GROUP OF SENIOR OFFICIALS ON GLOBAL RESEARCH INFRASTRUCTURES

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EXECUTIVE SUMMARY

This report summarizes the activities and results of the work of the Group of Senior Officials on Global Research Infrastructures following the extended mandate received from the G7 Science Ministers in October 2015 in Berlin. It stems from the 9th GSO Meeting, held on 15-16 May 2017 in Naples, and it is presented to the G7 Science Ministers' Meeting in September 2017 in Turin as well as to all the Ministers of the GSO members.

The GSO proactively works to identify opportunities for international collaboration among Research Infrastructures that are proposed by its members: it has identified five Case Studies and has carried out an analysis on their potential as Research Infrastructures for global collaboration. A specific roadmap for implementation has been identified for two of the Case Studies – the *Underground Laboratories Global Research Infrastructure-UG GRI* and the *International Mouse Phenotyping Consortium Global Research Infrastructures-IMPC GRI* – considered by the GSO as mature to proceed to the next stage of implementation. A recommendation is made to the G7 Science Ministers to support these conclusions and to endorse the UG GRI and IMPC GRI as **Advanced GRI Projects** with the request of reporting on their progress towards implementation at the next G7 Science Ministers' Meeting in 2019.

The GSO has further developed the relevant Policy Areas – also identifying the most advanced international good practices – and, on this base, has updated its Framework – the list of reference criteria for the establishment of GRIs – that is a living document, firstly approved by the G8 Science Ministers' Meeting in June 2013 in London.

The updated **GSO Framework** contains a refined definition of *global Excellent-driven Access* to GRI that recognises scientific merit as the principal criterion of access. An updated definition of *global Open Innovation* that refers to the specific direct contributions of the GRI to innovation and open innovation has been proposed. The GSO is also currently addressing the *global Open Research Data* issue including the key criteria for data management, data quality control and access to data, and sketching a preliminary set of potential guidelines for implementation by GRIs that builds on the results and good practices of, among others, the Research Data Alliance.

The Matchmaking Exercise, which is based on the list of potential GRIs identified by the GSO Members, continued since the last GSO Report in 2015. It has stimulated dialogues among the stakeholders at the international level, from bilateral to multilateral, and is expected to lead in the future to novel and focused opportunities for broad internationalization of research.

The GSO, since March 2011, has been chaired once by the European Commission, the United Kingdom and Australia, and twice by South Africa, Germany and Italy. The Chairman hosts the plenary meeting and coordinates the work until the next plenary meeting. The EC is a member of the GSO and provides its secretariat and archive. The current Chair is Italy; forthcoming hosts will be the Russian Federation for the 10th GSO Meeting in October 2017 in Dubna, followed by the United States of America in Spring 2018 and the United Kingdom in Autumn 2018.

INTRODUCTION

Research Infrastructures (RIs) are taking an ever increasingly central role in the strategic planning of major scientific investments as they are one of the most effective enablers of research at the frontiers of knowledge in all scientific domains. They are also significant facilitators of research capacity and mobility at the international level, as well as places where advanced technical training and research practises are developed. They are sources of direct and indirect innovation as they generate high quality reference data and new technologies in support of the scientific endeavour.

In all countries there are on-going efforts to support, develop and contribute to the overall structuring of the RI backbone of the research system. In this context, special attention is being given to the internationalisation process focusing on coordination of development and usage. This is due to the broad acknowledgement that many of the leading RIs are – by definition and practise – global, since they are either relevant only if inserted in a wider international context or have direct participation by a number of international members.

The Group of Senior Officials (GSO)[1] is the informal forum established by the G8 in 2008 to discuss and advance Global Research Infrastructures (GRIs). One of the first achievements of the GSO was the development of a Framework for GRIs which was formally adopted by the G8 Science Ministers in 2013 in London. The document describes the criteria that a RI needs to address to be considered as a potential GRI.

The GSO was mandated to identify, within the different classes of GRI recognised by the Framework – global single-sited, globally distributed, and national with internationalization potential – possible candidates that could actually start the implementation of the GRI Framework. A list of potential GRIs and five Case Studies were identified and presented by the GSO to the G7 Science Ministers' Meeting in 2015 in Berlin.

The GSO's activities reflect a twofold approach. First, the GSO develops analysis and facilitates international discussion on GRI policy issues concerning access, innovation policy and data policies, eventually leading to specific updates to the Framework. Secondly, the GSO seeks opportunities for collaboration among

1. The GSO is composed by representatives from Australia, Brazil, Canada, France, Germany, India, Italy, Japan, Mexico, People's Republic of China, Russian Federation, South Africa, United Kingdom, Unites States of America and European Commission. Participating countries were represented by government officials and experts in the areas of international research infrastructures and international relations

RIs, including the identification of Case Studies to track the development of RI internationalization efforts.

The GSO has refined the policy elements of GRI by taking note of internationally-recognized good practices, and by addressing specific issues such as international access to GRI, the specific role of GRI in innovation, and open data management and policy (DMP). Conclusions were reached on the criteria for global *Excellent-driven Access to GRIs*, an analysis was carried out on the GRI-specific contributions to innovation policies, and the on-going discussion will help refine a preliminary set of guidelines for GRIs concerning DMP.

This report highlights the results of the Case Study Exercise and identifies two GRI proposals – the *Underground Laboratories Global Research Infrastructure-UG GRI* and the *International Mouse Phenotyping Consortium Global Research Infrastructure-IMPC GRI* – that have developed robust implementation plans and that could greatly benefit from recognition and ministerial endorsement to pursue the realization of their roadmaps towards greater coordination at the international level, in good alignment with the GSO Framework criteria. The report also includes an update on developments of the GSO Matchmaking Exercise, and an outlook to future actions.

Both the recommendation to endorse the two **Advanced GRI Projects** and the updated **GSO Framework** represent concrete outputs of the GSO.

G8/G7 SCIENCE MINISTERS' MANDATES

FROM 2008 TO 2013

International cooperation on GRIs has been at the centre of high-level science policy discussion for many years. At the first G8 Science Ministers' Meeting, held on 15 June 2008 in Okinawa, the Science Ministers decided to better structure such dialogue by establishing a Group of Senior Officials on Global Research Infrastructures which could promote information sharing and facilitate international cooperation on the planning and development of Global Research Infrastructures.

The mandate of the GSO included:

> **i.** the promotion of international cooperation in large-scale research facilities through the exchange of relevant information and by allowing researchers from other countries access to such facilities including wider access by industry; **ii**. the sharing of information on plans to construct new large-scale research facilities in order to promote mutual international use by international groups or individuals to avoid international investment duplications and to facilitate cost sharing where appropriate; **iii.** promoting the international mobility of human resources in science and technology to further the development of science and technology on a global scale[2].

In its first years of work, the GSO strived to develop a **FRAMEWORK** to identify the key principles to be addressed in presenting a Research Infrastructure as a candidate for international partnership. The GSO prepared a background report giving the rationale of the Framework and arranged a questionnaire through which candidate projects would be able to address the single Framework criteria. A Data Working Group was established and produced a White Paper on Data with five principles for an Open Data Infrastructure and effective management.

2. G8 Science Ministers Statement Okinawa JP, 15 June 2008
http://www8.cao.go.jp/cstp/english/others/g8summary-e.pdf

EXTRACT OF THE G8 SCIENCE MINISTERS' STATEMENT ON COOPERATION IN RESEARCH AND DEVELOPMENT RESOURCES
15 JUNE 2008 – OKINAWA, JAPAN

We acknowledged the necessity of promoting international cooperation in large-scale research facilities through the exchange of relevant information, by allowing other countries access to such facilities in a proper way including wider access by industry, and by sharing information on plans to construct new large-scale research facilities in order to promote mutual international use by international groups or individuals to avoid international investment duplications and to facilitate cost sharing where appropriate.

In strengthening such international cooperation in large-scale research facilities available for international use, we reached a consensus to exchange information, such as accessibility, on existing large-scale research facilities and basic information, such as the scale, priority and schedule for future facilities in each country. In order to continue the dialogue for international cooperation on large-scale research facilities in the future, including discussion of different models for their operation and their use, we reached a consensus to set up an ad-hoc group of senior officials, composed of representatives of G8 members as well as other invited countries. We recognized that the work of this group should take account of the output of existing fora such as the OECD Global Science Forum. We welcomed the US invitation for a first meeting in Washington DC in September or October this year.

We also emphasized the importance of promoting the international mobility of human resources in science and technology to further the development of science and technology on a global scale. In this respect, we stressed that the international use of large-scale research facilities could contribute to facilitating the international mobility and capacity building of human resources in science and technology. We also recognized the importance of further discussions on the promotion of "brain circulation" in which G8 countries not only accept human resources from but also provide them to developing countries.

FROM 2013 TO 2015

At the G8 Science Ministers' Meeting that took place on 12 June 2013 in London, the Science Ministers endorsed the aforementioned actions and adopted the Framework and the White Paper on Data.

The GSO mandate was renewed with the emphasis to concentrate on:

> **i.** promoting the adopted Framework and continuing to exchange information on RIs which might offer opportunities for international collaboration, with specific reference to the role of RIs in addressing the Global Challenges; **ii**. sharing information on national RI priorities and prioritization processes; **iii.** identifying areas of potential benefit that could be achieved through sharing of good practices; **iv.** establishing a representative list of GRIs open to global cooperation. The Science Ministers invited the GSO to report in 2015 on their progress[3].

Since the 2013 Ministerial Meeting, the GSO has been working with a twofold approach. On one side, the GSO has been sharing good practices in specific **POLICY AREAS** – Access, Innovation, Data Management, RI lifecycle. On the other hand, the GSO has been testing the Framework and looking into possible internationalisation opportunities. One of the major milestones in the latter dimension was the establishment, as mandated by the 2013 Ministerial Meeting, of an exemplifying list of Global Research Infrastructures against which the Framework would be tested. The list is regularly updated and has set the basis for further activities conducted by the GSO, namely the **MATCHMAKING EXERCISE** and the **CASE STUDY EXERCISE** that are described in detail in the dedicated sections of this report. The most recent version of the list is also annexed to this report.

3. G8 Science Ministers Statement London UK, 12 June 2013
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/206801/G8_Science_Meeting_Statement_12_June_2013.pdf

EXTRACT OF THE G8 SCIENCE MINISTERS' STATEMENT ON GLOBAL RESEARCH INFRASTRUCTURES 12 JUNE 2013 – LONDON, UNITED KINGDOM

Research infrastructures (RI) are key elements in research and innovation policies. In some cases, their complexity as well as high development, construction and operation costs, requirement for a critical mass of highly qualified human resources, or simply the global nature of the scientific challenge addressed, makes it impossible for one country or region alone to build and operate these facilities. In such cases it becomes crucial to make concerted efforts at the international level for the realisation of "global research infrastructures" (GRI). We recognise the potential for increased international cooperation on global research infrastructures and the benefits that arise from a shared outlook on frontier research and collaboration and good governance.

We recognise the work of the Group of Senior Officials (GSO) formed after the G8 Ministerial meeting in Okinawa in 2008 to take stock and explore cooperation on GRIs.

i. We have decided to adopt the Framework for GRIs decided by the GSO as the principles and reference terms under which G8 countries consider cooperation on GRIs, and encourage other nations to adopt them.

ii. We approve a new mandate for the GSO to enable it to fulfil the areas of its original mandate that have not yet been addressed including to:

- Promote the Framework and continue to exchange information on potential future research infrastructure that may present opportunities for international collaboration, noting especially the needs of the Global Challenges; and
- Share information on national research infrastructure priorities and prioritization processes; identify areas of potential benefit that could be achieved through sharing of best practices.
- Create a representative list of GRIs open to global cooperation of interest to new partners.

We invite the GSO to report in 2015 on their progress.

FROM 2015 TO PRESENT

The GSO Report 2015[4] was presented at the G7 Science Ministers' Meeting that was held on 8-9 October 2015 in Berlin. The Science Ministers acknowledged the document, appreciated the progress in the activities conducted by the GSO and confirmed its mandate while expanding it to focus on:

i. testing the GSO Framework and identifying good practices for the establishment and development of future GRIs; **ii.** exploring the potential for existing research infrastructures to be opened up to international partners on the basis of existing legal structures; **iii.** guaranteeing that the access to GRIs would be established on the basis of a *peer review* process with a focus on scientific excellence; **iv.** achieving progress on sharing and managing scientific data and information, especially by continuing engagement with community based activities such as the Research Data Alliance (RDA)[5].

Under this renewed mandate, the GSO was asked to present another report in 2017 to the G7 Science Ministers demonstrating the progress made in terms of improved international coordination.

4. Group of Senior Officials on Global Research Infrastructures Progress Report 2015
https://www.bmbf.de/files/151109_G7_Broschere.pdf

5. G7 Science Ministers Statement Berlin DE, 8-9 October 2015
http://www.g8.utoronto.ca/science/G7_Science_2015-en.pdf

EXTRACT OF THE G7 SCIENCE MINISTERS' STATEMENT ON GLOBAL RESEARCH INFRASTRUCTURES 8-9 OCTOBER 2015 – BERLIN, GERMANY

In 2008, we decided to establish the "Group of Senior Officials on Global Research Infrastructures (GSO on GRIs)" in order to promote information sharing and facilitate international cooperation on the planning and development of global research infrastructures. In 2013, we agreed on the basic principles for international cooperation on GRIs through adoption of a Framework for GRIs. We mandated the GSO to promote the Framework, continue to share information on prospective GRIs, and to draft a representative list of those research infrastructures open to global cooperation of interest to new partners. We invited the GSO to report on progress in 2015.

We welcome the GSO's report and the accompanying list of those research infrastructures for which the GSO partner countries are interested in greater international cooperation in the future or in extending existing scientific collaboration.

We welcome the progress of the GSO and in particular support the following:

- The GSO will conduct representative case studies to test its Framework for GRIs and identify good practices for the establishment and development of future GRIs.
- The GSO should continue exploring the potential for existing research infrastructures to be opened up to international partners on the basis of existing legal structures.
- Access to GRIs should be established on the basis of a peer review process with a focus on scientific excellence.
- The GSO should continue to develop and promote the concept of global excellence-driven access for future GRIs, developing the specific details of the concept in a qualitative manner for further implementation.
- Further progress on sharing and managing scientific data and information should be achieved, especially by continuing engagement with community based activities such as the Research Data Alliance RDA.
- We encourage the GSO to continue their work on convergence and alignment of inter-operable data management that could accomplish an effective open-data science environment at the G7 level and beyond.

We affirm the mandate of the GSO and ask the GSO to present another report to the G7 Science Ministers on the progress made with improved international coordination and with the evaluation of good practice examples in spring 2017. The aim of this report will be to show what conditions are most suitable for improved coordination among international partners, to the benefit of international users and for effective policy and management related to open data in science.

In addition, noting that development of research infrastructure takes time, we ask that the GSO consider the future and that members increase efforts to share plans and domestic prioritisation exercises, in order to help identify potential opportunities, risks, gaps, or overlaps in capability that may need to be addressed as science and technology continue to develop over the next 20 years.

ACTIVITIES

Following the GSO Report 2015, the Senior Officials have implemented the action plan, also taking into account the objectives set out by the G7 Science Ministers, and have specifically been working on:

i. The **POLICY AREAS** that refine the concept of GRIs covering the fundamental aspects of access by the global scientific community, the dimension of open innovation and the data management, quality control and open sharing.

ii. The continuous refining and updating of the **GSO FRAMEWORK**, based on the progress in the Policy Areas, aiming at identifying good practices for the establishment of future GRIs.

iii. The exploration with a **MATCHMAKING EXERCISE** of the potential for existing national Research Infrastructures to be opened to international partners on the basis of existing legal structures.

iv. The in-depth analysis of five **CASE STUDIES**, representing different types of GRI, aiming at verifying their level of maturity to engage in a roadmap towards structured international collaboration.

v. The identification of two candidate **ADVANCED GRI PROJECTS** to be recommended to the G7 Ministers.

The GSO is steadily progressing in the direction mandated by the G7 with the continued support of the European Commission in its role of GSO Secretariat.

Since October 2015, the GSO has met four times: in November 2015 via videoconference, in February 2016 in Sydney (Australia), in October 2016 in Cape Town (South Africa) and most recently in May 2017 in Naples (Italy). The chairmanship has been held on a rotational basis with the country hosting the GSO meeting taking the chairmanship at the date of the hosted meeting.

POLICY AREAS

In line with its original mandate, the GSO has set up a number of subgroups to tackle the following Policy Areas:

- **GLOBAL EXCELLENCE-DRIVEN ACCESS TO RESEARCH INFRASTRUCTURES**, led by Germany;
- **GLOBAL OPEN INNOVATION - ROLE OF GLOBAL RESEARCH INFRASTRUCTURES**, led by the United Kingdom;
- **GLOBAL OPEN RESEARCH DATA - MANAGEMENT AND SHARING**, led by Australia.

At the 9th GSO Meeting in May 2017 in Naples, the GSO advanced in the discussion and improvement of the Policy Areas with the goal of refining the criteria of the Framework. The GSO Framework is a living document that will be regularly updated in the future to represent at any time the most advanced definition of GRI as well as the main instrument of communication of the GSO to the science community and the public more broadly.

GLOBAL EXCELLENCE-DRIVEN ACCESS TO RESEARCH INFRASTRUCTURES

Since the 2nd GSO Meeting in November 2011 in Cape Town, the development of an access policy for GRIs was identified as a central issue to achieve global impact. This issue has implications for research management by GRIs, but also on global mobility of the researchers that will compete for access to the GRI resources.

After the 6th GSO Meeting in April 2015 in Hamburg, the GSO agreed to mandate a subgroup, coordinated by Germany, to develop the concept of global Excellence-driven Access to Research Infrastructures, inspired by the European Charter for Access to Research Infrastructures[6].

The approach[7] was welcomed by the G7 Science Ministers in Berlin which stated that "*access to global research infrastructures (GRIs) should be established on the basis of a peer review process with a focus on scientific excellence and ii) the GSO should continue to promote the concept of global excellence-driven access for future GRIs, developing the specific details of the concept in a qualitative manner for further implementation*"[8].

Considering this request, at the 7th GSO Meeting in February 2016 in Sydney, the GSO agreed to draft a set of *PRINCIPLES OF GLOBAL EXCELLENCE-DRIVEN ACCESS* along with a *DECLARATION OF INTENT* which would be signed by any Research Infrastructure wishing to ascribe to these principles. Two national RIs (Canadian Light Source, PETRA III) and one regional RI (the European Spallation Source) were identified to be used as best practice access policy examples in this context. The gEA principles were tested on the access policies of these RIs.

