PART3

ESFRI PROJECTS & ESFRI LANDMARKS

ESFRI Research Infrastructures are facilities, resources or services of a unique nature, identified by European research communities to conduct and to support top-level research activities in their domains. ESFRI selects proposals of RIs in strategic areas of research and with an adequate level of maturity to become ESFRI Projects, and identifies successfully implemented RIs to become ESFRI Landmarks.

Each ESFRI Project and ESFRI Landmark is described by a dedicated card.

ESFRI PROJECTS

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The ESFRI Projects are RIs in their Preparation Phase which have been selected for the excellence of their scientific case and for their maturity, according to a sound expectation that the Project will enter the Implementation Phase within the ten-year term. They are included in the Roadmap to point out the strategic importance they represent for the European Research Area, and to support their timely implementation as new RIs or major updates of existing RIs. The Projects can be at different stages of their development towards implementation according to their respective date of inclusion in the Roadmap.

ESFRI LANDMARKS

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The ESFRI Landmarks are RIs that were implemented, or reached an advanced Implementation Phase, under the Roadmap and that represent major elements of competitiveness of the ERA. The Landmarks can be already delivering science services and granting user access, or can be in advanced stage of construction with a clear schedule for the start of the Operation Phase. The Landmarks need continuous support and advice for successful completion, operation and – if necessary – upgrade to achieve optimal management and maximum return on investment.

A short description of each ESFRI Project and ESFRI Landmark is given as well as updated information on the legal status, the timeline for the construction/operation, and the estimated costs. The information on the **POLITICAL SUPPORT** – expressed by Governments of Member States and Associated Countries – is validated by the ESFRI Delegations.

POLITICAL SUPPORT TO ESFRI PROJECTS

LEAD COUNTRY/ENTITY: MS, AC or EIROforum member leading the Preparation Phase.

PROSPECTIVE MEMBER COUNTRY/ENTITY: MS, AC and third country, which submitted Expressions of political Support (EoS) signed by the national ministries responsible for the RI, or other entity – such as EIROforum member – whose mandated authorities have expressed interest to join the RI through a Council resolution.

POLITICAL SUPPORT TO ESFRI LANDMARKS

LEAD COUNTRY/ENTITY: MS, AC or EIROforum member leading the Implementation/Operation Phases.

MEMBER COUNTRY/ENTITY: MS, AC, third country or other entity – such as EIROforum member – which is Member of the legal entity by any formal agreement, or applied to ERIC Step2 or to other international legal form.

***OBSERVER:** MS, AC, third country and other entity – such as EIROforum member – which is Observer of any legal entity by any formal agreement, or applied to ERIC Step2 or to other international legal form.

PROSPECTIVE MEMBER COUNTRY/ENTITY: MS, AC and third country, which have submitted Expressions of political Support (EoS) signed by the national ministries responsible for the RI, or other entity – such as EIROforum member – whose mandated authorities have expressed interest to join the RI through a Council resolution.

MS, AC and third country, neither being the Lead country, Member Country nor Prospective Member country, but which hosts research institutions and international organisations formally involved in the consortium, are not listed.

A complete list of stakeholder organizations – Research Institutes, Academia, Research Performing Organizations, territorial authorities – is to be found on the own website of the RIs, as institutional participation may not engage the direct responsibility of the Government.

PART3

ESFRI PROJECTS

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EU-SOLARIS

European Solar Research Infrastructure for Concentrated Solar Power

A COORDINATION EFFORT ON CONCENTRATING SOLAR THERMAL AND SOLAR CHEMISTRY TECHNOLOGIES

DESCRIPTION

The European SOLAR Research Infrastructure for Concentrated Solar Power (EU-SOLARIS) is a distributed Research Infrastructures that aims to achieve a real coordination of Research and Technology Development (RTD) capabilities and efforts in Concentrating Solar Power/Solar Thermal Energy (CSP/STE) technologies by the European Research Centres. EU-SOLARIS will become the reference for CSP/STE and maintain Europe at the forefront of these technologies by providing the most complete, high quality scientific portfolio and facilitating the access of researchers to highly specialised facilities via a single access point. EU-SOLARIS will link scientific communities and industry and speed up the development of research and innovation due to a closer collaboration model, knowledge exchange management and a wider dissemination of results. It will increase the efficiency of the economic and human resources required to achieve excellence and provide efficient resources management to complement research and avoid redundancies.

EU-SOLARIS was included in the ESFRI Roadmap 2010 and started the Implementation Phase in 2018 with expected start of operations in 2020.

BACKGROUND

Concentrating Solar Power/Solar Thermal Energy (CSP/STE) technologies are expected to become a considerable supplier of green energy throughout the world. When Concentrating Solar Technologies are deployed with thermal energy storage, they can provide a dispatchable source of renewable energy. EU-SOLARIS is aiming at creating a new legal entity to explore and implement new and improved rules and procedures for European experimental facilities for CSP/STE technologies, in order to optimize their use and Research and Technology Development (RTD) coordination. It is expected to be the first of its kind, where industrial needs will play a significant role and private funding will complement public funding. EU-SOLARIS is envisioned as a distributed large-scale RI with a strong central node in Spain (the CSP/STE RIs of CIEMAT-PSA) and additional facilities in Cyprus (CYI), France (CNRS), Germany (DLR), Greece (CRES, APTL), Italy (ENEA), Portugal (LNEG, U.EVORA), and Turkey (GÜNAM and SELCUK U). Partnership includes also the industrial sector as a main actor on the decision-making processes leading to the definition, development, siting and implementation of future CSP/STE experimental facilities and as a prominent user of most, if not all, experimental facilities included under the umbrella of EU-SOLARIS.

Due to a number of reasons, including a market failure in access to finance and unfavourable framework conditions, no new plants have been built in Europe since 2013, whereas more than 20 have been built or approved in third countries - in many cases still with participation of EU companies. Without innovation in the EU market, it is difficult for EU companies to offer technology references on their technology advances when competing for contracts abroad. Therefore, reactivating innovation in Europe is crucial for EU companies to keep their global competitive edge thanks to cheaper technologies, progress in the learning curve and economies of scale. And in this framework EU-SOLARIS will have an important role to play.

STEPS FOR IMPLEMENTATION

After the Preparatory and the Interim Phases, EU-SOLARIS is now in the Implementation Phase with operations expected to start in 2020. The Internal Law, Governance model, Access rules and procedures, Business Plan, policy for Technology Transfer and Intellectual Property Rights management, dissemination and outreach plans, list of services to be provided have been prepared during the Preparatory Phase by a consortium composed of 13 research institutions plus the Spanish Ministry of Economy and Competitiveness (MINECO) and the European Solar Thermal Electricity industry Association (ESTELA). The participation of the various non-RTD stakeholders, such as national and regional governments, renewable energy agencies and other funding bodies, was channelled through an Advisory Board for Funding and Administration. The legal form chosen by the consortium for the Operation Phase of EU-SOLARIS during the Preparatory Phase has been the European Research Infrastructure Consortium (ERIC): seven MS/AC already signed a letter of intents to become Members of the EU-SOLARIS ERIC.

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: ES
prospective member countries:
CY, DE, EL, FR, PT, TR

The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2010

TIMELINE

- 2010-2012 — Design Phase
- 2012-2016 — Preparation Phase
- 2017 -2018 — Interim/Transition Phase
- 2018-2020 — Implementation/Construction Phase
- 2020 — Operation Start

ESTIMATED COSTS
capital value: 7 M€
design: 0.5 M€
preparation: 0.5 M€
construction: 6 M€
operation: 0.2 M€/year

HEADQUARTERS
Plataforma Solar de Almeria - CIEMAT
Almeria, Spain

WEBSITE
www.eusolaris.eu

A unique Research Infrastructure for testing fusion materials in realistic conditions

IFMIF-DONES

International Fusion Materials Irradiation facility - DEMO Oriented NEutron Source

TYPE
single-sited

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: ES
prospective member country: HR, (EUROfusion)
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2018

TIMELINE
- 2007-2015 Design Phase
- 2015-2019 Preparation Phase
- 2019-2029 Implementation/Construction Phase
- 2029 Operation start

ESTIMATED COSTS
capital value: 710 M€
design: 150 M€
preparation: 40 M€
construction: 420 M€
operation: 50 M€/year

HEADQUARTERS
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas – CIEMAT
Madrid, Spain

WEBSITE
www.ciemat.es

DESCRIPTION

The International Fusion Materials Irradiation Facility - Demo Oriented NEutron Source (IFMIF-DONES) is a single-sited novel Research Infrastructure for testing, validation and qualification of the materials to be used in a fusion reactor. It is based on a unique neutron source with energy spectrum and flux tuned to those expected for the first wall containing future fusion reactors. Materials irradiation data under such conditions are of fundamental interest for the fusion community as those will feed and validate the modelling tools for materials radiation damage phenomena. The IFMIF-DONES will be a major step towards IFMIF as it will develop a unique high-current high-duty cycle accelerator technology, liquid metal target technology and advanced control systems.

IFMIF was first proposed to the ESFRI Roadmap in 2006, but the development of its concept was mostly carried out within the Broader Approach that will deliver the final results in 2020. The IFMIF-DONES will build on the results of the international community by establishing suitable collaboration schemes, whilst bringing back to Europe one important development in the roadmap to fusion energy.

BACKGROUND

The hard mono-energetic spectrum associated with deuterium-tritium fusion neutrons (14.1 MeV compared with <2 MeV on average in fission reactors) exhibit higher cross-sections for nuclear reactions that will generate significant amounts of H and He, as well as atomic displacements, leading to a presently undetermined degradation of structural materials after a few years of operation. Although fission and fusion materials share common issues, the study of radiation-induced damage for fusion materials necessarily has to go far beyond the damage level which is relevant for fission materials due to the the harder neutron spectrum. Therefore, specific sources, like the IFMIF and DONES, must be built to enable the development of fusion technology.

The original IFMIF project started in 1994 as an international scientific research program, carried out by Japan, the European Union, the United States, and Russia, and managed by the International Energy Agency (IEA). Since 2007, it has been pursued by Japan and the European Union under the Broader Approach Agreement in the field of fusion energy research, through the IFMIF/EVEDA (IFMIF Engineering Validation and Engineering Design Activities) project, which conducts engineering validation and engineering design activities for IFMIF, including IFMIF engineering design, Validation Activities of the Lithium Loop System, Validation Activities of the Irradiation Area System, Validation Activities of the Accelerator System that is still on-going with the design of the LIPAc prototype for the low energy section (9 MeV) of the IFMIF deuteron accelerator.

IFMIF-DONES is based on a 40 MeV, 125 mA in continuous wave mode (CW) deuteron accelerator (5 MW beam average power) hitting with a rectangular beam size (approx. 20 cm x 5 cm) a liquid Li screen target flowing at 15 m/s – to dissipate the beam power – and generating a flux of neutrons of 10^{18} m^{-2} s^{-1} with a broad peak at 14 MeV through stripping nuclear reactions, reproducing the expected conditions of fusion power plants. Materials are irradiated by the neutron beam as close as possible to the Li target to obtain damage rates up to 15 atomic displacements per year (dpa/year) under temperature controlled conditions. After a long irradiation period (up to two years), irradiated modules will be partially dismantled and the irradiated samples will be characterized.

STEPS FOR IMPLEMENTATION

EUROfusion and Fusion for Energy (F4E) started in 2015 a process to develop the engineering design of DONES and to identify possible EU sites to host the facility. In December 2017, F4E positively evaluated the joint Spain-Croatia proposal to site DONES in Granada. As the IFMIF-DONES enters the Roadmap 2018, it will be eligible for the Preparatory Phase grant by the EC and, simultaneously, will begin the Implementation Phase with the initial steps for the construction of the civil engineering infrastructure. Intense international activity is sought in order to benefit from the final results of the Broader Approach Agreement and to establish the broadest international collaboration in the design and construction of the DONES. ESFRI will assist and monitor since the beginning the developments of IFMIF-DONES.

MYRRHA

Multi-purpose hYbrid Research Reactor for High-tech Applications

THE VERY FIRST PROTOTYPE OF MULTI-PURPOSE HYBRID NUCLEAR RESEARCH REACTOR FOR HIGH-TECH APPLICATIONS

DESCRIPTION

The Multi-purpose hYbrid Research Reactor for High-tech Applications (MYRRHA) is a first-of-a-kind, innovative nuclear research reactor designed as an Accelerator Driven System (ADS), able to operate in subcritical and critical modes. MYRRHA will demonstrate the ADS concept intended for the efficient treatment of the high level nuclear waste through partitioning & transmutation. It will also fulfil the role of Experimental Technology Pilot Plant (ETPP) in the roadmap for the development of the lead fast reactor (LFR) technology, but its design integrates the function of multi-purpose flexible fast neutron spectrum research reactor (50-100 MWth). Its catalogue of applications includes R&D on the partitioning and transmutation of long-lived radioactive waste, the production of radioisotopes for medical applications and fundamental and applied research in support of the development of fast spectrum reactor and fusion safety and technology.

In the ESFRI Roadmap since 2010, MYRRHA will enter the Implementation Phase in 2019 and is expected to become gradually operational as of 2027.

BACKGROUND

In the framework of the European Sustainable Nuclear Industrial Initiative (ESNII), a R&D platform aiming to demonstrate Generation-IV Fast Neutron Reactor technologies, MYRRHA has been identified in 2010 as a major facility contributing to the EU's Strategic Energy Technology Plan (SET plan). Also the Nuclear Physics European Collaboration Committee (NuPECC), whose aim is to promote collaborative ventures between nuclear physicists within Europe, has selected ISOL@MYRRHA to be part of its long-range plan of the top facilities for nuclear physics in Europe.

MYRRHA is designed as a flexible fast spectrum irradiation facility. This means that a fast neutron spectrum is present at every location in the reactor and that every fuel assembly position can be loaded with a driver MOX fuel assembly, a minor actinides fuel experimental assembly, a dedicated experimental rig for material irradiation or medical and industrial radioisotopes production rig. In this way, the entire reactor volume offers possibilities of loading experimental fuel assemblies in conditions similar to the reactor conditions, being a fast neutron spectrum, and in contact with the flowing liquid lead-bismuth at reactor operating temperatures. MYRRHA will also be able to host at least 8 in-pile sections (IPS) (representing a total volume of 8 x 3.700 cm^3) with a core-loading pattern optimised to obtain the most appropriate irradiation conditions in the IPS. In this double-walled IPS, a different coolant (Na, NaK, He, H2O) can be present with temperature and pressure conditions optimised for the experimental fuel/material loaded in the IPS. The R&D programme supporting the design of MYRRHA aims at validating solutions on the main design challenges: lead-bismuth liquid metal in reactor conditions, MOX fuel qualification, materials qualification, resilience of innovative components, reactor physics and modelling of fast and sub-critical cores.

STEPS FOR IMPLEMENTATION

The MYRRHA Preparatory Phase was successfully completed in 2016. The MYRRHA implementation plan involves three phases. The first phase consists in the construction of the 100 MeV accelerator, which is a fully modular infrastructure able to function independently as of 2026-2027, and generating scientific results and revenue. At the end of the first phase, a stage-gate decision is taken whether to proceed with phases 2 and 3 – the development of the accelerator upgrade to 600 MeV and the construction of the reactor – either sequentially, or in parallel.

A legal entity for the construction, the operation and the decommissioning of MYRRHA was identified. The plan is to set up MYRRHA as an AISBL under Belgian law. Important aspects such as the appropriate rules concerning nuclear liability and contractual liability of the MYRRHA consortium and its members were analysed in detail and included in an Intergovernmental Agreement document.

TYPE
single-sited

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: BE
prospective member countries: CN, JP
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2010

TIMELINE
- 2010-2017 Design Phase
- 2012-2018 Preparation Phase
- 2019-2030 Implementation/Construction Phase
- 2027 Operation Start

ESTIMATED COSTS
capital value: 1.616 M€
design: 242 M€
preparation: 22 M€
construction: 1.352 M€
operation: 74 M€/year

HEADQUARTERS
Belgian Nuclear Research Centre - SCK•CEN
Mol, Belgium

WEBSITE
www.myrrha.be

WindScanner

European WindScanner Facility

A LARGE SCALE MOBILE EXPERIMENTAL FACILITY TO BETTER MEASURE, MODEL AND EXPLOIT THE WIND AND ITS ENERGY RESOURCE

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: DK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2010

TIMELINE
- 2012-2015 Preparation Phase
- 2016-2018 Interim/Transition Phase
- 2019-2021 Implementation/Construction Phase
- 2021 Operation Start

ESTIMATED COSTS
capital value: 20.5 M€
design: 8.5 M€
preparation: 5.9 M€
construction: 6.1 M€
operation: 2 M€/year

HEADQUARTERS
DTU Wind Energy
Roskilde, Denmark

WEBSITE
www.windscanner.eu

DESCRIPTION

The European WindScanner Facility (WindScanner) is set out to be a distributed Research Infrastructure for full scale atmospheric boundary-layer experimental research in wind and turbulence fields for wind energy. The WindScanner infrastructure builds upon recent advances in remote sensing-based technology developed on ground-based scanning wind lidars, able to measure and quantify the atmospheric wind fields and turbulence aloft. As well as being deployed onshore, the infrastructure can be operated offshore from stable and floating platforms or by doing measurement of near-coastal wind farms. WindScanner provides unique services for the scientific community and wind industry, a one-point of entry and a joint access programme, joint R&D development activities, joint training and educational programme, stable and effective management and a strategic approach for planning and implementing measurement campaigns in Europe.

In the ESFRI Roadmap since 2010, WindScanner is in the Interim Phase and has indicated the European Research Infrastructures Consortium (ERIC) as the legal form for the future.

BACKGROUND

Wind energy is about to become the leading electricity generating technology across Europe. In 2015, 43% of the electricity produced in Denmark came from wind energy. However, a massive increase in installed wind power capacity throughout Europe is still required to meet the political goals for this sustainable energy system. The energy system of the future must provide secure, affordable and climate-friendly energy, while at the same time creating new jobs and growth. Significant progress in lowering cost of energy (LCoE) has already been achieved, but there is still potential for cost reductions, through market development, research and innovation, for wind energy to reach its full potential. WindScanner is conceived as a new unique European distributed, mobile Research Infrastructure to provide the experimental data needed by the European wind energy's research community for high-quality full-scale atmospheric measurements of the wind fields surroundings today's huge wind turbines, wind farms, bridges, buildings, forests and mountains. The European WindScanner facility uses remote sensed wind measurements from space and time synchronized scanners to provide detailed wind field maps of the wind and turbulence conditions from the individual turbine scale to entire wind farms extending several kilometres. Via excessive data analysis WindScanner provides detailed inflow and wake measurements for validation and verification of wind turbine design and siting and for future optimisation of design making wind energy become cheaper and more reliable for the benefit of the society.

WindScanners generate very detailed and huge amounts of data, which are challenging for researchers and other users to analyse and interpret. Therefore, in the forthcoming years, the WindScanner data acquisition and post processing needs to become faster accessible to users and the scanned 3D wind velocity data interpretation less complex. The WindScanner infrastructure has its primary use within the fields of measurements around large wind turbines, on and off shore. However, it also serves other purposes such as atmospheric boundary layer research, air safety, wind loads on buildings and bridges, wind circulation in streets and the urban environment in general.

STEPS FOR IMPLEMENTATION

WindScanner was included in the ESFRI Roadmap as a European joint effort to coordinate a network between distributed WindScanner systems and demonstration nodes embedded within leading European organizations for wind energy research. WindScanner ended the Preparatory Phase in 2015 with a Business Plan for the realization of the ERIC as agreed by the research institutions partners. Currently in the Interim Phase, Windcanner is aiming to be operational from 2021.

Once fully established, the WindScanner RI is expected to consist of 6-8 National Nodes throughout Europe, each node having its own portable rapid deployable short and/or long-range WindScanner System. The mobile distributed Research Infrastructure will be led from a WindScanner Central Hub located in Denmark, hosted by DTU. The participants are all partners of the European Energy Research Alliance (EERA) and the WindScanner vision is to develop a European Research Infrastructure underpinning the EERA Joint Programme on Wind Energy.

ACTRIS

Aerosols, Clouds and Trace gases Research Infrastructure

GROUND-BASED STATIONS TO UNDERSTAND PAST, PRESENT AND PREDICT FUTURE EVOLUTION OF THE ATMOSPHERE

DESCRIPTION

The Aerosols, Clouds and Trace gases Research Infrastructure (ACTRIS) is a distributed infrastructure dedicated to high-quality observation of aerosols, clouds, trace gases and exploration of their interactions. It will deliver precision data, services and procedures regarding the 4D variability of clouds, short-lived atmospheric species and the physical, optical and chemical properties of aerosols to improve the current capacity to analyse, understand and predict past, current and future evolution of the atmospheric environment. ACTRIS serves a vast community of users working on observations, experiments, models, satellite data, analysis and predicting systems. It offers access to advanced technological platforms for exploration of the relevant atmospheric processes in the fields of climate change and air quality.

Included in ESFRI Roadmap in 2016, ACTRIS is striving to apply for the European Research Infrastructure Consortium (ERIC) in 2019.

BACKGROUND

Short-lived atmospheric components – aerosols, clouds, trace gases – have a residence time in the atmosphere from hours to few weeks. The short lifetimes make their concentrations highly variable in time and space and involve fast processes. They are recognised to be among the most significant anthropogenic pollutants affecting Earth's radiation balance and the largest source of uncertainty in terms of radiative forcing impact. In parallel, short-lived atmospheric compounds have recognized adverse health effects at concentrations typically found across Europe and potentially lead to more than 400.000 premature deaths annually in the EU28. Information on concentrations and distributions of aerosols and trace gases is therefore required to reduce air pollution and related adverse effects on health and ecosystems.

ACTRIS addresses these challenges by operating at National Facilities via a combination of measurements of aerosols, clouds and reactive trace gases both near-surface and with remote-sensing systems, and ancillary measurements of meteorological and radiation quantities. ACTRIS National Facilities consist of both observational and exploratory platforms. ACTRIS relies on appropriate Central Facilities – Topical Centres for instrument calibration and development, Data Centre for data access services, data curation and storage, and Head Office for coordination and management of the RI – to provide harmonized, reliable, and documented observational data and physical access to high quality National Facilities. The Central Facilities are fundamental in providing the physical and remote access to the ACTRIS services, organising training and education, both within and outside the RI, and delivering tailored services for various user groups including scientific community, space agencies, COPERNICUS and the private sector. ACTRIS complements the Environmental RIs domain as it contributes data and services on atmospheric composition changes.

STEPS FOR IMPLEMENTATION

In the ESFRI Roadmap since 2016, ACTRIS is the result of the long-term collaboration within the atmospheric science community sustained by a series of INFRA projects that started in 2000. The aim of the full implementation plan is to set up a Research Infrastructure service system for the complex data-stream that starts at the National Facilities and goes through quality screening and higher level data products made available through the Data Centre, and finally to the repositories that will secure long-term and global access by a large community of users. ACTRIS also offers physical access to Topical Centres, selected observational sites and exploratory facilities for users to conduct their own research.

ACTRIS is now in the Preparation Phase and will gradually move into the Implementation Phase – foreseen in 2019/2024 – to be fully operational in 2025. Interim ACTRIS Council has decided to apply for the ERIC with the aim to submit ERIC Step 1 application in early 2019.

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: FI
prospective member countries:
AT, BE, BG, CH, CY, CZ, EL, ES, FR, IT, NL, NO, PL, RO, UK

The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2016

TIMELINE
- 2016-2019 Preparation Phase
- 2019-2024 Implementation/Construction Phase
- 2025 Operation Start

ESTIMATED COSTS
capital value: 450 M€
design: 3 M€
preparation: 6 M€
construction: 190 M€
operation: 50 M€/year

HEADQUARTERS
University of Helsinki and Finnish - Meteorological Institute
Helsinki, Finland &
Consiglio Nazionale delle Ricerche - CNR
Rome, Italy

WEBSITE
www.actris.eu

FINLAND

An interdisciplinary research and innovation infrastructure for River-Sea systems

DANUBIUS-RI

International Centre for Advanced Studies on River-Sea Systems

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: RO
prospective member countries:
AT, BG, CZ, DE, EL, ES, IT, MD, NL, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2016

TIMELINE
- 2016-2019
  Preparation Phase
- 2012-2022
  Implementation/Construction Phase
- 2022
  Operation Start

ESTIMATED COSTS
capital value: 300 M€
design: Not Available
preparation: 2 M€
construction: 222 M€
operation: 28 M€/year

HEADQUARTERS
DANUBIUS-RI
Murighiol, Romania

WEBSITE
www.danubius-ri.eu

Description

The International Centre for Advanced Studies on River-Sea Systems (DANUBIUS-RI) is a distributed Research Infrastructure to enable excellent interdisciplinary research and innovation on River-Sea (RS) systems. It spans the environmental, social and economic sciences and brings together research on different environmental sectors. European research on RS systems and their transitional environments is world-leading but fragmented, largely discipline-specific and often geographically isolated. DANUBIUS-RI will draw on existing research expertise across Europe, enhance the impact of European research and maximise the return on investment. It will provide access to a range of European RS systems, facilities and expertise; a *one-stop-shop* for knowledge exchange in managing RS systems; access to harmonised data; and a platform for interdisciplinary research, inspiration, education and training.

In the ESFRI Roadmap since 2016, DANUBIUS-RI is in the Preparatory Phase. Operations are expected to start in 2022.

Background

Surface waters are central in global biogeochemical cycles, food and energy production, and societal wellbeing. Biodiversity hotspots at the interface between land and water provide essential ecosystem services and face natural and anthropogenic environmental perturbations at local and global scales. However, the nature of RS systems and their transitional environments and the lack of interdisciplinary Research Infrastructures has contributed to fragmentation of research.

DANUBIUS-RI – named from the world's most international river – covers the RS continuum with a focus on transitional environments, such as estuaries, deltas and the interface with groundwater, and rectifies this fragmentation. The Research Infrastructure will comprise a Hub and a Data Centre in Romania, a Technology Transfer Office in Ireland, and Supersites and Nodes across Europe. The Hub will provide leadership, coordination, and key scientific, educational and analytical capabilities. Supersites are designated natural sites for observation, research and modelling at locations of high scientific importance across a range of European RS systems. Supersites are: the Danube Delta (RO), Middle Danube (HU), Upper Danube (AT), Nestos (EL), Elbe Estuary (DE), Thames Estuary (UK), Ebro-Llobregat Deltaic System (ES), Po Delta–North Adriatic Lagoons (IT), Guadalquivir Estuary (ES), Tay Catchment (UK), Rhine/Meuse Delta (NL) and Mid Rhine (DE). Nodes are centres of expertise providing facilities and services, data storage and provision, experimental and *in situ* measurements facilities, state-of- the-art analytical capabilities and implementation of standardised procedures and quality control (DANUBIUS Commons). Leading Institutions for the Nodes are in the UK (Observation), Germany (Analysis), Italy (Modelling) and Netherlands (Impact). Additional needs will be met by Accredited Service Providers, under the coordination of the Institutions, thus increasing research capability and capacity across Europe.

Steps for implementation

DANUBIUS-RI has received political support from fourteen partner countries in Europe, four of which have already made financial commitments, and expressions of support from organisations in 16 other countries in Europe, Africa, Asia, and North America. DANUBIUS-RI has been designated a flagship project of the EU Strategy for the Danube Region.

The initial part of the Hub was inaugurated in September 2015. The Preparatory Phase work is to bring DANUBIUS-RI to the level of legal, financial, and technical maturity for implementation. This includes: further involvement with partners and stakeholders to develop the Nodes, Supersites and other components; seeking political support from additional countries; development of the DANUBIUS Commons; engagement with national funding bodies; application for Structural Funds; and development of ERIC statutes. The aim is to achieve the European Research Infrastructure Consortium (ERIC) status and become operational by 2022.

