

Space-based Innovation and Digitalisation for the School of Tomorrow

Use Case 3: Digital learning for STEM Education

<sup>02 November 2022</sup> Volker Schumacher European Space Agency

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### WELCOME TO THE WEBINAR!

### Before we start...

- Due to the number of attendees, please keep your microphones muted at all times and switch off the webcam function.
- You can use the conversation function anytime to submit your questions. They will be addressed during the Q&A at the end of the webinar.







## Agenda

- 1. Brief introduction: European Space Agency, ESA Space Solutions
- 2. Space-based Innovation and Digitalisation for the School of Tomorrow
  - I. Background and Objectives, example scenarios
    - Guest Speaker Prof Alexander Siegmund (Heidelberg University of Education): STEM education in schools
- 3. How to apply?
- 4. Open Questions & Answers session

•eesa SPACE-BASED INNOVATION PACE SOLUTIONS AND DIGITILISATION FOR THE SCHOOL **OF TOMORROW** Use Case 3: Digital learning for **STEM Education** 

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### THE EUROPEAN SPACE AGENCY

### **Purpose of ESA**

To provide for and promote, for exclusively peaceful purposes, cooperation among European states in space research and technology and their space applications.

### Facts and figures

- Over 50 years of experience
- 22 Member States
- 8 sites across Europe and a spaceport in French Guiana
- Over 80 satellites designed, tested and operated in flight

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### space transportation

earth observation

### science

### human spaceflight

### telecommunications and applications

### navigation

## exploration



### technology -

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ESA BUSINESS APPLICATIONS

Looking for sustainable business



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### **ESA SPACE SOLUTIONS**

The largest space innovation network in the world

- The go-to place for doing business involving • space to improve everyday life.
- Supporting European start-ups and SMEs to • develop businesses using space technology and data.
- Offering funding, business and technical support to help to generate successful business and create jobs.

### ESA SPACE SOLUTIONS OFFERS

· eesa SPACE SOLUTIONS



Zero-equity funding (from €50k to €2M+ per activity)

A personalised ESA

Technical support and commercial guidance

Tailored project management support

Access to our international network of ESA and partners

Access to our network of investors

Credibility of the

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## A tool at your disposal – the Ambassador Network

- Ambassadors are present in 9 countries
- They are your local interface for your ESA Space Solutions questions
- They can advise you on:
  - Preparation of the Activity Pitch Questionnaire
  - Give you an overview of ESA Space Solutions funding opportunities







## Space tech, users & markets

### Project web pages: business.esa.int/projects



### Space Technology...



Earth Observation



Satellite Navigation



Satellite Communication



Spaceflight Technologies



Space Weather **Big Data analytics** VR/AR Artificial Intelligence Mega-constellations Crowdsourcing IoT Cybersecurity Blockchain

... coupled with...

5G (https://artes.esa.int/esa-5g6g-hub)



## → USER-DRIVEN ACTIVITIES

involvement of user communities and relevant stakeholders



### **FEASIBILITY STUDY (9 months)**

Preparatory activity to assess and define new potentially sustainable applications and services

- assess the technical feasibility and commercial viability of service(s) able to meet the needs and conditions of relevant user community(ies),
- consolidate the business strategy
- secure the buy-in and involvement of important customers/users for the further implementation and market roll-out,
- reduce technical and commercial risks
- prepare a potential follow-on demonstration project

### DEMONSTRATION PROJECT (12-24 months)

- implement and perform a pilot/preoperational demonstration of the services with the involvement of relevant users
- validate the business case and undertake business development activities to ensure successful service roll-out
- deliver a **minimum viable service** after the conclusion of the demo project

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ESA will bear up to 50% of the eligible total project costs. The remainder has to be financed by the Tenderer through private sector directly and/or indirectly via co-funding and/or by the users based on terms and conditions to be agreed upon. Micro, small and medium-sized enterprises activities can be funded up to 80% by the Agency, depending on the funding level authorised by the related National Delegation(s).