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6. European Charter for Access to Research Infrastructures
https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf#view=fit&pagemode=none

7. Section 4.1 "Promoting Access to Research Infrastructures"
https://www.bmbf.de/files/151109_G7_Broschere.pdf

8. G7 Science Ministers Statement Berlin DE, 8-9 October 2015
https://www.bmbf.de/files/English_version.pdf

The concept was further discussed at the 8th GSO Meeting in October 2016 in Cape Town and the relative document **global Excellence-driven Access (gEA)** was finalized during the 9th Meeting in May 2017 in Naples (see **ANNEX 1**), when the GSO also agreed to update the access criterion number 8 of the Framework as follows:

Access goal based on merit review. *The GRI policies should reflect the global-Excellence-driven Access (gEA) paradigm through publication of a clear and transparent access goal. The goal should incorporate a peer-reviewed process that recommends access based on the most promising emergent ideas, regardless of the country of origin or the ability of the proposer to contribute financially.*

PRINCIPLES OF GLOBAL EXCELLENCE-DRIVEN ACCESS

In order to promote the GSO principle of global Excellence-driven Access (gEA) to global research infrastructure (GRI), the GRI agrees to implement the following principles:

1. The GRI establishes a clear, transparent and achievable goal for gEA based solely on the scientific excellence of the proposal (as determined through peer review) such that access to the RI in promoting emergent ideas will be supported, regardless of the country of origin or the ability of the proposer to contribute financially. The GRI will re-evaluate this goal on a periodic basis and publish it on the website of the GRI.
2. Information on services and facilities for international users is easily available and published on the website of the GRI.
3. Transparent guidelines on the access application procedures are published on the website of the GRI.
4. Requests for access are evaluated through a scientific peer review process, which considers international stakeholders and the published RI-specific goals for gEA.
5. The GRI offers training courses for all users, and encourages engagement of scientists from less developed countries and other underrepresented communities through targeted outreach.
6. If user fees are considered necessary and appropriate, the GRI commits to charge such user fees at a reasonable level that is derived from [or, directly related to] the resources and time allotted for use of the facility. Pricing information is published on the website of the GRI and is made available to users approved for access.

DECLARATION OF INTENT

In accordance with the results from the G7 Meeting of Science Ministers stating that the GSO should continue to promote the concept of global excellence-driven access for future Research Infrastructures of global interest and develop a qualitative manner for further implementation

The [...legal name of the Research Infrastructure] requesting to be considered in the frame of the GSO list of Research Infrastructures of global interest, declares to intend fulfilling the principles for global excellence-driven access as follows:

1. *The GRI establishes a clear, transparent and achievable goal for gEA based solely on the scientific excellence of the proposal (as determined through peer review) such that access to the RI in promoting emergent ideas will be supported, regardless of the country of origin or the ability of the proposer to contribute financially. The GRI will re-evaluate this goal on a periodic basis and publish it on the website of the GRI.*
2. *Information on services and facilities for international users will be made easily available and published on the website of the GRI.*
3. *Transparent guidelines on the access application procedures will be published on the website of the GRI.*
4. *Requests for access will be evaluated through a scientific peer review process, which considers international stakeholders and the published RI-specific goals for gEA.*
5. *The GRI will offer training courses for all users, and encourages engagement of scientists from less developed countries and other underrepresented communities through targeted outreach.*
6. *If user fees are considered necessary and appropriate, the GRI commits to charge such user fees at a reasonable level that is derived from [or, directly related to] the resources and time allotted for use of the facility. Pricing information will be published on the website of the GRI and is made available to users approved for access.*

The [...legal name of the Research Infrastructure] commits to make every effort to implement the above mentioned principles within a year from the signature of this Declaration. The Declaration of Intent will come into effect on the date of signature.

GLOBAL OPEN INNOVATION – ROLE OF GLOBAL RESEARCH INFRASTRUCTURES

A discussion on the Innovation Policy Area was launched at the 7th GSO Meeting in February 2016 in Sydney with particular reference to the role played by GRIs in the innovation process. The United Kingdom is coordinating this specific work strand. The GSO recognizes that policies to support innovation differ across countries, disciplines and industry sectors depending on national priorities. Nevertheless, it is clear that the knowledge base on which innovation can develop comes from research and GRIs can play an important role in critical research areas, like the Grand Societal Challenges.

Several aspects of innovation have been explored through the work of the GSO to date, focusing on the establishment of innovation hubs around GRIs, on GRIs as a source of knowledge for innovation, and on the intellectual property (IP) issues and their overall value. GSO discussions developed on technology transfer, intellectual property and socio-economic impact issues, which are referenced in criteria 13 and 14 of the Framework. The analysis further expanded to include training aspects and access arrangements, and to ensure that all partners share the benefits of innovation. The discussion paper presented at the 8th GSO meeting in October 2016 in Cape Town, identified innovation opportunities at each stage of the RI lifecycle.

At the 9th GSO Meeting in May 2017 in Naples, the GSO better defined the lifecycle-specific opportunities and challenges with respect to innovation, as extracted from the current working paper on **global Open Innovation (gOI)**.

GLOBAL OPEN INNOVATION OPPORTUNITIES AND CHALLENGES ACROSS THE GRI LIFECYCLE

	Lifecycle stage	Challenges and opportunities
1.	Development Stage	**Innovation opportunities, outlined at conceptual design study, in the international collaborative effort that defines the terms of the GRI. Innovation in the governance and management of GRI type. Innovation impact on the foreseeable in-kind contribution and its management adaptation to all participating Countries/Institutions. Innovation in the legal/financial tools to be adopted to establish the GRI.** Further identification of the types of innovation that could occur and the magnitude of activity, e.g. identifying novel technical developments required and potential uses of the data.
2.	Design Stage	**Innovation through co-design with industry, public services, and stakeholders for the technical design study, cost-book and in-kind contribution selection and tender.** Build and plan the innovation processes for this and all subsequent stages in the RI lifecycle. Communicate with stakeholders to manage expectations on what can be delivered for all partners e.g. Intellectual Property in the RI team, academic labs or industry that arises from R&D on new technologies to enable RI construction.
3.	Implementation Stage	**Innovation at first-contact level with the industry and services involved in the construction and beneficiaries, through tender, of the main part of the construction budget. Development and co-design by the GRI and industry/ services of the innovative technologies needed for the implementation. Policy for co-ownership of IP by the GRI and partners of the economy and/ or educational sector. Innovation issued by IP share of the co-design and prototyping.** Set up process tools for managing and monitoring innovation activities e.g. capturing the potential for companies delivering RI components for upskilling and delivery of higher quality products and services to other clients.
4.	Operations Stage	**Innovation from operation methodologies, co-development of services to support operation. Research data management policy and its openness towards innovation-oriented usage. Impact on innovation by research results.** Monitor innovation activities and revise the innovation plan to reflect any changes e.g. identifying the results flowing from the RI and how these are exploited by companies or establishing a data management centre that could potentially support other activities.
5.	Termination Stage	**Innovation in the long term conservation of data and access policy.** Ensure that any IP is distributed to stakeholders or released to collaborators for appropriate returns to the RI or successor organisations e.g. put arrangements in place to monitor ongoing returns on innovation investment by any successor organisation or select a stakeholder organisation to monitor this.
6.	Legacy Stage	Carry out a whole lifetime study after the RI is decommissioned. An example of innovation at this stage could be that after closure the location remains an innovation hub based on the cluster built up during the operations stage.

The GSO further discussed the specific role of GRIs in Open Innovation in creating at the international level the best environment – open laboratories, open data, cloud computing, internet of things, etc. – to enable the integration of science, industry, academia, governments and communities in the innovation processes. In particular, the GSO noted that the G20 Innovation Report 2016[9] analyses many aspects of economic and social development including the role of research and research data. The GSO concluded that it should concentrate on the specific role of GRIs in Open Innovation spanning over the aspects of industry as provider – pre-procurement and procurement when building/upgrading/maintaining a GRI – and as user of GRIs, as well as the issues of training and knowledge transfer to the private sector.

To reflect this, the GSO started a discussion that includes the proposal to modify the innovation criterion 13 of the Framework in such a way to express a wider and stronger expectation that GRIs will address innovation aspects at all stages of their lifecycle. The proposed new wording, not yet finalised and adopted, according to the currect working paper on **global Open Innovation (gOI)**, is as follows:

Innovation, Technology transfer and intellectual property. *Global Research Infrastructures should develop an innovation plan at the outset with clear policies for the promotion of innovation and technology transfer and the management of intellectual property. These should recognise the differing opportunities for innovation at each stage of the RI lifecycle as well as the barriers and drivers appropriate to the particular RI context. Members of the GSO should regularly exchange information on best practices regarding innovation and intellectual property rights management, and on the sharing and exploitation or utilisation of data and technology generated in global research infrastructures, and promote their adoption by the RIs they support.*

Inputs to the development of the global Open Innovation concept were also coming from the Case Studies that were requested to give a specific contribution.

9. G20 Innovation report 2016
https://www.oecd.org/sti/inno/G20-innovation-report-2016.pdf

CASE STUDIES DIRECT IMPACT ON GLOBAL OPEN INNOVATION

UG GRI

The integration of RIs is an opportunity to organise ideas and information exchanges to create an innovation environment to provide frontier services to frontier research:

- internalisation - invite innovative projects carried out by industries to use the unique facilities provided by the RIs
- externalisation - transfer of innovations and knowhow to stakeholders (e.g. innovative techniques for identifying trace elements and for new generations of highly sensitive radiation detectors)
- building a platform with a wide range of domains in science and technology to support job creation.

IMPC GRI

While developing the operational pipeline for high-throughput phenotyping, the IMPC has vetted and developed numerous protocols for each phenotyping assay. These Standard Operating Procedures (SOPs) and data relating to it are available on the IMPC website. The IMPC has also developed web based tools to view and analyze its data (http://www.mousephenotype.org).

- **Phenoview** is a publicly accessible database (https://www.mousephenotype.org/phenoview) developed by the IMPC for visualizing genotype-phenotype relationships.
- **PhenStat** is a freely available R package that provides a variety of statistical methods for the identification of phenotypic associations.

The methods have been developed for high throughput phenotyping pipelines implemented across various experimental designs with an emphasis on managing temporal variation in data collection.

ESS

The construction of the European Spallation Source has fostered innovation on multiple levels. The following demonstrate three main scientific innovations championed by the ESS project:

- **High-power modulators:** the non-existence of relevant technologies on the market, has led ESS to develop its own topology of high voltage power converters, also known as modulators, and to successfully test its first prototype. The potential application in other scientific and industrial fields is extremely broad and includes broadcasting and telecommunication, renewable energy production and transmission, non-destructive testing, sensors, detectors, and food treatment, among other.
- **Boron 10-Based Gaseous Detector (Multi Blade and Multi Grid Versions)**: Boron is one of a very few chemical elements that can be used to detect neutrons. Boron is more widely available than Helium-3, which has been commonly used and recently become scarce. Boron 10-based detectors have wide utilization in non-destructive testing.
- **2-Dimensional "Pancake" Moderators:** to moderate the speed of fast neutrons at ESS, a new 2-dimensional design geometry of moderators was introduced. The new design can release more neutrons than earlier designs and also requires smaller beamline penetrations, which will help to increase the brightness of the ESS facility. This innovation has applicability in the field of nuclear engineering.

CHARS

The CHARS campus will serve as a major hub for Arctic technology development and innovation by providing a research platform, expertise, infrastructure and support to northern entrepreneurs and innovators in developing, adapting, and testing technologies that could be used in the North, including the 'northernization' of southern-based technologies. Along with its research labs, the CHARS campus will include a technology development centre to promote the translation of knowledge into innovation and serve as a link to the private sector. To support the private sector and catalyze innovation in the development of the CHARS infrastructure, a construction management approach was used to overlap the design and construction phases (Design-Build acquisition strategy). This innovative approach not only allowed construction to begin as the design progressed, but also allowed the construction manager to promote smaller packages of work, making them more accessible to local companies and trades to encourage local skills development and to provide opportunities to Land Claim beneficiaries through Inuit Benefits Plans.

GLOBAL OPEN RESEARCH DATA – MANAGEMENT AND SHARING

The GSO has consistently focused on the important link between scientific data and GRIs. The GSO Framework for GRIs, endorsed by the G7 Science Ministers in October 2015, stresses the critical importance of data for Research Infrastructures. The establishment and on-going work of the Research Data Alliance (RDA)[10] , as an important and independent community of interest, reflects the successful evolution of the GSO's Data Working Group. A large part of the 7th GSO Meeting in February 2016 in Sydney was dedicated to this dimension where Australia offered to take the lead. Following the meetings in Cape Town and Naples, the GSO has reached a first consensus on management and sharing of global Open Research Data.

The GSO is working on promoting common awareness among all RIs regarding their responsibility for managing research data to enable appropriate storage, access, curation and re-use. The GSO aligns with the good practices that are being defined at the international level – notably by the RDA – in order to set goals for Open Research Data protocols for the GRIs. The GSO agreed to examine issues concerning the key role of GRI in data quality certification and management and other concepts related to data sharing, also considering the existing contributions by RDA, OECD Global Science Forum (OECD GSF)[11], European Open Science Cloud (EOSC)[12] and others. The GSO aims to underscore the data policy requirements for GRIs to be consistent with their own scope.

Open access to data is one of the key dimensions in this context, with emphasis on future work to coordinate and enable international data collaboration through the GRIs and to acknowledge the importance of the FAIR – Findable, Accessible, Interoperable and Reusable – principles for data management[13]. As such, the GRIs will likely be engaged in developing and enforcing Data Quality Control methodologies and rules. The GSO will further work on formulating guidelines for the GRI Data Management Policy (DMP).

The tentative guidelines – extracted from the current working paper on **global Open Research Data (gORD)** – will be refined and eventually become recommendations.

10. Research data Alliance RDA
https://www.rd-alliance.org

11. OECD Global Science Forum
http://www.oecd.org/sti/sci-tech/oecdglobalscienceforum.htm

12. European Open Science Cloud
https://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud

13. Open Science Initiatives
http://ec.europa.eu/research/openscience/index.cfm

TENTATIVE GUIDELINES ON GLOBAL OPEN RESEARCH DATA

As an effort to align the data policy of GRIs to the international good practices, the GSO agrees to develop the following principles::

1. The research facilities that produce data should have a data management policy compliant with, for examples, IP rules of the participating countries, procedures, and appropriate infrastructure to support that policy.
2. The policy should ensure that data that is produced by and at the facility – i.e. by scientific users – is as open as possible to further data-users by defining rules that should be accepted by the data producers, according to embargo periods, preparation of suitable metadata, acknowledgement of sources, IP rules. An example of good practice is the outcome of the PaNdata project in the photon-&-neutron community, as described in the ESRF data policy[14].
3. The GRI shall ensure that data is FAIR and Reproducible as a key support to the integrity, transparency and openness of the research.
4. The GRI shall cooperate with leading open data initiatives and standardisation bodies – e.g. the European Open Science Cloud – and align to, or adopt, the Data Management practices and Data Policies while however complying with any restriction which can be imposed by a possible sensitive nature of its data.
5. The GRI will ensure that raw data are stored and curated; access to raw data is awarded upon request and in compliance with the chosen open data access policy.
6. The GRI shall employ highly skilled data managers and operators and pro-actively enable, through training, the advanced use of data and data services.
7. The procedures and infrastructure – i.e. metadata catalogues, software and data repositories – shall help to support the formal publication of metadata and data sets, as well as to enable the tracking of their usage through persistent identifiers, citation and data licenses.
8. The metadata should be provided by the GRI (with the users involvement) and become part of a searchable worldwide online data catalogue.
9. The tools for data analysis and interoperability shall be available through the GRI or other e-infrastructure respecting the GRI Data Policy (including specialized rules for educational, SME, industry or public services).
10. The acceptance of the GRI Data Policy shall be a condition for access to GRI and to the data repositories, both as a data producer and temporary owner, and as a data user.
11. The GRI should actively participate in international fora and community-led consensus building initiatives in the area of data management, such as the RDA, to promote interoperability.

14. The ESRF Data Policy
http://www.esrf.eu/files/live/sites/www/files/about/organisation/ESRF%20data%20policy-web.pdf

GSO FRAMEWORK

The GSO implements the Framework as a living document that integrates the results of the Policy Areas as they are enhanced to incorporate the GRI best practises. The 2017 update to the Framework is as follows.

FRAMEWORK FOR GLOBAL RESEARCH INFRASTRUCTURES

Research Infrastructures (RIs) are recognised as key elements in research and innovation policies, for boosting scientific knowledge generation, for accelerating technology development, for enhancing both technological and social innovation, and for providing advanced scientific training for new generations of scientists and science managers. Furthermore, they provide an enabling environment for established researchers to improve their performance and knowledge and innovation outputs.

In some cases, their complexity as well as high development, construction and operation costs or simply the global nature of the scientific challenge addressed makes it impossible for one country or region alone to build and operate these facilities. In such cases it becomes crucial to make concerted efforts **at the international level** for the realisation of **Global Research Infrastructures (GRIs)**. The interest in a GRI relies on its capacity to address the research needs of world-wide scientific communities by combining the best available knowledge, human capital and resources in one specific scientific area with multi-source funding.

The potential for increased international cooperation on issues related to Global Research Infrastructures has been recognised during international high-level meetings on science policy and in different fora since 2007. At the first G8 Ministerial meeting, held in Okinawa on 15 June 2008, it was decided to form a **Group of Senior Officials (GSO)**[1] to take stock and explore cooperation on Global Research Infrastructures. This document reflects the main observations and recommendations of the GSO and provides a Framework for the GSO's continued consideration of Global Research Infrastructures.

The GSO recognises the vital role of Global Research Infrastructures in addressing world-wide S&T challenges and the benefits of coordinating investments in Global Research Infrastructures to efficiently use the available resources and fully realise their potential benefits.

Taking due account of national or regional strategies for S&T and Research Infrastructures, a common framework is needed to allow each country to take informed decisions on prioritisation, design of efficient governance structures, appropriate funding schemes, policies for access and utilisation, etc. While keeping in mind specificities of domains and projects, the existence of such a framework facilitates a common approach to address these elements in GRI initiatives and foster the use by international consortia of stable procedures for decision-making and operation, as well as opening of national facilities of global interest on the basis of internationally recognised best practice.

Due to the large variety of Research Infrastructures and the lack of a common terminology, the GSO agreed on three broad categories of Research Infrastructures of global relevance to be used in its discussions. The first two can be properly considered Global Research Infrastructures, while the third one constitutes a broader set of national facilities of global interest. These are:

- *Real single-sited global facilities* **are geographically localized unique facilities whose governance is fundamentally international in character.** The Large Hadron Collider (LHC) at CERN and ITER are current examples. The possibility of future opportunities which may arise from similar projects being developed in different countries needs to be kept in mind, in order to ensure that only one such facility is built.

- *Globally distributed Research Infrastructures* **are Research Infrastructures formed by national or institutional nodes, which are part of a global network and whose governance is fundamentally international in character**. Ocean, earth or seafloor observatories fit very well into this category, including oceanography fleets of research vessels and polar research facilities (both for the Arctic and Antarctic), as well as large telescope arrays. Ad-hoc distributed facilities, linked with time-limited campaigns of observations, might also be considered for possible inclusion in this category.

1. The GSO is composed by representatives from Australia, Brazil, Canada, China, the European Commission, France, Germany, India, Italy, Japan, Mexico, Russia, South Africa, UK, and USA. Participating countries were represented on the GSO by government officials and experts in the areas of international research facilities and international relations.

