

In-service Aircraft for a Global Observing System

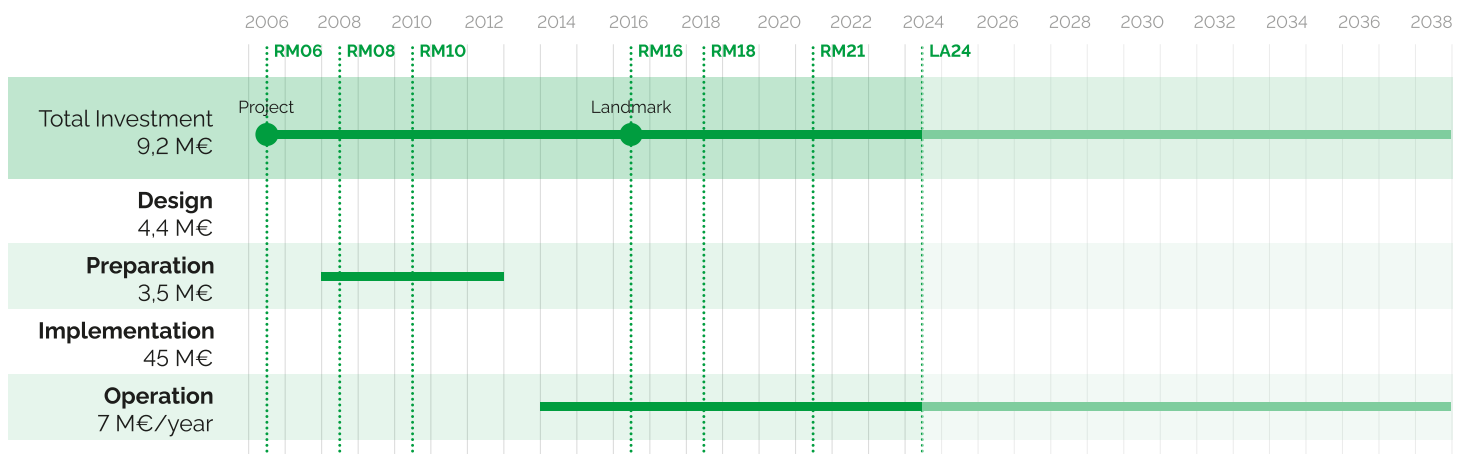
Website	Headquarters	Legal Status	Type	Access
http://www.iagos.org	IAGOS AISBL Brussels, Belgium	Established (ERIC, AISBL, GmbH, Others)	distributed	virtual

DESCRIPTION

The In-service Aircraft for a Global Observing System (IAGOS) is a Research Infrastructure that operates a global-scale monitoring system for atmospheric trace gases, aerosols and clouds by using the existing provisions of the global air transport system to provide essential data on climate change and air quality. It complements the global observing system in addition to ground-based networks, dedicated research campaigns and observations from satellites, balloons, and ships. IAGOS builds on the scientific and technological experience gained within the research projects MOZAIC – Measurement of Ozone and Water Vapour on Airbus in-service Aircraft – and CARIBIC – Civil Aircraft for the Regular Investigation of the Atmosphere Based on an Instrument Container. The technical, organisational and legal concept for IAGOS has been developed during its Preparatory Phase. The scientific mission has been defined as to provide high quality data throughout the troposphere and lower stratosphere, and scientific expertise to understand the evolution of atmospheric composition, air quality, and climate. The research infrastructure is distributed, and by virtue of the fact that we use commercial aircraft as a platform, it is global in nature, but does not have physical access sites. In order to provide data that is as global as

possible we have airline partners from Europe, Taiwan, Hong Kong, the United States and Canada. By working with a wide range of partners, we can build up a global network of routes to provide data at cruise altitude and at more than 300 worldwide airports spanning all continents except Antarctica. The backbone of IAGOS is the 30 year time-series of water vapour and ozone in the North Atlantic flight corridor at cruise altitude and the 30 year time-series of profiles of water vapour and ozone in Frankfurt. This can now be considered as a “climate” dataset according to the WMO definition. To enrich this essential ‘climate’ dataset and provide further scientific understanding we measure the principal precursors of ozone, greenhouse gases, aerosols and clouds. The data follow FAIR principles, and are accessible through the data centre. In addition to the measured parameters, we provide value-added products such as dynamical data, and source-receptor links for tracing the provenance of air masses. Visualisation tools have been developed to support this service. The profile data collected during landing and take-off are of great interest for air quality studies and used by the Copernicus Atmosphere Monitoring Service (CAMS) for the validation of global and regional air-quality models.

