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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 2005 Europlanet has been supported by European Commission (EC) Framework Programme (FP) funding. Presently, most of its activities are supported through the Europlanet 2020 Research Infrastructure (Europlanet-2020-RI), http://www.europlanet-2020-ri.eu, a €10 million project funded through Horizon 2020. However, it is necessary to plan for longer term stability independent of any single funding programme. The Europlanet Sustainability Plan is focused on the development of a longer-term framework to support the Europlanet Consortium, which in turn will provide a platform for sustaining the tools, data and structures developed in the current (and past) Europlanet projects.

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1 Europlanet – The Background

Europlanet emerged from the collaboration between scientists involved in the Cassini-Huygens mission, the first ESA mission with a distinctive European role (developing the Huygens probe to explore the atmosphere of Titan, Saturn's largest moon). This pioneering mission announced Europe's 'coming of age' as an independent space exploration power, and this position has been confirmed subsequently by Europe's missions to other planetary bodies, including Mars, and the highly successful Rosetta mission to 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 supporting the underpinning scientific communities, the European Space Agency is only responsible for building and operating the missions. Europe's scientific community is supported by 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 through a series of projects funded through 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, to identify science goals, to develop synergies between space missions and ground-based observations and to 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 has evolved into a self-sustaining meeting that is funded through fees of participants. In 2011 and 2016 EPSC was held jointly with the American Astronomical Society's Division of Planetary Sciences (DPS) annual meeting, making it one of the largest meetings on planetary science worldwide.

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, as well as to develop new tools and infrastructures. Europlanet RI 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 simulation 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 RI 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 now developed under H2020.

2015-2019, Europlanet Advanced Research Infrastructure

The Europlanet 2020 Research Infrastructure (Europlanet-2020-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 from 1st September 2015 until 31st August 2019. The project is led by the Open University in the 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)* is 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)* is giving European planetary scientists access to – for the first time – new methods, models, tools, interfaces, functionalities and/or plug-ins dedicated to planetary space weather.

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 that 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 to provide the most realistic analogues of surfaces of Mars, Europa and Titan (bodies to which planetary missions have either recently been directed or are planned). Access is provided for scientists to perform high quality scientific research, to test instrumentation for space missions under realistic planetary conditions and to undertake comparative planetology research.
- TA2 - Distributed Planetary Simulation Facility (DPSF). This theme provides access to a set of laboratory facilities that recreate and simulate the conditions found in the atmospheres and on the surfaces of planetary systems with special attention to Mars, Titan and Europa analogues. TA2 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 unparalleled precision, offering the application of a wide variety of stable and radiogenic isotopic systems.

Europlanet-2020-RI also acts as a forum for the European planetary science community. Community actions are organised through two Networking Activities:

- NA1 - Innovation Through Science Networking. NA1 is responsible for dissemination of EPN2020-RI's activities to the science community, as well as organising meetings, workshops and personnel exchanges to strengthen the community, developing industry-academic collaboration, discussing latest scientific results, and setting the strategy and goals for planetary science in Europe for decades to come.

- NA2 - Impact through Outreach & Innovation. NA2 engages the international media and Europe's citizens, teachers, students and policy makers with cutting-edge planetary science and exploration, and provides tools, training, funding and best practice workshops to support outreach and education related to planetary science.

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

2 Sustaining Europlanet infrastructures.

The partners/beneficiaries of Europlanet-2020-RI have agreed 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 project in August 2019. This will ensure the legacy of Europlanet-2020-RI and sustain access to the tools for the immediate future.

The VA services developed under Europlanet-2020-RI (VESPA and PSWS) are recognised as international exemplars of such virtual (online) services and have already been adopted by leading agencies such as ESA and instrument teams for planetary missions (e.g. members of ExoMars). PSWS has been noted as an innovative and unique service for the space exploration community whilst linking well with DG Research and Innovation 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 (or, in case of the SSHADE database in VESPA, have already secured) national funding. Both VESPA and PSWS will develop their own sustainability plans during the course of Europlanet-2020-RI which will include service provision for forthcoming space missions and exploring e-infrastructure opportunities in H2020 and FP9.

It is planned that VESPA will form part of the International Virtual Observatory Alliance (IVOA). In 2017 the Solar System Interest Group (SSIG) was created to review IVOA standards and scope out how Solar System sciences through VESPA can be incorporated into IVOA to provide a long-term data and tool repository. Europlanet VA activities are also working closely with, and are within, the

International Planetary Data Alliance (IPDA) supported by all the major space agencies and mission centred institutions. VESPA and PSWS are also integrated within France through the Strasbourg astronomical Data Centre (CDS) linking to the Aladin and VESPA tools/services. CDS is maintained through long-term sustainable funding programmes. VESPA has recently been certified in France by INSU as a service to the community. This will allow VESPA, in future, to hire researchers and thus help to sustain the service on a time scale of several years. Thus Europlanet-2020-RI virtual access tools and services will be secured beyond the end of current RI.