### Value of Space

### Space assets can play a key role in the development of services in education:

- Satellite Communication (SatCom) can:
  - Provide connectivity where terrestrial communications are insufficient to enable tele-education
- Satellite Navigation (SatNav) can:
  - Enable applications in the virtual reality (VR)/augmented reality (AR) environment
  - Validate the access to the virtual platform based on the location of the pupils and the time when the access is done
- Satellite Earth Observation (SatEO) can:
  - Provide collection of data for production of images and maps, e.g., to provide relevant parameters into the VR/AR environment used for the competition or for the training (e.g., geographical maps)



Satellite Navigation

Global Positioning Navigation Velocity Precision Timing Activity Tracking Route Optimisation Personal Security



Satellite Communication

Reliable and Secure Communication

Remote Connectivity (maritime, oil rigs, undeveloped areas)

Backup to Terrestrial Infrastructure



### Earth Observation

Land, Sea, Air Monitoring Resource Mapping Environment Sensing Change Detection Weather and Pollution Forecasting Chemical and Physical Properties Detection



## **ESA Education**

### The ESA STEM programme, for the school level

- ESA's education programme for the school age largely focuses on formal (curricular) school education and makes use of space as a teaching and learning context for STEM disciplines at large
- Space for Education 2030 fast track for the future, objectives
  - Support society in providing a long-term response to the emerging global socio-economic challenges (climate, energy, resources, health, safety) – and to support emerging economic sectors and megatrends (digital, green, and more), by means of education.
  - Support ESA's Agenda 2025: building the human capital that the rapidly evolving space sector needs to remain competitive





### https://www.esa.int/kids/en/home

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### ESA BUSINESS APPLICATIONS



space solutions

## **Robotiphy Severus**

- **Robotics Enablement Platform** with Space Asset Plugin Service for the virtual programming of robots through highfidelity "Digital Twin" technology
- a virtual simulation software in which students have their own personal fleet of robots that they can access online anytime, from any device, anywhere in the world. Students learn how to programme their robot companions to complete missions in high-fidelity simulations of real-life environments.
- The life-like in-browser simulations in Robotify are powered by software which pulls Digital Elevation Models (DEMs) and Earth observation (EO) data straight into Robotify's inbrowser engine
- Prime: Robotify Labs Limited (IE)

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Students using the platform. Image credit: Robotify

#### https://business.esa.int/projects/robotiphy-severus



### ESA BUSINESS APPLICATIONS



#### space solutions

### **Space for Children**

- Medical edutainment experience, based on Interactive technology and playable in smartphones and tablets
- USP: allows medical staff to acquire information about the feelings (stress, anxiety, fears, etc) developed by kids and teenagers during pandemic
- Target Market: citizens and medical professionals
- Space Connection: **Satellite communication** technology to reach children from remote areas experiencing isolation, **satellite positioning** for tailoring the behavioural approaches and guidelines of the tool according to the location of the user
- From: Hypex (IT), Istituto Gaslini (IT), Digivox (IT)







### ESA BUSINESS APPLICATIONS



### **OneClass!**

- eLearning platform for isolated schools, where small groups of children of different ages share the same didactic infrastructure ("multi-class"), and offering to foreign unaccompanied minors (FUM) educational and social inclusion services
- USP: didactic model based on the daily use of video conferencing between multi-class and standard school
- Target Market: schools and educational offices, NGOs
- Space Connection: Satellite communication technology will support those schools and reception centres hosted in areas affected by digital divide and limited access to other telecommunication means







From: Openet (IT)





Umbrella-call addressing different use cases defined together with stakeholders First use case: "Sport for Everyone" (closed now) Second use case: "Social Inclusion", deadline Outline proposals closed 15/07/22 Third use case: "Digital learning for STEM education" (opening Nov 2022)

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Space-based Innovation and Digitalisation for the School of Tomorrow: Digital Learning for STEM Education

Space-based Innovation and Digitalisat



ion for the School of Tomorrow: Digital Learning for STEM Education OPPORTUNITY Intended Tender		UC 1) Sport for everyone (closed now)		<b>STEM</b> = Scier Technology,	ice,
ACTIVITY OPENING DATE CLOSING DATE	Demonstration Project 31 October 2022 15 January 2023		UC 2) Social inclusion (closed now)	Engineering and Mathematics	
				UC 3) Digital learning/ STEM Nov/22- 15/01/23 (OP)	



### Use Case 3: Digital learning for STEM Education

### Challenges

- **Digital learning:** Currently, the education sector finds itself heavily underdigitised (less than 3% of expenditure). If this were to remain, it would mean that the industry will be unable to scale and meet the needs of 500 million students around the world by 2025.
- The COVID19 pandemics has made apparent current shortcomings of the education system and increased the push towards its digital transformation
- Satellite and digital technologies in education can help engage students and communities, enable inclusiveness, increase efficiencies, and provide tools to support excellent teaching and raise student attainment
- **Examples of targeted services:** Bidders are invited to propose use cases. For inspiration, some example use cases are presented here