TIMELINE & ESTIMATED COSTS





POLITICAL SUPPORT

Lead
DE, FR
Member
UK



IMPACTS

The direct socioeconomic impact is mainly on SMEs who are manufacturing instruments or are involved in the development and aeronautic maintenance of the instrumentation in order to assure continued airworthiness in accordance with international regulations for aviation. We have direct engagement of airline companies as suppliers of transportation capacity and technical support was achieved on the basis of individual negotiations and by direct involvement as full project partners. The development and deployment of advanced instrumentation for IAGOS contributes to technological innovation. This innovation not only enhances scientific capabilities but may also have broader applications in other industries leading potentially to economic growth and job creation in other sectors. Examples of this are our collaborations with instrument developers for the BCP and with a number of small and medium enterprises (SMEs) in the IAGOS chain. IAGOS has expanded the boundaries for measurement technology, particularly with regard to aerosol and cloud particle measurement techniques, towards applications in the harsh and safety-focussed environment of operational passenger aircraft. The importance of IAGOS in the Copernicus service chain is considerable. IAGOS has contributed to CAMS for the past 15 years, developing and providing a validation service for global and regional models used in forecasting global and regional atmospheric composition. Improving the accuracy of such forecast models leads to better public health outcomes by informing policies and initiatives to reduce pollution and enhance air quality standards. For example, "Windy", which provides leading weather forecast visualization services on smartphones and the web, features seven CAMS parameters for its global audience with over million individual users worldwide accessing CAMS layers. International activities under the guidance of the World Meteorological Organisation (WMO) target the reduction of the climate impact of aviation by developing and implementing operational procedures for re-routing passenger aircraft on climate-friendly flight trajectories.

SERVICES

IAGOS measures Essential Climate Variables and (up to 100) species of atmospheric composition (trace gases, diverse aerosol and cloud parameters), in situ and at high resolution, using commercial aircraft from various international airlines as measurement platforms. The measurements are made from the ground to 12 km altitude (the tropopause region). The data therefore cover profiles during landing and take-off at cities across the world, and tracks at cruise altitude all over the world. Data are provided via the IAGOS data portal (<https://www.iagos.org>) and directly in near-real-time to the Copernicus Atmosphere Monitoring Service (CAMS) for validating models of global atmospheric composition and air quality forecasts. We also deliver detailed meteorological data (based on ECMWF analysis) along the IAGOS flight tracks such as geopotential height and potential vorticity to foster the scientific interpretation. From the start in the year 1994, data of more than 69,000 flights are available. Further value-added products and services enable users to analyse the multi-parameter data, such as source receptor links for tracing the origins of pollution episodes. Indeed, two new interactive services developed in the frame of the ATMO-ACCESS are now publicly available (via www.atmo-access.eu and www.iagos.org). The first service, part of the trajectory and footprint analysis, is the IAGOS viewer of footprints and modelled CO contributions from recent sources (either anthropogenic or biomass burning). It allows the user to get information on the origin of the CO anomalies observed during vertical profiles over the selected visited airports. The second service, is a tool for analysing time series and allows the user to search, analyse and visualise data (Essential Climate Variables) from three Atmosphere European Research Infrastructures, ICOS, ACTRIS and IAGOS. The tools are designed to facilitate the search and use of IAGOS data. Improvements are regularly implemented and user feedback is requested.

INTERCONNECTIONS



COOPERATION WITH OTHER RIS

IAGOS has strong connections to and synergies with the other RIs from the environmental domain and in particular with the other atmospheric RIs ACTRIS and ICOS ATC at both national and European levels. ACTRIS-IAGOS-ICOS are particularly joining forces and seeking harmonisation of observation strategies, data provision, and service development as well as service provision (e.g. through the contribution to the projects dedicated to the CAMS for the evaluation of the model runs). In the context of services development, IAGOS cooperates closely with the other RIs of the Environment cluster via several EU Infrastructure projects: completed projects (ENVRI-Plus, ENVRI-FAIR), ongoing projects (ATMO-ACCESS, RI-Urbans and ICOS-cities) and starting projects (ENVRIINNOV, ENVRI-Hub-Next, IRISCC, OSCARS). IAGOS played an important role in the foundation of the Board of European Environmental Research Infrastructures (BEERI) which acts as a coordinating body for the cluster of environmental RIs. The leading role of IAGOS is underlined by the coordination of the Horizon 2020 Environmental Sciences Cluster project ENVRI-FAIR through its member Jülich, and here the co-coordination of the Atmosphere part through its member CNRS, by the technical coordination of the upcoming Horizon Europe project ENVRI-Hub NEXT, and by coordinating the contributions of the cluster of environmental RIs to the Horizon Europe science cluster project OSCARS (Open Science Clusters' Action for Research and Society).