-THE EARTHVIEWS PROJECT-
AN OUTREACH AND EDUCATION PROPOSAL FOR SMART-1

Sander van Dijk [*], Wubbo J. Ockels [‡], Peter Eckart [^]

[*] Faculty of Aerospace Engineering, Technical University of Delft, The Netherlands, a_van_dijk@hotmail.com
[‡] ESA Office for Educational Project Outreach Activities (ADM/RE), P.O. BOX 299, 2200 AG, Noordwijk, The Netherlands
[^] Division of Astronautics, Technische Universität München, 85747 Garching, Germany

ABSTRACT

Today, the Internet is providing new means to communicate the activities taking place in space. With its possibility of 'direct involvement' of the public, the normally so distant activities can be communicated directly to the people, allowing them to actively get involved in the process of space exploration. The EarthViews project is one of the projects, which aims to continue the communication of space along this line of direct involvement. Its goal is to mediate the reality of outer space by taking the general public on a journey into outer space via the Internet.
This paper describes the rationale of the EarthViews concept and provides a short overview of results of a first feasibility study which has been performed as part of the LunarSat Public Outreach and Education activities. Having established a comprehensive definition of the EarthViews outreach and education project, the project status is now such that it can be shared with the entire space community to investigate possible implementation in other missions. In this paper, it is specifically proposed as a possible contribution to the public outreach and education activities of ESA's SMART-1 to the Moon.

BACKGROUND: THE COMMUNICATION OF SPACE

Recently, the European Space Agency has once again emphasised the need to communicate space and space related activities to the European citizen. At the same time, it has stated its dedication to actively participate in this effort, a dedication also put forward in the second report of the ESA Long-term Space Policy Committee in the form of two proposed actions:

- Increase the public's awareness of Europe's space institutions, policies and programs
- Contribute to the creation of a European focus for space education

The first objective, creating awareness of today's European space activities, represents an important first step in this effort, as its aim is to get people's attention directed towards space. Achieving this will undoubtedly increase the reach and effectiveness of space science and technology education programmes focused on the European youth. Moreover, a successful outreach of the European space activities in itself already has a substantial educational character.

As in many other fields, the ongoing development of the Internet is currently revolutionising the means by which space agencies are able to communicate their activities to the public at large[1]. Where humankind's activities in outer space are often perceived as 'out of this world', the opportunity of the Internet to provide a continuous and up to date coverage of individual space missions is allowing the communication strategies to shift towards a more direct involvement of the public in the practice of space exploration.
Today's web exposure of space exploration activities however shows that this potential of the Internet to 'democratise' space exploration is still not fully used. Most websites still provide mostly static information about the mission and spacecraft and only a limited set of images and/or other scientific data is made available. In order for people to be attracted towards space, especially with the overwhelming amount of information already available on the World Wide Web, there is clearly a need to bring the communication of space exploration to a more sophisticated level. Nowadays, this appears to be possible only if the mission (i.e. the event) is mediated as an *experience*.

A good example where this was successfully done is the 1997 Mars Pathfinder mission. As the little rover 'Sojourner' was running around on the surface of Mars, the people sitting at home behind their desktop computers were given the opportunity to 'find out for themselves what it **feels** like to be on Mars'. It was not information that was being communicated but the event itself, the experience of being on Mars 'right here, right now'. The trick here was that the images, taken on the Martian surface, were distributed on the Internet in Near Real Time. More than anything else, it was this fact that elevated the exposure of the Mars Pathfinder mission from being mere images of Mars (which were already available from the Viking landers) to an experiential level. The Internet made Mars seem so incredibly real and close-by that the mission itself became an experience to be shared by the millions of Internet users

[1] The Internet is a popular medium among young people in the developed countries and is therefore very well suited for the communication of space to the European youth.

around the world. It resulted in one of the biggest events in Internet and space communication history.

