## SELECTION CRITERION 2: EXCELLENCE OF THE OVERALL PROPOSAL AND APPROACH

The goal of the CAMEO project is to develop a new online platform which will unlock the potential of Earth Observation (EO) data for Irish, and indeed international, non-specialist users. CAMEO will achieve this by leveraging the technical and domain expertise from UCD, the SME and MNC partners, as well as the many application partners and technical partners. To serve this ambition we have developed several key objectives for this platform:

- To exploit the significant expertise that resides within this consortium to support the development of an *economically sustainable* and expanding space-active industry, delivering quality jobs for the economy of tomorrow;
- To develop new market opportunities, new capabilities and to enhance the culture of innovation within the SME and application partners;
- To establish a sustainable internationally trading EO services sector in Ireland, establishing Ireland as a leader in EO research and innovation, with a specific focus on unlocking the potential of Earth Observational data for non-specialist users;
- To develop and attract talent for space industries and research;
- To increase industry, public and international awareness of space and Ireland's space activities;

In order to achieve this goal and these overarching objectives we have assembled an uniquely capable and experienced consortium made up of three key groups – the core partners, the application partners and the technology partners. We have brought together for the first time the key players in EO technology across three key domains – agriculture, climate and marine – and the key public sector bodies and SMEs/start-ups who stand to benefit most from the platform. We seek to build a new community around the use of EO in Ireland, and to help position as a international leader in the use of EO data for economic and societal good, ultimately establishing a sustainable internationally trading EO services sector in Ireland.

This collaboration will bring together domain specialists, computer scientists, physicists, agronomists, climate scientists, marine scientists and data scientists. CAMEO will not only unlock the innovation potential of EO, but will also deliver several ground-breaking innovations beyond the state-of-the-art:

- CAMEO will adopt a MicroServices Architecture (MSA) decomposing monolithic software systems into a loosely coupled federation of services[8] the composition of which can deliver internet scale applications. Further to this the CAMEO platform will deliver system level intelligence through the use of multi-agent systems which will be integrated seamlessly within the MSA. Prior work from UCD has pioneered this approach through the Multi-Agent Microservices Architecture (MAMS)[9] [10]
- CAMEO will provide an integrated single access point and support environment for EO data users (similar to but fundamentally different from Copernicus Open Access Hub and OpenEO). It will provide support for: data access, data brokerage, data conflation, data analytics, data security, data quality management and advanced data visualisation. This will be complemented by an integrated suite of learning resources anchored to the CAMEO software platform functionalities providing training and support targeted to user need.
- Create an *EO process chain capability* together with the necessary software supports whereby specific end user service requirements can be delivered through the aggregation and composition of CAMEO microservices derived from a CAMEO service catalogue thereby promoting *software bundle reuse*. This would radically reduce: service development time, software development errors and potentially enable a more cost competitive offering for SMEs.
- Deliver *integrated intelligent data analytics and machine learning* harnessing the capabilities of UCD, and

[8] Mario Villamizar, Oscar Garcés, Harold Castro, Mauricio Verano, Lorena Salamanca, Rubby Casallas, and Santiago Gil. 2015. Evaluating the monolithic and the microservice architecture pattern to deploy web applications in the cloud. In 2015 10th Computing Colombian Conference (10CCC). IEEE, 583–590.

[9] Rem W Collier, Eoin O'Neill, David Lillis, and Gregory O'Hare. 2019. MAMS: Multi-Agent MicroServices. In Companion Proceedings of The 2019 World Wide Web Conference. ACM, 655–662.

[10] Eoin O'Neill, David Lillis, Gregory MP O'Hare, Rem W Collier, Explicit Modelling of Resources for Multi-Agent MicroServices using the CArtAgO Framework, Proceedings of the 19th International Conference on Autonomous Agents and MultiAgent Systems (AAMAS 20), International Foundation for Autonomous Agents and Multiagent Systems.

and associated services, the delivery of secure data stream ingestion mechanisms ensuring data provenance and non modification, and to provide protection from data theft. The security of the platform and services is key as users will be storing valuable data, algorithms and analysis outputs on it.

- **WP5** - This WP recognises the significant investment needed to train and upskill non-specialist users of the platform to drive uptake, and to release the potential of EO data for private and public sector users. This WP will be led by UCD, and will draw on already developed resources from with UCD and with our partners where possible/appropriate.
- **WP6** - This WP will be led by UCD and will focus on the capture of the project results and their promotion through dissemination, evaluating and maximising their innovation impact via IP protection and communication with stakeholders. Most critically, this WP will focus on the commercialisation of the project outputs and the development of a go-to-market strategy and potential business models.
- **WP7** - This is one of the most important WPs in that it will define the use cases for the three domains - *agriculture, climate and marine* - thus will involve significant engagement with the application group to capture their needs and to best make use of available data-sets. The three EO SMEs - Icon, TWM, and Treemetrics - have extensive domain and technology expertise and will be crucial to the definition of user needs that will feed into WP2 and WP3. The EO SMEs will leverage existing relationships with the application partners - Bord Na Mona, DAFM, DPER, EPA, ESA, ESA BIC Ireland, Forest Services, GSI, Irish Defence Forces, Met Eireann, Naval Services, OSI, Parks and Wildlife, and Teagasc - to ensure the successful development of the platform. They will engage with each domain to identify recurrent/generic domain-specific service needs, compile current offerings using EO data, develop the use-cases, and develop demonstrators in each domain, developing new methods of external validation of EO data

  There is a significant discovery phase to this project where we will seek to build on the existing expertise within the core team, and draw on that of the application partners. The dependencies and interaction between the 8 work packages are called out in Figure 2.