### 1) Use of drones/UAV within education

### UAVs/ Drones are educational tools!

- UAV/drone can be seen as a microcosmos for STEM in many ways, eg.
  - Images and measurements taken by drones are an important asset to deepen the knowledge on: ecology, environment, geography, biology etc
  - Drones can also provide students with the opportunity to build capacity and knowledge that could be the basis for of their future career.
    - creation of 3D maps, DEMs and other geographical models., this can be useful experience within any industry that requires heavy construction such as mining, urban planning and civil engineering all of which can benefit from a 3D terrain model.

The innovative physics engine teaching students to code virtual robots in life-like landscapes

Home » News Archive » The innovative physics engine teaching students to code virtual robots in life-like landscapes



https://business.esa.int/news/innovative-physics-engine-teachingstudents-to-code-virtual-robots-life-landscapes



## 2) Shared platforms

### Participatory design

- Tools and services which facilitate easy the interactive exchange of innovative concepts and ideas when working within a co-design environment are needed to streamline the process and to make a more efficient use of the resources
- Within STEM education, a co-design environment can be used as a true hands-on experience in designing, developing, and testing for instance based on content derived from space-based Earth observation which provides a multi-faceted STEM experience for the students involved





→ THE EUROPEAN SPACE AGENCY

### 3) Educational Cube-/Nano/ CanSats

## Cubesats as instrumental and vocational educational tool

- Cubesats-/ nanosatellites were first conceived about 20 years ago as a hands-on education tool. They are typically composed of one or more units of 10x10x10cm in size with a mass of up to 1.33kg. Today, they have matured and have expanded beyond the education domain and are used operationally in space missions, technology demonstrations and industrial applications.
- Within STEM education, they can be used as a true handson experience in designing, developing, testing, and operating a real spacecraft system and its ground segment which provides a multi-faceted STEM experience for the students involved. In addition, and on an even more compact scale the size of a drinks can, CADSats (age groups 11-15) and CANSats (14-19) can provide similar opportunities linked to STEM education.





https://www.esa.int/Educa tion/ESA\_Academy/Studen ts\_experience\_of\_miniatur e\_satellites\_with\_CubeSats \_Hands-On\_training

https://www.esa.int/Educati on/CanSat/2023\_European\_C anSat\_Competition

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## Guest speaker

Prof Alexander Siegmund (Heidelberg University of Education): STEM education in schools



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## Potentials of Earth Observation in Schools – from concepts to applications

Prof. Dr. Alexander Siegmund

Heidelberg University of Education & Heidelberg University Department of Geography – Research Group for Earth Observation – (rgeo)





UNESCO Chair on World Heritage and Biosphere Reserve Observation and Education Heidelberg University of Education

## **UNESCO-Chair on Observation and Education of World Heritage and Biosphere Reserve**

Use of modern Geo-technologies & geoecological Field/Laboratory Methods for Analysis, Communication and sustainable Development of UNESCO Sites



nachhaltige Entwicklung

rgeo

Pädagogische Hochschule HEIDELBERG

unesco

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Research scientific & didactic accompanying



## adaptive Learning on Earth Observation Data

Section 2015 Se

Learning with original Satellite Data web-based Remote Sensing Application: "BLIF"

Learning with preprocessed Satellite Images web-based Remote Learning Platform: "GLOKAL Change"

game-based Learning web-based educational Game: "SILC" – Satellite Image Learning Center





online Learning Platform, on which young People learn:

RESEARCH GROUP FOR EARTH OBSERVATION

rgeo / 🖪

C answering environmental and spatial Issues

unesco

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- using the Potential of Remote
   Sensing and evaluating
   Satellite Images independently
- a playful and interactive
   Approach to different Topics of
   Geography & STEM Lessons

## www.geospektiv.de





### with the Help of the web based Application BLIF the Users learn:

unesco

rgeo

RESEARCH GROUP FOR EARTH OBSERVATION Pädagogische Hochschule HEIDELBERG

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- < to analyze Satellite Images
  indepentently</pre>
- C to calculate Vegetation Indices and own Land Use/Land Cover Classifications
- to investigate problemoriented geographic & environmental Issues

## www.blif.de



**Combining problem-based Learning with EO-Data in an interactive, adaptive e-learning Platform** 







### **Mobile Learning App: BLIF: Explorer**

### ■Use Satellite Imagery





#### Collect Data

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### Tender

Advice and Support of the Tender

### **Contact with Schools**

Creation of Access to Schools and School Institutions in at least 5 different European Countries

### **User Requirement**

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Advice and Support in the Definition of school-relevant User Requirements, including through the Organization of Workshops with Teachers, School Authorities etc. and a corresponding, project-oriented Network Formation.