DiSSCo
Distributed System of Scientific Collections

Data-intensive frontier research through unified access to European natural science collections

Description
The Distributed System of Scientific Collections (DiSSCo) is a new pan-European Research Infrastructure with the vision to place European natural science collections at the centre of data-intensive scientific excellence and innovation for taxonomic and environmental research, food security, health, and the bioeconomy. DiSSCo mobilises, links and delivers currently fragmented biodiversity and geodiversity information at a scale, form and precision required, tooling scientists to address major challenges of the Anthropocene.

The new RI introduces a step change by massively improving the capacity of scientists to discover, access and analyse complex and previously disjoined information deriving from the study of the vast European natural science collections.

Background
Natural science collections are an integral part of the global natural and cultural capital. They include hundreds of millions of animals, plants, fossils, rocks, minerals and meteorites, which account for 55% of the natural sciences collections globally and represent 80% of the world biodiversity and geodiversity. Data derived from these collections underpin countless innovations, including tens of thousands of scholarly publications and official reports – supporting legislative processes relating to health, food security, sustainability and environmental change; inventions and products critical to our bioeconomy, databases, maps and descriptions of scientific observations, instructional material for education, and informational material for the public.

DiSSCo directly addresses the current fragmentation of European collections, by transforming a network of institutions into a coherent RI: a *one-stop-shop* for European collections, collection data and associated expertise. DiSSCo unifies 115 leading natural science collection facilities in 21 countries and has a concrete plan for further expansion. DiSSCo will deploy its service portfolio under four classes and for a broad range of users: i) e-science services – unfied discovery, access, interpretation and analysis of complex linked biodiversity and geodiversity data, through a single-entry point; ii) transnational and remote access – universal pan-European physical access and digitisation-on-demand services for all major European collections; iii) support & training – integrated user support desk and open multi-modal training programmes to enhance digital skills across users; iv) Joint Research Programming – prioritisation and support of data-driven innovation-led joint programmes, building on the combined capacity of hundreds of European institutions.

Steps for implementation
DiSSCo represents the outcome of signficant scientific and socio-technical investments, started in 2004, enabling to design a pan-European RI, which unifies European natural collections into a single virtual organisation. Such infrastructure would massively widen the scientific reach of data linked to collections and leverage the impact of distributed facilities.

The European natural science collections develop DiSSCo as an integrated RI to provide unified access and analysis services, building on the super-advanced community – the CETAF network – and on multiple previous access programmes – e.g. SYNTHESIS. Since 2016, DiSSCo has engaged with strong scientific, managerial and technical leaders to prepare for its implementation plan. Each of the DiSSCo national nodes will identify complementary thematic priorities, relevant to the delivery of the DiSSCo service portfolio, ensuring alignment to national Strategies for Smart Specialisation (RIS3), and in support of a knowledge-driven regional growth.

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: NL
prospective member countries:
BE, BG, DK, EE, EL, FR, IT, PT, SK, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2018

TIMELINE
- 2004-2017 Design Phase
- 2018-2022 Preparation Phase
- 2020-2025 Implementation/Construction Phase
- 2025 Operation Start

ESTIMATED COSTS
capital value: 420.3 M€
design: 10.7 M€
preparation: 20.2 M€
construction: 69.4 M€
operation: 12.1 M€/year

HEADQUARTERS
to be defined

WEBSITE
www.dissco.eu

THE NETHERLANDS

INTEGRATED CROSS-SCALE AND CROSS-DISCIPLINARY APPROACH FOR THE ANALYSIS OF ECOSYSTEMS AND BIODIVERSITY

eLTER

Long-Term Ecosystem Research in Europe

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: DE
prospective member countries: AT, CH, EL, ES, FI, FR, IL, IT, LV, PL, PT, RO, RS, SI, SK, UK

The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2018

TIMELINE

- 2015-2019 Design Phase
- 2019-2021 Preparation Phase
- 2021-2026 Implementation/Construction Phase
- 2026 Operation Start

ESTIMATED COSTS
capital value: 119 M€
design: 6.4 M€
preparation: 5 M€
construction: 94 M€
operation: 35 M€/year

HEADQUARTERS
Helmholtz Centre for Environmental Research - UFZ
Leipzig, Germany

WEBSITE
www.lter-europe.net

DESCRIPTION

The Long-Term Ecosystem Research in Europe (eLTER) is a new distributed Research Infrastructure which aims at integrating traditional natural sciences and holistic ecosystem research approaches, including studies of the human component, to better understand ecosystems. Through research and monitoring, eLTER seeks to improve our knowledge of the structure and functions of ecosystems and their long-term response to environmental, societal and economic drivers.

eLTER will provide indispensable integrated data sets – abiotic, biotic, societal, covering all system structures and functions – for system model development and validation, hence supporting predictions and decision-making in an interdisciplinary framework and in collaboration with other *in situ*, domain specific RIs.

eLTER contributes to the knowledge base informing policy and to the development of management options in response to the *Grand Challenges*.

BACKGROUND

In a world of global *Grand Challenges*, multiple stressors act at different temporal and spatial scales with significant losses of biodiversity and ecosystem functions that eventually affect human life. While in the short-term such effects are well studied, little is known about long-term and systemic effects and cross-scale interactions. Closing these knowledge gaps requires a deep understanding of the multifaceted environmental system in order to develop appropriate mitigation measures. eLTER features a unique integrated system approach in a nested design, allowing for interdisciplinary natural science research as well as investigating human/environment/ systems at landscape scales. The design of the eLTER is guided by two overarching scientific concepts, applicable from point to continental scales: the Press Pulse Dynamic Model as *horizontal* component, and the spatially-nested hierarchical feedback paradigm of Macrosystems Ecology as a *vertical* component.

eLTER comprises: *in situ*, long-term, cross-disciplinary, multiple-use, large-scale coverage of major European socio-ecological systems. The aim is to secure scientific excellence through the highest quality interoperable services in close interaction with related European and global RIs. This implies both increased research quality through scientific cross-disciplinary synthesis at the system level – including human-environment interactions – and quantity in terms of the number of appropriately designed and equipped research sites. eLTER will contribute to the European environmental RI landscape by building up a pan-European network of long-term ecological research sites.

The design at the European and national level secures full complementarity with the related environmental *in situ* RIs like ICOS ERIC, AnaEE, DANUBIUS-RI and ACTRIS, and e-RIs such as LifeWatch ERIC and DiSSCo.

STEPS FOR IMPLEMENTATION

eLTER has evolved via flagship projects – e.g. ALTER-Net NoE, EnvEurope, ExpeER, and eLTER H2020 – and was cited as *emerging project* in the ESFRI Roadmap 2016. Based on this results, the EU-funded Advance_eLTER project elaborated a design and implementation plan for the submission to the Roadmap 2018.

The first stage of eLTER will be implemented based on an existing very large network of LTER sites – about 400 formally acknowledged ecosystem research sites and 35 LTSER Platforms for socio-ecological research operated by about 150 institutions. The eLTER design defines a hierarchy of sites, with major nodes playing a main role in driving scientific innovation and other sites focussing on data-provisioning and pan-European coverage. This mixed mode of operation will allow eLTER to play an important integrating role for policy-makers. The most important milestones for the planned Preparatory Phase are locations of the Central Services and establishment of the legal entity which is expected in 2026.

AnaEE

Infrastructure for Analysis and Experimentation on Ecosystems

INTEGRATED EXPERIMENTATION TO FORECAST THE IMPACTS OF CLIMATE AND LAND-USE CHANGES ON ECOSYSTEMS

DESCRIPTION

The Infrastructure for Analysis and Experimentation on Ecosystems (AnaEE) is a distributed Research Infrastructure designed to provide the knowledge needed to support a sustainable future. This infrastructure aims, through state-of-the-art experimental facilities, to support scientists in testing the potential impacts of climate change and land use in Europe, and forecasting the risks on European ecosystems, including agricultural systems. AnaEE will thus enable policy-makers, scientists and the industry to develop climate mitigation strategies and provide solutions to the challenges of food security, with the aim of stimulating the growth of a vibrant bio-economy.

In the ESFRI Roadmap since 2010, AnaEE is expected to become a European Research Infrastructure Consortium (ERIC) and start operations in 2019.

BACKGROUND

The sustainability of agricultural, forested, freshwater and other managed and natural ecosystems is critical for the future of mankind. However, the services provided by these ecosystems are under threat due to climate change, loss of biodiversity, and land-use changes. In order to meet the challenges of preserving or improving ecosystems services, securing food supply and building a 21st century bio-economy, we need to understand and forecast how ecosystems will respond to current and future changes including new management approaches and potential environmental tipping points. Without sufficient understanding of the sensitive interdependencies between ecosystems and the environment, Europe will be unable to assess the impacts, control the risks, or potentially utilize the benefits of anticipated large changes in ecosystems structure and function, for the production of nutritious food and goods which are environmentally sustainable and in balance with growing energy demands. Key benefits will include greenhouse gas mitigation and climate adaptation.

AnaEE will adopt an experimental approach built around ecosystems manipulation, measurements, modelling, mitigation and management. At the core of AnaEE's approach are the distributed experimental facilities needed to expose ecosystems to potential conditions to produce results that will inform predictive models and deliver realistic simulations. AnaEE research has to be process-oriented and address how major biogeochemical cycles, biodiversity and the relationship between biodiversity and ecosystem functions, including agricultural systems' function, will change under the various experimental drivers. The AnaEE experimental facilities will be equipped with state-of-the-art instrumentation and Information Technology Tools and will use common standards of measurements and analysis. AnaEE provides a nexus between the environment and food domains, and aims to cover the greatest number of ecosystem types, soil types, pressures and other factors in terms of experimentation on terrestrial and freshwater ecosystems. The infrastructure will include open-air and enclosed experimental platforms as well as analytical and modelling platforms.

STEPS FOR IMPLEMENTATION

AnaEE is currently in the Implementation Phase with six countries – France, Belgium, Czech Republic, Denmark, Israel and Italy. Additional countries are expected to join in 2018. The infrastructure coordination with its Central Hub has been attributed to France. The Technology Centre has been attributed to Denmark, the Interface and Synthesis Centre to Czech Republic and the Data and Modeling Centre to Italy. The application for the ERIC has been submitted in 2018 and the recruitment of the AnaEE Director General is ongoing.

The coordination and integration of the national platforms, through the Hub and centres will ensure international access, improved measurements and data harmonization, technology development, links between data and models, open access to raw data and syntheses. The Research Infrastructure will be based on distributed advanced experimental platforms that are sustainably funded and responding to a number of key commonly agreed-upon criteria in terms of quality and state-of-the-art equipment.

TYPE
distributed

LEGAL STATUS
ERIC Step1, 2018

POLITICAL SUPPORT
lead country: FR
prospective member countries:
BE, CZ, DK, IL, IT

The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2010

TIMELINE
- **2007-2010** Design Phase
- **2012-2016** Preparation Phase
- **2016-2018** Implementation/Construction Phase
- **2019** Operation Start

ESTIMATED COSTS
capital value: 337 M€
design: 1.2 M€
preparation: 4.7 M€
construction: 1.1 M€
operation: 0.8 M€/year

HEADQUARTERS
Institut National de la Recherche Agronomique - INRA
Paris, France

WEBSITE
www.anaee.com

FRANCE

A MULTI-SCALE PHENOTYPING PLATFORM FOR FOOD SECURITY IN DIFFERENT AGRO-CLIMATIC SCENARIOS

EMPHASIS

European Infrastructure for Multi-scale Plant Phenomics and Simulation

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: DE
prospective member countries:
BE, CY, CZ, FR, IE, IT, NL, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2016

TIMELINE
- 2017-2020 Preparation Phase
- 2020-2021 Implementation/Construction Phase
- 2021 Operation Start

ESTIMATED COSTS
capital value: 160 M€
design: Not Available
preparation: 4 M€
construction: 73 M€
operation: 3.6 M€/year

HEADQUARTERS
Forschungszentrum Jülich
Jülich, Germany &
Institut National de
la Recherche Agronomique-INRA
Montpellier, France

WEBSITE
https://emphasis.plant-phenotyping.eu/

DESCRIPTION

The European Infrastructure for Multi-scale Plant Phenomics and Simulation (EMPHASIS) is a distributed Research Infrastructure to develop and provide access to facilities and services addressing multi-scale phenotyping in different agro-climatic scenarios. EMPHASIS will establish an integrated European phenotyping infrastructure to analyse genotype performance under diverse environmental conditions and quantify the diversity of traits contributing to performance in diverse environmental scenario – plant architecture, major physiological functions and output, yield components and quality. EMPHASIS aims to address the technological and organizational limits of European Phenotyping, for a full exploitation of genetic and genomic resources available for crop improvement in changing climate.

Inserted in the ESFRI Roadmap in 2016, EMPHASIS is expected to enter the Implementation Phase in 2020 and become operational in 2021.

BACKGROUND

Sustainable intensification of crop production is a major challenge to ensure amount and quality of biomass for nutrition and industry. Designing high yielding crop varieties adapted to contrasting environmental conditions, climate change and management, is a priority. Technological advancements have boosted the characterisation of genomes, without sufficient development in phenotypic characterisation. The mission of EMPHASIS addresses an important bottleneck in sustainable and improved crop production in different, current and future, agro-climatic scenarios: how to translate from high-throughput genotypic analysis of crop variants to high-throughput and high-resolution phenotyping in order to identify high-yield crop varieties for defined environmental conditions. To achieve this, EMPHASIS proposes a major upgrade/reorientation of existing European Research Infrastructure by linking and developing national initiatives, amongst which are national platforms with (semi)-controlled conditions for high-resolution phenotyping and high-throughput phenomics, experimental fields with control of rainfall and CO2 highly-equipped with phenotyping devices, a coordinated network of field experiments in distributed sites with lighter but efficient phenotyping close to practical breeding set-ups and modelling platforms to test existing and virtual combinations of alleles in different climates and management practices. Some methods used will include sensors and imaging in plant architecture and dynamics, consistent distributed information system, and statistics and dynamic modelling.

EMPHASIS can test genotypes in current and future agro-climatic scenarios and provide community access to controlled and field conditions; link data acquisition to a European data management and to crop models simulating performance in current and future climates; develop, evaluate and disseminate novel technologies and provide new opportunities to European companies and make infrastructures and concepts accessible to academia and industry in Europe.

STEPS FOR IMPLEMENTATION

The Preparatory Phase of EMPHASIS started in 2017 to bring the project to the level of legal, financial, and technical maturity required for implementation. EMPHASIS PP provide the basis for the establishment of the legal framework, the business plan and the preparation of an information system for a sustainable and innovative pan-European infrastructure for plant phenotyping. Actually, political support and commitment to EMPHASIS has been expressed by nine European countries in the form of previous investments and an additional investment from Germany. EMPHASIS has already committed 49 M€ (67%) of the total cost until full establishment in the next five years. EMPHASIS is already placing Europe in a leading position via the International Plant Phenotyping Network, and has already engaged further Member States in their current plans. It is timely that this is secured in a long-term, sustainable pan-European Research Infrastructure filling an important gap in the Health & Food landscape.

EU-IBISBA

European Industrial Biotechnology Innovation and Synthetic Biology Accelerator

An accelerator for research and innovation in Industrial Biotechnology and Synthetic Biology

DESCRIPTION

The Industrial Biotechnology Innovation and Synthetic Biology Accelerator (EU-IBISBA) is a distributed Research Infrastructure aiming at supporting research in industrial biotechnology (IB) by providing access to first class facilities for all industrial biotechnology professionals, including academic researchers, SMEs and large companies. EU-IBISBA will operate in a multidisciplinary environment developing translational research in industrial biotechnology and developing the synthetic biology discipline.
These areas derive from underpinning knowledge from biochemistry, microbiology, genetics, mathematics, computational science, and engineering disciplines such as chemical and process engineering, which will be in large part drawn from European infrastructures dedicated to more basic research.

EU-IBISBA will provide a research nexus for biology researchers and chemical engineers, favouring the connection of different knowledge domains, and providing a hub for public-private collaboration. EU-IBISBA will form a perfect environment for education and training of biotechnologists and entrepreneurs.

BACKGROUND

Industrial biotechnology is the convergence of numerous scientific and engineering disciplines to provide biocatalysts and bioprocesses for the production of a wide variety of goods. Currently, synthetic biology promises to revolutionise industrial biotechnology using advanced techniques, including genome engineering for the construction of biocatalysts, especially microbial cell factories. However, to realize this promise and accelerate the development of advanced bioprocesses for a wide range of manufacturing sectors it is necessary to address numerous challenges linked to the application of process design specifications and engineering principles to complex biological systems.

EU-IBISBA will support this learning process, providing academics and the private sector with the infrastructure for the development and testing of innovation pipelines, beginning at TRL2 and moving upwards to TRL6, a range that corresponds to the so-called innovation valley of death. It will provide the infrastructure framework for translational research services and innovation in the area of IB. Its mission is to support the maturation of synthetic biology within the focused framework of end-to-end bioprocess development, using engineering principles to achieve industrial process fitness by design.

EU-IBISBA will provide innovation in areas such as computer-assisted design of biocomponents, biocatalysts and bioprocesses, from their early stage construction and proof-of-concept to pilot phase testing of integrated bioprocesses. EU-IBISBA will cover a range of technology areas, including downstream processing and multi-performance analyses. It is expected that EU-IBISBA will accelerate innovation for subsequent translation into goods and services for a wide range of sectors including energy (e.g. liquid biofuels), chemicals (e.g. organic acids), materials (e.g. bioplastics) and ingredients for the food, feed, cosmetics and pharma sectors (e.g. enzymes, antioxidant and antibiotics).

STEPS FOR IMPLEMENTATION

EU-IBISBA is built on a long-term collaboration between the consortium partners in international, mostly EU-funded projects – BIOCORE, NANO3BIO e RENESENG – and as the result of the successful deployment of facilities in several European countries, in particular the case of INRA's Toulouse White Biotechnology facility. In July 2017, the consortium MoU has been signed by partner institutions from 9 European countries. EU-IBISBA was the object of ESFRI assessment in 2016, which has provided the basis for the maturation of a new proposal built through stakeholder meetings, one-to-one discussions with industrial partners and the IBISBA 1.0 project, a H2020 Integrating Activities for Starting Communities project.

Currently in its Design Phase, EU-IBISBA reflects the necessity to provide Europe with a Research Infrastructures that will be competitive in the international arena facing US and China in industrial biotechnology.

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: FR
prospective member countries:
EL, ES, FI, IT, NL
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2018

TIMELINE
- **2018-2019** Design Phase
- **2019-2022** Preparation Phase
- **2022-2025** Implementation/Construction Phase
- **2025** Operation Start

ESTIMATED COSTS
capital value: 52.6 M€
design: 3 M€
preparation: 4 M€
construction: 1.1 M€
operation: 65.1 M€/year

HEADQUARTERS
Institut National Des Sciences Appliquées - INSA
Toulouse, France

WEBSITE
www.ibisba.eu

A COORDINATION EFFORT TO INTERCONNECT THE BEST EXPERIMENTAL AND MODELLING FACILITIES FOR SYSTEMS BIOLOGY

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: pending
prospective member countries: IT, SI
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2010

TIMELINE
- 2012-2015 Preparation Phase
- 2016-2019 Implementation/Construction Phase
- 2019 Operation Start

ESTIMATED COSTS
capital value: Not Available
design: Not Available
preparation: 4.7 M€
construction: 10 M€
operation: 5.2 M€/year

HEADQUARTERS
University of Naples Federico II
Naples, Italy

WEBSITE
http://project.isbe.eu/

PENDING

ISBE
Infrastructure for System Biology Europe

DESCRIPTION
The Infrastructure for Systems Biology Europe (ISBE) is a distributed Research Infrastructure that enables efficient access to the best expertise, resources and services, such as model building, fit-for-modelling data, tools and training in systems biology. ISBE is built on national strengths, through a matrix of interconnected national systems biology centres, and makes them easily accessible for all European researchers. ISBE will set, improve and promote standardisation of biological data, tools and models as well as operating procedures, ensuring that resources from different laboratories, countries and sectors can be integrated and become re-usable. ISBE play a key role in enhancing the European bio-economy by providing resources and services to academia, industry and the public sector to deliver solutions that address *Grand Challenges* in healthcare, food production, quality of life, and sustainable bio-energy.

Included in the ESFRI Roadmap 2010, ISBE is planning to apply for the European Research Infrastructure Consortium (ERIC) legal framework.

BACKGROUND
Biological processes are the result of complex dynamic interactions within and between molecules, cells, organs and entire organisms. Systems biology integrates multiple and diverse data sets in predictive computational models, which allow multi-scale exploration of biological systems. This requires combining biological and biomedical data and expertise with knowledge and technologies from the fields of mathematics, computer science, physics and engineering. National governments and the European Commission have recognised the importance of systems biology and have invested in it over the past ten years.

ISBE adds value to national and European investments by offering open access to expertise, resources and training through its matrix of national systems biology centres. The core of ISBE is a pan-European network of interconnected national Systems Biology Centres (nSBCs). Together they will span the wide spectrum of systems biology expertise in health, agriculture, biotech and other branches of the life sciences in academia, hospitals and industry. Each nSBC will be embedded within its national research community and linked to a central coordinating hub (CIO).

The expertise, resources and services that are offered by nSBCs cover the three tightly related expertise domains of ISBE: i) modelling, ii) stewardship and standardisation and iii) model-compliant data generation. In ISBE, the Data Integration Centres are particularly reliant on being able to identify data from suitable physiological conditions that can be incorporated into models. The Data Generation and Stewardship Centres can streamline this process by providing standard formats and interfaces for access, storage and exchange.

STEPS FOR IMPLEMENTATION
ISBE ended its Preparatory Phase in July 2015. The project was coordinated by the Imperial College London and executed by a Steering Committee with representatives from 23 research institutions and funding bodies from 11 countries. During the Preparatory Phase, ISBE played a key role to link various expertise and technologies into an integrated project and establishing connections with various other ESFRI RIs in a meaningful way – for example allowing the creation of computer models which integrate both *omics* data from existing Research Infrastructures in the area of life sciences and health.

During the Construction Phase, ISBE has started to deliver web-based services for: i) development of experimental and computational facilities for systems metabolomics; ii) modelling, stewardship of research assets – through FAIRDOM; and iii) training – continuing activities of ERASyAPP. Building phase activities are based on *in-kind* and *in-cash* contributions from members of the Consortium.

METROFOOD-RI

Infrastructure for Promoting Metrology in Food and Nutrition

High-level metrology services in food and nutrition for the enhancement of food quality and safety

DESCRIPTION

The Infrastructure for promoting Metrology in Food and Nutrition (METROFOOD-RI) is a new distributed Research Infrastructure aimed to promote scientific excellence in the field of food quality and safety. It provides high-quality metrology services in food and nutrition, comprising an important cross-section of highly interdisciplinary and interconnected fields throughout the food value chain, including agrifood, sustainable development, food safety, quality, traceability and authenticity, environmental safety, and human health.

METROFOOD-RI consists of a physical infrastructure (P-RI) and an electronic infrastructure (e-RI) to coordinate and integrate existing networks of plants, laboratories, experimental fields/farms for crop production/animal breeding, small-scale plants for food processing and storage, kitchen-labs for food preparation. The e-RI will make available an access platform to share and integrate knowledge and data on metrological tools for food analysis, focusing on food composition, nutritional contents, levels of contaminants and markers.

BACKGROUND

The agri-food sector is a strategic asset of all the European Countries and one of the largest and most important economic activities, with particular social relevance: it is vital to ensure employment, preserve rural public goods, supply healthy and quality food, and facilitate the integration of SMEs into the international food chain. Food quality and authenticity have now become a focus of consumer's requirements all over the world. Food traceability and safety are key factors to ensure food quality and to protect consumers' interests. In particular, food safety represents one of the most important elements of public health policies at a global level. High-quality data on the food chain are of fundamental importance to populate the expanding data technologies with useful contents and, according to the FAIR principles, enable advanced research on food and food metrology.

METROFOOD-RI mission is to enhance quality and reliability of measurement results and make available and share data, information and metrological tools, in order to enhance scientific excellence in the field of food quality and safety and strengthen scientific knowledge, also promoting scientific cooperation and to integration. The general objective is to enhance scientific cooperation and encourage interaction between the various stakeholders, as well as the creation of a common and shared base of data, information and knowledge. The scientific offer is addressed to a broad set of users and stakeholders, such as: public and private labs and groups engaged in research activities for food data collection and measurement reliability and basic frontier research in food and nutrition; Food Business Operators and producer associations; policy makers, food inspection and control agencies; consumers/ consumer associations and citizens.

STEPS FOR IMPLEMENTATION

METROFOOD-RI was cited as *emerging project* in the ESFRI Roadmap 2016 and in 2017 completed its Early Phase upon the EU-funded PROMETROFOOD project. During this phase, METROFOOD-RI has performed a detailed Design and Feasibility Study, including an inventory of the available facilities, an analysis of the physical-RI and e-RI services, the development of two pilot services, Quality Systems and Data Management Plans, an analysis of users and stakeholders, a users' strategy and access policy, and plans for training.

The main objectives for the planned Preparatory Phase are to attain firm additional MS/AC commitments, to better align governance and financial management models, and to set up all the legally binding agreements necessary to establish the ERIC status. The Implementation Phase is planned to start in 2021, with full operation foreseen for 2024.

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: IT
prospective member countries:
CH, CZ, EL, MD, MK, PT, RO, SI, TR

The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2018

TIMELINE

- **2015-2017** Design Phase
- **2018-2021** Preparation Phase
- **2021-2024** Implementation/Construction Phase
- **2019** Operation Start

ESTIMATED COSTS
capital value: 102.4 M€
design: 4.6 M€
preparation: 48.3 M€
construction: 78.8 M€
operation: 31 M€/year

HEADQUARTERS
Agenzia Nazionale per le nuove tecnologie, l'Energia e lo sviluppo economico sostenibile - ENEA
Rome, Italy

WEBSITE
www.metrofood.eu

A COORDINATED PLATFORM TO MANAGE MICROBIAL RESOURCES TO SUPPORT RESEARCH IN BIOTECHNOLOGY

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead countries: ES, PT
prospective member countries: BE, EL, FR, LV, NL, PL
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2010

TIMELINE
- 2012-2016 Preparation Phase
- 2017-2019 Implementation/Construction Phase
- 2021 Operation Start

ESTIMATED COSTS
capital value: Not Available
design: Not Available
preparation: 3.1 M€
construction: 0.8 M€
operation: 0.7 M€/year

HEADQUARTERS
University of Minho
Braga, Portugal

WEBSITE
www.mirri.org

SPAIN, PORTUGAL

MIRRI
Microbial Resource Research Infrastructure

DESCRIPTION
The Microbial Resource Research Infrastructure (MIRRI) is the pan-European distributed Research Infrastructure for microbial resources. MIRRI serves public and private bioscience users by facilitating access to a broad range of high quality bioresources and data in a legal compliant way. The MIRRI partners strive to alleviate the fragmentation of bioresource holdings and expertise, to deliver fit-for-purpose microbial material, to add value to microbial diversity, and to discover and preserve the yet unknown or uncultivated microorganisms. MIRRI cooperates with its users and other RIs to exploit the microbial diversity to the benefit of the bioeconomy. The materials and services will be provided by partners in MIRRI member countries, coordinated by their national nodes. Users will be able to easily search MIRRI services and make requests on the MIRRI access portal.