THE EARTHVIEWS CONCEPT

'If your reality is based on experience, what do you perceive to be more real in the modern world: Outer space or cyberspace?'

The objective of the EarthViews project is to further elaborate on the possibilities of the Internet to communicate space exploration and the reality of outer space on an experiential level. Looking at it from an experience point of view, one of the aspects which is most intrinsically related to any exploration in the physical world is undoubtedly the notion of travelling: in order to explore, one has to travel. This is not different in today's process of space exploration: not every spacecraft is going to land on Mars, but all exploratory spacecraft have to make long voyages through outer space. On average, it takes a spacecraft months if not years to finally get to the destination where it is supposed to do it's scientific measurements. With the Mars Pathfinder mission, this important aspect of space exploration was not successfully communicated, because the wide media coverage only started after the spacecraft had landed on the surface of Mars. With the Martian surface strongly resembling an Earth desert, the 497 million kilometres travelled during the 7 months voyage through outer space were instantly transformed into light minutes once the images of the Martian surface were being distributed over the Internet. Up to now, also other space exploration missions have only partially succeeded in mediating this reality, occasionally taking some snapshots of the Earth or other objects during their long voyages. Because of the discontinuity in these 'snapshots', they failed however to mediate the reality of space travel on an experiential level.

The goal of the EarthViews project is therefore to focus on mediating the experience of space travel by providing a complete visualisation of a spacecraft's journey in outer space through the 'eyes' of the satellite. Practically, this means that onboard cameras will continuously take images, which are then to be distributed on the Internet in Near Real Time. As the view of the Earth from space is unmistakably one of the most fascinating experiences to communicate, the aim is to continuously image the Earth throughout the voyage[2].

[2] The view of the Earth from space was mentioned by most Apollo astronauts to be one of the most impressive experiences during their Lunar journeys. Using the Internet, this experience can now be provided to entire World Wide Web community.

Of course, different scenarios are possible, e.g. at the end of the journey, the cameras can be directed to visualise the arrival. The visual coverage can also be expanded to include both pre-flight/launch activities and nominal orbit operations.

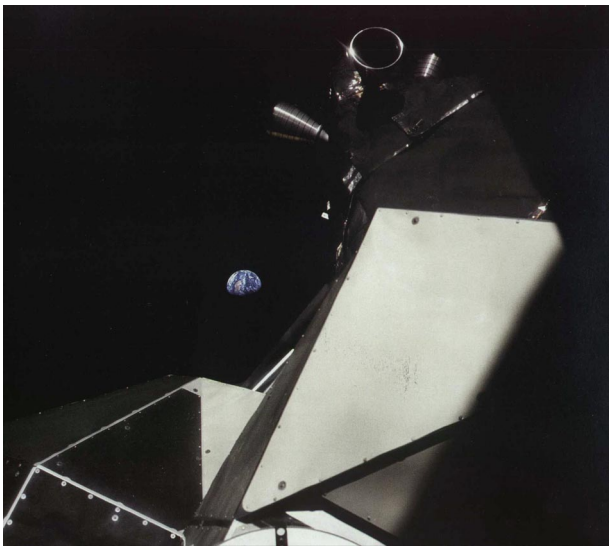

Figure 1. Earth seen beyond the lunar module Eagle. Photographed from the command module Columbia (11 July 1969).

Looking at today's space exploration missions, it follows that their general mission design greatly facilitates the realisation of this project:

- Nowadays, almost all spacecraft send out to explore outer space include optical cameras as part of their scientific payload.
- The transfer phase is usually perceived as having the sole purpose of bringing the spacecraft to the targeted destination, with the spacecraft residing in a state of hibernation. This phase thus presents a unique opportunity to use the spacecraft itself (i.e. the event) for PO/E purposes.

