

IAA Study Group Status Report

Responsible Commission: Commission 1

Study Number and Title: 1.12 Virtual Exploration (Telepresence Exploration)

Short Study Description (repeat from Study Group Proposal):

Virtual Reality (VR) is a computer-simulated environment able to simulate physical presence in remote places real or artificially created. Most current virtual reality applications are primarily visual experiences, displayed either on a computer screen or through special stereoscopic displays, such as special goggles, but may include additional sensory information: sound, tactile information, temperature and so on. Furthermore, virtual reality allows providing virtual presence of users with the concepts of telepresence and telexistence or a virtual artifact (VA).

Another kind of virtual reality technique is the Telerobotic. With a specially designed glove worn by an operator, it is possible to control a robotic arm located at a distant place. This can be applied to tasks such pick up some rock samples on the Moon or on a NEO or operate in a poorly known or hostile environment as a lunar lava tube by a robotic arm controlled by an operator on Earth wearing a special robotic data glove.

When latency time (time gap due to light speed limit and distance) is dramatically reduced [thanks to the establishment of closer control centers], instead of VR exploration we need to speak of **TELEPRESENCE (TP)**. This is indeed the new focus of the study.

The study will have to create connections and interfaces with the **Terrestrial Analogs** study as well as analyzing preliminary investments and studies carried out in the framework of Mars/Moon exploration missions.

Emerging countries with some established know how in space technology will have a great opportunity to participate in design, development and operations of telecommunications assets in space and on the ground. Moreover, familiarization with TLC techniques will have immediate beneficial spin-offs for the improvements of TLC infrastructure in their own countries.

Use of small satellites is also envisaged. To this goal, connections with the **Extremely Low Cost Satellite** study will be made.

Final goal of the study is a recommendation about the constitution of orbital (Mars, Moon and Lagrangian points) low cost satellite network and in-situ assets. We will investigate deep space communication stations technology trends to adapt the existing DSN networks to the new bit rates and telecommanding requirements.

The study will develop investigations to make virtual reality and telepresence as a powerful and cost efficient way to explore planetary surfaces. It will constitute a gate to low cost space exploration for non-space countries or space emerging countries.

Progress in past six months:

Thanks to the input of the new members (Dan Lester and George R. Schimdt) we are refocusing the study from Virtual Reality to Telepresence. Recent visit to the JPL Virtual Reality Lab has allowed the test of existing technologies. The head of the lab is being invited to join the group. The following report outline was prepared. Members were invited to select one or more items in the report outline and provide contributions:

What is telepresence (TP)?

What is virtual reality (VR)?

Telepresence vs virtual reality

Telepresence vs human presence

TP/VR vis-à-vis present GES

Telepresence as a safe and affordable tool to explore

Latency: an obstacle to real time exploration?

When is real time exploration needed?

Telepresence from Earth, Lagrangian Points, from on-target-orbit

The Moons of Mars as a base for telepresence w/o latency

Do we need telepresence to explore the Moon?

Do we need telepresence to explore asteroids?

Data flow: a possible bottleneck to telepresence?

The minimum infrastructure to carry out tele-exploration:

-On target assets

-TLC requirements

-In orbit assets

Sensorial experiences in telepresence: feeling the environment without dangerous exposures

Website Study Information up to date? (Study Group Membership, Study Plan and Schedule):

-Study membership needs updates (see below)

-The report Outline could be added to the web page

Issues requiring resolution? (recommend approach):

No feed back from Li Ming, Youri Razoumi and Filippo Graziani. I propose IAA Secretary General get in touch with them in order to verify their interest.

Product Deliveries on Schedule? (If modified explain rationale):

Delivery of the report is expected by the end of 2015.

A workshop jointly sponsored by IAA with NRC, NASA and ESA is being envisaged for the spring/summer 2015. Discussions with IAA Secretary General needed.

Study Team Membership

Marcello Coradini

Enrico Famini

Filippo Graziani

Tomas Komarek

Dan Lester

Li Ming

Karen S. McBride

Denis Moura

Maurizio Pajola

Yury Razoumny

Name of person providing Study Group Status (Study Group Chair or Co-Chair):

Marcello Coradini Group Chair

Status Report Date: August 23, 2014

Study Team Membership Changes

Discontinue:

Name Li Ming*

Current email address

Name Yury Razoumny*

Current email address

Name Filippo Graziani*

Current email address

*** Only after Secretary General will call them and verify their interest to contribute**

Add:

Name: **George R. Schmidt**

Name: **Jeff Norris**