



ESFRI

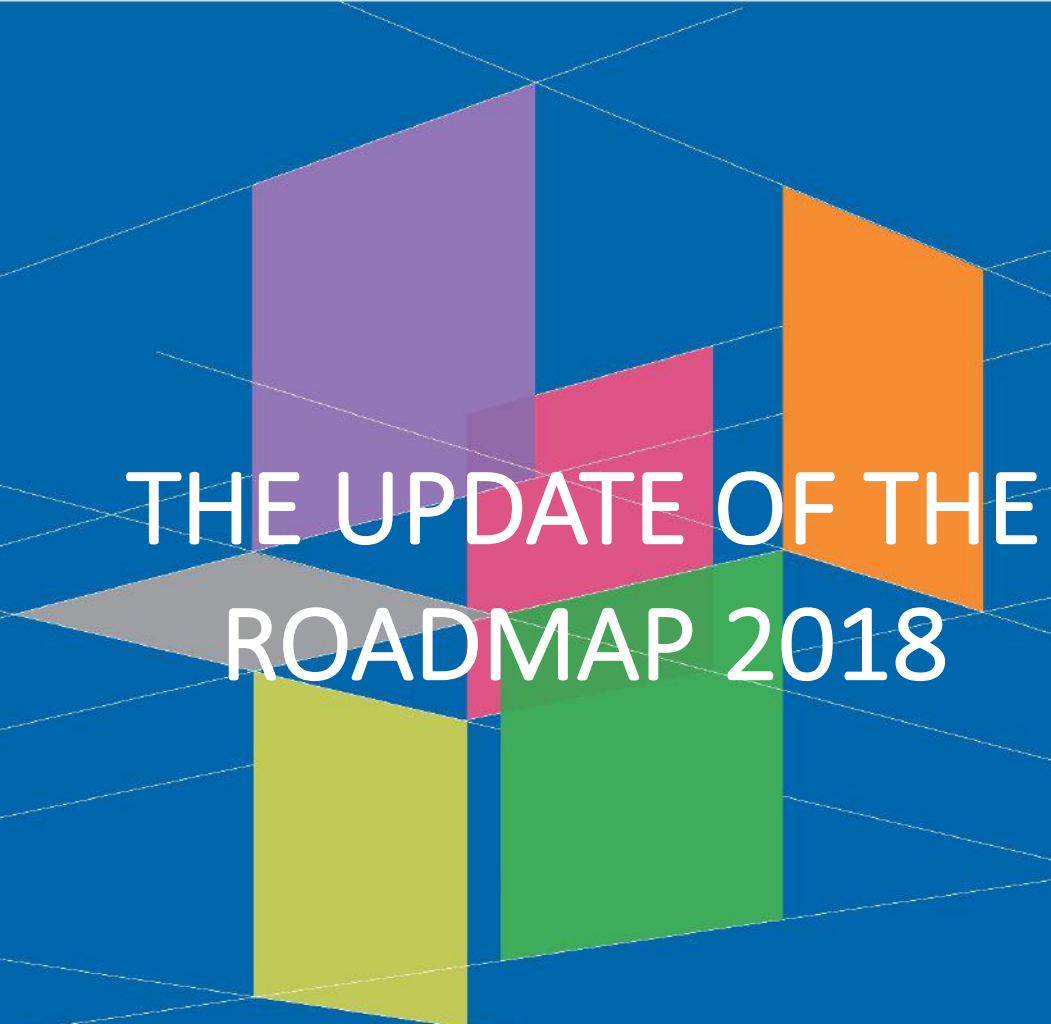


Roadmap 2018
Info Day



LIVE WEBCAST

17.01.17
Malaga, Spain



THE UPDATE OF THE
ROADMAP 2018

Strategy Report on Research Infrastructures
ROADMAP 2018

Info Day – 17th January 2017

Málaga
Spain

ROLE OF ESFRI

The European Strategy Forum on Research Infrastructures (ESFRI) was established in 2002 with a mandate from the Council of the European Union to:

- support a coherent and strategy-led approach to policy-making on research infrastructures in Europe
- facilitate multilateral initiatives leading to the better use and development of research infrastructures

ESFRI brings together representatives of Ministers of the 28 Member States, 12 Associated States, and of the European Commission that are the decision makers and financiers of the ESFRI Research Infrastructures

- Indicates strategies for the necessary major financial investment (~20 b€) and long-term commitment for operation (~2 b€/year, +15% of current effort)
- Upon mandate of Competitiveness Council of the European Union, ESFRI has completed the ESFRI Roadmap 2016 and starts now the update process that will lead to the

ESFRI Roadmap 2018

Info Day – 17th January
Málaga, Spain

ESFRI ROADMAP

The Roadmap identifies new pan-European Research Infrastructures or major up-grades to existing ones, corresponding to the needs of European research communities in the next 10 to 20 years, in all fields of research

The Roadmap was realised in:

- 2006, 35 RIs
- 2008, 44 RIs
- 2010, 48 RIs



NEW SINCE 2016:

The Roadmap 2016 also identifies the ESFRI Landmarks that are implemented projects leading in their domain and structuring the European and global landscape.

- 2016, 21 Projects & 29 Landmarks



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Three Sections, e-document

PL ESFRI ROADMAP 2016

STRATEGY REPORT ON RESEARCH INFRASTRUCTURES

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ESFRI PROJECTS

	NAME	FULL NAME	ROADMAP ENTRY (YEAR)	OPERATION (YEAR)	LEGAL STATUS (AS OF 10 MARCH 2016)	CONSTRUCTION COSTS (M€)	OPERATIONAL ANNUAL BUDGET (M€/YEAR)	
ENERGY	ECCSEL	European Carbon Dioxide Capture and Storage Laboratory Infrastructure	2006	2016	ERIC under preparation	80-120	1**	
	EU-SOLARIS	European SOLAR Research Infrastructure for Concentrated Solar Power	2010	2020*	ERIC under preparation	120	3-4	
	MYRRHA	Multi-purpose hybrid Reactor for High-tech Applications	2010	2024*		NA	100	
	WindScanner	European WindScanner Facility	2010	2018*		45-60	8	
ENVIRONMENT	ACTRIS	Aerosols, Clouds and Trace gases Research Infrastructure	2016	2025*		190	50	
	DANUBIUS-RI	International Centre for Advanced Studies on River-Sea Systems	2016	2022*		222	28	
	EISCAT_3D	Next generation European Incoherent scatter radar system	2006	2021*		74	6	
	EPOS	European Plate Observing System	2006	2020*	ERIC under preparation	53	15	
	SIOS	Svalbard Integrated Arctic Earth Observing System	2006	2020*		80	2-3	
	AnaEE	Infrastructure for Analysis and Experimentation on Ecosystems	2010	2018*		200	2-3**	
HEALTH & FOOD	EMBRIC	European Marine Biological Resource Centre	2006	2016	ERIC under preparation	4,5	6	
	EMPHASIS	European infrastructure for multi-scale Plant Phenomics and Simulation for food security in a changing climate	2016	2020*		73	3,6	
	ERINHA	European research infrastructure on highly pathogenic agents	2006	2018*		NA	NA	
	EU-OPENSREEN	European Infrastructure of Open Screening Platforms for Chemical Biology	2006	2018*	ERIC under preparation	7	1,2	
	Euro-BioImaging	European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences	2006	2017*	ERIC under preparation	NA	1,55	
	ISBE	Infrastructure for Systems Biology Europe	2010	2018*		30	7,2	
	MIRRI	Microbial Resource Research Infrastructure	2010	2019*		6,2	1	
	CTA	Cherenkov Telescope Array	2006	2023*		297	20	
PHYSICAL SCIENCES & ENGINEERING	EST	European Solar Telescope	2016	2026*		200	9	
	KM3NeT 2.0	KM3 Neutrino Telescope 2.0: Astroparticle & Oscillations Research with Cosmics in the Abyss	2016	2020*		92	3	
	E-RHS	European Research Infrastructure for Heritage Science	2016	2022*		4	5	

*expected **for centralised service NA=Not Available

21 Projects

29 Landmarks

ESFRI LANDMARKS

	NAME	FULL NAME	ROADMAP ENTRY (YEAR)	OPERATION (YEAR)	LEGAL STATUS (AS OF 10 MARCH 2016)	CAPITAL VALUE (M€)	OPERATIONAL ANNUAL BUDGET (M€/YEAR)	
ENERGY	JHR	Jules Horowitz Reactor	2006	2020*		1,000	NA	
	EMSO	European Multidisciplinary Seafloor and water-column Observatory	2006	2016	ERIC under preparation	108	36	
	EURO-ARGO ERIC	European contribution to the International Argo Programme	2006	2014	ERIC, 2014	10	8	
	IAGOS	In-service Aircraft for a Global Observing System	2006	2014	AISBL, 2014	25	6	
ENVIRONMENT	ICOS ERIC	Integrated Carbon Observation System	2006	2016	ERIC, 2015	48	24-35	
	LifeWatch	e-Infrastructure for Biodiversity and Ecosystem Research	2006	2016	ERIC under preparation	66	10	
	BBMRI ERIC	Biobanking and BioMolecular resources Research Infrastructure	2006	2014	ERIC, 2013	170-220	3,5	
	EATRIS ERIC	European Advanced Translational Research Infrastructure in Medicine	2006	2013	ERIC, 2013	500	2,5	
HEALTH & FOOD	ECRIN ERIC	European Clinical Research Infrastructure Network	2006	2014	ERIC, 2013	1,5	2	
	ELIXIR	A distributed Infrastructure for life-science information	2006	2014	ELIXIR Consortium Agreement, 2013	125	95	
	INFRAFRONTIER	European Research Infrastructure for the generation, phenotyping, archiving and distribution of mouse disease models	2006	2013	GmbH, 2013 ERIC under preparation	180	80	
	INSTRUCT	Integrated Structural Biology Infrastructure	2006	2012	International Consortium Agreement, 2012 ERIC under preparation	285	25	
	E-ELT	European Extremely Large Telescope	2006	2024*	Programme of ESO	1,000	40	
	ELI	Extreme Light Infrastructure	2006	2018*	AISBL, 2013 ERIC under preparation	850	90	
	EMFL	European Magnetic Field Laboratory	2008	2014	AISBL, 2015	170	20	
	ESRF UPGRADES	Phase I Phase II: Extremely Brilliant Source	2006 2016	2015 2022*	Programme of ESRF	180 150	82	
PHYSICAL SCIENCES & ENGINEERING	European Spallation Source ERIC	European Spallation Source	2006	2025*	ERIC, 2015	1,843	140	
	European XFEL	European X-Ray Free-Electron Laser Facility	2006	2017*	GmbH, 2009	1,490	115	
	FAIR	Facility for Antiproton and Ion Research	2006	2022*	GmbH, 2010	1,262	234	
	HL-LHC	High-Luminosity Large Hadron Collider	2016	2026*	Programme of CERN	1,370	100	
	ILL 20/20	Institut Max von Laue-Paul Langevin	2006	2020*	Programme of ILL	171	92	
	SKA	Square Kilometre Array	2006	2020*	SKAO, 2011	650	75	
	SPIRAL2	Système de Production d'Ions Radioactifs en Ligne de 2e génération	2006	2016	Programme of GANIL	110	5-6	
	CESSDA	Consortium of European Social Science Data Archives	2006	2013	Norwegian limited company, 2013 ERIC under preparation	NA	1,9	
	CLARIN ERIC	Common Language Resources and Technology Infrastructure	2006	2012	ERIC, 2012	NA	12	
	DARIAH ERIC	Digital Research Infrastructure for the Arts and Humanities	2006	2019*	ERIC, 2014	4,3	0,6	
SOCIAL & CULTURAL INNOVATION	ESS ERIC	European Social Survey	2006	2013	ERIC, 2013	NA	6	
	SHAPE ERIC	Survey of Health, Ageing and Retirement in Europe	2006	2011	ERIC, 2011	110	12	
	PRACE	Partnership for Advanced Computing in Europe	2006	2010	AISBL, 2010	500	120	

*expected NA=Not Available





ESFRI PROJECTS

The ESFRI Projects listed in **Part 1** are individually described in the following pages. They were selected for scientific excellence and maturity and represent strategic objectives for strengthening the European Research Infrastructure system.

Fifteen projects were listed in previous editions of the ESFRI Roadmap – nine in the 2008 update, and six in the 2010 update. Five new entries and one reoriented project integrate the Roadmap 2016. They were selected among the 20 eligible proposals through the evaluation procedure outlined in **Part 1**.

The ESFRI Projects have a maximum term of “residency” on the Roadmap of 10 years. After that term the fully implemented projects may become Landmarks. Non-implemented projects leave the Roadmap: if desired they can be re-submitted with a revised programme and will compete with other new projects.

