RESEARCH INFRASTRUCTURES IN THE EUROPEAN RESEARCH AREA

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LIST OF ACRONYMS

AC - Associated Country

AnaEE - Infrastructure for Analysis and Experimentation on Ecosystems

BBMRI - Biobanking and BioMolecular Resources Research Infrastructure

CERIC - Central European Research Infrastructure Consortium

CESSDA - Consortium of European Social Science Data Archives

CLARIN - Common Language Resources and Technology Infrastructure

CTA - Cherenkov Telescope Array

DARIAH - Digital Research Infrastructure for the Arts and Humanities

EATRIS - European Infrastructure for Translational Medicine

ECCSEL - European Carbon Dioxide Capture and Storage Laboratory

ECRIN - European Clinical Research Infrastructure Network

EISCAT_3D - Next generation European Incoherent Scatter radar system upgrade

ELI - Extreme Light Infrastructure

ELIXIR - Distributed infrastructure for life-information

ELT - Extremely Large Telescope

EMBRC - European Marine Biological Resource Centre

EMFL - European Magnetic Field Laboratory

EMSO - European Multidisciplinary Seafloor and Water-Column Observatory

EPOS - European Plate Observing System

ERIC - European Research Infrastructure Consortium

ESFRI - European Strategy Forum on Research Infrastructures

ESRF-EBS - Extremely Brilliant Source

ESS - European Social Survey

ESS - European Spallation Source

EuBI - European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences

European XFEL - European X-Ray Free-Electron Laser

EU-SOLARIS - European SOLAR Research Infrastructure for Concentrated Solar Power

FAIR - Facility for Antiproton and Ion Research

IAGOS - In-service Aircraft for a Global Observing System

ICOS - Integrated Carbon Observation System

IFMIF-DONES - International Fusion Materials Irradiation Facility - Demo Oriented Neutron Source

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

IPR - Intellectual Property Rights

ISBE - Infrastructure for Systems Biology Europe

JHR - Jules Horowitz research Reactor

JIVE - Joint Institute for Very Long Baseline Interferometry

KM3NeT 2.0 - KM3 Neutrino Telescope 2.0

MS – Member State

MIRRI - Microbial Resource Research Infrastructure

MYRRHA - Multi-purpose hybrid research reactor for high-tech applications

PRACE - Partnership for Advanced Computing in Europe

RI - Research Infrastructure

SHARE - Survey of Health, Ageing and Retirement In Europe

SKA - Square Kilometre Array

SPIRAL2 - Systeme de Production d'lons Radioactifs en Ligne de 2e generation

WindScanner - European WindScanner Facility

Part 1. THEORETICAL DEFINITIONS

WHAT IS A RESEARCH INFRASTRUCTURE?

The following definition for Research Infrastructure from Article 2 (6) of the Regulation (EU) No 1291/2013 of 11th December 2013 on Establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) applies:

"RI are facilities, resources and services that are used by the research communities to conduct research and foster innovation in their fields. They include: major scientific equipment (or sets of instruments), knowledge-based resources such as collections, archives and scientific data, e-Infrastructures, such as data and computing systems and communication networks and any other tools that are essential to achieve excellence in research and innovation".

RI are implemented along different organizational models, including central sources and laboratories for experiments and measurement sessions, coordination and management of geographically distributed observatories or laboratories, remotely accessible resources for computing, data banks, physical sample repositories, surveys and longitudinal studies. While the above definition captures the common features of RI, there are two main types of RI, as defined below.

TYPES OF RESEARCH INFRASTRUCTURES

1) SINGLE-SITED RI

Single-sited RIs are central facilities geographically localized in a single site or in a few dedicated complementary sites designed for user access, whose governance is European or international.

A single-sited RI needs to:

- have a legal status and a governance structure with clear responsibilities and reporting lines, including international supervisory and relevant external advisory bodies;
- have an access policy and access point for external users facilitating the submission of proposals and a user programme absorbing a considerable fraction of the total capacity of the RI;
- have a user support structure to optimize access to the relevant site, such as users' office, ancillary laboratories, accommodation arrangements and logistics;
- have a data management system providing metadata and data storage, retrieval tools and on-line/in situ/remote data reduction and analysis;
- identify relevant and measurable Key Performance Indicators addressing both excellence of scientific services and sustainability;
- enforce a human resources policy guaranteeing the necessary competences for its operation, users support, education and training by equal opportunity hiring and secondments.

2) DISTRIBUTED RI

A distributed RI consists of a Central Hub and interlinked National Nodes. A distributed RI particularly needs to:

- have a unique specific name, legal status and a governance structure with clear responsibilities and reporting lines, including international supervisory and relevant external advisory bodies;
- have legally binding attributions of coordination competences and resources to the Central Hub;
- have a unique access policy and provide for a single point of access for all users with a support structure dedicated to optimise the access for the proposed research;

- have a user programme absorbing a relevant fraction of the total capacity of the RI;
- identify and adopt measurable Key Performance Indicators addressing both excellence of scientific services and sustainability;
- have a human resources policy adequate to guarantee the effective operation of the Central Hub supporting the research, users programme, education and training by equal opportunity hiring and secondments;
- define a joint investment strategy aimed at strengthening the RI through the Nodes and the common/shared facilities.

These features characterize a distributed RI and thus mark the difference with respect to coordinated research networks (international collaborations of fully independent research performing organizations). The Nodes may be only partially absorbed by the distributed RI maintaining their national or institutional programmes, but the capacity and amount of resources devoted to the RI must be clearly identified, coordinated and managed by the Central Hub according to agreed statutes and common rules and procedures of the RI Consortium.

Importantly, distributed RI must demonstrate a capability to attribute optimal personnel capacity and coordinating power to the Central Hub, therefore displaying:

1. a high level of integration of the National Nodes (such as a unique portal with thorough explanation and guidance towards the common access policy, harmonized and coherent IPR & data policies; adequate central resources; procurement and upgrading of technological infrastructure; human resources policy allowing for staff exchange and secondment);

2. added value compared with the merits of a research cooperation network open to external use. The Central Hub therefore must represent a truly international organisation capable of operating with a high level of efficiency and mediating across different scientific cultures.

INITIATIVES, STRATEGIES AND NETWORKS

European Strategy Forum on Research Infrastructures (ESFRI)

ESFRI is a strategic body established in 2002 by the Council of the European Union to support a coherent and strategy-led approach to policy making on Research Infrastructures in Europe. Since then ESFRI has completed the ESFRI Roadmap 2006, 2008, 2010, 2016, 2018 while the further one is foreseen for 2021. The Roadmap contains probably the best European science facilities based on a thorough evaluation and selection procedure. The Roadmap combines ESFRI Projects, which are new Research Infrastructures in progress towards implementation, and ESFRI Landmarks, successfully implemented Research Infrastructures.

ESFRI Research Infrastructures are facilities, resources or services of a unique nature, identified by European research communities to conduct and 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.

ESFRI PROJECTS

Projects are Rl in their Preparation Phase, which have been selected for the excellence of their SCIENTIFIC CASE and implementation CASE, according to a sound expectation that the Project will reach the Implementation Phase within the ten-year term. They are included in the Roadmap in order to underline their strategic importance to the ERA and to support their timely implementation. The Projects can be at different stages of their development towards implementation, according to their respective date of inclusion in the Roadmap.

ESFRI differentiates between the following categories:

Lead country/entity: MS, AC or EIROforum Member, which leads the Preparatory Phase of the RI.

- 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 or other entity - such as EIROforum Member - which is Observer of the 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 has submitted Expressions of political Support 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.
- Participants: Research institutions and other entities which are partners in the RI Consortium.

ESFRI Landmarks are Research Infrastructures 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.

What is ERIC?

The European Research Infrastructure Consortium (ERIC) is a specific legal form that facilitates the establishment and operation of Research Infrastructures with European interest.

The ERIC allows the establishment and operation of new or existing Research Infrastructures on a non-economic basis. The Commission provides practical guidelines to help potential applicants. The ERIC becomes a legal entity from the date the Commission decision setting up the ERIC takes effect. An ERIC can carry out some limited economic activities related to this task.

Advantages of an ERIC:

- a legal capacity recognized in all EU countries
- flexibility to adapt to specific requirements of each infrastructure
- a faster process than creating an international organisation
- exemptions from VAT and excise duty

An ERIC may adopt its own procurement procedures which have to respect the principles of transparency, non-discrimination and competition.

Requirements for an ERIC

- it must be a European joint-venture (also allows the participation of countries from outside Europe)
- the infrastructure is necessary to carry out research programmes and projects
- it represents added-value in the development of the European Research Area (ERA) and significant improvement in the relevant scientific and technological fields
- effective access is granted to the European research community in accordance with the rules established in the statutes
- it contributes to the mobility of knowledge and/or researchers within the ERA
- it contributes to the dissemination and optimisation of the results.

PART 2. European Research Infrastructure Consortium Landscape

Members of the European Research Infrastructure Consortium (ERIC)

1. BIOBANKING AND BIOMOLECULAR RESOURCES RESEARCH INFRASTRUCTURE

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.

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.

IMPACT

BBMRI-ERIC provides a workable research infrastructure to process, share and store human biological samples, including associated medical data. It brings together all the main players from the biobanking field – researchers, biobankers, industry, and patients – to boost biomedical research. BBMRI ERIC provides 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.

Type	distributed
Participants	**Members** 1. Austria (lead country) 2. Belgium 3. Bulgaria 4. Czech Republic 5. Estonia 6. Finland 7. Germany 8. Greece 9. Italy 10. Latvia 11. Malta 12. Netherlands 13. Norway 14. Poland 15. Sweden **Observers** 1. Cyprus 2. Switzerland 3. Turkey 4. IARC/WHO INTERNATIONAL AGENCY FOR RESEARCH ON CANCER
Legal status	ERIC, 2013
Contacts	Neue Stiftingtalstrasse 2/B/6 8010 Graz, Austria Phone: +43 66488721890 Fax: +43 316 34 99 17-99 Mail: contact@bbmri-eric.eu
Web	https://www.bbmri-eric.eu

2. CENTRAL EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

DESCRIPTION

CERIC is a European Research Infrastructure Consortium (ERIC) providing open access through a single entry point to more than 50 different and complementary state of the art techniques and support laboratories, distributed in 8 countries (Partner Facilities), with the submission of single or multi-technique proposals in the fields of energy, health, food, cultural heritage and more.