Scientific information exchange, data preservation and distributed computing infrastructures relying on open high-speed connectivity, provide new opportunities in terms of virtualization of resources, advanced simulation environments and improved and wide access to Research Infrastructures

- *National facilities of global interest* **are national facilities with unique capabilities that attract wide interest from researchers outside of the host nation**. Antarctic or ocean drilling facilities are typical examples. Existing Research Infrastructures with the potential for wide international utilisation (for instance, facilities that leverage geographical advantages or exhibit unique opportunities for advanced research) may fall under this category. Countries may accordingly propose those national facilities that have the potential to be opened for global participation, taking due care of balancing international and national interests.

The development and operation of Global Research Infrastructures rely on **common principles** such as:

- Global Research Infrastructures may constitute the basis for the national or regional development of comprehensive innovation clusters around the Global Research Infrastructures, with the aim to coordinate other nationally or regionally important infrastructures, research labs, technology transfer and education structures which need to be identified and supported along the lifecycle of the Research Infrastructure. In addition, different RIs with complementary capabilities working in similar scientific areas should consider realising collaborative Global Research Infrastructure.

- Other common principles include: the use of variable geometry schemes where only interested stakeholders should participate along the full lifecycle; the use of harmonized evaluation criteria to assess the benefits of a Global Research Infrastructure; and clear rules for accepting additional partners.

The GSO will regularly compare long-term strategies or national or regional strategic roadmaps (including roadmaps prepared by scientific communities) in order to facilitate the **identification of Research Infrastructures of global relevance**. Sharing this information will help ensure that governments and scientific communities can effectively focus the resources they devote to development of Global Research Infrastructures, while considering national or regional laws and strategies.

National facilities of global interest should be identified considering policies agreed upon, including those agreed in wider international context. The adoption of the Framework by perspective GRIs will create the basis for opening their governance and funding schemes to stakeholders from other countries.

The **GSO therefore considers it essential to continue its activity in the context of this Framework** and to periodically report to the relevant authorities on its progress and proposed updates. The GSO should periodically share scientific Research Infrastructure interests of national priority among the participants to identify priority projects of mutual interest, and to also identify project-specific challenges to international collaboration that will need further attention.

FRAMEWORK CRITERIA

The following recommendations form the basis for the Framework for Global Research Infrastructures. The Framework is a living document that builds on the continuous work of the GSO and is based on previous experience with existing Global Research Infrastructures available worldwide, on the analysis of selected case studies, and on updates in the relevant Policy Areas addressed. The GSO proceeds with the **periodic review and refinement of the Framework** as well as to its **testing** on carefully selected case studies in the context of international cooperation in Global Research Infrastructures initiatives.

1. **Core purpose of Global Research Infrastructures.** Global Research Infrastructures should address the most pressing global research challenges, i.e. those frontiers of knowledge where a global-critical-mass effort to achieve progress is required. Science, technology, innovation, and advanced research training goals should be fully integrated throughout the infrastructure plans from their early development.

2. **Defining project partnerships for effective management.** Global Research Infrastructures initiatives should explicitly and clearly define, as early as possible, the roles and responsibilities of the partners through the different phases of a project's full lifecycle: planning, construction, operation, upgrading, and termination or decommissioning. Rules for future participation should be defined to allow the inclusion of new partners.

3. **Defining scope, schedule, and cost.** Stakeholders should agree upon a shared understanding of the foreseen scope, schedule (including a timetable) and cost, addressing inherent uncertainties and any external constraints, and define processes to effectively address deviations.

4. **Project management.** Appropriate management structures and professional top level management should be established, consistent with best practices derived from existing recommendations and experience at the international level, to ensure rigorous project management.

5. **Funding management.** The development of a Global Research Infrastructure should foresee a careful balance between the minimum acceptable percentage of in-cash contributions and the appropriate level of in-kind contributions. The in-kind contributions have to be effectively evaluated regarding quality and schedule.

6. **Periodic reviews.** The scientific output and strategic goals of Global Research Infrastructures should be periodically evaluated and updated if needed throughout the entire lifecycle to ensure consistent excellence of the scientific output. In addition, an assessment of the quality of the services offered to the scientific communities is necessary to ensure the long-term usefulness and success of the infrastructure. Partnership agreements among funding agencies must enable each nation to fulfil its unique stewardship responsibilities on behalf of its national government for oversight of contributed funds.

7. **Termination or decommissioning.** Planning for termination or decommissioning of a Global Research Infrastructure initiative should be established early in the development of the facility where possible or relevant, by defining criteria for the conclusion of operation, and establishing exit criteria and procedures for closing down and recognizing future termination liabilities or encumbrances on the sponsors at the conclusion of operation

8. **Access goal based on merit review.** The GRI policies should reflect the global-Excellence-driven Access (gEA) paradigm through publication of a clear and transparent access goal. The goal should incorporate a peer-reviewed process that recommends access based on the most promising emergent ideas, regardless of the country of origin or the ability of the proposer to contribute financially.

9. **E-infrastructure.** Global Research Infrastructure initiatives should recognize the utility of the integrated use of advanced e-infrastructures, services for accessing and processing, and curating data, as well as remote participation (interaction) and access to scientific experiments.

10. **Data exchange.** Global scientific data infrastructure providers and users should recognise the utility of data exchange and interoperability of data across disciplines and national boundaries as a means to broadening the scientific reach of individual data sets.

11. **Clustering of Research Infrastructures.** Where clustering of complementary Research Infrastructures appears to be consistent with the mission of the Global Research Infrastructure, schemes for access and mobility of researchers, engineers and technicians through the cluster should be actively encouraged.

12. **International mobility.** Measures to facilitate the international mobility of scientists and engineers to participate in Global Research Infrastructures should be promoted.

13. **Technology transfer and intellectual property.** In order to facilitate technology transfer activities and the most productive participation of industry, members of the GSO should regularly exchange information on best practices regarding intellectual property rights management, and on the sharing and exploitation or utilisation of data and technology generated in Global Research Infrastructures, by following internationally accepted regulations, in order to facilitate technology transfer activities and the participation of industry.

14. **Monitoring socio-economic impact.** The socio-economic impact and knowledge transfer issues of Global Research Infrastructures should be assessed not only in the beginning but during the lifecycle of the project. The GSO will refer also to the OECD Global Science Forum work on the socio-economic impact of Research Infrastructure[2].

2. OECD Global Science Forum 2017: Establishing a reference framework for assessing the socio-economic impact of Research Infrastructures.
https://demo-ipp.nuvole.org/socio-economic-impact-research-infrastructures/ri-impact-files/oecd-gsf-activity-socio-economic

MATCHMAKING EXERCISE

During the 6th GSO Meeting in April 2015 in Hamburg, and following up on the positive reception of the established exemplifying list of Global Research Infrastructures (see **ANNEX 2**), the GSO launched an exercise aimed at identifying infrastructures located in the GSO member countries that would have an interest in establishing contact with any of the facilities on the GRI list. The purpose of the exercise was to facilitate the development of new collaborations, on a bilateral or multilateral basis, among Research Infrastructures and related institutions in different countries. The activity also demonstrated its potential in setting the conditions for the future creation of new GRIs through coordination between existing national infrastructures. In this context, the matchmaking activity gave rise to the Case Study Exercise as further discussed in the relevant section of this document.

Since 2015, the GRI list has been periodically updated. In 2016, the GSO launched a new iteration of the Matchmaking Exercise addressing all the listed GRI candidates. The initial results highlight interests having been raised regarding 32 of the 52 GRI on the GSO list coming from 76 entities. The outcome of the exercise did not meet expectations, but this may be due mostly to its perception as a bureaucratic burden, whilst the broad coverage of the list did indeed prompt contacts and early dialogues among several RIs. The GSO therefore acknowledges that the number of explicit responses to the exercise does not represent the actual contacts established as a result of the matchmaking initiative. Connections between the fusion research communities of the UK and China or the initial contacts between the European Spallation Source and the Brazilian community, or bilateral contacts developed by South Africa, have effectively spun out of this activity. In this context, the GSO will renew with regular iterations the Matchmaking Exercise, redefining it in a "softer way" to avoid the perception of an unwanted rigid scaffold for the dialogue.

The GSO also recognized that a number of Global Research Infrastructure initiatives that develop worldwide are not immediately brought to the attention of the GSO itself although the Framework could be of guidance for their preparation. In the future, the GSO will actively scout new initiatives in order to reach a systematic recognition of all the relevant on-going GRI efforts. The GSO may also identify areas of special opportunity of international collaboration towards GRI and consequently invite new Case Studies to address the possibilities of globalization in such fields.

CASE STUDIES

During the 6th GSO Meeting held in April 2015 in Hamburg, the members agreed on the need to analyse a number of Case Studies to test the Framework adopted in 2013 and identify good practices for the establishment and development of future GRIs. The exercise was launched with the aim to enhance international collaboration among Research Infrastructures while exploring new processes and deriving good practices in the domain of possible international partnerships.

The rationale for the choice of the Case Studies was to cover diverse types of RI that could develop different models of internationalisation and in accordance with the RI categories identified in the Framework, including:

- coordinating/federating large national laboratories in a specific field of science to become a world reference;
- a distributed RI pursuing a grand challenge (human health) and factorizing the capacity of multiple nodes to reach the goal more efficiently;
- a new single-sited infrastructure with unprecedented features enabling novel science that may gather broad international participation in the construction and operation phases;
- a single-sited unique infrastructure in a key geographical location for effective research on a grand challenge (climate change) with an interest in international collaboration;
- a unique observatory whose expansion gives the opportunity to broaden the international partnership.

Five Case Studies were consequently selected for this exercise based on the GRIs that had aggregated the broadest interest among the GSO:

- **Underground Laboratories Global Research Infrastructure-UG GRI**, proposed by Italy;
- **International Mouse Phenotyping Consortium Global Research Infrastructures-IMPC GRI**, proposed by Italy;
- **European Spallation Source**, proposed by the European Commission;
- **Canadian High Arctic Research Station-CHARS**, proposed by Canada;
- **High Altitude Water Cherenkov Observatory-HAWC**, proposed by Mexico.

The exercise was conducted using a set of guidelines elaborated by the GSO and each of the Case Studies was requested to regularly report back to the GSO.

During the 8th GSO Meeting in October 2016 in Cape Town, the GSO recognised that each proposal would effectively have the potential to confirm the utility of the GSO Framework, illustrating good practices that could be replicated at the international level and setting the basis for further collaboration opportunities. Specifically:

- **Underground Laboratories Global Research Infrastructure-UG GRI**, is an example of a potential coordination effort among national endeavours that could lead to a more effective integration of the underground laboratories at the international level, with a focus on developing common protocols and reference standards on management, safety, access and data management aspects;

- **International Mouse Phenotyping Consortium Global Research Infrastructures-IMPC GRI**, is an example of a consolidated globally distributed infrastructure and a reference on how to develop good practices in the data management dimension;

- **European Spallation Source-ESS**, is an example of good practices derived from a multilateral initiative developed at regional level (Europe) with particular reference to the in-kind contribution (IKC) scheme set up in developing a large and extremely costly single-sited regional facility;

- **Canadian High Arctic Research Station-CHARS**, is an example of a national laboratory of potential global interest;

- **High Altitude Water Cherenkov Observatory-HAWC**, is an example of a bilateral cooperation effort between Mexico and USA, around a single-sited RI with the aim to attract more international partners in connection with the plans for a second site in the Southern Hemisphere.

For the purpose of this report, four Case Studies have provided a synthesis of the activities conducted, covering the following issues:

- an assessment of the utility of the GSO Framework benchmarking each of the criteria against their experience (all – minimum requirement);

- the illustration of at least one lesson identified to be shared with the wider community;

- a proposed way ahead – roadmap – in terms of activities that would enable further integration of the dimension being considered;

- a statement on the specific impact on innovation/open innovation that is being already produced or expected.

The Executive Summary of four Case Studies is found below, as well as their alignment to the Framework criteria. A full description of the Case Studies is available at the GSO section on the Research Infrastructure page of the European Commission website[15]. The fifth Case Study, HAWC, is currently in a more preliminary stage and is expected to deliver a complete proposal in the future.

At the 9th Meeting in May 2017 in Naples, the GSO has evaluated the readiness level of the Case Studies in terms of adhesion to and implementation of the Framework and of their overall advancement in the roadmap towards full internationalization. The GSO recognizes that two of the Case Studies – the UG GRI and the IMPC GRI – have worked out a clear roadmap towards the establishment of an effective operational GRI and should be given a recommendation to support the implementation of their roadmap. The GSO recommends the G7 Science Ministers to acknowledge this result and to support the process to establish the two GRIs by identifying them as **Advanced GRI Projects**. The GSO engages in monitoring periodically their progress as the application of the Framework is concerned and in their overall advancement. **The Advanced GRI Projects** should also periodically refer to the G7 Science Ministers on the fulfilment of their role and overall progress.

15. DG RTD – Research Infrastructures – GSO
http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=gso

A snapshot of the five Case Studies as they were presented at the 9th GSO Meeting in Naples is shown below, highlighting some of the (quickly evolving) features for each of them.

SNAPSHOT OF THE FIVE CASE STUDIES

RI	Type	Lifecycle Stage	Current Partners (Interested Parties)	Good Practice	Lessons Learned	Next Steps
UG GRI	National	Operation	3 (10)	Common protocols and standards	Operation Commons as basis for internationalization	Implement Phase 1 of Roadmap to GRI status
IMPC GRI	Distributed	Operation	13 (5)	Data management, data quality control, standard of research protocols	Need to reach global capacity to reach full scientific and societal impact	Increase Global Capacity as stage 2 of GRI implementation
ESS	Single-sited	Implementation	15 (4)	In-Kind Contribution (IKC) Scheme	Significant management effort with IKC for large single sited RIs	Expansion outside of the European Research Area
CHARS	National	Design & Implementation	1 (6)	Open access to data	Importance of defining partnership/ collaboration goals and arrangements	Engage international partners in the delivery of the science and technology program
HAWC	Single-sited	Operation	2	Bilateral cooperation	Internationalization in conjunction with major upgrade	Develop GRI proposal

UNDERGROUND LABORATORIES GLOBAL RESEARCH INFRASTRUCTURE

(recommended as G7 Advanced GRI Project)

In 2012 in Hamburg, the proposal for a world-underground laboratory with the participation of the main operational facilities that fulfil the GSO category of national facilities with global potential, was put forward by Italy that hosts Laboratorio Nazionale del Gran Sasso (LNGS), the largest underground laboratory in operation, also noting that Canada had independently proposed SNOLAB that is the deepest operational underground laboratory. The GSO visited LNGS as part of its 2014 meeting, and the scope of the **Underground Laboratories Global Research Infrastructures-UG GRI** conceptually developed by LNGS and SNOLAB was further discussed. In 2015, the Group of Senior Officials on Global Research Infrastructures selected the UG GRI as one of five case studies in a pilot exercise aiming to investigate and promote various options for international collaboration.

The mission of the UG GRI is to host experiments that require a low background environment, in which the main research topics of the present scientific programme are: neutrino physics with neutrinos naturally produced in the Sun and in Supernova explosions, determination of the neutrino masses in neutrino-less double beta decays; WIMP (Weakly Interacting Massive Particles) dark matter search; and studies of cross sections of nuclear reactions of astrophysical interest. Moreover, the geological characteristics of the Underground Laboratories GRI and the ultra-low background radiation environment they provide, have increased impressively the multidisciplinary science activities including Climate Change research, Geoscience, Biology, Mining Innovation and Environmental Sciences. Since the end of nineteen-eighties the Underground Laboratories GRI are large scale facilities, not limited to the need of one specific detector for one specific experiment, but rather complex laboratories capable of hosting several – usually international – collaborations and detectors at a given time, spanning on different science fields. These infrastructures are costly in construction and operation and could greatly benefit from a coordinated development of operational standards – security, safety, management of resources and materials – and to further enhance the quality and complementarity of access to the differently specialized sites.

Several medium-size or small-size underground laboratories are operational in the world, and a few new undertakings are planned in the Andes and in Australia and a major upgrade is planned in China.

LNGS and SNOLAB have taken the lead to develop the UG GRI global concept in dialogue with most underground laboratories and with the scope to develop a roadmap towards a full alignment of standards, opportunities for economies of scale in the main technical dimensions, further development of the open access policies and sustainable collaboration at global level towards a global optimization of effort and maximum scientific output.

The readiness of the UG GRI to implement its roadmap, the ongoing expansion of the international membership, the clear objectives of the phase 1 of establishment of the GRI were considered by the GSO as elements of maturity that warrant the **Advanced GRI Project** status that, in turn, will give maximum international visibility to the project creating most favourable conditions for its successful implementation.

INTERNATIONAL MOUSE PHENOTYPING CONSORTIUM GLOBAL RESEARCH INFRASTRUCTURE

(recommended as G7 Advanced GRI Project)

The **International Mouse Phenotyping Consortium Global Research Infrastructures-IMPC GRI** addresses one of the grand challenges for biology and biomedical science in the 21st century – to determine the function of all the genes in the human genome and their role in disease. The bold goal of the IMPC of creating an encyclopaedia of mammalian gene function will require the support, infrastructures and cooperation of multiple countries. By the beginning of 2017, the IMPC had generated over 6,000 mouse mutant lines and phenotyped nearly 5,000 lines. These mouse strains are characterized using a standardized, broad-based biological and physiological analysis platform, in which data are collected and archived centrally by the IMPC-Data Coordinating Centre. The data are uploaded in standardized formats, checked for data quality and completeness by the DCC before release to the public database.

The IMPC, at present, operates as a distributed global research infrastructure comprised of 19 research institutions and 5 national funders, representing 13 counties from 4 continents and has been in operation since 2011. There is no centralized funding for the IMPC, but each center must generate financial support for the project from local, national and international funding agencies. The consortium is managed by a Steering Committee (SC) comprised of all members and overseen by the Chair of the SC and an Executive Director. The groups adhere to a non-legally binding Governance Document that defines project interactions, goals, operations and expectations.

The next stage for the IMPC to implement a Global Research Infrastructure according to the Framework criteria will be crucial for the science project and for the full internationalization of the effort to increase the production and phenotyping level. As of today the IMPC has reached a critical mass of members and its organization has reached maturity, but the overall financial effort has not gone beyond our Phase 1. A Phase 2 with more members and an increase of contribution by the current Phase 1 members is the crucial goal of IMPC GRI to enable the necessary increase in both quantity and diversity of phenotyping tests. The GSO Case Study exercise has already helped the IMPC gain a new member in South Africa. The GRI status will facilitate the recruitment of new members, focusing on India and China. The IMPC GRI will develop on the strong basis that is represented by the IMPC centers that insofar all became key reference centers at national level for mouse genetics and functional genomics, and provide centres of national expertise and resources.

The implementation of the GRI with the support of the GSO and, possibly, of G7 will set the basis for a full international status of IMPC which, in turn, would help the national centers continue to garner political and financial support for their efforts. We envision that the IMPC will serve as a resource to work with precision medicine initiatives to rapidly create mouse models and confirm human disease correlations. It is imperative that IMPC keep its momentum and recognition as a global infrastructure to develop and support these rapidly advancing projects. The IMPC can serve as a focal point of these converging areas of research, and facilitate machine learning across expanding mouse and human data sets. The potential impact on human disease understanding is enormous. Furthermore, the recognition of the IMPC as a GRI, will help secure IMPC's position as a resource infrastructure for future large-scale projects to utilize the IMPC and not build again. We envision several new "super projects" that would utilize the IMPC platform. One such example would be large-scale humanization projects of biochemical and druggable target pathways to create not just more relevant disease models but also interface with industry to facilitate pharmaceutical development. The upgrade of IMPC as a GRI would help preserve this valuable infrastructure that would be difficult to recreate and will also set a high standard on data quality of advanced research results, at the frontiers of knowledge, that will contribute to the richness and trust of the open data policies at the global level.