10 years maximum
Term for status of
ESFRI Project

Scientific and
maturity evaluation

Pan-European
added value

Hearings

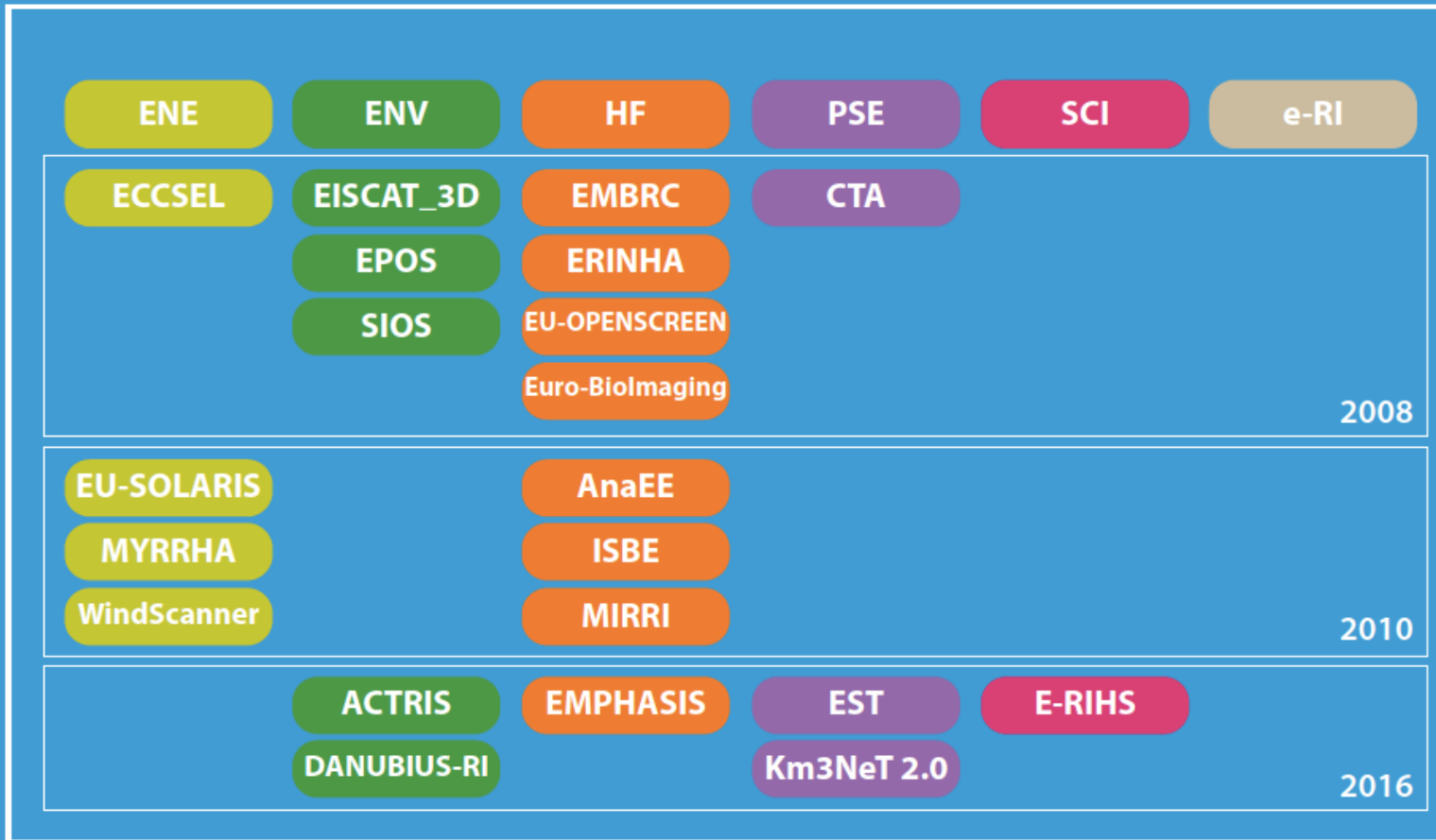
Monitoring

Assessment



ESFRI PROJECTS

ESFRI PROJECTS



MONITORING 2018

— 2008 PROJECTS

— 2010 PROJECTS



An infrastructure for heritage interpretation, preservation, documentation and management

TYPE: distributed
COORDINATING COUNTRY: IT
PROSPECTIVE MEMBER COUNTRIES: BE, CZ, DE, EL, ES, FR, HU, IT, NL, PT, UK

PARTICIPANTS: BG, BR, CY, DK, IE, IL, PL, SE, SI

TIMELINE

- ESFRI Roadmap entry: 2016
- Preparation phase: 2016-2019
- Construction phase: 2020-2021
- Operation start: 2022

ESTIMATED COSTS

- Capital value: Not Available
- Preparation: 2 M€/year
- Construction: 4 M€ (Central Hub)
- Operation: 5 M€/year

HEADQUARTERS

Proposed in Florence, Italy. To be finalized in the Preparatory Phase with possibly the involvement of ICCROM-International Centre for the Study of the Preservation and Restoration of Cultural Property

WEBSITE

www.e-rihs.eu



ITALY

E-RIHS

European Research Infrastructure for Heritage Science

Description

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

Background

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

E-RIHS exploits the synergy of the cooperation among the academy, research centers and cultural institutions. The global lead that the EU holds in this research field, so precariously supported by a combination of

national and EU measures, requires a joint and resolved effort. This has been fully recognized by the European Union with the continuous and reiterated support of initiatives aimed at integrating existing Heritage Science infrastructures, as well as, with a focus on Member States' national research programs, the JPI on Cultural Heritage, coordinating efforts of 17 EU national funding bodies supporting heritage science. The enthusiastic reviews of these initiatives testify the success of their action to advance knowledge and to establish a research community, acknowledged as "advanced" in official EU documents concerning conservation, or quickly growing in the field of archaeology as shown by the performance indicators of the relevant project ARIADNE.

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

Steps for implementation

E-RIHS is expected to lead a Preparatory Phase in the years 2016-2019 which will be used to address legal status and governance/management organization. This will lead to application to ERIC (or to other suitable legal form). The establishment of a legal structure and governance and the refinement of the business plan for long-term sustainability will be the three most important deliverables, together with demonstrators of users access as implemented by the consortium availing of the existing infrastructure projects.

Preliminary work will also be done in the framework of the H2020 IPERION-CH project started in May 2015. E-RIHS will be launched as a stand-alone RI in 2020. Further developments are planned for connecting and including partners and facilities outside EU, and gradually reaching the status of a global distributed research infrastructure.



Distributed under construction

Distributed delivering scientific services

EPOS

European Plate Observing System

Description

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

Background

Solid Earth science is concerned with the internal structure and dynamics of planet Earth, from the inner core to the surface; it deals with physical and chemical processes covering wide temporal and spatial scales, from microseconds to billions of years and from nanometres to thousands of kilometres. 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 observatories, satellite data and products, geomagnetic observatories, anthropogenic hazards, geological information and modelling, multi-scale laboratories and geo-energy test-beds for low-carbon energy.



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

Steps for implementation

The EPOS implementation phase builds on the achievements of the EPOS Preparatory Phase and will last from 2015 to 2019. During this phase two key outcomes will be achieved: the implementation of the community and integrated services — Thematic Core Services (TCS) and Integrated Core Services (ICS) — and the legal establishment of the EPOS European Research Infrastructure Consortium (ERIC). EPOS will build the new research platform by ensuring sustainability, governance and integration within the whole EPOS delivery framework of the community services (TCS), by developing the integrated services (ICS) for interoperability and data management, by creating optimal conditions for the central coordination as well as designing the access to distributed computational resources, and by ensuring long-term financial and legal sustainability through the harmonization of the EPOS research infrastructure with national priorities and strategies.

With an ERIC to be located in Rome (Italy), EPOS will provide an opportunity for Europe to maintain world-leading European Earth sciences and will represent a model for pan-European federated infrastructure.

A long-term plan for the integration of national and transnational facilities and resources for solid Earth science

TYPE: distributed
COORDINATING COUNTRY: IT
PROSPECTIVE MEMBER COUNTRIES: CH, CZ, DK, EL, ES, FI, FR, IE, IS, IT, NL, NO, PL, PT, RO, SI, SK, TR, UK

PARTICIPANTS: AT, BE, BG, DE, HU, SE

TIMELINE

- ESFRI Roadmap entry: 2008
- Preparation phase: 2010-2014
- Implementation phase: 2015-2019
- Construction phase: 2019-2022
- Operation start: 2020

ESTIMATED COSTS

- Capital value: 500 M€
- Preparation: 4.5 M€
- Implementation: 32 M€
- Construction: 53 M€
- Operation: 15 M€/year

HEADQUARTERS

Istituto Nazionale di Geofisica e Vulcanologia-INGV
 Rome
 Italy

WEBSITE

<http://www.epos-eu.org/>



ITALY

An advanced telescope for observing the Sun and its magnetic activity

TYPE: single-sited
COORDINATING COUNTRY: ES
PROSPECTIVE MEMBER COUNTRIES: ES, SE, UK

PARTICIPANTS: AT, CH, CZ, DE, FR, HR, HU, IT, NL, NO, PL, SK

TIMELINE

- ESFRI Roadmap entry: 2016
- Preparation phase: 2011-2019
- Construction phase: 2019-2025
- Operation start: 2026

ESTIMATED COSTS

- Capital value: Not Available
- Preparation: 10 M€
- Construction: 200 M€
- Operation: 9 M€/year

HEADQUARTERS

Instituto de Astrofísica de Canarias
 Canary Islands
 Spain

WEBSITE

<http://www.est-east.eu/>



SPAIN

EST European Solar Telescope

Description

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

Background

The solar physics community was involved in the development of the project from the beginning: i) creation of the EAST consortium, ii) elaboration of the conceptual design study, iii) I3 Trans-National Access network SOLARNET and iv) GREST project. The solar astronomy community is organized through SOLARNET and ASTRONET and operates with success, since the last decades, a set of national observing facilities and infrastructures on the Canary Islands including the Swedish Solar Telescope, the DOT, the VTT, GREGOR and THEMIS, most of which are approaching the end-of life stage. These national observatories shall be decommissioned or reoriented to become test facilities for detector development or to educational programmes, and the research programme shall concentrate to the EST. Key elements of the landscape



are the space missions, in particular the ESA Solar Orbiter programme to be launched in 2018, and the US Daniel K. Inouye Solar Telescope (DKIST, formally the Advanced Technology Solar Telescope ATST), currently being built in Hawaii. DKIST is an asymmetric telescope with an observation programme concentrated on the Sun's corona and linked with space missions. EST has the same diameter (4m) but it is symmetric and optimized to detect light polarization as it is mandatory for the study of the emergence of magnetic fields at the solar surface and transfer of magnetic and kinetic energy from subsurface layers to the solar atmosphere. A significant advance can be achieved by obtaining observations, of the lower/cooler part of the solar atmosphere, with greatly improved spatial and temporal resolutions. The behaviour of the solar atmosphere in response to the input of magnetic energy is then observable with space instrumentation. The combination of space and ground-based instrumentation will allow a throughout comprehension of the solar magnetic dynamics.

Steps for implementation

EST will be built in the Canary Islands, where the current aging telescopes are already situated. This will give continuity and increase the importance of the scientific parks existing at present in the islands. Operation of the telescope will progressively implement "queue-mode" observing, which is standard for night-time telescopes, allows optimisation of the observations, and does not require on-site presence of the beneficiary. 30% of the observing time will be through open calls for proposals, and the open access data policy (after a one year proprietary period) allows access to the whole interested scientific community. Siting will be decided between the Tenerife or Roque de los Muchachos both at 2.400 m of altitude in the Canary islands along with sea-level and mainland facilities including the TOSC (Telescope Operation and Science Center) to steer the operation of the EST and the Science Data Center in Germany, to provide data storage and access to the solar physics community.

To be constructed

Siting outside Europe: Chile-Paranal -gGmbH

CTA Cherenkov Telescope Array

Description

The Cherenkov Telescope Array (CTA) will be an advanced facility for ground-based very high-energy gamma-ray astronomy. With two sites, in the southern and northern hemispheres, 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.

Background

High-energy gamma-rays probe a non-thermal Universe because, apart from the Big Bang, there is nothing hot enough in the known Universe to emit such gamma-rays. These gamma-rays can be generated when highly relativistic particles collide with ambient gas, or interact with photons and magnetic fields (bottom-up process). By studying their energy and flux spectrum, it is possible to trace these cosmic rays and electrons in distant regions of our own Galaxy or even in other galaxies. High-energy gamma-rays can also be produced in a top-down fashion by decays of heavy particles such as the hypothetical dark matter particles. Therefore, gamma-rays provide a window to the discovery of the nature and constituents of dark matter, relics which might be left over from the Big Bang.

The present generation of imaging atmospheric Cherenkov telescopes (H.E.S.S., MAGIC and VERITAS) has in recent years opened the realm of ground-based gamma ray astronomy in the energy range above a few tens of GeV. The Cherenkov Telescope Array will explore our Universe in depth in Very High Energy (VHE, E>10 GeV) gamma-rays and investigate cosmic non-thermal processes, in close cooperation with

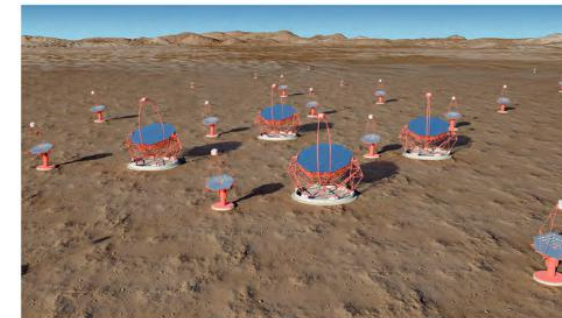
observatories operating at other wavelength ranges of the electromagnetic spectrum, and those using other messengers such as cosmic rays and neutrinos.

The CTA Research Infrastructure 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.

Steps for implementation

CTA is included in the ESFRI Roadmap since 2008 and it is a priority for scientific communities in astronomy at an international level. It represents one of the "Magnificent Seven" of the European strategy for Astroparticle Physics published by ASPERA, and highly ranked in the strategic plan for European astronomy of ASTRONET. In addition, CTA is a recommended project for the next decade in the US National Academies of Sciences Decadal Review.

After a 5-years preparation phase, CTA is now in a pre-construction phase and is about to transit to the implementation phase. On July 2015, the CTA Resource Board decided to enter into detailed contract negotiations for hosting CTA on the European Southern Observatory (ESO) Paranal grounds in Chile and at the Instituto de Astrofísica de Canarias (IAC), Roque de los Muchachos Observatory in La Palma, Spain. The CTA facility will be operational as a proposal-driven observatory, with a Science Data Centre providing transparent access to data, analysis tools, and user training.



Cherenkov Telescope Array for High-Energy Gamma-Ray Astronomy to probe a non-thermal Universe

TYPE: distributed
COORDINATING COUNTRY: DE

PARTICIPANTS: AM, AR, AT, AU, BG, BR, CA, CH, CL, CZ, DE, EL, ES, FI, FR, HR, IE, IN, IT, JP, MX, NA, NL, NO, PL, SE, SI, TH, UA, UK, US, ZA

TIMELINE

- ESFRI Roadmap entry: 2008
- Preparation phase: 2011-2016
- Construction phase: 2017-2023
- Pre-operation start: 2019
- Operation start: 2023
- Legal status: CTAD gGmbH, 2014

ESTIMATED COSTS

- Capital value: 400 M€
- Preparation: 8 M€/year
- Construction: 297 M€
- Operation: 20 M€/year

HEADQUARTERS

Cherenkov Telescope Array Observatory, gGmbH
 Heidelberg
 Germany

WEBSITE

<https://portal.cta-observatory.org>



GERMANY

KM3NeT 2.0

KM3 Neutrino Telescope 2.0: Astroparticle & Oscillations Research with Cosmics in the Abyss

Description

The KM3 Neutrino Telescope 2.0 (KM3NeT 2.0) intends to examine astrophysical objects by detecting their high-energy neutrino emission and to investigate neutrino properties by measuring neutrinos produced through cosmic-ray interactions in the atmosphere. The research infrastructure comprises two deep-sea installations with shore stations, located off shore Toulon, France and Capo Passero, Italy. Data are processed and stored on three main computing centres: CCIN2P3-Lyon (CNRS), CNAF (INFN) and the ReCaS infrastructure. The deep-sea installations will also feature user ports for earth and sea sciences, thus offering unique opportunities for interdisciplinary research for continuous, real-time measurements, for example for marine biology, oceanography or environmental sciences.