The EarthViews project can in principle therefore be realised with almost every mission, the nominal mission design in this case serving as constraint for the level of sophistication of the project. With the eventual outcome of the project being based on the actual mission and spacecraft design, the outreach which is achieved with the project directly relates to the mission itself (e.g. the visualisation of the transfer depends on the combination of available cameras and foreseen transfer). The project thus allows a variety of mission specific elements and more general scientific and technological phenomena to be communicated in a very interesting way.

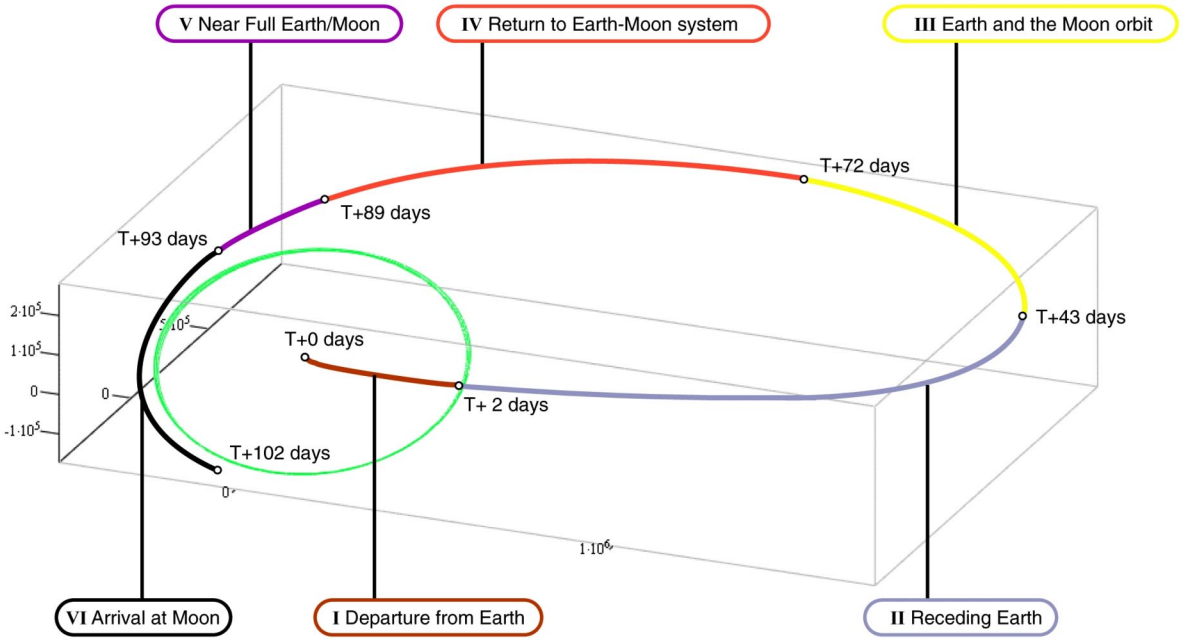

Figure 2. EarthViews visualisation concept for the LunarSat transfer to the Moon (LTO only).

LUNARSAT-EARTHVIEWS FEASIBILITY STUDY

The EarthViews project was first proposed for the Euromoon2000® mission, a mission that strongly emphasised the objective of space Public Outreach and Education (PO/E). With the goal to communicate the Euromoon2000® mission as a first step in the eventual return of humankind to the Moon, the EarthViews project was thought to be very well suited for the mission: what better way to initiate this renewed focus on the Moon than by inviting the general public for a visionary journey to the Moon. With the public again becoming familiar with the Moon as a *place to go to*, the communication of a human return to the Moon to stay will be much more credible. Furthermore, the fact that the Moon is a familiar nightly appearance in people's every day life experience on Earth will help to make the mediated experience of virtually flying to the Moon more profound.

After the discontinuation of the Euromoon2000® project, the proposal was associated with the smaller LunarSat mission that emerged from the Euromoon2000® project. A LunarSat-EarthViews feasibility study was performed as a thesis assignment by the first author of this paper at the ESA Office for Educational Project Outreach Activities (ADM/RE) in co-operation with the LunarSat team. The goal of this thesis work was both to perform a technical and operational feasibility study for incorporation of the project in the LunarSat mission and to further work out the PO/E potential of the project.