The laboratories and field sites supporting Transnational Access (TA) are largely funded by national agencies and the basic infrastructure and staffing is therefore largely independent of the TA funding provided by Europlanet-2020-RI. The laboratories offered under 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. TA1 field sites consist of existing research facilities that are part of national/international research programmes or infrastructures (e.g. Iceland, Rio Tinto and Ibn Battuta) and the new sites developed as part of the Europlanet-2020-RI JRA programme (the Danakil Depression, Ethiopia and Lake Tírez, Spain). The sustainability of access to the Danakil Depression is expected to require national support (in terms of personnel and infrastructure) and is the topic of ongoing consultation with local institutions (University of Mekele) and Ethiopian Government agencies. Access to Lake Tirez is expected to follow the pattern of Rio Tinto with national funding supplemented by international grants (e.g. H2020/FP9).

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 a subset of groups included in grant applications. However, these will be no substitute for the access supported by the Europlanet-2020-RI TA programme which is seen as very important by the European planetary (and wider space) sciences community. Europlanet-2020-RI has established an independent peer-review process, led by the European Science Foundation (ESF), and through the many applications to its TA programme demonstrated a growing need for such facilities. Indeed, several NA1 expert exchange visits during Europlanet-2020-RI have involved representatives of laboratories/field sites that wish to prepare for future TA use. Europlanet would strongly advocate a call in FP9 to support a continued and expanded TA programme to include new facilities.

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. Since 2013, institutions or companies with an interest in planetary science have been able to join

the Europlanet Consortium by signing a Memorandum of Understanding (MoU). To date, the Europlanet Consortium has a membership of over 140 organisations 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.

The Europlanet Consortium was established to provide a sustainable forum and voice for the European planetary science community, independent of nations, government and funding agencies. It is complementary to ESA and other space councils, being a 'bottom-up' organisation whose objective is to support and represent planetary sciences in Europe. Europlanet engages in strategic consultations and provides input to and commentary on space initiatives in Europe (and when invited in collaboration with non-EU partners beyond). Thus, the Europlanet Consortium has enabled discussion within the community and feedback on the recent EC Space Strategy, the space programme of H2020, and will feed into discussions of the role and content of space in the forthcoming FP9 programme. The Europlanet Consortium represents predominantly the pan-European perspective and does not aim to engage in national dialogues except when it is appropriate and it has been invited to do so.

In 2017, new structures were put in place to provide long-term stability of the Europlanet Consortium. From 2018, it is planned to open Europlanet to individual members (as well as institutions) forming the Europlanet 'Society', which will be funded through subscriptions. This new structure will be organised through a 'Europlanet Executive Board', composed of members drawn from the institutions that have signed the MoU. The membership of the Board shall comply with Europlanet's commitments to diversity, equity and inclusiveness, as well as representing both academia and industry. The Board can also co-opt representatives from other European organisations (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 and the Board is expected to meet face to face at the Europlanet annual meeting EPSC. Two Sub-boards have been established: (i) The European Planetary Sciences Congress Executive Board (EPSC) to oversee running of annual EPSC meeting; and (ii) the European Planetary Early Career Network (EPEC) with focus on training and developing next generation of European planetary scientists.

A Steering Group has been established to define the new structure and prepare a revised MOU and statutes of the new 'Society' chaired by Professor Nigel Mason (Open University, UK) with Professor Athena Coustenis (Observatoire de Paris, France) as Deputy (roles they also hold in Europlanet-2020-RI). Other members include: Professor Tilmann Spohn (DLR, Germany), Professor Berndt Feuerbacher (Germany), Professor Leonid Gurvits (JIVE, The Netherlands), Professor Maria Cristina De Sanctis (INAF, Italy), Professor Ewa Szuszkiewicz (University of Szczecin, Poland), Professor Hannu Koskinen (University of Helsinki, Finland), Professor Stéphane Udry (Observatoire de Geneva, Switzerland) and Dr Nicolas Walter (European Science Foundation, France). The first meeting of the steering Board will be on December 20, 2017 at ESF, Strasbourg (see below).

3.2 Future Structures.

Europlanet is developing a 'distributed' management structure that may have several offices hosted within 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 both the Europlanet Consortium and 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 (and due to uncertainty of UK participation in H2020 and FP9 programmes beyond 29th March 2019) a second office was established in October 2017 within the premises of the European Science Foundation (ESF) in Strasbourg. The co-location of Europlanet with the secretariat and administration of the European Space Sciences Committee of ESF, together with ESF's experience in bidding for and coordinating EU Framework Programme projects, is seen to be mutually beneficial to Europlanet and ESF. ESF, including its recently launched ESF Science Connect expert services division, fosters partnerships, provides project management services, hosts and supports European Expert Boards and Committees, and provides peer review and evaluation services. Thus, ESF provides Europlanet with the interdisciplinary support needed to build a sustainable community for European planetary science.