Background

Neutrinos are unique messengers from the most violent, highest-energy processes in our Galaxy and far beyond. Their measurement will allow for new insights into the mechanisms and processes that govern the non-thermal Universe and will complement high-energy gamma ray astronomy and cosmic ray studies. Neutrinos are extremely light particles and electrically neutral thus travelling in straight lines from their origin to the Earth. They interact weakly and thus can escape dense regions where they are generated. They are inevitably produced in any environment containing protons or nuclei at the typical energies observed in cosmic rays. Neutrinos are ideal for observing the highest-energy phenomena in the Universe and, in particular, pinpointing the hitherto unknown sources of cosmic rays.

The IceCube neutrino telescope at the South Pole has detected a flux of cosmic neutrinos which is assumed to have its origin in extragalactic sources. They might

be the same sources that produce the flux of the highest energy gamma rays observed, for instance, by H.E.S.S. The high-energy neutrino part of KM3NeT 2.0 (ARCA) will detect the neutrino flux reported by IceCube and will provide essential data concerning its origin, energy spectrum and flavour composition. Due to its location in the Northern hemisphere, the ARCA information will be complementary to the IceCube measurements.

The ANTIARES experiment, which represents the proof of concept for KM3NeT, has demonstrated that the instrumentation of neutrino telescopes has the capability of studying neutrino oscillations. Therefore, the second major objective of KM3NeT 2.0 (ORCA) is to examine the properties of neutrinos and to determine the neutrino mass hierarchy. The ORCA detector will provide in addition sensitivity to low-mass dark matter and possibly also to the composition of the earth's interior via neutrino tomography.

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

KM3NeT appeared on the ESFRI Roadmap in 2006 for the first time. The phase one of the project has led to the engineering of the modular detector and to construction of the final prototypes. The resubmission of KM3NeT 2.0 redefines the previous project and adopts it to the scientific and technological progress which has been made in the last years. It is effectively under construction as a first set of the new detectors is being deployed at this time.

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

TYPE: distributed
COORDINATING COUNTRIES: NL
PROSPECTIVE MEMBER COUNTRIES: EL, FR, IT, NL

PARTICIPANTS: CY, DE, ES, IE, PL, RO, UK

TIMELINE

- ESFRI Roadmap entry: 2006, 2016
- Preparation phase: 2008-2014
- Construction phase: 2016-2020
- Operation start: 2020

ESTIMATED COSTS

- Capital value: 137 M€
- Preparation: 45 M€
- Construction: 92 M€
- Operation: 3 M€/year

HEADQUARTERS

KM3NeT-HQ
 Amsterdam Science Park
 Amsterdam
 The Netherlands

WEBSITE

<http://www.km3net.org/>



THE NETHERLANDS

One Project that Resubmitted in 2016 as Reoriented / Renewed Proposal in competition with all New Proposals and was selected:

Updated Science Programme
 Updated Management/Governance
 New technology (developed and proven in previous period)
 Restructured budget
 Restructured partnership and coordination



ESFRI ROADMAP 2016

STRATEGY REPORT ON RESEARCH INFRASTRUCTURES

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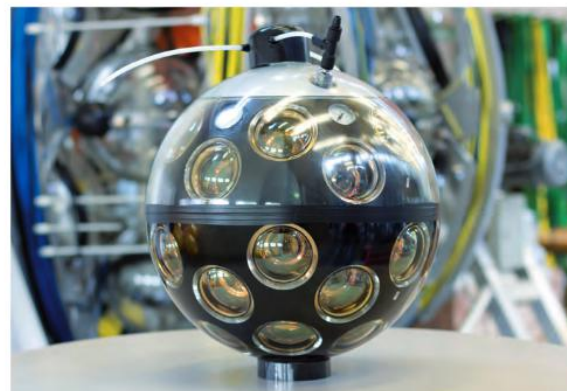
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Periodic monitoring
for confirmation of
status of
ESFRI Landmark

Scientific impact
and good
management
evaluation

GLOBAL dimension
GLOBAL access
GLOBAL data access

Possible evolution
towards GRI

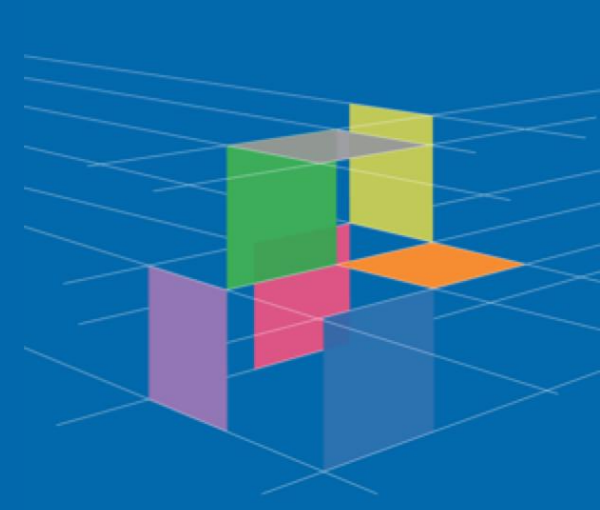


ESFRI LANDMARKS

The ESFRI Landmarks listed in **Part 1** are individually described in the following pages. These are former ESFRI Projects that have reached the implementation stage and are now established as major elements of competitiveness of the European Research Area.

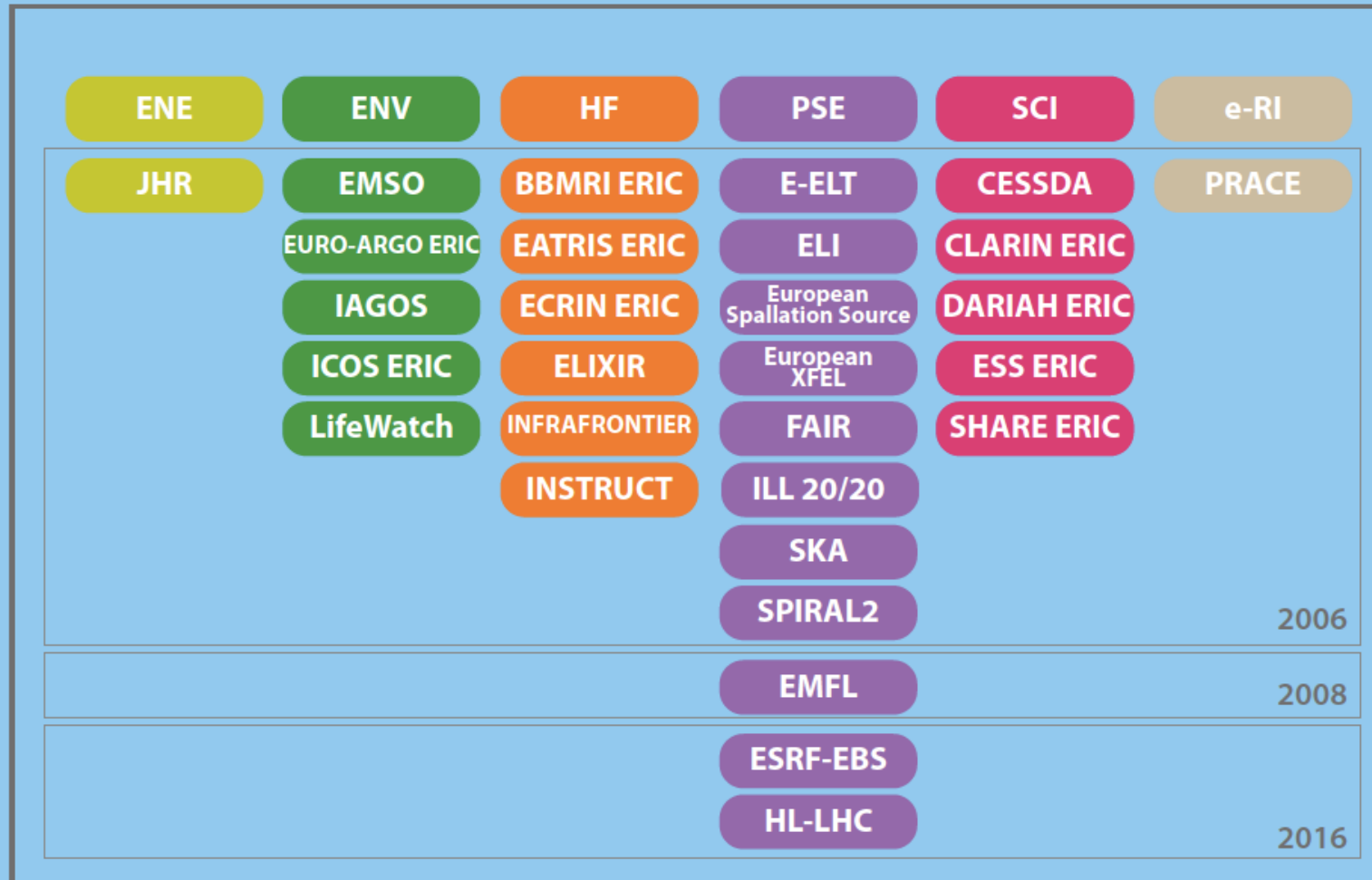
Most of the Landmarks were first identified as ESFRI Projects in the Roadmaps 2006 and 2008. Two Landmarks were selected among the 20 eligible proposals through the evaluation procedure outlined in **Part 1** recognizing that their implementation is underway.

The ESFRI Landmarks need continuous support for successful completion, operation and upgrade in line with the optimal management and maximum return on investment criteria. Periodic review of the Landmarks will be carried out by ESFRI in order to verify the continuous fulfilment of the reference role in their respective domains.



ESFRI LANDMARKS

ESFRI LANDMARKS



PILOT PERIODIC REVIEW

- ICOS ERIS
- ELIXIR
- SPIRAL2
- European Social Survey ERIC

Info Day – 17th January
Málaga, Spain



The world's biggest eye on the sky to revolutionise our perception of the Universe

TYPE: single-sited
COORDINATING ENTITY: ESO
MEMBER COUNTRIES: AT, BE, CH, CZ, DE, DK, ES, FI, FR, IT, NL, PL, PT, SE, UK

PARTICIPANTS: BR

TIMELINE

- ESFRI Roadmap entry: 2006
- Preparation phase: 2006-2012
- Construction phase: 2014-2024
- Operation start: 2024

ESTIMATED COSTS

- Capital value: 1.000 M€
- Operation: 40 M€/year

HEADQUARTERS

ESO
 Garching
 Germany

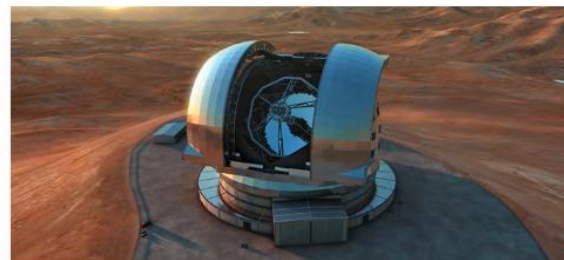
WEBSITE

<http://www.eso.org/public/teles-instr/e-elt/>



ESO

E-ELT European Extremely Large Telescope



Description

The European Extremely Large Telescope (E-ELT) is a revolutionary new ground-based telescope developed by ESO 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 main mirror, the E-ELT will be the largest optical/near-infrared telescope in the world: the world's biggest eye on the sky.

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

Activity

The telescope's primary mirror will be almost half the length of a soccer pitch in diameter and will gather 15 times more light than today's largest optical telescopes. The optical design comprises a three-mirror anastigmat with two flat folding mirrors providing the adaptive optics to correct for the turbulent atmosphere, giving unprecedented image quality. One is supported by more than 6.000 actuators operating at a frequency of 1.000 Hz. The primary mirror consists of 798 hexagonal segments, each 1,4 metres wide. The secondary mirror will have a diameter of 4 metres. The telescope will have several science instruments, with switching from one instrument to another within minutes. The ability to observe over a wide range of wavelengths from the optical to mid-infrared will allow scientists to exploit the telescope's size to the fullest extent.

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

Impact

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

Concerning the contribution to societal challenges, astronomy is basic science in its most fundamental form and its main purpose is to enhance our understanding of the Universe, its evolution and the role of planet Earth as our cosmic home. It does not aim to contribute towards addressing short-term societal challenges, but just as for example quantum physics, the findings in astronomy have a potentially most profound impact on society in the long run, both in technological and cultural terms.

Under Construction Delivering Science Services

ELIXIR A distributed infrastructure for life-science information



Description

The distributed infrastructure for life-science information (ELIXIR) is a unique initiative that consolidates Europe's national centres, services, and core bioinformatics resources into a single, coordinated infrastructure. By coordinating these resources, ELIXIR supports the data-related needs of Europe's 500.000 life-scientists and helps address the Grand Challenges across life sciences from marine research via plants and agriculture to health research and medical sciences.

In 2013, ELIXIR became a permanent legal entity following the ratification of the ELIXIR Consortium Agreement (ECA) by EMBL and the first five countries. The countries that have signed the ECA are full members of the ELIXIR Board. Additional Observer countries (Greece, Ireland and Slovenia) are progressing the ratification of the ECA.

Activity

ELIXIR is an inter-governmental organisation, which builds on existing data resources and services within Europe. It follows a Hub and Nodes model, with a single Hub located alongside EMBL-EBI at the Wellcome Genome Campus in Hinxton (Cambridge, UK) and a growing number of Nodes located at centres of excellence throughout Europe, which coordinate nationally the bioinformatics services within that country. The ELIXIR Hub accommodates the ELIXIR Executive Management and Secretariat, coordinates and supports integration of services run from the ELIXIR Nodes, has overall responsibility for developing and delivering the ELIXIR Programme and managing ELIXIR-funded activities carried out by Nodes.