ACTIVITY

CERIC-ERIC aims at furthering the integration of national multidisciplinary analytical, synthesis and sample preparation capabilities of Partner Facilities operating mainly in the Central European Area, into a unique, EU-level distributed Research Infrastructure, open to researchers at world level. CERIC's main goal is to

contribute to the creation of excellent science, both as in-house activity and as a service to international users. This is achieved mainly by providing open access to its research facilities through two calls for proposals per year, addressing researchers requiring the use of one or more complementary techniques for structural investigation, analysis, synthesis and imaging of materials and biomaterials down to the nano-scale. Between 2014 and 2019, 1009 proposals were received from research groups coming from 49 countries worldwide. 567 proposals were selected for open access to the CERIC facilities, and the number of publications has significantly increased over the years.

CERIC also promotes and supports training actions for students and researchers. Examples include the yearly participation in the Hercules School on the use of Neutron and Synchrotron radiation, and the coordination of projects aiming at training perspective users on the possible uses of the instruments available in CERIC.

IMPACT

CERIC-ERIC contributes to European research and innovation, representing an added value for the development of the European Research Area (ERA) and to its innovation potential. It stimulates beneficial impact on the scientific, industrial and economic advancement by improving the quality and capability in education, technology and in the attraction of other socioeconomic returns.

CERIC collaborates with industry, contributing to science-driven innovation. It offers services for commercial users on market-based conditions, which include:

- Research and Development (R&D)
- Training
- Innovations' marketplace
- Spin-off and start-up support
- Learn more about the joint projects between CERIC and industrial partners.

CERIC-ERIC may carry out limited economic activities, provided that they are closely related to its principal task and that they do not jeopardise the achievement thereof.

Type	
Participants	1. Austria 2. Croatia 3. Czech republic 4. Hungary 5. Italy 6. Poland 7. Romania 8. Slovenia
Legal status	
Contacts	S.S. 14 - km 163,5 in AREA Science Park 34149 Basovizza Trieste - Italy T +39 040 375 8953 E info@ceric-eric.eu
Web	www.ceric-eric.eu

3. CONSORTIUM OF EUROPEAN SOCIAL SCIENCE DATA ARCHIVES

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.

ACTIVITY

Members of CESSDA nominate a national Service Provider (SP) to be responsible for delivering the relevant services. Those SPs provide data services to their own country, but they are also explicitly funded to provide pan-European activities. CESSDA integrates the work of the SPs by establishing a one-stop shop for data location, access, analysis and delivery. Each SP 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. SPs also carry out a curation function, which means that data is always fit for contemporary use, and are available for discovery and re-use. Thus, each SP ensures that data are always available for social science research purposes.

The overall aim 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.

IMPACT

CESSDA provides access to numerous data collections, enabling European comparative research and contributing to thousands of theses and scientific publications. It enables researchers within the same fields, from different scientific disciplines and from different countries to work together, develop leading-edge research methods and efficiently analyse large and complex datasets. 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.

Type	Distributed
Participants	**Members**

	1. Austria 2. Belgium 3. Croatia 4. Czech Republic 5. Denmark 6. Finland 7. France 8. Germany 9. Greece 10. Hungary 11. Netherlands 12. North Macedonia 13. Norway (lead country) 14. Portugal 15. Serbia 16. Slovakia 17. Slovenia 18. Sweden 19. Switzerland 20. United Kingdom **Partners** Albania Bosnia and Herzegovina Bulgaria Estonia Iceland Ireland Italy Kosovo Latvia Lithuania Luxembourg Montenegro Poland Romania Russia Ukraine
Legal status	**ERIC, 2017**
Contacts	Parkveien 20, Bergen, Norway Phone: (+47) 401 00 964 E-mail: cessda@cessda.eu
Web	https://www.cessda.eu/

4. COMMON LANGUAGE RESOURCES AND TECHNOLOGY INFRASTRUCTURE

DESCRIPTION

CLARIN, the Common Language Resources and Technology Infrastructure, provides a virtual language observatory that enables scientists to get access to existing and emerging digital language data collections (in written, spoken or multimodal form) as well as to

advanced tools to discover, explore, exploit, annotate, analyse or combine them, ready to operate on standardized data. All this is available on the internet using a service-oriented architecture based on secure grid technologies. To this end CLARIN is building a network 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.

ACTIVITY

CLARIN's distributed network is made out of centres. There are several types of centres. 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 over 20 certified B-centres and several more centre candidates. This list is constantly growing, as new members are joining CLARIN ERIC. Information on all centres and their services can be found in the Centre Registry.

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.

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.

Type	**distibuted**
Participants	**Members** 1. Austria 2. Bulgaria 3. Croatia 4. Cyprus 5. Czech Republic Denmark 6. Estonia 7. Finland 8. Germany

	9. Greece 10. Hungary 11. Iceland 12. Italy 13. Latvia 14. Lithuania 15. Netherlands (lead country) 16. Norway 17. Poland 18. Portugal 19. Slovenia 20. Sweden **Observer** 1. France 2. South Africa 3. United Kingdom **Third party** Carnegie Mellon University (USA)
Legal status	ERIC, 2012
Contacts	CLARIN ERIC c/o Utrecht University Drift 10 3512 BS Utrecht The Netherlands Phone: +31 30 253 6378 Email: clarin@clarin.eu
Web	https://www.clarin.eu

5. DIGITAL RESEARCH INFRASTRUCTURE FOR THE ARTS AND HUMANITIES

DESCRIPTION

The Digital Research Infrastructure for the Arts and Humanities (DARIAH) aims to enhance and support 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 in support of ICT-based research practices and helps researchers build, analyse and interpret digital resources. DARIAH brings together individual state-of-the-art digital arts and humanities activities and scales their results up to a European level. It supports researchers in all phases of their work: in the acquisition of information needed for a research question, in the analysis of the data gathered and in the publication of the results.

ACTIVITY

DARIAH integrates digital arts and humanities research and activities from across Europe, enabling transnational and transdisciplinary approaches. 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 Virtual Competency Centres (VCCs). Each VCC is coordinated by one or two leading European institutions. VCC 1 e-Infrastructure focuses on technology development, VCC 2 Research and Education Liaison provides an interface between DARIAH and the researchers, VCC 3 Scholarly Content Management will produce guidance and reference material to share data and publications with a wide audience, and VCC 4 Advocacy, Impact and Outreach aims at measuring the added value of DARIAH for the research community and seeks to build beneficial relationships with wide groups of stakeholders. 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.

Type	**distributed**
Participants	**Members** 1. Austria 2. Belgium 3. Bulgaria 4. Croatia 5. Cyprus 6. Czech Republic 7. Denmark 8. France (lead country) 9. Germany 10. Greece 11. Ireland 12. Italy 13. Luxembourg 14. Malta 15. The Netherlands 16. Poland 17. Portugal 18. Serbia 19. Slovenia

	Cooperating Partners 1. Finland 2. Hungary 3. Norway 4. Romania 5. Sweden 6. Switzerland 7. Slovakia 8. United Kingdom.
Legal status	ERIC, 2014
Contacts	DARIAH-EU c/o TGIR Huma-Num CNRS UMS 3598 54 bd Raspail 75006 Paris info@dariah.eu
Web	https://www.dariah.eu

6. EUROPEAN SPALLATION SOURCE

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. 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.

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. In the long term, expansion of the suite up to 22 instruments is anticipated. The user programme for the earliest instruments set to open in 2023.

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. The latter 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 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.

Type	single-sited
Participants	**Members** 1. Czech Republic 2. Denmark (lead country) 3. Estonia 4. France 5. Germany 6. Hungary 7. Italy 8. Norway 9. Poland 10. Spain 11. Sweden (lead country) 12. Switzerland 13. United Kingdom **Observers** Belgium Netherlands
Legal status	**ERIC, 2015**
Contacts	**Postal Address:** European Spallation Source ERIC Box 176 SE-221 00 Lund Sweden **Visiting Addresses:** The European Spallation Source Odarslövsvägen 113 224 84 Lund Sweden ESS Switchboard: +46 (0) 46 888 30 00
Web	https://europeanspallationsource.se

7. EUROPEAN INFRASTRUCTURE FOR TRANSLATIONAL MEDICINE

DESCRIPTION

Translational medicine combines biological insight, sophisticated analytical techniques and clinical expertise to develop novel interventions. This requires involvement of scientists, both from the academic and the industrial world. Accelerating and optimizing the translational process is the aim of EATRIS, 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.

ACTIVITY

Translational research is a highly multi-disciplinary and complex undertaking. 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. Via its central hub, EATRIS offers access to a vast array of clinical expertise and high-end facilities that are available within the 80+ top-tier academic centres across Europe. 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 preclinical development to clinical trials.

IMPACT

EATRIS is a meeting ground for 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. Improving the output of scientific discoveries into innovative and high impact medicines, diagnostics and medical devices will have a considerable socioeconomic impact in Europe and globally. The wide range of interest of EATRIS, that extends also to rare and neglected diseases and includes personalised medicine, is expected to improve the drug discovery process leading to the development of innovative solutions, also aimed at patient groups. 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.

Type	distributed
Participants	**Members** 1. Bulgaria 2. Czech Republic

	3. Finland 4. France 5. Italy 6. Luxembourg 7. Netherlands 8. Norway 9. Portugal 10. Slovenia 11. Spain 12. Sweden **Observers** Latvia
Legal status	ERIC, 2013
Contacts	EATRIS ERIC De Boelelaan 1118 1081 HZ Amsterdam The Netherlands Phone: +31 20 444 2254 Email: info@eatris.eu
Web	https://eatris.eu

8. EUROPEAN CARBON DIOXIDE CAPTURE AND STORAGE LABORATORY

European Carbon Dioxide Capture and Storage Laboratories
European Research Infrastructure Consortium (ERIC)

DESCRIPTION

The European Carbon Dioxide Capture and Storage Laboratory Infrastructure (ECCSEL) aims to open up access to a European Research Infrastructure with high-quality research facilities dedicated to next-generation Carbon Dioxide Capture and Storage (CCS) technologies in an effective and organized manner to allow industry and power generation low to zero CO2 emissions to tackle global climate change. ECCSEL opens access to researchers from universities, research institutes, industry and SMEs from Europe and beyond. Within the 5 member countries, 21 service providers offer open access to more than 79 world class research facilities across Europe; coordinated by ECCSEL and accessible through the ECCSEL website. The research facilities comprise universities, research institutes and industry in the five ECCSEL member countries. ECCSEL ERIC provides researchers across the globe easy access to all those facilities through its website and coordinates facility upgrades and new builds.

