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ESA INTERACTION WITH ACADEMIA ON ADVANCED RESEARCH TOPICS: ARIADNA

STATEMENT OF WORK

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1 SCOPE OF THE DOCUMENT

This document describes the procedures that will be adopted by the European Space Agency (referred to as "ESA" or "the Agency") in the frame of the Ariadna initiative, as defined hereunder, and its associated activities. It will become part of the formal contract and shall serve as a governing document throughout the execution of all work within the Ariadna framework.

2 INTRODUCTION

ESA interacts with the academic world through a number of mechanisms and schemes, including research, software and hardware development contracts, direct support and research fellowships. A number of ESA initiatives contribute to improve communication with universities and to provide opportunities for cooperation, especially those involving industrial partners (see annex A). However, a need for a closer link between ESA and the academic world and an easier way to cooperate on advanced research topics is felt on both sides. Taking into consideration the academic community's limited administrative resources and particular needs and interests, a suitable method of interaction tailored to accommodate these peculiarities was found to be missing. In particular, we wish to enable cost-effective, focused consultation of the academic community on innovative concepts and studies.

Given the needs outlined above, a dedicated line of activity, called *Ariadna*, was created in 2003. Ariadna deals with research in areas such as theoretical physics, energy systems, advanced propulsion, plasma physics, mission analysis and design, mathematics and informatics, biomimetics, and other subjects in which both space systems engineering competence and specific theoretical knowledge is required. The target communities are university research groups and departments (including their non-profit entities providing contractual and administrative support). Proposals by all other entities will not be considered.

The benefits resulting from the *Ariadna* scheme are as follows:

1. The planning of activities. *Ariadna* provides common goals for sets of activities, giving their progress consistency and continuity. It does that by defining priorities i.e. strategic lines of activity for advanced research, which will be periodically updated by the Agency.
2. The simple and open approach. In addition to a widespread utilisation of web technologies for solicitation announcement, information exchange and study documentation dissemination, active collaboration – rather than merely supervision - between ESA and the researchers is sought throughout the studies. This collaboration typically puts the ACT researcher into the inner working loop of studies, with some work-packages eventually performed by ACT research fellows. Specifically, in non-traditional space domains, space systems engineering knowledge is provided by the ACT.

3. Targeted solicitations. The Call for Proposals will be targeted to specific forums where the relevant expertise is available.

4. Improved communication. Exchange of information between universities and ESA is not discontinued at the end of each study as members of the academic community have a simple way to keep track of new developments in ESA relevant to their field of expertise through *Ariadna* and the information and support provided by the Advanced Concepts Team, which remains involved beyond the duration of a single contract. The ACT web site and other means provided by ESA – e.g. workshops and invited presentations- also facilitate the flow of information.

In addition, joint proposals are encouraged, where teams comprise members from different departments or universities, especially for those studies with multi-disciplinary requirements.

5. Outreach. The successful implementation of the project, encompassing publications in international journals and presentations of results at international conferences, greatly enhances the interest of the research community in other ESA activities.

3 OBJECTIVES

The objectives of the *Ariadna* scheme are therefore the following:

- To perform high-level research and facilitate research partnerships between ESA and investigators in university research groups, while encouraging cooperation between all participants with common interests
- To provide ESA with a mechanism to enable fast and efficient access to expertise available in academic community on advanced research topics,
- To increase the awareness of the academic research community of ESA activities, programmes and priorities.

4 REFERENCE DOCUMENTS

The following links provide useful background information on other ESA activities of interest for universities. Further details on some of these are provided in Annex A:

ESA's Advanced Concepts Team

<http://www.esa.int/act>

ESA's University-Industry Relations Database (UIRD) (currently being updated)

<http://uird.esa.int/>

ESA's Innovation Triangle Initiative

<https://iti.esa.int/iti/index.jsp>

ESA's Directorate of Human Spaceflight, Microgravity and Exploration programmes (D/HME) - Research Announcements and Topical Teams

<http://www.spaceflight.esa.int/users/index.cfm?act=default.page&level=16&page=454>

ESA's Education Office

<http://www.esa.int/export/esaED/index.html>

ESA's Electronic Invitation to Tender System (EMITS)