ELIXIR Nodes, sited throughout ELIXIR Member States, run the resources and services that are part of ELIXIR. These include: data deposition resources for depositing data safely and securely; added-value databases providing researchers with access to well curated data; bio-compute centres for cloud computing and analysis; services for the integration of data, software, tools and resources; training; and standards, ontology and data management expertise. For example, the ELIXIR Tools and Service registry is a discovery portal for researchers to access over 2.100 life science databases and analysis tools.

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

Impact

Industry's interest in, and usage of, Europe's bioinformatics resources is high as demonstrated by the 110 million hits from commercial users to the EMBL-EBI website in 2014. Promoting the future innovation potential and industry impact is an important objective of ELIXIR. This clearly extends beyond the obvious industry "users" of data and related services, and includes professional data publishers, SMEs providing data and bioinformatics services and tools as well as hardware and infrastructure providers.

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 such as the 1.000 Genomes. The development and validation of drug-design tools, many of which are have been successfully commercialised, has relied on carefully curated datasets extracted from publicly archived data resources such as the Protein Data Bank. This integrated infrastructure is essential for European life science research as the enhanced technical architecture will facilitate access to well-curated data, international collaboration and ultimately play an integral role in the transformation of bio-industries.

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 benefited from bespoke events targeting the pharma and agri-tech sectors.

A sustainable infrastructure for interoperability of public biological and biomedical data resources

TYPE: distributed
COORDINATING COUNTRY: UK
MEMBER COUNTRIES/ENTITY: BE, CH, CZ, DK, EE, ES, FI, FR, IL, IT, NL, NO, PT, SE, UK, (EMBL)

PARTICIPANTS: EL, IE, SI

TIMELINE

- ESFRI Roadmap entry: 2006
- Preparation phase: 2007-2013
- Construction phase: 2013-2020
- Operation start: 2014
- Legal status: ELIXIR Consortium Agreement, 2013

ESTIMATED COSTS

- Capital value: 125 M€
- Operation: 95 M€/year

HEADQUARTERS

Wellcome Genome Campus
 Hinxton
 United Kingdom

WEBSITE

<http://www.elixir-europe.org>



UNITED KINGDOM

The top level of the European High Performance Computing ecosystem

TYPE: distributed
COORDINATING ENTITY: PRACE-AISBL

PARTICIPANTS: AT, BE, BG, CH, CY, CZ, DE, DK, EL, ES, FI, FR, HU, IE, IL, IT, LT, NL, NO, PL, PT, RO, SE, SI, SK, TR, UK

TIMELINE

- ESFRI Roadmap entry: 2006
- Preparation phase: 2010-2013
- Construction phase: 2011-2015
- Operation start: 2010
- Legal status: AISBL, 2010

ESTIMATED COSTS

- Capital value: 500 ME
- Operation: 120 ME/year

HEADQUARTERS

PRACE-AISBL
Brussels
Belgium

WEBSITE

<http://www.prace-ri.eu/>



PRACE-AISBL

PRACE Partnership for Advanced Computing in Europe

**Description**

The Partnership for Advanced Computing in Europe (PRACE) is a pan-European supercomputing RI providing access to computing and data resources and services for large-scale scientific and engineering applications at the highest performance level.

It enables high impact scientific discovery and engineering research and development across all disciplines by offering world-class computing and data management resources and services through a peer-review process. PRACE also seeks to strengthen the European users of High Performance Computing (HPC) in industry through various initiatives. PRACE has a strong interest in improving energy efficiency of computing systems and reducing their environmental impact.

PRACE is established as an International not-for-profit Association under Belgian Law (AISBL) with seat in Brussels. It has 25 member countries whose representative organizations create a pan-European supercomputing Infrastructure. A total of six supercomputers and their operations accessible through PRACE are provided by four hosting members – France, Germany, Italy and Spain.

Activity

The four hosting members – BSC representing Spain, CINECA representing Italy, GCS representing Germany and GENCI representing France – committed a total funding of 400 million € for the initial PRACE systems and operations. In pace with the needs of the scientific communities and technical developments, systems deployed by PRACE are continuously updated and upgraded to be at the apex of HPC technology. Currently, the Fourth PRACE Implementation Phase is coordinated by Forschungszentrum Jülich (DE). PRACE-4IP is designed to start new innovative and collaborative activities including: assisting the transition to PRACE 2, strengthening the internationally recognized PRACE brand, preparing strategies and best practices towards Exascale computing, coordinating and enhancing the operation of the multi-tier HPC systems and services and supporting and educating users to exploit massively parallel systems and novel architectures. PRACE is evolving from the business model used in the initial period (2010-2015) that deployed the existing petaflop/s systems made possible by the strong engagement of four hosting partners towards a long-term sustainable configuration that will promote and consolidate Europe's leadership in HPC applications. The novel application codes for PRACE need to prepare for future system architecture embodied in accelerators or co-processors, by investigating new programming tools and developing suitable benchmarks. PRACE Advanced Training Centres (PRACs), target both the academic and industrial domains aiming to increase European human resources skilled in HPS applications. New services are being developed, including "urgent computing", the visualization of extreme size computational data, and the provision of repositories for open source scientific software libraries. Links will be strengthened with other international e-Infrastructures and Centres of Excellence. Energy-efficiency and lower environmental impact throughout the life cycle of Exaflop/s HPC RIs and best practices for prototype planning and evaluation are being addressed.

Impact

European scientists and engineers need to exploit more broadly high-end HPC and connection with many ESFRI RIs 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, EG – the European Grid Infrastructure, EUDAT – the European data infrastructure and HBP – the Human Brain Project.

AISBL, Delivering Science Services

CESSDA Consortium of European Social Science Data Archives

**Description**

The Consortium of European Social Science Data Archives (CESSDA) provides large scale, integrated and sustainable data services to the social sciences (and beyond) by supporting high-quality, national and international research and cooperation. It brings together social science data archives across Europe, with the aim of facilitating social, economic and political research and by doing so allows researchers to gain a better understanding of the challenges facing society today and to help solve them. Presently 14 countries are members of the Consortium and one country is a formal observer. Additionally social science data archives from nine other European countries are cooperating, taking part in some way or aiming at membership.

In Roadmap since 2006, CESSDA has been listed as success story in Roadmap 2010. Since 2013, CESSDA has been organised as a limited company under Norwegian law. CESSDA is owned and financed by the individual Member States' ministries of research or relevant delegated institution. CESSDA is hosted by Norway and its main office is located in the city of Bergen.

Activity

Members of CESSDA nominate a national Service Provider to be responsible for providing the relevant services. These Service Providers have a primary responsibility to provide data services to their own country, but they are also explicitly funded to provide pan-European activities. The Service Providers are the main resource for CESSDA, and CESSDA integrates the work of the Service Providers by establishing a one-stop shop for data location, access, analysis and delivery. Each Service Provider has different overall objectives, but in general they each (for their own nation) have a responsibility for acquiring data from data creators (government, researchers, commerce, etc.) and preparing those data for long-term access. Service Providers also carry out a curation function, which means that data is always fit for contemporary use, and are available for discovery and re-use. In essence each Service Provider ensures that data are always available for social science research purposes. CESSDA encourages standardisation of data and metadata, data sharing and knowledge mobility across Europe, streamlining the activities of all the Service Providers, and ensuring equality of data use across boundaries. CESSDA plays an active role in the development of standards and, even more importantly, encourages and facilitates the use of metadata standards for documenting and publishing the existing inventories of research data available from national as well as cross-national data resources in Europe. Put together, the overall ambition is to organise a range of data collections and to coordinate common activities across different national institutions. The institutions will increasingly function as a network in a flexible technical architecture, using standard open protocols and interfaces, designed to contribute to the emerging European and global information commons. The vision for CESSDA is thus to develop a system for data service provision that is open, extensive and evolvable. CESSDA will also attempt to maximise the use of its Service Providers' data holdings while maintaining the rights of subjects and relevant intellectual property rights.

Impact

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

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

A large scale, integrated and sustainable platform providing access to research data from archives across Europe

TYPE: distributed
COORDINATING COUNTRY: NO
PROSPECTIVE MEMBER COUNTRIES: AT, CH, CZ, DE, DK, EL, FI, FR, LT, NL, NO, SI, SE, UK

PARTICIPANTS: SK

TIMELINE

- ESFRI Roadmap entry: 2006
- Preparation phase: 2007-2010
- Construction phase: 2011-2012
- Operation start: 2013
- Legal status: Norwegian limited company, 2013

ESTIMATED COSTS

- Capital value: NA ME
- Operation: 1,9 ME/year

HEADQUARTERS

CESSDA AS
Bergen
Norway

WEBSITE

<http://www.cessda.net>



NORWAY

A unique effort to generate the highest possible magnetic fields for use in scientific research

TYPE: distributed
COORDINATING COUNTRIES: DE, FR, NL
MEMBER COUNTRIES: DE, FR, NL

PARTICIPANTS: UK

TIMELINE
• ESFRI Roadmap entry: 2008
• Preparation phase: 2009-2012
• Construction phase: 2009-2014
• Operation start: 2014
• Legal status: AISBL, 2015

ESTIMATED COSTS
• Capital value: 170 M€
• Operation: 20 M€/year

HEADQUARTERS
EMFL
Office Helmholtz Association
Brussels
Belgium

WEBSITE
<http://www.emfl.eu/>



FRANCE, GERMANY,
THE NETHERLANDS

EMFL European Magnetic Field Laboratory



Description

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

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

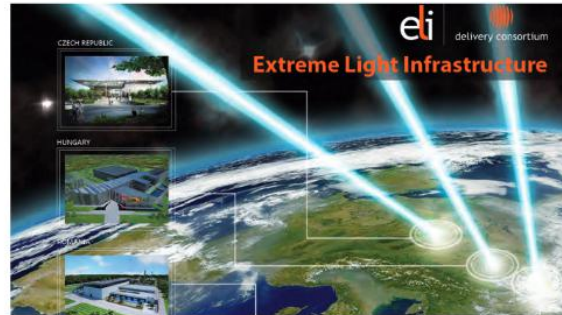
Activity

The LNCMI is a French large-scale facility operated by CNRS and associated to INSA, UPS and UGA, enabling researchers from all over the world to perform experiments in the highest possible magnetic fields. Continuous fields up to 36 Tesla are available at the Grenoble site and pulsed fields up to 180 Tesla 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. A record field close to 94.2 Tesla has been reached in 2012. 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 the Foundation for Fundamental Research on Matter (FOM). In the HFML resistive magnets with fields up to 37.5 T are available and a 45T hybrid magnet is under development. The main research activities supported by the EMFL are: magnetic and superconducting materials, strongly correlated electron systems, low-dimensional magnetic materials, nanostructured materials, magnet design and technology, semiconductors and nano-systems, mesoscopic physics, 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. 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.

ELI Extreme Light Infrastructure



Description

The Extreme Light Infrastructure (ELI) is a Research Infrastructure of Pan-European interest for experiments on extreme light-matter interactions at the highest intensities, shortest time scales and broadest spectral range. ELI will make available unprecedented power 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 is based on three sites (pillars, under construction in the Czech Republic, Hungary and Romania) with complementary scientific profile, and a possible implementation of a fourth pillar. Implementation is coordinated by the ELI Delivery Consortium International Association (ELI-DC), International not-for-profit Association under Belgian Law (AISBL) that is acting to establish a European Research Infrastructure Consortium (ELI-ERIC).

Activity

The ELI-Beamlines facility in Dolní Břežany, near Prague, Czech Republic, focuses 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, and laboratory astrophysics. The ELI Attosecond Light Pulse Source (ELI-ALPS) in Szeged, Hungary will provide ultra-short light pulses with high repetition rate in the spectral range between THz and X-rays. ELI-ALPS will be dedicated to extremely fast dynamics by taking snap-shots on the attosecond scale (a billionth of a billionth of second) of electron dynamics in atoms, molecules, plasmas and solids. The ELI Nuclear Physics (ELI-NP) facility in Magurele, Romania, will focus on laser-based nuclear physics, using ultra-high intensity lasers and a laser-based gamma source. Applications include nuclear physics experiments to characterize laser-target interaction, photonuclear reactions, and exotic nuclear physics and astrophysics. A fourth pillar of ELI, the highest intensity pillar, is still in pre-implementation stage as its definition will depend on on-going laser technology development and validation, and will be based on the experience of the three pillars. The laser power is expected to exceed that of the current ELI pillars by another order of magnitude, allowing for an extended scientific programme in particle physics, nuclear physics, gravitational physics, nonlinear field theory, ultrahigh-pressure physics, astrophysics and cosmology (generating intensities exceeding 10^{22} W/cm²).

Impact

ELI will be the gateway to new regimes in fundamental physics. At the same time, it will also promote the advent of new technologies, such as novel laser-plasma-accelerators expected to be able to deliver particles and photon sources with extremely high energies beyond the physical limits of conventional technologies. Due to its unique characteristics as the first international laser user facility, ELI will offer access to an international community of scientific and – to some extent – industrial users, attracting the world's best scientists to unique research opportunities including physics, chemistry, biology, medicine, materials sciences, and combinations thereof. Contributions towards addressing the Grand Societal Challenges arise in vast areas, ranging from analytical studies applied to environmental research, climate research, medical diagnostics and treatment, pharmacology, bio-medicine, or from materials research for renewable and nuclear energies, nuclear waste management, and space applications, or from laser-based materials processing on micro- and nano-scales for information and communication technologies, to name only few.