ACTIVITY

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, thermogravimetric measurements under high pressure, and studies of microbiological and geochemical processes. ECCSEL provides the infrastructure for research into CCS which must ensure up to 17% of the global annual CO2 emission cuts, and 14% of the accumulated cuts from now on. ECCSEL will provide a dedicated and coordinated research environment, pushing the

forefront of technological development beyond the state-of-the-art, and thereby accelerating the commercialisation and deployment of CCS methods. Indeed, it enables spin-off activities and generation of new business, facilitating 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. It helps 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.

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Type	Distributed
Participants	**Members** **1.** Norway (lead country) **2.** France **3.** Italy **4.** Netherlands **5.** UK
Legal status	**ERIC, 2017**
Contacts	Email: info@eccsel.org
Web	https://www.eccsel.org

9. EUROPEAN CLINICAL RESEARCH INFRASTRUCTURE NETWORK

DESCRIPTION

The European Clinical Research Infrastructure Network (ECRIN) is a distributed RI that supports multinational clinical trials in Europe. It provides sponsors and investigators with advice, management services and tools to overcome hurdles to multinational trials and enhance collaboration. 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.

ACTIVITY

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.

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.

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 optimization of healthcare solutions and promotion of evidence-based medical practice in Europe and globally.

Type	distributed
Participants	**Members** 1. Czech Republic 2. France (lead country) 3. Germany 4. Hungary 5. Ireland 6. Italy 7. Norway 8. Portugal 9. Spain **Observers**

	1. Poland 2. Slovakia 3. Switzerland
Legal status	**ERIC, 2013**
Contacts	5 rue Watt, 75013 Paris, France SIRET: 801 933 235 00021 - APE: 7219Z - TVA Intracom: FR91 801 933 235
Web	www.ecrin.org

10. EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE

DESCRIPTION

Marine biodiversity is becoming a major target for fundamental science as well as an increasingly important resource for food, energy and industrial applications. This creates the need for 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.

The European Marine Biological Resource Centre is a distributed research infrastructure with a central hub/headquarter responsible for the coordination and centralised management of the infrastructure, and national nodes in member countries. Those nodes are renowned marine biological stations and institutes - the EMBRC Operators, across EU and EU-Associate countries. By organising access to these state-of-the-art facilities, EMBRC-ERIC provides the necessary and relevant services, facilities and technology platforms to study marine organisms and ecosystems.

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.

ACTIVITY

EMBRC-ERIC 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 delivers 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 acts as a centre for knowledge transfer and as a core technology infrastructure for the utilization of marine bioresources. It provides 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 offers access to the infrastructure sites, on-site or remote access to biological resources and analytical services as well as virtual access to data.

IMPACT

EMBRC members operate their centers, facilities, laboratories mostly in Marine Research Stations that are located in maritime peripheral European regions. Thus, national nodes 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. In recent years EMBRC has also 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.

Type	Distributed
Participants	**Members** **1.** Belgium **2.** Greece **3.** Spain **4.** France (lead country) **5.** Israel **6.** Italy **7.** Norway **8.** Portugal **9.** United Kingdom
Legal status	**ERIC, 2018**
Contacts	EMBRC-ERIC HEADQUARTERS 4 Place Jussieu - BC 93 75252 Paris Cedex 05 (FR) Email: secretariat@embrc.eu Phone: +33.1.44.27.63.37
Web	http://www.embrc.eu

11. EUROPEAN MULTIDISCIPLINARY SEAFLOOR AND WATER-COLUMN OBSERVATORY (EMSO)

DESCRIPTION

The European Multidisciplinary Seafloor and water-column Observatory (EMSO) is a consortium of partners sharing in a common strategic framework scientific facility (data, instruments, computing and storage capacity). EMSO offers data and services to a large and diverse group of users, from scientists and industries to institutions and policy makers. It is an extraordinary infrastructure to provide relevant information for defining environmental policies based on scientific data. It does it by acquiring 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.

ACTIVITY

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.

Type	Distributed
Participants	**Members** **1.** Greece **2.** Spain **3.** France 4. Ireland **5.** Italy (lead country) **6.** Portugal 7. Romania **8.** United Kingdom
Legal status	**ERIC, 2016**
Contacts	**Headquarters** Via di Vigna Murata 605 00143 Rome **Operative Office**

	via Giunio Antonio Resti 63 00143 Rome Tel 06.45431040 Email: info@emso-eu.org
Web	http://emso.eu

12. EUROPEAN PLATE OBSERVING SYSTEM

DESCRIPTION

The European Plate Observing System (EPOS) is a pan-European infrastructure facilitating integrated use of data, data products, and facilities from distributed research infrastructures for a solid Earth science in Europe. It brings together Earth scientists, national research infrastructures, ICT (Information & Communication Technology) experts, decision makers, and public to develop new concepts and tools for accurate, durable, and sustainable answers to societal questions concerning geo-hazards and those geodynamic phenomena (including geo-resources) relevant to the environment and human welfare. EPOS enables groundbreaking multidisciplinary work to better understand the physical and chemical mechanisms of the Earth that influence earthquakes, volcanic eruptions, ground instability and tsunamis, as well as the processes that drive tectonics and surface dynamics on Earth.

ACTIVITY

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 offers 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. The ground-breaking nature of the EPOS approach relies on joining the capacity of delivering high-quality standardized and multi-disciplinary data, the involvement of ICT experts in guaranteeing novel e-science opportunities and the leverage effect of user's engagement.

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.

Type	distributed
Participants	**Members** 1. Belgium 2. Czech Republic 3. Denmark 4. Finland 5. France 6. Germany 7. Greece 8. Hungary 9. Iceland 10. Ireland 11. Italy (lead country) 12. Netherland 13. Norway 14. Poland 15. Portugal 16. Romania 17. Slovenia 18. Spain 19. Sweden 20. Switzerland 21. Turkey 22. United Kingdom **Associate partners** 1. Austria 2. Slovakia 3. Bulgaria (under negotiation)
Legal status	**ERIC, 2018**
Contacts	Headquartered in Rome, Italy Istituto Nazionale di Geofisica e Vulcanologia (INGV) Via di Vigna Murata 605 00143 Roma Tel: +39 06518601 https://www.epos-ip.org/contact-US
Web	https://www.epos-ip.org

13. EUROPEAN SOCIAL SURVEY

DESCRIPTION

Public attitudes really matter in democratic societies. Policy makers as well as social scientists and society are interested in what citizens believe, want, fear and prefer. This gives a nuanced picture of Europe and its societies and thus provides an understanding of how public attitudes differ throughout Europe and how they change through the years. It is important both for informing academia and public policy debate. And here is where ESS comes into play, as a cross-national RI to assemble, interpret and disseminate data on social attitudes and behaviours. The European Social Survey (ESS) is an academically driven cross-national general social survey that has been conducted across Europe since 2002. Every two years, face-to-face interviews are conducted in people's homes with newly selected, cross-sectional samples of all those aged 15+ living within a country. 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.

ACTIVITY

The European Social Survey ERIC organizes 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.

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.

Type	Distributed
Participants	**Members** 1. Albania 2. Austria 3. Belgium 4. Bulgaria 5. Croatia 6. Cyprus 7. Czechia 8. Denmark 9. Estonia 10. Finland 11. France 12. Germany 13. Greece 14. Hungary 15. Iceland 16. Ireland 17. Israel 18. Italy 19. Kosovo 20. Latvia 21. Lithuania 22. Luxembourg 23. Montenegro 24. Netherlands 25. Norway 26. Poland 27. Portugal 28. Romania 29. Russian Federation 30. Serbia 31. Slovakia 32. Slovenia 33. Spain 34. Sweden 35. Switzerland 36. Turkey 37. Ukraine 38. United Kingdom (lead country)
Legal status	**ERIC, since 2013**
Contacts	ESS ERIC Headquarters c/o City, University of London Northampton Square, London, EC1V 0HB, United Kingdom T: +44 (0)207 0404901 ess@city.ac.uk ESS Archiving Team NSD - Norwegian Centre for Research Data Harald Hårfagres gate 29, N-5007 Bergen, Norway T: +47-55 58 21 17 - Fax: +47-55 589650 essdatasupport@nsd.no
Web	https://www.europeansocialsurvey.org

14. EURO-ARGO ERIC

DESCRIPTION

The oceans play an important role in climate change. Rising sea levels and shrinking arctic sea ice coverage are only two of the symptoms which have further impact on its development. To understand and predict climate change, it is crucial to understand and predict changes of the oceans. The International Argo Programme was initiated in 1999 as a pilot project endorsed by the Climate Research Program of the World Meteorological Organization, GOOS, and the Intergovernmental Oceanographic Commission. Today it is a global array of more than 4000 autonomous instruments, deployed over the world ocean, reporting subsurface ocean properties to a wide range of users via satellite transmission links to data centre. EURO-ARGO is a distributed Research Infrastructure with a common aim to provide an optimized and sustained European contribution to Argo by deploying 350 floats per year, 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. It also aims at developing the new phase of Argo by extending the network to abyssal oceans, biogeochemical parameters, marginal seas and high latitudes.

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. 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 longterm 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). Longterm 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.

Type	Distributed
Participants	1. Bulgaria 2. Germany (lead country) 3. Greece

	4. Finland 5. France 6. Ireland 7. Italy 8. Netherlands 9. Norway 10. Spain 11. UK **Observers** Poland **Candidates** Portugal
Legal status	**ERIC, since 2014**
Contacts	**EURO-ARGO ERIC** Campus Ifremer Technopole Brest Iroise 1625 Route de Sainte-Anne 29280 PLOUZANÉ FRANCE Phone: +33(0)2 98 22 44 83
Web	https://www.euro-argo.eu

15. EU-OPENSCREEN ERIC

DESCRIPTION

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. EU-OPENSCREEN ERIC (EU-OS) is a distributed research infrastructure consisting of high-throughput screening platforms and chemistry resources for Life Sciences, operating on a global scale.

EU-OS is a distributed Research Infrastructure that develops novel small chemical compounds which elicit specific biological responses on organisms, cells or cellular components. EU-OS 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. EU-OS is a cost-effective solution to the need of the broad scientific community, aiming at the following targets:

- providing access to Europe's leading screening platforms and chemistry groups;
- constructing a jointly used compound collection;
- operating an open-access database accessible on a global basis.

ACTIVITY

EU-OS 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-OS supports all stages of a tool development project, including assay adaptation, high-throughput screening, and chemical optimization of the hit compounds. All tool compounds and data are made available to the scientific community.

IMPACT

EU-OPENSCREEN can have several impacts, not only from the RI 's perspective on technology and data sharing but also from a societal perspective.