The first goal required at first the establishment of the main drivers for bringing the visualisation on the Internet to the anticipated experiential level:

- **Continuous imaging during transfer**
  The spacecraft should continuously take images throughout the transfer at a fixed interval. The latter being important because only with a continuous downstream of images will the visualisation elevate from being more than just snapshots. This means that the imaging process must also continue even when the eventual images will turn out to be very similar. For the LunarSat mission, a targeted imaging interval of 1 image per hour was selected because it is an interval strongly related to the way people experience time in everyday life on Earth.

- **Near Real Time image distribution on Internet**
  As explained with the example of Mars Pathfinder, the images should be distributed over the Internet in Near Real Time in order to create the experiential link between the images on the Internet and the presence of the spacecraft 'out there'.

Using these concept drivers, the feasibility study was performed for the LunarSat mission. A visualisation concept was developed based on the existing transfer and camera payload characteristics (Figure 2). Both concept drivers were found to be both technically and operationally feasible, although further study and development is required concerning the LunarSat ground segment design (e.g. ground station coverage).

The second goal of the feasibility study was to work out further the PO/E potential of the EarthViews project. Some examples are provided in Table 1.

Table 1. PO/E examples related to EarthViews project.

Conversion of a former radio telescope into an educational ground station in Europe for telemetry reception of EarthViews image data (Figure 3)
Involvement of young people from different disciplines (e.g. art academy students for LunarSat-EarthViews web interface design)
Display of EarthViews images at various locations (e.g. airports, TV channels, museums etc.)

Figure 3. Former radio telescope (25m) in Dwingeloo, the Netherlands.

As such, the feasibility study provides a good basis for the further development of the LunarSat-EarthViews project, while at the same time providing a good starting point to initiate similar projects for other missions.

EARTHVIEWS WITH SMART-1

Although the EarthViews project is generally applicable to almost every space mission, it is for reasons mentioned earlier at first considered to be most interesting for a Lunar mission. It is therefore that the EarthViews project is specifically proposed here for the SMART-1 mission, a mission which both bares some resemblance to the LunarSat mission and which specifically states PO/E as one of its objectives.
Considering the fact that the EarthViews concept is based on the idea to see what can be done regarding PO/E within the nominal design of a mission, the feasibility (i.e. level of sophistication) of the SMART-1 EarthViews project is at first largely determined by the SMART-1 mission and spacecraft design. At the time of writing, information on these issues was not readily available apart from the general information provided on ESA's SMART-1 website. From this brief description, the two main things that became apparent are that the SMART-1 spacecraft does already include an optical camera as part of it's scientific payload and that the SMART-1 orbit can be very interesting to visualise the Earth as it will show the Earth under various illumination conditions (i.e. Earth phases). With regard to the feasibility of the two visualisation drivers, it is emphasised here that the goal of a Near Real Time distribution of the images is considered more vital to create an 'outer space experience' than the eventual imaging interval.

CONCLUSIONS

The LunarSat-EarthViews feasibility study has shown the project to be feasible within the LunarSat mission while at the same time providing a good overall definition of the project's concept. With the recommendation stated in the study report that the EarthViews concept be distributed in the widest possible sense, this paper is the first step in proposing the concept for the communication of future space exploration missions. A first prelimenary survey of the SMART-1 mission's characteristics shows the most important condition (i.e. optical camera onboard the spacecraft) to already be fulfilled. Further study is however required to see to what extend the EarthViews project can actually be realised within the SMART-1 mission. Overall, it is believed that performing this study and actually implementing the EarthViews concept in the SMART-1 mission can contribute to a wider appreciation of Europe's role in space.

More information on the EarthViews project can be found on the web: www.tobedetermined.org (reference documents 2 and 3 are available in pdf format on this website).

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