The world's fastest and most powerful lasers and secondary radiation sources to unravel light-matter interactions

TYPE: distributed
COORDINATING ENTITY: ELI-DC
MEMBER COUNTRIES: CZ, DE, HU, IT, RO, UK

TIMELINE
• ESFRI Roadmap entry: 2006
• Preparation phase: 2007-2010
• Construction phase: 2011-2017
• Operation start: 2018
• Legal status: AISBL, 2013

ESTIMATED COSTS
• Capital value: 850 M€
• Operation: 90 M€/year

HEADQUARTERS
ELI-DC AISBL
Brussels
Belgium

WEBSITE
<http://www.eli-laser.eu/>



ELI-DC

Delivering Science and Users Access, ahead of 10y
Advanced Construction and reference in the Field

The European contribution to the global sea and ocean in depth profiling by floats

TYPE: distributed
COORDINATING COUNTRY: FR
MEMBER COUNTRIES: DE, EL, FI, FR, IT, NL, UK

PARTICIPANTS: BG, ES, IE, NO, PL, PT

TIMELINE
• ESFRI Roadmap entry: 2006
• Preparation phase: 2008-2011
• Construction phase: 2011-2014
• Operation start: 2014
• Legal status: ERIC, 2014

ESTIMATED COSTS
• Capital value: 10 M€
• Operation: 8 M€/year

HEADQUARTERS
EURO-ARGO PROJECT Office
Plouzané
France

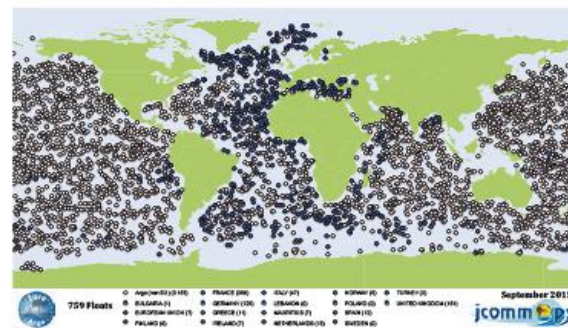
WEBSITE
<http://www.euro-argo.eu>



FRANCE

EURO-ARGO ERIC

European contribution to the international Argo Programme



Description

The European component of ARGO (EURO-ARGO) is a distributed research infrastructure that organizes and federates the European contribution to the international ARGO programme for in-situ ocean observations. EURO-ARGO aims at maintaining a global array of profiling floats which measure every 10 days temperature and salinity throughout the deep global oceans, down to 2,000 meters, to deliver data both in real-time and delayed mode for climate change research and monitoring.

EURO-ARGO has completed a Preparatory Phase project (2008-2011) that led to the governance framework and implementation plan for the first years of operation of the infrastructure. EURO-ARGO was granted the ERIC status on May 2014 upon agreement amongst 9 European countries (7 members and 2 observers).

Activity

The overall objective of the EURO-ARGO research infrastructure is to deploy about 250 new floats per year as necessary to maintain an array of about 800 floats in operation at any given time (1/3 of the global array) with enhanced coverage in the European regional seas that requires increased sampling in the Nordic, Mediterranean and Black seas. EURO-ARGO contributes to the establishment of the ARGO global array – almost 4,000 drifting profiling floats worldwide – for in-situ measurements integrated with other elements of the climate observing system, in particular satellite observations, to detect climate variability from seasonal to decadal scales and provide long-term observations of climate change in the oceans. This includes regional and global changes in temperature and ocean heat content, salinity and freshwater content, sea level and large-scale ocean circulation. In addition, EURO-ARGO provides data to constrain global and regional ocean analysis and forecasting models, delivers information to initialize seasonal and decadal forecasting ocean/atmosphere-coupled models and produce the evidences necessary for calibration and validation of satellite data. Contributions to the global array are progressing and European partners continue to be major actors in the ARGO data management system to target research (climate and oceanography) and operational oceanography communities and to prepare and start implementing the next phase of ARGO. The EURO-ARGO research infrastructure is indeed at the forefront of the development of the new phase of ARGO with an extension to biogeochemical variables, the deep ocean and the polar seas.

Impact

Given the prominent role of the EURO-ARGO research infrastructure for climate change research and its contribution to seasonal and decadal climate forecasting, the socio-economic impacts are expected to be largely on the medium and the long-term runs. EURO-ARGO has developed strong links with the European ocean and climate change research communities that are heavily relying on ARGO observations. The EURO-ARGO is also a major in-situ infrastructure for the Copernicus Marine Environment Monitoring Service (CMEMS) and the European Marine Observation and Data Network (EMODnet). In 2015, two EU projects that support the European contribution to ARGO started: MOCCA (DG-Mare) and AtlantOS (DG-Research/H2020). Long-term global ocean observations will lead to a better understanding and prediction of climate change (e.g. sea level change) and improved mitigation strategies. Through the purchase of 200-250 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 floats and marine equipment.

ERIC, Delivering Science Services

SHARE ERIC

Survey of Health, Ageing and Retirement in Europe



Description

The Survey of Health, Ageing and Retirement in Europe (SHARE) is a multidisciplinary database of microdata on health, socio-economic status, social and family networks of individuals from 20 European countries plus Israel, aged 50 or older. SHARE aims at documenting and better understanding the repercussions of demographic ageing for individuals and the European society as a whole, and forming a sound scientific basis for countermeasures adopted by health and social policy. SHARE's scientific method is based on a panel design that grasps the dynamic character of the population ageing process in all relevant aspects. Rigorous procedural guidelines and program ensure an ex-ante harmonized cross-national design. The data are harmonised with the US Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA) and are accessible free of charge to the scientific community.

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

Activity

To date, SHARE has collected five panel waves (2004, 2006, 2010, 2013, 2015) of current living circumstances and one wave of retrospective life histories (2008, SHARELIFE); four additional waves are planned until 2024. With the public release of Wave 5 data in March 2015, the data available to the scientific community are based on more than 220,000 interviews administered on about 110,000 respondents and collected in 21 countries. A comprehensive overview of all available data is given in the SHARE "data resource profile" which has been authored by the central coordination team and published in 2013 open access by the International Journal of Epidemiology. SHARE is also engaged in several additional data dissemination activities: easySHARE, a simplified dataset for training and teaching purposes, and the Job Episodes Panel, a refined panel dataset spanning the entire working life of SHARELIFE respondents, were both released already in 2013. In 2014, 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 550 journal articles since the first data release in 2005, or more than 50 per year on average. Trends in publication number are showing that the scientific output is increasing over time. By the end of 2015, SHARE has about 5,100 officially registered data users. Most of the users are from European countries, but there is also an increase in scientific operators from the US and other countries worldwide which may partly be due to the comparability of SHARE data with other international ageing surveys, such as HRS in the US, ELSA in the UK, and others. Most users of SHARE reside in Germany; US is second, before Italy and the Netherlands.

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 such 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.

An evidence-based system of survey on ageing of European population to study retirement, health and socio-economic aspects

TYPE: distributed
COORDINATING COUNTRY: DE
MEMBER COUNTRIES: AT, BE, CZ, DE, EL, FR, IL, IT, NL, PL, SE, SI

PARTICIPANTS: CH, DK, EE, ES, HR, HU, IE, LU, PT

TIMELINE
• ESFRI Roadmap entry: 2006
• Preparation phase: 2007-2010
• Construction phase: 2010-2012
• Operation start: 2011
• Legal status: ERIC, 2011

ESTIMATED COSTS
• Capital value: 110 M€
• Operation: 12 M€/year

HEADQUARTERS
SHARE ERIC
Munich
Germany

WEBSITE
<http://www.share-project.org/>



GERMANY

The continuous upgrade of the world's flagship for neutron science for condensed matter physics, chemistry, biology and materials research

TYPE: single-sited
COORDINATING ENTITY: ILL
MEMBER COUNTRIES: DE, FR, UK

PARTICIPANTS: AT, BE, CH, CZ, DK, ES, HU, IT, PL, SE, SK

TIMELINE

- ESFRI Roadmap entry: 2006
- Preparation phase: 2007-2011
- Construction phase: 2012-2016
- Operation start: 2020

ESTIMATED COSTS

- Capital value: 171 M€
- Operation: 92 M€/year

HEADQUARTERS

Institut Max von Laue-Paul Langevin
Grenoble
France

WEBSITE

<http://www.ill.eu>



ILL

ILL 20/20
Institut Max von Laue-Paul Langevin



Description

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

The ILL 20/20 project, part of the wide-ranging Millennium Programme, entered the Roadmap in 2006 to support the Preparatory Phase of the overall upgrade of ILL's neutron science facilities to strengthen its world-leading position and provide for the future scientific needs of users in Europe and beyond. Identified as successfully implemented in the 2010 Roadmap, the Millennium phase has been completed. The Endurance phase of ILL20/20 aims at a further renewal of 9 new neutron instruments and experiments linked to neutrons or gamma rays, plus accompanying infrastructure improvements.

Activity

The ILL offers neutron measurements to the scientific community employing 38 instruments installed on the existing source of neutrons at the ILL, 29 operational instruments managed by the ILL and 9 instruments handled by external consortia. Each piece of the instrument suite is designed to be state-of-the-art in each particular research field and undergoes major as well as continuous upgrades to fulfil the world-reference role. The ILL's staff have expertise and experience in neutron production (reactor physics, reactor design and operation, cold and hot source design and operation), neutron beam delivery (beam-tubes, neutron guides including supermirror guides), neutron optics (collimators, monochromators, neutron velocity selectors and choppers), neutron detection and the complete range of neutron instruments for scientific research and sample environment. Some 1,500 researchers from over 40 countries visit the ILL each year, performing over 800 experiments and producing about 600 published papers that put the ILL at the leading edge of neutron science covering all the relevant scientific domains: soft condensed matter (13%), nuclear and particle physics (10%), biology (10%), chemistry (13%), materials science (17%), physics including magnetism and nanoscience (32%), other (instrumentation, cultural heritage, environment; 5%). The ILL's Industrial Liaison Unit provides a single and specialised point of contact for any potential user from industry and services, offering industrial clients a choice of specific modes of access ranging from quick-access proprietary research or a combination with academic access for maximum innovation.

The ILL adopts a pioneering data access policy (PaNdata) to allow the access and treatment of the data generated at the institute. After initial priority access to the data for the scientist(s) carrying out the experiment, the data is publicly accessible and reusable.

Impact

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

Delivering Science Services and Users Access

ESRF UPGRADES
Phase II: Extremely Brilliant Source



Description

The European Synchrotron Radiation Facility (ESRF) is the world-leading source of synchrotron X-rays operating 43 beamlines with state-of-the-art instrumentation for imaging and studying the structure of matter at the atomic and nanometric scale in all fields of research: it is a truly European facility and a key component of the ERA. The ESRF initiated an Upgrade Programme in 2009, and has completed the initial phase with 19 new and rebuilt beamlines, mostly in the domain of imaging and structural studies, enabling a 3 orders of magnitude gain in performance of X-ray microscopy and imaging experiments.

The ESRF-EBS is the new planned major upgrade project (~150 M€; 2015-2022). Centred on rebuilding the ESRF storage ring by adopting an all-new hybrid multi-bend achromat lattice design, it will deliver unprecedented source brilliance and coherence (~100x). The EBS project also includes the construction of four new state-of-the-art beamlines, a scientific instrumentation programme with ambitious detector projects and a data management and analysis strategy. An instrumentation upgrade is also planned for some more beamlines including the "national beamlines" operated by Collaborating Research Groups. Due to the very high brilliance of the EBS, methods developed also at Free Electron Laser (FEL) Facilities, such as serial crystallography, will be used in the new experimental infrastructures, thus expanding the capabilities for structural biology and material science in Europe.

Activity

The ESRF started operations in 1994 and construction was completed in 1998. Every year, more than 8,000 scientific users across all disciplines of natural sciences use the ESRF and their work generates ~2,000 peer-reviewed publications annually. ESRF has delivered up to now ~254,000 instrument-shifts (i.e. ~17,000 8-hour-shifts per year). Approximately 98% of the beam time at the ESRF is granted through peer-reviewed scientific excellence based access and 2% is acquired for proprietary research. Approximately 30% of all projects submitted to the ESRF involve innovation/industrial technology developments. A transparent scheme monitors beam time distribution among the scientists' countries and aims for a "juste retour" with respect to the shareholders' contributions.

A programme of continuous review and upgrade or replacement of beamlines has been implemented since the beginning. The ESRF provides scientific support to users and carries out the necessary research and development work in synchrotron techniques enabling, among others, Nobel Prizes in Chemistry in 2003, 2009 and 2012. The ESRF has created, together with the ILL and EMBL, a hub of excellence that has stimulated co-location of specialist laboratories such as the Institute for Structural Biology, the Partnership for Structural Biology, the Partnership for Soft Condensed Matter and industrial research collaborations.

Impact

The new ESRF-EBS will enhance the ESRF's impact on science and on partner countries. After a shutdown in 2018-2020, the ESRF-EBS will be the global reference for at least one more decade. Services and contracts placed by the ESRF in member and associated states help secure follow-on industrial benefits. The engineering challenges of the ESRF-EBS will boost 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. It is therefore vital that the ESRF continues to be supported to carry on these capabilities as a driving force in the ERA.

A unique Synchrotron Radiation Facility to the benefit of science and innovation in condensed and living matter fields

TYPE: single-sited
COORDINATING ENTITY: ESRF
MEMBER COUNTRIES: BE, CH, DE, DK, ES, FI, FR, IT, NL, NO, RU, SE, UK

PARTICIPANTS: AT, CZ, HU, IL, PL, PT, SK, ZA

TIMELINE

- ESFRI Roadmap entry: 2006, 2016
- Preparation phase: 2012-2015
- Construction phase: 2015-2022
- Operation start: 2022

ESTIMATED COSTS

- Capital value: +150 M€
- Operation: 82 M€/year

HEADQUARTERS

European Synchrotron Radiation Facility-ESRF
Grenoble
France

WEBSITE

<http://www.esrf.eu>



ESRF

The world's most powerful neutron source for life sciences, energy, environmental technology, cultural heritage and fundamental physics

TYPE: single-sited
COORDINATING COUNTRIES: DK, SE
MEMBER COUNTRIES: CH, CZ, DE, DK, EE, FR, HU, IT, NO, PL, SE

PARTICIPANTS: BE, ES, NL, UK

TIMELINE

- ESFRI Roadmap entry: 2006
- Preparation phase: 2008-2010
- Pre-construction phase: 2010-2012
- Construction phase: 2013-2025
- Operation start: 2025
- Legal status: ERIC, 2015

ESTIMATED COSTS

- Capital value: 1.843 M€
- Operation: 140 M€/year

HEADQUARTERS

European Spallation Source ERIC
 Lund
 Sweden

WEBSITE

<http://www.europeanspallationsource.se>



DENMARK, SWEDEN

European Spallation Source ERIC



Description

The European Spallation Source is a research infrastructure committed to the goal of building and operating the world leading facility for research using neutrons. The ESS will deliver a neutron peak brightness of at least 30 times greater than the current state-of-the-art, thus providing the much-desired transformative capabilities for interdisciplinary research in the physical and life sciences.

