USE-CASES – ENHANCING PORT SAFETY AND EFFICIENCY THROUGH SPACE

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Table of Contents

1. INTRODUCTION

This document outlines the use cases to be incorporated into the “Enhancing Port Safety and Efficiency through Space” thematic call for proposals.
The use cases presented have been developed through collaboration between the European Space Agency (ESA) and Belfast Harbour.
The initiative aims to foster the development of sustainable services that leverage space assets and technology to address critical challenges and unlock opportunities for operational solutions.
When preparing the initial proposal (APQ/Outline proposal), applicants must clearly specify which use-case(s) their proposed solution intends to address.

2. USE CASES

The European Space Agency (ESA) and key stakeholders have identified several focus areas and use cases where space-enabled solutions can provide significant benefits. Potential bidders responding to this thematic call for proposals are encouraged to submit proposals that address the outlined use cases or propose alternative concepts based on their own research and expertise.

2.1 Belfast Harbour

Belfast Harbour , known as "a gateway to opportunity," is Northern Ireland’s main maritime gateway and logistics hub, serving the Northern Ireland economy and increasingly that of the Republic of Ireland, in addition of playing an essential role in global trade. It handles around 24 million tonnes of trade and hosts 1.7 million passengers annually.

The port also accommodates an average of 158 cruise ships each year, from a wide range of lines. Spanning 2,000 acres, Belfast Harbour significantly contributes to the city's transport infrastructure and represents about 20% of Belfast City's area. The Harbour's strategy focuses to shape the landscape of the Harbour Estate creating an attractive and vibrant area for work, living, and leisure. It is important to mention that Belfast Harbour is available to act as pilot user

to validate new solutions in pre-operational scenario and assist the development through its expertise and knowledge of the port environment.

2.1.1 Use-case#1: Port safety

- **Emergency response:** space data and AI can be used to communicate in case of safety-threatening situations occurring at the port or for ships approaching the port.
- **Port safety training course**: Innovative training courses could be developed making use of port digital twin based on satellite images and AR/VR and metaverse and leveraging on satellite communication for seamless connectivity.

2.1.2 Use-case#2: Navigation in ports

- **Safety of ships**: space data and AI can be used for the safety of ships entering the ports, using satellite images and radar data to monitor changes in water depth.
- **Navigation in ports**: space data and AI can be used to detect water depth changes from long-term trends in sedimentation and sea level or event-based changes due to storms. The information about the changes might be used by the port at regular intervals[1] , for example, for monitoring port operation or to optimize ship navigation.

2.1.3 Use-case#3: Port security

- **Monitoring and inspection of transferred cargo**: space data and AI can be used to increase the security of the marine transport in the port requiring diligent monitoring and inspection of transferred cargo involving security guards, video surveillance, alarm systems, CCTV cameras and sensors.
- **Port security**: space data and AI can be used to introduce innovative port security measures together with maps obtained by satellite images processed with sophisticated machine learning algorithms and using additional digital technologies as AR/VR and blockchain.

[1] https://www.porttechnology.org/wp-content/uploads/2019/05/088-089.pdf

- **Monitoring port movements**: space data and AI can be useful to provide maps movement within the ports and even enable the identification of “dark” vessels, those that operate without radar transponders or that disable transponders

2.1.4 Use-case#4: Port automation

- **Port operations automation**: space data and AI can be used to provide to the autonomous vehicles the information required of the terminal layout to navigate efficiently within the port, including information about roads, lanes, buildings, and other fixed features.
- **Management of autonomous vehicles:** space data and AI could be used to manage the routes according to the passengers’ demand, to assess the safety and efficiency of moving large numbers of passengers simultaneously, and the development of control platforms connecting the arrival of the passengers with the availability of vehicles.

2.1.5 Use-case#5: Movement of passengers

- **Optimization transport network in port**: space data and AI play a key role by enabling real-time seamless communication between vehicles, roadside infrastructure, mobile devices and back-office systems, which improves the safety and manageability of the transport network within the port while reducing congestion and costs.
- **Movement of passengers**: space data and AI can be used for the movement of passengers by means of autonomous vehicles to travel from the port premises to nearby airports, terminals or rail stations.

2.1.6 Use-case#6: Movement of goods

- **Optimization transport of goods in port**: this use case related to the optimization of the movement of autonomous trucks in the port for the transport of containers to streamline port processes, reducing operating costs, increased safety and improved cargo tracking.