PERSPECTIVES FOR THE NETWORK OF CENTRES IN THE SPACE DOMAIN

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OVERVIEW

Cooperation models for European technical centres in the space domain have been discussed for many years. Against this background, the European Space Policy Institute (ESPI) in Vienna has performed a study about the "Network of Centres" initiative. It involved experts from ESA, DLR and CNES. This paper will present major findings and recommendations of the study report [1]. For example, different network types are discerned. Also, a pragmatic approach for the further development of network structures is recommended, taking advantage of existing structures until the new European Space Policy (ESP) is implemented.

1. NETWORK OF CENTRES: TERMS AND IMPLICATIONS

1.1. Original Definition

Europe is on the way to prepare a comprehensive and coherent European Space Policy (ESP), which will require appropriate structures and governance concepts. Facing ever tighter budgets, the optimal utilization of public resources and skills is recognized as a key issue. This calls for harmonisation of space structures and procedures in Europe and urges to make maximum use of national capabilities for European projects and programmes. Enhancing networked activities appears as a logical consequence, not only because it may have the potential to deliver the desired results, but also because it fosters cooperation in Europe, which can be considered as a (political) goal in itself.

At its 141st meeting 1999 in Brussels, the ESA Council decided to form "an integrated network of specialised centres, working together in a spirit of transparency, complementarity and reciprocity, concerted by ESA and offering greatly increased opportunities for mobility" [2]. The centres referenced were both the ones belonging to ESA and the ones belonging to national organisations (agencies, institutes, universities). Industry centres were not mentioned as such, although it could be argued that the term "national organisations" also comprises privately owned companies or shared technical infrastructures.

On this basis, the Director General (DG) of ESA proposed a plan of action for a network of technical centres in Europe [3]. There, a technical centre was defined as "a set of resources (…) grouped as a unit dedicated to fulfilling one or more technical functions". Provision of test facilities or services, flight operations, project reviews or management activities were listed as examples of such technical functions. Networking of centres was described as being driven by "sharing of the same technical function(s)". The difference between the concept of a technical centre and that of an agency was stressed – the latter including among others programmatic aspects.

Benefits for the European space system from networks were seen to follow from their long term orientation, allowing for a build-up of sustainable know-how which in turn could serve as a basis for innovation and increased overall efficiency. This long term orientation was considered as a contrast to short term horizons of industry, where activities tend to aim at immediate return of investment. Possible savings for Member States through networks were specified to be realized by the avoidance of duplication as well as by the chance for cooperative management, optimal capacity sizing, efficient work distribution and joint procurement.

The document also stated that centres to be included into a specific network should fulfil certain criteria such as being "more than half publicly funded" and having minimum size. The composition of a network should be set up on a case by case basis, according to the interests of the centres and of the network itself. Going back to the Council's resolution, the main criterion for a centre's network eligibility was claimed to be transparency, though. It was referred to as the "mutual availability of key data" in a variety of fields. Lack of transparency was stated as being equivalent to network exclusion for a centre. Still, a flexible approach was recommended and concessions were made accounting for the diversity of centres.

1.2. Evolution of the Concept

Another item within the plan of action was the installation of pilot networks to demonstrate the feasibility of the introduced concepts. Three functions were picked and corresponding networks suggested: Flight operations, project review and provision of test facilities. These functions were selected because networking in the respective areas promised to deliver successful results in relatively short time and to be exploitable in terms of lessons to be learnt.

An evaluation of the NoC project was performed by the ESA executive in an internal document in the year 2003. The results were not made public. There is evidence that the people in charge of designing and running networks were sometimes not really satisfied with the way they functioned. Sometimes, concerns about ESA perceiving the new networks as competition, seeing itself more as leader or manager than coordinator and trying to gain control over national programmes were found and in part still remain today.

In any case, there seems to be a tendency towards a more flexible handling of networks. The original plans of ESA focussed on concepts for a highly regulated system with a strong role of ESA. Although being aware of diversity and different degrees of network maturity, a kind of "one size fits all" strategy was employed. Nowadays, "tailor made approaches" are increasingly called for and will most likely be the future way of organizing networks. Still, varied positions can be found with the different ESA Member States.

Recent thoughts include the evolution of the present system towards a "Network of Competences". This could be interpreted as follows: The "Network of Centres" addresses a set of competences of different natures, which are supposed to be linked through networks. Most of these competences can be assigned to one of the categories information provision, technical know-how or management capacities. However, the way the term competence is understood by various actors varies considerably. Some consider networks of competences as subset of networks of centres and some see it the other way around. A commonly accepted definition as a basis for understanding is thus urgently recommended.