In the ESFRI Roadmap since 2010, MIRRI is striving to establish the European Research Infrastructure Consortium (ERIC) by 2019.

BACKGROUND
Microbial resources have been recognised as essential raw materials for the advancement of health and for biotechnology, agriculture, food technology and research in the life sciences. To date, less than 1% of the estimated number of species are described and available to be harnessed by man and less than 0,1% of prokaryote strains published in the scientific literature were deposited in public service collections or mBRCs or simply retained for future study and use. About 0.5 million strains are supplied each year by collections registered with the World Data Centre for Microorganisms (WDCM). It is estimated that 70% of strains used in published research are not coming from collections, thus tens of thousands resource strains are sourced for research often without proper authentication and provenance.

MIRRI will provide a wealth of additional information and linking to datasets such as literature, environmental data, sequences and chemistry that will facilitate scientists to select organisms suitable for their research and enable innovative solutions to be developed. MIRRI will support researchers from academia and bio-industry offering a facilitated access to genetic resources via the envisioned MIRRI portal – a *one-stop-shop* for material, data and expertise; broader coverage of genetic resources – coordinated approach towards isolation and deposit of microorganisms; improved tailored service offer from mBRCs also coordinating smaller collections, interoperability of data – facilitated mining of trusted data, increase knowledge transfer to users and implementation of best practices for transition to a mBRC.

By offering long-term deposition of raw material of high scientific and economic value for basic research and innovation in biotechnology, MIRRI will contribute to the H2020 societal challenge to improve health, food security, agriculture, forestry, marine and maritime and inland water research and to address aspects of clean and efficient energy.

STEPS FOR IMPLEMENTATION
MIRRI was included in the ESFRI Roadmap 2010 and the Preparatory Phase was conducted in 2012-2016. Recently it was decided that the statutory seat of MIRRI ERIC will be located in Portugal (University of Minho, Braga) while the Collaborative Working Environment Hub will be operated from Spain (University of Valencia, Paterna) in cooperation with LifeWatch-Spain, a closely related e-Infrastructure. It is envisaged to submit the Step 1 application for the establishment of MIRRI ERIC in Autumn 2018 in order to have the official inauguration of MIRRI ERIC in 2019.

The Assembly of Members shall be the decision-making body of MIRRI ERIC. Those decisions shall be implemented by the Executive Director, assisted by the staff of the Central Coordinating Unit. The National Coordinators Forum will support the Executive Director with the development of annual work programmes and budgets and will ensure efficient interaction between MIRRI ERIC and the national mBRCs.

EST

European Solar Telescope

An advanced telescope for observing the Sun and its magnetic activity

Description

The European Solar Telescope (EST) is a 4-metre class telescope dedicated to study the fundamental processes in the Sun that control the solar atmosphere and its activity and the physical conditions in the heliosphere. EST will be optimized for high-resolution multi-wavelength simultaneous multi-instrument observations of the photosphere and chromosphere, as well as magnetic structures therein. One aim is to address the still unresolved and difficult question concerning the emergence of magnetic fields at the solar surface and transfer of magnetic and kinetic energy from subsurface layers to the solar atmosphere. This is the key question for understanding how the magnetic field is controlling the solar atmosphere and its activity. As the Sun is the only star at which photospheric and chromospheric features can be resolved, these observations will be of astrophysical wide relevance. Understanding the interaction of plasmas with magnetic fields has many technological application, e.g. in fusion nuclear reactors. Space missions are also tributary of data from ground solar telescopes.

In the ESFRI Roadmap since 2016, EST will enter the Implementation Phase in 2021. First light is planned for 2027.

Background

The solar physics community was involved in the development of the project from the beginning: i) creation of the EAST consortium, ii) elaboration of the conceptual design study, iii) I3 Trans-National Access network SOLARNET and iv) GREST project. The solar astronomy community is organized through SOLARNET and ASTRONET and operates with success, since the last decades, a set of national observing facilities and infrastructures on the Canary Islands including the Swedish Solar Telescope, the DOT, the VTT, GREGOR and THEMIS, most of which are approaching the end-of life stage. These national observatories shall be decommissioned or reoriented to become test facilities for detector development or to educational programmes, and the research programme shall concentrate on the EST. Key elements of the landscape are the space missions, in particular the ESA Solar Orbiter programme to be launched in 2018, and the US Daniel K. Inouye Solar Telescope (DKIST, formally the Advanced Technology Solar Telescope ATST), currently being built in Hawaii. DKIST is an asymmetric telescope with an observation programme concentrated on the Sun's corona and linked with space missions.

EST has the same diameter (4m) but it is symmetric and optimized to detect light polarization as it is mandatory for the study of the emergence of magnetic fields at the solar surface and transfer of magnetic and kinetic energy from subsurface layers to the solar atmosphere. A significant advance can be achieved by obtaining observations, of the lower/cooler part of the solar atmosphere, with greatly improved spatial and temporal resolutions. The behaviour of the solar atmosphere in response to the input of magnetic energy is then observable with space instrumentation. The combination of space and ground-based instrumentation will allow a throughout comprehension of the solar magnetic dynamics.

Steps for implementation

EST will be built in the Canary Islands, where the current aging telescopes are already situated. This will give continuity and increase the importance of the scientific parks existing at present in the islands. Operation of the telescope will progressively implement *queue mode* observing, which is standard for night-time telescopes, allows optimisation of the observations, and does not require on-site presence of the beneficiary. 30% of the observing time will be through open calls for proposals, and the open access data policy – after a one-year proprietary period – allows access to the whole interested scientific community.

Siting will be decided between the Tenerife or Roque de los Muchachos both at 2.400 m of altitude in the Canary Islands along with sea-level and mainland facilities including the Telescope Operation and Science Center (TOSC) to steer the operation of the EST and the Science Data Center in Germany, to provide data storage and access to the solar physics community.

TYPE
single-sited

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: ES
prospective member countries: SE, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2016

TIMELINE
- 2008-2011 Design Phase
- 2016-2021 Preparation Phase
- 2021-2027 Implementation/Construction Phase
- 2029 Operation Start

ESTIMATED COSTS
capital value: Not Available
design: 6 M€
preparation: 15 M€
construction: 200 M€
operation: 12 M€/year

HEADQUARTERS
Instituto de Astrofísica de Canarias
Canary Islands, Spain

WEBSITE
www.est-east.eu

A network of neutrino telescopes in the Mediterranean Sea for astroparticle and oscillations research

KM3NeT 2.0

KM3 Neutrino Telescope 2.0

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: NL
prospective member countries: EL, FR, IT
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2016

TIMELINE
- 2008-2014 Preparation Phase
- 2016-2020 Implementation/Construction Phase
- 2020 Operation Start

ESTIMATED COSTS
capital value: 196 M€
design: Not Available
preparation: 45 M€
construction: 151 M€
operation: 3 M€/year

HEADQUARTERS
KM3NeT-HQ Amsterdam Science Park Amsterdam, The Netherlands

WEBSITE
www.km3net.org

Description

The KM3 Neutrino Telescope 2.0 (KM3NeT 2.0) is a three-sites Research Infrastructure housing the next generation neutrino telescopes. Once completed, the telescopes will have detector volumes between megaton and several cubic kilometres of clear sea water. Located in the deepest seas of the Mediterranean, KM3NeT 2.0 will open a new window on our Universe, but also contribute to the research of the properties of the elusive neutrino particles. With the ARCA telescope, KM3NeT 2.0 scientists will search for neutrinos from distant astrophysical sources such as supernovae, gamma-ray bursters or colliding stars. The ORCA telescope is the instrument for KM3NeT 2.0 scientists studying neutrino properties exploiting neutrinos generated in the Earth's atmosphere. Arrays of thousands of optical sensors will detect the faint light in the deep sea from charged particles originating from collisions of the neutrinos and the Earth. The facility will also house instrumentation for Earth and Sea sciences for long-term and on-line monitoring of the deep sea environment and the sea bottom at depth of several kilometers.

In the ESFRI Roadmap since 2016, KM3NeT 2.0 is in the Implementation Phase and will start delivering science in 2020.

Background

The discovery of a flux of very energetic cosmic neutrinos reported by IceCube represents *de facto* the birth of the neutrino astronomy. Many questions arose about the origin of the observed cosmic neutrinos – do they come from sources in our galaxy or do they have an extragalactic origin, can these sources be localised and are they point-like or not? Other questions concern the energy spectrum and the flavour composition of the flux. As a consequence of this discovery, the importance of building a cubic kilometre (KM3) scale high-energy neutrino telescope in the northern hemisphere became even more strong and led to the definition of the next phase in construction of the KM3NeT 2.0 infrastructure with the ARCA telescope dedicated to the search for very high-energy cosmic neutrinos. Thanks to its location in the Mediterranean Sea, the ARCA telescope provides a coverage of 87% of the neutrino sky and allows a survey of almost the whole galaxy including the Galactic Center.

Another goal of the KM3NeT 2.0 scientists is to study the properties of the neutrino particles themselves. The sizable contribution of electron neutrino to the third neutrino mass eigenstate as reported by Daya Bay, Reno and other experiments paved the way for the determination of the neutrino mass hierarchy that is one of the last neutrino properties to be measured. The design of the ORCA detector of KM3NeT 2.0 is optimised for the study of neutrinos created by cosmic rays in the Earth's atmosphere. Together, the ARCA neutrino telescope and the ORCA neutrino detector of the KM3NeT 2.0 Research Infrastructure offer the scientists the unique possibility of performing both all flavour neutrino astroparticle physics and also to advance fundamental neutrino particle physics.

KM3NeT 2.0 addresses neighbouring disciplines like astrophysics (sources of cosmic rays, high-energy neutrino astronomy), particle physics (neutrino oscillations, search for exotic particles) and cosmology (dark matter), but has also strong connections to Earth and Sea Sciences. To measure deep-water parameters with cabled sensors will add a novel option to the toolbox of oceanographers and marine biologists.

Steps for implementation

Three suitable deep-sea sites are identified, namely going from west to east, KM3NeT-Fr, off-shore Toulon (France), KM3NeT-It, off-shore Portopalo di Capo Passero (Italy) and KM3NeT-Gr, off-shore Pylos (Greece). The first phase of construction of the KM3NeT 2.0 Research Infrastructure has begun in 2015 at the KM3NeT-It and KM3NeT-Fr site and is expected to be finished in 2017. For this, a Memorandum of Understanding for KM3NeT-phase1 has been sign by all participating funding agencies. For the next phase of construction, a Letter of Intent for KM3NeT 2.0 has been published. This Letter of Intent will serve as a reference document for requests for funding by the various stakeholders in Europe and abroad. Pending funding, KM3NeT 2.0 could become reality as early as in 2020. The third and final phase of construction of the KM3NeT Research Infrastructure will also include the KM3NeT-Gr site and is foreseen to start after 2020.

E-RIHS

European Research Infrastructure for Heritage Science

AN INFRASTRUCTURE FOR HERITAGE INTERPRETATION, PRESERVATION, DOCUMENTATION AND MANAGEMENT

DESCRIPTION

The European Research Infrastructure for Heritage Science (E-RIHS) is a distributed Research Infrastructures to support research on heritage interpretation, preservation, documentation and management. It will comprise: E-RIHS Headquarters and National Hubs, fixed and mobile instruments in national infrastructures of recognized excellence, physically accessible collections/ archives and virtually accessible heritage data. Both cultural and natural heritage are addressed: collections, buildings, archaeological sites, digital heritage. E-RIHS will provide state-of-the-art tools and services to cross-disciplinary research communities advancing understanding and preservation of global heritage. It will provide access to a wide range of cutting-edge scientific infrastructures, methodologies, data and tools, training, public engagement, access to repositories for standardized data storage, analysis and interpretation. E-RIHS will enable the community to advance heritage science and global access to the distributed infrastructures in a coordinated and streamlined way.

In the ESFRI Roadmap since 2016, E-RIHS is in the Preparatory Phase towards the Implementation Phase that is foreseen to start in 2021.

BACKGROUND

Heritage Science has brought about the need of structuring the net of infrastructures operating throughout Europe. Fragmentation, duplication of efforts, isolation of small research groups put at risks the competitive advantage of European heritage science research, promoted so well by the unique cultural heritage. The long-term tradition of this field of research, the ability to combine with innovation, and the integration promoted by EU-funded projects such as EU-ARTECH, CHARISMA and IPERION CH in conservation science, and ARIADNE in archaeology represent the background of E-RIHS.

E-RIHS exploits the synergy of the cooperation among the academy, research centres and cultural institutions. The global lead that the EU holds in this research field, so precariously supported by a combination of national and EU measures, requires a joint and resolved effort. This has been fully recognized by the European Union with the continuous and reiterated support of initiatives aimed at integrating existing Heritage Science infrastructures, as well as, with a focus on Member States' national research programs, the JPI on Cultural Heritage, coordinating efforts of 17 EU national funding bodies supporting heritage science. The enthusiastic reviews of these initiatives testify the success of their action to advance knowledge and to establish a research community, acknowledged as *advanced* in official EU documents concerning conservation, or quickly growing in the field of archaeology.

This demonstrates beyond any doubt both the scientific and the socio-economic importance connected with Heritage Science: it is a sector and a research community that has achieved the maturity necessary to make the leap towards a permanent European Research Infrastructure that will impact broadly on society and economy.

STEPS FOR IMPLEMENTATION

E-RIHS is currently leading a Preparatory Phase with the aim to establish the European Research Infrastructures Consortium (ERIC). The establishment of a legal structure and governance and the refinement of the business plan for long-term sustainability will be the three most important deliverables, together with the implementation of users' access strategy taking advantage of the existing projects of the consortium. E-RIHS partnership joins 15 countries – 14 EU Member States plus Israel, 2 ERICs RIs and 3 institutions representing scientific communities. E-RIHS also involves over 100 heritage science institutions worldwide. Participation to E-RIHS ERIC is open to more potential founding Members – or Observers – throughout the next years of the Preparatory Phase. E-RIHS will be launched as a stand-alone RI in 2021. Further developments are planned for connecting and including partners and facilities outside Europe, and gradually reaching the status of a Global Research Infrastructure.

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: IT
prospective member countries:
BE, CY, CZ, DE, EL, ES, FR, HU, IL, NL, PL, PT, SI, UK

The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2016

TIMELINE
- 2017-2020 Preparation Phase
- 2019-2021 Interim/Transition Phase
- 2021-2025 Implementation/Construction Phase
- 2025 Operation Start

ESTIMATED COSTS
capital value: Not Available
design: 25 M€
preparation: 4 M€
construction: 20 M€
operation: 5 M€/year

HEADQUARTERS
to be hosted in Italy, Florence

WEBSITE
www.e-rihs.eu

A Research Infrastructure for Holocaust research and remembrance

EHRI

European Holocaust Research Infrastructure

TYPE
distributed

LEGAL STATUS
pending

POLITICAL SUPPORT
lead country: NL
prospective member countries:
AT, CZ, DE, IL, RO, SK, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY
2018

TIMELINE
- 2010-2019 Design Phase
- 2019-2021 Preparation Phase
- 2021-2022 Implementation/Construction Phase
- 2022 Operation Start

ESTIMATED COSTS
capital value: 15 M€
design: 15 M€
preparation: 3 M€
construction: 0.8 M€
operation: 2 M€/year

HEADQUARTERS
to be defined

WEBSITE
www.ehri-project.eu

THE NETHERLANDS

DESCRIPTION

The European Holocaust Research Infrastructure (EHRI) is a new pan-European distributed RI that supports the Holocaust research community. It provides access to information about dispersed sources, and develops tools and methods that enable researchers and archivists to collaboratively work with such sources. It thereby seeks to overcome one of the hallmark challenges of Holocaust research – the wide dispersal of sources across Europe and beyond, and the concomitant fragmentation of Holocaust historiography. By integrating sources and research, EHRI enables the study of the Holocaust as a European phenomenon.

Providing access – both online via the EHRI Portal and physical via fellowships and training – is vital for the innovation of Holocaust research and for the training of the next generation of Holocaust researchers and archivists. Through its outreach and public history activities, EHRI further ensures the meaningful remembrance of the Holocaust as a formative European experience.

BACKGROUND

Holocaust archives are an important part of European cultural heritage. The availability and accessibility of properly contextualised and researched documentation are vital to enable transnational research on the Holocaust as a local, European and universal phenomenon. Until 1989, Israel, the United States and Western Europe were the main centres for Holocaust research. Locating and researching Holocaust documentation in other parts of Europe is still difficult due to the wide dispersal of the archival source material in national, regional and local research infrastructures. As a result studying the Holocaust from a truly European perspective remains challenging.

By facilitating an extensive network of researchers and archivists, EHRI initiates new transnational and collaborative approaches to the study of the Holocaust. From the beginning, EHRI has invested in the integration of multiple disciplines – history, archival science and digital humanities. The development of innovative approaches to deal with digital content facilitates the processing of large amounts of data, which is conducive for new and enhanced research. By establishing working relationships with archivists and researchers active in related fields – Nazi crimes against non-Jewish victims' groups, Genocide Studies – EHRI will maximise its reach and impact, and ensure that it benefits from insights gained in related fields.

EHRI particularly focuses on increasing visibility of local, peripheral and hidden archives, thereby facilitating local research into Jewish life during the Holocaust. This focus enables the study of the Holocaust from below, contributes to the strengthening of local community consciousness, and others educational opportunities at a local level. All these aspects are important given the increasing challenges to the memory of the Holocaust in Europe.

Online availability of Holocaust sources and research has relevance well beyond the walls of academia. The Holocaust continues to have enormous social, cultural and political resonance, and EHRI supports the democratisation of knowledge about the Holocaust, thereby contributing to the fight against Holocaust denial and ensuring that its lessons will never be forgotten.

STEPS FOR IMPLEMENTATION

EHRI has been working on integrating Holocaust-related sources and research documentation since 2010. The first phase was funded under FP7 and the current project is supported under Horizon 2020. More than twenty organisations – research institutions, libraries, archives, museums and memorial sites – form a core working group, but EHRI equally relies on the support of many other individuals and organisations in the broad fields of Holocaust studies and digital humanities.

By bringing together experts from different fields, and by building an innovative digital infrastructure supported by a large community, EHRI is a flagship project that showcases the opportunities for historical research in the digital age. EHRI aims at a relatively short Preparation Phase to prepare the financial, legal and the remaining technical aspects of the permanent RI. The Implementation Phase is foreseen in 2021 with the Operation Phase starting in 2022.

PART3

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ECCSEL ERIC

European Carbon Dioxide Capture and Storage Laboratory Infrastructure

CARBON DIOXIDE CAPTURE AND STORAGE TECHNOLOGIES TO ENABLE LOW TO ZERO CO2 EMISSIONS

TYPE distributed

LEGAL STATUS ERIC, 2017

POLITICAL SUPPORT
lead country: NO
member countries: FR, IT, NL, UK
prospective member countries: CH, EL, ES
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2008

TIMELINE

- 2008-2010 Design Phase
- 2011-2014 Preparation Phase
- 2014-2015 Interim/Transition Phase
- 2015-2030 Implementation/Construction Phase
- 2016 Operation Start

ESTIMATED COSTS
capital value: 1.000 M€
design: Not Available
preparation: 10 M€
construction: 100 M€
operation: 0.85 M€/year

HEADQUARTERS
ECCSEL ERIC
Trondheim, Norway

WEBSITE
www.eccsel.org

DESCRIPTION

The European Carbon Dioxide Capture and Storage Laboratory Infrastructure (ECCSEL) aims at opening access to a European Research Infrastructure with high-quality research facilities devoted to next generation Carbon Dioxide Capture and Storage (CCS) technologies in an efficient and structured way to help enable low to zero CO2 emissions from industry and power generation to combat global climate change. ECCSEL has implemented, operates and develops a distributed, integrated RI based on a selection of the best research facilities in Europe for Carbon capture, transport and storage. ECCSEL opens access to researchers from universities, research institutes, industry and SMEs from Europe and beyond.

Conceived and included in the ESFRI Roadmap 2008, ECCSEL was established as a European Research Infrastructure Consortium (ERIC) in June 2017. ECCSEL ERIC started operation with five initial European founding Member countries – France, Italy, Netherlands, United Kingdom and Norway, hosting the Operations Centre.

ACTIVITY

Fourteen facility owners in currently five ECCSEL ERIC Member countries offer open access to more than 55 world-class research facilities across Europe. More facilities and member countries are planned to be included in the future. ECCSEL covers a large range of research areas relevant for capture, transport, storage and use (selected technologies) of CO2. This includes fabrication and testing of polymer-based membranes, absorption kinetics studies, solvent degradation, thermodynamics studies, solvent production, chemical looping combustion facility, high pressure absorption, ultra-low permeability media, rock engineering, geo-mechanical testing, hydrothermal studies, gas monitoring, CO2 injection, meteo-oceanographic physical and geochemical studies, marine biology, double loop circulating fluidized bed reactor system, high-pressure oxy-fuel combustion facility, coal to hydrogen generation pilot plant, gas-phase densities and gas-phase composition, thermo-gravimetric measurements under high pressure, and studies of microbiological and geochemical processes. A number of current facilities are being upgraded and some new facilities are currently being constructed. Further future extensions and new facilities are being planned too. ECCSEL ERIC has created a research strategy and a facility roadmap based on the analysis of current research and facility gaps. This guides and coordinates member countries' and facilities' upgrades and new investments.

ECCSEL facilitates fundamental and applied research leading to commercial applications. It enables its users to act commercially in the knowledge market in various ways: i) engineering and technology companies may promote their newest ideas and solutions based on research and innovation in the forefront of the technological development; ii) plant owners and industries may increase knowhow to invest in state-of-the-art technologies.

IMPACT

ECCSEL ERIC operates a world-class distributed CCS Research Infrastructure that offers access to conduct research, enabling researchers to generate substantial knowledge which can lead to new innovative solutions – more efficient products, processes and services related to CCS – and thereby help to address societal challenges like climate change and secure energy supply. ECCSEL raises the technological level of European industry and SMEs, improving their competitiveness through their involvement in instrument and technology development and service provision.

It helps to maintain Europe at the forefront of the international CCS scientific community making the European Research Area more attractive for European and international scientists, and reinforces cooperation between research institutions. ECCSEL also helps provide insight into the social and economic impact of European science.

A HIGH-FLUX FACILITY FOR NUCLEAR FUEL AND MATERIAL PERFORMANCE, AND FOR RADIOISOTOPES PRODUCTION

JHR
Jules Horowitz Reactor

TYPE single-sited

LEGAL STATUS

POLITICAL SUPPORT
lead country: FR
prospective member countries: BE, CZ, ES, FI, IL, IN, SE, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2007-2009
Preparation Phase

2009-2020
Implementation/Construction Phase

2022
Operation Start

ESTIMATED COSTS
capital value: 1.800 M€
design: 200 M€
preparation: 100 M€
construction: 1.500 M€
operation: Not Available

HEADQUARTERS
Cadarache Research Centre - CEA
Cadarache, France

WEBSITE
www-rjh.cea.fr

DESCRIPTION

The Jules Horowitz Reactor (JHR) is a reference international user facility to observe and understand material and fuel behaviour in extreme nuclear environment with irradiation loops reproducing the operational condition of the different power reactor technologies. Its primary uses will be research into the performance of nuclear fuel at existing reactors, testing of materials used in reactors, testing designs for fuel for future reactors and the production of radioisotopes used in medicine.

The site preparation for the project began at the Cadarache Research Centre in 2007. The first concrete step for the reactor's foundations was poured in 2009, and the central containment structure was completed with the addition of a 105-tonne dome in late 2013. JHR will be built and managed in the framework of an international cooperation between several organizations bound by a Consortium Agreement signed on March 2007 by partners from 9 countries. JHR is expected to be in operation in 2022.

ACTIVITY

The JHR is an experimental reactor facility. It is not intended to generate electrical power, but to provide scientific data concerning nuclear fuel and material behaviour under exposure to very high stresses – high neutron fluxes. The nuclear unit is composed of only one civil engineering structure supporting two zones with different containments: the Reactor Building (RB) and the Nuclear Auxiliary Building (NAB). The objective of this single structure is to contain all the radioactive materials in one place. The reactor is a pool type reactor with a maximum power output of approximately 100 megawatts. This power is dissipated via the primary and the secondary circuit to the external cold source during irradiation; the core, the primary circuit and experimental rigs, are completely enclosed in the RB. The Fission Product Laboratory will be settled in this area to be connected to several fuel loops either for low activity gas measurements (HTR) or high activity gas measurements (LWR rod plenum) or water measurements (LWR coolant) with gaseous chromatography and mass spectrometry.

The reactor pool is connected to several storage pool and hot cells located in the NAB through a water block. The experimental process will make use of two hot cells to manage experimental devices before and after the irradiation. Safety experiments are an important objective for JHR and require an *alpha cell* to manage devices with failed experimental fuel. A fourth hot cell will be dedicated to the transit of radioisotope for medical application and to the dry evacuation of used fuel. Three storage pools are dedicated respectively to spent fuel, experimental devices and mechanical components management. The reactor's versatile modular design allows it to accommodate up to 20 simultaneous experiments. Its instrumentation allows previously unavailable real-time analysis to be performed.

IMPACT

JHR has a planned lifespan of around 50 years, and is designed to be adaptable for a variety of research uses by nuclear utilities, nuclear steam system suppliers, nuclear fuel manufacturers, research organisations and safety authorities. JHR will represent in Europe a unique experimental facility accessible to industry, research institutes, nuclear regulatory authorities and their technical supports.

JHR will be a key RI for the nuclear international community extending performances and assessing safety for nuclear power plants in doing so also strengthening technology credibility and public acceptance. In addition, it will be effective in training new generations of scientist and engineers in the strategic field of nuclear energy also guaranteeing the high level of expertise needed in the staff of power plants in all steps of their lifecycle, including operation and decommission. JHR will also ensure the production of radioelements for nuclear medicine and for non-nuclear industry.

EISCAT_3D

Next generation European Incoherent Scatter radar system

AN UPGRADE OF THE EISCAT SYSTEMS TO INVESTIGATE THE ATMOSPHERE AND NEAR-EARTH SPACE ENVIRONMENT

TYPE single-sited

LEGAL STATUS EISCAT Scientific Association, 1975

POLITICAL SUPPORT
lead country: SE
member countries: CN, FI, JP, NO, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2008

TIMELINE

- 2005-2009 Design Phase
- 2010-2014 Preparation Phase
- 2015-2017 Interim/Transition Phase
- 2017-2021 Implementation/Construction Phase
- 2022 Operation Start

ESTIMATED COSTS
capital value: 123 M€
design: 2.6 M€
preparation: 8.5 M€
construction: 72.2 M€
operation: 5.1 M€/year

HEADQUARTERS
EISCAT Scientific Association
Kiruna, Sweden

WEBSITE
www.eiscat3d.se

DESCRIPTION

The next generation European Incoherent Scatter radar system upgrade (EISCAT_3D) will be a three-dimensional imaging radar to study the atmosphere and the near-Earth space environment above the Fenno - Scandinavian Arctic as well as to support the solar system and radio astronomy sciences. The EISCAT_3D system will consist of a phased-array radar system located in Northern Fenno Scandinavia near space research centres in Kiruna (Sweden), Sodankylä (Finland) and Tromsø (Norway), two rocket launch facilities at Andøya (Norway) and Esrange (Sweden), and several other distributed instrument networks for geospace observation such as magnetometers and auroral cameras. The radar system is designed to investigate how the Earth's atmosphere is coupled to space but it will also be suitable for a wide range of other scientific targets including climate change, space weather, plasma physics, space debris and near-Earth object studies.

