

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.

We have been carrying out of number of activities these including searching for new and qualified members, organizing public events, making contacts with industries designing and producing specific tools, establishing contacts with ISECG.

New member: Bob Anderson, who is the group supervisor for Geophysics and Planetary Geosciences at JPL to be on our exploration telepresence working group. Maybe you know him. Bob is very enthused about the strategy, and brings to it science operations experience with MSL and MERs, and work on OASIS and the JPL AXEL teleoperated rover concept.

Bergamo Scienza Festival : I am organizing a round table on Telepresence, a public event and I am also gathering European and American companies to support this event with their technologies.

Industries: We got in touch with a US company capable of producing real time 3-D scenes based on laser ranging. This is a tremendous tool to create VR environment and can be used to acquire information in TP.

ISECG: we are in touch with the group chair and we want to establish synergetic interfaces.

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. The group chair is involved in the development of an airborne Mars drone which may become an essential tool for telepresence

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 issue

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 Marcello.Coradini@jpl.nasa.gov **Chair**

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NEW MEMBER: Bob Anderson, group supervisor for Geophysics and Planetary Geosciences at JPJPL
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Name of person providing Study Group Status (Study Group Chair or Co-Chair):

Marcello Coradini Group Chair

Status Report Date: March 21, 2015

Study Team Membership Changes

Discontinue:

Add:

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