This is illustrated by the demand to generate improved effectiveness and safety of health treatments in European citizens' daily lives. EU-OPENSCREEN also covers, in addition to pharmacology applications in early drug discovery and toxicology, the production of crop-protective compounds, which are of paramount importance to society through understanding the response of wild or crop plants to environmental and agricultural substances. EU-OPENSCREEN 's broad biological approach would encourage 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.

Type	Distributed
Participants	**1.** Germany (lead country) **2.** Czech Republic **3.** Denmark **4.** Finland **5.** Latvia **6.** Norway **7.** Poland **8.** Spain
Legal status	**ERIC, since 2018**
Contacts	**EU-OPENSCREEN ERIC** Building C87, 1st floor Robert-Rössle-Str. 10 13125 Berlin, Germany Phone: +49 (0)30 9489 2422 Contact form: https://www.eu-openscreen.eu/index.php?id=21
Web	https://www.eu-openscreen.eu

16. EUROPEAN RESEARCH INFRASTRUCTURE FOR IMAGING TECHNOLOGIES IN BIOLOGICAL AND BIOMEDICAL SCIENCES

DESCRIPTION

The European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences (EuBI) provides a large-scale open physical user access to state-of-the-art imaging technologies for life

scientists. The fully distributed infrastructure of EuBi is coordinated by a Hub and offers its services via internationally renowned imaging facilities called Nodes and the European Molecular Biology Laboratory, EMBL. The infrastructure is empowered by a strong supporting and coordinating entity, the EuBI Hub, which provides the virtual entry point from which users are directed to their desired technology. Through EuBi, life scientists can access imaging instruments, expertise, training opportunities and data management services that they might not find at their home institutions or among their collaboration partners. All scientists, regardless of their affiliation, area of expertise or field of activity can benefit from these pan-European open access services, which are provided with high quality standards by leading imaging facilities.

ACTIVITY

European life scientists often lack access to pioneering imaging technologies. EuBI helps overcome this barrier by coordinating a distributed imaging infrastructure offering open access to external users from other European research institutions, bringing 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
- it allows life scientists working in academia, health care and industry to gain access to a broader range of much-needed advanced imaging technologies and knowledge.

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

IMPACT

The massively improved research conditions for life scientists not only allow Europe to secure its global leadership position in imaging technologies and open new research fields 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 provides 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.

Type	Distributed
Participants	**Members** **1.** Austria, **2.** Bulgaria **3.** Czech Republic **4.** Denmark **5.** EMBL **6.** Finland (lead country) **7.** France **8.** Hungary **9.** Israel **10.** Italy **11.** Norway

	12. Netherlands **13.** Portugal **14.** Sweden **15.** UK **Observers** Belgium **Candidates** 1. Slovakia 2. Poland 3. Spain
Legal status	**ERIC, since 2018**
Contacts	**Euro-BioImaging ERIC** **P.O. Box 123, Tykistökatu 6A** **FI-20521, Turku, FINLAND** **info@eurobioimaging.eu**
Web	https://www.eurobioimaging.eu

17. INTEGRATED CARBON OBSERVATION SYSTEM

DESCRIPTION

The Integrated Carbon Observation System (ICOS) is a distributed pan-European research infrastructure producing high-quality data on greenhouse gas concentrations in the atmosphere, as well as on carbon fluxes between the atmosphere, the land surface and the oceans. It was listed on the first Roadmap for European Research Infrastructures in 2006, reaching its final legal status (ICOS ERIC) in 2015.

ACTIVITY

Objectives:

- 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. ICOS aims at establishing a reference standard for the future development of similar integrated and operative GHG observation networks also beyond Europe;
- 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. 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

ICOS data helps to give an account of the Earth system and its response to climate change and other environmental challenges. The ICOS data generate scientific knowledge, which advances the fulfilment of the United Nations' Sustainable Development Goals and the European Union's Societal Challenges, especially those concerning climate change. It actively communicates to society the science-based knowledge that is relevant to climate action and decision-making.

ICOS generates important knowledge on our ecological life support systems that provide priceless services. A failure to reach 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.

Type	distributed
Participants	**Members** 1. Belgium 2. Czech Republic 3. Denmark 4. Finland (lead country) 5. France 6. Germany 7. Italy 8. Netherlands 9. Norway 10. Sweden 11. Switzerland 12. United Kingdom
Legal status	**ERIC, 2015**
Contacts	**Visiting Addresses:** ICOS ERIC Head Office, Erik Palménin aukio 1, FI-00560 Helsinki, FINLAND E-mail: info@icos-ri.eu
Web	https://www.icos-cp.eu

18. INSTRUCT-ERIC

DESCRIPTION

Instruct-ERIC is a pan-European distributed research infrastructure making high-end technologies and methods in structural biology available to users. Its aim is to promote innovation in biomedical science, operating on a non-economic basis within the scope of the ERIC Regulation. INSTRUCT is a major player in delivering an integrated approach to biological and medical research, by 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

Open Access to the Instruct infrastructure, expertise and methods is available to academic and industry researchers from all countries.

Access is granted subject to scientific peer review and is available either:

1. For academic research (users agree to publication of data). Researchers from member countries can apply for funding.

2. On a service basis for commercial use (user access is on a fee for service basis; no obligation to disclose or publish data)

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 characterization 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. INSTRUCT is working to reinforce the ERA by establishing commonalities with other R&I 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 R&I use. INSTRUCT has and continues to establish an extensive network of international partners.

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.

Type	distributed
Participants	**Members** 1. Belgium 2. Czech Republic 3. Denmark 4. EMBL 5. Finland 6. France 7. Israel 8. Italy 9. Latvia

	10. Lithuania 11. Netherlands 12. Portugal 13. Slovakia 14. Spain 15. United Kingdom (lead country)
Legal status	**ERIC, 2017**
Contacts	Instruct-ERIC Hub, Oxford House, Parkway Court, John Smith Drive, Oxford OX4 2JY Phone: +44 (0) 1865 98 86 39 E-mail: admin@instruct-eric.eu
Web	https://www.structuralbiology.eu

19. JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY

DESCRIPTION

JIVE
Joint Institute for VLBI
ERIC

Joint Institute for VLBI is an European Research Infrastructure Consortium. Its primary task is to operate the data processor for the European VLBI Network (EVN). JIVE provides support to the world-wide EVN user community and also supports EVN operations. JIVE is hosted by the Netherlands Institute for Radio Astronomy (ASTRON).

The European VLBI Network is a longstanding consortium with flexibly expandable structure that offers an astronomical observing facility through joint observations of radio telescopes across Europe and other continents and which is used by a vital and globally distributed scientific community. The EVN has been proven to maintain very high standards and a very stable network for more than two decades.

ACTIVITY

Very Long Baseline Interferometry (VLBI) is a type of astronomical interferometry used in radio astronomy. It allows observations of an object that are made simultaneously by many telescopes to be combined, emulating a telescope with a size equal to the maximum separation between the telescopes. Normally the participating radio telescopes function individually, working on their own specific projects. In the case of VLBI, they all observe the same source at the same time, allowing much higher spatial resolution. There are many complex and challenging hurdles that need to be overcome to enable this effort. One challenge is the data processing requirement. JIV-ERIC operates the EVN data processor, known as the correlator - a special-purpose supercomputer for astronomical VLBI data correlation.

IMPACT

JIV-ERIC provides more sustainability to the longstanding collaboration of nationally established research institutes in the field of Very Long Baseline Interferometry. The VLBI-networks are critical and key technology for leading and future research infrastructures in radio astronomy.

The JIVE correlator is the core of the JIV-ERIC infrastructure. It is an essential central component to form the VLBI Research Infrastructure. JIV-ERIC shall continue the existing collaboration and contractual obligations with all the EVN-partners and structure and align this with the JIV-ERIC mission. JIV-ERIC will correlate any EVN projects. Additionally, JIV-ERIC will promote and implement the use of VLBI and other radio-astronomy techniques.

JIVE provides day-to-day support to users of the European VLBI Network, while working on the operation and development of the EVN MkIV Data Processor. JIVE staff are also involved in a wide range of scientific

research. Much of this research activity makes use of the EVN, but JIVE astronomers also frequently make use of other radio instruments, such as VLBA, MERLIN, VLA, WSRT, ATCA, AT-LBA, JCMT, IRAM 30-m.

Type	distributed
Participants	**Members** 13. France 14. Latvia 15. Netherlands (lead country) 16. Spain 17. Sweden 18. United Kingdom. Also supported by the following participating research institutes: China: National Astronomical Observatories (NAOC) Germany: Max Planck Institute for Radio Astronomy (MPIfR) Italy: National Institute for Astrophysics (INAF) South Africa: National Research Foundation (NRF)
Legal status	**ERIC, 2014**
Contacts	Joint Institute for VLBI ERIC Oude Hoogeveensedijk 4 7991 PD Dwingeloo The Netherlands Telephone: +31 521 596 524 Fax: +31 521 596 539 Email: jive@jive.eu
Web	http://www.jive.nl

20. LIFEWATCH ERIC

DESCRIPTION

LifeWatch ERIC is a distributed research infrastructure consortium consisting of seven European Member States, Its central components and Common Facilities are located in three Member States (Spain, Italy and the Netherlands), and national nodes in all other countries. LifeWatch ERIC is Europe's first line of response to biodiversity loss, applying and advancing ICT technologies, web networks and interconnecting scientific communities and research centers into its web-based nternational research infrastructure. LifeWatch ERIC's e-Science capabilities facilitate the sharing and aggregation of data on biodiversity and ecosystems, their integration and analysis in advanced models, and provide the computational power to derive scenarios of biodiversity organisation and conservation in future ecosystems under multiple pressures of change.

ACTIVITY

Located in Spain, LifeWatch's Statutory Seat and the ICT e-Infrastructure Technical Offices 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.

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 identifies new data resources, incorporates vocabularies, semantics and services to aggregate larger typologies of data; 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.

IMPACT

LifeWatch ERIC's Virtual Research Environments (VRE) 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.

Type	distributed
Participants	**Members** 1. Belgium 2. Greece 3. Italy 4. Netherlands, 5. Portugal 6. Slovenia 7. Spain (lead country) **Observer** Slovakia
Legal status	**ERIC, 2017**
Contacts	Plaza España SN, SECTOR II-III ERIC 41013 Seville (Spain) E-mails: info@lifewatch.eu communications@lifewatch.eu
Web	https://www.lifewatch.eu

21. SURVEY OF HEALTH, AGEING AND RETIREMENT IN EUROPE

DESCRIPTION

Facing the challenges of population ageing needs a profound long-term data base from across Europe. To turn the challenges of population ageing in Europe into opportunities, it is crucial to understand how older peoples' living conditions depend on the interplay of health, economics, social networks and institutional conditions, which may differ from country to country and over the years.