In the ESFRI Roadmap since 2008, EISCAT_3D is in the Implementation Phase since June 2017 and operations are expected to start at the end of 2021.

ACTIVITY

EISCAT_3D will be an integral part of EISCAT Scientific Association which has successfully managed incoherent scatter radars on the mainland and on Svalbard for more than thirty-five years. The present EISCAT systems are fully integrated in the global network of incoherent scatter radars. The EISCAT_3D system will consist of five phased-array antenna fields located in the northernmost areas of Finland, Norway and Sweden. Each field will consist of around 10.000 crossed dipole antenna elements arranged in 109 hexagons in a honeycomb-structure. One of these sites – the core site – will transmit radio-waves at 233 MHz, and all five sites will have sensitive receivers to measure the returned radio signals. The central array of each site will be of a size of about 70 m from side to side, and the sites will be located from 90 km to 250 km from the core site in order to be able to maximise the coverage by the system.

EISCAT_3D is designed to use several different measurement techniques which, although they have individually been used elsewhere, have never been combined together in a single radar system. The design of EISCAT_3D allows large numbers of antennas to be combined together to make either a single radar beam, or a number of simultaneous beams, via beam-forming. EISCAT_3D will measure the spectra of radio-waves that are back-scattered from free electrons, whose motions are controlled by inherent ion-acoustic and electron plasma waves in the ionosphere. The measured spectra reveal high-resolution information on the ionospheric plasma parameters, but can also be used for obtaining atmospheric data and observations of meteors and space debris orbits. In both active and passive mode, the receivers will provide high-quality scientific and monitoring data from the ionosphere as well as from space within its designed frequency spectrum. The research will both be organized through common observation modes and through requests from individual groups.

IMPACT

The original scientific vision for EISCAT_3D was that it would become a RI almost fully dedicated to the research area of solar-terrestrial physics. This is an area of physics where the interaction between the Sun and the Earth is studied, which is significant for most aspects of human life. Understanding, and being able to predict, the effects of solar-terrestrial processes has profound consequences for a range of practical applications including long-term global climate change, human space-flight, satellite operations, communications, position finding, terrestrial monitoring, long-distance energy transport and human health.

EISCAT_3D, while functioning mainly as a radar for scientific research, was also envisioned to have a substantial user community from the applied sciences sector, requiring data products relevant to the above mentioned applications. Additionally, it was also designed to be used as a vehicle to advance all aspects of the incoherent scatter technique, including the development of new methods of radar coding, signal processing and data analysis.

EMSO ERIC

European Multidisciplinary Seafloor and water-column Observatory

INTERACTIVE, REAL-TIME OCEAN OBSERVATION SYSTEMS TO ADDRESS SOCIETAL AND SCIENTIFIC CHALLENGES

TYPE distributed

LEGAL STATUS ERIC, 2016

POLITICAL SUPPORT
lead country: IT
member countries: EL, ES, FR, IE, PT, RO, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2012
Preparation Phase

2012-2016
Implementation/Construction Phase

2016
Operation Start

ESTIMATED COSTS
capital value: 100 M€
design: Not Available
preparation: 5.4 M€
construction: 137.8 M€
operation: 20 M€/year

HEADQUARTERS
EMSO ERIC
Rome, Italy

WEBSITE
www.emso.eu

DESCRIPTION

The European Multidisciplinary Seafloor and water-column Observatory (EMSO) is a European Research Infrastructure that includes open-ocean, seafloor observatories down to 4.850 metres depth, and shallow-water test sites from the Northeast Atlantic, across the Mediterranean to the Black Sea. EMSO acquires high-quality environmental data and represents a major asset for researchers who have access to multidisciplinary data to respond to pressing scientific and societal challenges. These data cover a multi- and inter-disciplinary range of research areas including biology, geology, chemistry, physics, engineering and computer science, from polar to tropical environments, down to the abyss. The data generated in EMSO allow facing multivariate questions over different space and time scales, overcoming the traditional approach of focusing on single data streams.

EMSO is a European Research Infrastructure Consortium (ERIC) since 2016, with the goal of ensuring long-term, sustained, continuous data streams from the ocean, the majority of the biosphere of our planet.

ACTIVITY

EMSO is an array of seafloor and water-column observatories distributed across Europe seas. EMSO provides crucial data for the understanding of fundamental processes in the marine domain that is significant for a number of short, medium and long-term events such as global change or catastrophic episodes with slow patterns that are difficult to discern with short sampling due to long-term processes variability. The high resolution, long-time-series collection of multiple variables across a breadth of environments represents the only approach capable of shedding light on the complexity of these systems and is required to document and predict episodic events, such as earthquakes, submarine slides, tsunamis, benthic storms, biodiversity changes, pollution, and gas hydrate (methane) release. Climate change, ocean ecosystem disturbance, and marine hazards represent urgent scientific and societal challenges and EMSO is designed to provide relevant data at an unprecedented level of accuracy, consistency, comparability, and continuity at the regional scale. In real-time it also generates long-term measurements of ocean parameters.

The interactive monitoring capacity of EMSO allows tracking these critical changes and delivering knowledge and tools to enable Europe to evaluate strategies to prepare and adapt to these changes. EMSO allows the pooling of resources and expertise, and coordination to assemble harmonised data into a comprehensive regional ocean image, which will then be made available to researchers and stakeholders worldwide via an open and interoperable data access system.

IMPACT

EMSO offers opportunities for hosting new hi-tech jobs and spurring development of innovative applications and services in strategic industry sectors such as fishing and tourism, renewable energy, deep-sea mining, offshore industry. EMSO has already started to generate significant socio-economic benefits; advanced training and support services (incubator, testing) for industry, particularly for SMEs; high quality educational and services for academic and mass media; a lobby group for marine research policy, innovation and ethics for government; and education and citizen science interactivity for the general public.

The accurate and timely environmental information gained with EMSO will nourish mitigation and protection strategies of challenges and threats including geo-hazards, habitat loss, human and animal migration, and food security, including anthropogenic damage to marine-related industry activities, tourism, recreation and aesthetics.

EPOS

European Plate Observing System

A LONG-TERM PLAN FOR THE INTEGRATION OF NATIONAL AND TRANSNATIONAL RESEARCH INFRASTRUCTURES FOR SOLID EARTH SCIENCE

TYPE distributed

LEGAL STATUS ERIC Step2, 2018

POLITICAL SUPPORT
lead country: IT
member countries: DK, FR, NO, PT, SI, UK
***observers:** CH, EL
prospective member countries: AT, BE, ES, FI, IE, IS, NL, PL, RO
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2008

TIMELINE

2000-2010 Design Phase
2010-2014 Preparation Phase
2015-2022 Implementation/Construction Phase
2020 Operation Start

ESTIMATED COSTS
capital value: 500 M€
design: 30 M€
preparation: 4.5 M€
construction: 32 M€
operation: 18 M€/year

HEADQUARTERS
Istituto Nazionale di Geofisica e Vulcanologia - INGV
Rome, Italy

WEBSITE
www.epos-eu.org

DESCRIPTION

The European Plate Observing System (EPOS) aims to create a pan-European infrastructure to monitor and unravel the dynamic and complex solid Earth system by integrating the diverse and advanced Research Infrastructures for solid Earth science relying on new e-science opportunities. EPOS will enable innovative multidisciplinary research for a better understanding of the Earth's physical and chemical processes that control earthquakes, volcanic eruptions, ground instability and tsunamis as well as the processes driving tectonics and Earth's surface dynamics. Through integration of data, models and facilities, EPOS will allow the Earth science community to make a step change in developing new concepts and tools for key answers to scientific and socio-economic questions concerning geo-hazards and geo-resources for a safe and sustainable society.

EPOS is currently in the Implementation Phase. The establishment of the European Research Infrastructure Consortium (ERIC) is foreseen in 2018.

ACTIVITY

Solid Earth science is concerned with the internal structure and dynamics of planet Earth, from the inner core to the surface; it deals with physical and chemical processes covering wide temporal and spatial scales, from microseconds to billions of years and from nanometres to thousands of kilometres. Geology, natural hazards, natural resources and, in general, environmental processes do not respect national boundaries, therefore seamless, transnational integration of measurements and data is often vital for optimal research and related activities. Integration of data and services from different disciplines in Earth science is an essential step to unravel and monitor these processes with the final goal of forecasting their impact on the environment. Indeed, the solid Earth science community has chosen to establish an all-encompassing framework including all the different solid Earth disciplines: seismology, near-fault observatories, geodetic data and products, volcanic observations, satellite data and products, geomagnetic observations, anthropogenic hazards, geological information and modelling, multi-scale laboratories and geo-energy test-beds for low-carbon energy.

EPOS is developing such a holistic, sustainable, multidisciplinary research platform to provide coordinated access to harmonized and quality controlled data from diverse Earth science disciplines, together with tools for their use in analysis and modelling. EPOS brings together 25 European nations and combines national Earth science facilities, the associated data and models, together with the scientific expertise into one integrated delivery system for the solid Earth. This infrastructure will allow the Earth sciences to achieve a step change in our understanding of the planet; it will enable us to prepare for geo-hazards and to responsibly manage the subsurface for infrastructure development, waste storage and the use of Earth's resources.

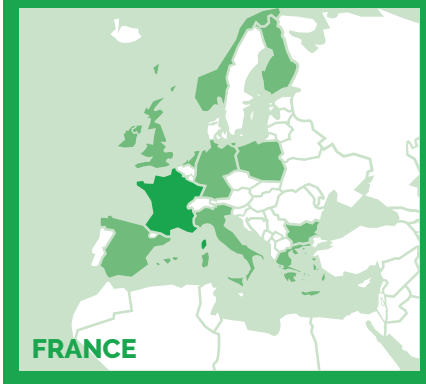
IMPACT

The data and services made available by EPOS are of interest to academy, industry and society. Understanding how the Earth works as a system is critically important to modern society. Society requires resources to support home life, industry and business and it needs security in the face of natural hazards. Volcanic eruptions, earthquakes, floods, landslides and tsunamis are all Earth phenomena impacting on society. Solid Earth science by bringing together many diverse disciplines such as geology, seismology, geodesy, volcanology, geomagnetism as well as chemistry and physics, is the place where to find answers on how to maintain the Earth a safe, prosperous, and habitable planet. Combining a sound physical understanding of natural hazards with the means to monitor and forecast their occurrence will mitigate their effects increasing public awareness of natural risks.

EURO-ARGO ERIC

European contribution to the international Argo Programme

THE EUROPEAN CONTRIBUTION TO THE GLOBAL SEA AND OCEAN IN DEPTH PROFILING BY FLOATS



TYPE distributed

LEGAL STATUS ERIC, 2014

POLITICAL SUPPORT
lead country: FR
member countries: BG, DE, EL, ES, FI, IE, IT, NL, UK
***observers:** NO, PL
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2011
Preparation phase

2011-2014
Implementation/Construction phase

2014
Operation start

ESTIMATED COSTS
capital value: 10 M€
design: Not Available
preparation: Not Available
construction: Not Available
operation: 8 M€/year

HEADQUARTERS
EURO-ARGO ERIC
Plouzané, France

WEBSITE
www.euro-argo.eu

DESCRIPTION

The European contribution to the International Argo Programme (EURO-ARGO) is a distributed Research Infrastructure that organizes and federates the European contribution to the international Argo programme for *in situ* ocean observations. EURO-ARGO aims at sustaining the European contribution to the global Argo array of profiling floats which measure temperature and salinity every 10 days throughout the deep global oceans to deliver data both in real-time and delayed mode for climate change research and monitoring as well as operational services such as Copernicus. It also aims at developing the new phase of Argo extending the network to abyssal oceans, biogeochemical parameters, marginal seas and high latitudes.

The EURO-ARGO ERIC was established in 2014 after a successful Preparatory Phase project with 7 Members and 2 Observers. In 2018, the EURO-ARGO ERIC federates 10 Members and 2 Observers.

ACTIVITY

The overall objective of the EURO-ARGO Research Infrastructure is to deploy about 350 new floats per year as necessary to maintain an array of about 1.000 floats in operation at any given time – 25% of the global array – with enhanced coverage in the European regional seas that requires increased sampling in the Nordic, Baltic, Mediterranean and Black seas.

EURO-ARGO contributes to the establishment of the Argo global array – almost 4.000 drifting profiling floats worldwide – for *in situ* measurements integrated with other elements of the climate observing system, in particular satellite observations, to detect climate variability from seasonal to decadal scales and provide long-term observations of climate change in the oceans. This includes regional and global changes in temperature and ocean heat content, salinity and freshwater content, sea level and large-scale ocean circulation. In addition, EURO-ARGO provides data to constrain global and regional ocean analysis and forecasting models, delivers information to initialize seasonal and decadal forecasting ocean/atmosphere-coupled models and produce the evidences necessary for calibration and validation of satellite data.

Contributions to the global array are progressing and European partners continue to be major actors in the Argo data management system to target research – climate and oceanography – and operational oceanography communities and to implement the new phase of Argo. The EURO-ARGO Research Infrastructure is indeed at the forefront of the development of the new phase of ARGO with an extension to biogeochemical variables, the deep ocean and the polar seas.

IMPACT

Given the prominent role of the EURO-ARGO Research Infrastructure for climate change research and its contribution to seasonal and decadal climate forecasting, the socio-economic impacts are expected to be largely on the medium and the long-term runs. EURO-ARGO has developed strong links with the European ocean and climate change research communities that are heavily relying on Argo observations. The EURO-ARGO is also a major *in situ* infrastructure for the Copernicus Marine Environment Monitoring Service (CMEMS) and the European Marine Observation and Data Network (EMODnet). Long-term ocean observations will lead to a better understanding and prediction of climate change – e.g sea-level rise – and improved mitigation strategies. Through the purchase of 1/4 of the deployed floats per year, EURO-ARGO will contribute to the consolidation and to the strengthening of the global competitiveness of European manufacturers in the highly aggressive field of innovation related to marine equipment.

IAGOS

In-service Aircraft for a Global Observing System

GLOBAL-SCALE AND LONG-TERM ATMOSPHERIC MONITORING SYSTEM FROM COMMERCIAL AIRCRAFT

TYPE distributed

LEGAL STATUS AISBL, 2014

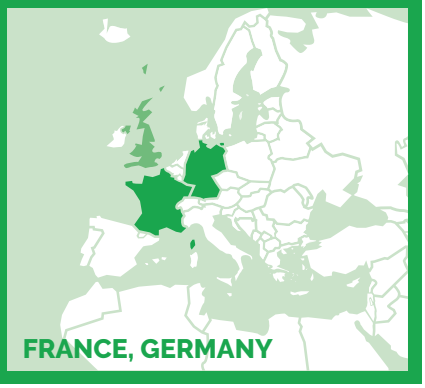
POLITICAL SUPPORT
lead countries: FR, DE
member country: UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2013 Preparation Phase

2014 Operation Start



ESTIMATED COSTS
capital value: 9.2 M€
design: 4.4 M€
preparation: 3.5 M€
construction: 45 M€
operation: 7 M€/year

HEADQUARTERS
IAGOS AISBL
Brussels, Belgium

WEBSITE
www.iagos.org

DESCRIPTION

The In-service Aircraft for a Global Observing System (IAGOS) is a distributed 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.

IAGOS was formally implemented in January 2014 as an International not-for-profit Association under Belgian Law (AISBL) with its seat in Brussels.

ACTIVITY

The dual setup of IAGOS aims at providing global-scale coverage of key observables on a day-to-day basis with a more complex set of observations with reduced coverage. The IAGOS-CORE component comprises the implementation and operation of autonomous instruments installed on long-range aircraft of several internationally operating airlines for continuous, global-scale and daily measurements of reactive gases, greenhouse gases (e.g. CO_2, CH_4), aerosol and cloud particles. The IAGOS-CARIBIC component consists of a heavily modified cargo container equipped with instruments for a large suite of trace gases and aerosol parameters, which is deployed once per month for four intercontinental flights. At present 8 aircraft are equipped with IAGOS-CORE instrumentation and one aircraft carries the IAGOS-CARIBIC container. At the end of its Construction Phase,

IAGOS aims for an operational fleet of up to 20 equipped passenger aircraft. IAGOS contributes to improved understanding of climate change and global air quality by providing regular *in situ* observations on a scale and in numbers that would be impossible to achieve using research aircraft and for which other measurement methods (e.g. satellites) have technical limitations. This input is essential for climate research, emissions monitoring, weather prediction and air quality forecasting. Data is provided for climate models, including those used by the Copernicus Atmosphere Monitoring Service, and for the carbon cycle models employed for the verification of CO_2 emission and Kyoto monitoring. Regional air quality models will assimilate IAGOS near real-time data to improve forecasts. IAGOS data are also utilised for the calibration and validation of satellite sensors. Cooperation with aviation industry and instrumentation developers aims at designing strategies to deal with the observation of ice particles and dust, including volcanic ash and their operational consequences.

IMPACT

The direct 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. 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. Currently 3 European airlines – Deutsche Lufthansa, Air France and Iberia – and 3 airlines from outside Europe – China Airlines, Cathay Pacific, and Hawaiian Airlines– are involved. Negotiations with other airlines from Europe and other countries are on-going in order to extend coverage. IAGOS contributes observational data directly to the aviation industry and airlines for improving operational procedures and thus reducing costs and enhancing aviation safety.

A long-term impact comes through the improved accuracy of numerical model predictions for air quality and climate change on the global and regional scale.

ICOS ERIC

Integrated Carbon Observation System

HIGH PRECISION SCIENTIFIC DATA ON CARBON CYCLE AND GREENHOUSE GAS BUDGETS TO SUPPORT CLIMATE ACTION

TYPE distributed

LEGAL STATUS ERIC, 2015

POLITICAL SUPPORT
lead country: FI
member countries: BE, CZ, DE, DK, FR, IT, NL, NO, SE, UK
***observer:** CH
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2005-2006 Design Phase
2008-2013 Preparation Phase
2013-2016 Implementation/Construction Phase
2016 Operation Start

ESTIMATED COSTS
capital value: 116 M€
design: Not Available
preparation: 4.3 M€
construction: 80 M€
operation: 24.2 M€/year

HEADQUARTERS
ICOS ERIC
Helsinki, Finland

WEBSITE
www.icos-ri.eu

DESCRIPTION

The Integrated Carbon Observation System (ICOS) is a distributed Research Infrastructure to generate high-precision data and integrate knowledge on the carbon cycle and greenhouse gas (GHG) budgets and of their perturbations. ICOS conducts long-term observations in three networks – atmosphere, ecosystems, and oceans – as required to understand the present state and extrapolate to the future behaviour of the global carbon cycle and GHG fluxes. ICOS has an increasing role in scientific support of climate policy. The most important technological impact is standardisation. Further technology developments and implementations, related to GHGs, will be promoted by a close integration of research, education and innovation.

The structure of ICOS consists of ICOS National Networks, ICOS Central Facilities, and the ICOS European Research Infrastructure Consortium (ERIC) which was established in October 2015. ICOS ERIC manages and oversees the activities and strategic goals, and distributes data and elaborated data products.

ACTIVITY

The first objective of ICOS is to build a single and coherent data set and to open it for effective access to facilitate research on GHG concentration, related emissions and natural sinks. Data are assimilated in biogeochemical and ecological process models. ICOS aims at establishing a reference standard for the future development of similar integrated and operative GHG observation networks also beyond Europe. The second objective is to provide information for understanding of regional budgets of greenhouse gas sources and sinks, their human and natural drivers, and the controlling mechanisms. ICOS ERIC allows detecting changes in regional greenhouse gas fluxes, early warning of negative developments and the response of natural fluxes to extreme climate events. In order to provide this information ICOS builds National Networks of atmospheric, ecosystem and ocean stations. European level ICOS Central Facilities, are dedicated to collecting and processing the data received from the National Networks and to provide calibration gases or specific analyses. The ICOS ERIC data policy endorses full and open exchange of data, metadata and products that will be made available to the researchers with minimum time delay. It follows general data sharing principles as outlined by GEOSS.

The data and knowledge provided by ICOS ERIC will reduce the uncertainties in Earth System models and in predictions on future GHG concentrations as exploited in the Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC).

IMPACT

Environmental Research Infrastructures in general, and ICOS in particular, generate important knowledge on our ecological life support systems that provide priceless services. This is particularly evident in the field of GHG: not reaching our safe climate change target level by inadequate mitigation will lead to extremely large societal costs for adaptation and predictable high damages. The investments and running costs needed for a global GHG monitoring and analysis network are marginal compared to these costs and could be easily compensated due to improved effectiveness of the mitigation strategies. Additional benefit will come from detecting and pointing to surprise changes in the earth system and from detecting non-compliance of regions, sectors or countries with the agreed objectives. Furthermore, ICOS GHG observations and outreach activities, have already increased the public awareness and stimulated changes towards green economy and decarbonisation of agricultural, industrial and transport processes.

A substantial impact comes also from the harmonization and standardization of measurements and data formats including improved QA/QC standards and data protocols. These efforts support primarily the research community, but industry and policy makers also benefit from reliable and standardized openly accessible data sets.

LifeWatch ERIC

e-Infrastructure for Biodiversity and Ecosystem Research

A DISTRIBUTED e-INFRASTRUCTURE TO SUPPORT RESEARCH AND SUSTAINABILITY OF BIODIVERSITY AND ECOSYSTEMS

TYPE distributed

LEGAL STATUS ERIC, 2017

POLITICAL SUPPORT
lead country: ES
member countries: BE, EL, IT, NL, PT, SI
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2011
Preparation Phase

2011-2016
Implementation/Construction Phase

2017
Operation Start

ESTIMATED COSTS
capital value: 150 M€
design: 3 M€
preparation: 5 M€
construction: 142 M€
operation: 12 M€/year

HEADQUARTERS
LifeWatch ERIC
Seville, Spain

WEBSITE
www.lifewatch.eu

DESCRIPTION

The e-Infrastructure for Biodiversity and Ecosystem Research (LifeWatch) is a distributed Research Infrastructure to advance biodiversity research, to address the big environmental challenges and support knowledge-based strategic solutions to environmental preservation. This mission is achieved by providing access to a multitude of data sets, services and tools enabling the construction and operation of Virtual Research Environments (VREs).

LifeWatch has been established as a European Research Infrastructure Consortium (ERIC) since March 2017, with the Statutory Seat and the ICT e-Infrastructure Technical Offices – located in Spain – that jointly assist the coordination and management of the day-to-day institutional relationships and administrative, legal, financial issues. It also coordinates the implementation of e-Services demanded by the Service Centre in Italy, the Virtual Laboratories and Innovations Centre in The Netherlands, as well as other distributed facilities located in other Member Countries of the LifeWatch ERIC which are encouraged to establish Thematic Centres in accordance with its overall architectural scheme.

ACTIVITY

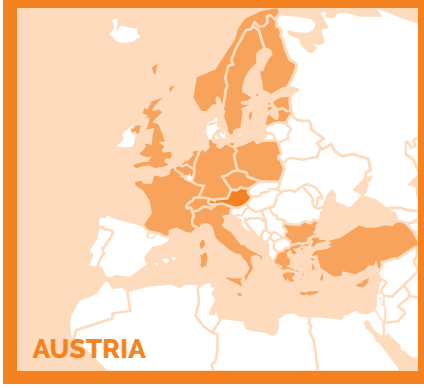
The Statutory Seat and the ICT e-Infrastructure Technical Offices also coordinate and manage the ICT e-Infrastructure distributed construction, maintenance, deployment and operations. The Service Centre provides the interface with the Biodiversity and Ecosystem Research Scientific Community, identifies the needs of the multiple users' groups from different domains and areas of interest and coordinates the development and operation of the related Services. It also assists in deploying the Services provided by LifeWatch ERIC, including those enabling discovery, visualization, and download of data and applications for analysis, synthesis and modelling of scientific topics. Thus the Service Centre identifies new data resources, incorporates vocabularies, semantics and services to aggregate larger typologies of data. It also provides the optimisation of the access and use of Service Centre facilities as a whole, and offers web-based tools to facilitate Social Networking and Social Learning (including e-Learning). Finally, it promotes the awareness of LifeWatch ERIC for users and general public, and enhances the visibility of LifeWatch ERIC scientific outcomes, by publicising and disseminating them.

The Virtual Laboratories and Innovations Centre coordinates and manages the requirements and needs analysis, design and implementation of the scientific case studies and productions of the LifeWatch ERIC Virtual Laboratories. These e-Labs are implemented and deployed through the LifeWatch ERIC ICT distributed e-Infrastructure facilities, and made accessible through the Service Centre to the Biodiversity and Ecosystem Research Scientific Community. This procedure guarantees the overall coherence of the Research Infrastructure by promoting synergies in regards to the semantic interoperability among data, services and their final users.

IMPACT

LifeWatch ERIC provides the instruments to empower its users, as its Virtual Research Environments enable ideas and people to move in an open way within a digital context. It builds capacity to foster opportunities for large-scale scientific development; to enable accelerated data capture; to support knowledge based decision making for the management of biodiversity and ecosystems. It benefits the ERA through the design of infrastructure capabilities driven by scientific and societal needs; enabling new ways of interoperability among science, policy and society; providing the adequate VRE for the interaction of user-driven research, training and innovation activities; cooperating with the private sector in developing the best ICT technologies needed for its construction and operation, providing innovative applications derived from the research carried out; delivering excellence, as a key principle by building capacity and by the priority of the most promising talent.

A GATEWAY FOR ACCESS TO BIOBANKS AND BIOMOLECULAR RESOURCES FOR HEALTH RESEARCH



BBMRI ERIC

Biobanking and BioMolecular Resources Research Infrastructure

TYPE distributed

LEGAL STATUS ERIC, 2013

POLITICAL SUPPORT
lead country: AT
member countries: BE, BG, CZ, DE, EE, EL, FI, FR, IT, LV, MT, NL, NO, PL, SE, UK
***observers:** CH, CY, TR, (WHO/IARC)
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2011 Preparation Phase

2011-2013 Implementation/Construction Phase

2014 Operation Start

ESTIMATED COSTS
capital value: 195 M€
design: Not Available
preparation: Not Available
construction: Not Available
operation: 3.5 M€/year

HEADQUARTERS
BBMRI ERIC
Graz, Austria

WEBSITE
www.bbmri-eric.eu

DESCRIPTION

The Biobanking and BioMolecular Resources Research Infrastructure (BBMRI) is one of the largest Research Infrastructures for health research in Europe by providing a gateway for access to biobanks and biomolecular resources coordinated by the National Nodes. BBMRI aims at improving the accessibility and interoperability of the existing comprehensive collections, either population-based or clinical-oriented, of biological samples from different (sub-) populations of Europe or rare diseases. These collections include the associated data on factors such as health status, nutrition, lifestyle, and environmental exposure of the study subjects.

BBMRI became a European Research Infrastructure Consortium (ERIC) in December 2013. The agreement of ultimately 19 countries – 17 Members and 3 Observers, and one International Organisation (WHO/IARC) – enabled to set up a pan-European distributed Research Infrastructure that shall develop into one of the most important tools in biomedical and clinical discovery.

ACTIVITY

BBMRI ERIC facilitates the access to quality-defined human disease relevant biological resources in an efficient as well as ethically and legally compliant manner. It aims at reducing the fragmentation of the biomedical research landscape through harmonisation of procedures and by implementing common standards and fostering high-level collaboration.