The readiness of the IMPC GRI to upgrade at the GRI level, its ongoing expansion of the international membership, the effective operational level already reached in its first stage, were considered by the GSO as elements of maturity that warrant the **Advanced GRI Project** status that, in turn, will give maximum international visibility to the project creating most favourable conditions for its successful implementation.

EUROPEAN SPALLATION SOURCE

In 2015, the GSO selected the **European Spallation Source ERIC-ESS** as one of five case studies in a pilot exercise aiming to investigate and promote various options for international collaboration. While large-scale research facilities play an increasingly important role in solving contemporary societal challenges, a single country alone often does not have the funding and expertise necessary to build and operate them. The mandate of the GSO is, among other things, to promote international collaboration and analyse how countries evaluate and prioritize the construction of large-scale research facilities. The approach taken at ESS – to build and operate the world leading neutron source mainly through in-kind contributions (IKC) from international partners – can serve as a source of inspiration for other single-sited research facilities under construction seeking to increase their membership base and strengthen their network of partners.

As a partnership of 15 countries, the European Spallation Source is special in its approach to construction through in-kind contributions from institutes in the Member States. The IKC process adopted by the organisation serves to deploy the expertise of scientists and engineers from all over Europe and mobilise their knowledge to deliver an unprecedented facility for the use of the international community. IKC are non-cash contributions in labour or material to ESS and have several important purposes. They allow Partner Countries to politically justify their investments in an international project outside their borders by ensuring that some of the value of their contributions remains with their respective institutions and industry. They enable technology transfer through the participation of the organisations in the construction of a large-scale Research Infrastructure. Lastly, they allow ESS to leverage the collective knowledge, experience and resources of Europe's leading research institutions and industry.

Partnership building is essential to a successful and timely construction of the ESS facility, which is one of the largest science infrastructure projects being built in Europe today. The organisation has established an internationalisation model that allows interested countries to take a series of small steps on their way to full membership. Fifteen countries have joined the European Spallation Source ERIC and the organization actively seeks to enlarge its membership base. The European Spallation Source and potential new Member Countries must satisfy a set of overlapping criteria related to scientific knowledge, funding, and political motivation. The European Spallation Source ERIC Statutes currently allow two forms of collaboration between ESS and national states and their respective research institutes and industry:

- Member: Members are represented in the European Spallation Source ERIC Council and jointly decide on the ESS scientific programme, the overall allocation of beam-time and the budget in the construction and future operations phase.

- Observer: Observers are national states who have indicated in writing to the Council that ESS fits with their own national scientific agenda on material sciences, and who wish to participate fully in the Research Infrastructure. Normally Observers shall be admitted for a three-year period. Observer status means that the national state can be present at Council meetings, but it does not have a vote.

In order to anchor ESS as a truly international facility, the organisation is currently working on identifying new categories of membership, which would provide for additional forms of collaboration between ESS and national states outside the European Research Area. The involvement of ESS in the GSO has further encouraged the organisation to move in this direction and pursue a global membership base. The broad international character of the GSO has supported ESS in the process of establishing contacts with stakeholders outside Europe. The framework has complemented the stand-alone efforts of ESS and has proved to be helpful in opening avenues for strategic dialogues with GSO countries such as Brazil, Canada, China, India, Japan, and Russia.

The European Spallation Source aligns with the GSO Framework Criteria introduced with the aim to secure a coherent and coordinated world-wide development and operation of Global Research Infrastructures. The fourteen criteria address a number of important technical, managerial, economic, and organisational aspects related to the building and operating of large-scale research facilities. The criteria are exhaustive and provide a good framework for a unified approach on the global scale.

CANADIAN HIGH ARCTIC RESEARCH STATION

The **Canadian High Arctic Research Station-CHARS** is an example of a new federally-funded and federally-owned research station in an area of global relevance and interest. The location of the CHARS campus is significant, since it is already experiencing significant effects of climate change and it is adjacent to areas with a high potential for resource development.

Work on the CHARS campus began in 2014, and the station is expected to be fully operational in fall 2017. Once complete, the CHARS campus will serve as the headquarters of Polar Knowledge Canada (POLAR), a recently-formed Government of Canada agency. The fully operational research campus will provide a broad range of services, including a technology development centre, mechanical and electrical workshops, a knowledge-sharing centre, and advanced laboratories. It is anticipated that approximately 40 full time resident staff will be employed at the station in science and technology, knowledge management, lab management, facilities management, and general administration. It is also estimated that CHARS could host an additional 100 visitors during the summer, which is the peak research season, and a smaller number of visiting users the rest of the year.

International partners will be able to use the CHARS campus and monitoring infrastructure for their own research on a cost-shared basis (through in-kind support). POLAR does not have a membership model for use of the CHARS campus as the infrastructure is fully funded and owned by the Government of Canada. In the future, international partners could be involved in expanding the infrastructure on the CHARS campus. However, to date, international partners have not contributed financially to construction and operations.

POLAR participates in a number of multilateral scientific and research organizations, including the International Arctic Science Committee and the Scientific Committee on Antarctic Research. POLAR is also Canada's competent national authority for the Arctic Council Agreement, Enhancing International Arctic Scientific Cooperation, signed in May 2017. Moreover, POLAR engages with other international Research Infrastructures that are part of the International Network for Terrestrial Research and Monitoring in the Arctic and the Circumpolar Biodiversity Monitoring Program. POLAR has also signed letters or memoranda of understanding with organizations in Iceland, Japan and Korea.

Since POLAR is a relatively new agency, policies are still being developed and implemented. The alignment of these policies with the Group of Senior Officials (GSO) Framework criteria will continue to evolve. Because the facility is owned and operated by the Government of Canada, international partners have not been critical for the development of the CHARS campus to this stage. However, international partners will be instrumental in POLAR's delivery of its science and technology program. Going forward, the guidance provided by the GSO, along with the partnerships it can facilitate, will be important to POLAR, as the CHARS campus develops into a Global Research Infrastructure.

GRIs ALIGNMENT TO THE FRAMEWORK

The Case Studies provide a stress-test of the Framework. Below, the comments provided by the Case Studies on each criterion of the Framework are summarised. The results suggest that the Case Studies are actively implementing the good practises identified by the Framework and will continue to make reference to the Framework to help shape their policies and practices going forward.

1. Core purpose of global research infrastructures. Global research infrastructures should address the most pressing global research challenges, i.e. those frontiers of knowledge where a global-critical-mass effort to achieve progress is required. Science, technology, innovation, and advanced research training goals should be fully integrated throughout the infrastructure plans from their early development.

The Case Studies identify the GRI-enabled scientific optimization of effort in addressing the global research challenge in their own fields. The IMPC clearly addresses a broad societal challenge (human health) through an efficient and effective global effort in the study of the full model genome of the mouse by phenotyping gene knockout mice. The CHARS has the potential to address climate change and can support the development of evidence for mitigation and adaptation processes.
The core purpose of the GRI is captured by all Case Studies.

2. Defining project partnerships for effective management. Global research infrastructures initiatives should explicitly and clearly define, as early as possible, the roles and responsibilities of the partners through the different phases of a project's full life-cycle: planning, construction, operation, upgrading, and termination or decommissioning. Rules for future participation should be defined to allow the inclusion of new partners.

The Case Studies all acknowledge the relevance of an early definition of partnership rules. The different GRI being considered in the frame of the exercise are at different stages of development with the ESS having adopted a binding legal status, although currently limited to European partners with the ERIC, the IMPC having established clear rules, conditions and distributed responsibilities for the partners of the International Consortium.

3. Defining scope, schedule, and cost. Stakeholders should agree upon a shared understanding of the foreseen scope, schedule (including a timetable) and cost, addressing inherent uncertainties and any external constraints, and define processes to effectively address deviations.

The Case Studies all acknowledge the relevance of early definition of scope, schedule and cost. IMPC and ESS have established "cost books" for participation in-kind (either contributing instrumentation/services or providing research work). The UG GRI has only considered costs related to networking activities. The CHARS foresees in-kind contributions in services and equipment.

4. Project management. Appropriate management structures and professional top level management should be established, consistent with best practices derived from existing recommendations and experience at the international level, to ensure rigorous project management.

The Case Studies all acknowledge the relevance of appropriate project management. The IMPC has an elaborated governance and management structure for the consortium with defined executive bodies and reporting organizational elements. The ESS has adopted the ERIC and elaborated a management structure accordingly (Council). The UG GRI will explore the best solutions during the pre-implementation stage (phase 1). The CHARS has its own governance and will establish managerial aspects of international collaboration on a case-by-case basis.

5. Funding management. The development of a global research infrastructure should foresee a careful balance between the minimum acceptable percentage of in-cash contributions and the appropriate level of in-kind contributions. The in-kind contributions have to be effectively evaluated regarding quality and schedule.

The Case Studies all acknowledge the relevance of appropriate funding management, but this is understood to have very different arrangements in different cases. The IMPC partners contribute a one-time fee and in-kind activity to the Consortium, taking care for their own resources at national level. The ESS has established shares among the partners with cash and in-kind contributions such as instruments and expertise. The UG GRI will explore the best solutions during the pre-implementation stage (phase 1). The CHARS will determine specific support for international agreements on a case-by-case basis, including financial and in-kind contributions.

6. Periodic reviews. The scientific output and strategic goals of global research infrastructures should be periodically evaluated and updated if needed throughout the entire life-cycle to ensure consistent excellence of the scientific output. In addition, an assessment of the quality of the services offered to the scientific communities is necessary to ensure the long-term usefulness and success of the infrastructure. Partnership agreements among funding agencies must enable each nation to fulfil its unique stewardship responsibilities on behalf of its national government for oversight of contributed funds.

The Case Studies all acknowledge the relevance of well-structured periodic reviews involving key stakeholders. All Case Studies include both an internal review done by the GRI itself on its partner facilities and an external review on an annual or quarterly cycle that addresses the overall scientific progress of the GRI. The ESS also includes an external assessment of the financial aspects of the ERIC.

7. Termination or decommissioning. Planning for termination or decommissioning of a global research infrastructure initiative should be established early in the development of the facility where possible or relevant, by defining criteria for the conclusion of operation, and establishing exit criteria and procedures for closing down and recognizing future termination liabilities or encumbrances on the sponsors at the conclusion of operation.

This point does not have a unique application to all types of GRI. Those that are single-site large-scale installations with potential impact on the territory, like the ESS, generally have a decommissioning plan included in their statutes; those that are globally distributed with each node belonging to a different National owner will only consider a termination of the international consortium, whilst the termination and decommissioning of each node shall be a responsibility at national level.

8. Access based on merit review. The definition of an access policy to the global research infrastructure on the basis of peer-reviewed excellence should be agreed upon by the relevant stakeholders from the beginning of the project.
**the new reading of point 8 with the definition of gEA is reported on page 15*

Access based on merit is the general rule for those GRI where users need to exploit the technical installations to produce research data, and to those where the users only access data. The UG GRI and the ESS have international peer review mechanisms and a single entry point for users (to be still developed in the case of the distributed UG). The IMPC has a strict evaluation for those laboratories contributing to the data, but warrants free access (not selected by merit) to the users of the data repository. The CHARS will provide reserved access to partners while also allowing national and international researchers to access the infrastructure, evaluated on a case-by-case basis in relation to the availability of resources.

9. E-infrastructure. Global research infrastructure initiatives should recognize the utility of the integrated use of advanced e-infrastructures, services for accessing and processing, and curating data, as well as remote participation (interaction) and access to scientific experiments.

All Case Studies address the e-Infrastructure dimension covering data management, repository, search and retrieval, remote support for analysis, and external communication. In some cases, common standards are to be developed to ensure alignment at the global level among different partners.

10. Data exchange. Global scientific data infrastructure providers and users should recognise the utility of data exchange and interoperability of data across disciplines and national boundaries as a means to broadening the scientific reach of individual data sets.

All Case Studies recognize the relevance of data access and exchange. The GRIs are at different stages in terms of standardization of data format and policies. The IMPC makes data access available on Cloud systems, with an internal validation process of the data that are opened for access. Interoperability will grow along with the development of open cloud systems. The CHARS has developed its own data principles and guidelines.

11. Clustering of research infrastructures. Where clustering of complementary research infrastructures appears to be consistent with the mission of the global research infrastructure, schemes for access to and mobility of researchers, engineers and technicians through the cluster should be actively encouraged.

This Framework criterion has been interpreted differently among the Case Studies. Clustering of geographically distinct RIs into a GRI is one interpretation. Clustering of RIs and technology development activities/centres around a GRI to foster innovation is another interpretation that mostly applies to large single-sited GRIs. Clustering at the national level in a network organization is also an interpretation. A more precise definition of the point by GSO is therefore to be implemented in the future revision of the Framework.

12. International mobility. Measures to facilitate the international mobility of scientists and engineers to participate in global research infrastructures should be promoted.

International mobility is a key element for the GRIs that allow researchers to access the GRI premises to run experiments, to develop technologies, and to spread good practices. This is common to the UG GRI and the ESS. The IMPC provides data that are generated at local facilities. However, mobility is connected with scientific alignment at workshops and joint planning. The users are mostly users of the data, which does not imply international mobility. The CHARS has not yet developed an international mobility program or policy.

13. Technology transfer and intellectual property. In order to facilitate technology transfer activities and the most productive participation of industry, members of the GSO should regularly exchange information on best practices regarding intellectual property rights management, and on the sharing and exploitation or utilisation of data and technology generated in global research infrastructures, by following internationally accepted regulations, in order to facilitate technology transfer activities and the participation of industry.

All Case Studies develop, or will develop, their own policies to foster knowledge transfer, data access and ultimately technology transfer. The GSO will monitor to identify good practices.

14. Monitoring socio-economic impact. The socio-economic impact and knowledge transfer issues of global research infrastructures should be assessed not only in the beginning but during the life-cycle of the project. Reference may be made to relevant documents such as those published by the OECD Global Science Forum.

All Case Studies recognize the need to monitor socio-economic impact all along the GRI's lifecycle. Different initiatives are being considered, but no models emerge from the Case Studies at present. More work is required on identifying and promoting good practices and standard metrics for socio-economic impact.

COORDINATION ACTIVITIES
WITH OTHER ORGANIZATIONS

The GSO is putting significant effort into ensuring appropriate alignment with other activities on Research Infrastructure being conducted at the international level. One of the International Organisations that is, historically, relevant in the international RI arena is the OECD Global Science Forum. The work conducted by the Global Science Forum constitutes a strategic reference. In order to ensure complementary activities and avoid redundant efforts, the GSO is represented through its secretariat in the activities of the OECD GSF and the OECD is always invited to participate in the GSO meetings.

In addition, the GSO regularly makes use of major international gatherings such as the International Conference on Research Infrastructures (ICRI) to promote its activities to the wider international RI community.

RECOMMENDATIONS
TO G7 SCIENCE MINISTERS

The GSO asks the G7 Science Ministers to take note of its Report 2017 and to consider the following recommendations concerning the results obtained to date, and for a possible renewal of the GSO mandate:

- To acknowledge the work done by the GSO in continuously refining and updating the **GSO Framework** of GRI and to identify relevant opportunities for its application.
- To encourage the GSO to pursue the refinement of Policy Areas in order to regularly update the Global Research Infrastructure criteria and good practices.
- To acknowledge the work done by the GSO in identifying the five Case Studies and in helping them to establish their own roadmap towards GRI.
- To recommend moving ahead with the implementation of the two **Advanced GRI Projects**, UG GRI and IMPC GRI. The recommendation implies that UG GRI and IMPC GRI shall be monitored by the GSO as regards their implementation of the Framework, and shall report periodically on their overall progress to G7.
- To invite the GSO to develop an analysis of the broad and evolving landscape of the GRI initiatives that are developing in all fields of research, also identifying potential new Case Studies.
- To acknowledge the work done by non-G7 members in the frame of the GSO and to affirm the relevance of an inclusive approach to RI development at international level.

FUTURE ACTIVITIES
AND OUTLOOK

All activities reported in the present document project into the future, as described in the relevant sections, and will be pursued by the GSO, also according to the renewed mandate by G7 Science Ministers. The following actions are foreseen:

- The finalization of the global Open Innovation and global Open Research Data policies, the identification of guidelines and the update of the relevant points of the Framework. The refinement on the working documents and the adoption of the new definitions of points 13 and 14 of the Framework will be accomplished in the next plenary meetings.

- The scouting of new GRI opportunities with an update of the Matchmaking Exercise and with the identification of new Case Studies to be analysed and encouraged to implement the Framework. Open discussion within the GSO will cover all current initiatives for new international science undertakings that can be identified as potential GRIs. These on-going developments shall be captured by the GSO and evaluated as their potential for GRI status is concerned.

- The monitoring of the implementation of the Framework by GRIs, Case Studies and more. Monitoring will be limited to the implementation of the Framework and will be carried out by means of progress questionnaires and, when agreed, presentations to the GSO meetings. The Case Studies identified as Advanced GRI Projects will be permamently invited to the plenary meetings to report on their progress and overall fulfilment of their implementation roadmap.

- The discussion about how to increase the international inclusiveness of the GSO with the lead of the non-G7 members, seeking approporiate ministerial representation at global level.

MEMBERSHIP

The GSO seeks broad ministerial representation. In the current configuration, the GSO report is presented periodically to the G8 or G7 Science Ministers' Meetings, which represent part of the current GSO members. Within the remit of its original mandate, the GSO asks the G7 Science Ministers to recognize the significant and important contributions by non-G7 members of the GSO. The GSO expects the non-G7 members to be at the forefront of any action towards a broader interface of the GSO at the international ministerial level.

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ANNEX 1

DEVELOPMENT OF SPECIFIC DETAILS OF THE CONCEPT OF GLOBAL EXCELLENCE-DRIVEN ACCESS

Respectfully, the GSO Access Working Group
Germany, France, Canada and EC delegations
Draft 27 January 2017

The considerable costs of constructing and operating large-scale Research Infrastructures (RI), can lead the owners and managers of the RI, either governments or non-governmental organisations, to carefully control access in order to ensure that funders receive the maximum return on investment for their scientific communities and other key stakeholders. Furthermore, access to RI could be restricted on the basis of issues such as national security, privacy and confidentiality (especially in the life sciences area), and commercial and intellectual property considerations.

Despite these constraints, there is a common acknowledgement of the need to promote global access to RI of global interest. Therefore, the GSO developed a concept of global excellence-driven access (gEA) derived mainly from the European Charter for Access to Research Infrastructures[1]. This approach was welcomed in 2015 by the G7 science ministers and was included in the G7 Communiqué 2015[2] which states:

- Access to global research infrastructures (GRIs) should be established on the basis of a peer review process with a focus on scientific excellence.

- The GSO should continue to develop and promote the concept of global excellence-driven access for future GRIs, developing the specific details of the concept in a qualitative manner for further implementation.