### **Implementation of Measures**

Support in the Implementation of Measures to promote and disseminate the Project Results, e. g. via own Networks, Newsletters and Contacts.

### **Evaluation**

Conception and Implementation of an Evaluation of the developed Services in the School Context

## www.siegmund-se.de







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SEIT 1386

## Thank you for your attention!

## Potentials of Earth Observation in Schools – from concepts to applications

Prof. Dr. Alexander Siegmund

Heidelberg University of Education & Heidelberg University Department of Geography – Research Group for Earth Observation –('geo)



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European Space Agency

How to apply?

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## Where to find the information

### Go to business.esa.int

- Scroll down to the part "Featured Opportunities" to see all activities currently open or in preparation
- Specific Call website available at <u>https://business.esa.int/funding/intended-</u> <u>tender/space-based-innovation-and-digitalisation-</u> <u>for-school-tomorrow-digital-learning-for-stem</u>



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### ELIGIBILITY

Funded participation is open to any company and/or organisation residing in the following Member States:

Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Estonia, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Switzerland, Sweden, United Kingdom

• Furthermore, Austria, Canada, Czech Republic, Denmark, Finland, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, and the United Kingdom have subscribed to 5G SPL.

Economic Operators (both prime and subcontractor), intending to respond to this AO are requested to send their Outline Proposal to their National Delegation(s).





### How to Apply

### Two steps are involved in applying to this call:

- Step 1. Outline Proposal: the first step is the submission of an Outline Proposal. The Outline Proposal template can be downloaded from the Call website.
- Outline Proposals shall be submitted to ESA at the latest on <u>15/01/23</u>, EOB at the following email address indicating "School of Tomorrow Use Case 3 "Digital learning for STEM Education [Your Project Name]" as subject.
- Submit on the **online web submission form available** on the call website
  - and send in CC to the relevant National Delegation(s)



- Step 2. Full Proposal: Following notification by ESA on the acceptance of the Outline Proposal, the Tenderer may decide to prepare a Full Proposal using the provided template.
- Only Full Proposals supported with a "Letter(s) of Authorisation of Funding" (AOF) from National Delegations covering the Full Proposal will be admitted for evaluation. The Full Proposals shall be delivered via "esa-star".

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### How to Apply

### **Outline Proposal**

- Section 1: The team- what is the level of expertise / know-how of your team;
- Section 2: The Idea- what you propose, to address which needs, for whom, and the associated level of maturity;
- Section 3: The Activities- which activities you intend to perform, including the pilot utilisation of your solution, the associated costing and pricing, and the perspective to scale up and reach a sustainable target.

Appendix 3 to ESA AO/1-10662/21/UK/AL/fm Outline Proposal Template

#### OUTLINE PROPOSAL TEMPLATE SPACE-BASED INNOVATION AND DIGITALISATION FOR THE SCHOOL OF TOMORROW

#### Click or tap here to enter text.

The present Outline Proposal template for the <u>"Space-based</u> innovation and digitalisation for the school of tomorrow" intends to collect in a standardised way information on various aspects of your proposition in the following respect:

- 1. The Team: what is the level of expertise / know-how of your team;
- <u>The Idea</u>: what you propose, to address which needs, for whom, and the associated level of <u>maturity</u>:
- <u>The Activities</u>: which activities you intend to perform, including the pilot utilisation of your solution, the associated costing and pricing, and the perspective to scale up and reach a sustainable target.

Both Prime and Subcontractor(s) are requested to send to their National Delegations<sup>1</sup> this Outline Proposal, prior to the submission to ESA.

Note that the answers provided in this Outline Proposal will be directly integrated in the Full Proposal (in the sense that every element of the Outline Proposal will be directly integrated in the Full Proposal).

Outline Prop asal		Full Proposal
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Please, keep your answers to a maximum limit of <u>5 pages</u> (excluding this page), maintaining font size and structure.