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 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.

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. 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. 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.

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.

Type	distributed
Participants	**Members** 1. Austria 2. Belgium 3. Bulgaria 4. Croatia 5. Cyprus 6. Czech Republic 7. Denmark 8. Estonia 9. Finland 10. France 11. Germany (lead country) *12.* Greece 13. Hungary 14. Ireland 15. Israel 16. Latvia 17. Lithuania 18. Luxembourg 19. Malta 20. Netherlands 21. Poland 22. Portugal 23. Romania 24. Slovakia 25. Slovenia 26. Spain 27. Sweden **Observer** Switzerland
Legal status	**ERIC, 2011**
Contacts	SHARE-ERIC Amalienstr. 33 80799 Munich Germany Email: info@share-project.org
Web	http://www.share-project.org

Part 3. Other important RI's, according to ESFRI Strategic Report on RIs in Europe

1. Infrastructure for Analysis and Experimentation on Ecosystems (AnaEE)

DESCRIPTION

The Infrastructure for Analysis and Experimentation on Ecosystems (AnaEE) is a distributed RI that 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 policymakers, scientists and the industry to develop climate mitigation strategies and provide solutions to the challenges of food security, stimulating the growth of a vibrant bio-economy.

BACKGROUND

AnaEE is an integrated, long-term, pan-European, continent-wide experimental RI based on four types of advanced distributed platforms:

- *Open-air ecosystem platforms*: located in terrestrial or aquatic ecosystems, managed and unmanaged, crossing Europe's climate zones;
- *Closed ecosystem platforms*: they complement outdoor platforms by allowing a higher level of environmental control and process measurement;
- *Analytical platforms*: they provide advanced biological, physical and chemical analyses for a better understanding of ecosystem processes;
- *Modeling platforms*: they provide access to software solutions and advanced installations for model development.

AnaEE will adopt an experimental approach built around ecosystems manipulation, measurements, modelling, mitigation and management. At the heart of AnaEE 's approach are the distributed experimental facilities needed to expose ecosystems to potential conditions to produce outcomes that 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 IT 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.

STEPS FOR IMPLEMENTATION

AnaEE is currently in the Implementation Phase with seven countries - France, Belgium, Czech Republic, Denmark, Israel, Italy and Finland. 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.
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 RI 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
ESFRI status	project RI
Legal status	ERIC (pending)
Participants	**Members** 1. Belgium 2. Czech Republic 3. Denmark 4. France (lead country) 5. Finland 6. Israel 7. Italy
Contacts	https://www.anaee-france.fr/en/contact-en
Web	https://www.anaee.com/

2. Cherenkov Telescope Array

DESCRIPTION

The Cherenkov Telescope Array (CTA) is the next generation ground-based observatory for gamma-ray astronomy at very-high energies. With more than 100 telescopes located in the northern and southern hemispheres, CTA will be the world's largest and most sensitive high-energy gamma-ray observatory.

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.

ACTIVITY

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 data will provide new insights into how cosmic particle accelerators work. These naturally occurring cosmic accelerators reach energies and efficiencies much higher than man-made accelerators like the Large Hadron Collider and have contributed to shaping the evolution of our Universe. Besides, it 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.

Type	single-sited
ESFRI status	landmark RI
Legal status	gGmbH, 2014
Operation start	2024
Participants	1. Armenia 2. Australia 3. Austria 4. Brazil 5. Bulgaria 6. Canada 7. Chile 8. Croatia 9. Czech Republic 10. Finland 11. France 12. Germany 13. Greece 14. India 15. Ireland 16. Italy 17. Japan 18. Mexico 19. Namibia 20. Netherlands 21. Norway 22. Poland 23. Slovenia 24. South Africa 25. Spain 26. Sweden 27. Switzerland 28. Thailand 29. Ukraine 30. United Kingdom

	31. United States of America
Contacts	Cherenkov Telescope Array Observatory gGmbH (CTAO gGmbH) Saupfercheckweg 1 69117 Heidelberg, Germany Phone: +49 (6221) 516 471 Email: info@cta-observatory.org
Web	https://www.cta-observatory.org

3. Next Generation European Incoherent Scatter Radar System Upgrade

DESCRIPTION

The next generation European Incoherent Scatter radar system upgrade (EISCAT_3D) will become 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 radar system is intended to investigate how the Earth's atmosphere is combined with space but it would also be applicable for a broad range of other scientific objectives including climate change, space weather, plasma physics, space debris and near-Earth object studies.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. Operations are expected to start at the end of 2021.

ACTIVITY

EISCAT_3D will be an integral part of EISCAT Scientific Association (created in 1975). 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 70m 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 will use several different measurement techniques which have never before 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. The infrastructure 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

IMPACT

EISCAT_3D will become a RI almost fully dedicated to the research of solar-terrestrial physics – an area of physics where the interaction between the Sun and the Earth is studied. Understanding and foreseeing the effects of solar-terrestrial processes has profound consequences for a range of practical applications like long-term global climate change, human space-flight, satellite operations, communications, position finding, terrestrial monitoring, long-distance energy transport and human health.

EISCAT_3D 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.

Type	single-sited
Participants	**Members** 1. China 2. Finland 3. Japan 4. Norway 5. Sweden (lead country) 6. United Kingdom
Legal status	EISCAT Scientific Association, 1975
Contacts	Visiting address: Rymdcampus 1 SE-981 92 Kiruna Sweden Mailing address: Box 812 SE-981 92 Kiruna Sweden
Web	https://eiscat.se/eiscat3d/

4. Extreme Light Infrastructure

DESCRIPTION

The Extreme Light Infrastructure (ELI) is a RI of global interest using extreme light-matter interactions at the highest intensities, shortest time scales and broadest spectral range. ELI will be the world's first international laser research infrastructure, pursuing unique science and research applications for international users. It 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. Thus, it is the first ESFRI project to be fully implemented in the newer EU Member States. ELI is pioneering a novel funding model combining the use of EU structural funds (ERDF) for the implementation, and member contributions to a yet to be established European Research Infrastructure Consortium ERIC for the operation.

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.

The ELI Attosecond Light Pulse Source (ELI-ALPS) in Szeged, Hungary is establishing a unique facility, which provides light sources between THz (1012 Hz) and X-ray (1018-1019 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.
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 1023 - 1024 W/cm2, 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.

IMPACT

ELI will be the gateway to new regimes in fundamental physics. It will also promote the advent of new technologies, such as novel laser-plasma-accelerators delivering particles and photon sources with extremely high energies beyond the physical limits of conventional technologies. ELI will contribute to societal benefits in medicine, due to its basic research on new radiography and hadron therapy methods. It will also contribute to material science with the possibility to unravel and control dynamical effects in micro-electronics by use of novel laser-based, ultra-short-pulse x-rays. It may help investigating and controlling aging processes in materials under extreme conditions, such as in nuclear reactors, and help protecting the environment by offering new ways to treat nuclear waste.
Due to its unique characteristics as the first international laser user facility ELI will open a new era of laser-based research, attracting the world's best researchers to world-wide unique research opportunities
ELI will promote an aggressive technology transfer. Fields such as laser and particle accelerator engineering, nuclear pharmacology, oncology, X-ray and gamma-ray imaging could be revolutionized by ELI.

Type	distributed
ESFRI status	landmark RI
Legal status	AISBL, 2013
Participants	1. Czech Republic (lead country) 2. France 3. Germany 4. Hungary (lead country) 5. Italy 6. Romania (lead country) 7. United Kingdom
Contacts	Dóra VÖRÖS ELI-DC Communications Manager ELI-DC Szeged Office Email: Dora.Voros@eli-laser.eu Tel.: +36 1 212 5496
Web	https://eli-laser.eu

5. Distributed Infrastructure for Life-Information

DESCRIPTION

The distributed infrastructure for life-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, analyze 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.

BACKGROUND

ELIXIR is a distributed RI, which builds on existing data resources and services across Europe. There are 22 countries in ELIXIR, working together using a 'Hub and Nodes' model:

- *ELIXIR Hub*: The ELIXIR Hub is like a headquarters and coordinates the work across ELIXIR. The Hub is based at the Wellcome Genome Campus, near Cambridge, UK.
- *ELIXIR Nodes*: Each member state of ELIXIR establishes a 'Node'. A Node is a network of organizations that work within a member state. Each Node has a lead organization that coordinates the local ELIXIR activities e.g. the Dutch Techcentre for Life Sciences (DTL) in Utrecht oversees the work of ELIXIR Netherlands, the Dutch Node.
- *EMBL* (European Molecular Biology Laboratory) is an intergovernmental organization so it is the only Node that is not associated with a country.

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.

As a distributed infrastructure, ELIXIR has a mixed funding model with contributions coming from a number of mostly public sources:

- Collectively, the ELIXIR Hub and Nodes compete for grant funding from the European Union, under Horizon 2020 and the Innovative Medicine Initiative (IMI);
- The ELIXIR Hub is funded through membership fees paid by Member countries, and much of this funding is then transferred back to Nodes (e.g. via Implementation Studies) to deliver ELIXIR's five-year Scientific Programme;
- ELIXIR Nodes are typically funded through national-level investments, supporting national coordination, and the development and operation of services;

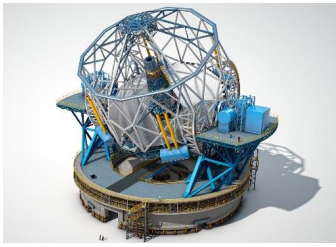
IMPLEMENTATION

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 commercialized, has relied on carefully curated datasets extracted from publicly archived data resources such as the Protein Data Bank.

Type	distributed
ESFRI status	landmark RI
Legal status	ELIXIR Consortium Agreement, 2013
Participants	**Members:** 1. Belgium 2. Czech Republic 3. Denmark 4. Estonia 5. Finland 6. France 7. Germany 8. Greece 9. Hungarian 10. Ireland 11. Israel 12. Italy 13. Luxembourg 14. Netherlands 15. Norway 16. Portugal 17. Slovenia 18. Spain 19. Sweden 20. Switzerland 21. UK (lead country) **Observers:** Cyprus
Contacts	ELIXIR, Wellcome Genome Campus, Hinxton, Cambridgeshire, CB10 1SD, UK Phone: +44 (0)1223 492 670 Email: info@elixir-europe.org
Web	https://elixir-europe.org

6. Extremely Large Telescope



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. The ELT construction is expected to be completed by 2024.