In February 2016, the GSO met in Sydney and agreed on the following approach for the development of gEA principles:

Step 1: Use the list of possible gEA commitments as proposed in the GSO Progress Report 2015[3] as the basis for the development of gEA principles.

Step 2: Assess and discuss "best practices" for access policies derived from RI belonging to the GSO countries such as ESS, XFEL, PETRA III or others.

Step 3: Draft "Principles" for gEA to GRI along with a "Declaration of Intent" which shall be signed by potential GRI.

The GSO Members were consequently asked to provide to Germany, as lead in this activity, examples of access policies for RI. Two national RI (Canadian Light Source, PETRA III) and one regional RI (the European Spallation Source) were chosen to derive the access policy best practices to be used in this context (see Annex for additional details).

Based on this exercise and previous work undertaken by the GSO, the following gEA principles (already mentioned to some extent in the Progress Report 2015) are proposed. If approved, implementation of these principles will become a "best practice" for GRI requesting to be considered in the frame of the GSO as follows:

In order to promote the GSO principle of global excellence-driven access (gEA) to global research infrastructure (GRI), the GRI agrees to implement the following principles:

1. *The GRI establishes a clear, transparent and achievable goal for gEA based solely on the scientific excellence of the proposal (as determined through peer review) such that access to the RI in promoting emergent ideas will be supported, regardless of the country of origin or the ability of the proposer to contribute financially. The GRI will re-evaluate this goal on a periodic basis and publish it on the website of the GRI.*

2. *Information on services and facilities for international users is easily available and published on the website of the GRI.*

3. *Transparent guidelines on the access application procedures are published on the website of the GRI.*

4. *Requests for access are evaluated through a scientific peer review process, which considers international stakeholders and the published RI-specific goals for gEA.*

1. European Charter for Access to Research Infrastructures https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf#view=fit&pagemode=none

2. Communiqué Meeting of the G7 Ministers of Science, 8-9 October 2015 – Berlin https://www.bmbf.de/files/English_version.pdf

3. Section 4.1 "Promoting Access to Research Infrastructures" https://www.bmbf.de/files/151109_G7_Broschere.pdf

5. The GRI offers training courses for all users, and encourages engagement of scientists from less developed countries and other underrepresented communities through targeted outreach.

6. If user fees are considered necessary and appropriate, the GRI commits to charge such user fees at a reasonable level that is derived from [or, directly related to] the resources and time allotted for use of the facility. Pricing information is published on the website of the GRI and is made available to users approved for access.

DECLARATION OF INTENT OF THE RESEARCH INFRASTRUCTURE OF GLOBAL INTEREST (GRI)

[...]

in accordance with the results from the G7 Meeting of Science Ministers stating that the GSO should continue to promote the concept of global excellence-driven access for future Research Infrastructures of global interest and develop a qualitative manner for further implementation

The [...legal name of the Research Infrastructure] requesting to be considered in the frame of the GSO list of Research Infrastructures of global interest , declares to intend fulfilling the principles for global excellence-driven access as follows:

1. The GRI establishes a clear, transparent and achievable goal for gEA based solely on the scientific excellence of the proposal (as determined through peer review) such that access to the RI in promoting emergent ideas will be supported, regardless of the country of origin or the ability of the proposer to contribute financially. The GRI will re-evaluate this goal on a periodic basis and publish it on the website of the GRI.

2. Information on services and facilities for international users will be made easily available and published on the website of the GRI.

3. Transparent guidelines on the access application procedures will be published on the website of the GRI.

4. Requests for access will be evaluated through a scientific peer review process, which considers international stakeholders and the published RI-specific goals for gEA.

5. The GRI will offer training courses for all users, and encourages engagement of scientists from less developed countries and other underrepresented communities through targeted outreach.

6. *If user fees are considered necessary and appropriate, the GRI commits to charge such user fees at a reasonable level* that is derived from [or, directly related to] the resources and time allotted for use of the facility. *Pricing information will be published on the website of the GRI and is made available to users approved for access.*

The [name of the RI] commits to make every effort to implement the above mentioned principles within a year from the signature of this Declaration.

The Declaration of Intent will come into effect on the date of signature.

BEST PRACTICE ACCESS POLICY EXAMPLES

CANADIAN LIGHT SOURCE (CLS)

CLS is a synchrotron light source with 22 photon beamlines either operational or under construction.

1. How is the use of the facility organized?
For the use of the facility the principle of 'excellence of science' is fundamental to the operation of Canada's light source. Academic access is granted on the basis of a peer review system, with a public Call for Proposals issued twice per year.

CLS access policies also allow for experimental time on all beamlines for first-come, first-served fee-for-service clients in which intellectual property ownership is clearly identified and rapid access is a requirement. Currently accounting for around 10% of the operational time across beamlines, this program is recognized as the world leader in the application of synchrotron science to finding industry solutions.

There is also special reserved beamtime for groups that assist us building new infrastructure.

2. How are the proposals reviewed?
The proposals are reviewed by a Peer Review Committee made up of prominent international synchrotron scientists. Each proposal is reviewed and scored by at least six reviewers, including at least three external reviewers.

3. What are the evaluation criteria?
Three Evaluation Criteria are used: (1) Quality of scientific research in the context of the field (quality & significance); (2) Quality and capability of the researchers based on their track record (quality & significance); (3) Suitability of CLS resources being allocated relative to the proposed research (pertinence).

4. How are the decisions taken?
After discussion of the results of the reviews by the Peer Review Committee, proposals will be ranked based on scores for the quality of science and suitability. These scores and recommendations with respect to shifts are then passed on to the Allocation Committee, chaired by the CLS Director of Research, and composed of Beamline

Scientists and the Assistant Director of Research. They are responsible for the final allocation of time. Proposals close to the cut-off score will be closely analysed, and score for the quality and capability of the researcher may be the deciding factor.

5. What is done for the support of the users?
For the support of the users, CLS organises trainings and postgraduate summer schools. Training takes several forms, including formal training in specific applications using a synchrotron. Annual postgraduate summer schools have been conducted since 2006. These schools provide hands-on use of our beamlines with real-world experiments to demonstrate our capabilities. The schools include basic training in the beamline methods being used, synchrotron light production and beamline function. Aspects of data acquisition and control are covered, along with data interpretation.

These comprehensive training schools have been successful in introducing new, highly productive researchers to the CLS.

Furthermore, training modules are required by everyone who has facility access, and can be completed online prior to arrival at the CLS. This is strongly recommended since it saves a considerable amount of time during the check-in process at the User Services Office:

Beamline Specific Orientation (BSO): A required hands-on orientation of the beamline before conducting experiments on it. CLS beamline staff provide this orientation.

Experiment-specific training: users login and view their Experimental Permits online to identify any additional training or controls required prior to the start of their experiments. Training is completed online in specific training modules.

PETRA III

Petra III is a high brilliance 3rd generation synchrotron radiation facility with 14 beamlines and 30 experimental stations.

1. How is the use of the facility organized?
Use of facility for academic research whose results are published according to established standards of evaluation via international peer-review is free of charge. There are two calls for proposals per year, whereby the proposals are valid for one beamtime period only, which corresponds to a half-year. For industrial users direct and fast access to the beamlines to a certain percentage, is granted. They can obtain direct and rapid access to DESY's large-scale facilities for payment of full costs and with consideration of the EU Grant Law. Going through a scientific review is not required for this. A limited number of special "Access Groups" that contribute to the construction and operation of the facility are also selected via international peer-review. For non-proprietary research by publicly funded institutions the access to the facility is free of charge.

2. How are the proposals reviewed?
All scientific proposals, after passing an internal safety and feasibility check, are evaluated by international Proposal Review Panels (PRP). Currently the proposal review is carried out by 10 PRP committees for PETRA III, in total about 70 reviewers are presently involved in the peer review. Each proposal is reviewed by a Project Review Panel of international expert concerning quality, suitablility for the proposed instrument, and their relation to the general research program.

3. What are the evaluation criteria?
The only key parameter for the review process is "excellence". In case users have already performed experiments at DESY photon sources, publication record related to this earlier work should be provided. Users from industry have the possibility of privileged access for payment of full costs and with consideration of the EU Grant Law.

4. How are the decisions taken?
Each proposal is reviewed by at least three to four external referees. The final ratings are discussed and determined in a face-to-face meeting of the panel members at DESY. In a subsequent step, an appropriate number of beamtime shifts is allocated to the top-rated projects.

5. What is done for the support of the users?
For each user group a staff member of the requested beamline acts as local contact to support the users in preparing and performing the experiments. Training courses are being organized on demand.

The actual user support for user experiments starts when users consult experts of the PETRA III beamlines prior to the beam time proposal to discuss the planned experiment, to estimate the expected outcome and to optimize the experimental setup. Also addressed during these discussions are the required hardware, how it has to be integrated into the beamline equipment and which hardware has to be provided by DESY Photon Science. Specific X-ray detectors and experimental equipment are available at the DESY Photon Science Detector Pool and the DESY Photon Science Sample Environment Team. Furthermore during this discussion it is addressed, if lasers or workshops are required or if the experiments demand chemical, biological and/or clean room environments. In this case the DESY Photon Science groups "Technical Infrastructure" and "Beamline Technology" are giving advice prior to the proposal. Finally, when planning to submit a proposal with a strong nano-science focus the users can contact the DESY Photon Science Nano-Lab which offers full support for certain nano-preparation methods and likewise on request consults the users during the process of writing the proposal. All the above mentioned benefits and supports are of course also available for users with granted proposals prior to a beam time.

The actual beam time plus one day preparation and one day wrap-up is free of charge for academic users. The hostel and the travel costs are compensated for maximum three German users per beam time. European users receive compensation depending on European grants (Calipso). Industrial users are charged depending on the required support. At the beamline the users will receive full support in setting-up the experimental hard- and software, in aligning the beamline and getting instructed. Same holds, if support labs are required (Nano-lab, Chemical lab, Bio lab, Clean room lab, Laser Lab). This full support is granted until the experiment runs. As it is expected from the users to learn how to operate the experiment independently, the supporting DESY staff is not permanently present at the beamline. However, after the general working hours until 10-11pm the beamline staff is ready to take phone calls, to solve problems by remote login or to come in to solve serious problems. Furthermore, a shift service is available all days from 7am (9am on weekends) until 1am in case of technical problems. In general, users have access to the DESY canteen, the DESY bistro and the DESY cafeteria for breakfast, lunch and dinner. Vendor machines are installed in the experimental hall and a kitchen is open for users.

After the beam time the users are supported in getting the data stored and, in some cases, processed. DESY IT archives all data and makes them available to the assigned users via DOOR. Depending on the specific experiment and request users can be supported in preprocessing and evaluating the data. There is no general rule, that all data will be evaluated by DESY staff. This support strongly depends on the available software, beamline man power and available specialists at DESY.

ESS Neutron

ESS is a spallation neutron faclility which will provide 22 instruments from 2023 onwards. The ESS lab facilities will provide the possibility to condition the samples, including sample handling, preparation, and storage. Users can provide over neutron test beamlines for instrument development and scientific feasibility studies.

1. How is the use of the facility organized?

The ESS User Programme will be essentially based on Peer Review Access. The peer review proposal system ensures transparency and equal access to the research facilities. User Programme starts in 2023, so that Review Committees can be appointed in 2021 and meetings can be organised twice a year from 2022 onwards. Yearly user meetings will be organised by ESS to disseminate information on progress from the facility. The access policy is reflected in the articles 16 and 2.2 in the ERIC statutes. Consistent with the statutes only basic principals for the allocation of beam time have been drafted also considering the European Charter for Access to Research Infrastructures. A detailed policy is anticipated to be decided by ESS council later, when approaching the operations of the facility, but no later than three years before first neutrons are planned. Planned access modes are very similar to those at existing European neutron and synchrotron radiation scattering facilities (such as ILL and ESRF). ERIC statutes, Art. 17 (2) also read: "The ESS shall be open for access to others than member countries. Such access shall be open to European as well as international users and be available on the basis of the access policy adopted by Council."

2. How are the proposals reviewed?

Peer Review Access (PRA) will be the basic mode of access and time will be dispensed via independent review committees composed of scientists (external to ESS but expert in the field, plus ESS representatives).

3. What are the evaluation criteria?

Scientific merit and feasibility will be the prime selection criteria. Priorities will be recommended by peer review committees composed of highly qualified scientists. Instrument scientists assess the feasibility of proposed experiments.

4. How are the decision taken?

The beam time allocation process and results will be monitored by the ESS Scientific Advisory Committee (SAC) advising ESS management and reporting their findings to Council.

5. What is done for the support of the users of the RI?

Scientific productivity at neutron facilities depends primarily on the neutron flux and the size and quality of the instrument suite, but also on the scientific support provided to the users. As part of methodological support and scientific collaboration, instrument scientists will assist users and participate in the experiments; they will take part in the subsequent data reduction and analysis, required for publication of the data. Sample preparation and characterisation and sample environment support laboratories will operate on the site in order to guarantee successful science. Sample environment equipment and expertise will also be provided by ESS.

ANNEX 2

LIST OF RESEARCH INFRASTRUCTURES OF GLOBAL INTEREST

SECTION I
NATIONAL BASED RESEARCH INFRASTRUCTURES

RI Name, web site and contact details	Scientific Domain	Description	Proposed collaboration opportunity
AUSTRALIA			
Australia Telescope National Facility – ATNF – www.atnf.csiro.au Dr **Yeshe FENNER** *Executive Officer* Astronomy Australia Ltd yeshe.fenner@astronomyaustralia.org.au +61 3 9214 5520	Astronomy	The Australian Telescope National Facility (ATNF) operates a number of world-class astronomical facilities, including; ▪ the Parkes Telescope, the most powerful single dish telescope in the southern hemisphere; ▪ the Compact Array, the largest radio interferometer in the southern hemisphere; ▪ the Australian SKA Pathfinder (ASKAP) telescope, a ground-breaking high speed survey instrument. The Parkes Telescope and Compact Array are both fully operational. The ASKAP telescope is partly constructed and is operational at proof of concept level.	The ATNF is a unique set of facilities due to their combination of technical features and their position in the southern hemisphere. There are strong relationships between ATNF facilities and international partners and opportunities exist for further international partnerships and investment. Co-funding of facilities would allow greater diversity of instrumentation and higher research support levels, as well as increasing operational planning horizons.
Australian Astronomical Observatory – AAO – www.aao.gov.au Dr **Yeshe FENNER** *Executive Officer* Astronomy Australia Ltd yeshe.fenner@astronomyaustralia.org.au +61 3 9214 5520	Astronomy	The Australian Astronomical Observatory (AAO) provides world-class optical and infrared observing facilities based at a remote site with dark skies and excellent views of the southern hemisphere. The Anglo-Australia Telescope and the United Kingdom Schmidt Telescope at the AAO have been in operation since the 1970s, but remain at the forefront of research due to the innovative instrumentation developed through the AAO's expertise in optical fibre and spectrographic technologies.	The AAO presents opportunities for international partners to co-develop and utilize new instrument technologies which could be used in conjunction with complementary facilities in the northern hemisphere.
Murchison Widefield Array Radio Telescope – MWA – www.mwatelescope.org Dr **Yeshe FENNER** *Executive Officer* Astronomy Australia Ltd yeshe.fenner@astronomyaustralia.org.au +61 3 9214 5520	Astronomy	The Murchison Widefield Array (MWA) is a low-frequency radio telescope which provides the facilities to study the sun, the heliosphere, the ionosphere, and radio transient phenomena. The MWA is unique because of its novel design and architecture, and because of its geographic location; it is sited in the remote Murchison Shire of Western Australia, one of the best locations in the world for radio astronomy due to its very low population density and lack of radio interference. The MWA views the southern hemisphere, making it complementary to its close cousin, the LoFAR telescope based in The Netherlands.	As part of an international cluster of activities and facilities associated with the Square Kilometre Array telescope, the MWA is closely coupled to other research infrastructure in Australia and around the world. There is enormous scope for additional partners to bring new scientific and technical knowledge to exploit the MWA, in collaboration with existing MWA partners. In particular, due to the massive datasets involved, partners with expertise in the management of Big Data projects are welcome.

Population Health Research Network – PHRN – www.phrn.org.au Dr **Merran SMITH** *Chief Executive* Population Health Research Network merran.smith@telethonkids.org.au +61 8 6389 7301	Social Sciences	The Population Health Research Network (PHRN) provides nationwide data linkage e infrastructure capable of securely and safely managing population health information from around Australia. A dispersed network, the PHRN operates data linkage units across every state and territory in Australia, increasing the efficiency and effectiveness of population health research. With the ability to provide large sample groups, the PHRN enables a whole-of-population approach to health and health related research.	The PHRN is a founding member of the International Population Data Linkage network, in partnership with facilities in Canada, Germany, the United Kingdom and New Zealand. Apart from world-class infrastructure, the PHRN provides partners with access to uniquely high quality, long term patient-level data drawn from across the Australian population. The PHRN data linkage ability enables individual patients to be tracked across sectors and years, and all data has been collected under a well-established national reporting system. The combination of high quality infrastructure and high quality datasets with an already established set of international linkages makes PHRN an excellent partner for international collaboration with the goal of building a globally significant dispersed facility.
Open-Pool Australian Light-water reactor – OPAL – www.ansto.gov.au/AboutANSTO/OPAL Dr **Herma BUTTNER** *Senior Adviser Scientific Liaison* Australian Nuclear Science and Technology Organisation – ANSTO government.liaison@ansto.gov.au +61 2 9717 3535	Neutron Science	The Open-Pool Australian Light-water reactor (OPAL) is a high intensity neutron source suitable for a range of nuclear medicine, research, scientific, industrial and production goals. OPAL is highly versatile, making it suitable for industrial and production uses, but also for world-class basic research using a wide array of instrumentation.	OPAL is not globally unique, being one of a number of similar facilities around the world, but is recognised in the Asia-Pacific region as a leader in neutron-scattering research. At a regional level, partnerships between OPAL and international users present the opportunity to consolidate resources and expertise, and provide research opportunities which may not otherwise be available within countries around the region.
BRAZIL			
Brazilian Centre for Research in Energy and Materials – CNPEM –	Energy and materials	The CNPEM is a private research and development institution (R&D) mainly owned by the Brazilian Ministry of Science, Technology, and Innovation (MCTI). CNPEM is responsible for the management of the following main research laboratories: Br Synchrotron Light Laboratory (LNLS), Bioscience Lab (LNBio), National S&T Laboratory for Bioethanol (CTBE), and the National Laboratory for Nanotechnology (LNNano).	The four CNPEM's national laboratories have facilities open to academic and business communities of Brazil and overseas. On average, 1900 external researchers are benefited annually by the campus infrastructure. The laboratories also develop their own research projects and participate in the cross-investigation agenda coordinated by the CNPEM, combining facilities and scientific skills around strategic themes related to energy and materials.
Brazilian Synchrotron Light Laboratory – LNLS –	Synchrotron Materials Science	The LNLS operates the only Synchrotron Light Source in Latin America and a set of scientific instrumentation for the analysis of organic and inorganic materials; The Brazilian Synchrotron Light Source (LNLS) aims to make available to the scientific and technological community experimental state-of-the-art facilities, in an open, multi-user and multi-disciplinary way to foster excellence and complex research, thus contributing to the development of STI in the country and promoting international integration.	The Institute is open to users and researchers worldwide can come to perform their experiments. To do this, proposals can be submitted twice per year. All the proposals are evaluated by an external committee and those approved will receive beam-time in the following semester.