ESA Member States keep on considering networks as a decisive issue for the upcoming European Space Policy. At the Council's meeting 2005 in Berlin held at ministerial level, a corresponding resolution was adopted [4]. It stressed the need for "systematic research of the optimal utilization of the Agency's and Member States' capabilities, thus avoiding useless duplication of efforts". Thereby, the NoC concept has now become part of the bigger picture associated with the European Space Policy to be devised.

2. PAST AND PRESENT EXPERIENCES WITH NETWORKS

2.1. Case Studies in the Space Sector

In the following, some networks that have already been implemented in the Space Sector will be shortly described. Three networks run in the framework of NoC will be treated: Flight Operations, Space Debris, and Project Reviews (PRINCE). ESA's scientific programme will be described as well, because its implementation has some links to the network of centres.

Flight Operations

The Flight Operations network was set up as one of the first pilot networks under the NoC project of ESA. The participants

ASI/TPZ, BNSC, CDTI, CNES, DLR, NSC, SSC and ESOC where organised as working group (FOWG, flight operation working group) coordinated by ESOC. The objective of the group was to work out and demonstrate a concept of collaboration between the centres along the four network principles "transparency, reciprocity, complementarity, non-discriminatory access". The scope of Flight Operations activities was defined as preparing and conducting satellite, related ground segment and ground station network operations. European as well as national missions or cooperative missions with international partners were to be addressed.

Two major governance models were discussed for the operational phase of the network. The "classical" concept was based on the idea to nominate a "lead centre" for each mission. This role was to be taken by the responsible agency: By ESOC for ESA missions and by the responsible national agency for national missions. The missions were supposed to be carried out in flexible cooperation with the other centres using the criteria of available resources, facilities, cost and schedule problems. The "ESA umbrella" scenario was developed as an alternative option to the "classical" scenario. ESA would become the formal NoC coordinator and the national centres the "associated" ESA centres. ESA would have the responsibility for and the authority over the overall harmonisation process. The participating Member States recommended the "classical" scenario for the operational phase. A "charter" signed by all network partners was to be the legal basis for the network.

The pilot network group established a dialogue of information exchange between the centres and constructed a detailed database of technical facilities and competences. The "flight operation" network set up, however, did not reach an operational stage. Obstacles were mainly legal and political problems besides technical ones. They could not be solved within the group. Also, concerns to lose control over the development of national facilities, staff and funding hampered further progress. This was demonstrated by the preference for the "classical" scenario, which leaves responsibilities for national activities at a national level. In addition, the work of the pilot network was severely handicapped by the fact that all Member States pay towards the cost of running ESA/ESOC, although many Member States are effectively competing with it.

The Flight Operations network's original design was complex and ambitious. It was felt that bilateral agreements could be a useful way to promote inter-agency collaboration. GSOC and ESOC took the initiative for a closer bilateral cooperation based on a LoI exchange in parallel to the network of centres process. The goal of the cooperation was to create an operational kernel for Flight Operations which other centres could join subsequently. Detailed objectives close to the objectives of the FOWG and in line with the network principles were defined. They included a bilateral approach: an increase in transparency and efficiency, sharing of expertise, facilities and services, coordination of new investments and provision of a technical basis for future advanced technical integration. Governance was executed by a steering group at DG and executive board level for policy issues and a management board at director level for organisational and technical guidance. GSOC and ESOC reached a high level of transparency, mutual understanding and a certain stage of harmonisation, which was not promoted further due to the lack of resources the centres needed to invest. Systematic cost savings based on the harmonisation, however, could not be demonstrated at the level of harmonisation reached so far.

CNES/CST later joint discussions with GSOC and ESOC and was invited to participate in the cooperation. The pace of the bilateral and trilateral approach slowed down when negotiation of the joint offer for the Galileo IOV phase started. The offer was submitted as network approach by the following partners: GSOC, ESOC, CNES, TPZ, SSC, NSC, HISPASAT, AENA and INMARSAT. The character of this network is very close to a regular consortium also involving private partners.

Flight Operations is a network of technical facilities and capabilities, but also a management network. It has a relation to both the public and the private market. Consequently, permanent operational structures need to be geared to market

rules. On the other hand, Flight Operations is a political-strategic issue on regional, national and European level and therefore needs public governance. These two partially contradicting aspects, which characterise Flight Operations, may cause the difficulty to define an appropriate governance approach for a European network in this area. Another problem is that the Flight Operations network faces market competition and actually constitutes a complex of different technical and management networks, which significantly hampers its handling.