ESS officially became a European Research Infrastructure Consortium (ERIC) in October 2015. The facility is under construction in Lund (Sweden), while the ESS Data Management and Software Centre (DMSC) will be located in Copenhagen (Denmark). The foreseen milestones include the beginning of the first on-site Accelerator installations (Sep 2016), facility ready for Accelerator beam on the Target (Dec 2019), the first call for user proposals (2022), the Machine installed for 2.0 GeV performance (Dec 2022), start user programme (2023), and the completion of the 16 construction phase instruments (Dec 2025).

Activity

A total of 16 instruments will be built during the construction phase to serve the neutron user community 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 Neutron Scattering Systems (NSS) Project at ESS is responsible for the development and coordination of state-of-the-art instrument concepts for ESS, in collaboration with international partners. Around 40 concepts were developed by ESS scientists and our partners. Of those, 16 concepts have now been selected and approved by the ESS Steering Committee for construction within the NSS project. Our partners from the member countries will lead the construction of most of the instruments, and many will benefit from contributions from two or more participating organisations. The NSS project is coordinating the construction and installation of these instruments, and the associated support systems (such as sample environments and data processing and analysis capabilities) to ensure the highest quality outcomes for the European Community. Selection of the additional 6 instruments will occur once construction of the initial suite of 8 instruments is approaching completion.

Impact

ESS will be an attractive and environmentally sustainable large compound including industrial and laboratory buildings, office space, and guest accommodation facilities all housed within a significant architectural design that will make an impact on the world's stage. Before the expected world-scale scientific impact can be realised with the operation phase, the construction of the ESS does have a direct economic impact by generating growth and jobs, advance development and fuel innovation potential in the Öresund region and across the EU. With ESS being built as a collaborative project, the growth effect will be shared between the host countries (Sweden and Denmark) and the ESS-ERIC partners. 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.

Construction Phase and reference for the Field
 Forthcoming Commissioning and Users Access

European XFEL European X-Ray Free-Electron Laser Facility



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 synchrotron X-ray radiation sources. 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 "under extreme conditions" such as those occurring deep inside planets.

The international European XFEL project, with 11 participating countries, is being built in Hamburg and Schleswig-Holstein. Commissioning, with the first beam of the facility, is expected to start in early 2017.

Activity

X-ray free-electron lasers (FELs) are accelerator based light sources that generate extremely brilliant and ultra-short, from few to 100 femtoseconds (fs) pulses of transversely coherent X-rays with very short wavelengths (down to ~ 0.05 nm). The goal is to exploit these X-rays for revolutionary scientific experiments in a variety of disciplines, including physics, chemistry, materials science, and biology. In the US and Japan, FELs are based on room-temperature linear accelerators (warm-LINACs). In Europe, the European X-ray Free Electron Laser (XFEL) Facility exploits the superconducting linear accelerator technology (cold-LINAC). The superconducting technology allows for a very large number of pulses per second, in the case of the European XFEL up to 27,000 pulses per second. Electron bunches shall be accelerated to high energies (up to 17.5 GeV) in a ~2 km LINAC and then passed through (up to 200 m long) undulators, where they will generate bursts of coherent X-rays through the self-amplified spontaneous emission (SASE) process. Initially, 3 photon beamlines and 6 instruments will be built. Eventually, 5 photon beamlines and 10 experimental stations will enable experiments ranging from coherent diffraction imaging to spectroscopy and exploit the high intensity, coherence, and time structure of the new source. Some expected scientific benefits will consist in studying molecular configuration rearrangements during chemical reactions down to the sub-picosecond (ps) scale, observing the dynamics of fluctuations on unprecedented time and length scales, providing experimental access to regions of the phase diagram of materials currently found only in astrophysical environments. A fascinating perspective benefit is the investigation of the structure of individual macromolecules down to atomic resolution, without the need for crystallization.

Impact

The European XFEL facility expands the leading position of Europe in accelerator based X-ray sources, that are pushing the frontiers of condensed matter physics, materials science, chemistry, structural biology and pharmacology. The specific developments in detector and accelerator technology generate innovation and know-how transfer to industry. The expected fundamental research breakthroughs in materials sciences, chemistry and catalysis, and macromolecular structure, will also generate innovation. The European XFEL provides an opportunity to educate a new generation of scientists to address the frontiers of research on nano-scale materials, and this in a multi-national, open environment, promoting the European dimension of knowledge and its international mobility. Consortia are created among European universities and research centers to develop instrumentation for the XFEL, impacting the coordination of efforts in the fields of research related with health issues, energy and environment.

First Superconducting X-ray Free Electron Laser for high repetition rate ultra-short X-ray flashes for the life sciences and materials

TYPE: single-sited
COORDINATING ENTITY: European XFEL
MEMBER COUNTRIES: CH, DE, DK, FR, HU, IT, PL, RU, SE, SK

PARTICIPANTS: ES

TIMELINE

- ESFRI Roadmap entry: 2006
- Preparation phase: 2006-2009
- Construction phase: 2009-2017
- Operation start: 2017
- Legal status: GmbH, 2009

ESTIMATED COSTS

- Capital value: 1.490 M€
- Operation: 115 M€/year

HEADQUARTERS

European XFEL GmbH
 Hamburg
 Germany

WEBSITE

<http://www.xfel.eu>



European XFEL

IAGOS 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. It complements the global observing system in addition to ground-based networks, dedicated research campaigns and observations from satellites, balloons, and ships.

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

Activity

The dual setup of IAGOS aims at providing global-scale coverage of key observables on a day-to-day basis with a more complex set of observations with reduced coverage. The IAGOS-CORE component comprises the implementation and operation of autonomous instruments installed on long-range aircraft of several internationally operating airlines for continuous, global-scale and daily measurements of reactive gases, greenhouse gases (e.g. CO₂, CH₄), aerosol and cloud particles. The IAGOS-CARBIC 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 inter-continental flights. At present 6 aircraft are equipped with IAGOS-CORE instrumentation and one aircraft carries the IAGOS-CARBIC container. At the end of its construction phase, IAGOS aims at an operational fleet of up to 20 equipped passenger aircraft. IAGOS contributes to improved understanding of climate change and global air quality by providing regular in-situ observations on a scale and in numbers that would be impossible to achieve using research aircraft and for which other measurement methods (e.g. satellites) have technical limitations. This input is essential for climate research, emissions monitoring, weather prediction and air quality forecasting. Data is provided for climate models, including those used by the Copernicus Atmosphere Monitoring Service, and for the carbon cycle models employed for the verification of CO₂ emission and Kyoto monitoring. Regional air quality models will assimilate IAGOS near-real-time data to improve forecasts. IAGOS data are also utilised for the calibration and validation of satellite sensors. Cooperation with aviation industry and instrument developers aims at designing strategies to deal with the observation of ice particles and dust, including volcanic ash and their operational consequences.

Impact

The direct impact is mainly on SMEs who are manufacturing instruments or are involved in the development and aerospace maintenance of the instrumentation in order to assure continued airworthiness in accordance with international regulations for aviation. Engagement of airline companies as suppliers of transportation capacity and technical support was achieved on the basis of individual negotiations and by direct involvement as full project partners. Currently 3 European airlines – Deutsche Lufthansa, Air France and Iberia – and 2 airlines from outside Europe – China Airlines and Cathay Pacific – are involved. Negotiations with other airlines from Europe and other countries are on-going in order to extend coverage. IAGOS contributes observational data directly to the aviation industry and airlines for improving operational procedures and thus reducing costs and enhancing aviation safety. A long-term impact comes through the improved accuracy of numerical model predictions for air quality and climate change on the global and regional scale.

Global-scale and long-term atmospheric monitoring system from commercial aircraft

TYPE: distributed
COORDINATING COUNTRIES: DE, FR
MEMBER COUNTRIES: DE, FR, UK

PARTICIPANTS: ES

TIMELINE

- ESFRI Roadmap entry: 2006
- Preparation phase: 2006-2013
- Operation start: 2014
- Legal status: AISBL, 2014

ESTIMATED COSTS

- Capital value: 25 ME
- Operation: 6 ME/year

HEADQUARTERS

IAGOS-AISBL
Brussels
Belgium

WEBSITE

<http://www.iagos.org>



GERMANY, FRANCE

SKA Square Kilometre Array



Description

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

The SKA Organisation (SKAO), that became a legal entity in 2011, coordinates the design and the policy making for the SKA. In 2012, the members of the SKAO agreed on a dual site location for the SKA telescope in the deserts of South Africa and Australia, while the site for the Headquarters, to be established in the UK, was decided in 2015. The construction phase will take place from 2018 to 2023 – with early science in 2020 – 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 the late 2020s.

Activity

The first phase of SKA will use ~200 dishes and ~130,000 low-frequency antennas that will enable astronomers to monitor the sky in unprecedented detail, and to survey the entire sky much faster than any system currently operating. The total collecting area of the full SKA will be well over one square kilometre, or 1,000,000 square metres, obtained with thousands of mid- to high-frequency steerable dishes, each of 15 metres in diameter, in South Africa and a much larger million digitally-steerable low-frequency antennas in Australia. The SKA will truly be at the forefront of scientific research with a broad range of exciting science such as observing pulsars and black holes to detect the gravitational waves predicted by Einstein's General Relativity, looking at how the very first stars and galaxies formed after the Big Bang, better than any experiment so far, helping scientists to investigate the nature of the mysterious dark energy, trying to understand the vast magnetic fields which permeate the cosmos, and exploring the origins of life itself. Moreover, the SKA will challenge information technology developments at the vanguard of the emerging era of Big Data and High Performance Computing. The data analysis software needed will leap a generation in sophistication. The SKA is expected to become the largest public, research data project in the world, producing in its first phase, raw data totalling more than five times the estimated global internet traffic of 2015.

Impact

To date, there are ten nations funding the SKA with membership across five continents: Australia, Canada, China, India, Italy, the Netherlands, New Zealand, South Africa, Sweden and the UK, which represent about 40% of the world's population. Over 100 research and industrial organisations are working together to design the initial phase of the SKA with over 500 researchers and engineers involved around the world. Impact is foreseen through the hosting the SKA Headquarters and telescopes, by increasing activity in pre-construction at the telescope sites in South Africa and Australia, and by involving industry for developing technology solutions in meeting the challenges of SKA. The SKA project is also expected to generate substantial innovation in key technology areas such as Information and Communication Technology (ICT) and renewable energy as well as to impact on knowledge transfer and human capital development.

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

The largest radio telescope on Earth to explore the Universe and the origins of life

TYPE: distributed
COORDINATING COUNTRY: UK
MEMBER COUNTRIES: AU, CN, IN, IT, NL, NZ, UK, ZA

PARTICIPANTS/ENTITY: CA, ES, FR, MT, PT, SE, US, (ESO)

TIMELINE

- ESFRI Roadmap entry: 2006
- Preparation phase: 2008-2017
- Construction phase: 2018-2023
- Operation start: 2020
- Legal status: SKAO, 2011

ESTIMATED COSTS

- Capital value: 650 ME
- Operation: 75 ME/year

HEADQUARTERS

Jodrell Bank Observatory
Lower Whinton
United Kingdom

WEBSITE

<http://www.skatelescope.org>



UNITED KINGDOM

Being implemented, AISBL
Global: European Headquarters, ZA and AU sites

A gateway for access to biobanks and biomolecular resources for health research

TYPE: distributed
COORDINATING COUNTRY: AT
MEMBER COUNTRIES: AT, BE, CZ, DE, EE, EL, FI, FR, IT, MT, NL, NO, SE, UK

PARTICIPANTS: CH, PL, TR, (ARC/WHO)

TIMELINE

- ESFRI Roadmap entry: 2006
- Preparation phase: 2006-2011
- Interim phase: 2011-2013
- Operation start: 2014
- Legal status: ERIC, 2013

ESTIMATED COSTS

- Capital value: 170-220 ME
- Operation: 3,5 ME/year

HEADQUARTERS

BBMRI ERIC
Graz
Austria

WEBSITE

<http://www.bbmri-eric.eu>



AUSTRIA

BBMRI ERIC

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 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.

On December 2013 BBMRI became a European Research Infrastructure Consortium (ERIC). The agreement of ultimately 17 countries (14 members and 3 observers) and one International Organisation enabled to set up a pan-European distributed research infrastructure that shall develop into one of the most important tools in biomedical and clinical discovery.

Activity

BBMRI strives to facilitate access to quality-defined human disease relevant biological resources in an efficient as well as ethically and legally compliant manner by reducing the fragmentation of the biomedical research landscape through harmonisation of procedures and by implementing common standards and fostering high level collaboration. This is achieved by defining criteria for high quality assured samples and their data to be provided by members for selected disease entities and by defining the quality of samples and data.

In a first step, enriched data pools will facilitate the trans-national cross-biobank search for suitable biopspecimens. Thus, the IT-Gateway to European biobanks will provide a single access point to the European biobank network and lays the basis for national as well as trans-national research consortia based on the entire samples and data from various sites. It also allows for highly targeted research, where small teams achieve statistical significance of their results by combining their resources throughout Europe. This approach extends previous catalogue-based solutions by enabling the processing of requests on a sample-based level explicitly challenging privacy aspect and solving it at least on the first level by delivering highly aggregated data.

Ultimately, BBMRI will provide a one-stop access to the collections of the European biobanking community, expertise and services to foster access to other parties, including the private sector. Collections will include documents, SOPs and best practices developed by BBMRI, published results and data in coordination with partners of BBMRI, samples and related clinical data primarily based on merit review of the proposal by the relevant biobank scientific and ethical committee.

Impact

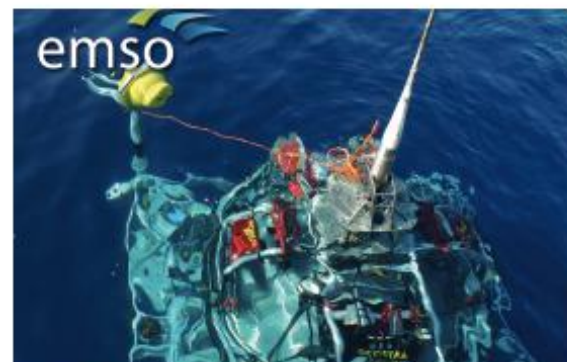
New medical applications, new therapies, new preventives, new diagnostics, personalised or stratified medicine and new biomedical industries shall evolve to improve socio-economic competitiveness and increasing possibilities for equitable healthcare in Europe. Expectantly, BBMRI-ERIC will impact on partnerships 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.