BBMRI ERIC provides tools and expertise, as well as knowledge and experience sharing on ethical, legal and societal issues (ELSI), Information Technologies (IT) as well as Quality Management (QM) for biobanks and research on biomolecular resources. Key ELSI services include: providing an Ethics Check for projects; providing a custom-based Helpdesk and Knowledge Base; sharing of knowledge, experiences and best practices; monitoring of relevant ethical and legal frameworks in development and coordinating joint replies to relevant public consultations. Key IT services include: Directory 4.0 provides aggregate information about biobanks and their sample/data collections to ensure their findability; Negotiator 1.0 facilitates access to biobanks allowing communication between researchers requesting samples/data from biobanks, allowing refinement of their queries; BIBBoX is an integrated toolbox for biobanks based on open-source software to support biobanks in implementing missing IT components; MIABIS 2.0 represents the minimum information required to initiate collaborations between biobanks and to enable the exchange of biological samples and data with the aim to facilitate the reuse of bio-resources and associated data. Key QM services include: recommended standards and best practices; sharing QM expertise on a European scale; Quality Expert Working Groups; and Self-Assessment Surveys.

All services are intended for researchers searching for high-quality samples and data, for biobankers promoting their biobanks and looking for fellow biobanks, for funding organisations to provide overview of infrastructure, as well as other users for the benefit of European citizens.

IMPACT

BBMRI ERIC will provide a one-stop access to the collections of the European biobanking community, expertise and services to foster access to other parties, including the private sector for the benefit of mankind. New medical applications, new therapies, new preventives, new diagnostics, personalised or stratified medicine and new biomedical industries shall evolve to improve socio-economic competitiveness and increasing possibilities for equitable healthcare in Europe. Expectantly, BBMRI ERIC will impact on partnerships with patients/donors, who will be informed that their own tissues, samples and personal data can yield discoveries and advances in medicine, diagnostics, and therapies. In return, BBMRI ERIC is taking up the responsibility to use the samples and data made available to the research in the best way for the advancement of knowledge, ultimately contributing to improve EU's healthcare systems.

EATRIS ERIC

European Advanced Translational Research Infrastructure in Medicine

A NEW DEVELOPMENT PATHWAY FOR TRANSLATING NOVEL BIOLOGICAL INSIGHTS INTO EFFECTIVE SOLUTIONS

TYPE distributed

LEGAL STATUS ERIC, 2013

POLITICAL SUPPORT
lead country: NL
member countries: CZ, EE, ES, FI, FR, IT, LU, NO, PT, SE, SI
***observer:** LV
prospective member country: RO
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2010 Preparation Phase
2010-2011 Interim/Transition Phase
2011-2013 Implementation/Construction Phase
2013 Operation Start

ESTIMATED COSTS
capital value: 500 M€
design: Not Available
preparation: 5 M€
construction: 4.5 M€
operation: 2.5 M€/year

HEADQUARTERS
EATRIS ERIC
Amsterdam, The Netherlands

WEBSITE
www.eatris.eu

DESCRIPTION

The European Advanced Translational Research Infrastructure in Medicine (EATRIS) is a distributed RI that provides a unique *one-stop shop* access to the combined expertise and high-end technologies, required to develop new products for translational medicine, from target validation to early clinical trials. By selecting several key resources in Europe, users can access to research tools and guidance required for drug development, ranging from state-of-the-art scientific equipment, knowledge-based resources from sample collections to GMP manufacturing and regulatory guidance. Services and access to patient cohorts are provided in the fields of advanced therapy medicinal products, biomarkers, imaging and tracing, small molecules and vaccines.

EATRIS received the status of European Research Infrastructure Consortium (ERIC) in November 2013. It comprises 90 leading institutes in 13 countries – 12 Members and 1 Observer – that represent the wide diversity of stakeholders who seek solutions to the many issues arising in the development of new therapies.

ACTIVITY

By bringing together Europe's best institutions in academic translational medicine, EATRIS has created a portfolio of research services focused on predicting the performance of novel products, selecting the right patient, and entering clinical development as safely and effectively as possible. On the basis of a detailed database and knowledge of its growing member institutions, EATRIS quickly matches the users' needs with the right expertise and facilities to build project teams along technology pipelines and supporting services, running from target/biomarker validation up to clinical proof of concept, covering the following areas: Advanced Therapy Medicinal Products (ATMP) and biologics – including Gene Therapy Medicinal Products (GTMP), Cell Therapy Medicinal Products (CTMP), and Tissue Engineered Products (TEP) - represent a new category of medicines with a wide therapeutic potential for treating different types of diseases such as cancer, neurodegenerative and cardiovascular diseases; Small Molecules, to support the pre-clinical and clinical development of drug candidates, utilising academic expertise around novel targets; Vaccines, to cover the entire vaccine development and production pipeline ranging from late-phase pre-clinical development to clinical trials.

These pipelines are supported by cutting edge enabling technologies: Imaging and Tracing, to provide a single point of entry to high-end expertise and cutting-edge translational imaging facilities, defragmenting the technical know-how and making optimal use of resources to improve R&D output; Biomarkers for precision medicine, to facilitate the validation and development of biomarkers for the prevention, diagnosis and prognostic assessment of disease as well as for the prediction of therapy response.

In order to ensure that each project has a comprehensive team and best chance of success, EATRIS also offers regulatory support, as well as education and training opportunities in translational research.

IMPACT

Improving the output of scientific discoveries into innovative and high impact medicines, diagnostics and medical devices will have a considerable socio-economic impact in Europe and globally, especially in the long-term. The wide range of interest of EATRIS, that extends also to rare and neglected diseases and includes personalised medicine, is expected to give a general improvement in the drug discovery process leading to the development of innovative solutions, also aimed at patient groups. EATRIS acts as a forum for open debate between the three sectors – academic community, industry and the public – in order to improve communication, legal and regulatory alignment and competitiveness, and reduce uncertainty for the practitioners of translational science. Also, by encouraging training in translational science, EATRIS supports the long-term sustainability of the discipline, and will facilitate further innovation by providing the next generations of top international talent.

ECRIN ERIC

European Clinical Research Infrastructure Network

A NETWORK FOR MULTINATIONAL, HIGH-QUALITY, CLINICAL TRIALS FOR TOP-LEVEL MEDICAL RESEARCH

TYPE distributed

LEGAL STATUS ERIC, 2013

POLITICAL SUPPORT
lead country: FR
member countries: CZ, DE, ES, HU, IT, NO, PT
***observer:** CH
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2011 Preparation Phase
2011-2014 Implementation/Construction Phase
2014 Operation Start

ESTIMATED COSTS
capital value: 5 M€
design: 1 M€
preparation: 6 M€
construction: 20 M€
operation: 5 M€/year

HEADQUARTERS
ECRIN ERIC
Paris, France

WEBSITE
www.ecrin.org

DESCRIPTION

The European Clinical Research Infrastructure Network (ECRIN) is a distributed RI that supports the conduct of multinational, high-quality, transparent clinical trials by overcoming the obstacles caused by fragmentation and poor interoperability of the national, clinical research environment in Europe. ECRIN creates added value through access to expertise and patients, increasing the reach, diversity, and result quality of clinical trials. As such, it fulfils the vision of a society where all decisions in medical practice are based on sound scientific evidence from high-quality clinical research.

ECRIN started in 2004 by connecting research facilities at multiple sites in countries across Europe and providing services for top-level clinical research. ECRIN was officially awarded the status of European Research Infrastructure Consortium (ERIC) in December 2013. With 8 Members and 1 Observer, ECRIN ERIC became fully operational in 2014.

ACTIVITY

Difficulties in locating clinical trials units, fulfilling local legal, regulatory and ethical requirements, and coordinating multinational trial management deter many researchers from attempting multinational trials. This means that most independent trials are conducted in single centres, or multiple centres within one country.

ECRIN provides a pathway through Europe's fragmented health and legal systems with its pan-European infrastructure that is designed to support multinational clinical research and unlock access to patients and medical expertise. ECRIN's support is primarily provided during implementation, but also for preparation and protocol evaluation of the trial study. While advice and information are freely provided during preparation, access to ECRIN trial management services is subject to scientific and logistical evaluation of the full study protocol.

ECRIN's work comprises multiple strands of activity. ECRIN provides guidance, consulting and operations management for multinational clinical trials on a not-for-profit basis. This work is facilitated by European Correspondents, based in Member and Observer countries, who maintain connections with national clinical trial unit networks. ECRIN maintains openly accessible tools for key trial features including regulations, ethical requirements, outcome measures, and trial unit locations for medicines, medical devices and nutrition, and risk-adapted monitoring strategies. Communication of ideas, news and principles behind clinical research to people working in the field, patients, policymakers and the public is a key ECRIN activity. Interaction with disease-related investigation networks and other distributed research infrastructures ensures extensive collaboration with various research fields, synergistic use of resources and expansion of the user community and reach of ECRIN activities. ECRIN works with colleagues worldwide to promote implementation of recommendations for integrated clinical trial governance.

IMPACT

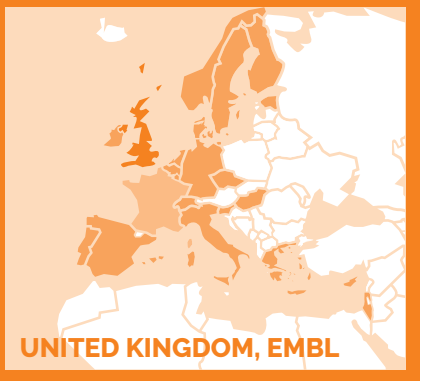
ECRIN is a major tool to address the health *Grand Challenge* and has major impact on citizens and economy. Clinical trials assessing the safety and efficacy of new products result in health innovation, with a strong positive impact on the health industry – medicines, vaccines, medical devices, diagnostics – and nutrition sectors.

In addition to enlarging the health industry market, clinical trials exploring new indications for already authorized products – repurposing trials – have an impact on citizens' health. Clinical trials comparing authorized treatments – comparative effectiveness trials – result in an improvement in healthcare strategies, with a measurable economic impact on wellbeing and productivity, and in healthcare cost containment. Independent, multinational trials are key instruments for optimisation of healthcare solutions and promotion of evidence-based medical practice in Europe and globally.

ELIXIR

A distributed infrastructure for life-science information

A SUSTAINABLE INFRASTRUCTURE FOR INTEROPERABILITY OF PUBLIC BIOLOGICAL AND BIOMEDICAL DATA RESOURCES



TYPE distributed

LEGAL STATUS ELIXIR Consortium Agreement, 2013

POLITICAL SUPPORT
lead country: UK, (EMBL)
member countries: BE, CH, CZ, DE, DK, EE, ES, FI, HU, IE, IL, IT, LU, NL, NO, PT, SE, SI
***observers:** CY, EL
prospective member country: FR
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2007-2011 Preparation Phase
2011-2013 Interim/Transition Phase
2013-2020 Implementation/Construction Phase
2014 Operation Start

ESTIMATED COSTS
capital value: 125 M€
design: Not Available
preparation: Not Available
construction: Not Available
operation: 95 M€/year

HEADQUARTERS
Wellcome Genome Campus
Hinxton, United Kingdom

WEBSITE
www.elixir-europe.org

DESCRIPTION

The distributed infrastructure for life-science information (ELIXIR) is a unique initiative that consolidates national centres, services, and core bioinformatics resources into a single, coordinated infrastructure. ELIXIR coordinates and develops life science resources across Europe so that researchers can more easily find, analyse and share data, exchange expertise, and implement best practices, and gain greater insights into how living organisms work. By coordinating these resources, ELIXIR helps address the *Grand Challenges* across life sciences, from marine research – via plants and agriculture – to health research and medical sciences.

In 2013, ELIXIR became a permanent legal entity following the ratification of the ELIXIR Consortium Agreement (ECA) by EMBL and the first funding five countries. At present, ELIXIR includes 20 countries and an inter-governmental organisation (EMBL) that have signed the ECA and are full members of the ELIXIR Board. In addition, one country is an Observer.

ACTIVITY

ELIXIR is a distributed Research Infrastructures, which builds on existing data resources and services across Europe. It follows a Hub and Nodes model, with a single Hub located alongside EMBL-EBI at the Wellcome Genome Campus in Hinxton (Cambridge, UK) and a growing number of Nodes located at centres of excellence throughout Europe, which coordinate nationally the bioinformatics services within that country.

The ELIXIR Hub accommodates the ELIXIR Executive Management and the administrative staff, coordinates and supports integration of services run from the ELIXIR Nodes, has overall responsibility for developing and delivering the ELIXIR Programme and managing ELIXIR-funded activities carried out by Nodes. The Hub coordinates and supports ELIXIR's governance bodies and technical committees works with other biomedical science infrastructures to help address the challenges of Big Data together. It leads ELIXIR's communications and external relations activities, including support to industry supports the institutions within the Node, and collaborates with national and European funders and policy-makers.

ELIXIR Nodes, sited throughout ELIXIR Members' countries, run the resources and services that are part of ELIXIR infrastructure. An ELIXIR Node is a collection of research institutes within a member country and each Node has a lead institute that oversees the work of that Node. The Nodes build on the strengths of the scientific communities of that country. Resources include: safe and secure data repositories; added-value databases providing researchers with access to well curated data; bio-compute centres for cloud computing and analysis; services for the integration of data, software, tools and resources; education and training; standards, ontology and data management expertise.

ELIXIR ensures that users – individual scientists, large consortia or indeed other Research Infrastructures – can easily access data resources that are sustainable, built on strong community standards, and safeguarded in the long-term.

IMPACT

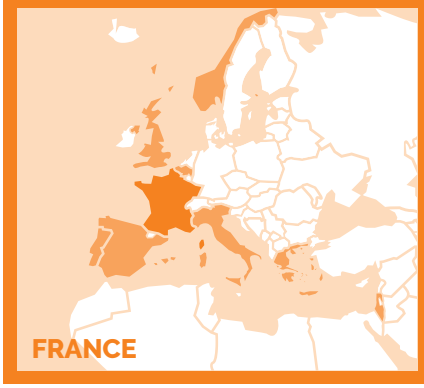
Industry's interest in, and usage of, European bioinformatics resources is high as demonstrated by the millions of hits from commercial users to the websites of ELIXIR Nodes and the number of patents awarded that reference life science databases. ELIXIR's Innovation and SME programme ensures that high-tech companies across Europe can access the services run by ELIXIR partners; over one hundred such companies have so far benefitted from bespoke events targeting the pharma and agri-tech sectors.

Open life science data drives major societal value and truly facilitates researchers to solve the *Grand Challenges*. For example, the identification of novel risk factors for Alzheimer's disease based on a large-scale meta-analysis are founded on prior estimates on human genetic variation calculated from public datasets. The development and validation of drug-design tools, many of which have been successfully commercialised, has relied on carefully curated datasets extracted from publicly archived data resources such as the Protein Data Bank.

EMBRC ERIC

European Marine Biological Resource Centre

A WORLD-CLASS PLATFORM FOR FUNDAMENTAL AND APPLIED RESEARCH ON MARINE BIORESOURCES AND MARINE ECOSYSTEMS



TYPE distributed

LEGAL STATUS ERIC, 2018

POLITICAL SUPPORT
lead country: FR
member countries: BE, EL, ES, IL, IT, NO, PT, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2008

TIMELINE

2011-2014
Preparation Phase

2014-2016
Implementation/Construction Phase

2017
Operation Start

ESTIMATED COSTS
capital value: 164.4 M€
design: 15.7 M€
preparation: 4.9 M€
construction: 92 M€
operation: 11.2 M€/year

HEADQUARTERS
EMBRC ERIC
Paris, France

WEBSITE
www.embrc.eu

DESCRIPTION

The European Marine Biological Resource Centre (EMBRC) is a distributed Research Infrastructures providing a strategic delivery mechanism for excellent and large-scale marine science in Europe. EMBRC offers services to users from academia, industry, technology and education in all sectors in the fields of marine biology and ecology, particularly supporting the development of blue biotechnologies. Users will be able to easily search EMBRC services and prices and make requests on the EMBRC access portal on the EMBRC website. The EMBRC investigation capacity and capability covers the whole range of marine biodiversity, using approaches ranging from molecular biology to ecology, chemistry, bioinformatics and mathematics, and to integrative biology. EMBRC key thematic areas include marine biodiversity and ecosystem function, developmental biology and evolution, marine products and resources – biotechnology, aquaculture, fisheries – and biomedical science.

In the ESFRI Roadmap since 2008, EMBRC established the European Research Infrastructure Consortium (ERIC) in 2018.

ACTIVITY

Marine biodiversity is becoming a major target for fundamental science as well as an increasingly important resource for food, energy and industrial applications. EMBRC will provide key facilities, equipment and services to access and study marine ecosystems and biodiversity, to develop key enabling technologies and to deliver training for staff and users as well as joint development activities to improve access to marine biological resources and marine models. EMBRC will develop system administration and data integration and connect to important e-Infrastructures in life and environmental sciences. The RI is at a pivotal position between biological sciences, biomedical sciences and agronomical, ecological and environmental science, with a unique potential to attract new actors in marine biology. It will deliver new resources and new services, leading to new processes and products for Blue Growth. EMBRC addresses Europe's *Grand Challenges*, including Biodiversity, Food Security and Competitive Industry. In particular, the RI complies with the following demands: respond to growing demand for bioresources, develop sustainable new materials, strengthen knowledge for health research and train future scientists.

EMBRC will act as a centre for knowledge transfer and as a core technology infrastructure for the utilisation of marine bioresources. It will provide the framework to significantly enhance interactions between science and industry, notably in the key domains of resource management and conservation, aquaculture and blue biotechnology. It will offer access to the infrastructure sites, on-site or remote access to biological resources and analytical services as well as virtual access to data. It will help to coordinate the negotiation of Material Transfer Agreements and host and collaborative agreements, in order to avoid restrictions in accessing the Research Infrastructure.

IMPACT

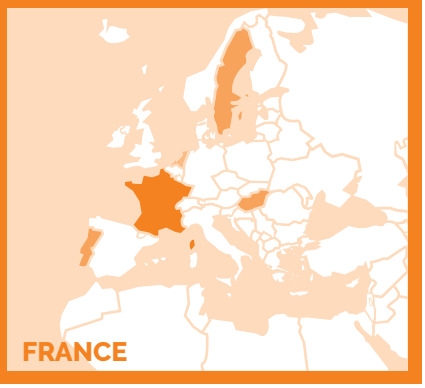
EMBRC members operate their centres, facilities, laboratories mostly in Marine Research Stations that are located in maritime peripheral European regions. Thus, EMBRC Research Infrastructures are often geographically separated from major areas of industry concentrations; they are located in areas with lower economies and unemployment rates sometimes above the European or their respective national averages. EMBRC nodes help to overcome isolation of the regions and to build trans-regional/national complementarities and synergies. EMBRC not only evidences the territorial socio-economical impact but it has also the potential to provide this impact via its outcome of research and innovation strategies using its biological resources and technological platforms. This kind of socio-economic impact would have wider and maybe also more important impact as it could be showed across all EU countries.

EMBRC has in recent years developed closer collaboration with relevant industries. It can be expected that EMBRC will play a central role in addressing the development of bioresources and contribute to establish a prominent European Blue Bioeconomy.

ERINHA

European Research Infrastructure on Highly Pathogenic Agents

THE EUROPEAN COORDINATION FOR THE STUDY OF HIGHLY PATHOGENIC MICRO-ORGANISMS CLASSIFIED AS RG4



TYPE distributed

LEGAL STATUS AISBL, 2017

POLITICAL SUPPORT
lead country: FR
member countries: HU, PT, SE
prospective member country: NL
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2008

TIMELINE

2010-2017 Preparation Phase

2017-2018 Implementation/Construction Phase

2018 Operation Start

ESTIMATED COSTS
capital value: 5.8 M€
design: Not Available
preparation: 5.1 M€
construction: 0.7 M€
operation: 0.7 M€/year

HEADQUARTERS
ERINHA AISBL
Brussels, Belgium &
ERINHA CCU
Paris, France

WEBSITE
www.erinha.eu

DESCRIPTION

The European Research Infrastructure on Highly Pathogenic Agents (ERINHA) aims to develop an adequate and coordinated effort to address the challenges posed by the emergence or re-emergence of highly dangerous human and animal micro-organisms infecting humans, with high risks for public health, society and the economy. ERINHA seeks to reinforce the European capacities for the study of Risk Group 4 pathogens, enhance the coordination of Biosafety Level 4 (BSL-4) activities and give access to BSL-4 and complementary facilities to all interested European scientists by establishing a pan-European distributed RI.

ERINHA encompasses basic research into pathogen isolation/characterisation, the pathogenesis of human diseases caused by dangerous micro-organisms. It enables translational research to develop new counter measures including diagnostic tools, therapeutics and prophylactics and applied research to improve knowledge, skills and the evidence-base around high containment working practices.

ERINHA is on the ESFRI Roadmap since 2008 and in the Implementation Phase since July 2017.

ACTIVITY

One of the great challenges of the 21st century is the capability to react on human and animal highly pathogenic micro-organisms which are characterized by a high mortality rate induction, unavailability of prophylactic or therapeutic means and easy human-to-human transmission. All infectious micro-organisms are classified by risk group according to the pathogenicity, modes of transmission and host range of the organism. The most highly infectious pathogens are classified as Risk Group 4. To protect environment from spread and to protect scientists from infection, these micro-organisms must be handled and stored in Biosafety Level 4 facilities. The recent epidemic context – outbreak of Ebola, recent cases of Lassa and CCHF in Europe – have demonstrated the reality of dangerous infectious threats and the worldwide vulnerability towards emerging and re-emerging infectious diseases and has highlighted the need for such an infrastructure to prevent and respond to the spread of epidemics more effectively and efficiently. A European coordinated strategy is needed to ensure preventing each European citizen from pandemics or bioterrorist attack involving suspected group 4 pathogens. It implies a coordinated pan-European distributed RI providing access to high containment facilities and complementary functions.

ERINHA is the sole European Research Infrastructure specifically dedicated to Highly infectious pathogens of RG4 study. It is a unique and innovative infrastructure that intends to bring Europe to the forefront of research on highly virulent agents and offer European expertise to overcome and prevent the spread of epidemics. ERINHA contributes to the H2020 societal challenge *Secure societies – protecting freedom and security of Europe and its citizens* and *Health, Demographic Change and Wellbeing*.

IMPACT

The benefit to society by coordinating capacities to prevent and respond to the spread of epidemics is high, directly affecting human health, avoiding negative impact on national health care systems, and on the economy. Disease outbreaks cost millions to countries' economies, therefore optimising Europe's preparedness to detect and tackle these diseases is crucial.

ERINHA has potential to contribute to boost European competitiveness and Research & Innovation. It aims to facilitate complex and comprehensive research programmes able to compete with those conducted outside the EU. It has capacity to respond to the needs of academia and industry better and faster than the field would in general. Industry is an important user sector, interested in paying the facilities to run their own experiments rather than access the facilities themselves. This could contribute to ERINHA's long term sustainability and ERINHA will need to balance the needs of its different users.

EU-OPENSCREEN ERIC

The high-throughput screening platforms and chemistry resources for Life Sciences

European Infrastructure of Open Screening Platforms for Chemical Biology

TYPE distributed

LEGAL STATUS ERIC, 2018

POLITICAL SUPPORT
lead country: DE
member countries: CZ, ES, FI, LV, NO, PL
prospective member countries: DK, EL
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2008

TIMELINE

2010-2013 Preparation Phase
2013-2017 Interim/Transition Phase
2018-2019 Implementation/Construction Phase
2019 Operation Start

ESTIMATED COSTS
capital value: 82.3 M€
design: Not Available
preparation: 4.3 M€
construction: 6.2 M€
operation: 1.2 M€/year

HEADQUARTERS
EU-OPENSCREEN ERIC
Berlin, Germany

WEBSITE
www.eu-openscreen.eu

Description

The European Infrastructure of Open Screening Platforms for Chemical Biology (EU-OPENSCREEN) is a distributed Research Infrastructure that develops novel small chemical compounds which elicit specific biological responses on organisms, cells or cellular components. EU-OPENSCREEN enables scientists to use compound screening methods to validate novel therapeutic targets and support basic mechanistic studies addressing fundamental questions in cellular physiology – across human, animal and plant systems – using the methods of chemical biology. As a large-scale RI with an "open" pre-competitive character, EU-OPENSCREEN is a cost-effective solution to the need of the broad scientific community providing access to Europe's leading screening platforms and chemistry groups, constructing a jointly used compound collection and operating an open-access database accessible on a global basis.

In the ESFRI Roadmap since 2008, EU-OPENSCREEN has established the European Research Infrastructure Consortium (ERIC) in 2018.

Activity

Understanding how biological processes operate and how the underlying mechanisms function at the organismic, cellular, and molecular level is fundamental to a knowledge-based management of the needs and risks of the world's growing population. This understanding touches all aspects of life such as human health and well-being, nutrition and environment. Ground-breaking insights into cellular and organismic metabolic or signalling pathways, which are involved – e.g in the progression of diseases – are gained by studying the effect of chemical compounds on biological systems – i.e. pharmacology. Post-genome biology with its powerful technologies of genome sequencing, transcriptomics, proteomics and metabolomics has provided a deluge of information on new cellular targets for basic research and early drug discovery. Unfortunately, the availability of suitable tools for systematic biochemical investigation of cellular target and pathway function is substantially lagging behind this deluge of omics data. This forms the basis for the development of novel diagnostic and therapeutic approaches in health research and opens novel opportunities in many other areas of the Life Sciences.

EU-OPENSCREEN integrates high-capacity screening platforms throughout Europe, which jointly use a rationally selected compound collection, comprising commercial and proprietary compounds collected from international chemists. By testing systematically and repeatedly this chemical collection in hundreds of assays originating from very different biological themes, the screening process generates enormous amounts of information about the biological activities of the substances and thereby steadily enriches our understanding of how and where they act. EU-OPENSCREEN supports all stages of a tool development project, including assay adaptation, high-throughput screening, and chemical optimisation of the hit compounds. All tool compounds and data are made available to the scientific community.

Impact

EU-OPENSCREEN may have several impacts, not only from the perspective of the RI in sharing technologies and data but also from the societal point of view. This is exemplified by mentioning the demand to generate improved efficacy and safety of health treatments in the day-to-day lives of European citizens. In addition to pharmacology applications in early drug discovery and toxicology, EU-OPENSCREEN also covers the production of crop-protective compounds, which are of paramount importance to society via the understanding of the response of wild or crop plants to environmental and agricultural substances. The broad biology approach of EU-OPENSCREEN will promote the availability of safe, efficacious and sustainable chemical products for unmet needs in medicine, nutrition, agriculture and the environment.

Academic stakeholders, providing the physical screening infrastructure, are joined by industrial stakeholder companies – large, medium and small – of the Pharmaceutical, Agri-Science and Biotechnology sectors. By doing so, EU-OPENSCREEN will advance the development of solutions for the *Grand Challenges* and guarantee the European competitiveness.

Euro-BioImaging

European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences

THE LARGE-SCALE OPEN PHYSICAL USER ACCESS TO STATE-OF-THE-ART BIOLOGICAL AND BIOMEDICAL IMAGING TECHNOLOGIES

TYPE distributed

LEGAL STATUS ERIC Step2, 2018

POLITICAL SUPPORT
lead country: FI
member countries: BG, CZ, HU, IT, NO, PT, (EMBL)
***observer:** BE
prospective member countries: AT, EL, ES, IL, NL, PL, SK, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2008

TIMELINE

2010-2014 Preparation Phase
2014-2015 Interim/Transition Phase
2016-2018 Implementation/Construction Phase
2016 Operation Start

ESTIMATED COSTS
capital value: 90 M€
design: Not Available
preparation: 5.2 M€
construction: 21 M€
operation: 1.6 M€/year

HEADQUARTERS
to be hosted in Finland

WEBSITE
www.eurobioimaging.eu

DESCRIPTION

The European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences (Euro-BioImaging, EuBI) provides a large-scale open physical user access to state-of-the-art imaging technologies for life scientists. It will offer image data support and training for infrastructure users and providers and continuously evaluate and include new imaging technologies to ensure sustainable cutting-edge services. EuBI consists of a set of complementary, strongly interlinked and geographically distributed Nodes – specialised imaging facilities – to reach European scientists in all Member States. The infrastructure is empowered by a strong supporting and coordinating entity, the EuBI Hub. The Hub provides the virtual entry point from which users are directed to their desired technology as served by the respective EuBI Nodes. Since May 2016, EuBI has opened Interim Operation and provides open access to 28 of 29 Node Candidates in 11 countries and at EMBL, offering 36 imaging technologies.