<http://emits.esa.int/>

International Space University

<http://www.isunet.edu/>

5 ACRONYMS AND ABBREVIATIONS

ACT	Advanced Concepts Team
AO	Announcement of Opportunity
EMITS	ESA Invitation to Tender System
ESTEC	European Space Research and Technology Centre
FUSE	Future of Space Exploration Academia Network
GSP	General Studies Programme
ITI	Innovation Triangle Initiative
HME	Human Spaceflight, Microgravity and Exploration
SoW	Statement of Work
SME	Small and Medium Enterprise
TBC	to be confirmed (by the Agency)
TBD	to be determined (by the contractor)
TT	Topical Team
UIRD	University-Industry Relations Database
WPs	Work Packages

6 ORGANISATION OF THE WORK

The following sections explain in detail the organisation of work in the frame of the Ariadna scheme.

6.1 *Classes of Proposal Solicitation*

The Agency carries out periodic and ad-hoc Announcements of Opportunity targeted to specific research communities. Ariadna produces two classes of these proposal solicitations:

Calls For Proposals

The *Calls for Proposals* consist of announcements of specific assessment studies, in which the topic of research and tasks to be performed have been previously defined by ESA's Advanced Concepts Team and have been identified to have potential in terms of ESA's objectives (see <http://www.esa.int/act> for details on current ACT research). The descriptions of the study topics available will be included in an annex of this document (Annex B).

Calls for Proposals will be made public on a dedicated website (<http://www.esa.int/ariadna>) and simultaneously in the general ESA's Electronic Invitation to Tender System, EMITS (<http://emits.esa.int/>). Those interested in replying to these announcements will then be able to submit simplified proposals electronically, following the directions in provided in http://www.esa.int/gsp/ACT/ariadna/proposal_submission.htm. Users of the system are strongly encouraged to register (http://www.esa.int/gsp/ACT/ariadna/contact_form.htm) in order to be notified automatically of any calls or relevant events.

Periodicity of the announcements will be determined by the Agency according to the specific circumstances, though normally they will be carried out every six months. Exceptional announcements in between the periodic ones will also be considered, in case they are required by the Agency.

6.2 *Study Types*

In order to ease planning, improve transparency and enhance predictability of the associated administrative procedures, only three types of studies have been defined and will be considered:

- a) Fast: duration of 2 months, with study budget not exceeding 15 k€ Additional travel allowance (if applicable) covering 2 persons (junior and senior researcher) travel expenses to the "Kick-Off" meeting at ESTEC. No mid-term review or final presentation on completion of the study is foreseen, only the submission of the final study report.

- b) Medium: duration of 4 months, with study budget not exceeding 25 k€ Additional travel allowance (if applicable) covering 2-persons (junior and senior researcher) travel expenses to the "Kick-Off" meeting and Final Presentation both at ESTEC. Progress Meeting, if required, will be at contractor premises and thus travel expenses will not be applicable.
- c) Extended: duration of 6 months, with study budget not exceeding 35 k€ Additional travel allowance if applicable as in Medium studies. "Kick-Off" meeting and Final Presentation both at ESTEC. Progress Meeting, if required, will be at contractor premises.

These three simple modalities will enable easy replication of the procedures while providing the required flexibility to accommodate studies with different degrees of complexity. Further details on travel budget may be found in the Proposal Template (Annex B, Section 3) to the Special Conditions of Tender.

6.3 Study Team Definition

Proposed study teams must consist of, **at minimum**, **two researchers** per university. These are the principal researchers/team members. One must be a senior research fellow or professor, having at least five (and preferably more) years of post-doctoral research experience and a proven track record in a research field relevant to the study; this person will be the main responsible for the study. The other study member must be either a post-graduate doctoral student or a research fellow with **up to five years experience** of post-doctoral research.

The Curricula Vitae and lists of publications of the principal study team members, in which publications relevant to the study should be highlighted. Evidence of relevant scholarly publications from all team members will be taken into account during proposal evaluation.

In addition, any other researchers that may contribute to the study should be identified.

While contracted team members must be employed at ESA member state or cooperating state universities or associated non-commercial laboratories, individuals from research institutes, industry and non-ESA states may participate in studies on a zero-cost basis. Zero-cost participation for such participants shall be confirmed in the proposal. Similarly, proposed use of resources from research institutes, industry and non-ESA states shall be on a zero-cost basis, confirmed in the proposal.