To at least partly resolve the contradiction described above, partners in the Flight Operations network should be of the same type – either private or public. Otherwise, there are very different motivations for network participation among the members. Information exchange as well as harmonisation of tools and procedures can successfully be managed by a "bottom up" process. This was demonstrated by the GSOC-ESOC cooperation. The management of a mission by the Flight Operations network, however, must be directed and supported from the highest level within the involved organisations and must start at the mission definition state in order to allow the network concept to succeed.

Space Debris

Like the networks of Flight Operations and PRINCE, the network "Space Debris" was initiated as one of the first pilot networks in the Network of Centres initiative. The founding members were the five agencies ESA, CNES, BNSC, DLR and ASI. It replaced the Space Debris Advisory Group (SDAG) that was founded in 1989 by the ESA Council. From 2000 on, ESA's activities on space debris were funded through a dedicated budget line, and the related work plan was coordinated within the network of Space Debris. The network entered into the qualification phase in 2002 through an ESA Council decision taken at that time. The scope of the qualification phase was to reinforce the existing European coordination in the domain, thus strengthening Europe's position through the implementation of a coherent plan of activities. It was supposed to harmonize the activities of the participating centres and to optimize the utilization of the resources, taking in due consideration the constraints existing in each centre.

A coordination group, consisting of representatives of the five members, was inaugurated. It reported to the steering group of the network on the progress of the integrated work plan. Out of the latter, four areas were specified where a higher degree of coordination was to be exercised. The four areas were:

- Space-based Optical Observations (coordination by CNES)
- In-situ Detection and Material Returned from Space (coordination by ESA)
- Hypervelocity Impacts and Protection (coordination by ESA)
- European Space Debris Mitigation and Safety Standards (coordination jointly by CNES/ESA)

In addition, a special "space surveillance" task force was established with representatives from the participating members. This task force prepared a report with recommendations and requirements for a European space surveillance system. Several options going from limited capabilities to a fully autonomous European system were to be considered and to be assessed in price. The draft report is currently under review in the network.

As envisaged, the qualification phase lasted for two years. Subsequently, the network was moved to its operational phase. However, the ambitious goal of setting a framework for a fully autonomous European space surveillance system could not be reached until now. Anyway, circumstances for the Space Debris network have been more favourable than for Flight Operations, because ESA Member States are aware that the topic is critical to ensure secure space activity and because there is no market competition up to now. If the latter appears one day, it will surely complicate matters.

The network was supposed to report back to the Steering Group of the whole NoC initiative. Since the Steering Group is not active any more, there is currently no reporting line implemented. With the qualification phase having ended in 2004, there is no clear mandate or instruction for further proceeding. However, the network is still operating on a working level.

Project Review Integrated Network of Centres (PRINCE)

PRINCE is an initiative of centres in charge of projects to enhance the performance of their technical project reviews. The project members are seconded from BNSC, CNES, CDTI, DLR, ESA and EUMETSAT. It started in 2000 as a pilot case under the regime of the network of centres initiative and became operational in 2003 after approval of the ESA Council in October 2003. Since it began, PRINCE has provided every type of space project review with experts from a wide range of technical disciplines. It operates on a no exchange of funds basis. The rules and regulations have been tested in a two year trial phase and have been adapted to the needs. The process has proved to be flexible enough to deal with urgent requests and it allows for the continuous involvement of specific reviewers. Feedback during the trial phase revealed [5]

- The fresh insights brought by truly independent reviewers were helpful to projects
- 80% believed that PRINCE is likely to improve pan-European cooperation
- 75% of chairs of review boards believed that PRINCE is likely to improve the quality of Europe's space programme
- 95% of participants were willing to use PRINCE in future reviews.

The success is also due to the fact that no commercial interests are involved in this network. Everyone is driven by a common intention to provide the best possible support to reviews.

The ESA Scientific Programme

The Science Programme is the only mandatory element of the ESA programmes, and it is both a flagship and a symbol for the Agency. It enhances European capability in space science and applications, builds European industrial technical capacity, and brings together European national space programmes in a network of technical centres. It makes best use of competences in Europe without duplication between the different national and international technical centres. It clearly demonstrates the European capability to do what individual European nations cannot do on their own. Scientists from European nations can function at world-class level in their specialist fields. Working in this way gives a framework for national programmes and allows for integration of the best national approaches into one joint European approach. ESA staff and contractors assemble and test ESA scientific spacecraft including the scientific payload at ESTEC. These are then operated from ESOC.