In the ESFRI Roadmap since 2008, EuBI is striving to establish the European Research Infrastructure Consortium (ERIC) by 2018.

ACTIVITY

Advanced and innovative imaging technologies are becoming increasingly important for analysis of molecular dynamics in cells and organisms, delivering crucial information more easily than standard biochemical methods. Nevertheless, European life scientists often lack access to pioneering imaging technologies. EuBI reduces this gap by coordinating a distributed imaging infrastructure offering open access to external users from other European research institutions. Such open access model brings numerous benefits to the scientific community: it mitigates the scarcity of expert staff and the high costs for individual institutions to install innovative imaging technologies; it increases international cooperation and boosts transfer of knowledge among European researchers. EuBI will allow life scientists working in academia, health care and industry to gain access to a broader range of much-needed advanced imaging technologies and knowledge, building bridges from basic biological to medical and clinical research.

In practice, the EuBI ERIC provides: i) physical access to cutting-edge imaging technologies at the Nodes, including advanced probes, expertise and training, methods, software and analysis tools, and ii) virtual access to common image data services provided by the Hub such as software tools for image processing, common repositories for reference image data sets for sharing and re-use, academically owned cloud storage and compute services. The significantly improved research conditions for life scientists will increase European competitiveness, exchange the brain drain for a brain gain and open new research fields to European researchers. In a next step, this will fundamentally advance the molecular understanding of health and disease. For example, new and faster drug development processes will be enabled, leading to better diagnosis, therapy and disease prevention.

IMPACT

The massively improved research conditions for life scientists will not only allow Europe to secure its global leadership position in imaging technologies and open new research fields to European research but also to fundamentally advance the molecular understanding of health and disease. New and faster drug development will be enabled, leading to better diagnosis, therapy and disease prevention and therewith increasing the quality of life for patients. In addition, EuBI will provide the essential imaging infrastructure for European scientists to develop the innovative solutions for other *Grand Challenges* including food security, bio-economy, inclusive and innovative societies.

By opening access to the complete range of cutting-edge technologies while at the same time coordinating and sharing the costs of deployment, EuBI allows its Member States a much better return on investment for biological and medical imaging platforms. The harmonization of access to imaging technologies across Europe Infrastructures overcomes the current duplication of infrastructure investments and the fragmentation of the European research landscape in this area.

A COLLECTION OF SERVICES ON MOUSE MODELS TO UNRAVEL THE ROLE OF GENE FUNCTION IN HUMAN HEALTH AND DISEASE

INFRAFRONTIER

European Research Infrastructure for the generation, phenotyping, archiving and distribution of mouse disease models

TYPE distributed

LEGAL STATUS GmbH, 2013

POLITICAL SUPPORT
lead country: DE
member countries: CZ, EL, FI, FR, (EMBL)
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2012 Preparation Phase
2010-2013 Implementation/Construction Phase
2013 Operation Ptart

ESTIMATED COSTS
capital value: 180 M€
design: Not Available
preparation: Not Available
construction: Not Available
operation: 80 M€/year

HEADQUARTERS
INFRAFRONTIER GmbH
Munich, Germany

WEBSITE
www.infrafrontier.eu

DESCRIPTION

The European Research Infrastructure for the generation, phenotyping, archiving and distribution of mouse disease models (INFRAFRONTIER) is providing the biomedical research community with the tools needed to study the systemic effects of genetic alterations to unravel the role of gene function in human health and disease. By offering access to a unique collection of mouse models and research tools and associated data, and to state-of-the-art technologies for mouse model development and phenotype analyses, INFRAFRONTIER enhances medical research by promoting studies that lead to breakthrough discoveries in cancer, metabolic and cardiovascular diseases, lung diseases, infectious diseases and the group of rare diseases, global threats to our socio-economic wellbeing.

The INFRAFRONTIER GmbH was established in April 2013. The application for the INFRAFRONTIER ERIC is currently under preparation in an Inter-Ministry Working Group.

ACTIVITY

In basic biomedical research the identification of the genetic bases for human disease is a fundamental goal and the investigation of gene function through mouse mutants and phenotyping is a central element in achieving this goal. The disease models available from INFRAFRONTIER can be used to address basic and fundamental scientific questions about in vivo gene function and may further our understanding of disease genetics. The number of human genetic studies has increased over the last years and a great opportunity now exists to validate possible disease candidates and pathways in human using mouse models. Overall, the mouse is widely regarded as the best model system for developing an understanding for human biology.

The INFRAFRONTIER RI is providing open access to international resources for mouse models, data, scientific platforms and services to study the functional role of the genome in human health and disease and supports the global user community in biomedical research. INFRAFRONTIER provides access to: i) mouse disease model generation using different genetic resources and technologies; ii) archiving and distributing of scientifically valuable mouse strains through the European Mouse Mutant Archive (EMMA), the third largest mouse repository worldwide and integral component of INFRAFRONTIER; iii) whole-organism, systemic analysis of genotype-phenotype interactions using cutting-edge analytical and diagnostic methodology in the INFRAFRONTIER mouse clinics. INFRAFRONTIER supports a bottom-up approach for individual scientists and research groups and provides top-down capacities for large-scale international initiatives such as the International Mouse Phenotyping Consortium (IMPC).

In addition, INFRAFRONTIER offers a wide range of state-of-the-art training opportunities and consulting services. Training courses cover hands on cryopreservation courses that are offered by EMMA partners for many years. Mouse clinics of INFRAFRONTIER offer outstanding training opportunities in first-line mouse phenotyping as well as specialised phenotyping courses.

IMPACT

In addition to the wide use to focus on basic and fundamental scientific questions in human health and disease, mouse models are exploited for addressing more applied questions ranging from the identification and validation of novel drug targets to the analysis of drug action and side effects and safety and efficacy testing of potential drugs. Drug companies exploit phenotype results from mouse models at multiple key decision points during pre-clinical research, including target and compound selection but also for avoiding unwanted target liabilities that could lead to failures later on in the clinic.

Furthermore, genetically engineered mouse models are successfully used for testing treatment regimes in co-clinical trials in mouse and humans contributing to the rational design of clinical trials. By offering open access to centralised and sustainable gold-standard resources, INFRAFRONTIER reduces duplication of efforts thereby contributes to cost efficiency, reduction of animal use, and data reproducibility.

INSTRUCT ERIC

Integrated Structural Biology Infrastructure

A PEER-REVIEWED ACCESS TO A BROAD RANGE OF TECHNOLOGY, EXPERTISE AND TRAINING IN STRUCTURAL BIOLOGY

TYPE distributed

LEGAL STATUS ERIC, 2017

POLITICAL SUPPORT
lead country: UK
member countries: BE, CZ, DK, FR, IL, IT, NL, PT, SK
***observers:** EL, ES, SE, (EMBL)
prospective country: FI
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2012 Preparation Phase
2011-2012 Interim/Transition Phase
2012-2017 Implementation/Construction Phase
2017 Operation Start

ESTIMATED COSTS
capital value: 400 M€
design: Not Available
preparation: 8 M€
construction: 175 M€
operation: 30 M€/year

HEADQUARTERS
Instruct ERIC
Oxford, United Kingdom

WEBSITE
www.instruct-eric.eu

DESCRIPTION

The Integrated Structural Biology Infrastructure (INSTRUCT) is a distributed Research Infrastructure that provides peer-reviewed access to a broad palette of state-of-the-art technology and expertise as well as training and technique development in the area of integrated structural and cell biology, with the major goal of underpinning fundamental research and promoting innovation in the biological and medical sciences. Biological and medical research requires an integrated approach combining multiple technologies: INSTRUCT is a major player in delivering this strategy, promoting innovation and discovery in biomedical science, defining a plan for structural biology in Europe that will help to develop the European Research Area, supporting the biotechnology and pharmaceutical industries, and helping to meet the *Grand Challenges* as defined by Horizon 2020.

Entered in the ESFRI Roadmap 2006, INSTRUCT established the European Research Infrastructure Consortium (ERIC) in July 2017.

ACTIVITY

INSTRUCT ERIC offers access to structural biology facilities at its Centres upon application by the users. All proposals are peer-reviewed using an efficient and transparent process. Applications for access can be submitted at any time or via special calls with specific criteria. All applications are evaluated on scientific merit with specific attention for those that require innovative integrative approaches. INSTRUCT ERIC provides advanced technologies and unique expertise across the range of technologies and methods for sample preparation, structural and cellular characterisation, and data analysis. Access to the advanced technologies are underpinned by foundation methods at each Centre to ensure high sample quality and preparative work.

In addition to access to state-of-the-art technologies, INSTRUCT also generates scientific output through grants for small pilot projects, internships, and an extensive training programme. In five years of operations, 49 Training Courses have been commissioned and funded, 26 internships have been awarded, 35 R&D pilot awards have been made. The training courses have included a total number of 695 participants who have had opportunities to improve their skills in structural biology methods. A total of 455 publications have acknowledged INSTRUCT support and the number is constantly increasing. INSTRUCT is working to reinforce the ERA by establishing commonalities with other RI procedures and service provision. A key contribution is the access management system (ARIA) which was developed by INSTRUCT and is made available to other ESFRI and national infrastructures, helping to create a common web platform that supports cross-disciplinary RI use. INSTRUCT has and continues to establish an extensive network of international partners. MoUs and formal partnerships have been defined or are at final stages of definition with China, India, Brazil, Argentina, Uruguay and Mexico, and with the Middle East synchrotron SESAME in Jordan.

IMPACT

The impact of structural biology is considerable, including both academic, commercial and more indirect economic gains. INSTRUCT ERIC has a direct impact on academic science: it serves a community of more than 35.000 structural biologists. Dissemination and training activities targeting non-structural biological scientists potentially expand the user community to more than 100.000 with a potentiality to exceed 400.000 globally.

INSTRUCT is embedded in the drug discovery process through collaborations with several European companies and the EU-funded vaccine network. There is considerable potential to contribute to the design of innovative, effective and safe medicines using structural approaches. Any reduction in the burden of disease through improved prevention and/or treatment produces considerable potential economic gains, as well as contributing to healthier ageing and improved public health.

CTA
Cherenkov Telescope Array

Cherenkov Telescope Array for high-energy gamma-ray astronomy to probe a non-thermal Universe

TYPE single-sited

LEGAL STATUS gGmbH, 2014

POLITICAL SUPPORT
lead country: IT
member countries: AT, AU, CH, CZ, DE, ES, FR, JP, SI, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2008

TIMELINE

2011-2016 Preparation Phase
2017-2018 Interim/Transition Phase
2019-2024 Implementation/Construction Phase
2024 Operation Start

ESTIMATED COSTS
capital value: 400 M€
design: Not Available
preparation: 8 M€
construction: 297 M€
operation: 20 M€/year

HEADQUARTERS
CTAO gGmbH
Heidelberg, Germany

WEBSITE
www.cta-observatory.org

DESCRIPTION

The Cherenkov Telescope Array (CTA) is a Research Infrastructure for ground-based very high-energy gamma-ray astronomy. With two host sites in the southern and northern hemispheres – on the European Southern Observatory (ESO) at Paranal grounds in Chile and at the Instituto de Astrofisica de Canarias (IAC) in Roque de los Muchachos Observatory in Spain – it will extend the study of astrophysical origin of gamma-rays at energies of a few tens of GeV and above, and investigate cosmic non-thermal processes. CTA will provide the first complete and detailed view of the universe in this part of the radiation spectrum and will contribute towards a better understanding of astrophysical and cosmological processes, such as the origin of cosmic rays and their role in the Universe, the nature and variety of particle acceleration around black holes and the ultimate composition of matter and physics beyond the Standard Model.

In the ESFRI Roadmap since 2008, CTA became a gGmbH in 2014 and is actually striving to establish the European Research Infrastructure Consortium (ERIC) with operations expected to start in 2024.

ACTIVITY

High-energy gamma-rays probe a non-thermal Universe because, apart from the Big Bang, there is nothing hot enough in the known Universe to emit such gamma-rays. These gamma-rays can be generated when highly relativistic particles collide with ambient gas, or interact with photons and magnetic fields (bottom-up process). By studying their energy and flux spectrum, it is possible to trace these cosmic rays and electrons in distant regions of our own Galaxy or even in other galaxies. High-energy gamma-rays can also be produced in a top-down fashion by decays of heavy particles such as the hypothetical dark matter particles. Therefore, gamma-rays provide a window to the discovery of the nature and constituents of dark matter, relics which might be left over from the Big Bang. The present generation of imaging atmospheric Cherenkov telescopes (H.E.S.S., MAGIC and VERITAS) has in recent years opened the realm of ground-based gamma-ray astronomy in the energy range above a few tens of GeV. The Cherenkov Telescope Array will explore our Universe in depth in Very High Energy (VHE, E>10 GeV) gamma-rays and investigate cosmic non-thermal processes, in close cooperation with observatories operating at other wavelength ranges of the electromagnetic spectrum, and those using other messengers such as cosmic rays and neutrinos.

CTA will consist of arrays of Cherenkov telescopes that will be built at two separate sites, one in the southern hemisphere with wide gamma-ray energy range and high resolution to cover the plane of the Milky Way, and the second in the northern hemisphere specialised for lower energies, which will focus on extragalactic and cosmological objects. The array will allow the detection of gamma-ray induced cascades over a large area on the ground, increasing the number of detected gamma rays dramatically, while at the same time providing a much larger number of views of each cascade. The design foresees an improvement in sensitivity of a factor of 5-10 in the current very high-energy gamma ray domain from ~ 100 GeV to some 10 TeV – and an extension of more than three orders of magnitude in the accessible energy range, up to above 100 TeV.

IMPACT

CTA has broad social and economic impact. In social dimension, being a world-wide RI, CTA fosters international collaboration and mobility across not only Europe but also Americas, Asia, Africa and Australia requiring people from different cultures work together. It also creates a unique network of researchers in academia and in industry giving a new dimension to the publicly funded basic science.

CTA telescopes demand forefront research and their large number implies that technologies involved cannot remain at laboratory scale but need to scale up to large deployment of products useful for commercialisation and application in other areas – e.g. photosensors with vastly improved characteristics may find application in medical imaging. SMEs in different countries are already involved in production of CTA components, and various aspects of operation and maintenance of CTA will be outsourced to local industry. The array sites, headquarters and data management centre will attract skilled individuals who will directly contribute to the local economy and training of local technicians and engineers in an intellectually challenging environment.

ELI

Extreme Light Infrastructure

THE WORLD'S FASTEST AND MOST INTENSE ADVANCED LASERS TO UNRAVEL THE FUNDAMENTAL SECRETS OF THE UNIVERSE AND MATERIALS

TYPE distributed

LEGAL STATUS AISBL, 2013

POLITICAL SUPPORT
lead countries: CZ, HU, RO
member countries: DE, FR, IT, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2007-2010
Preparation Phase

2011-2017
Implementation/Construction Phase

2018
Operation Start

ESTIMATED COSTS
capital value: 850 M€
design: Not Available
preparation: 6 M€
construction: 850 M€
operation: 80 M€/year

HEADQUARTERS
ELI-DC AISBL
Brussels, Belgium

WEBSITE
www.eli-laser.eu

DESCRIPTION

The Extreme Light Infrastructure (ELI) is a Research Infrastructure of global interest using extreme light-matter interactions at the highest intensities, shortest time scales and broadest spectral range. ELI will provide unprecedented energy and attosecond resolution of coherent radiation and laser-accelerated particles for fundamental studies in atomic, molecular, plasma and nuclear physics to serve a large variety of scientific applications, ranging from biology, chemistry and medicine to astrophysics in the laboratory.

ELI has facilities in the Czech Republic, Hungary and Romania with complementary scientific profiles. Construction has been implemented by national authorities in the host countries and coordinated by the ELI Delivery Consortium International Association (ELI-DC), International not-for-profit Association under Belgian Law (AISBL). The three facilities will jointly operate as a European Research Infrastructure Consortium (ERIC) starting in 2018.

ACTIVITY

In Dolni Brezany, near Prague, Czech Republic, the ELI-Beamlines facility mainly will focus on the development of short-pulse secondary sources of radiation and particles, and on their multidisciplinary applications in molecular, biomedical and material sciences, physics of dense plasmas, warm dense matter, laboratory astrophysics. In addition, the pillar will utilise its high-power, high-repetition-rate lasers for high-field physics experiments with focused intensities of about 10^{23} W/cm^2, investigating exotic plasma physics, and non-linear QED effects (www.eli-beams.eu).

The ELI Attosecond Light Pulse Source (ELI-ALPS) in Szeged, Hungary is establishing a unique facility, which provides light sources between THz (10^{12} Hz) and x-ray (10^{18}-10^{19} Hz) frequency range in the form of ultrashort pulses with high repetition rate. ELI-ALPS will be dedicated to extremely fast dynamics by taking snap-shots in the attosecond scale (a billionth of a billionth of second) of the electron dynamics in atoms, molecules, plasmas and solids. It will also pursue research with ultrahigh intensity lasers (http://www.eli-alps.hu).

In Magurele, Romania, the ELI Nuclear Physics (ELI-NP) facility focuses on laser-based nuclear physics. It will host two machines, a very high intensity laser, where beams from two 10 PW lasers are coherently added to get intensities of the order of 10^{23} - 10^{24} W/cm^2, and a very intense, brilliant gamma beam, which is obtained by incoherent Compton back scattering of a laser light off a brilliant electron beam from a conventional linear accelerator. Applications include nuclear physics experiments to characterize laser – target interaction, photonuclear reactions, and exotic nuclear physics and astrophysics (http://www.eli-np.ro).

IMPACT

The Extreme Light Infrastructure will lead to new regimes in fundamental physics, enable the advent of new technologies, and deliver particles and photon sources with extreme high energies, beyond the physical limits of conventional technologies. As the first international laser user facility, ELI is open to an international community of scientific and industrial users, attracting the world's best scientists to unique research opportunities including physics, chemistry, biology, medicine, materials sciences, and combinations thereof.

Contributions to *Grand Societal Challenges* will cover a broad range of areas: analytical studies in environmental research, climate research, medical diagnostics and treatment, pharmacology, bio-medicine, or from materials research for renewable and nuclear energies, nuclear waste management, and space applications.

ELT
Extremely Large Telescope

THE WORLD'S BIGGEST EYE ON THE SKY TO REVOLUTIONISE OUR PERCEPTION OF THE UNIVERSE

TYPE single-sited

LEGAL STATUS ESO, EIROforum member

POLITICAL SUPPORT
lead entity: ESO
The following countries are members of ESO
member countries: AT, BE, CH, CZ, DE, DK, ES, FI, FR, IT, NL, PL, PT, SE, UK
prospective member country: IE
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE
2006-2012 Preparation Phase
2014-2024 Implementation/Construction Phase
2024 Operation Start

ESTIMATED COSTS
capital value: 1.120 M€
design: Not Available
preparation: Not Available
construction: Not Available
operation: 45 M€/year

HEADQUARTERS
ESO
Garching bei München, Germany

WEBSITE
www.eso.org/public/teles-instr/elt

DESCRIPTION

Extremely Large Telescope (ELT) is a revolutionary new ground-based telescope for the advancement of astrophysical knowledge, allowing detailed studies of objects including planets around other stars, the first objects in the Universe, super-massive black holes, and the nature and distribution of the dark matter and dark energy which dominate the Universe. Equipped with a 39-metre primary mirror, the ELT will be the largest optical/near-infrared telescope in the world: the world's biggest eye on the sky.

The ELT is an integral part of ESO, the EIROforum organisation operating facilities at a number of sites in Chile. The ELT programme was approved in 2012 and green light for the first phase of construction was given at the end of 2014. It will be located at Cerro Armazones, a 3060-metres high mountain in the central part of Chile's Atacama Desert, about 20 kilometres from Cerro Paranal, home of ESO's Very Large Telescope (VLT). The ELT construction is expected to be completed by 2024.

ACTIVITY

The telescope's primary mirror will be almost half the length of a soccer pitch in diameter and will gather 15 times more light than today's largest optical telescopes. The optical design comprises a three-mirror anastigmat with two flat folding mirrors providing the adaptive optics to correct for the turbulent atmosphere, giving unprecedented image quality. One is supported by more than 5.000 actuators operating at a frequency of 1.000 Hz. The primary mirror consists of 798 hexagonal segments, each 1,4 metres wide. The secondary mirror will have a diameter of 4 metres. The telescope will have several science instruments, with switching from one instrument to another within minutes. The ability to observe over a wide range of wavelengths from the optical to mid-infrared will allow scientists to exploit the telescope's size to the fullest extent.

Science with the ELT covers many areas of astronomy – from the Solar System to extra-solar planets, from nearby galaxies to the furthest observable objects at the edge of the visible Universe, from fundamental physics to cosmology. They include discovering and characterising planets and proto-planetary systems around other stars, resolving stellar populations in a representative sample of the Universe, the study of the physical processes that form and transform galaxies across cosmic time, the discovery and identification of distant type Ia supernovae and constraining dark energy by directly observing the global dynamics of the Universe, as well as searching for possible variations over cosmic time of fundamental physical constants.

IMPACT

The ELT is a major technological challenge and triggers industrial interest and preparedness to deliver extraordinary performance, as it occurred in previous ESO projects (notably the VLT and ALMA). ESO has since many years devolved its instrumentation programme so that science instruments are largely designed and built by national institutes, often in collaboration with industry. In this model, national facilities cover the human resources cost against compensation in guaranteed observing time. The ELT will employ advanced technologies and engineering solutions in a number of areas, from gigantic, lightweight high-precision structures, opto-mechanical systems, optical design and control systems. Many of these technologies will be applicable to other areas of technology development. As regards short-term benefits, these are found in spin-off technologies and the inspirational and educational aspects, strengthening the scientific and engineering recruitment base and public awareness of science.

Concerning the contribution to societal challenges, astronomy is basic science in its most fundamental form and its main purpose is to enhance our understanding of the Universe, its evolution and the role of planet Earth as our cosmic home. Astronomy findings have a profound impact on society in the long run, both in technological and cultural terms. Astronomy is a major theme in education and training, inspiring new generations in STEM topics. It also triggers innovative technology solutions, and international cooperation.

EMFL

European Magnetic Field Laboratory

A UNIQUE EFFORT TO GENERATE THE HIGHEST POSSIBLE MAGNETIC FIELDS FOR EXCELLENT RESEARCH

TYPE distributed

LEGAL STATUS AISBL, 2015

POLITICAL SUPPORT
lead countries: FR, DE, NL
member country: UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2008

TIMELINE

2009-2012
Preparation Phase

2014
Operation Start

2009-2014
Implementation/Construction Phase

ESTIMATED COSTS
capital value: 170 M€
design: Not Available
preparation: Not Available
construction: Not Available
operation: 20 M€/year

HEADQUARTERS
EMFL AISBL
Brussels, Belgium

WEBSITE
www.emfl.eu

DESCRIPTION

The European Magnetic Field Laboratory (EMFL) develops and operates the highest possible magnetic fields that can be used for scientific research, and making them available to the scientific community. The EMFL unites, coordinates and reinforces all existing European large-scale high magnetic field Research Infrastructures in a single body. These facilities are the Laboratoire National de Champs Magnétiques Intenses (LNCMI), with its sites for pulsed fields in Toulouse and continuous fields in Grenoble, the Dresden High Magnetic Field Laboratory (HLD) and the High Field Magnet Laboratory (HFML) in Nijmegen. The EMFL formally represents and operates tasks, in particular the access program, of the parent laboratories. The UK community, represented by the University of Nottingham, joined EMFL at the end of 2015.

The parent organizations of the three facilities have created a legal structure in the form of an International not-for-profit Association under Belgian Law (AISBL) sited in Belgium. The AISBL statutes were signed in January 2015.

ACTIVITY

The LNCMI is a French large-scale facility operated by CNRS and associated to INSA, UPS and UGA, enabling researchers from all over the world to perform experiments in the highest possible magnetic fields. Continuous fields up to 37 Tesla are available at the Grenoble site. Pulsed fields up to 99 Tesla and 208 Tesla semi-destructively are available at the Toulouse site. The HLD in the Helmholtz- Zentrum Dresden-Rossendorf (HZDR) focuses on modern materials research at high magnetic fields. It serves as a research facility for both in-house and user projects and provides research opportunities for pulsed magnetic fields up to 90 Tesla for routine operation. The HLD aims at reaching magnetic fields up to the feasibility limit of about 100 Tesla. The HFML in Nijmegen is committed to generate the highest available continuous magnetic fields. HFML is a Dutch large European research facility open for external researchers and operated by the Radboud University (RU) and Netherlands Organisation for Scientific Research (NWO). In the HFML resistive magnets with fields up to 37.5 Tesla are available and a 45 Tesla hybrid magnet is under development.

The main research activities supported by the EMFL are: magnetic and superconducting materials, strongly correlated electron systems, low-dimensional magnetic materials, nanostructured materials, magnet design and technology, semiconductors and nano-systems, mesoscopic physic, strongly correlated electron systems, molecular magnetism, soft condensed matter.

IMPACT

The EMFL has developed transportable pulsed magnets and generators allowing fields of up to 40 Tesla to be combined with large neutron, X-ray, or laser sources impacting fundamental science programmes across disciplines. Neutron and synchrotron experiments in pulsed fields allow researchers to reveal the microscopic properties of matter; they are conducted jointly between the EMFL and a number of large facilities that are leaders in their field. Both in Dresden and Nijmegen the adjacent THz radiation facilities ELBE and FELIX Laboratory are connected to the high field magnets and offer combined experiments.

Magnetic fields can help defeat cancer as they are used to trace tumours or to do nanodrug delivery, in combination with Magnetic Resonance Imaging (MRI). EMFL researchers also develop a compact and inexpensive beam delivery alternative for proton beam therapy. EMFL supports applied research for forming, joining, and welding metals by using the large compressive forces produced by very short and intense energy-efficient magnetic-field pulse technology with many extra benefits for economy and environment. Magnetic fields can help scientists reveal the hidden physical properties of neodymium-like or other brand new magnetic materials that can be used to create smaller, more efficient electric motors. EMFL supports the application of high-temperature superconductivity to energy storage and transport, and into developing magnetic levitation and was involved in preliminary measurements demonstrating the enormous technological potential of graphene.

REVOLUTIONARY STORAGE RING AND BEAMLINES FOR X-RAY SYNCHROTRON SCIENCE AND INNOVATION

ESRF EBS

European Synchrotron Radiation Facility
Extremely Brilliant Source

TYPE single-sited

LEGAL STATUS ESRF, EIROforum member

POLITICAL SUPPORT
lead entity: ESRF
The following countries are members of ESRF
member countries: BE, CH, DE, DK, ES, FI, FR, IT, NL, NO, RU, SE, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2016

TIMELINE
2012-2015 Preparation Phase
2015-2022 Implementation/Construction Phase
2023 Operation Start

ESTIMATED COSTS
capital value: 128 M€
design: 1 M€
preparation: 1 M€
construction: 150 M€
operation: 82 M€/year

HEADQUARTERS
ESRF
Grenoble, France

WEBSITE
www.esrf.eu

DESCRIPTION

The European Synchrotron Radiation Facility (ESRF) is the world-leading source of synchrotron X-rays. Operating more than 40 beamlines with state-of-the-art instrumentation, the ESRF serves ~10.000 scientists each year who study materials and living matter at the atomic and nanometric scale. It is a truly European facility and a key component of the ERA. The ESRF initiated an Upgrade Programme in 2009, and completed the initial phase in 2015 with 19 new and rebuilt beamlines, enabling 3 orders of magnitude gains in performance for X-ray microscopy and imaging experiments.