7 STUDY MANAGEMENT, REPORTING AND DELIVERABLES

7.1 *Study meetings and reporting*

In case of a positive evaluation of the proposal, the study Kick-Off meeting will typically take place within two months of the closing date of the Call for Proposals. This meeting will be used to clarify any open issues, discuss the scope of the proposed study and agree on the programme of work. On submitting a proposal, study team members should commit themselves to being available for this meeting. If this was not possible at all times during the four month of validity of the proposal(s) they should state so, explain the reasons for this circumstance and provide details on their availability.

In the case of Medium and Extended studies (according to the three categories defined above), dates for other meetings will be agreed during Kick Off meeting.

Other than during the meetings, communication between the Study Team and ESA will be carried out by teleconference and electronic mail. In general it is expected that the ACT researcher(s) (Technical Officer) following the study will be closely involved in the actual carrying out of the research. At minimum teleconferences will be held every two weeks starting from the Kick Off meeting, unless otherwise agreed with ESA. Telephone calls will be initiated by the Agency, so that the study team does not incur in any expenses as a result of these teleconferences. Short progress reports shall be submitted monthly by email and should include details of any problems encountered.

7.2 *Study deliverables*

Deliverables will consist of

- the final report (including its draft version) of the activity and any code or data set produced as part of the research.
- an executive summary of the final report (one page), highlighting the objectives and the main results of the performed research, with an emphasis on their relevance for space, including an illustration or relevant image.
- the questionnaire (attached as Annex E) to be completed together with the final report

All deliverables shall be submitted by electronic mail to the ESA Technical Officer on completion of the study. The cover page of the final report and the executive summary shall be based on the provided template (http://www.esa.int/gsp/ACT/ariadna/proposal_submission.htm) In the case of the medium and extended studies, submission should be at least one week before the date of the final presentation. The final delivery should take place no later than one month after acceptance of the final draft by the Agency.

The final report shall contain only original scientific work, following the guidelines of good scientific practice, especially concerning copyright issues. ESA may use plagiarism detection software to evaluate the final report.

Special emphasis is made in encouraging the publication of the study results in peer-reviewed technical and scientific journals. A publication plan shall be discussed during the negotiation / kick-off meeting. In general, publications of results obtained during the study shall be joint publications of the involved Academia's and ACT's researcher teams. Authorship of publications of study's research results not obtained as a team shall be agreed between the latter following standard academic practices.

All publications incorporating some results of the study and not co-authored by at least one ACT researcher shall acknowledge the support of the ESA's Advanced Concepts Team and include the ESA contract number and the study title.

The final report will be published on the ESA/ACT website and should also be available through the contractor university's website unless a prior agreement with the Agency is made, no proprietary information shall be included.

All documents related to Ariadna studies shall be based on SI units.

ANNEX A. RELATIONSHIP WITH OTHER ESA ACTIVITIES INVOLVING UNIVERSITIES

1. General Studies Programme

Academic involvement in the activities of the General Studies Programme, which is providing the support for the development of Ariadna, is still expected. Ariadna will complement existing GSP mechanisms such as the “Fast Track” studies. In the case of activities involving exclusively academic institutions Ariadna often can provide common goals for sets of studies, giving their sequence consistency and continuity. It also provides opportunities for active collaboration between ESA and non-ESA investigators. In addition, it results in a better understanding of the strengths and weaknesses of European space research, and finally it contributes to improving the visibility ESA interests and activities to the academic world.

2. Aurora Network of Universities

In order to support Aurora Programme goals, a network of European technical universities was established in 2001. A number of leading European universities that are carrying out research relevant to space exploration teamed up to create the Future Space Exploration Academia Network, known as FUSE.

Not being limited to planetary exploration technologies, the scope of Ariadna is broader and its time horizon stretches even further into the future. Ariadna will in any case benefit from the Aurora Network experience and many interests will undoubtedly be common. Coordination will ensure that there is no duplication of activities.

3. University-Industry Relations Database (UIRD)

As part of a project to identify, promote and enhance collaboration within the space sector, particularly within the academic community and small- and medium-sized enterprises (SMEs), ESA has developed a web-based database which comprises the technological and research competencies of universities and research centres in the ESA Member States, as well as the partnerships and relations they may have with industry.

