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**European Space Agency**  
**Directorate of Technical and Operational Support**

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**STATEMENT OF WORK**

***Online Game Technology for Space  
Education and System Analysis***

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## 1. Introduction

### 1.1 Scope of the Document

This document describes the activity to be executed and the deliverables required by the European Space Agency in relation to the Online Game Technology for Space Education and System Analysis Activity.

It will be part of the contract and shall serve as an applicable document throughout the execution of the work, with amendments as agreed at the Kick-off meeting if appropriate.

### 1.2 The General Studies Programme

ESA's General Studies Programme (GSP) (<http://www.esa.int/gsp>) interfaces in different ways with all of ESA's programmes, but its main role is to carry out preparatory analysis and act as a "think tank", laying the groundwork for the agency's future activities.

The objectives of the general studies programme are to:

- Contribute to the formulation of the overall ESA strategy
- Study feasibility for selection of new mission concepts
- Prepare/demonstrate the case for approval and funding of new optional projects/programmes
- Support the evolution of ESA by analysing and testing new working methodologies

A diversity of topics is investigated via GSP undertakings, running across the entire spectrum of the agency's activities. In average, each study lasts one to two years, sufficient time for in-depth exploration of each subject.

The assessment studies undertaken by the GSP provide the ESA and its member states with the necessary information on which to base their decisions about the implementation of new programmes and the future direction of space activities.

### 1.3 Applicable and Reference Documents

#### 1.3.1 Applicable Documents (ADs)

There are no applicable documents.

### 1.3.2 Reference Documents (RDs)

The following documents can be consulted by the Contractor as they contain relevant information:

Tag	Reference
[RD1]	Online game on Energy consumption: <a href="http://www.willyoujoinus.com/energyville/">http://www.willyoujoinus.com/energyville/</a>
[RD2]	ESA's Lunar Robotic Challenge: <a href="http://www.esa.int/esaCP/SEMGAASHKHF_index_2.html">http://www.esa.int/esaCP/SEMGAASHKHF_index_2.html</a>
[RD3]	Distributed Observer Network at NASA: <a href="http://don.valador.com/">http://don.valador.com/</a>

### 1.4 Acronyms and abbreviations

Acronym	Meaning
MMOG	Massively Multiplayer Online Game
GSP	General Studies Programme
ESA	European Space Agency
ESTEC	European Space Technology Centre

## 2. Background and Objective(s)

### 2.1 Background

The next generation of engineers and potential supporters of space activities are mostly growing up in a world with full electronic means of communication and ubiquitous networking capabilities. Network centric computing (cloud computing) influences the way social networks are built up and how facts and concepts of the environment are perceived and assimilated.

In order to address this generation and be sufficiently attractive and “connected” to create sufficient understanding for the activities and objectives of the Agency it is necessary to use these communication and interaction channels and to create a presence and representation in this environment, creating a perception comparable to other networks. NASA has already created a presence in secondlife.com and is looking into possibilities to use multiplayer online games to promote their activities.

In the light of these activities it is necessary to explore the suitability of the available technology (cloud computing, social networks, online gaming) and to define suitable scenarios and content to be used via this media.

In particular technology related to massively multiplayer online games (MMOGs) provides an environment for presentation and interaction. The main application areas of potential interest to the Agency are:

- Dissemination of educational material (such as specifically addressing issues of science research, Earth Observation applications, microgravity research), but also
- Promotion of ESA activities by providing information and data based on ESA activities in a form suitable for the targeted audience.

In both cases, well designed interaction with the users allows to get a feedback on the concepts.

Depending on the target audience and interaction desired, either multiplayer or single player environments can be envisaged. An example of the latter is e.g. demonstrated in Energyville [RD1], representing a simple but attractive implementation of a “game”. This software cleverly addresses several purposes: It aims at educating / orienting a public on a subject and at the same time is used to gather data from users and qualify their choices – possibly for “crowdsourcing” but more likely to carry out opinion polls without making people having to fill boring questionnaires.

An application to space of a similar approach (decision making validation / data gathering + training + outreach) clearly has to be adapted to the number of users which in the case of the Agency would be much smaller, but maybe also more likely to be highly educated and scientifically interested. This would be especially the case if the application is targeted at an academic community - without precluding the participation of the wider public of course.