The ongoing new phase – the ESRF Extremely Brilliant Source (EBS) – consists of the construction of a new storage ring, based on a revolutionary ESRF lattice design, and of new beamlines that will exploit the new source. EBS, bringing two orders of magnitude increase in source brilliance, will open a new era in X-ray science.

ACTIVITY

The ESRF – the first and highly successful third-generation synchrotron source – started operations in 1994, and since then has promoted and inspired synchrotron science and innovation worldwide.

Every year, ~10.000 scientific users across all disciplines of natural sciences use the ESRF and their work generates ~2.000 peer-reviewed publications. ESRF has delivered up to now ~2.400.000 instrument-hours (i.e. ~140.000 hours/year). Approximately 98% of the beam time at the ESRF is granted through peer-reviewed scientific excellence based access and 2% is acquired for proprietary research. Approximately 30% of all projects submitted to the ESRF involve innovation/industrial technology developments. A transparent scheme monitors beam time distribution among the scientists' countries and aims for a *juste retour* with respect to the shareholders' contributions.

The ESRF provides scientific support to users and carries out the necessary research and development work in synchrotron techniques enabling, among others, Nobel Prizes in Chemistry in 2003, 2009 and 2012. The ESRF has created, together with the ILL and EMBL, a hub of excellence that has stimulated the co-location of specialist laboratories such as the Institute for Structural Biology, the Partnership for Structural Biology, the Partnership for Soft Condensed Matter, industrial research collaborations and a world class cryo-EM platform.

Centred on rebuilding the ESRF storage ring – based upon the all-new hybrid multi-bend achromat lattice designed at the ESRF – the ESRF EBS will deliver unprecedented source brilliance and coherence (~100x). The EBS project includes also the construction of four new state-of-the-art beamlines, a scientific instrumentation programme with ambitious detector projects and a data management and analysis strategy. Most beamlines, including the Collaborating Research Groups beamlines, will also be upgraded. The ESRF EBS represents an investment of 150 M€ over the period 2015-2022.

IMPACT

The new ESRF EBS enhances the ESRF's impact on science and on partner countries. The ESRF EBS source will start operations in 2020 but is already a global reference: more than 13 projects worldwide aim at reproducing the ESRF EBS model, which will be the reference for at least another decade. The construction of EBS is currently securing industrial innovation with contracts and partnerships with companies based in ESRF Member and Associate countries.

The engineering challenges of the ESRF EBS are boosting industrial capacity in areas such as magnet and detector technology, nano-manipulation, control systems, vacuum technology, precision mechanics and high-power radiofrequency technology for accelerators. Developments in data management, analysis tools and open access repositories will further impact science and technology at European and global levels with an impact in the broader field of analytical science and facilities.

European Spallation Source ERIC

European Spallation Source

THE WORLD'S MOST POWERFUL NEUTRON SOURCE FOR INTERDISCIPLINARY RESEARCH IN PHYSICAL AND LIFE SCIENCES

TYPE single-sited

LEGAL STATUS ERIC, 2015

POLITICAL SUPPORT
lead countries: DK, SE
member countries: CH, CZ, DE, EE, ES, FR, HU, IT, NO, PL, UK
***observer:** BE, NL
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2010
Preparation phase

2010-2025
Implementation/Construction Phase

2025
Operation Start

ESTIMATED COSTS
capital value: 1.843 M€
design: Not Available
preparation: 80 M€
construction: 654 M€
operation: 140 M€/year

HEADQUARTERS
European Spallation Source ERIC
Lund, Sweden

WEBSITE
www.europeanspallationsource.se

DESCRIPTION

The European Spallation Source (ESS) is a Research Infrastructure with the vision to build and operate the world's most powerful neutron source, enabling scientific breakthroughs in research related to materials, energy, health and the environment, and addressing some of the most important societal challenges of our time. The ESS will deliver a neutron peak brightness of at least 30 times greater than the current state-of-the-art, thus providing the much-desired transformative capabilities for interdisciplinary research in the physical and life sciences.

ESS officially became a European Research Infrastructure Consortium (ERIC) in October 2015. The facility is under construction in Lund (Sweden), while the ESS Data Management and Software Centre (DMSC) is based in Copenhagen (Denmark). When the ESS user programme begins in 2023, an estimated two to three thousand visiting scientists will come to ESS annually to perform experiments. Most users will be based at European universities and institutes, and others within industry.

ACTIVITY

Neutrons are excellent for probing materials on the molecular level. For everything from motors and medicine, to plastics and proteins, detailed studies are dependent on how many neutrons can be produced by a neutron source. This is a significant limitation for existing sources based on nuclear reactors. As a result, scientists and engineers have developed a new generation of neutron sources based on particle accelerators and spallation technology, a much more efficient approach.

ESS will provide up to 100 times brighter neutron beams than existing facilities today. A total of 15 instruments will be built during the construction phase to serve the neutron user community – Europe today has nearly 6.000 researchers using neutrons – with more instruments during operations. The suite of ESS instruments will gain 10-100 times over current performance enabling neutron methods to study real-world samples under real-world conditions. The 15 instrument concepts were selected through an inclusive process, involving applications from the community and peer-review by scientific and technical committees. The final recommendation was made by the ESS Scientific Advisory Committee and approved by ESS Council. In the long term, expansion of the suite up to 22 instruments is anticipated. Commissioning of the accelerator will begin in 2019, with the user programme for the earliest instruments set to open in 2023.

To succeed in its mission ESS relies on the expertise of its partners from across Europe, and also from other areas of the globe. The European Spallation Source has a large network of laboratories to exchange knowledge, personnel and experience with, and that in many cases will contribute directly to the project through In-Kind Contributions (IKCs). These IKCs are expected to finance more than 35% of the total 1.843 million € estimated for the construction costs.

IMPACT

ESS will be an attractive and environmentally sustainable large compound that will make an impact on the world's stage. Before the expected world-scale scientific impact can be realised with the operation phase, the construction of the ESS does have a direct economic impact by generating growth and jobs, advance development and fuel innovation potential in the Öresund region and across the EU. The realisation of ESS enables access to frontier technology, experienced technical and scientific staff as well as unique production facilities and technologies, which would otherwise be unattainable.

In addition, the ESS will be a key instrument for addressing the *Grand Challenges* through novel insights on matter at the molecular and atomic level and applications to energy, carbon sequestration methods, health issues at biology level as well as drug development and delivery strategies, plant water-uptake processes of relevance for agriculture, novel data storage materials, and more.

European XFEL

European X-Ray Free-Electron Laser Facility

THE FIRST SUPERCONDUCTING HARD X-RAY FREE-ELECTRON LASER FOR LIFE AND MATERIALS SCIENCES

TYPE single-sited

LEGAL STATUS European XFEL, EIROforum

POLITICAL SUPPORT
lead entity: European XFEL
The following countries are members of European XFEL
member countries: CH, DE, DK, ES, FR, HU, IT, PL, RU, SE, SK, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2006-2009
Preparation Phase

2009-2017
Implementation/Construction Phase

2017
Operation Start

ESTIMATED COSTS
capital value: 1.490 M€
design: Not Available
preparation: Not Available
construction: 1.490 M€
operation: 118 M€/year

HEADQUARTERS
European XFEL GmbH
Schenefeld, Germany

WEBSITE
www.xfel.eu

DESCRIPTION

The European X-Ray Free-Electron Laser (European XFEL) will be the world leading facility for the production of high repetition rate ultra-short X-ray flashes with a brilliance that is a billion times higher than that of the best conventional synchrotron X-ray radiation sources. The European XFEL is opening up areas of research that were previously inaccessible. Using the X-ray flashes of the European XFEL, scientists will be able to map the atomic details of viruses, decipher the molecular composition of cells, take three-dimensional images of the nanoworld, film chemical reactions, and study processes such as those occurring deep inside planets.

The European XFEL is organized as a non-profit company with limited liability under German law (GmbH) that has international shareholders. The international European XFEL project – with 12 participating countries – is being operated in Hamburg and Schleswig-Holstein since October 2017.

ACTIVITY

X-ray free-electron lasers (FELs) are accelerator based light sources that generate extremely brilliant and ultra-short, from few to 100 femtoseconds (fs) pulses of transversely coherent X-rays with very short wavelengths (down to ~ 0.05 nm). The goal is to exploit these X-rays for revolutionary scientific experiments in a variety of disciplines, including physics, chemistry, materials science, and biology. In the US and Japan, FELs are based on room-temperature linear accelerators (warm-LINACS). In Europe, the European XFEL Facility exploits the superconducting linear accelerator technology (cold-LINAC). This technology allows for a very large number of pulses per second, in the case of the European XFEL up to 27.000 pulses per second. Electron bunches are accelerated to high energies (up to 17.5 GeV) in a ~2 km LINAC and then passed through (up to 200 m long) undulators, where they will generate bursts of coherent X-rays through the self-amplified spontaneous emission (SASE) process. Initially, 3 photon beamlines and 6 instruments are being built. Eventually, 5 photon beamlines and 10 experimental stations will enable experiments ranging from coherent diffraction imaging to spectroscopy and exploit the high intensity, coherence, and time structure of the new source.

Some expected scientific benefits will consist in studying molecular configuration rearrangements during chemical reactions down to the sub-picosecond (ps) scale, observing the dynamics of fluctuations on unprecedented time and length scales, providing experimental access to regions of the phase diagram of materials currently found only in astrophysical environments. A fascinating perspective benefit is the investigation of the structure of individual macromolecules down to atomic resolution, without the need for crystallization.

IMPACT

The European XFEL facility expands the leading position of Europe in accelerator based X-ray sources, that are pushing the frontiers of condensed matter physics, materials science, chemistry, structural biology and pharmacology. The specific developments in detector and accelerator technology generate innovation and know-how transfer to industry. The expected fundamental research breakthroughs in materials sciences, chemistry and catalysis, and macromolecular structure, will also generate innovation.

The European XFEL provides an opportunity to educate a new generation of scientists to address the frontiers of research on nano-scale materials, and this in a multi-national, open environment, promoting the European dimension of knowledge and its international mobility. Consortia are created among European universities and research centres to develop instrumentation for the facility, impacting the coordination of efforts in the fields of research related with health issues, energy and environment.

FAIR

Facility for Antiproton and Ion Research

AN ANTIPROTON AND ION BEAMS ACCELERATOR FACILITY TO EXPLORE THE NATURE OF MATTER AND THE EVOLUTION OF THE UNIVERSE

TYPE single-sited

LEGAL STATUS GmbH, 2010

POLITICAL SUPPORT
lead country: DE
member countries: FI, FR, IN, PL, RO, RU, SE, SI, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2005-2010
Preparation Phase

2012-2025
Implementation/Construction Phase

2025
Operation Start

ESTIMATED COSTS
capital value: Not Available
design: Not Available
preparation: Not Available
construction: 1.262 M€
operation: 234 M€/year

HEADQUARTERS
FAIR GmbH
Darmstadt, Germany

WEBSITE
www.fair-center.de

DESCRIPTION

The Facility for Antiproton and Ion Research (FAIR) is a new accelerator complex providing high-energy, high-intensity primary and secondary beams of antiprotons and ions to enable forefront research into the structure and dynamics of matter under extreme conditions, thereby also providing new insights into the evolution of the Universe and the nucleosynthesis in stars and star explosions.

On October 2010, ten countries signed an international agreement on the construction of the FAIR accelerator facility in Darmstadt. These countries are the shareholders of the FAIR GmbH, the established legal entity for the realization of FAIR. In total over 50 countries are involved in the FAIR science program by contributing to the construction and to the exploitation of the FAIR detectors. The FAIR experiments are organized in four large collaborations: APPA, CBM, NUSTAR and PANDA encompassing more than 2.500 scientists in total. FAIR is expected to deliver beams for science experiments in 2025. Partial operation – FAIR Phase 0 science programme – will start in 2018.

ACTIVITY

FAIR will be constructed in Darmstadt, adjacent to the GSI facility, and will use the upgraded GSI accelerators as injector chain. Within a broad scientific-technological approach, FAIR develops and exploits novel accelerator, detector and computing technologies for unprecedented research into nuclear structure and nuclear astrophysics, physics of hadrons and fundamental physics with antiproton beams, physics of compressed nuclear matter, plasma physics, atomic physics, materials research and biomedical applications.

The heart of the new facility is the superconducting synchrotron SIS100 with a circumference of about 1.100 metres. A complex system of storage-cooler rings and ca 3.2 kilometres of beam transport lines deliver the beams to various experiment stations which house a suite of highly sophisticated detectors. Altogether, the buildings and tunnel sections provide about 135.000 square metres of usable space for the complex scientific-technical infrastructure. The superconducting synchrotron SIS100 is capable of delivering for the science programs high intensity primary beams with energies of up to 11.5 GeV for uranium and of 29 GeV for protons. Moreover, a broad range of exotic radioactive ion beams and antiproton beams can be provided at the facility. FAIR will enable parallel operation of up to four research programs, thereby allowing a very cost-efficient exploitation of the facility.

The scientific scope and instrumentation of FAIR is complementary to that at other existing or planned large accelerator Research Infrastructures, but none of the other facilities combines the full set of features in one and the same project: large variety of the ion species – from antiprotons to uranium, high beams intensities, high beam energies, cooled antiproton and exotic ion beams, parallel operation.

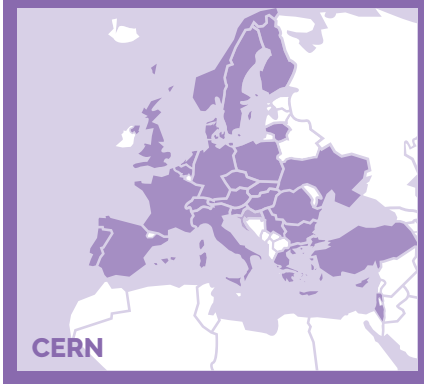
IMPACT

In addition to the fundamental science research, FAIR is focusing on applications like radiobiological risk assessments for manned space missions, material sciences, plasma physics studies, and radiotherapy research and development. FAIR has also a potential of broader impact at international level as collaborations in detector and magnet development – e.g. with JINR-Dubna – are already active. This is also reflected by strong and active cooperation between FAIR and many laboratories worldwide optimizing synergies in research and development, and use of existing infrastructures. FAIR is intended to provide research opportunities well beyond the European scope from the beginning, thus catering for scientific communities of countries that cannot afford such large Research Infrastructure by themselves and would greatly benefit from it.

HL-LHC

High-Luminosity Large Hadron Collider

AN UPGRADE OF THE HIGHEST-ENERGY PARTICLE COLLIDER IN THE WORLD TO EXPLORE NEW PHYSICS



TYPE single-sited

LEGAL STATUS CERN, EIROforum member

POLITICAL SUPPORT

lead entity: CERN

The following countries are members of CERN

member countries: AT, BE, BG, CH, CY, CZ, DE, DK, EL, ES, FI, FR, HU, IL, IN, IT, LT, NL, NO, PK, PL, PT, RO, RS, SE, SI, SK, TR, UA, UK

prospective member countries: HR

The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2016

TIMELINE

2014-2017
Preparation Phase

2017-2025
Implementation/Construction Phase

2026
Operation Start

ESTIMATED COSTS

capital value: 1.408 M€
design: 205 M€
preparation: 34 M€
construction: 1.169 M€
operation: 136 M€/year

HEADQUARTERS

CERN
Geneva, Switzerland

WEBSITE

http://home.cern/

DESCRIPTION

The Large Hadron Collider (LHC) at CERN is the highest-energy particle collider in the world. The LHC experiments (ALICE, ATLAS, CMS and LHCb) have produced a large number of beautiful physics results, summarised in more than 2.000 publications in peer-reviewed scientific journals as of today. The highlight is the breakthrough discovery of the Higgs boson by the ATLAS and CMS experiments in 2012. This discovery marked the start of a major programme to measure this particle's properties with the highest possible precision with a view to testing the validity of the Standard Model and searching for new physics at the energy frontier. To extend its discovery potential, the LHC will be upgraded to the High-Luminosity LHC (HL-LHC).

The HL-LHC will be implemented over the coming decade in order to increase the data sample for ATLAS and CMS by an order of magnitude compared to the integral collected by the end of 2023. To benefit fully from the increased data sample in terms of scientific production, the LHC detectors will also need to be upgraded, together with the computing infrastructure required to handle the substantially increased data rates. The full exploitation of the LHC, including the HL-LHC, was identified as the highest priority for European particle physics, in the update of the European Strategy for Particle Physics approved by the CERN Council in May 2013. The HL-LHC project is considered a high-priority component also in the national roadmaps of many countries across the world, including the USA.

ACTIVITY

The accelerator and detector systems for the HL-LHC project will take close to a decade to complete. The accelerator relies on a number of innovative technologies including a combination of cutting-edge superconducting magnets, ultra-precise superconducting radiofrequency cavities for beam rotation, as well as high-power superconducting links with zero energy dissipation. In addition, the higher luminosity sets novel constraints on vacuum, cryogenics and machine protection, and will require new concepts for beam collimation and diagnostics to maximise the physics output of the collisions. The success of experiments at the HL-LHC will rely upon innovative instrumentation such as radiation-hard detectors, high-granularity calorimeters, and large-area silicon trackers, together with state-of-the-art infrastructures and large-scale data-intensive computing.

The first physics goal is to push further the validation of the Standard Model at the energy frontier, in particular by measuring, with the highest possible precision, the properties of the Higgs particle and the longitudinal components of the massive vector bosons, with a view to identifying any deviations from the Standard Model predictions. The second goal is to check whether the Higgs particle is accompanied by other new particles at the TeV energy scale, which could play a role in addressing outstanding questions in particle physics, such as the nature of dark matter and the matter-antimatter asymmetry in the Universe.

IMPACT

The LHC is a unique international infrastructure dedicated to studying the fundamental constituents of matter and their interactions. The high luminosity upgrade of the existing LHC will allow full exploitation of its scientific potential and will map out the scientific programme up to 2035 and possibly beyond. The scientific community at CERN consists of over 13 000 users from around the world, of whom a large majority work on the LHC.

The HL-LHC and its associated facilities will require a constant stream of supplies and services, including civil engineering and the systems and equipment needed to build and operate the accelerator and the experiments. Collaboration with many types of industries and businesses will be required in order to pursue the physics goals of the HL-LHC. Society will benefit greatly from the knowledge and technology that will be developed during the HL-LHC project. Many young physicists and engineers trained during the project will transfer their expertise to society and industry. Whether in the field of accelerators, detectors or computing, the HL-LHC is a major undertaking that will impact many technologies that are of relevance for other Research Infrastructures and for the *Big Data* and computing paradigm.

ILL

Institut Max von Laue - Paul Langevin

THE CONTINUOUS UPGRADE OF THE WORLD'S FLAGSHIP CENTRE FOR NEUTRON SCIENCE

TYPE single-sited

LEGAL STATUS ILL, EIROforum member

POLITICAL SUPPORT
lead entity: ILL
The following countries are members of ILL
member countries: AT, BE, CH, CZ, DE, DK, ES, FR, IT, PL, SE, SK, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2007-2011
Preparation Phase

2012-2019
Implementation/Construction Phase

2020
Operation Start

ESTIMATED COSTS
capital value: 188 M€
design: Not Available
preparation: Not Available
construction: Not Available
operation: 97 M€/year

HEADQUARTERS
Institut Max von Laue - Paul Langevin
Grenoble, France

WEBSITE
www.ill.eu

DESCRIPTION

The Institut Max von Laue - Paul Langevin (ILL) is an international research centre at the leading edge of neutron science and technology, to support researchers in a variety of fields – condensed matter physics, chemistry, biology, nuclear physics and materials science – and make their combined know-how available to the scientific community. ILL operates the most intense reactor source in the world, supplying neutrons to a suite of highperformance instruments that are constantly developed and upgraded. The continuous instrumentation upgrade programmes aim at increasing the signal to noise performance, adapting the instrumentation to the changing research environment and offering new innovative techniques.

Entered in the ESFRI Roadmap 2006, ILL developed programmes to support the overall upgrade of its instrument suit. The successfully implemented upgrade programme Millennium and the ongoing Endurance programme strengthen the world-leading position and provide for the future scientific needs of users in Europe and beyond.

ACTIVITY

ILL offers neutron measurements to the scientific community employing 39 instruments installed on the existing source of neutrons at ILL, 29 operational instruments managed by ILL and 10 instruments handled by external consortia. Each piece of the instrument suite is designed to be state-of-the-art in each particular research field and undergoes major as well as continuous upgrades to fulfil the world-reference role. ILL's staff have expertise and experience in neutron production (reactor physics, reactor design and operation, cold and hot source design and operation), neutron beam delivery (beamtubes, neutron guides including supermirror guides), neutron optics (collimators, monochromators, neutron velocity selectors and choppers), neutron detection and the complete range of neutron instruments for scientific research and sample environment. 1.400 researchers from over 40 countries visit ILL each year, performing over 850 experiments and producing about 600 publications that put ILL at the leading edge of neutron science covering all the relevant scientific domains: soft condensed matter (14%), nuclear and particle physics (5%), biology (9%), chemistry (12%), materials science (20%), physics including magnetism and nanoscience (36%), other (instrumentation, cultural heritage, environment; 4%). ILL's Industrial Liaison Unit provides a single and specialised point of contact for any potential user from industry and services, offering industrial clients a choice of specific modes of access ranging from quick-access proprietary research or a combination with academic access for maximum innovation.

ILL adopts a pioneering data access policy to allow the access and treatment of the data generated at the institute, following FAIR data principles. After initial priority access to the data for the scientist(s) carrying out the experiment, the data is publicly accessible and reusable. ILL also endorsed the principles of the EOSC Declaration of 10 July 2017.

IMPACT

The economic impact of the implantation of the ILL in Grenoble is very important for France and the Auvergne-RhôneAlpes region in terms of direct and indirect jobs and activities. Installations at ILL are used by more than 50 French and European companies for R&D work. The implementation of the instrumentation upgrade programmes of ILL will reinforce the potential performances of the R&D tools and favour the competitiveness of the companies specialized in precision mechanics, vacuum and engineering, neutron guides and neutron choppers. Technologies developed by ILL and companies in partnership are often subsequently used by national and international facilities and laboratories.

THE LARGEST RADIO TELESCOPE ON EARTH TO EXPLORE THE UNIVERSE AND THE ORIGINS OF LIFE

SKA
Square Kilometre Array

TYPE single-sited

LEGAL STATUS

POLITICAL SUPPORT
lead entity: UK
prospective member countries: AU, CA, CN, ES, FR, IN, IT, NL, NZ, SE, ZA
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2012 Design Phase
2012-2017 Preparation Phase
2018-2019 Interim/Transition Phase
2020-2027 Implementation/Construction Phase
2027 Operation Start

ESTIMATED COSTS
capital value: 1.000 M€
design: Not Available
preparation: Not Available
construction: 674 M€
operation: 77 M€/year

HEADQUARTERS
Jodrell Bank
Lower Withington, United Kingdom

WEBSITE
www.skatelescope.org

DESCRIPTION

The Square Kilometre Array (SKA) is a global effort to build the largest radio telescope on Earth, with eventually over one million square metres of collecting area. SKA will be able to look back into the furthest reaches of the cosmos to study the first structures in the Universe, helping to understand some of the most fundamental questions in physics, as well as probing the nature of gravity and cosmic magnetism and exploring the origins of life itself.

The SKA Organisation (SKAO), that became a legal entity in 2011, coordinates the design and the policy making for the SKA. In 2012, the members of the SKAO agreed on a dual site location for the SKA telescope in the deserts of South Africa and Australia, while the site for the Headquarters – established in the UK – was decided in 2015. The Construction Phase will take place from 2020 to 2027 – with early science in 2025 – providing an operational array of telescopes capable of carrying out some of the key science set by the community, before scaling up to the full SKA by 2030s.

ACTIVITY

The first phase of SKA (SKA-1) will use ~200 dishes and ~130.000 low-frequency antennas that will enable astronomers to monitor the sky in unprecedented detail, and to survey the entire sky much faster than any system currently operating. The total collecting area of the full SKA will be well over one square kilometre, or 1.000.000 square metres, obtained with thousands of mid- to high-frequency steerable dishes, each of 15 metres in diameter in South Africa, and around half a million digitally-steerable low-frequency antennas in Australia. The SKA will truly be at the forefront of scientific research with a broad range of exciting science such as observing pulsars and black holes to detect the gravitational waves predicted by Einstein's General Relativity, looking at how the very first stars and galaxies formed after the Big Bang, better than any experiment so far, helping scientists to investigate the nature of the mysterious dark energy, trying to understand the vast magnetic fields which permeate the cosmos, and exploring the origins of life itself.

Moreover, the SKA will challenge information technology developments at the vanguard of the emerging era of Big Data and High Performance Computing. The data analysis software needed will leap a generation in sophistication. The SKA is expected to become the largest public, research data project in the world, producing in its first phase, raw data totalling more than five times the estimated global internet traffic of 2015.

IMPACT

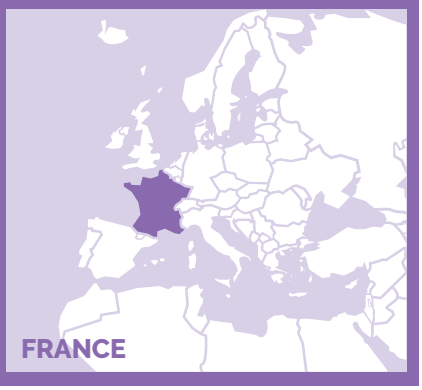
To date, there are ten nations funding the SKA with membership across five continents: Australia, Canada, China, India, Italy, the Netherlands, New Zealand, South Africa, Sweden and the UK, which represent about 40% of the world's population. Over 100 research and industrial organisations are working together to design the initial phase of the SKA with over 600 researchers and engineers involved around the world. Impact is foreseen through the hosting the SKA Headquarters and telescopes, by increasing activity in pre-construction at the telescope sites in South Africa and Australia, and by involving industry for developing technology solutions in meeting the challenges of SKA. The SKA project is also expected to generate substantial innovation in key technology areas such as Information and Communication Technology (ICT) and renewable energy as well as to impact on knowledge transfer and human capital development.

A high profile project like SKA truly excites scientists, and the general and non-specialist public worldwide. In fact, astronomy appeals to our natural curiosity, but it is also a stepping-stone to many other fields of science and technology development, including engineering, aerospace, mathematics and the natural sciences, all of which will have profound impact on our future economy and society.