ERIC, Delivering Science Services

ERIC, under construction

EMSO

European Multidisciplinary Seafloor and water-column Observatory



Description

The European Multidisciplinary Seafloor and water-column Observatory (EMSO) is a technologically advanced, distributed research infrastructure at fixed open-ocean monitoring nodes that is connecting marine research facilities across the oceans and seas of Europe: from the Arctic, through the North Atlantic, through the Mediterranean to the Black Sea. EMSO represents a major asset for European marine researchers who now have a powerful new aid to address pressing scientific and societal challenges. These include tracking and controlling the effects of climate change, mitigating geo-hazards and increasing biodiversity safety.

EMSO is under construction. Nine out of eleven nodes are presently operational for data production and basic service supply. The long-term goal of the EMSO ERIC is to ensure long-term, sustained, continuous data streams from the ocean, the majority of the biosphere of our planet.

Activity

EMSO is an array of seafloor and water-column observatories geographically distributed across Europe. EMSO provides key data for the understanding of processes in the marine environment that form the basis for any prediction of short-, intermediate- and long-term global change, from episodic catastrophic events to slow trends that are difficult to discern from the overlying variability of short-term processes. 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 trading 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 exciting opportunities for hosting new hi-tech jobs, and spawning development of innovative applications and services in strategic marine-related industry sectors such as offshore oil and gas, deep-sea mining, renewable energy, fishing and tourism. Through the installation and operational phases, EMSO has already started to generate significant socio-economic benefits, including advanced training and support services (incubator, testing) for industry, particularly for SMEs; high quality educational content and services for academia and media; a one-stop-shop world-class reference point and 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 against important challenges and threats including geo-hazards, habitat loss, human and animal migration, food security, including the consequent damage to marine-related industry activities, tourism, recreation and aesthetics.

Interactive, real-time ocean observation systems to address urgent societal and scientific challenges

TYPE: distributed
COORDINATING COUNTRY: IT
PROSPECTIVE MEMBER COUNTRIES: EL, FR, IT, UK

PARTICIPANTS: ES, IE, NL, RO, PT

TIMELINE

- ESFRI Roadmap entry: 2006
- Preparation phase: 2008-2012
- Construction phase: 2012-2016
- Operation start: 2016

ESTIMATED COSTS

- Capital value: 108 ME
- Operation: 36 ME/year

HEADQUARTERS

EMSO Central Management Office
Rome
Italy

WEBSITE

<http://www.emso-eu.org>



ITALY

Landscape Analysis

the ecosystem of Research Infrastructures in Europe and more



- Survey and analysis of the context, in each domain, of the operational national or international research infrastructures ***open Internationally to scientists and technology developers through peer-review of competitive science proposals.***
- Identifies the gaps and the potential evolution of each field in the foreseeable future
- *ESFRI in no case acts as an advocate of specific potential future projects.*

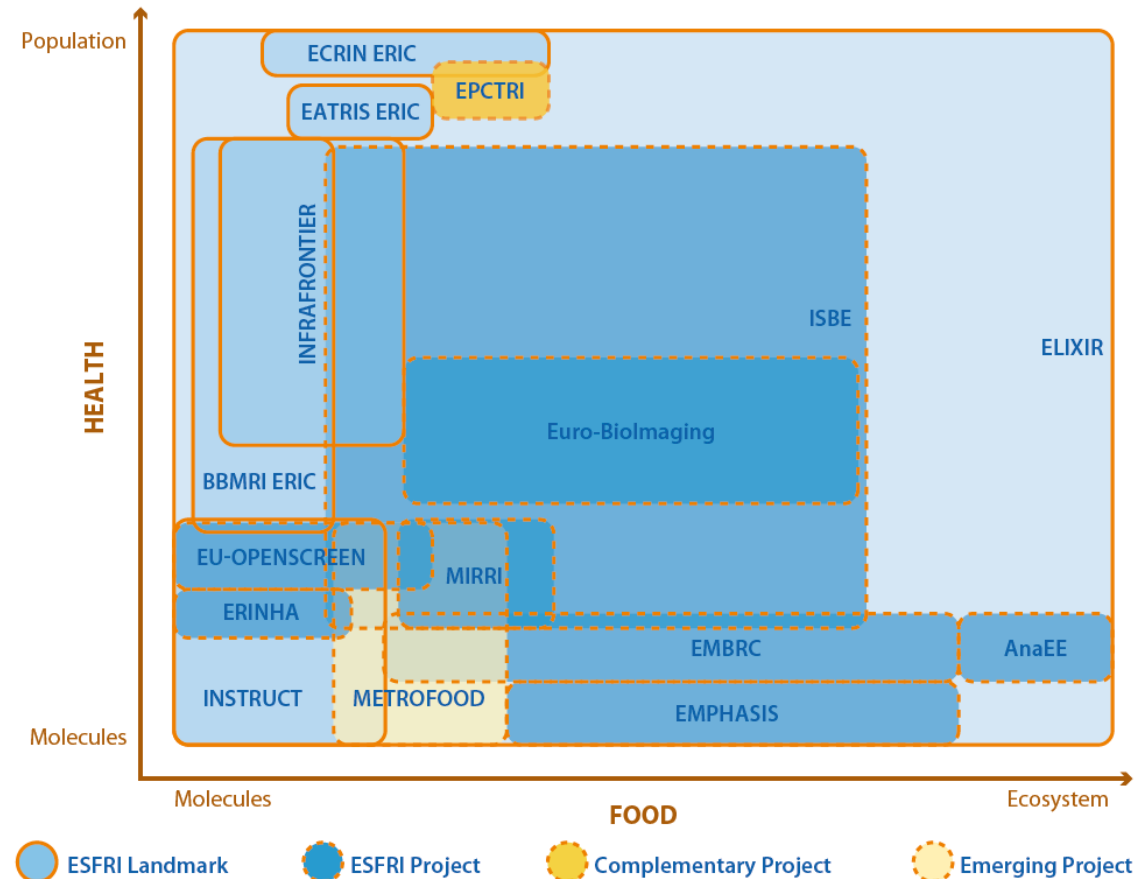


Health and Food Strategy Working Group

Landscape analysis

Criteria

- Scientific and technological knowledge delivered (or contribution to the advancement of science and technology);
- Potential for structuring the ERA and addressing fragmentation;
- Timeliness (urgency; opportunities Europe will lose if delayed);
- Range of scientific communities covered and potential for integration;
- Potential for knowledge and technology transfer, training and increasing capacity;
- The extent to which the new infrastructure responds to the needs and improves the access for scientific communities;
- The extent to which the new infrastructure meets a gap in and connects to HF SWG landscape.





PSE SWG Landscape Analysis (2016)

PSE covers a wide range of research areas and types of infrastructures from *advanced international/global experiments addressing fundamental knowledge* issues to *user-intense facilities for multi-scale investigation on matter* and applications.

The overall “investment value” of the currently operational RIs in the physics-based sector is of the order of 70 billion € and its operational yearly cost is 10% of initial investment, i.e. approximately 7 billion € per year or about 10% of the cost of external services acquired by the physics sector of economy, corresponding to a fraction of five millionths of the physics sector Gross Value Added.

ROADMAP DYNAMICS

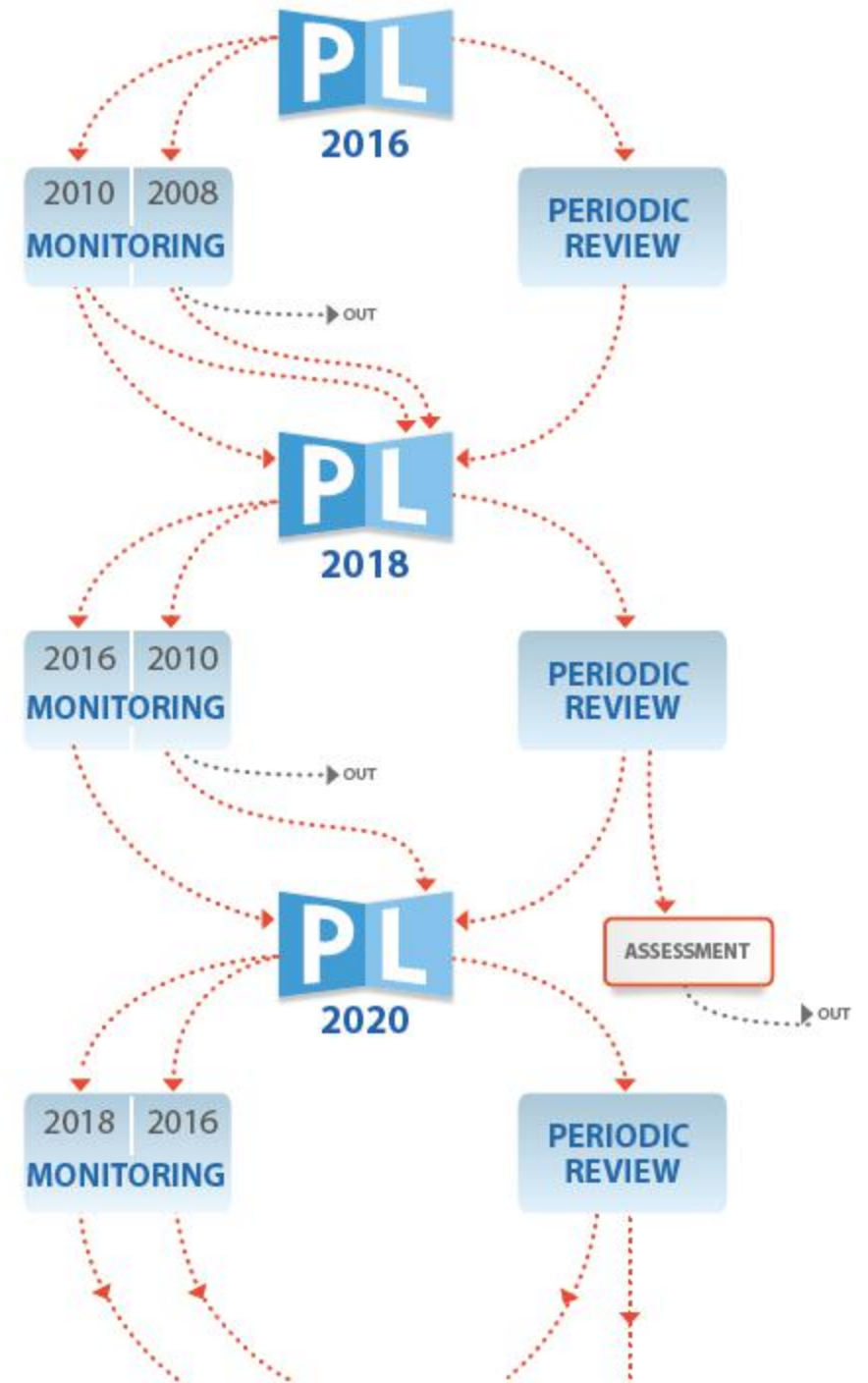
- Guide for Projects & Landmarks for Users is online

ROADMAP INFO DAY VENUE AGENDA REGISTRATION TRAVEL & ACCOMMODATION SOCIAL EVENTS

ESFRI Roadmap 2018 Guide

The public version of ESFRI Roadmap 2018 Guide offers support to proposers preparing a submission and to the Projects and Landmarks involved in the update procedure. It contains the definitions, models, methods and describes the procedures applied for this update. It represents ESFRI's best effort in road-mapping methodology and may thus serve as reference to complementary national exercises.

- Exchange of Experience Workshop for Projects & Landmarks in Malaga on 18th January 2017
- various publication dates & deadlines for specific questionnaires



ESFRI INSTRUMENTS

- the *Strategy Working Groups*
- the *Implementation Group*
- ad-hoc Expert Working Groups*

Experts of the research and innovation in the domain

Experts of e-infrastructures (specific and general)

Experts of research infrastructure management, risk analysis and human capital management

Covering the aspects of *users access strategy* and issues connected to siting, governance and financing

Chaired by a member of the Forum with specific competences or by an Expert, nominated by the Forum and permanently invited to the Forum meetings





ESFRI INSTRUMENTS – SWGs

Assess the scientific excellence of the Research Infrastructure Projects and Landmarks

- carry out the *Landscape Analysis*
- perform the scientific evaluation of *new proposals*
- carry out the *monitoring of Projects* and the *Periodic Review of Landmarks*
- engage, through the Forum, *additional experts* according to the specificity of the project
- consult *external, international referees*, with proven experience and declared absence of conflict of interest
- *collaborate with the IG* on evaluation/monitoring procedures
- *report their results to EB and Forum*
- *enforce the dialogue with the Projects and Landmarks*

Info Day – 17th January
Málaga, Spain



ESFRI INSTRUMENTS – IG

Assesses the maturity of the Research Infrastructure Projects and the implementation/strengthening of the Landmarks

- assess the maturity of *new proposals* for an ESFRI roadmap update
- monitor the *implementation of ESFRI Projects*
- contribute to the *periodic review of ESFRI Landmarks*
- *collaborate with the SWGs* on evaluation/monitoring procedures
- *report their results to EB and Forum*
- offer *targeted and specific (non-financial) support* to ESFRI Projects to move towards implementation and to ESFRI Landmarks
- contribute to the further development of the *methodology* for ESFRI roadmap updates

ESFRI INSTRUMENTS – MOS DATABASE

The Monitoring System of ESFRI has been implemented by the StR-ESFRI Project and will guarantee an *updated description* of the Projects and Landmarks as of the legal, membership, siting of headquarters, budgetary aspects as certified by the *ESFRI National Delegations*

The modular design of ESFRI-MOS includes

- a *repository* for viewing, editing, adding, and querying basic ESFRI data and statistics on research infrastructures
- a *monitoring system* for performance data of corresponding research infrastructures.

