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Abstract: Europlanet operates both as a Research Infrastructure and as a Consortium of European Institutions dedicated to the promotion of European expertise in planetary sciences in Europe. Since 2004 Europlanet has been supported by Framework funding and presently most of its activities are supported through the Europlanet research infrastructure, <http://www.europlanet-2020-ri.eu>. However it is necessary to plan for longer term stability independent of any single funding programme. The Europlanet Sustainability plan is focussed on the development of a longer term framework to support Europlanet, the consortium, which in turn will provide the platform for sustaining the tools, data and structures developed in the current (and past) Europlanet Infrastructures.

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1 Europlanet – The Background

Europlanet emerged from the collaboration between scientists across Europe involved in the Cassini-Huygens mission to explore Saturn and its largest moon, Titan. This pioneering mission announced Europe's 'coming of age' as an independent space exploration power, subsequently confirmed by Europe's missions to Mars and the highly successful Rosetta mission to rendezvous and explore a comet.

Europe now hosts one of the largest international communities of planetary scientists, with over 800 tenured academics and around 3000-4000 young researchers in more than 200 research groups/institutions, spread across nearly all Europe's national states. Unlike other space agencies, which have responsibility for both space missions and the supporting the scientific communities, the European Space Agency is only responsible for building and operating the missions. Europe's scientific community is supported by the national states and individual institutions, each with their own funding regimes and requirements. Fragmentation is, thus, a particular challenge in Europe and it was this fragmentation that Europlanet was established to overcome. Since its foundation in 2004, Europlanet has forged a considerable degree of cohesion and unity of purpose amongst Europe's planetary scientists funded through a series of EU Framework programmes (FPs).

2005-2009, European Planetology Network (EuroPlaNet) Coordination Action

EuroPlaNet received €2 million under Framework 6 for networking activities to build a strong community for European planetary science through meetings and workshops, identify science goals, develop synergies between space missions and ground-based observations and lay the foundations for a Virtual Planetary Observatory. The European Planetary Science Congress (EPSC), established under EuroPlaNet in 2006, has now become the largest annual meeting on planetary science in Europe and in 2011 and 2016 held its meeting jointly with the US Division of Planetary Sciences annual meeting making these meetings the largest collection of planetary scientists in the world. EPSC is a self-sustaining meeting that ran without any FP funding in 2013-14.

2008-2012, Europlanet Research Infrastructure

Europlanet received €6 million under Framework 7's Integrated Infrastructure Initiative programme to develop a distributed Research Infrastructure (RI). Europlanet RI (<http://www.europlanet-ri.eu>) enabled European researchers to access state-of-the-art laboratory facilities, planetary analogue field sites and virtual access facilities. It developed new tools and infrastructure, and consolidated the community through meetings, workshops and the sharing of resources, ideas, data and personnel.

Under its FP7 transnational access provision, Europlanet RI enabled European researchers to make 17 visits to planetary analogue field sites (55% more than anticipated), 246 visits to planetary simulators (facilities to explore physical and chemical processes of planetary atmospheres and surfaces) and 160 visits to distributed sample analysis facilities (68% more than anticipated).

Virtual Access services established by Europlanet under FP7 are still receiving ~1,600 requests per month for the planetary datasets which is in excess of the typical numbers for scientific databases and form the basis for the larger VA programmes being developed under H2020.

2014-2019, Europlanet Advanced Research Infrastructure

The Europlanet 2020 Research Infrastructure (RI) is a €9.95 million project to integrate and support planetary science activities across Europe. The project is funded under the European Commission's Horizon 2020 programme; it was launched on 1st September 2015 and will run until 31 August 2019. The project is led by the Open University, UK, and has 33 beneficiary institutions from 19 European countries. Europlanet 2020 RI is addressing key scientific and technological challenges facing modern planetary science by providing open access to state-of-the-art research data, models and facilities across the European Research Area.

Europlanet 2020 RI supports two ground breaking Virtual Activities.

VESPA (Virtual European Solar and Planetary Access) building a Virtual Observatory for Planetary Science, connecting all sorts of data in the field, and providing modern tools to retrieve, cross-correlate, and display data and results of scientific analyses;

PSWS (Planetary Space Weather Service) that will give the European planetary scientists, for the first time, new methods, interfaces, functionalities and/or plug-ins dedicated to planetary space weather in the form of tools and models available within the partner institutes.