SPIRAL2

Système de Production d'Ions Radioactifs en Ligne de 2e génération

THE INSTALLATION TO ACCELERATE AND DELIVER VERY HIGH INTENSITY LIGHT AND HEAVY-ION BEAMS OF STABLE AND EXOTIC NUCLEI



TYPE single-sited

LEGAL STATUS GANIL

POLITICAL SUPPORT
lead country: FR
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2005-2010
Preparation Phase

2010-2019
Implementation/Construction Phase

2019
Operation Start

ESTIMATED COSTS
capital value: 281 M€
design: 11 M€
preparation: 3.9 M€
construction: 266 M€
operation: 6 M€/year

HEADQUARTERS
GANIL
Caen, France

WEBSITE
www.ganil-spiral2.eu

DESCRIPTION

The Système de Production d'Ions Radioactifs en Ligne de 2e generation (SPIRAL2) is a new facility to extend significantly the actual possibilities of Radioactive Ion Beam (RIB) physics and related applications. SPIRAL2 will produce the only ion beams of their kind in the world to support research from hadron and isotope therapy to the physics of the atom and its nucleus, from condensed matter to astrophysics. The study of the properties of nuclei forming these beams or their interactions with stable nuclei is a rapidly developing field of contemporary nuclear physics, astrophysics and interdisciplinary research. Novel research in nuclear physics at the limits of stability will be covered at SPIRAL2, including the study of the r and rp-process nuclei, shell closure in the vicinity magic numbers as well as the investigation of very heavy elements. Further research areas will be material sciences, radiobiology, research for hadron and isotope therapy, energy, environment, social sciences, health, engineering, space, ICT as well as Inter and multi-disciplinary research in radiobiology.

SPIRAL2 is part of the GANIL infrastructure, which is the largest research infrastructure in Lower Normandy (Caen, France). Under construction since 2005, it will deliver science from 2019 as a scientific and technologic complement to the existing infrastructure.

ACTIVITY

The SPIRAL2 project is based on a multi-beam driver in order to allow both ISOL and low-energy in-flight techniques to produce RIB. SPIRAL2 comprises a linear accelerator (LINAC) and experimental areas with three halls for experiments with high flux of fast neutrons (Neutron for Science, NFS), with very high intensity beams of heavy-ions (Super Separator Spectrometer, S3) and with low-energy exotic nuclei (DESIR) produced at S3 and with SPIRAL1 facility. The construction of a new injector of the SPIRAL2 Linear Accelerator is planned in order to expand a range of available high-intensity beams up to Uranium. In addition, a Radioactive Ion Beam (RIB) production building is foreseen to produce RIB with an intensity that exceed by factor of 10 to 100 intensities available today worldwide. The superconducting light/heavy-ion LINAC, with an potential of about 40 MV capable of accelerating 5 mA deuterons up to 40 MeV and 1 mA heavy ions up to 14.5 MeV/u, is used to bombard both thick and thin targets. The beams could be used for the production of intense RIB by several reaction mechanisms (fusion, fission, transfer, etc.) and technical methods (ISOL, IGISOL, recoil spectrometers, etc.). The production of high-intensity RIB of neutron-rich nuclei will be based on fission of Uranium target induced by neutrons, obtained from a deuteron beam impinging on a graphite converter (up to 10^14 fissions/s) or by a direct irradiation with a deuteron, 3He or 4He beam. The post acceleration of RIB in the SPIRAL2 project is assured by the existing CIME cyclotron, which is well adapted for separation and acceleration of ions in the energy range from about 3 to 10 MeV/u for masses A~100-150.

IMPACT

The impact of SPIRAL2 in the structuring of the European Research Area is enabling a scientific programme based on unique high-intensity beams of light, heavy-ions and neutrons delivered well suited to address the most challenging nuclear and astrophysics questions aiming at the deeper understanding of the nature of atomic nucleus. SPIRAL2 will contribute to the physics of nuclear fission and fusion based on the collection of unprecedented detailed basic nuclear data, to the production of rare radioisotopes for medicine, to radiobiology and to materials science.

The SPIRAL2 facility is an intermediate step towards EURISOL, the most advanced nuclear physics research facility presently imaginable and based on the ISOL principle. The realisation of SPIRAL2 will substantially increase the know-how of technical solutions to be applied not only for EURISOL but also in a number of other European and world projects.

CESSDA ERIC

Consortium of European Social Science Data Archives

A LARGE SCALE, INTEGRATED AND SUSTAINABLE PLATFORM FOR DATA SERVICES TO THE SOCIAL SCIENCES

TYPE distributed

LEGAL STATUS ERIC, 2017

POLITICAL SUPPORT
lead country: NO
member countries: AT, BE, CZ, DE, DK, EL, FI, FR, HU, NL, PT, SE, SI, SK, UK
***observer:** CH
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2007-2010 Preparation Phase
2011-2012 Implementation/Construction Phase
2013 Operation Start

ESTIMATED COSTS
capital value: 117 M€
design: 4 M€
preparation: 2.7 M€
construction: 78 M€
operation: 39 M€/year

HEADQUARTERS
CESSDA ERIC
Bergen, Norway

WEBSITE
www.cessda.eu

DESCRIPTION

The Consortium of European Social Science Data Archives (CESSDA) is a distributed Research Infrastructures serving as a large scale, integrated and sustainable platform for data services relevant to the social sciences. It supports high-quality, national and international research and cooperation by bringing together social science data archives across Europe, with the aim of facilitating social, economic and political research, and allowing researchers to gain a better understanding of the challenges facing society today, thus contributing to the production of effective solutions.

In the ESFRI Roadmap since 2006, CESSDA has been listed as success story in the Roadmap 2010. CESSDA became a limited company under Norwegian law (CESSDA AS) in 2013 and a European Research Infrastructure Consortium (ERIC) in July 2017. Presently 16 countries are Members of the Consortium and one country is a formal Observer. Additionally, social science data archives from nine other European countries are cooperating, taking part to some activities or aiming at membership.

ACTIVITY

Members of CESSDA nominate a national Service Provider to be responsible for delivering the relevant services. These Service Providers have a primary responsibility to provide data services to their own country, but they are also explicitly funded to provide pan-European activities. The Service Providers are the main resource for CESSDA, and CESSDA is responsible to integrate the work of the Service Providers by establishing a one-stop shop for data location, access, analysis and delivery. Each Service Provider has different overall objectives, but in general they have a responsibility for acquiring data from data creators – government, researchers, commerce, etc. – and preparing those data for long-term access. Service Providers also carry out a curation function, which means that data is always fit for contemporary use, and are available for discovery and re-use. In essence each Service Provider ensures that data are always available for social science research purposes. CESSDA encourages standardisation of data and metadata, data sharing and knowledge mobility across Europe, streamlining the activities of all the Service Providers, and ensuring equality of data use across boundaries. CESSDA plays an active role in the development of standards and, even more importantly, encourages and facilitates the use of metadata standards for documenting and publishing the existing inventories of research data available from national as well as cross-national data resources in Europe.

Put together, the overall ambition is to organise a range of data collections and to coordinate common activities across different national institutions. The institutions will increasingly function as a network in a flexible technical architecture, using standard open protocols and interfaces, designed to contribute to the emerging European and global information commons. The vision for CESSDA is thus to develop a system for data service provision that is open, extensive and evolvable. CESSDA will also attempt to maximises the use of its Service Providers' data holdings while maintaining the rights of subjects and relevant intellectual property rights.

IMPACT

CESSDA has already an impact on the social sciences and related research communities. CESSDA Data Catalogue provides a single interface to thousands of unique datasets from social science data archives across Europe, thus widening access to data, permitting European comparative research and proving an input into numerous scientific publications. CESSDA also has an impact on its area of work by providing effective leadership and acting as a catalyst for change across its area of interest – data curation in its broadest sense – by allowing transfer of knowledge and tools across the consortium and reducing duplication of certain activities.

All CESSDA's objectives have at their heart the end-user of the data holdings of the various Service Providers. Every objective ensures that the rights of the data subjects and the responsibilities of the data owners are managed appropriately. CESSDA supports Open Data but only in cases where the rights of the subjects and the data controllers are respected.

CLARIN ERIC

Common Language Resources and Technology Infrastructure

A UNIQUE SINGLE SIGN-ON ACCESS TO ALL DIGITAL LANGUAGE RESOURCES AND TOOLS FOR HUMANITIES AND SOCIAL SCIENCES

TYPE distributed

LEGAL STATUS ERIC, 2012

POLITICAL SUPPORT
lead country: NL
member countries: AT, BG, CZ, DE, DK, EE, EL, FI, HR, HU, IT, LT, LV, NO, PL, PT, SE, SI, (DLU)
***observers:** FR, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2011
Preparation Phase

2011-2015
Implementation/Construction Phase

2012
Operation Start

ESTIMATED COSTS
capital value: Not Available
design: Not Available
preparation: 4 M€
construction: Not Available
operation: 14 M€/year

HEADQUARTERS
CLARIN ERIC
Utrecht, The Netherlands

WEBSITE
www.clarin.eu

DESCRIPTION

The Common Language Resources and Technology Infrastructure (CLARIN) is a distributed RI that provides easy and sustainable access for scholars in the humanities and social sciences to digital language data – in written, spoken or multimodal form – and advanced tools to discover, explore, exploit, annotate, analyse or combine them, independent of their location. To this end CLARIN is building a networked federation of language data repositories, service centres and centres of expertise, with single sign-on access for all members of the academic community in all participating countries. Tools and data from different centres are interoperable, so that data collections can be combined and tools from different sources can be chained to perform complex operations to support researchers in their work.

CLARIN became a European Research Infrastructure Consortium (ERIC) in February 2012. Since then several countries have joined either as full Member, or as Observer. The ultimate goal is to include all EU and associated countries as well as third countries in or outside Europe.

ACTIVITY

CLARIN distributed Research Infrastructure is made out of several types of centres. The operation, maintenance and continuous expansion of the infrastructure is carried out in the participating countries at the individual CLARIN centres – currently over 40, which have to meet clearly defined technical and organizational criteria, ensuring the coherence of the whole infrastructure. The backbone of CLARIN is provided by technical centres, in particular Service Providing Centres or CLARIN B-Centres, for short. These units, often a university or an academic institute, offer the scientific community access to resources, services and knowledge on a sustainable basis. Therefore, there are strict criteria to become a CLARIN B-Centre: it should be based on a stable technical and institutional foundation. The Assessment Committee checks these requirements during an assessment procedure, while the technical coordination among the centres takes place in the Centre Committee. Currently there are around 20 certified B-centres and several more centre candidates. This list is constantly growing as new members are joining CLARIN ERIC. Other centre types are: C-Centres – Metadata Providing Centres, their metadata are integrated with CLARIN but they need not to offer any further services; K-Centres – Knowledge Centres, part of the CLARIN Knowledge Sharing Infrastructure; T-Centres – Trust Centres, providing access to protected resources via the Service Provider Federation; E-Centres – External Centres offering central services without being part of any national consortium. Institutions in countries which are not part of CLARIN ERIC can become a CLARIN Centre of type C and K.

CLARIN also works closely together with research communities in creating and expanding a knowledge infrastructure that can support developers of language resources and tools, as well as the end-users of the available data and services. In total over 100 institutes across Europe are involved and more will be involved.

IMPACT

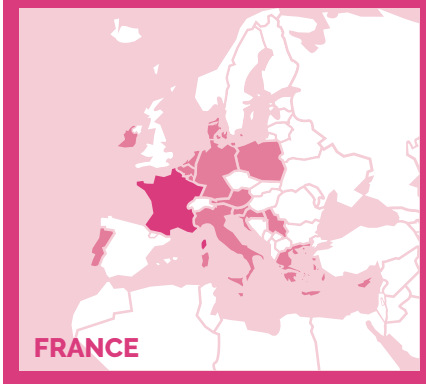
CLARIN stimulates the reuse and repurposing of available research data, thereby enabling scholars in SSH – including digital humanities – to increase their productivity and, more importantly, open new research avenues in and across disciplines that address one or more of the multiple societal roles of language: as a carrier of cultural content and information, both synchronically and diachronically, as a reflection of scientific and societal knowledge, as an instrument for human communication, as one of the central components of the identity of individuals, groups, cultures or nations, as an instrument for human expression, or as an object of study or preservation. Through the access and discovery services,

CLARIN increases the potential impact of data and tools produced with publicly funded projects. Working with CLARIN data and tools will increase the skill levels for data analysis tasks among the new generations of SSH students, which is likely to be welcomed by the data science sector.

DARIAH ERIC

Digital Research Infrastructure for the Arts and Humanities

A NETWORK TO ENHANCE AND SUPPORT DIGITALLY ENABLED RESEARCH AND TEACHING ACROSS THE ARTS AND HUMANITIES



TYPE distributed

LEGAL STATUS ERIC, 2014

POLITICAL SUPPORT
lead country: FR
member countries: AT, BE, CY, DE, DK, EL, HR, IE, IT, LU, MT, NL, PL, PT, RS, SI
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2011 Preparation Phase
2014-2018 Implementation/Construction Phase
2019 Operation Start

ESTIMATED COSTS
capital value: Not Available
design: Not Available
preparation: 3.7 M€
construction: 3.3 M€
operation: 0.7 M€/year

HEADQUARTERS
DARIAH ERIC
Paris, France

WEBSITE
www.dariah.eu

DESCRIPTION

The Digital Research Infrastructure for the Arts and Humanities (DARIAH) enhances and supports digitally-enabled research and teaching across the arts and humanities. DARIAH is a network of people, expertise, information, knowledge, content, methods, tools and technologies from its member countries. It develops, maintains and operates an infrastructure that sustains researchers in building, analysing and interpreting digital resources. By working with communities of practice, DARIAH brings together individual state-of-the-art digital arts and humanities activities and scales their results to a European level. It preserves, provides access to and disseminates research that stems from these collaborations and ensures that best practices, methodological and technical standards are followed.

DARIAH was established as a European Research Infrastructure Consortium (ERIC) in August 2014. Currently, DARIAH has 17 Members and many cooperating partners across eleven non-member countries.

ACTIVITY

DARIAH integrates digital arts and humanities research and activities from across Europe, enabling transnational and transdisciplinary approaches. In particular, it provides value to its members and stakeholders through the validation and sharing of data, services and tools; by providing training and education opportunities; by enabling 'bottom-up' organisation around emerging research needs; and through the exercise of foresight and policy engagement. Through these activities, DARIAH promotes the further development of research methods in the arts and humanities, documenting the state-of-the-art, supporting the preservation and curation of research data with a focus on particular challenges including diversity, provenance, multimedia collections and granularity, and acting as a coordinator and integrator for a diverse community of practice.

Structurally, DARIAH operates through the Europe-wide networks of the Virtual Competency Centres (VCCs) and their constituent working groups. Each of the four VCCs is cross-disciplinary, multi-institutional, international and centred on a specific area of expertise. VCC1, the e-Infrastructure, is responsible for DARIAH's technological foundations. It maintains a digital environment that allows community-developed data and tools to be shared and ensures the quality, permanence and growth of technical services for the arts and humanities. VCC2 is the Research and Education Liaison and acts as the primary interface with the research and teaching communities. VCC3 deals with Scholarly Content Management in the various stages from creation, curation, and dissemination, through to the pooling of scholarly digital resources and results for reuse. VCC4 focusses on Advocacy, Impact and Outreach, interfacing with key influencers in and for the arts and humanities. Within this structure, DARIAH has over 20 dynamic working groups to integrate national services under specific operational categories.

IMPACT

DARIAH has impact on four interconnected domains: research, education, culture and economy. The consortium supports the sustainable development of digitally-enabled research in the arts and humanities by building services for researchers working with ICT-based methods. It helps them to further advance their research and ensures the long-term accessibility of their work, thus directly contributing to the understanding of the cultural, economical, social and political life in Europe and beyond. In addition, it offers teaching material as well as teaching opportunities to develop digital research skills.

DARIAH is at the forefront of a changing knowledge discovery market and possesses significant strength in this field through its partners. DARIAH also demonstrates how traditional humanities research skills play a prominent role in the digital age, and how such skills can be deployed in a commercial setting.

ESS ERIC

European Social Survey

A CROSS-NATIONAL SURVEY TO ASSEMBLE, INTERPRET AND DISSEMINATE DATA ON SOCIAL ATTITUDES AND BEHAVIOURS

TYPE distributed

LEGAL STATUS ERIC, 2013

POLITICAL SUPPORT
lead country: UK
member countries: AT, BE, CY, CZ, DE, EE, FI, FR, HU, IE, IT, LT, LV, NL, NO, PL, PT, SE, SI
***observer:** CH
prospective member countries: IS, RS, SK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

- 1996-1999 Design Phase
- 1999-2001 Preparation Phase
- 2002-2012 Interim/Transition Phase
- 2010-2012 Implementation/Construction Phase
- 2013 Operation Start

ESTIMATED COSTS
capital value: Not Available
design: Not Available
preparation: 6.4 M€
construction: 2.3 M€
operation: 2.5 M€/year

HEADQUARTERS
ESS ERIC
City, University of London
London, United Kingdom

WEBSITE
www.europeansocialsurvey.org

DESCRIPTION

The European Social Survey (ESS) is an academically driven cross-national survey that has been conducted across Europe since its establishment in 2001. Every two years, face-to-face interviews are conducted with newly selected, cross-sectional samples. The ESS RI assembles, interprets and disseminates data on social attitudes and behaviours that are gathered in each of the participating countries. It responds to the academic, public policy and societal needs to understand social stability and change within the European context. The topics of the ESS include: citizen involvement and democracy, family and working life, personal and social wellbeing, attitudes to and experiences of ageism as well as trust in institutions. The survey allows for new topics to be introduced over time via an open academically-led competition.

The ESS was established as European Research Infrastructure Consortium (ERIC) in November 2013. Currently, 21 countries are Members, there is 1 Observer country and 2 Guest countries.

ACTIVITY

The European Social Survey ERIC organises data that are gathered in each of the participating countries in accordance with specifications issued by the Director of the ESS ERIC. The main aims of the ESS include: i) to chart stability and change in social structure, conditions and attitudes in Europe and to interpret how Europe's social, political and moral fabric is changing; ii) to achieve and spread higher standards of rigour in cross-national research in the social sciences, including for example, questionnaire design and pre-testing, sampling, data collection, reduction of bias and the reliability of questions; iii) to introduce soundly-based indicators of national progress, based on citizens' perceptions and judgements of key aspects of their societies; iv) to undertake and facilitate the training of European social researchers in comparative quantitative measurement and analysis; v) to improve the visibility and outreach of data on social change among academics, policy makers and the wider public.

In 2011, ESS launched a new series of ESS Topline Results, which are concise cross-national summaries of particular topics covered in the questionnaire. Topline publications are written by the groups of academics whose rotating module was selected for the ESS. Issue 1 in the series focuses on justice findings using data from Round 5 of the survey. Issue 2 focuses on welfare attitudes in Europe using data from Round 4 of the survey. Issue 3 focuses on the economic crisis, quality of work and social integration using data from Rounds 2 and 5 of the ESS, gathered either side of the economic downturn. Issue 4 focuses on Europeans' understandings and evaluations of democracy using data from Round 6 of the ESS and issue 5 looked at personal and social wellbeing based on Round 6 data. Issue 6 was published using Round 7 data gathered from the rotating module on health inequalities. Issue 7 uses ESS data on immigration from Rounds 1 and 7.

New rounds launched more recently still need to be analysed. In Round 8 ESS investigated attitudes to *Grand Challenges* such as climate change and energy security and the future of the welfare state. Forthcoming topics in Round 9 include justice and fairness and the timing of life.

IMPACT

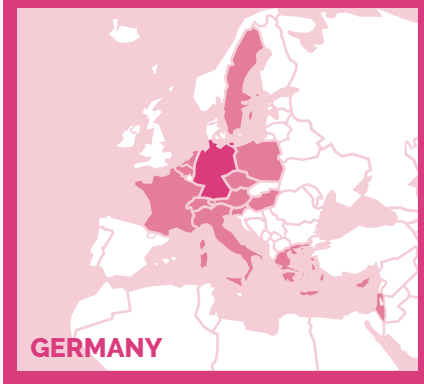
ESS is designed for use primarily by the academic community. However, the data itself and publications using the data which are produced by academics are also used to provide direct and contextual evidence across a range of non-academic bodies, both governmental and agencies. ESS has helped inform the work of other surveys in Europe in terms of methodology and questionnaire content including the European Quality of Life Survey, the European Values Survey and the International Social Survey Programme. ESS data and methodology are used in academic teaching in many countries.

In addition, the ESS has a programme of knowledge transfer directly with policy makers and has held seminars at the European Parliament, Italian parliament and OECD, European Commission amongst other locations. As part of ESS SUSTAIN (H2020 GA 676166) Technopolis was commissioned to carry out a wide-ranging impact study of ESS; the report (September 2017) is available via the ESS website (www.europeansocialsurvey.org).

SHARE ERIC

Survey of Health, Ageing and Retirement in Europe

MULTIDISCIPLINARY AND CROSS-NATIONAL PANEL DATABASE OF MICRODATA OF INDIVIDUALS AGED 50 OR OLDER



TYPE distributed

LEGAL STATUS ERIC, 2011

POLITICAL SUPPORT
lead country: DE
member countries: AT, BE, CY, CZ, EL, FR, HU, IL, IT, NL, PL, SE, SI
***observer:** CH
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2007-2010 Preparation Phase
2010-2012 Implementation/Construction Phase
2011 Operation Start

ESTIMATED COSTS
capital value: 250 M€
design: Not Available
preparation: Not Available
construction: Not Available
operation: 18 M€/year

HEADQUARTERS
SHARE ERIC
Munich, Germany

WEBSITE
www.share-project.org

DESCRIPTION

The Survey of Health, Ageing and Retirement in Europe (SHARE) is a multidisciplinary database of microdata on health, socio-economic status, social and family networks of more than 120.000 individuals from 27 European countries plus Israel, aged 50 or older. SHARE aims at documenting and better understanding the repercussions of demographic ageing for individuals and the European society as a whole, and forming a sound scientific basis for countermeasures adopted by health and social policy. SHARE's scientific method is based on a panel design that grasps the dynamic character of the population ageing process in all relevant aspects. Rigorous procedural guidelines and program ensure an ex-ante harmonized cross-national design. The data are harmonised with the US Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA) and are accessible free of charge to the scientific community.

SHARE was identified as successfully implemented in the ESFRI Roadmap 2010 and was the first RI to be established as European Research Infrastructure Consortium (ERIC) in March 2011.

ACTIVITY

To date, SHARE has collected six panel Waves – 2004, 2006, 2010, 2013, 2015, 2017 – of current living circumstances and one wave of retrospective life histories – 2008, SHARELIFE; the main data collection of Wave 7 took place in 2017 and the release of Wave 7 data is scheduled for spring 2019. With the public release of updated data on panel Waves in March 2018, the data available to the scientific community are based on more than 297.000 interviews administered on about 120.000 respondents and collected in 28 countries. A comprehensive overview of the up-to-date data sets of the different SHARE waves as well as additional data sets are available via the SHARE Research Data Center.

SHARE is also engaged in several additional data dissemination activities: easySHARE, a simplified dataset for training and teaching purposes, and the Job Episodes Panel, a refined panel dataset spanning the entire working life of SHARELIFE respondents, were both released already in 2013 and updated recently. In 2017, SHARE released an update of the Job Episodes Panel, now including information on migration histories, fertility histories and relationship histories, as well as contextual variables on pension institutions.

SHARE has stimulated the publication of about 950 journal articles since the first data release in 2005, or more than 70 per year on average. Trends in publication number are showing that the scientific output is increasing over time. By Q1 2018, SHARE has more than 8.000 officially registered data users. Most of the users are from European countries, but there is also an increase in scientific operators from the US and other countries worldwide which may partly be due to the comparability of SHARE data with other international ageing surveys, such as HRS in the US, ELSA in the UK, and others. Most users of SHARE reside in Germany; Netherlands is second, before the UK and the US.

IMPACT

Many of the SHARE findings have strong policy implications with large economic and societal impacts. SHARE with its broad data on the economic, social and health situation of European citizens enables Member States to base difficult economic and social decisions on evidence rather than beliefs. The SHARE data permit an accurate account of who gains and who loses economically from a policy change because the data capture the life circumstances of Europe's citizens which vary so much not only within, but also between Member States.

SHARE has developed innovative software for electronic survey operations, including designing questionnaires, translating them, administering them to respondents, monitoring fieldwork, and creating the databases. In addition, SHARE has innovated the health measurement in large population surveys by introducing physical performance measures – grip strength, chair stand, peak flow – and dried blood spot sampling (DBSS) using devices and materials from small/medium-size companies.

PRACE

Partnership for Advanced Computing in Europe

The top level of the European High Performance Computing ecosystem

TYPE distributed

LEGAL STATUS AISBL, 2010

POLITICAL SUPPORT

The following countries are members of PRACE

lead countries: FR, DE, IT, ES, CH

member countries: AT, BE, BG, CY, CZ, DK, EL, FI, HU, IE, IL, LU, NL, NO, PL, PT, SE, SI, SK, TR, UK

The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2006

TIMELINE

2008-2010
Preparation Phase

2010
Operation Start

2011-2020
Implementation/Construction Phase

ESTIMATED COSTS

capital value: 500 M€
design: Not Available
preparation: 20 M€
construction: Not Available
operation: 60 M€/year

HEADQUARTERS

PRACE AISBL
Brussels, Belgium

WEBSITE

www.prace-ri.eu

DESCRIPTION

The Partnership for Advanced Computing in Europe (PRACE) is a pan-European supercomputing Research Infrastructure providing access to world-class computing and data resources and services through a peer-review process, for large-scale high-impact scientific and engineering applications at the highest performance level across all disciplines. PRACE also seeks to strengthen the European users of High Performance Computing (HPC) in industry through various initiatives. PRACE has a strong interest in improving energy efficiency of computing systems and reducing their environmental impact.

PRACE is established as an International not-for-profit Association under Belgian Law (AISBL) with seat in Brussels. It has 26 Member countries whose representative organisations create a pan-European supercomputing infrastructure. A total of 7 supercomputers and their operations accessible through PRACE are provided by 5 hosting members: France, Germany, Italy, Spain and Switzerland.

ACTIVITY

The computer systems and their operations accessible through PRACE are provided by 5 PRACE members (BSC representing Spain, CINECA representing Italy, ETH Zurich/CSCS representing Switzerland, GCS representing Germany and GENCI representing France). Four Hosting Members (FR, DE, IT, ES) secured funding for the initial period 2010-2015. In 2016, a 5th Hosting Member – ETH Zurich/CSCS (CH) – opened its system via the PRACE Peer Review Process. In pace with the needs of the scientific communities and technical developments, systems deployed by PRACE are continuously updated and upgraded to be at the apex of HPC technology.

Currently, the fifth PRACE Implementation Phase is coordinated by Forschungzentrum Jülich (DE). The objectives of PRACE-5IP are to build on and seamlessly continue the successes of PRACE and start new innovative and collaborative activities proposed by the consortium. These include: assisting the transition to PRACE 2 including an analysis of Trans National Access; strengthening the internationally recognised PRACE brand; continuing and extend advanced training which so far provided more than 18.800 person-training days; preparing strategies and best practices towards Exascale computing; coordinating and enhancing the operation of the multi-tier HPC systems and services; and supporting users to exploit massively parallel systems and novel architectures. A high level Service Catalogue is provided. The activities are designed to increase Europe's research and innovation potential especially through: seamless and efficient Tier-0 services and a pan-European HPC ecosystem including national capabilities; promoting take-up by industry and new communities and special offers to SMEs; implementing a new flexible business model for PRACE 2; proposing strategies for deployment of leadership systems; collaborating with the ETP4HPC, CoEs and other European and international organisations on future architectures, training, application support and policies.

IMPACT

European scientists and engineers need to exploit more broadly high-end HPC and connection with many ESFRI RIs is to be strengthened to maximize the impact on the ERA and on broad applications in industry and services. PRACE actively interfaces with XSEDE – the Extreme Science and Engineering Discovery Environment (USA), RIKEN (Japan) and Compute Canada, and also with GÉANT – the pan-European data network for the research and education community, EGI – the European Grid Infrastructure, EUDAT– the European data infrastructure and HBP – the Human Brain Project.