Brazilian Bioethanol Sci&Tech Laboratory – CTBE –	Bio Fuel	The CTBE investigates new technologies in bioenergy. The CTBE is a National Laboratory that operates with the scientific and technological community and the Brazilian productive sector, aiming to contribute to the maintenance of competence of the Country in the production of sugarcane ethanol and other compounds from biomass. The CTBE Mission is contributing to the advancement of scientific technological knowledge in the production, use and conversion of biomasses on energy materials, through research, development, innovation and personnel training.	
Brazilian Bioscience National Laboratory – LNBIO –	Bioscience	LNBio conducts research in frontier areas of Bioscience, focusing on biotechnology and drugs. LNBio is responsible for the following programs: a. The Cancer Biology Scientific Program. This program aims at the prospection of potential candidate biomarkers, target molecules, active compounds and delivery strategies for therapeutic purposes, and likely for diagnosis, prognosis and treatment follow-up stages. b. Neglected diseases. c. Biology of the Cardiovascular System. d. Microorganisms and plants. At LNBio several research projects aim. at studying the molecular mechanisms governing plant-pathogen interactions. LNBio has employed a multidisciplinary approach to investigate the biological role of plant proteins involved in resistance against bacterial pathogens as well as the function of bacterial and fungal proteins required for pathogenicity or pathogen adaptation in the host.	
Brazilian Nanotechnology National Laboratory – LNNANO –	Nanotechnology	LNNano conducts investigations with advanced materials, besides hosting the China-Brazil Binational Center for Nanotechnology. The Brazilian Nanotechnology National Laboratory (LNNano) was created in 2011. LNNano aims to attend the scientific and industrial community and to align with thematic RD&I programs of CNPEM. The laboratory seeks, by means of applied and basic research carried out by its researchers, experts and technicians, to exploit the opportunities offered by nanotechnology to satisfy the needs of agriculture, industry and services on the regional, national and international scale, aiming at the creation and development of sustainable products and processes and the generation of knowledge and wealth.	The LNNano collaborates with its partner laboratories in CNPEM for the characterization of advanced materials and the creation and implementation of novel search methodologies. Unique in the world since it is the first laboratory which has performed implementation of thermomechanical simulation and X-ray scattering (XTMS) equipment associated with an X-ray diffraction line of the LNLS (XRD1). This attracts outstanding researchers from Brazil and other countries such as the USA, Argentina, India and Japan. In 2013, the LNNano — in collaboration with the LNLS - has completed the installation of an apertureless scanning nearfield optical microscope (SNOM) at the LNLS IR beamline (IR1).

SIRIUS	Fundamental Physics Materials Science	3 GeV, 4th generation synchrotron light source, emittance of 0.27 nm.rad, 13 beamlines in the first phase, will be able to hold up to 40 beamlines, first beam schedule for 2018. It is an evolution of the current 2nd generation light source already in operation at LNLS. The current source is a 1.37 GeV machine, 100 nm.rad, with 18 operational beamlines. It is today the only synchrotron light source in Latin-America.	
CANADA			
SNOLAB www.snolab.ca **Samantha KUULA** *Communications Officer* SNOLAB Samantha.Kuula@snolab.ca 1-705-692-7000, 2222	Fundamental Physics Astrophysics Low-Background Counting Genomics and Bioinformatics	SNOLAB is an underground science laboratory specializing in neutrino and dark matter physics. Situated two Kms below the surface in the Vale Creighton Mine located near Sudbury Ontario Canada, SNOLAB follows on the important achievements in neutrino physics achieved by SNO and other underground physics measurements. The primary scientific emphasis at SNOLAB will be on astro-particle physics with the principal topics being: ▪ Low Energy Solar Neutrinos ▪ Neutrino less Double Beta Decay ▪ Cosmic Dark Matter Searches ▪ Supernova Neutrino Searches	Currently the lowest radioactivity laboratory in the world, SNOLAB hosts multiple experiments and is available for any user (domestic or international) through merit-based access. Potential users must demonstrate a sound science program that requires the underground laboratory and retain funding for their experiment. Letters of Interest can be submitted to the Director.
Ocean Networks Canada – ONC – www.oceannetworks.ca www.neptunecanada.ca www.venus.uvic.ca Dr. **Kate MORAN** *President and CEO* Ocean Networks Canada oncsec@uvic.ca 1-250-721-7231	Oceanography Energy Environment Marine Technology Climate Change Operational Oceanography ICT	Ocean Networks Canada (ONC) is a world-leading organization supporting ocean discovery and technological innovation. ONC is a not-for-profit society, established in 2007 by the University of Victoria under the BC Society Act. Under a Management Agreement with the University, the purpose of ONC is to govern, manage and develop: ▪ the Ocean Networks Canada Observatory (comprised of the VENUS and NEPTUNE Canada networks) as a national research platform; ▪ the ONC Centre for Enterprise and Engagement as a federal centre of excellence for commercialization and research.	ONC operates the first and largest cabled ocean observatory in the world with networks of ocean sensors off the coast of British Columbia, Canada, with some data collection in the Arctic ocean. Sensors are connected nationally and internationally to facility users via the internet. This facility supports both inter and multi-disciplinary research spanning biology, geology, oceanography, ecology, earthquakes, tsunamis, climate change, and technology. International collaborators could benefit both at the experimental and the data use levels. Data can be accessed remotely. ONC's facilities and data are open to any user (domestic or international) through open calls to scientists, with priorities set by advisory committees.

Canadian High Arctic Research Station – CHARS – www.science.gc.ca **David MATE** *Director* Science and Technology Operations Polar Knowledge Canada david.mate@polar.gc.ca +1 613-295-4896	Energy Environment Climate	CHARS will provide a world-class hub for science and technology in Canada's North that complements and anchors the network of smaller regional facilities that exist across Canada's North and internationally. The new Station will provide a suite of services including a technology development centre, mechanical and electrical workshops, a knowledge-sharing centre, and advanced laboratories. It will provide logistics support for scientists going into the field. The mandate for the Station is covering four broad themes in its mandate: ▪ Resource Development, ▪ Exercising Sovereignty, ▪ Environmental Stewardship and Climate Change, ▪ Strong and Healthy Communities.	CHARS infrastructure, program, and cross-cutting capabilities will provide a platform and resources to engage potential collaborators around targeted science and technology priorities as defined in the Stations inaugural S&T Plan. Recognizing the multiplicity of stakeholders that need to be engaged to address these key issues effectively, CHARS is being designed explicitly to broker partnerships and collaborations. The Station will link relevant industry, academic, Aboriginal, Northern, government, and international stakeholders and leverage their expertise, experience, and resources to address shared goals. CHARS is already engaged in discussions internationally to partner on monitoring. International partners are welcomed on the delivery of the S&T Plan where goals and objectives match those articulated in the Plan.
TRIUMF www.triumf.ca Mr. **Sean LEE** *Head of External Relation* TRIUMF seanlee@triumf.ca 1-604-222-7655	Particle Physics Nuclear Physics Nuclear Medicine Materials Science Accelerator Science	TRIUMF, located in Vancouver, BC, is Canada's national laboratory for particle and nuclear physics. In addition, TRIUMF also operates world-class programs in the areas of accelerator science, nuclear medicine, and materials science. TRIUMF operates several particle accelerators on its 13-acre site, including the world's largest cyclotron (520 MeV protons), a new state-of-the-art superconducting linear electron accelerator, and the ISAC heavy-ion accelerator for rare isotopes.	1) TRIUMF operates user facilities for rare isotope science (ISAC) and molecular and materials science using MuSR and betaNMR. Collaboration opportunities include using the existing experimental infrastructure as well as developing new experimental facilities. 2) Collaboration opportunities exist for developing modern accelerator technologies, including SRF and target technologies for the production of isotopes. 3) With the presence of multiple cyclotrons and hotcell facilities on-site, TRIUMF has world-class accelerator target, isotope production, and radiochemistry expertise, and interest in known or novel isotopes as applied to medicine, medical imaging/radiotherapy, or other sciences (i.e., oceanography, mining/geology, etc.).
The Wind Engineering Energy and Environment – WindEEE – www.windeee.ca Dr. **Horia HANGAN** *Director* WindEEE Research Institute hmhangan@uwo.ca 1-519-857-9679	Wind Engineering Wind Energy Wind Environment	WindEEE covers research in the three main areas of wind engineering, wind energy, and wind environment. WindEEE currently brings together more than 20 researchers at Western University, approximately 40 across Canada and at least 20 internationally. The research covers three areas of research in Engineering (Civil, Mechanical and Electrical) as well as in the Sciences (geography, physics and mathematics) and business/economics. WindEEE is an integral part of the Wind Energy Strategic (WESNet) Network of Canada and has been declared by both WESNet and the Wind Energy Institute (WEICan) as a "facility of national character".	WindEEE is open to new international research partners and users and can offer the unique capabilities of this facility to the international community. WindEEE is currently co-applicant through the European Energy Research Association (EERA) to Horizon 2020 together with several EU partners from Germany (Fraunhofer IWES), Denmark (DTU Wind Energy), Spain (CENER), Holland, Italy (Poli Milano), etc.

Canadian Light Source – CLS – www.lightsource.ca Prof **Robert LAMB** *Chief Executive Officer* Canadian Light Source Inc. robert.lamb@ lightsource.ca 1-306-657-3600	Materials Science Life Sciences Energy Environment Health	CLS, located in Saskatoon, is a 2.9 GeV 3rd generation synchrotron light source with 22 photon beamlines either operational or under construction. It currently supports over 900 users per year which includes ~20% international users. Primary access is through a peer review process, with proposals being accepted twice a year. CLS is known for its innovative and business-friendly Industrial Science program. CLS has also pioneered the production of Mo-99 using an electron accelerator.	CLS is open to international users who compete on an equal basis for access through peer review, or they can purchase beamtime via the Industrial Science program. CLS seeks to facilitate access for Canadian users to international synchrotron and free-electron laser facilities. CLS also seeks collaborators to develop new technologies and experimental facilities, and welcomes the exchange of people.
CHINA			
Beijing Electron Positron Collider – BEPC – english.ihep.cas.cn	Fundamental Physics Materials Science	BEPC II is a two-ring e+e- collider running in the tau-charm energy region (Ecm = 2.0-4.2 GeV), which, with a design luminosity of 1 × 1033 cm-2s-1 at the beam energy of 1.89 GeV, is an improvement of a factor of 100 over its successful predecessor, BEPC. The machine also provides a high flux of synchrotron radiation at beam energy of 2.5 GeV.	1. Welcome to join BESIII collaboration to analyse BESIII data for τ-charm physics study. The related procedure and the management policy can be found at website http://bes3.ihep.ac.cn/orga/manage.htm 2. BEPCII is also for producing synchrotron radiation —Beijing Synchrotron Radiation Facility (BSRF). BSRF welcome international users to come to do multidisciplinary research. The procedure for users to apply for beam time at BSRF is in accordance with international practices: http://english.ihep.cas.cn/rs/fs/srl/usersinformation/
Experimental Advanced Superconducting Tokamak – EAST – www.ipp.cas.cn/ east.ipp.ac.cn/	Energy research	EAST tokamak is designed on the basis of the latest tokamak achievements of the last century, aiming at the world fusion research forefront. Its mission is to conduct fundamental physics and engineering researches on advanced tokamak fusion reactors with a steady, safe and high performance, to provide a scientific base for experimental reactor design and construction, and to promote the development of plasma physics and related disciplines and technologies. EAST has three distinct features: non-circular cross-section, fully superconducting magnets and fully actively water cooled plasma facing components which will be beneficial to explore the advanced steady-state plasma operation modes.	EAST is fully open to the world fusion community as a valuable test bench for physical and technical issues on advanced steady-state plasma operation for ITER and future DEMO. It warmly welcomes all fusion/plasma scientists and engineers in the world come to EAST to explore the relevant theory, physics, and technology for fusion energy. It includes, but not limited in, plasma control, wave heating and current drive, divertor, plasma surface interaction, superconducting technology, high efficient cooling, remote handling maintenance, etc.. The partners can join the research on EAST by bring innovative ideas, know-how, or additional funds with bilateral agreements. The scientists and engineers can also work on EAST as a staff, guest professor, post-doctor, Master/Ph. D student.
Heavy Ion Research Facility at Lanzhou – HIRFL – www.impcas.ac.cn	Nuclear Physics Atomic Physics Materials Science Biophysics Energy	Employing low and high energy heavy ion beams provided by accelerators, to search for the existing limit of super heavy elements, to study the nuclear structure and properties, nuclear processes relevant to astrophysics, atomic structure in strong fields and atomic collision dynamics, radiation damage of materials, radiobiological Effects. New technology in accelerator development and ion sources.	International partners will participate actively in the construction of the RI and associated detector systems. They would bring their expertise, know-how and additional funds to the HIRFL. It is proposed that international partners take part in the construction of the new facility – HIAF. The conditions to use the new facility in future could be signed through bilateral negotiations.

FRANCE			
Système de Production d'Ions Radioactifs et Ligne de 2éme génération – SPIRAL2 – www.ganil-spiral2.eu/spiral2-us pro.ganil-spiral2.eu/spiral2 **Florent STALEY** *Director of GANIL* GANIL florent.staley@ganil.fr +33 (0)2 31 45 45 91	Fundamental Nuclear Physics Atomic Physics Materials Science Radiobiology Research for hadron and isotope therapy	SPIRAL2 is a new facility that will be scientifically and technologically complementary to the existing infrastructure, GANIL. SPIRAL2 is supported by the existing structure of GANIL for both personnel and technological development needs and will be operated as part of the GANIL facility. SPIRAL2, which is as large as the current GANIL facility, will produce the only ion beams of their kind in the world. The fields of experimentation with SPIRAL2 range from radiotherapy to the physics of the atom and its nucleus, from condensed matter to astrophysics. SPIRAL2 will reinforce the European leadership in the field of nuclear physics based on exotic nuclei. *France proposes an international enlargement of the collaboration process of the SPIRAL2 IR project for its second development phase.*	It is proposed that partners (or their representatives) join the GIE GANIL-SPIRAL2 as scientific partners having voting rights in the Scientific and Strategy Committees and as such fully participate in the definition of the scientific policy of the facility. The partners participating in the running costs of the facility will acquire rights to propose and perform experiments at the preferential conditions defined in the corresponding bilateral agreements between the partner and the GIE GANIL-SPIRAL2. International partners will participate actively in the construction of the RI and associated detector systems. They would bring their expertise, know-how and additional funds to the one of the world-leading nuclear physics RI.

GERMANY			
PETRA III photon-science.desy.de/facilities/petra_iii/index_eng.html Dr. **Hermann FRANZ** *Deputy Director* DESY Photon Science hermann.franz@desy.de +49 (0)40 8998 4534	Structure and Dynamics of Matter Materials Science Energy Enabling Technologies Health	PETRA III at DESY is a world leading high energy (6 GeV) 3rd generation synchrotron radiation source and Germany's main source for experiments in the hard X-ray regime from 200 eV up to 150 keV. The user operation of the first beamlines started in 2010 and all 14 beamlines are in full operation since end of 2012. By providing the worldwide smallest horizontal emittance and photon beam spot sizes down to the 5 nm range PETRA III offers the best conditions for all experiments needing high brilliance or a high degree of coherence, such as for micro- and nano-focussing applications, samples under extreme conditions and high-resolution spectroscopy. It also provides ideal conditions for a broad range of hard X-ray experiments like in engineering materials science and structural biology. Moreover, the large circumference of 2.3 km, in combination with a top-up mode of operation, enables special bunch patterns, which are important for timing experiments, without loss in overall beam intensity. At present, PETRA III is being extended by two experimental halls with 11 new beamlines. They will be dedicated to experimental techniques either not covered or extremely high in demand in the main hall.	DESY accepts so-called "Special Access Groups" at PETRA III. These are institutions or consortia represented by a legal entity, which contribute to the construction and operation of the facility. In return, they are granted beamtime "Special Access Beamtime" up to a certain maximum amount. The details of such collaborative schemes are subject to careful case-to-case negotiations, ending in a written agreement. Special Access Groups may join DESY's peer review system or may also establish their own peer review system, to be approved by DESY. The technical state and scientific achievement of all beamlines (including the Special Access Groups in their dedicated time) will be evaluated by an external expert group under guidance of the DESY advisory board "Photon Science Committee" (PSC) every 4 years. The above considerations refer exclusively to the scientific, non-commercial use of the PETRA III facility. Any commercial use of the facility requires a separate written agreement with DESY. As a general rule, Special Access Groups are not entitled to allocate beamtime for commercial purposes at their own discretion. Further options for collaborative partnerships on a larger scale must be explored in the context of the DESY future strategy in close cooperation with the funding agencies and supervisory board.

FLASH at DESY photon-science.desy.de/facilities/flash/index_eng.html Dr. **Wiebke LAASCH** Deutsches Elektronen-Synchrotron DESY Photon Science wiebke.laasch@desy.de T: +49-40-8998-3065 f: +49-40-8998-4475	Dynamics of Matter	FLASH is a free-electron laser (FEL) and Germany's main source for experiments in the soft X-ray regime from 4.2 nm to 45 nm with ultra-short pulses. Five beamlines are in full operation for scientific users since its start as the worldwide first VUV-FEL in 2005. After the upgrade in 2014/2015 a second undulator line and a new experimental hall with space for up to 7 beamlines are available. Two beamlines are almost completed in the new hall. Since April 2016, FLASH is serving two user experiments in parallel operation. The free-electron laser FLASH is providing photon pulse lengths down to a few 10 fs and extremely high pulse intensities in the soft X-ray regime. The timing jitter between optical laser and XUV pulses at the experimental station from one 10 Hz pulse train to the next one is currently on the order of 80 - 90 fs rms in standard operation. Moreover, the light source offers excellent conditions for pump-probe experiments combining an FEL with an optical laser system for two-colour measurements. It also provides ideal conditions for a broad range of soft X-ray experiments like for understanding chemical reactions or basic properties.	All options for special access or collaborative partnerships on a larger scale must be explored in the context of the DESY future strategy in close cooperation with DESY advisory boards. The details of such collaborative schemes are subject to case-to-case negotiations, ending in a written agreement. Any commercial use of the facility requires a separate written agreement with DESY based on a full cost recovery model.
Wendelstein 7-X www.ipp.mpg.de/w7x Prof. **Robert WOLF** robert.wolf@ipp.mpg.de +493834882507	Plasma Physics Materials Science Fusion Technology Engineering.	Wendelstein 7-X is the most advanced and the only superconducting, optimized stellarator in the world. Its unique capabilities extend to e.g. the first high power steady state heating facility or a device control system for steady state plasma operations. The core mission of Wendelstein 7-X is the demonstration of power plant capabilities of optimized stellarators of the modular HELIAS (HELical Axis Advanced Stellarator) concept. Beyond the validation of stellarator optimization in high-performance plasma discharges, W7-X is to develop integrated steady-state plasma scenarios with high plasma pressure and confinement time, which can be extrapolated to burning fusion plasmas.	Fusion research has always been a globally coordinated effort (EUROfusion consortium, IEA Technology Collaboration Programme). As the scientific program is selected purely on scientific merit, additional international partners will promote the scientific excellence of the research program. In addition, in kind contributions (e.g. diagnostics systems) improve the scientific capability of the project.
BESSY II **BESSY VSR** www.helmholtz-berlin.de/quellen/bessy/index_en.html Prof. Dr.-Ing. **Anke KAYSSER-PYZALLA** *Scientific Director* BESSY II anke.pyzalla@helmholtz-berlin.de +49 (0)30 8062 - 43812	3rd generation Synchrotron radiation source	The BESSY II synchrotron radiation source is a 3rd-generation 1.7 GeV storage ring dedicated to the VUV and soft X-ray photon energy range, serving an international user community. The source and the instrument suite are very versatile and provide photons at a high average brilliance. This together with purpose-made insertion devices allows for energy, spatial, temporal and polarization control of the photon beam at repetition rates of up to 500 MHz.	An upgraded or new source, BESSY III, will be required after about 2028 in order to continue providing VUV/soft to tender X-rays at an internationally competitive level for the international user community of BESSY II. HZB is seeking international partners interested in contributing to the BESSY III project, and to a possible joint application for inclusion on the ESFRI roadmap. The identification phase will be the first phase of the whole project. This gives potential partners the opportunity to actively contribute to the definition of the planned facility and to ensure that special requirements of their communities are adequately taken into account.