Finding a concrete application and one that is exciting, can be easily understood and offers the possibility of competition could be a good approach to ensure success. For this reason possible scenarios could be the following:

- A “game-like” competition based on the ongoing Lunar Robotic Contest [RD2], involving the design of a rover that should carry out some tasks with certain

constraints. Data / images of both the moon and of the real competition could be used to create a virtual toolbox and environment in the virtual world

- A "deflecting an asteroid" game. A huge amount of data on different options and graphic material exists; the objective of avoiding an Earth impact can make it more dramatic and attractive to play. In reality, the game could be used to assess the combination of a number of options: Providing the elements to educate on the complexity of system engineering challenges for a complex simulation problem, including the human perception of. This could be linked to a suitable conference or / and to a planetary society contest, and hence have international visibility. It could also be an engineering challenge (as the first one).
- Definition of e.g. human infrastructure on the Moon or Mars. An environment would need to be set up and key elements should be provided to establish group dynamics. Scientific / research challenges can be formulated and key indicators (e.g. cost, environmental impact, complexity, schedule...) can be defined, with limited availability on each of them as the challenge. This is obviously more complex and potentially more difficult to define in a consistent way.

## 2.2 Objective(s) of the activity

Widespread interest in these developments is clear but so far it has not materialise in concrete space-specific applications. The main challenge is to find and define suitably attractive scenarios with a positive return for the Agency.

The study shall therefore

- Identify the areas of promotion and education which can be mapped on the electronic social networks and interactive spaces of the youth.
- Suitable technologies shall be identified and the scenarios shall be mapped to an affordable architecture (taking into account the smaller audience compared to a MMOG)
- Recommendations shall be developed for the "branding" of the Agency, and a prototype shall be developed for demonstration of highly interactive scenarios / games

If successful, a roadmap needs to be established for the necessary developments.

## 3. Work to be performed

### 3.1 Work Logic

Please note that this section describes the execution logic of the work to be performed. It is clear that many tasks can be performed in parallel and that some tasks have to be performed in an iterative manner for a successful outcome. In particular task 1 and 2 have to be interacting.

The Contractor shall present the proposed logic and any additional tasks that is best for or could improve the overall outcome of the work.

### 3.2 Task 1: Technology Assessment

#### *Activity*

In this task relevant technologies shall be analysed w.r.t. their suitability for space related game scenarios. The analysis shall include single player as well as multiplayer online games, such as

- EVE Online
- World of Warcraft
- Second Life
- Energyville
- Simworld
- ...

The analysis shall address at least the following aspects:

- Suitability of technology (in interaction with task 2)
- Development effort (availability of suitable libraries)
- Deployment strategy
- Scalability
- Branding with ESA name
- All cost elements (investment and recurrent, developer and user)

The findings shall be documented in a Technical Note, classifying the different environments according to their suitability for different types of scenarios.

#### *Output*

D1: Technical Note "Online game technologies for Space Applications"

### 3.3 Task 2: Scenario Identification

#### *Activity*

In this task relevant scenarios shall be identified. The scenarios shall address the different areas of interest of the Agency, i.e.

- Education
- Promotion
- Engineering

For this task it is proposed to have a set of workshops / focus meetings with representatives of the Agency. It will be necessary to animate these discussions, providing information and background on the available features and possibilities of existing game engines, and providing examples from other domains. In the assessment of the scenarios the attractiveness for the target audience (young people and academics) shall be judged.

Scenarios need to be identified which allow a progression / learning process to happen during the game (line of activities / challenges). An assessment shall be made if several age brackets can be addressed by the same scenario or if different scenarios need to be identified.

The main focus shall lie on the multi-player aspect to allow the exploitation of the technology and associated (social) networks. Team building to achieve space-related challenges or "virtual competitions" could be candidates. Activities can address the challenges to conquer space (building infrastructure, engineering...) as well as the exploitation of results (observation data, samples, ...).

The identification with ESA as the entity providing the context shall also be addressed.

At the end a selection of suitable scenarios for a demonstrator shall be made in cooperation with the Agency.

*Note: It needs to be stressed in this context that space applications are not limited to human spaceflight exploration, but should also cover other areas of the Agency's activities.*

#### *Output*

D2: Technical Note "Space related game scenarios"

### **3.4 Task 3: Mock-up Development**

#### *Activity*

In this task the selected scenario shall be further elaborated. This elaboration shall include the drafting of

- Scenes and characters
- Storybook for the scenarios
- Identification of roles (player, game-master, scenario developer...)
- Infrastructure architecture definition

This should be presented at a dedicated workshop for a test group. The constitution of the group shall be done in collaboration with the Agency.

#### *Output*

D3: Storybook and visual mock-up

D4: Technical Note on "Infrastructure Architecture for Space Games"

## 3.5 Task 4: Recommendation and Roadmap

### *Activity*

This task concludes the activity with an assessment in how far the objectives have been reached. An increased awareness in the target group of ESA's activities and an increased knowledge of space relevant research shall be parameters to be checked.