A central part of the programme is to allow any European researcher interested in pursuing planetary science research access to a comprehensive set of laboratory facilities and field sites tailored to the needs of planetary research. Access is provided by a Transnational Access (TA) programme which supports travel and local accommodation costs of European researchers (and of researchers from Third Countries under certain conditions), at the facility for an approved period of time to conduct their own research programme. Applications are made in response to annual calls and are subject to peer review. The TA programme is organised in three themes;

- TA1 - Planetary Field Analogues (PFA). This theme offers access to 5 well-characterised terrestrial field sites that have been selected so as to provide the most realistic analogues of surfaces of Mars, Europa and Titan, to which planetary missions have either recently been directed or are planned. Access is provided for scientists to perform high quality scientific research and test instrumentation for space missions under realistic planetary conditions and undertake comparative planetology research.
- TA2 - Distributed Planetary Simulation Facility (DPSF). This theme provides access to a set of laboratory facilities that are able to recreate and simulate the conditions found in the atmospheres and on the surfaces of planetary systems with special attention to Martian, Titan and Europa analogues. The TA also includes the possibility to characterise the texture and mineral composition of samples in unprecedented detail as well as the ability to detect and characterise life, including Next Generation Sequencing.
- TA3 - Distributed Sample Analysis Facility (DSAF). This theme combines the resources of four of the world's leading analytical laboratories to analyse meteoritic and sample returns with un-paralleled precision, offering possibility to apply a wide variety of stable and radiogenic isotopic systems.

The Research Infrastructure also acts as a major forum for European planetary science community. Community actions are organised through two Networking Activities:

NA1: Innovation through Science Networking
 NA2: Impact through Outreach & Innovation

NA1: Innovation Through Science Networking; Innovation in the area of planetary science is driven by the demanding environments in which spacecraft and their instruments must work, by the large datasets and challenging observations that must be made to understand planetary systems, and by the sheer curiosity of humans as a species to understand their own world in relation to the others we have found and are finding. NA1 provides the key scientific backbone of EPN2020 and focuses on the human resources of the project itself and beyond - on researchers and engineers working in the field of planetary exploration in the ERA, contributing to overall capacity building in Europe. Our ambition is to integrate and network the providers of planetary science infrastructures with the users and with the wider European Planetary Science community and European Industrial partners. The main objectives are:

- to integrate and network the providers of planetary science infrastructures with the users and with the wider European Planetary Science community and European Industrial partners.
- to promote innovative measurement techniques in forthcoming planetary science/mission, with commercial and industrial companies including SMEs.
- to integrate scientists from the less established planetary science communities and states in Europe into the European planetary science community.
- to support the inclusion of amateur communities in European planetary science campaigns.
- to engage young scientists with the European planetary science community.
- to promote Open Access as a method and tool to disseminate data and research results.
- to support the activities of EPN2020 with exchange of experts.
- to link the Europlanet2020 RI with other Horizon 2020 activities and to develop Europlanet links with other international planetary science communities (e.g. in China India, Japan and USA).

NA2: Impact through Outreach & Innovation; The Impact through Outreach and Innovation Networking activity will engage a wide range of stakeholders, including industry, policy makers, the media and the public. NA2 will engage with stakeholders through:

- the Europlanet Media Centre, a comprehensive media service for the planetary science community.
- a sustained presence on social media platforms, optimised for different audiences (e.g. Twitter for engaging with journalists, LinkedIn and webpages to build industry engagement, Google Hangouts on Air for engaging with schools and the general public etc).

NA2 will:

- organise a series of workshops to share best practice and develop new ideas for effective communication.
- provide training workshops to enhance the communication and engagement skills of scientists in the planetary community.
- work with the astroEDU open-access platform to create peer-reviewed astronomy education activities for quality-assured planetary science related outreach activities.

- provide a professional-quality translation service for selected outreach and dissemination materials.
- identify an effective, user-friendly suite of evaluation tools for outreach and engagement activities.
- support an outreach funding scheme, which awards grants of between 5,000 and 10,000 Euros for public engagement activities relating to planetary science.
- Awarding the annual Europlanet Prize for Public Engagement with Planetary Science.
 - prepare a series of short animated videos (each lasting about 5 minutes), aimed at school (and general) audiences, that explain key topics related to planetary science and technology.
 - develop 'Planetary Climate Detectives', a project that challenges students to collect data on Earth's climate and compare with real data from Mars, Venus and Titan, demonstrating how the comparison of Earth with our planetary neighbours can help understand complex environmental issues.

The Europlanet RI sustainability plan must secure the long term legacy of all of the aforementioned programmes (VAs, TAs, NAs) post the support of the Europlanet 2020 Research Infrastructure.

2 Sustaining Europlanet infrastructures.

The current Europlanet partners/beneficiaries providing services within the Europlanet 2020 Research Infrastructure agree to the maintenance of the tools and services developed within the RI (e.g. as Joint Research Projects, JRAs) for at least five years after the conclusion of the RI (August 2019).