INDIA			
India-based Neutrino Observatory – INO – www.ino.tifr.res.in	High Energy Physics	The project aims to create an underground laboratory in India where front ranking experiments in the area of neutrino physics can be carried out. This site can also be used to setup experiments to study dark matter. Development of particle detectors of various kinds will be an integral part of this project. The project will have two components: ▪ Development of underground laboratory infrastructure and support services ▪ the Iron Calorimeter (ICAL).	A 50 kiloton Magnetised Iron Calorimeter detector (ICAL) to be set up in the INO facility will address the neutrino mass hierarchy issue using atmospheric neutrinos. International partners are welcome to participate in the construction of the ICAL detector and its operation as well as in the analysis of the data as equal partners. The exact role of partners and their contributions could be defined through bilateral agreements between the partners and INO. International partners are also welcome to join other proposed experiments like dark matter search and neutrino-less double beta decay to be setup in the INO underground facility.
ITALY			
Gran Sasso National Laboratories / Laboratori Nazionali Del Gran Sasso – LNGS – www.lngs.infn.it **Stefano RAGAZZI** *Director* LNGS Stefano.Ragazzi@lngs.infn.it	Fundamental physics Astronomy	LNGS is a world class international facility for deep underground science, located at a depth of 1.4 Km under the Gran Sasso Massif. LNGS main scientific goal is the study of extremely rare and weak processes in particle physics. Shielding from cosmic rays provided by the rock coverage, low environmental radioactivity and additional shielding with ultra-pure material provide ideal conditions for studying rare processes. Facility upgrades have been planned and partially funded.	Opening LNGS as a Global Research Infrastructure will consolidate LNGS mission by widening the international participation to science at LNGS. The international science community will benefit of an easily accessible and fully equipped underground laboratory, of advanced workshops and services, and of world-class expertise in ultrapure materials. Participation to governance and sharing of costs, in the form of cash or in-kind contribution, will be part of the action towards a wider international opening.
JAPAN			
Deep Sea Scientific Drilling Vessel – CHIKYU – www.jamstec.go.jp/chikyu/e/ International Affairs Division jam-kokusai@jamstec.go.jp +81 46 867 9220	Climate and Ocean Change Biosphere Frontiers Earth Connections and Earth in Motion	Our science program will bring together the Earth, ocean, atmospheric, and life sciences with a common goal of understanding the Earth's past, present and future. The program's science plan, Illuminating Earth's Past, Present and Future, addresses pressing scientific priorities and social concerns within four themes: Climate and Ocean Change, Biosphere Frontiers, Earth Connections and Earth in Motion. The plan for NanTroSEIZE includes drilling, below the ocean, very deep into the Earth to observe earthquake mechanisms. Other plate convergent margins, mid-ocean, continental margins, etc. are also our target areas.	Scientific drilling vessel which explores as the main platform of the International Ocean Discovery Program (IODP). It explores 26 countries such as Japan, USA and Europe to open the new frontier of the scientific knowledge and contributes to the international collaborative research and human resource. With regards to the IODP's international project led by both Japan & US, it is necessary to establish the partnerships, propose the scientific research, and adopted by each three ships operated by Japan, US, and Europe. To board on CHIKYU, becoming a contribution member of the project (with a voluntary contribution) is required. We hope to extend the framework of the corporate research with the GSO country members which have not been collaborated in the past.

E-Defense www.bosai.go.jp/hyo-go/ehyogo/index.html **Takahito INOUE** *Deputy Manager* e-def@bosai.go.jp +81-794-85-8211	Seismology Earthquake effects mitigation	To mitigate the damage caused by earthquakes, E-Defense provides the opportunity to examine the failure/collapse process of full- and large-scale structures, by directly applying to the structures, three-dimensional forces equivalent to the level of large earthquakes. Accumulated experimental data are used to reveal the collapse process, as well as to develop new technology for the mitigation of damage to structures from large earthquakes. Experimental study on collapse process of structures and relating development of new technology in order to mitigate damage to structures from large earthquakes Research on numerical methods that simulate collapse process of structures for development of a simulation system called "E-Simulator".	International collaboration of utilizing each other's earthquake engineering test facilities and sharing experimental results will make it possible to promote effective research and better outcomes. International corporate research of E-defense will be carried out without any particular limitation. There will be no public offering of the corporate research although; instead, research proposals and consultations are needed to be carried out. In this case, it is necessary to pay part of the facility uses. As a specific example of such cooperation, the earthquake engineering research group operated by The US National Science Foundation (NSF) carried out the opportunities for cooperative activities related to earthquake research, citing E-Defense collaboration. By registering to the list, we hope to extend the framework of the corporate research with the GSO country members which have not collaborated in the past.
Radioactive Isotope Beam Factory – RIBF – www.nishina.riken.jp/RIBF Dr. **Hideto EN'YO** *Director* RIKEN Nishina Center for Accelerator-Based Science enyo@riken.jp +81-48-467-9450	Nuclear physics Accelerator-based science	RIBF is a leading research facility in the field of nuclear physics based on heavy-ion accelerator complex consisting of cyclotrons and linacs. It produces a wide variety of beams of unstable nuclei (Radioactive Isotopes, RIs) with the highest intensities in the world. By using these RI beams, pioneering research achievements are expected in nuclear physics. Also, various applications to many research fields are being promoted by exploiting unique properties of RIs.	At present, several international collaborations are being conducted at RIBF, using large experimental detectors developed by major institutes in European countries and the US. We expect to expand these scientific opportunities further by inviting new collaborations under the framework of GSO. We are also planning personal exchange programs between the institutes that are currently operating and under construction, in order to promote scientific research activities. International collaborations in the modern accelerator technology are desired between major facilities in the world, such as FRIB, FAIR, Spiral2, and IBS for the future plan of RIBF. It will also be useful for future evolution of accelerator-based science if international collaborations are established between the other Asian countries for human resource developments under the framework of GSO.
MEXICO			
The Large Millimeter Telescope Alfonso Serrano – LMT – www.lmtgtm.org	Astrophysics Astronomy Engineering	Principal scientific goals: understand the physical processes of structure formation and its evolution throughout the full history of the Universe. The LMT will exploit its unprecedented combination of sensitivity, resolution and mapping speeds to investigate subjects as subjects such as the constitution of comets and planetary atmospheres, the formation of extra-solar planets and the birth and evolution of stars, the hierarchical growth of galaxies, as well as the cosmic microwave background.	

High Altitude Water Cherenkov Observatory – HAWC – www.hawc-observa-tory.org Dr. **Andrés SANDOVAL ESPINOSA** asandoval@fisica.unam.mx	Astrophysics	Unlike optical or radio telescopes that observe light from astronomical phenomena directly, HAWC will study high-energy cosmic and gamma rays indirectly. Cosmic and gamma rays from the highest energy phenomena, such as supernovae and gamma ray bursts, smash into molecules in the air as they enter the earth's atmosphere. These collisions set off chain reactions that produce showers of particles, including both photons and charged particles such as electrons and positrons. These showers of particles hit the surface of the earth where the HAWC observatory detects them with an array of 300 tanks, each filled with approximately 50,000 gallons of extra-pure water. When the particles from the air shower pass through the tanks, they are travelling faster than the speed of light in the water. As they travel through the water, the particles emit flashes of light called "Cherenkov" light, in much the same way that a speed boat can produce a bow wave or an airplane can produce a sonic boom if it is traveling fast enough. The tanks are equipped with detectors that capture this Cherenkov light. With the highly sensitive HAWC observatory, astrophysicists will use the Cherenkov light to reconstruct the timing, the energy and the source direction of that initial gamma ray.	The HAWC collaboration comprises scientists and engineers from 'collaborative institutions'. The condition for recognition as a Collaborative Institution is that the participants at the institution be capable to make significant contributions including those to the detector, to operations, or to data analysis. Persons that devote a significant fraction of their research time to HAWC and make a substantive contribution to HAWC are normally full members. A user of HAWC must be a full member. Associate members may be interested in one aspect of the HAWC science and have an expertise particularly useful for HAWC. Associate members need not devote a significant fraction of their research time to HAWC, but must make a substantive contribution to one or more of the operating tasks. Partners are members of collaborations from other instruments and their access to HAWC data and results are regulated by MoUs.
RUSSIAN FEDERATION			
Nuclotron-based Ion Collider fAcility – NICA – nica.jinr.ru **Vladimir KEKELIDZE** *Professor* Joint Institute for Nuclear Research Vladimir.Kekelidze@cern.ch	Fundamental physics	NICA is the new accelerator complex. Its aim is to start in the coming years an experimental study of hot and dense strongly interacting QCD matter and search for possible manifestation of signs of the mixed phase and critical endpoint in heavy ion like Au, Pb or U collisions. Range of center-of-mass energy available for experiments is 4–9 GeV · u^{-1} with average luminosity of 10^{27} $cm^{-2} \cdot s^{-1}$.	The NICA collaboration includes already more than 110 scientific centers and organizations from more than 30 countries. About 190 scientists participate in the NICA physical programme preparation (see http://theor.jinr.ru/twiki/pub/NICA/WebHome/WhitePaper_10.01.pdf). More than 300 experts participate in accelerator complex design and construction and more than 300 physicists are involved in design and preparation of the MPD, BM@N and SPD detectors. It is expected that the collaboration will be extended by physicists and engineers both from Russia and other countries.
Reactor complex PIK www.pnpi.spb.ru **Mikhail POPOV,** *Deputy Director* NRC «Kurchatov Institute» Popov_MV@nrcki.ru	Neutron source	One of the highest research nuclear reactors in Europe. The main feature of complex PIK consists in multifunctionality and interdisciplinarity. On the base of the reactor complex PIK will be built up The International Center for Neutron Research. The creation of this center will enable to conduct breakthrough investigations in the field of condensed matter physics, biology, physics of polymers, neutron and nuclear physics and physics of elementary particles and fundamental interactions, which will contribute to supporting Russian Federation leadership in scientific community. Technical characteristics: max. heating power – 100 MWatt; The flux density of thermal neutrons – $5 \cdot 10^{15}$ $cm^{-2} \cdot c^{-1}$; max. volumetric energy-release in active zone – 6,6 MWatt · l^{-1}.	Currently exist already or are in preparation cooperation agreements on the joint use of the experimental reactor PIK stations with the Helmholtz Zentrum Geesthacht (GKSS) (Germany, Hamburg), a research centre of the Helmholtz Society in Jülich (HFZ Julich) (Jülich, Germany), the Budapest Neutron Centre (Budapest, Hungary), the European Centre for Neutron Research – Institute and Laue-Langevin (Grenoble, France). There are perspectives for collaboration with the European Spallation Source – ESS (Lund, Sweden). The ICNR on the basis of PIK Reactor Complex is open for collaboration with International Research Centers whose activities are based on neutron research.

Tokamak IGNITOR **Mikhail POPOV** *Deputy Director* *NRC* «Kurchatov Institute» Popov_MV@nrcki.ru	Fusion energy	IGNITOR is the first tokamak in the world with high magnetic field. The ignition of thermonuclear reaction in IGNITOR will be set up at the flowing current without extra heating devices. The design (dimensions) of IGNITOR will be much less than international thermonuclear reactor ITER. For current excitation will be used central solenoid with high field (more than 14 T). Plasma will be stabilized at strong poloidal magnetic fields.	Originally bilateral Russian-Italian collaboration in the framework of the Tokamak «IGNITOR» project realization will be open for the International Tokamak Research Centers in the construction phase.
Super synchrotron radiation source of the 4^{th} generation – SSRS-4 – **Mikhail POPOV** *Deputy Director* NRC«Kurchatov Institute» Popov_MV@nrcki.ru	Fundamental Physics Materials Science	The synchrotron radiation source of the 4^{th} generation will have high space coherence corresponding to laser radiation, high brightness and temporal pattern. The main scientific goals of SSRS-4 will consist in researching of structure and dynamics of substance with atomic space and femtosecond temporal resolution, developing new synthesis and characterization of nanostructure materials, researching in sphere of biomedicine, etc. Technical characteristics: photon energy – 1-30 keV, average luminiosity – about 10^{24} photons sec mm^{-2} $mgrad^{-2}$, duration of an electronic bunch – 0,1 ps.	The representatives of NRC "Kurchatov Institute", ANL, DESY, ESRF, SLAC and SPRING-8 recognize the importance of X-ray science for the future development of International Society beyond 2020 and signed Agreement on International Design Effort for the Future Light Source (Moscow Communiqué). The purpose of the Agreement is to collaborate on the design of a unique new generation facility on the basis of Synchrotron Radiation Source of the 4th generation. The SSRS-4 project is open for collaboration with International Research Centers whose activities are based on using the synchrotron radiation sources.
Exawatt Center for Extreme Light Studies – XCELS – www.xcels.iapras.ru **Alexander LITVAK** Director Institute of Applied Physics RAS litvak@appl.sci-nnov.ru	Fundamental Physics Materials Science	A large research infrastructure – the Exawatt Center for Extreme Light Studies, will be a new unique source of light having the power of about 200 Petawatt with a further prospect to increase it up to 1 Exawatt (1 Exawatt = 10^{18} W) and beyond. The research program includes such scientific direction as high energy physics, nuclear physics, astrophysics, and biomedicine.	XCELS would like to explore possible collaboration opportunities with: ▪ ELI delivery consortium international association (EC) ▪ Commissariat of Atomic Energy of France ▪ Thales (France) ▪ Deutsches Elektronen-Synchrotron DESY (Germany) ▪ Center for Antiproton and Ion Research FAIR (Germany) ▪ Rutherford Appleton Laboratory (UK) ▪ John Adams Institute for Accelerator Science (UK) ▪ Institute of Laser Engineering Osaka University (Japan) ▪ High Energy Accelerator Research Organization KEK (Japan) ▪ Shanghai Institute of Optics and Fine Mechanics (China) ▪ Gwangju Institute of Science and Technology (Korea)

A Super c-τ (charm-tau) Factory ctd.inp.nsk.su/c-tau **Iouri TIKHONOV** *Professor* Budker Institute of Nuclear Physics RAS Iouri.Tikhonov@cern.ch	Fundamental Physics	An electron-positron collider operating in the range of energies from 2-6 GeV with a high luminosity of about 10^{35} $cm^{-2} \cdot s \cdot -1$. Study of the processes with c quarks or leptons, the search and study of an entirely new form of matter: glueballs, hybrids, etc. The data, which are planned to record, by 3-4 orders exceed everything that has been recorded so far in any other experiment.	The scientists from Dubna and IHEP at BEPS II are interested in participating in the Super-Tau Charm Factory program. They also have an intention to develop a Super-Tau Charm Factory project in China. There is the signed agreement between Budker INP and Dubna.
SOUTH AFRICA			
Southern African Large Telescope – SALT – www.salt.ac.za Dr **Ted WILLIAMS** *Director* williams@saao.ac.za Tel: +27 (0)23 571 1205 Fax: +27 (0)23 5712456	Astronomy	To provide a large telescope (10m diameter) for optical and near infra-red astronomy. It is used to tackle fundamental questions about how the Universe works. SALT collects light from astronomical objects and accurately focuses it on one of four selectable foci. The light then proceeds into an optical instrument while the telescope tracks the relative movement of the object across the sky to maximise exposure time.	SALT is seeking partners who wish to purchase observing time without becoming a shareholder, alternatively, additional partners who wish to contribute to the project will be welcomed as well.
UNITED KINGDOM			
ISIS neutron and muon source – ISIS – www.isis.stfc.ac.uk Professor **Robert MCGREEVY** *Director* ISIS Neutron and Muon Source Science and Technology Facilities Council robert.mcgreevy@stfc.ac.uk +44 (0)1235 445599	Neutron/Muon science	Short pulse accelerator (spallation) source utilising neutrons and muons for a broad range of scientific applications in the physical and life sciences. Started operation in 1984 as an evolution of an earlier particle physics accelerator. Second target station (TS2) started operation in 2008. Only RI of its kind in Europe (2 in USA and 1 in Japan). ESS – a complementary long pulse spallation source – just started construction in Sweden.	ISIS welcomes international partners who are able to fund increased facility operation (preferably including staff to be based at ISIS) and facility development (e.g. instrumentation, including in-kind contributions), leading to increased capacity and capability. New partners benefit from access for their national researchers and existing partners benefit from the improved capabilities. Specific programmes to attract new users are encouraged. Partnerships at any level can be discussed, though periods less than 5 years do not tend to be sufficiently beneficial for partners.
USA			
Ocean Observatories Initiative – OOI – oceanobservatories.org **Bauke HOUTMAN** bhoutman@nsf.gov 703-292-7704	Environmental Sciences Oceanography	When completed in 2015, the Ocean Observatories Initiative (OOI) will encompass an integrated, global network of ocean sensors providing near-real time data that will transform the study of interrelated ocean processes on coastal, regional, and global spatial scales. OOI will provide a coordinated cyberinfrastructure managing a diverse, high-volume data stream, the capability to alter sampling frequency to potentially capture transient events such as ocean fronts, eddies, storms, eruptions, earthquakes, and harmful algal blooms, high frequency, long time-series sampling by advanced suites of sensors, continuous feeds of selected data sets that can be used in global models, the capability to conduct controlled experiments using instruments that can track unexpected changes and accept commands from shore, the capability to support new sensors for biological and chemical research and the potential to support the next wave of instrument and sensor innovation.	The potential level of involvement of international partners is still to be defined. NSF plans to initiate in 2016 a call for proposals for operation of the OOI with an award expected in 2017. Organizations and institutions will have the opportunity to consider potential collaborations with international partners as part of their proposal submissions.