ESA's Rosetta mission is a good example of an integrated network of specialized centres. The Rosetta spacecraft will undertake a long-term exploration of a comet at close quarters. It comprises a large orbiter, which is designed to operate for a decade at large distances from the Sun, and a small lander. Each of these carries a large complement of scientific experiments provided and funded by the member states, designed to complete the most detailed study of a comet ever attempted. After entering orbit around Comet 67P/Churyumov-Gerasimenko in 2014, the spacecraft will release a small lander onto the icy nucleus, and spend the next two years orbiting the comet as it heads towards the Sun.

The ESA Rosetta orbiter has eleven scientific instruments provided by member states and the Rosetta lander is provided by a European consortium under the leadership of DLR. Other members of the consortium are ESA and institutes from Austria, Finland, France, Hungary, Ireland, Italy and the UK. The Rosetta lander has nine scientific instruments. Rosetta's industrial team involves more than 50 contractors from 14 European countries and the United States. The operation is scheduled to last for 12 years and includes the following centres:

- Mission Operations Centre: ESOC
- Prime Ground Station: New Norcia, near Perth, Australia
- Science Operations Centre: Collocated at ESOC and ESTEC
- Lander Control Centre: DLR, Cologne, Germany
- Lander Science Centre: CNES, Toulouse, France

The Scientific programme of ESA is definitely a very successful model of network cooperation. Beneath a common ESA management umbrella, each partner

participates for his own interest, which happens to be in line with that of the other partners: national capabilities on their own do not suffice, but adding them and creating relevant interfaces brings about a critical mass. Moreover, the contents in a way come naturally – they are largely a matter of transposing existing science programmes into space. This specific character cannot be found, to this extent, in other programmes of ESA.

2.2. Other Network Schemes in Europe

Other European cooperation schemes outside the space sector exist as well, like the German-Dutch Wind Tunnels (DNW) and the "Network of Excellence (NoE)". The latter one is a tool of the European Union, which also puts high emphasis on networking, as can be seen from its common research agenda meant to link existing competences. Consolidation of activities is seen as a necessary prerequisite to step from the national to the European dimension.

The German-Dutch Wind Tunnels (DNW)

DNW is a non-profit organisation under Dutch law founded by DLR and the Dutch National Aerospace Laboratory (NLR) in 1976. At first, the objective of DNW was to build and operate the Large Low-speed wind tunnel Facility (LLF) owned by DNW in a joint effort, thus avoiding duplication of investments, efforts and facilities. Step by step in 1995 and 1999, DLR and NLR charged DNW with the operational responsibility of wind tunnels owned by themselves. Meanwhile, the major aeronautical wind tunnels of DLR and NLR – distributed over 5 sites – are operationally integrated into DNW. They are operated by DNW while DLR and NLR stay owners of the facilities. DNW staff is seconded from both organisations. They are working together as an integrated team under the management of DNW. DNW performs a wide spectrum of wind tunnel tests and simulation techniques for customers from industry, government and research. Operational losses or profits of all wind tunnels are consolidated in one profit and loss account and losses that are not covered through profits from other wind tunnels operated by DNW are shared equally between the founding organisations.

Governance is organised through the "Board of DNW" with high level representatives from both organisations, including government representatives, and the "Board of Directors" with one member from each DLR and NLR for the management of the common organisation. The "Board of DNW" is advised by an Advisory Committee representing industry and research to direct the development of the organisation to the long term needs of customers.

In April 2006, a cooperation agreement between DLR, NLR, DNW and ONERA was signed, leading to the foundation of the "Aero Testing Alliance (ATA)" between DNW and ONERA. ATA supports DNW and ONERA in marketing of wind tunnel services, in conducting technology developments and in realising investments. DNW is also a member of the "Network of Excellence" project "European Wind Tunnel Association" which aims at the integration of the activities of 14 partners in Europe. The DNW is an example of how joint operational activities could be organised and which other levels of cooperation are possible.

Network of Excellence

The European Union introduced a new networking instrument in the 6th framework programme. "Network of Excellence (NoE)" is supposed to interlink, consolidate and integrate research activities in Europe, aiming at improving the progress towards the vision of a "European Research Area".

NoE encompasses all facets of networking like the enhancement of communication, harmonisation of tools and processes, common exploitation and integration of expertise and facilities, development of a joint work programme and common portfolio. The EC supports the process by funding so called "integration activities" such as meetings, common conferences, harmonisation efforts, joint platforms or staff exchange.