ACTIVITY

The ELT has a main mirror 39 metres in diameter, covering a field of view on the sky about a tenth of the size of the full Moon. The telescope's "eye" will be almost half the length of a soccer pitch in diameter and will gather 15 times more light than the largest optical telescopes operating today. The mirror design itself is revolutionary, and is based on a novel five-mirror scheme which results in exceptional image quality. The primary mirror consists of 798 segments, each 1.4 metres wide and only 50 mm thick. The optical design calls for a secondary mirror four metres in diameter — the largest secondary mirror ever employed on a telescope, and the largest convex mirror ever produced. 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

By probing the most distant regions of the Universe, the ELT will help to enhance our understanding of the formation of the earliest objects and the relationships between then: primordial stars, primordial galaxies and black holes. Studies of extreme objects like black holes will also benefit from the power of the ELT to give us new insights into the rapidly evolving processes at play around compact objects.

The ELT is designed to make detailed studies of the first galaxies and to follow their evolution through cosmic time. Observations of these early galaxies with the ELT will give us clues that will help understand how they form and evolve. In addition, the ELT will be a unique tool for making an inventory of the changing content of the various elements in the Universe, and to understand how star formation began and evolved in galaxies.

One of the most exciting goals of the ELT is the possibility of making a direct measurement of the acceleration of the Universe's expansion. Such a measurement would have a major impact on humanity's understanding of our Universe. The ELT will also search for possible variations in the fundamental physical constants with time. An unambiguous detection of such variations would have far-reaching consequences for our comprehension of the fundamental laws of physics.

Type	single-sited
ESFRI status	Landmark RI
Legal status	ESO, EIROforum member
Operation start	2024
Participants	1. ESO (European Southern Observatory) 2. Austria 3. Belgium 4. Switzerland 5. Czech Republic 6. Germany 7. Denmark 8. Spain

	9. Finland 10. France 11. Italy 12. Netherlands 13. Poland 14. Portugal 15. Sweden 16. United Kingdom Prospective member: Ireland
Contacts	Email: information@eso.org.
Web	https://www.eso.org/public/teles-instr/elt/telescope/

7. European Magnetic Field Laboratory

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 is dedicated to unite, coordinate and reinforce the four existing European high magnetic field laboratories – the Dresden High Magnetic Field Laboratory (HLD, Germany), the Laboratoires National des Champs Magnétiques Intenses (LNCMI) in Grenoble and Toulouse (France), and the High Magnetic Field Laboratory in Nijmegen (HFML, The Netherlands) – within a single body as a world-leading infrastructure. Since December 2015, the University of Nottingham is a member of EMFL. Since January 2019, the University of Warsaw is a member, too.
The parent organizations 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 Laboratoire National de Champs Magnetiques Intenses is a French large-scale facility operated by CNRS, 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 Organization 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, lowdimensional 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 tumors 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.

Type	distributed
ESFRI status	landmark RI
Legal status	AISBL, 2015
Participants	**Members** 1. Germany (lead country) 2. France (lead country) 3. Netherlands (lead country) 4. U.K. 5. Poland
Contacts	European Magnetic Field Laboratory – AISBL Rue du Trône 98 1050 Ixelles, Brussels Belgium Executive Manager Martin van Breukelen Tel: (+31) (0)24 3653005
Web	https://emfl.eu

8. Extremely Brilliant Source (ESRF-EBS)

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 ~lO.OOO 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.
ESRF–EBS (Extremely Brilliant Source) is the ESRF's 150M€ facility upgrade, over 2015-2022, bringing its scientific users a first-of-a-kind, low-emittance, high-energy synchrotron light source and new, cutting-edge beamlines. With a revolutionary new storage ring concept that increases the brilliance and coherence of

the X-ray beams produced by a factor of 100 compared to present-day light sources, ESRF–EBS represents a new generation of synchrotron and an extraordinary new tool for scientists to study the heart of matter.

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.
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 (~l00x).
ESRF–EBS consists of four components:

- A new storage ring based on an ESRF-developed hybrid multi-bend achromat (HMBA), producing extremely brilliant X-rays and open to users in 2020.
- Four brand-new flagship beamlines over the period 2020-2022, covering a multitude of scientific techniques, making it possible to study the structure of matter at the atomic level in greater detail, with higher quality, much faster:
  - EBSL1: Coherence applications – dynamics and imaging at the nanoscale;
  - EBSL2: Hard X-ray diffraction microscopy on material complexity;
  - EBSL3: High-throughput large-field phase-contrast tomography,
  - EBSL8: Serial synchrotron crystallography on macromolecular nanocrystals.
- An ambitious scientific instrumentation programme, including high-performance X-ray detectors.
- A data strategy to fully exploit the performances of the new X-ray source.

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.

Type	distributed
ESFRI status	Landmark RI
Legal status	ESRF, EIROforum member
Operation start	2023
Participants	**MEMBER STATES** France Germany Italy United Kingdom Russia Belgium Netherlands Denmark

	Finland Norway Sweden Spain Switzerland **SCIENTIFIC ASSOCIATES** Austria Israel Czech Republic Hungary Slovakia Poland Portugal India South Africa
Contacts	European Synchrotron Radiation Facility 71, avenue des Martyrs CS 40220 38043 Grenoble Cedex 9
Web	https://www.esrf.eu

9. European SOLAR Research Infrastructure for Concentrated Solar Power (EU-SOLARIS)

EU SOLARIS

The European Research Infrastructure for Concentrated Solar Power

DESCRIPTION

The European SOLAR Research Infrastructure for Concentrated Solar Power (EU-SOLARIS) is a distributed Research Infrastructure 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 benchmark for CSP/STE and will keep Europe at the forefront of these developments by offering the most extensive, high-quality science portfolio and enabling researchers' access to extremely advanced facilities through a single point of entry. EU-SOLARIS will bridge the science and industrial communities and accelerate the growth of research and innovation through a closer collaboration, knowledge exchange and a wider outcome dissemination.

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

ACTIVITY

EU-SOLARIS seeks to establish a new legal entity to explore and apply new and improved rules and procedures for European experimental facilities for CSP/ STE technologies, in order to optimize their use and Research and RTD coordination. It is supposed to be the first of its kind where a significant role will be played by business needs and private investment will supplement public support. Partnership includes 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.

EU-SOLARIS intends to provide the most complete, high quality scientific infrastructure portfolio at international level and to facilitate researchers´ access to highly specialized research infrastructure

through a single access point. This will be accomplished by linking scientific communities, industry and universities involved in the CST sector. Moreover, it is expected to increase the efficient use of the economic and human resources required throughout the European research context. EU-SOLARIS will provide efficient resource management to complement research and to avoid unnecessary technological duplication and repetition.

IMPLEMENTATION

EU-SOLARIS is currently in the Implementation Stage, following the Preparatory and Interim Phases, with operations scheduled to begin 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 and the European Solar Thermal Electricity industry Association. 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).

Type	distributed
ESFRI status	project
Legal status	pending
Expected operation start	2020
Participants	**Members** 1. Portugal 2. Spain 3. France 4. Italy 5. Germany 6. Greece 7. Cyprus **Associate countries** 1. Turkey 2. Israel
Contacts	**Project Manager** CTAER - Advanced Technology Center for Renewable Energies Ctra. Sevilla-Coria del Río (Pol. Ind. Eurocei) s/n.41920 San Juan de Aznalfarache Sevilla, Spain e-mail: EUSOLARIS_PO@ctaer.com Tel :+34 954174367 **Coordinator** Manuel J. Blanco, Ph.D., Dr.Ing. CTAER - Advanced Technology Center for Renewable Energies Ctra. Sevilla-Coria del Río (Pol. Ind. Eurocei) s/n.41920 San Juan de Aznalfarache Sevilla, Spain e-mail: coordinator.eusolaris@ctaer.com

	Tel: +34 954174367
Web	http://www.eusolaris.eu

10. Facility for Antiproton and Ion Research (FAIR)

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. FAIR is expected to deliver beams for science experiments in 2025. Partial operation - FAIR Phase 0 science programme - started back in 2018.

ACTIVITY

Currently the FAIR, one of the largest research projects worldwide, is being built in Darmstadt, Germany. At FAIR, matter that usually only exists in the depth of space will be produced in a lab for research. Scientists from all over the world will be able to gain new insights into the structure of matter and the evolution of the universe from the Big Bang to the present. FAIR is under construction at GSI Helmholtzzentrum für Schwerionenforschung. Its existing accelerator facilities will become part of FAIR and will serve as first acceleration stage. For the realization of FAIR, accelerator experts, scientists and engineers of FAIR and GSI are working closely together in teams all over the world. FAIR 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.

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.

Type	single-sited
ESFRI status	Landmark RI
Legal status	GmbH, 2010
Operation start	2025
Participants	**Members:** 1. Germany (lead country) 2. Finland 3. France 4. Germany 5. India 6. Poland 7. Romania 8. Russia 9. Slovenia 10. Sweden **Associated partner:** United Kingdom **Aspirant partner:** Czech Republic
Contacts	FAIR - Facility for Antiproton and Ion Research in Europe GmbH Planckstr. 1 64291 Darmstadt GERMANY Email: publicrelations@fair-center.eu
Web	https://fair-center.de

11. In-service Aircraft for a Global Observing System

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. In order to provide optimal information, two complementary systems have been implemented:

(i) IAGOS-CORE providing global coverage on a day-to-day basis of key observables;
(ii) (ii) IAGOS-CARIBIC providing a more in-depth and complex set of observations with lesser geographical and temporal coverage.

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 configuration of IAGOS seeks to provide a 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. CO2, CH4), 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.

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 CO2 emission and Kyoto monitoring. Regional air quality models will assimilate IAGOS near real-time data to improve forecasts.. Cooperation with the aviation industry and manufacturers of instrumentation seeks to devise approaches to tackle the observation of ice particles and dust like volcanic ash and its operating implications.

IMPACT

The direct impact is mainly on SMEs that are manufacturing instruments or are involved in the instrumentation development and aeronautical maintenance in order to ensure continued airworthiness in accordance with international aviation regulations. The involvement of airline companies as transport capacity suppliers and technical assistance was achieved on the basis of individual negotiations and by direct involvement as full project partners. IAGOS actively provides observational data to the aviation industry and airlines in order to enhance operating practices and thus minimize costs and increase 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.

