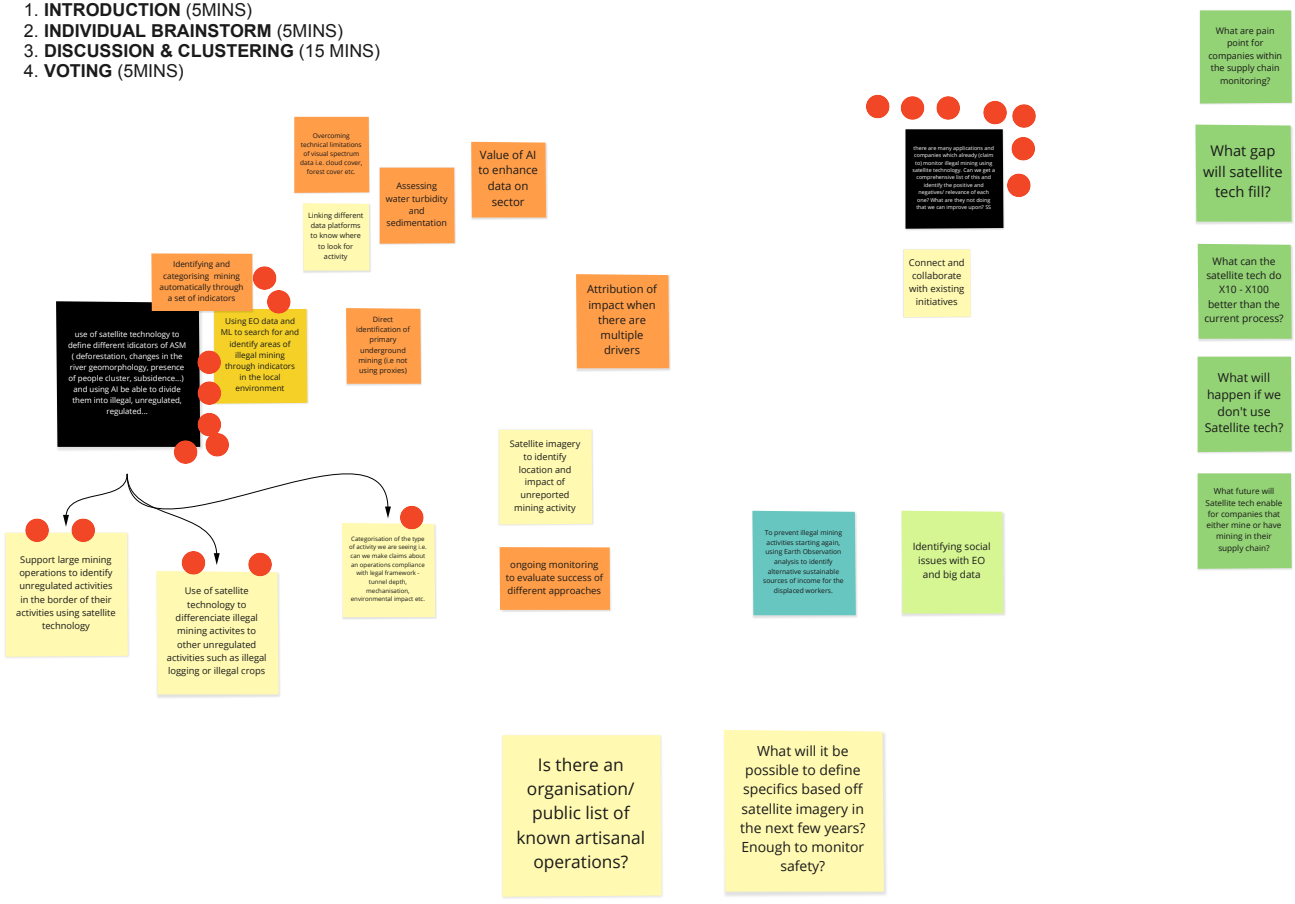
Be aware of any existing initiatives, and see if we can link in to one.

Illegal, Unreported, Artisinal
Joel, Emma

GROUP 2 - IDEAS BOARD - *30 minutes*

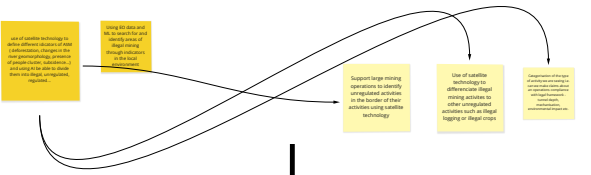
INSTRUCTIONS:

1. **INTRODUCTION** (5MINS)
2. **INDIVIDUAL BRAINSTORM** (5MINS)
3. **DISCUSSION & CLUSTERING** (15 MINS)
4. **VOTING** (5MINS)



identifying and categorising mining automatically through a set of indicators

TOP IDEA SUMMAR:Y



IDEA DEVELOPMENT BOARD 2 - *30 minutes*

WHAT CHALLENGE ARE YOU SOLVING?

WHAT IS HAPPENING RIGHT NOW? WHY IS THIS A PROBLEM?

Currently unable to map huge areas in very remote regions

Activities being monitored are very dynamic, so even after a year it will have changed a lot

the cost and logistics of having people on the ground is unmanageable

Remote sensing is a fundamental technology to monitor across wide-area, currently it is getting updated every two years, by the time the data is there it is too late

To really understand over large areas there is no other way to monitor using regular satellite imagery

WHAT SOLUTION ARE YOU PROPOSING?

HOW MIGHT TECHNOLOGY BE USED? WHO MIGHT THE USER BE?

Birds eye view across the breadth of ASM over large regions regularly updated giving trends and patterns

Identifying impacts

Identifying a set of indicators from satellite imagery that can be identified via ML / AI

Which indicators are technologically viable and commercially feasible

Utilising free data can give useful insights

SAR data can see through clouds for areas usually cloud covered

gives such large areas you would need ML to look for changes

Challenges from SAR data that may obscure different data that must be used

Baseline map of indicators and activities that can be accessed and utilised for other purposes

Good for Auditing companies

Law enforcement

alerting exploitation and local mining can be a good indication of illegal activities nearabouts

Environmental monitoring

Compliance monitoring

Support large mining companies to identify unregulated activities in the border of their activities using satellite technology

HOW COULD THIS BE TAKEN FORWARD?

HOW COULD THIS BE FUNDED? WHAT ARE THE NEXT STEPS?

Create working group to carry out research

Identify indicators are technologically viable and commercially feasible

link to existing research institutions

List of existing services along with pros and cons of each to identify the gaps

Demonstrate the value of a general product that can build interest in different user communities.

who might the fully committed end users

Need to understand user needs in order to define how a service should be positioned