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1. Introduction

CALL: Developing, consolidating and optimising the European research infrastructures landscape, maintaining global leadership (2023) (HORIZON-INFRA-2023-DEV-01)

TOPIC: HORIZON-INFRA-2023-DEV-01-07 - HORIZON-CSA HORIZON Coordination and Support Actions

PROJECT: Cooperation and AgReements enhancing Global interOperability for Aerosol, Cloud and Trace gas research infrastructures (CARGO-ACT) https://www.cargo-act.eu/

PROJECT: The overarching goal of CARGO-ACT is to deliver a clear roadmap for sustainable global cooperation between key organisations in Europe and in the United States to provide all users, in the scientific community and beyond, with the best possible services for accessing and using information from monitoring climate- and air quality-relevant properties of aerosol, cloud and trace gases in the atmosphere. CARGO-ACT has the following specific objectives:

1. develop sustainable partnerships and decision-making processes with the relevant partner RIs;
2. demonstrate the benefits of converging interoperability and standards to stakeholders and the global research community;
3. establish the mechanisms for providing international access to distributed, global atmospheric RIs; and
4. develop a roadmap for upscaling towards an integrated global research infrastructure for aerosol, cloud and trace gases.

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2. Relevance and contribution of the CARGO-ACT project to the policy areas for research infrastructures in Europe

Access to research infrastructures.

CARGO-ACT has significantly contributed to shaping European policy on access to global RIs by addressing sustainable international access. By analysing access practices in Europe and the United States, the project identified barriers for implementing access on an international level, including strategic, structural, legal, financial and coordination challenges. In response, CARGO-ACT has developed a stepwise framework and guiding principles to provide the conceptual and practical basis for piloting international access mechanisms, promoting an equitable access framework for users, institutions, and stakeholders. These measures are expected to streamline cross-border access to facilities and data, increase participation from underrepresented regions and countries, and foster

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global scientific collaboration. The adoption of the proposed strategies will broaden RI use and ensure more effective international utilisation. To secure long-term impact, stakeholders should integrate these principles into governance and funding schemes, harmonise international access procedures, and actively support engagement with global partners and communities.

Funding of research infrastructures.

CARGO-ACT has identified existing opportunities to support international access to the RIs through current EU, US, and national funding programmes. It has also developed a shared action plan to leverage these opportunities and prepare potential agreements aimed at facilitating reciprocal access. At the same time, CARGO-ACT has also shown that dedicated funding is essential to further advance global RI cooperation, particularly in establishing a framework for coordinated global access, with attention to both technical and governance aspects. CARGO-ACT has highlighted the necessity of future funding calls specifically targeted at global cooperation to support the harmonisation and convergence efforts required at the international level.

International co-operation of research infrastructures.

The main premise of the CARGO-ACT project is to build international cooperation and increase harmonisation efforts between the European and US RIs in the atmospheric domain. As such, CARGO-ACT tackles this subject directly, and all of its results were achieved in cooperation with networks in the US. CARGO-ACT has demonstrated that global datasets from multiple networks can be interoperable because the majority of involved RIs already have a high degree of data FAIRness. As an EU-US cooperation effort, CARGO-ACT will help address important global challenges, particularly climate change, health and open access of data. The framework and guiding principles developed in CARGO-ACT can be adapted and extended to incorporate more countries and networks. CARGO-ACT has also encountered and highlighted the challenges in developing a truly global infrastructure, which may be significant for future global collaboration efforts.

Employment and skills in research infrastructures.

CARGO-ACT's recommendations and roadmaps for harmonization are the key results of this project. These are based on cross-network and network-stakeholder discussions, and exchange of documented existing standards, practices, and collected training materials. Individuals trained with the harmonized practices, learning from international experience and information exchange, will improve their skills to encompass a broad global competence. This, in turn, will lead to enhanced job prospects for the individuals as well as an increased and more diverse recruitment pool for all RIs. Developing further cross-network harmonisation and capacity building will make the exchange of personnel between industry and RI easier in both directions.

Technology development, data and digital services, digitalisation.

CARGO-ACT has identified key FAIR principles and technologies where global networks can converge towards and has demonstrated how the implementation of FAIR principles in each network has

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enabled delivery of metadata in multiple data portals (i.e. ACTRIS RI metadata being visible in a US network data portal and vice versa). CARGO-ACT has shown how the development of the cross-network harmonisation on a global scale, producing community-derived international standards, could increase RI's impact on industry (instrumentation, software development, services, etc.), further expanding the long-term impact of this project.

Contribution to other research areas and to broader EU priorities.

CARGO-ACT has demonstrated that the increasing convergence in data FAIRness and quality control methodologies enables provision of harmonised global datasets. CARGO-ACT has shown the significance of harmonising European data with other networks, which is highly relevant for e.g. the EC-ESA Aerosol-cloud interaction cluster (*HORIZON-CL5-2023-D1-01-04)*. Beneficiaries of CARGO-ACT are already participating in this particular cluster through, e.g., CERTAINTY, CleanCloud and airsense projects. The roadmap towards convergence and lessons learnt in CARGO-ACT should be adapted and extended to incorporate more countries and networks and help guide global harmonisation activities for more observation types. Such efforts would aid in developing global standards and international policies, such as, for example, global air quality guidelines.

Sustainability of research infrastructures.

CARGO-ACT has attracted a lot of attention from global stakeholders and demonstrated the interest in a global infrastructure in the atmospheric domain. CARGO-ACT activities attracted the awareness of the international stakeholders and resulted in an increased and continued demand for global long-term data, access and services. CARGO-ACT has shown that developing international cooperation amongst RIs also helps improve the internal practices of each individual RI. CARGO-ACT has highlighted the necessity of future funding calls targeted at global cooperation due to the amount of time and effort required for harmonisation and convergence at the global level. At the same time, the sustainability of international cooperation and a potential global RI are heavily dependent on the geopolitical situation among the countries involved.

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