Type	distributed
ESFRI status	landmark
Legal status	International not for profit Association (IAGOS-AISBL), 2014
Participants	**Members** 1. Germany (lead country) 2. France (lead country) 3. U.K.
Contacts	Rue du Trone 98 B-1050 Bruxelles Tel.: +33 5 61 33 27 69 Internet: https://www.iagos.org Email: info@iagos.org
Web	https://www.iagos.org

12. International Fusion Materials Irradiation Facility - Demo Oriented Neutron Source (IFMIF-DONES)

DESCRIPTION

The international Fusion Materials Irradiation Facility - Demo Oriented Neutron Source (IFMIF-DONES) is a novel RI 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.

ACTIVITY

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 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.

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 1018 m-2 s-1 with a broad peak at 14 MeV through stripping nuclear reactions, reproducing the expected conditions of fusion power plants.

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, Fusion for Energy (F4E) evaluated positively the joint Spain Croatia proposal to site the IFMIF-DONES in Granada. Since then, all parties involved in IFMIF-DONES have joined forces to begin the implementation phase with the initial steps for the construction of the civil engineering infrastructure. As a result, the IFMIF-DONES Preparatory Phase project was conceived, the aim of which is to elaborate and draft the consortium agreement allowing for the construction of the facility, included in the ESFRI 2018 Roadmap, in the province of Granada.

The high impact on society of such critical infrastructure goes beyond the interaction with purely scientific sectors. This infrastructure is conceived as a necessary milestone towards nuclear fusion and, hence, towards clean and sustainable energy production to mitigate climate change. As a result, IFMIF-DONES

and its deep implications are considered essential and must be adequately and thoroughly explained to society and other scientific and industrial communities through the promotion of the relevant actions.

Type	single-sited
ESFRI status	project
Legal status	pending
Operation start	2029
Participants	**MEMBER STATES** 1. Spain 2. UK 3. France 4. Italy 5. Poland 6. Portugal 7. Germany 8. Croatia 9. Belgium 10. Hungary **OBSERVERS** **Switzerland** **Japan** **EU:** EUROfusion; Fusion for Energy; Nuclear Physics European Collaboration Committee
Contacts	Vice-Rectorate for Research and Knowledge Transfer University of Granada Gran Vía 48, 18071, Granada, Spain Email: communication@ifmifdones.org
Web	https://ifmifdones.org

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

DESCRIPTION

The European Research Infrastructure for the generation, phenotyping, archiving and distribution of mouse disease models (INFRAFRONTIER) aims to build a world-class research infrastructure that provides the biomedical research community with the tools needed to unravel the role of gene function in human disease. By offering access to a unique collection of mouse models and research tools and associated data, as well as 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.

ACTIVITY

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 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:

1. mouse disease model generation using different genetic resources and technologies;
2. 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;
3. 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.

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. 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 centralized and sustainable gold-standard resources, INFRAFRONTIER reduces duplication of efforts thereby contributes to cost efficiency, reduction of animal use, and data reproducibility. It shapes the European Research Area in the field of mouse functional genomics and thereby make an important contribution to the study of human disease. It also sets standards for systemic phenotyping of mouse models and for archiving and distribution of mouse mutants in Europe.

Besides, INFRAFRONTIER offers highest-quality services and cutting-edge technologies provided by the leading labs in Europe and disseminates knowledge by state-of-the-art training courses.

Type	distributed
ESFRI status	landmark RI
Legal status	GmbH, 2013
Participants	**Members:** 1. Austria 2. Barcelona 3. Belgium 4. Canada 5. Czech Republic 6. Denmark 7. France 8. Germany (lead country) 9. Greece 10. Israel 11. Italy 12. Netherlands 13. Portugal 14. Spain

	15. Sweden 16. United Kingdom
Contacts	INFRAFRONTIER GmbH Ingolstädter Landstraße 1 85764 Neuherberg / München Germany Email: info@infrafrontier.eu
Web	https://www.infrafrontier.eu

14. Infrastructure for Systems Biology Europe

DESCRIPTION

The Infrastructure for Systems Biology Europe (ISBE) is a distributed RI that enables efficient access to the best expertise, resources and services 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 standardization 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 plays 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.

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.
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 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 is 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: 1) modelling, 2) stewardship and standardisation and 3) 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.

IMPACT

By interconnecting national systems biology centres and making their collective expertise, resources and services easily accessible for all European researchers, ISBE brings systems biology within easy reach of scientists. Through ISBE, researchers are able to gain easy access to the best systems biology expertise,

resources and services including state-of-the-art facilities, data, models, tools and training. ISBE will drive the development and uptake of standards for biological data, tools and models as well as operating procedures, ensuring that data and models across different laboratories, countries and sectors become combinable and re-usable.

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.

During the Construction Phase, ISBE has started to deliver web-based services for: 1) development of experimental and computational facilities for systems metabolomics; 2) modelling, stewardship of research assets; and 3) training. Building phase activities are based on in-kind and in-cash contributions from members of the Consortium.

Type	distributed
ESFRI status	project RI
Legal status	pending
Participants	**Members:** 1. UK 2. Netherlands 3. Greece 4. Ireland 5. Germany 6. Finland 7. Norway 8. Czech Republic 9. Spain 10. Slovenia 11. Sweden **Associate Partner:** Italy
Contacts	Professor Richard Kitney is the Coordinator of ISBE Richard Kitney OBE, FREng, DSc (Eng), FCGI, Co-Director of the EPSRC National Centre for Synthetic Biology and Innovation, Chairman of the Institute of Systems and Synthetic Biology, Professor of BioMedical Systems Engineering Tel: +44 (0)20 7594 6226 Email: r.kitney@imperial.ac.uk
Web	https://project.isbe.eu

15. Jules Horowitz research Reactor

DESCRIPTION

The Jules Horowitz research Reactor (JHR), a project conducted by the Nuclear Energy Division, is an answer to a key technological and scientific challenge: testing fuel and material behavior under irradiation in support of current and future nuclear reactors. JHR, under construction at CEA Cadarache site, will represent in Europe a unique experimenting tool available to nuclear power industry, research institutes, nuclear regulatory authorities and their technical supports.

The site preparation for the project began at the Cadarache Research Centre in 2007. The first concrete step for the reactor's foundations was taken in 2009, and the central containment structure was completed with the addition of a 105-tonne dome in Late 2013. JHR is expected to be in operation in 2022.

ACTIVITY

The JHR is an experimental reactor. As opposed to a production reactor, it is not intended to generate electrical power, but only to provide scientific data concerning nuclear fuel and material behavior when they are exposed to very high stresses (high neutron fluxes). The JHR will submit the samples of components that researchers or industrial partners would like to test under an intense neutron flux. Within JHR experimental devices, these samples may also be exposed to extreme pressures and temperatures if required. These components will thus undergo accelerated aging, and will be pushed beyond the limits of their normal use, if required up to incidental and accidental situations, which will allow an experimental qualification before their use in industry.

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 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.

IMPLEMENTATION

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 organizations 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. It will also 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.

Type	single-sited
ESFRI status	Landmark RI
Legal status	-
Operation start	2022
Participants	**Members:** 1. Spain 2. Belgium 3. Czech Republic 4. Finland 5. France (lead country) 6. Israel 7. India 8. United Kingdom 9. Sweden
Contacts	CEA Cadarache 13108 Saint-Paul-lez-Durance, France Email: wwwjhreactor@cea.fr
Web	http://www-rjh.cea.fr/index.html

16. KM3 Neutrino Telescope 2.0 (KM3NeT 2.0)

DESCRIPTION

KM3NeT 2.0 is a RI housing the next generation neutrino telescopes. Once completed, the telescopes will have detector volumes between megaton and several cubic kilometers of clear sea water. Located in the deepest seas of the Mediterranean, KM3NeT 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 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 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.

ACTIVITY

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 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 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. 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 serves as a reference document for requests for funding by the various stakeholders in Europe and abroad. 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.

Type	distributed
ESFRI status	project RI
Legal status	pending
Participants	**Members:** 1. Australia 2. China 3. Cyprus 4. Ecuador 5. France 6. Georgia 7. Germany 8. Greece 9. Ireland 10. Italy 11. Morocco 12. Poland 13. Romania 14. Russia 15. South Africa 16. Spain 17. The Netherlands 18. UK
Contacts	Outreach committee Email: phase1-oc@km3net.de
Web	https://www.km3net.org

17. Microbial Resource Research Infrastructure (MIRRI)

DESCRIPTION

The Microbial Resource Research Infrastructure (MIRRI) is the pan-European distributed RI 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.

BACKGROUND

Microorganisms provide essential raw material for biotechnology - but to date less than 1% of the estimated number of species are described and available to be harnessed by man. Furthermore, recent studies suggest that less than 0.1% of prokaryote strains published in the scientific literature were deposited in public service collections or mBRCs (microbial Biological Resource Centres) or simply retained for future study and use. Some 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 from collections thus tens of thousands resource strains are sourced for research often without proper authentication and provenance.

A coordinated policy to make such genetic resources available is needed to support research and development in academia as well as industry.

As new species are discovered, the expertise is difficult to locate to ensure their correct identification and this human resource is diminishing. By an increased interoperability of existing data and databases MIRRI will overcome this problem: material as well as expertise can easily be accessed via the MIRRI web portal. The existing but fragmented resources, distributed across Europe, need to be coordinated and operated to common standards with facilitating policy. The vision of MIRRI is to be a unique pan-European high-performance platform adding value to known and yet unknown microbial biodiversity and exploiting novel sources and knowledge to discover and disclose for the bioeconomy and bioscience.

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. MIRRI is in its construction phase to establish as an European Research Infrastructure Consortium (ERIC) under EU law. 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.

Type	distributed
ESFRI status	project
Legal status	pending
Participants	**Members:** 1. Belgium 2. Czech Republic 3. Denmark 4. Finland 5. France 6. Germany 7. Greece 8. Hungary 9. Italy 10. Latvia 11. Netherlands 12. Poland (lead country) 13. Portugal 14. Romania 15. Russia 16. Slovakia 17. Spain (lead country)
Contacts	https://www.mirri.org/page/Contact%20us Email: info@mirri.org
Web	https://www.mirri.org

18. Multi-purpose hybrid research reactor for high-tech applications (MYRRHA)

DESCRIPTION

MYRRHA (Multi-purpose hybrid Research Reactor for High-tech Applications) is the world's first large scale Accelerator Driven System (ADS) that consists of a subcritical nuclear reactor driven by a high-power linear accelerator. With the subcritical concentration of fission material, the nuclear reaction is sustained by the particle accelerator only. Turning off the proton beam results in an immediate and safe halt of the nuclear reactions. MYRRHA's 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. MYRRHA is expected to become gradually operational as of 2027.

BACKGROUND

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 optimized 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 optimized 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.