As a function of this, recommendations for further implementation steps shall be made, and a roadmap for the "branding" of the Agency in these new media shall be proposed.

The results of the study shall be presented at a Final Presentation at ESTEC.

### *Output*

D5: Technical Note "Implementation and Deployment of Online Technology for ESA"

## 4. Requirements for Management, Reporting, Meetings and Deliverables

The standard requirements for Management, Reporting, Meetings and Deliverables (Appendix 2 to the contract) shall apply, taking account of the following specific requirements for the present activity, which shall prevail in case of conflict.

### 4.1 Management

Section 1 of the standard requirements shall apply.

The contractor shall describe the organization to execute the work. This will include a person fully responsible for the execution of the activities covered under this Contract.

The Agency Technical Officer nominated in the Contract will be responsible for the management of the activity, which includes providing guidance to the contractor as well as monitoring the progress of the activity and assessing its results.

### 4.2 Reporting

Section 2 of the standard requirements shall apply.

The contractor shall provide the Agency with a Monthly Progress Report. This monthly report shall contain as a minimum:

- The approximate percentage completion of each task, identified in the planning document, and a comparison of the actual status with the planned status.
- The tasks completed in the previous month
- The tasks planned for the following month
- A list of pending actions and their status
- A notification and description of any problem areas (technical and/or contractual)

If time slippage with respect to the planned completion dates has occurred the progress report shall indicate the actions proposed by the contractor in order to recover the lost time, and shall also include a revised bar chart of the contract schedule.

Any change which might affect the contractual relationship between the Contractor and the Agency shall be notified directly and immediately to the ESA Contracts Officer with a copy to the ESA Technical Representative

### 4.3 Meetings

Section 3 of the standard requirements shall apply.

The Agency intends to monitor the execution of the Contract through dedicated meetings: the Kick-Off Meeting at ESTEC, two Progress Meetings at Contractor's premises and an Acceptance Review at ESTEC. Additional ad hoc meetings shall be planned if necessary.

## 4.4 Deliverables

This section list a summary of all required procurements and deliverables.

### 4.4.1 Documentation

The contractor shall deliver the following documentation:

Ref	Title	Schedule
D1	Technical Note “Online game technologies for Space Applications”	Workshop 1
D2	Technical Note “Space related game scenarios”	Workshop 2
D3	Storybook and visual mock-up	Workshop 2
D4	Technical Note on “Infrastructure Architecture for Space Games”	Final Presentation
D5	Technical Note “Implementation and Deployment of Online Technology for ESA”	Final Presentation

#### 4.4.1.1 Final report

Shall apply

#### 4.4.1.2 Technical Data Package

Shall apply

#### 4.4.1.3 Summary Report

Shall not apply

#### 4.4.1.4 Executive Summary Report

Shall apply

#### 4.4.1.5 Abstract

Shall **not** apply

#### 4.4.1.6 Brochure

Shall apply

#### 4.4.1.7 Photographic Documentation

Shall **not** apply

### 4.4.2 Hardware

For this contract no specific hardware needs to be procured.

### 4.4.3 Software

No software development is foreseen in this activity. However, it would be appreciated if a prototype could be developed for demonstration purposes.

### 4.4.4 Project Web Page

Shall not apply

## 4.5 Commercial Evaluation

A report in Commercial Evaluation according to Section 5 of Appendix 2 to the Contract **is** required.

In this case, the Commercial Evaluation is a report containing an analysis and evaluation of the potential in the non-space market of the output of the contract.

The commercial evaluation report shall identify the commercial applications that could result from:

- i) the output of the subject activity (hardware, software, documentation) and/or
- ii) the output of the subject activity after additional development to meet the requirements of potential commercial users

In addition the Report shall identify industrial financing or funds from national or international programs or agencies, available for developments ii) and/or iii) foregoing. Unless the Contractor himself intends to undertake such commercialisation, he shall, as far as practicable, provide a list of potentially interested companies.

## 5. Schedule and Milestones

This section presents a schedule logic, milestones and reviews. The Contractor however, shall present the proposed schedule logic that is best or could improve the overall outcome of this study.

### 5.1 Duration

The duration of the work shall not exceed **6** months from kick-off to end of the activity (delivery of final documentation).

### 5.2 Milestones

The following milestones shall apply:

Milestone	Description	Location	Schedule	Payment
KO	Kick-off	ESTEC	KO	Yes
Workshop 1	Progress Meeting 1	Contractor	KO+TBD*	No
Workshop 2	Progress Meeting 2	Contractor	KO+TBD*	No
FR	Demonstration, Final Review	ESTEC	KO+6	Yes

\* to be proposed by Contractor and agreed by Agency