The objectives of ESFRI-MOS are

- to *support key target groups in their periodical monitoring / review process*
- to develop a user-friendly and user-targeted scalable system

Available online by login credentials

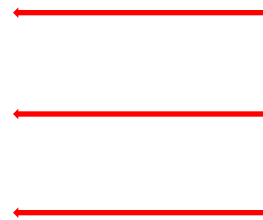




PARALLEL PROCESSES

STRATEGY WORKING GROUPS (SWG) IN FIVE SCIENTIFIC DOMAINS EVALUATE SCIENTIFIC CASE

1. SCIENTIFIC EXCELLENCE
2. PAN-EUROPEAN RELEVANCE
3. SOCIO-ECONOMIC IMPACT
4. E-NEEDS



IMPLEMENTATION GROUP (IG) ASSESSES IMPLEMENTATION

1. STAKEHOLDER COMMITMENT
2. USER STRATEGY & ACCESS POLICY
3. PREPARATORY WORK
4. PLANNING
5. GOVERNANCE & MANAGEMENT
6. HUMAN RESOURCES POLICY
7. FINANCES
8. RISKS

ESFRI INSTRUMENTS – ad hoc WGs

- ESFRI can **create ad hoc Working Groups** of experts to develop specific studies on strategic issues and/or to fulfil specific mandates by the EU Council.
- The results of the work of the ad hoc WGs is **evaluated and adopted by ESFRI**
- ESFRI may decide, when the results are of general interest, to publish **ESFRI Scripta** as reference books for the Research Infrastructure community at large, not engaging ESFRI



This is **ESFRI Scripta Volume 1** from the **Neutron Landscape Group** downloadable at www.esfri.eu

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Málaga, Spain

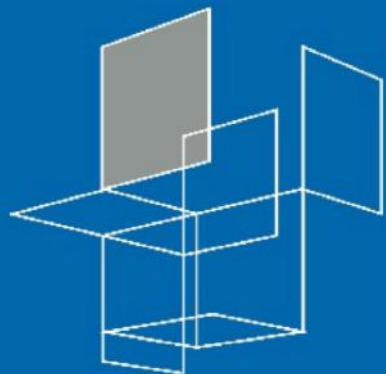
e-INFRASTRUCTURE

Council's mandate on coordination of Members States' investment strategies in e-Is

convergent policy of funding mechanisms for e-I including *support and financing of e-I* for scientific users, providing incentives to researchers to generate *FAIR and reproducible (+R) data*, as well as the *development* of enabling e-tools/e-technologies

building on the EOSC HLEG vision and by *strengthening the data FAIR+R generator role of RIs* and the coordination of science and innovation communities also at broad international level as described by the e-IRG roadmap Realising the European Open Science Cloud Report 2016

urgent actions must be taken to support the *training and hiring of e-I experts/scientists* and to expand the *data literacy* at all levels of education and innovation activities to enable the return from the investment in e-I and RI and maximize societal benefits



Long Term Sustainability expert working-group to prepare recommendations

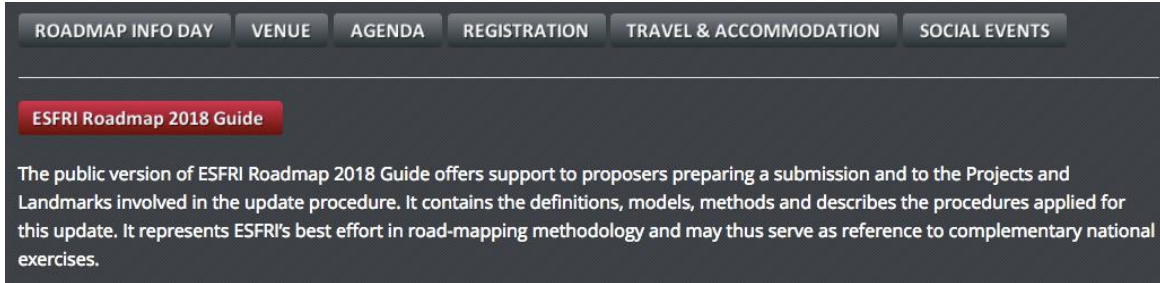


- Costs of all the stages of the LIFECYCLE of the RI, including decommissioning
- Public perception of **VALUE** of RI is a key element for sustainability
- Strategic planning of resources according to LIFECYCLE
- Understanding the **VALUE** of Research Infrastructure investment in economic terms
- Training, impact in forming scientists and international managers of complex undertakings
- Understanding the **optimal fraction of GERD** to be invested in RIs

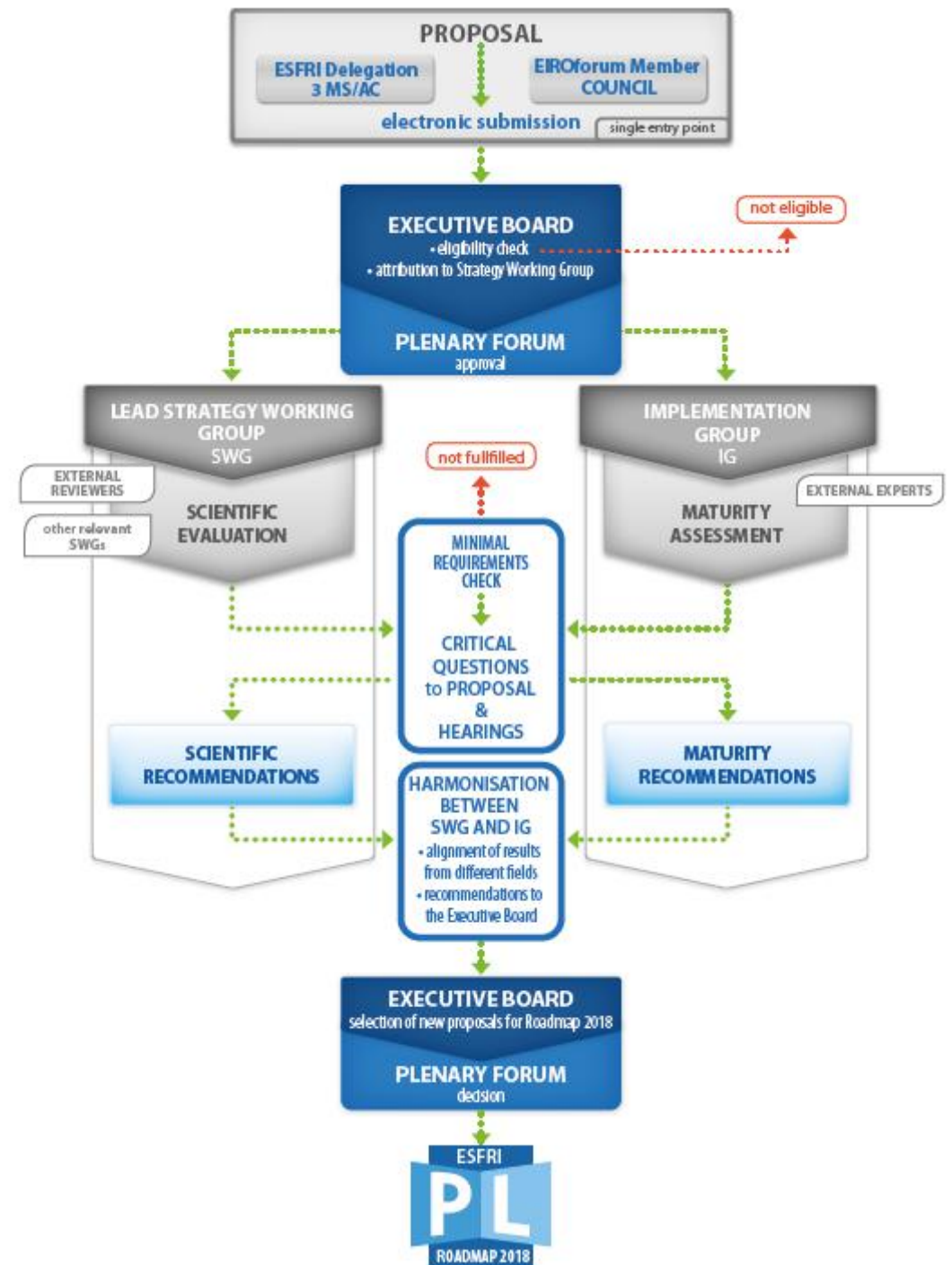


NEW PROPOSALS

- Guide for Proposers & submission form is online



- Submission through the EU Survey are open from **next week**
- only ESFRI Delegations and EIROforum members can submit until **31st August 2017**
- Non European sites may be needed and are welcome
- International/Global partners are welcome/needed





ESFRI 2018 SUBMISSION FORM



- Hosted by the EU Survey of the European Commission
- Available online after 25th January through www.esfri.eu
- Login credentials will be provided to ESFRI Delegates and EIROforum members
- Template in Word will be provided online
- Three parts:
 - Part A – General Information
 - Part B – Scientific case
 - Part C – Implementation
- Support and assistance: esfri@ec.europa.eu

Questionnaire For Submission Of Proposals For Roadmap 2018



Create better online surveys and forms

Fields marked with * are mandatory.

This questionnaire consists of three parts to be completed fully:

PART A: GENERAL INFORMATION is used for the eligibility check by the EB and – if selected - for the public description of the Project in the Roadmap 2018.

PART B: SCIENTIFIC CASE and PART C: IMPLEMENTATION are used by the SWG to evaluate the scientific case of the proposal and by the IG to assess its implementation.

- This questionnaire must be completed in one go as no saving of work underway is technically possible.
- Some questions require to tick a bullet, to fill a text section with a strictly limited number of characters or to upload supporting documents in PDF at maximum 1 MB each.
- If you believe a question does not apply to your proposal, you may enter 'not applicable', but you should explain why the question is not relevant in your case.
- Only the electronic version of this questionnaire may be used to submit proposals for the Roadmap 2018 until the 31st August 2017 at 18:00 CET.

PART A: GENERAL INFORMATION

NAME

Provide the name of your RI:

* FULL NAME (maximum 200 characters with spacing)

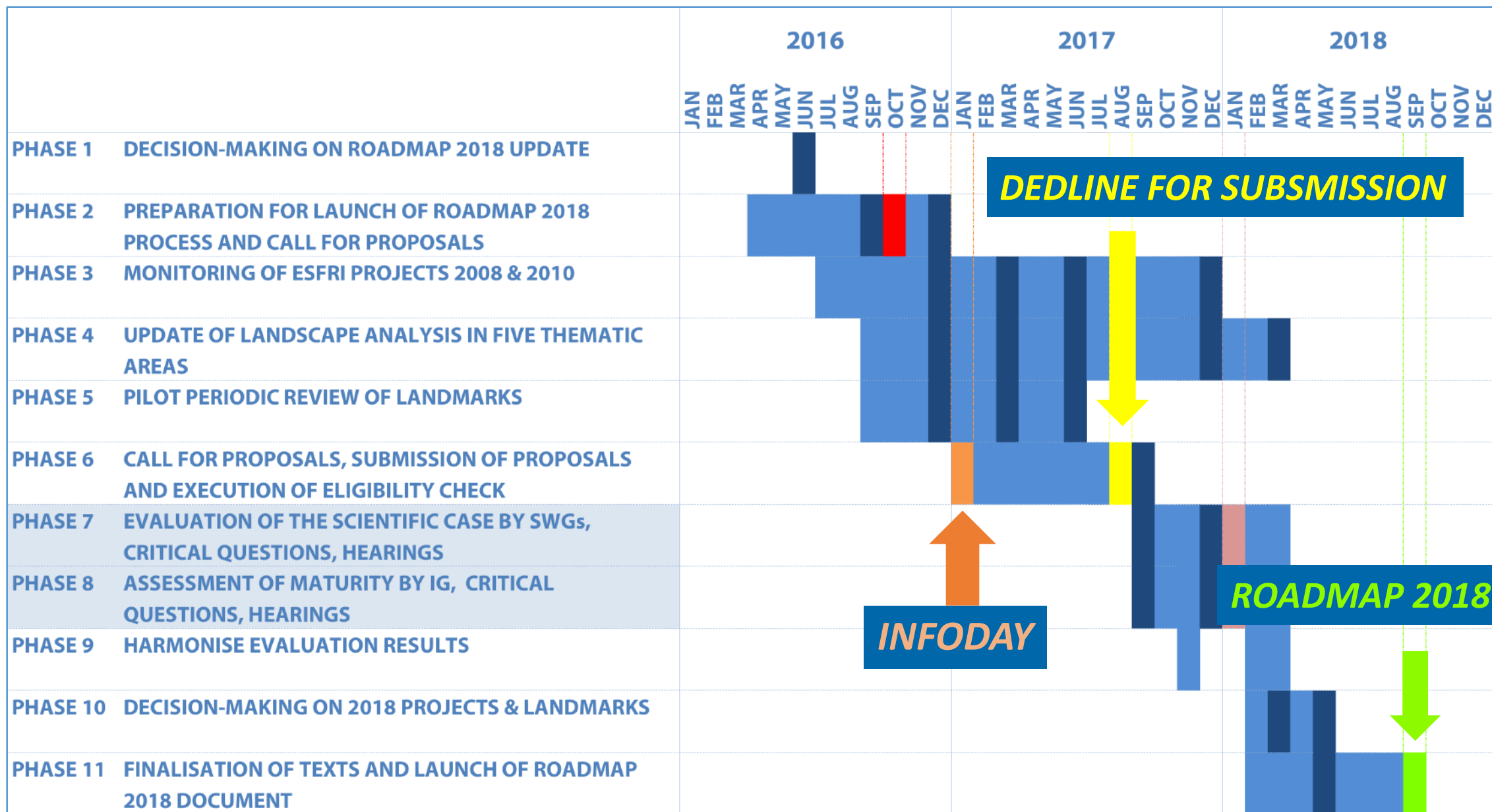
Text of 1 to 200 characters will be accepted (still 1 more characters expected)

* ACRONYM (maximum 20 characters with spacing)

Text of 1 to 20 characters will be accepted (still 1 more characters expected)



KEY DATES & TIMELINE





TODAY'S PROGRAMME

Philippe Froissard, DG RTD, EC

H2020 support for the ESFRI Roadmap

David Bohmert, EB member

The criteria, definitions, methods, procedures and questionnaires for the Submission and the Evaluation of new proposals

Odd Ivar Eriksen, IG Chair

Assessment of maturity of new proposals

Harald Bolt, ENE

The landscape of RIs how the ESFRI projects impact on it

Gelsomina Pappalardo, ENV

José Luis Martínez, PSE

Jacques Dubucs, SCI

Maria Anvret, HF (Vice-Chair)

Sverker Holgren, e-INFRA

Cristina Martínez, DG CNET, EC

The contribution of e-Infrastructures to the European Open Science Cloud

Questions and answers

Info Day – 17th January
Málaga, Spain



ESFRI



Roadmap 2018
Info Day



LIVE WEBCAST

17.01.17
Malaga, Spain