The laboratories and field sites supporting Trans-National Access (TA) and largely funded by national agencies and the basic infrastructure and staffing is largely independent of the access funding provided by the RI. Therefore, the laboratories listed in TA2 and TA3 are regarded as self-sustaining and their future development/upgrade is expected to be part of their general research programmes drawing on National and international funding. TAs (Field sites) consist of those sites that already form existing research facilities which are part of national/international research programmes and infrastructures (e.g. Iceland, Rio Tinto and Ibn Battuta) and the new sites developed as part of the RI JRA programme (the Danakil Depression, Ethiopia and Tirez Lake, Spain). The sustainability of access to the Danakil Depression, Ethiopia is expected to require national support (in terms of personnel and infrastructure) and will be part of the forthcoming consultation with local (University of Mekele) and Ethiopian Government agencies, whilst access of Lake Tirez is expected to follow the pattern of Rio Tinto.

The longer term support of access to any TA facility by researchers outside the host country is problematic. Some bilateral national agreements may be fashioned and support for a subset of groups included in grant applications. However, these will be no substitute for the access supported by the RI TA programme which is welcomed by the European planetary (and wider space) sciences community. Having established an independent peer review process (led by European Science Foundation, ESF) and demonstrated the (growing) need for such facilities access we hope that in any future FP9 programme Europlanet will be able to apply for a continued TA programme,

indeed it is a programme we would wish to expand to include new facilities, several of whom have benefited from NA1 expert visits to prepare their own laboratories/field sites for Trans-National Access.

The VA Services Developed under Europlanet 2020 RI (VESPA and PSWS) are recognised as international exemplars of such virtual (on line) services and have already been adopted by leading Agencies such as ESA and planetary missions (e.g. members of ExoMars). The PSWS has been noted as an innovative and unique service for the space exploration community whilst linking well with DG12 space initiatives (e.g. in COMPET calls 2014-17). Both are expected to be sustained by their host institutions after the current project and both are seeking (and in case of VESPA, e.g. SHADE database, have already secured) national funding. Both VESPA and PSWS will develop their own sustainability plans during the course of the current RI which will include service provision for forthcoming space missions and exploring e-infrastructure opportunities in H2020 and FP9.

3 Sustaining Europlanet.

Europlanet brings together researchers active in planetary and space research from across Europe. Since 2005, Europlanet has provided Europe's planetary science community with a platform to exchange ideas and personnel, share expertise, research tools, data and facilities, define key science goals for the future, and familiarise and engage stakeholders, policy makers and European citizens with planetary science. Today, Europlanet is a collegial organisation designed to support European planetary science with a sustainable, active community for decades to come. In 2013 Europlanet established a method of Institutional membership that to date has a membership of over 90 institutions, linked by a Memorandum of Understanding (MoU) (<http://www.europlanet-2020-ri.eu/join-us>, *Annex I*), that have agreed to cooperate on an informal and mutually beneficial basis. Europlanet members include past beneficiaries of Europlanet as well as new partners. By the end of the decade, Europlanet aims to have more than 180 members signed up to the MoU – at least 90% of planetary science institutions in the European Research Area.

3.1 The Europlanet Consortium.

Europlanet, The Consortium has been established to act as a forum (and voice) for the European planetary science community, independent of nations, government and funding agencies. It is a counterpart of ESA and other space councils being a 'bottom-up' organisation whose objective is to support and represent planetary space sciences in Europe. The Europlanet Consortium engages in strategic fora and provides input to and commentary on space initiatives in Europe (and when invited in collaboration with non-EU partners beyond). Thus Europlanet has engaged in discussion of the recent EC Space Strategy, the space programme of H2020 and will feed into discussions of role of space in any FP9 programme. Europlanet predominantly provides a pan-European perspective and does not aim to engage in national dialogues except when it is suitable to do (e.g. Europlanet through two of its members is a participant in Hungarian application for a Centre of Excellence in Space Science and Technology under the H2020 Widespread 'Teaming' programme).

The Europlanet Consortium will be organised through a 'Consortium Board' composed on members drawn from the Institutions that have signed the MoU. Chaired

by Prof N J Mason with Prof Athena Coustenis as Deputy (roles they also hold in the Europlanet 2020 RI) the Board will be responsible for the long term sustainability of Europlanet. The board shall comply with Europlanet's aim to be fully inclusive with a balance gender membership and representative from 'Inclusiveness' countries as well as well as academia and industry. The Board can also co-opt representatives from other European space policy units (e.g. European Space Sciences Committee of ESF and Eurospace, representing Europe's space industry). The Board will meet as required but not less than twice a year; most meetings will be virtual (on-line conference calls) but the Board is expected to meet face to face at The Europlanet annual meeting (EPSC).