It should also be noted that Strasbourg is a key strategic location for a Europlanet office. Local universities, including the University of Strasbourg and the International Space University, have several groups relevant to planetary science (e.g. the CDS that will support virtual access to VESPA). Moreover, Strasbourg is home to the European Parliament, the focus of Europlanet's programme of engagement with policy makers. Within the European Parliament, Europlanet has developed strong links with Members of STOA and the ITRE Committee, which discuss topics of relevance to space and planetary science. To date Europlanet's activities (one-to-one briefings, dinner debates, an exhibition) have taken place in Brussels. However, a permanent base in Strasbourg will offer many more opportunities for Europlanet representatives to meet with MEPs and their policy advisors, as well as to participate in or organise space policy-related events.

The ESF will therefore, from 2018, manage the Europlanet Consortium/Society membership, collecting fees and holding the financial account. It will also hold the account pertaining to the EPSC annual meeting. A Membership Secretary will be appointed and hosted by ESF. In addition, a Europlanet media/outreach officer will be recruited at ESF in 2018 in preparation for ESF taking over long-term hosting of the Europlanet Media Centre following the end of Europlanet-2020-RI project in August 2019. This media/outreach post may be shared with ESF European Space Sciences Committee and the nascent European Astrobiology Institute (also planned to be HQ in ESF).

The formal arrangement between Europlanet and ESF will be established by the Europlanet Executive Board but the draft agreement states:

'The European Science Foundation (ESF) will host the Europlanet consortium and therefore provide the network with a legal entity while limiting the liability of Europlanet's stakeholders. Through this setting, ESF will be the contracting entity –on behalf of the network- for all Europlanet contractual, financial and legal matters and activities (including with EPSC PCO); ESF will also provide office and meeting space. ESF support functions (human resource, accounting and finance as well as general services and chief executive Office) will accompany the setting-up and development of Europlanet activities while ESF-hired staff (scientific, communication, administrative) will be in charge of Europlanet's operations under the supervision of the Europlanet board. As to financial matters, ESF will oversee and validate the Europlanet's Board finance and budget planning in order to ensure its viability; ESF accounts are annually audited.'

3.3 Financial Plan.

Long-term, is recognised that Europlanet requires a secure financial basis. To date, Europlanet activities have been supported through EC Framework Programmes, but H2020/FP9 should not be regarded as a guaranteed source of funding for future activities. Therefore, the Europlanet Consortium will explore mechanisms for supporting its central activities that lower the risk of 'single funding'.

In addition to membership fees (institutional and individual) to be collected annually as part of the new Europlanet Consortium/Society and used to support administration of Europlanet office(s) and Board/Assembly meetings, the Europlanet Board will review the opportunity of forming a European Research Infrastructure Consortium (ERIC) (please see: https://ec.europa.eu/research/infrastructures/pdf/eric_en.pdf), an entity that has already been adopted successfully by the JIVE (Joint Institute for Very Long Base Line Interferometry ERIC) (please see: https://www.jive.nl/). Such a structure may allow Europlanet to be its own legal entity, securing its own PIC number for future FP bids.

Europlanet must also seek, through its members, to secure research project funding to support its research and related activities. Europlanet Management, Europlanet-2020-RI Work Package Boards, Europlanet Consortium members and other partners have already identified forthcoming H2020 (and related pan-European) calls that could be used to complement and support ongoing or future Europlanet activities. As stated above, TA and VA activities supported through EU funding provide a service to the European planetary community that cannot be secured elsewhere e.g. from national funding. Continued TA and VA access will be one of Europlanet's main recommendations for the final H2020 Infrastructure calls in 2019 and the upcoming FP9.

EPSC is a self-sustaining conference, funded through registration fees, and will remain an integral part of Europlanet's future structures. As the main dissemination platform and largest meeting opportunity for the European planetary science community, access to EPSC will be a central membership benefit (e.g. members may be 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 similar manner to DPS Annual meeting in USA.

4 Summary

Europlanet is now a recognised ‘brand’ that has the support and confidence of the European planetary science community. Funded through three EU Framework programmes for more than 12 years, it is timely for Europlanet to evolve into a more permanent structure so that it can continue its research and community-building activities across the European Research Area. The establishment of a second Europlanet office at ESF, which will be responsible for the creation of an individual membership (as well as institutional membership) organisation and the establishment of a new Europlanet Board in 2017/18, is a significant step in the sustainability strategy of Europlanet and consolidating the legacy of Europlanet-2020-RI.

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