IMPLEMENTATION

MYRRHA will be constructed in three phases:

Phase 1: design and construction of the first linac section (up to 100 MeV). This phase will confirm the linac's operational reliability required later to drive the reactor with the 600 MeV proton beam. In addition, it consists of the Proton Target Facility for the production of medical radioisotopes and for fundamental and applied research in physics as well as for material research. The third component is the Fusion Target Station, where materials for fusion reactors will be tested. The first phase also includes research and development of the linac extension to 600 MeV and of the sub-critical reactor. Finally, reactor pre-licensing is also part of Phase 1. This phase is scheduled for completion in 2026.

Phase 2: extension of the 100 MeV linac to 600 MeV. This extension is required to drive the reactor. When completed, the linac will be approximately 400 m long. Phase 2 is scheduled for completion in 2033.

Phase 3: construction of the reactor. The double wall, unpressurised pool-type vessel will accommodate all primary systems. The sub-critical reactor will be fed by neutrons that are generated by the spallation source that, in turn, is fed with protons from the linac. This fast reactor is cooled by lead-bismuth eutectic (LBE) and has a maximum thermal power output of 100 MW. The reactor is scheduled to be commissioned in 2036.

Type	single-sited
ESFRI status	project RI
Legal status	pending
Operation start	2027
Participants	**Members:** Belgium **Prospective countries:** China Japan
Contacts	MYRRHA Boeretang 200 2400 Mol, Belgium Phone: +32 (0)14 33 21 11 Email: info@myrrha.be
Web	https://myrrha.be

19. Partnership for Advanced Computing in Europe (PRACE)

DESCRIPTION

The Partnership for Advanced Computing in Europe (PRACE) is a pan-European supercomputing RI 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 (AISBL) with its seat in Brussels. It has 26 member countries whose representative organizations create a pan-European supercomputing infrastructure, providing access to computing and data management resources and services for large-scale scientific and engineering applications at the highest performance level.

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 (France, Germany, Italy, and Spain) secured funding for the initial period from 2010 to 2015. In 2016 a fifth Hosting Member, ETH Zurich/CSCS (Switzerland) opened its system via the PRACE Peer Review Process to researchers from academia and industry. 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. PRACE systems are available to scientists and researchers from academia and industry from around the world through the following forms of access:

- Preparatory Access is intended for short-term access to resources, for code-enabling and porting, required to prepare proposals for Project Access and to demonstrate the scalability of codes. Applications for Preparatory Access are accepted at any time, with a cut-off date every 3 months.
- The PRACE SME HPC Adoption Programme in Europe (SHAPE) provides support to SMEs to include HPC in their business model.
- The Distributed European Computing Initiative (DECI) which is designed for projects requiring access to resources not currently available in the PI's own country and whose projects do not require resources on the very largest (Tier-0) European Supercomputers or very large computational allocations.
- Project Access is intended for individual researchers and research groups including multi-national research groups and can be used for 1-year production runs, as well as for 2-year or 3-year (Multi-Year Access) production runs.

Project Access is subject to the PRACE Peer Review Process, which includes technical and scientific review. Technical experts and leading scientists evaluate the proposals submitted in response to the bi-annual calls. Applications for Preparatory Access undergo technical review only.

IMPLEMENTATION

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 GEANT - 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.

Type	distributed
ESFRI status	landmark
Legal status	AISBL, 2010
Participants	1. Austria 2. Belgium 3. Bulgaria 4. Cyprus 5. Czech Republic 6. Denmark 7. Finland 8. France 9. Germany 10. Greece 11. Hungary 12. Ireland 13. Israel 14. Italy 15. Luxembourg 16. Netherlands 17. Norway 18. Poland 19. Portugal 20. Slovakia 21. Slovenia 22. Spain 23. Sweden 24. Switzerland 25. Turkey 26. UK
Contacts	Silke Lang Communications Officer Phone: +32 2 613 09 28 S.Lang@staff.prace-ri.eu For all general questions Email: info@prace-ri.eu Phone: +32 2 613 09 27
Web	https://prace-ri.eu

20. Square Kilometre Array (SKA)

DESCRIPTION

The Square Kilometre Array (SKA) initiative is an international endeavor to create the world's largest radio telescope, potentially with a target collecting area of over a square kilometer (one million square metres). One of the largest scientific endeavours in history, the SKA will bring together a wealth of the world's finest scientists, engineers and policy makers to bring the project to fruition. 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 SKA is being developed over a phased timeline. Pre-construction development officially started in 2013 and has taken place over a period of seven years, involving the detailed engineering design and governance work needed to bring the SKA to construction readiness. Construction of the SKA is scheduled to begin in 2021, while routine science observations are expected to start in the late 2020s.
In Australia, the SKA's low-frequency telescope should initially comprise 512 stations arranged in a large core with three spiral arms, spread over a distance of 65km. Each station will contain 256 individual antennas, representing more than 130,000 antennas in total.
In South Africa, 133 dish antennas shall be added to the existing 64-dish MeerKAT precursor telescope, totalling nearly 200 dishes to form the SKA's mid-frequency telescope array. Most dishes will be concentrated in a core, with three spiral arms extending over 150km.
This forms part of the "design baseline", an agreed description of the attributes of the telescope.
However, unlike single dish telescopes, the scalable nature of interferometers like the SKA means that more antennas can be added over time to increase its capability. The ultimate vision of the scientific community is to expand the SKA further across both sites and into other African countries. Such vision is commonly known as full SKA.

IMPACT

To date, there are 14 nations funding the SKA with membership across five continents. Over 100 research and industrial organizations 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 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.

Type	single-sited
ESFRI status	landmark RI
Operation start	2027
Participants	1. Australia 2. Canada 3. China 4. France 5. Germany 6. India 7. Italy 8. New Zealand 9. Spain 10. South Africa 11. Sweden 12. Switzerland 13. Netherlands 14. United Kingdom (lead country)
Contacts	SKA Organization Jodrell Bank Lower Withington Macclesfield Cheshire, SK11 9FT, UK Registered in England & Wales Company Number: 07881918 Phone: +44 (0)161 306 9600 Email: enquiries@skatelescope.org
Web	https://www.skatelescope.org

21. Systeme de Production d'lons Radioactifs en Ligne de 2e generation (SPIRAL2)

DESCRIPTION

The Systeme de Production d'lons 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).

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

Every year GANIL receives several hundred researchers and engineers to collaborate on scientific experiments and projects. In total, nearly 700 researchers from 65 laboratories in 30 different countries come to GANIL every year to conduct experiments or attend seminars.
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.

Type	single-sited
ESFRI status	landmark
Legal status	GANIL
Participants	**Members:** France
Contacts	Grand Accélérateur National d'Ions Lourds Bd Henri Becquerel BP 55027 – 14076 CAEN Cedex 05 France Phone: 33 (0)2.31.45.46.47 Email: accueil@ganil.fr
Web	https://www.ganil-spiral2.eu

22. European WindScanner Facility (WindScanner)

DESCRIPTION

The European WindScanner Facility (WindScanner) is set out to be a distributed RI for full scale atmospheric boundary-layer experimental research in wind and turbulence fields for wind energy. 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.

BACKGROUND

Wind energy is about to become the leading electricity generating technology across Europe. WindScanner is conceived as a new unique European distributed, mobile RI 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 kilometers. Via excessive data analysis WindScanner provides detailed inflow and wake measurements for validation and verification of wind turbine design and siting and for future optimization of design making wind energy cheaper and more reliable for the benefit of the society.

WindScanners generate very detailed and vast amounts of data, which are challenging for researchers and other users to interpret. In the forthcoming years, the WindScanner.eu research infrastructure operation needs to be made easier accessible to users and the scanned 3D wind velocity data interpretation less complex.

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.

When the research infrastructure has been established it is expected to consist of 6-8 national distributed nodes in Europe in which each node possesses and operates its own sets of mobile WindScanner Systems. The mobile distributed research infrastructure will be led from the WindScanner central hub (WCH) located in Denmark at DTU. 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.

The participants are all partners of the European Energy Research Alliance (EERA) and the WindScanner vision is to develop a European Research Infrastructure that underpins the EERA Joint Programme on Wind Energy.

Type	distributed
ESFRI status	project
Legal status	pending
Participants	1. Denmark (lead country) 2. Germany 3. Greece 4. Netherlands 5. Norway 6. Portugal 7. Spain
Operation start	2021
Contacts	DTU Wind Energy DTU Risø Campus Frederiksborgvej 399 4000 Roskilde Mr. Søren Knudsen Email: sknu@dtu.dk
Web	https://www.windscanner.eu

23. European X-Ray Free-Electron Laser (European XFEL)

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.

ACTIVITY

The European XFEL provides academic and industrial users with ideal testing opportunities, offering a unique source, excellent science facilities and outstanding customer experience across the entire scientific process, from requests for experimental ideas to data processing. Thereby, the facility creates all conditions to obtain a large number of high-impact scientific results, and delivers breakthroughs in fundamental and applied research, enabled by the unique characteristics of the European XFEL beams. In doing so the European XFEL has created a vibrant scientific community in all its member states within the use of X-ray and free electron laser science.
To seize the very wide range of scientific opportunities opened up by the European XFEL, the facility has extended the application of FEL X-rays into completely new areas of science, including (i) ultrafast structural and electronic dynamics in atoms, molecules, (ii) dynamics in liquid solutions of chemical and catalytic compounds, (iii) dynamics in complex soft and hard materials and nanomaterials, (iv) high energy dense matter and (v) static structures and kinetics of biomolecules and complex bio-systems. These are areas where scientific breakthroughs inevitable will lead to new technologies that are not only important

for industry, but might also be decisive for the directions our society will develop in terms of health, transportation, communication, energy and sustainability. New drugs and targeted medical treatments will be developed on the basis of a better understanding on the structure and dynamics of membrane proteins, new complex materials with advanced functionalities will be developed for computing and sensing, new energy storage materials will be developed for batteries and the improved understanding of the dynamics of materials will lead to longer lifetimes and more advanced functionalities.

IMPLEMENTATION

In the long run, the European XFEL will lead to socio-economic impact by utilizing new knowledge and creating new technologies. In order to achieve this long-term goal, the facility has a vigorous technology transfer program in place that will facilitate new technologies developed at the European XFEL to be transferred into economic growth. Furthermore, the European XFEL promotes knowledge transfer via human capital.

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.

Type	single-sited
ESFRI status	landmark
Legal status	GmbH, European XFEL, EIROforum
Participants	1. Denmark 2. France 3. Germany 4. Hungary 5. Italy 6. Poland 7. Russia 8. Slovakia 9. Spain 10. Sweden 11. Switzerland 12. United Kingdom
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