3.2 Future Structures.

Europlanet is exploring a 'distributed' management structure where its 'offices' will be hosted within several institutions across the European Research Area (ERA). Europlanet will represent all nations in the European geographic area and not just those full members of the European Union.

Currently the HQ and operational office of Europlanet consortium and the Europlanet 2020-RI is located at The Open University, in Milton Keynes in the UK. This will continue to be the main HQ until at least September 2019.

However as part of this sustainability plan we aim to establish an office (or offices) in other European states. In the recent Hungarian application for a Centre of Excellence in Space Science and Technology under the H2020 Widespread 'Teaming' programme Europlanet has expressed the desire to create an office in that Centre, with responsibility for developing planetary sciences in Central, Eastern Europe and the Balkans countries where the community is fragmented and lacks infrastructure support (e.g. for developing tenders to ESA and applying for H2020/FP programmes).

Should Europlanet determine to become an individual membership organisation (similar to the American Astronomical Society's Division for Planetary Science (DPS)) then we anticipate establishing a 'membership office' responsible for membership communications and subscriptions.

Europlanet's outreach and dissemination is currently managed by the specialist science communication SME, the Science Office (<http://www.scienceoffice.org/>); the continued support of the Europlanet Media Centre and our outreach and public relations (e.g. engagement with EU parliament) will require an outreach office either within one of the Europlanet offices or in a dedicated hub (such as Science Office).

The Europlanet Consortium Board is to consider the office structure and determine where a second (non UK) office should be established (and any subsequent ones). The relative roles and responsibilities of this office(s) will be determined by the Board which should be in place by end of the Europlanet 2020 RI.

3.3 Financial Plan.

It is recognised that the activities of Europlanet require a longer term secure financial basis. To date Europlanet activities have been based on Framework programme funding and this should not be regarded as a guaranteed source of funding. Therefore,

the Europlanet consortium will explore mechanisms for supporting its central activities that lower the risk of ‘single funding’.

One option is to establish Europlanet as a membership organisation with individual members paying fees (e.g. 30 Euros per year for full membership, 15 Euros for students) with options for institutional membership. With 800 tenured academics and around 3000-4000 young researchers in more than 200 research groups/institutions being identified as forming European planetary sciences community membership may generate 30,000- 40,000 Euros subscription income per year. Sponsorship (from industrial partners, publishers, etc) as well as agencies may develop an overall income stream of some 50-60,000 Euros per year which would be sufficient to support a small central staff base (on part time contracts).

Europlanet must also seek through its members to secure research project funding to support its research and related activities. Europlanet 2020 RI Management and Work Package Boards and the Europlanet Consortium have already identified forthcoming H2020 (and related pan European) call to which to apply with partner funding in such bids being used to complement and support current Europlanet activities. As stated above the opportunity to continue to support TA and VA activities in FP9 (providing a service to EU community that cannot be secured from national funding) should be encouraged as part of Europlanet’s engagement with FP9.

The European Planetary Space Congress (EPSC) is the main communication forum of Europlanet and has developed to be a largely self-sustaining (fee based) conference. EPSC will remain an integral part of Europlanet structures and central to the provision of membership services of any future Europlanet structure (e.g. members being eligible for a lower EPSC fee). EPSC is also expected to be the vehicle for many of Europlanet’s community activities thus acting in a manner similar to DPS Annual meeting in USA.

The Europlanet Board will again review the opportunity for forming a European Research Infrastructure Consortium (ERIC) https://ec.europa.eu/research/infrastructures/pdf/eric_en.pdf though this was not successful in previous RI nor for the e-infrastructure VAMDC. Recent changes in the legal protocols may allow this to be developed with the advantage of Europlanet securing its own PIC number for future FP bids, nonetheless it should be based in a country where ERIC’s are generally recognised and legal obstacles (e.g. for employment) may be minimised.

4 Summary

Europlanet is now a recognised ‘brand’ that has the support and confidence of the European planetary science community. Supported in three EU Framework programmes for more than 12 years it is timely for Europlanet to evolve into a more permanent structure that can continue its research and promotional activities across the European Research Area. As part of the current Europlanet 2020 RI a Europlanet sustainability plan is to be developed to establish new structures and financial plan for the continued operation of Europlanet.

The establishment of the Europlanet Board in 2016 will be pivotal to the furtherance of the sustainability strategy and the development of the proposed 'distributed' office structure as well as the review of the case for establishing Europlanet as membership organisation and the opportunity to create a Europlanet ERIC.

This sustainability plan is a living document and is expected to be updated in each year of the Europlanet 2020 RI.