Similarly to other instruments of the EC, NoE requires at least three partners. All partners are involved in the definition and execution of the project governance and management. The NoE are coordinated by one partner who is accepted by all other partners. Up to now, NoE has no success

story and it is unclear how many of the running NoE will reach the ambitious goal of integration in a period of five years. However, it seems that some features of this tool could advantageously be employed in future European networking concepts.

3. TOWARDS A MORE EFFICIENT IMPLEMENTATION OF NETWORKS

Having had a look at the past and the present of the networks and the NoC initiatives, the future has to be examined as well. Scenarios and perspectives for the networking scene will be sketched and modifications of current network set up and handling will be suggested. These modifications reflect the views and experiences by actors in the network scene that have been probed in the course of the study.

3.1. Possible Scenarios

A formulation of general scenarios for networking schemes is not feasible in the space sector. The situations appearing in the real world are too different to allow for concepts that are applicable in each single case. Instead, a differentiated and differentiating view has to be taken. Networks should be implemented on a case by case basis, around competencies and needs. The study distinguishes between four basic categories of networks in the space sector and develops scenarios and perspectives for each of the four types separately.

The first type of networks encountered in practice is the cooperation at the level of technical centres dealing with basic technology, possibly involving industry centres. Here, the principles laid down in the ESA ministerial council resolution of 1999 work fairly well. Only coordination is required. The networks allow exchange of information and discussions on expert level. They find mutual benefits among participating centres and possibly a way to divide and share the tasks they have to execute. Present examples would be the network on Reviews (PRINCE) or Space Debris. For this type of networks, the rules are adapted to the needs of the specific competence area. They are operated on a no exchange of funds basis and they link experts in a wide range of different disciplines.

A subset of this category could be formed by ad-hoc purpose oriented teams. By such teams, a grouping of experts from a specific technical or scientific area is understood that is adaptively formed to cope with a specific problem within a limited period of time, allowing for quick reactions. The teams are in charge of their organisation and pick their leader themselves, usually based on expertise considerations. After fulfilment of the project goals, the teams may dissolve.

The second type of network addresses infrastructure, facilities and laboratories. Examples are the European Test Services (ETS), but also the German-Dutch Wind Tunnel (DNW). This network type is characterized by the coordination of facility exploitation. The involved national and European organisations stay owners of the respective facilities. Scenarios for this type of network could be:

- a rather loose link between participants: facilities work together whenever they see advantages (present example is ETS)
- a close link between participants: common management, sharing of investments and risks (see DNW)
- certainly all steps between these two border cases are possible

The third kind of networks one encounters is the one realizing innovative programmes on the development level. Financial risks at this level can not be taken by industry. The objective is to share responsibilities and tasks between technical centres organized and managed similarly to European projects with distributed competences. This is in line with the Ministerial ESA Council's Resolution of 2005 calling for the optimal use of existing competence and experience in Europe for European space projects. A general principle should be that the partners are involved in the network governance according to their share. Partners agree on the work load share and on the organisation of management. Structures established through project implementation will last during the life-time of the project. For this kind of network, different approaches could be

implemented because of the variety of projects:

- integrated management teams based on national contribution of staff to the co-located team (see ExoMars mission).
- sharing of technical supporting tasks between technical centres (keeping and developing competencies or using competencies that are not available internally).
- technical centre specialisation
- technical competition between the European centres in the initial phase to ensure efficiency of the system
- for critical developments: possibly duplication of technical activities

The fourth and last category of networks are cooperation schemes that are supposed to act in a market oriented way, facing direct competition of other entities. Here, the applicability of ESA's network principles as such needs to be checked. The network of Flight Operations could serve as an example of a key European Space Programme. For this category, networking is driven by the centres' interest to reduce costs, increase revenues or project task and project participation. It implies not too many regulations for the partners.

3.2. Suggestions/Modifications concerning the Way forward

Taking into account the movement towards the definition of a comprehensive space policy on European level over the last years, it makes sense to consider the development of a Network of Centres Strategy as a subset of the European Space Strategy. The study doesn't aim at providing this strategy, but it gives some general ideas.

The overall vision is based on a future European Space Policy driven by one politically responsible player in Europe. It takes into consideration a landscape of shared competences within the member states. Subsidiarity is a major principle. Space activities are expected to increase because of the growing demand coming from EU policies. Transport, Environment, Security and Defence can be mentioned as example areas where space applications will play a distinctive role in the future. Competences and capabilities essential for the implementation of European Space Policy are organised through industry or in European networks. The networks pull together the competences generally represented by the public domain and distributed throughout Europe, replenished by those that are not yet available.