Please note the following important points before you decide to prepare your submission:

- 4. The proposed activity shall involve the use of some space technologies (i.e. satellite communications, satellite navigation, images from Earth Observation satellites, technologies coming from the human space flip(ht):
- The proposed activity shall include a deployment of the solution and a pilot utilisation of the solution, in at least 2 schools, to be performed within the target utilisation scenarios with the involvement of relevant users.
- The evaluation of the Full Proposal will be executed following the submission in the ESA system. The Full Proposal will require a "Letter(s) of Authorisation of Funding" (AOF) from the relevant National Delegation(s) of the entities involved in the proposed activity.

This requirement does not apply for entities which National Delegation has pre-authorised this Open Call for Proposals.

- Selected activities can be funded up to 80% for SMEs as well as Universities and Research Institutes, and up to 50% for non SMEs.
- The funding of Universities or Research Institutes shall not exceed 30% of the total allowable cost. Moreover, they shall be involved as subcontractors, unless exceptionally provided otherwise in the express authorization of funding.

<sup>1</sup> Contact details of the National Delegations can be found under: <u>https://business.esa.int/national-delegations</u>. Appendix 3 to ESA AO/1-10662/21/UK/AL/fm Outline Proposal Template

#### OUTLINE PROPOSAL

#### This document use elements (content controls) that may have issues of compatibility on a Mac computer

Activity Title:	[Insert Activity Title here]		
Company Name:	[Insert Company Name here]		

Activity Title:	Insert Activity Title here		
Company Name:			
Please confirm that this Outli National Delegation(s):	ne Proposal has been sent to the relevant	yes	

#### Section 1: The Team

	[Insert Compan	y Address here]	
1.1 Company proposing: (address, country, website)	[Insert Point of Contact here]		
contact point name, telephone	[Insert Company Phone here]		
and e-mail)	[Insert Company E-mail here]		
1.2 Company background: Year of creation		: [Insert Year of Creation here]	
	Number of full time employees in 2020: [Insert Number of Employees		
	here in numeric format only]		
	Turnover in 2020 KEuro: [Insert Turnover in 2020 here in numeric format		
Notes on background:	only, excluding the currency symbol]		
	SME status: false		
1.4 Are you familiar with E	SA? (Yes/No)	no	
1.5 Are you applying as a consortium?		yes	
Who are the other entities?			
1.6 Does your team (company /		no	
consortium) have experience in providing turn-key solutions to the relevant users?			
1.7 Have you already identified schools		yes	
to validate the solution you propose in a pilot? (Yes/No/Partial. If Yes or Partial, provide relevant information on the right)			
1.8 Have you already estal relationships with these se	blished chools?	No	
(Yes/No/Partial. If Yes or Partial, provide relevant information on the right)			
1.9 Do you plan to offer your solution to Italian Schools?		yes	



### How to Apply

### **Activities scope**

- Be in line with the general objectives and address the identified use case (s);
- Engage with at least two schools and agree with the relevant personnel a pilot trial to verify and deploy in an operational environment the proposed service(s).
- Deploy and provide a solution which will support the digital transformation of the school for the benefits of the students and the teachers;
- Prove the benefit of including at least one space asset in the proposed solution;
- Potential Bidders are invited to explore the Agency's tool esamach – European Space Agency's industry matchmaking portal, where other Bidders are expressing their willingness in engaging into building consortiums for the Agency's initiatives, under the following link: <u>https://esastar-esamatch.sso.esa.int/</u>

### Welcome to the European Space Agency's industry matchmaking portal





European Space Agency

London

Belarus

Ukrain

Istanbul Ank.

## Roadmap



**\*\*\*OPENING DATE: TBC SOON** 



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### → APPLICATION PROCESS

- Please read the Management ٠ requirements!
  - https://business.esa.int/documents •
- Smart Contract tool
- **MSP-PSS tool** ٠
- Contractor portals ۲
  - ESA P, ESA STAR ٠



Full Proposal: MSP-PSS Tool Management Requirements Smart Contract Tool and related Tutorial

#### **European Space Agency**

Slide 39



## $\rightarrow$ Thank you for your attention

Volker Schumacher European Space Agency (ESA) Downstream Business Applications Department volker.schumacher@esa.int | www.esa.int | business.esa.int

## **Open Questions & Answers Session**

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