NEON **Michael JANUS** *Vice President and General Manager* Infrastructure and Environmental Business Unit janus@battelle.org 410-306-8553	Biological and Ecological Sciences	The National Ecological Observatory Network (NEON) provides open, continental-scale data that characterize and quantify complex, rapidly changing ecological processes. NEON was conceived as a research infrastructure to advance the ability of scientists to examine and understand the interactions between life and the environment at the scale of an entire continent. Technology and research tools have rapidly evolved to harness the power of networked technology to gather and provide high-quality information on interactions between land, life, water and climate across a continent and over the course of a human generation. The insights gleaned from NEON data and tools may inform decisions at the national and community levels that will impact natural resource management and human well-being for generations to come.	Operational collaboration and linkages to other national biological and ecological observatories to eventually establish a global observatory.

SECTION II
INTERNATIONAL BASED RESEARCH INFRASTRUCTURES

Note: the "Country" heading of this section does not indicate the "lead" nation of the RI, but has only a practical traceability function with regards to the Country that originally proposed it to the Group.

RI Name, web site and contact details	Scientific Domain	Description	Proposed collaboration opportunity
GERMANY			
In-service Aircraft for a Global Observing System – IAGOS – www.iagos.org Dr. **Andreas PETZOLD** Forschungszentrum Jülich GmbH Institut für Energie- und Klimaforschung a.petzold@fz-juelich.de +49 (0) 2461-615795	Climate Change Air Quality Physics Chemistry Meteorology Atmospheric Science Aerospace Engineering.	The In-service Aircraft for a Global Observing System (IAGOS) is a distributed research infrastructure with Members from Germany, France and the UK, 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. The overarching objective of IAGOS is to establish a cost efficient world class Research Infrastructure (RI) for high-quality long-term observations of atmospheric composition on a global scale by merging scientific technology with commercial aviation. The monitoring infrastructure builds on the installation of autonomous analytical instrumentation for the measurement of greenhouse gases, reactive gases, aerosols, and dust and cloud particles aboard up to 20 long-range Airbus aircraft of internationally operating airlines. IAGOS complements the global integrated observing system in addition to ground-based networks, dedicated research campaigns and observations from satellites, balloons, and ships. Observation data for selected species are provided in near-real-time for the validation of global and regional models by ECMWF in the framework of CAMS. Additional, IAGOS provides added-value products like climatological data and trajectory analyses of probed air masses for further scientific analyses.	IAGOS provides a policy of full and open data access compliant with GEO/GEOSS/CAMS. Current practice is that new users are invited to submit a brief summary of the project they want to use the data for. After approval by the partners, the new user of the database is provided with login details to access the database at CNRS. Support to users is also provided. IAGOS fosters collaboration with other research infrastructures for the development of joint data products and services in the atmospheric domain. Beyond the use of open data and collaborations, new Members may join the Association which is operating IAGOS. Membership in general is open to any organisation with legal personality or individual, actively involved or interested in atmospheric research using commercial aircraft platforms. Members have the duty to foster the objectives of the Association and take part in the activities necessary for carrying out the purposes of the Association as applicable.

INDIA			
Laser Interferometric Gravity-wave Observatory – LIGO – www.gw-indigo.org	Fundamental Physics Astronomy	This project aims at the construction and operation of an advanced interferometric gravitational wave detector in India in collaboration with LIGO Laboratory (USA) and its international partners, Australia, Germany and UK. Detection of GW and the consequent new astronomy that will open a new window to the universe. The endeavour pushes technology on many fronts.	IndIGO-LSC is a subgroup of the LIGO Scientific Collaboration (LSC) involved in many data analysis projects related to Advanced LIGO (including LIGO-India) and participation in areas of mutual interest would be possible. Two Tier 2 Data centres are planned to be set up which would be available for LSC related activities. Some specific Research and Development activities for the next generation detectors and related technologies also offer scope for collaboration around LIGO-India.
ITALY			
European Plate Observing System – EPOS – www.epos-ip.org Dr. **Massimo COCCO** *Research manager* EPOS massimo.cocco@ingv.it T. (+39) 06 51 86 04 01 F (+39) 06 51 86	Seismology Volcanology Geology, Geodesy and Geomagnetism applied to Earth processes	The European Plate Observing System (EPOS) is a planned research infrastructure for solid Earth Science integrating existing and new research infrastructures to enable innovative, multidisciplinary research for a better understanding of processes controlling earthquakes, volcanic eruptions, unrest episodes, ground stability, and tsunamis as well as those processes driving tectonics and Earth surface dynamics. The overarching goal of EPOS is to create the capacity of using research infrastructures and services across disciplines not only providing access to a wealth of observational data, but offering to diverse communities data products, tools, and services for intelligible integrated analyses. The easy discovery of data and data products as well as the access to visualization, processing and modelling tools is the best way to progress and sustain the integrated approach to research and collaborations. Accessible data and new e-infrastructures will bring novel cross-fertilization of ideas and lead to innovative research and new discoveries. This will encourage scientists to share their research in ways that bring new applications for society.	The perspectives guaranteed by the EPOS federated approach to research have global relevance and impact beyond the scientific communities involved. In this framework, EPOS proposes a federated approach to research infrastructures in order to foster integrated access to data and products of relevance for science and society. The implication of this federated approach goes beyond the access to multidisciplinary solid Earth data and services and, in general, it might involve governance issues at global level. The possibility that this global landscape for solid Earth science could contribute to the financial sustainability of regional research infrastructures requires a profound analysis and political decisions.

International Mouse Phenotyping Consortium – IMPC – www.impc.org **Mark MOORE** *Executive Director* IMPC m.moore@ mousephenotype.org	Genome Mapping	The IMPC is an integrated network of 16 leading research Institutions around the World, which manage international excellence centres in basic and applied biomedical sciences. IMPC is providing the first encyclopedia of mammalian gene function, a critical step forward in biomedical sciences, and will underpin future developments in systems biology and drug development. IMPC builds on the efforts in the International Knockout Mouse Consortium (IKMC) to generate and characterize mutant mice strains for every gene in the mouse genome. The IMPC integrated mouse genetics centres carry out large scale, standardized, high-throughput mouse mutant production, phenotyping, cryopreservation and world-wide distribution. The ultimate goal is to produce, phenotype and disseminate the resulting 20,000+ individual mouse mutant lines, as innovative ad-hoc models of human diseases. The IMPC has envisaged two phases to its programme: Phase 1, 2011-2016, is already well underway and is carrying out the phenotyping of around 5000 mouse lines; Phase 2, 2016-2021, will undertake the analysis of 15,000+ mouse lines. All data from each production and phenotyping centre are being uploaded to a central Data Coordination Centre. Following quality control and analysis they are archived and disseminated to the wider biomedical sciences community, with appropriate annotation tools and state-of-the art data storage and preservation facilities, according to global e-infrastructure standards.	Interest in contributing to a fully international dimension of the IMPC research programme and distributed infrastructure.

Research Infrastructure for Heritage Science – E-RIHS – www.e-rihs.eu Dr. **Luca PEZZATI** *Scientific coordinator* E-RIHS luca.pezzati@cnr.it	Cultural Heritage	Preservation of cultural and natural heritage is a global challenge for science and society at large. RIHS integrates national facilities of recognized excellence in heritage science making up a distributed RI with a sustainable plan of activities, including joint research, access to a wide range of high-level scientific instruments, methodologies, data and tools, advancing and sharing knowledge in conservation, interpretation and management of heritage. The European Infrastructure for Heritage Science – operating since ten years under the project names of EU-ARTECH (FP6), CHARISMA (FP7) and now applying for the project IPERION CH (H2020) – is collecting a strong interest by prominent international institutions and is ready to start assembling a world-wide network of affiliated partners.	Interest in establishing a global dimension of E-RIHS, the European Research Infrastructure on Heritage Science, via the establishment of a steady relationship at institutional and ministerial level on the definition of international organizations and research infrastructures, concerning scientific, data management and governance topics. The GRI dimension of RIHS can then be reached by building on this partnership, reinforcing the commitments of all its members and, with the guide of the intergovernmental organization ICCROM, leading to the creation of a fully functional global RI. International partners will be asked to play seminal roles by introducing in their regional ecosystems the innovations and the cutting-edge tools provided by the global infrastructure. Furthermore, they will make it possible for the distributed infrastructure to widen its scope providing access to highly advanced facilities to an extended community of users. International partners are key stakeholders that engage local communities in study and preservation of heritage. They are instrumental in disseminating, communicating, and using best practices, standards and protocols. Global partners will be integrated in the governance bodies of the EU infrastructure, making thus possible to extend the very strong European cooperation, already established between the partners of IPERION CH, to the global level, producing a better mutual understanding and stimulating the growth of a global research area for heritage science.

SOUTH AFRICA / AUSTRALIA			
Square Kilometre Array – SKA – skatelescope.org Prof **Philip DIAMOND** *Director General* Jodrell Bank The University of Manchester p.diamond@ skatelescope.org P. +44 (0)1477 571321 F.+44 (0) 1477 571618	Astronomy Astrophysics	The SKA project is an international effort to build the world's largest radio telescope, with a square kilometre (one million square metres) of collecting area. The scale of the SKA represents a huge leap forward in both the engineering and research & development of radio telescopes, and will deliver a transformational increase in science capability when operational. Deploying thousands of radio telescopes, in three unique configurations, it will enable astronomers to monitor the sky in unprecedented detail and survey the entire sky thousands of times faster than any system currently in existence. The SKA telescope will be co-located in Africa and in Australia. It will have an unprecedented scope in observations, exceeding the image resolution quality of the Hubble Space Telescope by a factor of 50 times, whilst also having the ability to image huge areas of sky simultaneously. With a range of other large telescopes in the optical and infrared being built and launched into space over the coming decades, the SKA will perfectly augment, complement and lead the way in scientific discovery. The SKA Organisation, with its headquarters at Jodrell Bank Observatory, near Manchester, UK, was established in December 2011 as a not-for-profit company in order to formalise relationships between the international partners and to centralise the leadership of the project. Eleven countries are currently members of the SKA Organisation.	It is possible for new members to join the project during the current pre-construction (detailed design) phase of the project, which it is foreseen will run until 2018. Either full or associate membership is possible, full membership requiring a cash membership contribution, and associate membership not. Both full and associate members contribute in-kind to the work of design consortia working through a globally distributed programme (already underway) in the following areas: Assembly, Integration and Verification; Central Signal Processor; Dish; Infrastructure; Low-Frequency Aperture Array; Mid-Frequency Aperture Array; Signal and Data Transport; Science Data Processor; Telescope Manager; Wideband Single Pixel Feeds. Associate Members can participate in project meetings without voting rights and are required to upgrade to full membership during the pre-construction phase. In 2015 formal negotiations are due to start to prepare for the establishment of the legal entity to govern the construction and operation phases of the project. The new governance structure will have the flexibility to allow new members to join the project at any time.

UNITED KINGDOM

European Life Sciences Infrastructure for Biological Information – ELIXIR – www.elixir-europe.org **Andrew SMITH** *External Relations Manager* ELIXIR Hub, South Building Wellcome Genome Campus andrew.smith@elixir-europe.org +44 (0) 1223 494635	State of the art ICT provision to support biological and medical data processing and managing	ELIXIR is the European Life Sciences Infrastructure for Biological Information. ELIXIR has been nominated because it is a world-leading infrastructure, vital for enabling the life sciences to derive maximum knowledge and understanding from biological, medical and environmental 'Big Data', which delivers benefits to research and innovation in Europe and beyond. ELIXIR is the largest ESFRI Research Infrastructure in terms of Membership, with 19 countries and EMBL as Members, and one Observer. For ELIXIR to realize its potential on the world stage and drive global bioinformatics collaboration, regular interaction and ultimately direct membership with countries and global initiatives outside Europe are required. Equally, collaboration with other major global data and infrastructure initiatives is necessary. ELIXIR's International Strategy (https://drive.google.com/file/d/0BxqILhwJcm1qaXNRcUctcXJQNDA/view) sets out our vision for this. Importantly, ELIXIR plays a key role in linking global data resources since one of its key aims is to network and integrate life science data resources. The UK is the home of many of the major data archives in Europe, yet in the era of personalised medicine all countries need to develop their own national bioinformatics capacities in a coordinated manner. The life science community and the data it uses are global in nature with Europe and the USA the main players. Indeed, global usage of the databases and services that are run by ELIXIR partners is already high. For example, the website of EMBL-EBI receives over 12 million web hits a day from all over the world. ELIXIR's service registry (https://bio.tools/) acts as a repository of all bioinformatics analysis tools from across the globe, and which is used and accessed by researchers anywhere. Equally, ELIXIR's training portal TeSS (https://tess.elixir-europe.org/) acts as a global entry point into free training courses and e-learning content.	Global integration of life science data is essential and requires close links between ELIXIR and the USA (in addition to other) resources to provide rapid and efficient access to biological 'Big Data'. A key role of ELIXIR is dissemination of data standards, which requires close links with other global resources. ELIXIR is currently a unique, world-leading infrastructure but the USA, Canada and Australia are moving towards developing similar infrastructures and ELIXIR can play an important role in developing and disseminating best practice. Initially partnership is by scientific collaboration between centres, but membership of ELIXIR is welcome where new members would commit to maintain their national Node and contribute to the joint costs on an NNI shared basis. Discussions are already taking place with the US Big Knowledge to Data Initiative (BD2K), Genome Canada and Australia's Bioplatforms.

EUROPEAN COMMISSION (ESFRI)			
Biobanking and BioMolecular resources Research Infrastructure ERIC – BBMRI ERIC – www.bbmri-eric.eu Prof. **Jan-Eric LITTON** *Director General* BBMRI ERIC jan-eric.litton@bbmri-eric.eu P.+43 316 34 99 17-11 F. +43 316 34 99 17-99	Biomedical research, infrastructure, e-infrastructure, biobanks, biomolecular, resources, predictive (personalized) medicine, population based studies, rare diseases, health, enabling technologies	BBMRI-ERIC establishes, operates and develops a pan-European distributed research infrastructure of biobanks and biomolecular resources in order to facilitate the access to resources as well as facilities and to support high quality biomolecular and medical research. BBMRI-ERIC operates on a non-economic basis. BBMRI-ERIC combines the strength and expertise of 17 Member States and one International Organisation (IARC). It is the largest Research Infrastructure for health in Europe today.	BBMRI-ERIC makes samples and data in databases affiliated with or developed by BBMRI-ERIC Partner biobanks available to researchers and research institutions according to the access procedure and criteria as approved by the Assembly of Members. Access shall respect conditions set by sample and data providers that affiliate their databases to BBMRI-ERIC. Member States, third countries as well as intergovernmental organisations may become members BBMRI-ERIC at any time, subject to approval by the Assembly of Members (BBMRI-ERIC Statutes, Article 4). Proposed collaboration opportunities are in 6 areas: ▪ A Global Biobank Directory ▪ ISO standardization and development ▪ International Expert Centres ▪ Predictive medicine ▪ European Cohort Consortium ▪ Rare Diseases
EUROPEAN COMMISSION (EIROFORUM)			
European Southern Observatory – ESO – www.eso.org **Laura COMENDADOR FRUTOS** *Head of Cabinet of the Director General* *Head of Legal and International Affairs* ESO lcomenda@eso.org T.+49 89 3200 6654 F. +49 89 3200 6440	Astronomy and Astrophysics	ESO, the European Southern Observatory, is the foremost intergovernmental astronomy organisation in Europe and the world's most productive astronomical observatory. ESO provides state-of-the-art research facilities to astronomers and is supported by 14 Member States. In addition two countries are currently in the process of joining. Several other countries have expressed an interest in membership.	ESO's preferred mode of partnership is through full membership of the organisation and thus participation in the entire ESO programme and decision-making processes with all rights and obligations. The ESO Council has opened up for membership of non-European countries that are deemed able and willing to contribute to the aims of the organisation and to further its activities. Non-EU countries can join thus apply for membership upon invitation by the ESO Council. This notwithstanding, ESO has, in specific cases, itself become a partner in projects. In the case of ALMA, it represents the ESO Member States in that project. In such cases, the role of the partners are regulated by an appropriate agreement. In case of the APEX collaboration, ESO is the operating partner in charge of running the facility in Chile.

European Molecular Biology Laboratory EMBL www.embl.org **Plamena MARKOVA-ANDERSON** *International Relations* EMBL markova@embl.de +496221 387 8681	Molecular Life Sciences	EMBL is the only laboratory-based intergovernmental organisation specialising in basic research in the life sciences. It is supported by 21 Member States and 2 Associate Member States, and has also three Prospect Member States. EMBL has a fivefold mission which includes: ▪ performing state-of-the-art basic research in molecular biology; ▪ training scientists, students and visitors at all levels; ▪ offering vital scientific services to scientists in the member and associate member states; ▪ developing new instruments and methods and actively engaging in technology transfer; ▪ integrating life sciences across Europe and globally.	All opportunities under EMBL's five missions – collaborative research, training of young talent, access to cutting-edge technology, facilities and expertise, integration of national scientific communities in the larger EMBL network of excellence, etc. – are made available to Member and Associate Member States of EMBL. Non-European countries with a well-developed national life science programme can become an Associate Member State of EMBL, benefiting from a reduced membership fee. European Countries, i.e. countries-members of the Council of Europe, can join EMBL as Member States. The membership offers an important opportunity to EMBL and the Member or Associate Member to improve the quality of research through competitively striving for excellence, assembling critical mass, facilitating the flow of ideas and perspectives, avoiding duplication, and enabling complementarity and synergy at the national, regional and international level.
EUROPEAN COMMISSION (ESFRI)			
European Spallation Source ERIC europeanspallation-source.se **Ute Gunsenheimer** *Head of External Relations & EU Projects* European Spallation Source ute.gunsenheimer@esss.se	Neutron Science	The European Spallation Source (ESS) will be a multi-disciplinary research centre and will provide the scientific community with new opportunities for research using neutrons. This new facility will be around 30 times brighter than today's leading facilities and is one of the largest science and technology infrastructure projects being built today. It is the result of Europe's need for an advanced, high-power neutron facility which was articulated already 20 years ago. Relevant research fields include life sciences, energy, environ-mental technology, cultural heritage and fundamental physics. Together with the adjacent MAX IV synchrotron ESS will become a world-leading centre for materials research. To ensure a successful project it is key that its development is governed by the scientific needs of the future users.	The European project ESS with its, at present, 17 Partner Countries, would be glad to welcome additional Partner Countries interested in taking part in construction and operations. Now is the time to get involved in the scientific and technological development of ESS, and ESS is keen to collaborate with both the academic and the industrial research sector. Countries joining now during construction will have a unique opportunity to participate in the development of ESS as the project will be highly dependent on contributions of knowledge and technology from leading universities, laboratories and companies. This means that a significant proportion of Partner Countries' contribution to the ESS can be provided as in-kind contributions. It is estimated that approximately 35 % of the ESS construction budget may be accounted as in-kind contributions. Becoming a Partner also gives the Country's neutron user community the possibility to take part in defining the scientific possibilities at ESS, as well as access to the facility once in operation. An access policy for the future neutron users at ESS is yet to be produced but it is proposed that the share of the operation costs should set proportionally to the use of the facility. There can also be possibilities for In-kind contributions to ESS in the operation phase. One opportunity is the financing of staff that maintain and operate instruments that they construct as part of their In-kind contributions to construction.