To move towards this vision, a sound analysis of what competences and capabilities are needed in the upcoming ten to twenty years with respect to the needs of European Space Policy and its deduced European Space Strategy has to be undertaken. This includes identifying missing links and clarifying which of these competences should be provided by industry and which ones should be with public institutions and organisations.

One gets the impression that the political driver for the "top down" process "Network of Centres" and therefore the responsible actor for the development of a Network of Centres Strategy is missing. The European Union has the political authority, but is not yet ready to play that role for the space sector. ESA as an intergovernmental agency successfully carries out space programmes and projects on European scale since decades, but does not have the required political authority. The question who will be the political driver thus remains open and should be settled as soon as possible. Perhaps the ESA Council at ministerial level could play that role.

To nevertheless improve the Network of Centres concept today, a more pragmatic approach should be chosen, taking advantage of existing structures: Network of Centres should be used as an instrument to maintain the high quality level of space activities in Europe and to enable Europe to conduct present and future programmes and projects in space at a global stage. The objectives of NoC therefore should be re-stated as

- Harmonisation of European and national resources and activities
- Teaming resources to achieve the highest quality level
- Risk minimisation
- Multilateral cooperation in Europe
- Need orientation by reactivity, awareness and efficiency.

Rationalisation has been widely discussed to be a major goal of NoC. However, it should not be a paramount objective unless it turns out to be appropriate in the implementation process of the single networks. Neither should it be a basic principle or objective to avoid duplications. Duplications should even be supported in critical areas to ensure competition and thus promote the creation of excellent solutions or to avoid "single point failures". Also, saving money is not looked upon as a realistic objective. At least in the initial period, money will be required to feed the harmonisation process. Even in a later phase, investments for coordination and consolidation may exceed cost savings.

A general concept for the implementation of networks is not useful and a differentiated approach has to be taken. Networking efforts have to be pushed, supported and flanked by the highest level in charge. Political will could manifest itself, for example, in offering incentives, like giving priority to network offers rather than to single bidders. Also, mechanisms for the exchange of staff should be strongly supported at the political level so that mobility is facilitated in case it is wanted by the participants. The way networks are organised, however, should be determined in a "bottom-up" process. It should not be regulated, but left to the decision of the network members. Still, minimum standards for networks should be kept:

- Members have to come from at least two countries
- Organisational structure, work plan and budget planning have to be agreed upon by all members
- The extent of industry engagement in networks should depend on the market orientation of the space sector in question

Regarding the organisation of networks in the European space field, it is recommendable to take over some ideas and aspects of the European Commission's "Network of Excellence" tool, such as:

- partners participate for their own interest, which is essential for the success of the project
- partners receive funding, e.g. for harmonisation activities (note that GSOC – ESOC harmonisation got stuck due to its cost!)
- definition of common projects with variable geometry based on the expertise that is needed to carry out the different projects
- all partners are involved in the development of the governance model
- each network decides on its own coordinator; there is no overall coordinator for all networks

At the present stage, NoC will serve the implementation of the ESA programmes decided upon at the last Ministerial Council. This requires the definition of a decision making process for European networks in the ESA frame. Therefore, one could set up a Working Group at ESA Council level which reports back to ESA Council with a proposal on steering and decision making within the initiative as soon as possible.

The ESA programmes addressed are the GMES space segment, Future Launchers and ExoMars. Expected needs of these programmes have to be defined as soon as possible. In parallel, an analysis and a mapping of the existing space enabling competences in Europe that satisfy the needs of the respective programmes have to be carried out. Matching the needs with the existing expertise in Europe will then lead to the definition and creation of the corresponding networks.

Another suggestion is to use the ad-hoc teams mentioned before to assess entire projects or single project phases in advance. This could be done as a standard procedure within a systematic approach when tackling large and complex projects. From the very first planning phase on, before execution or implementation has started, leading experts from all over Europe could check proposals of difficult projects (or parts thereof) together, identifying pressure points, critical issues and decisive hurdles as well as independently evaluating budget questions and financial perspectives. The experts would be called upon by the unit in charge of the programme in question. These teams could also propose adequate ways of project organisation and governance. By doing so, the credibility of complicated space projects towards political decision makers and funding entities could be

increased at very low extra cost – a circumstance the whole space community has been anticipating for some time.

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