The University-Industry Relations Database purpose is to:

- identify potential academic technology research capabilities
- enhance the visibility of technology research competencies
- optimise support for university/research centre R&D
- show partnerships with and links to industry, particularly SMEs
- contribute to an enhancement of academic-industry relations

- improve knowledge and technology transfer to industry.

The database consists of information contributed by the institutes involved in space-related research themselves, and as such it represents a valuable asset for ESA as a whole and for Ariadna in particular.

Thus an important effort will be made to ensure consistency and mutual support, and to exchange useful data between both initiatives. Ariadna will continue to push the search for academic expertise even further, including disciplines that would not be traditionally associated with space technology research (e.g. fundamental physics, biology) and provide an insight into basic research methods and trends. Ariadna will also put a strong emphasis in studying the feasibility of high-risk “over the horizon” technologies that might only be developed or find industrial application over the next coming decades, or might even not do so.

Work in close cooperation with ESA’s ACT experts is enabling a wider and more extensive recognition of ESA’s own in-house research capabilities.

4. *ITI - Innovation Triangle Initiative*

ITI is another of ESA’s initiatives. It has the objective not only to identify but also to support the development of space innovations. A part of ITI will therefore focus on interaction with academia, space customers and industry. Mechanisms to support the demonstration of feasibility of new technological concepts, such as small contracts, are provided.

There are areas of common interest between Ariadna and ITI, though also in this case the technology horizon lies further into the future for Ariadna. ITI activities will also include industrial innovation, and there is a strong emphasis on the user aspects. On the other hand Ariadna will concentrate exclusively on academic research, especially on certain areas of strategic interest. These areas, which will have been defined before each solicitation to the research community, will be continuously screened and periodically updated by the Agency’s ACT.

5. *D/HME Research Announcements and Topical Teams*

ESA’s directorate of Human Spaceflight, Microgravity and Exploration programmes issues at regular intervals Announcements of Opportunity that are the official access route for institutional users to the utilisation of the various research facilities that are managed by the D/HME directorate, including in particular the International Space Station.

The Announcements of Opportunity are issued for the various utilisation disciplines: physical sciences, life sciences, technology, Earth observation and space science.

Also, by supporting “Topical Teams” ESA’s HME is also encouraging the teaming-up of European scientists from life sciences, biotechnology and physical sciences, who all share a common interest in performing experiments under microgravity conditions. Topical Teams comprise researchers from academia and industry who are already actively involved in space experiments, but also scientists who are presently not yet involved in space research.

As before, points of common interests with Ariadna activities will be identified and harmonised. Initiatives with potential interest in the domain of Human Spaceflight and Microgravity research will be oriented and if necessary re-directed towards these mechanisms already put in place by HME.

6. *Education Office activities*

Ariadna will also benefit from the extensive experience of the Education office in communication with universities and organisation of activities and events to promote public understanding of science and space research.

7. *ESA Network Partnering Initiative*

The goals of the Networking/Partnering Initiative (NPI) are to enhance research for space applications and to take advantage of potential ‘spin-ins’ for space from technologies originally developed for application in areas such as consumer electronics and material sciences, as well as new developments in the nano and microtechnology domain.

This initiative supports technology development in selected universities and research institutes, giving preference to new ideas or concepts originating in the non-space industrial or research sectors. To this end, NPI supports research by co-funding PhDs for up to 50% (max. €30 000) per year for a doctorate degree or post-doctoral investigations.

ANNEX B. CALL FOR PROPOSALS

Available at (<http://emits.esa.int/>).

ANNEX C. TEMPLATE FOR FINAL REPORT

Available at (<http://emits.esa.int/>).

ANNEX D. TEMPLATE FOR EXECUTIVE SUMMARY

Available at (<http://emits.esa.int/>).

ANNEX E. QUESTIONNAIRE

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	It does not apply/ Don't know
The idea behind this Ariadna project was innovative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The Ariadna study description clearly explained what was required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
We were already working on this particular topic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The cooperation with the ACT researchers was important for the success of the project	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have been continuously in contact with the ACT throughout the project	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our research team never worked on space applications before	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The administrative effort required for this project was high (strongly agree), low (strongly disagree)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
After the Ariadna project we will continue this research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The idea, as exposed in the original study description, did not make sense	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The project produced the results we expected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The project produced also unexpected results	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
During this Ariadna project we increased our knowledge about ESA / space in general	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other comments						