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PROTECTION OF THE PLANETARY ENVIRONMENT – THE POINT OF VIEW OF AN ASTRONOMER

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Abstract

There is a fundamental conflict between the interest of future exploiters of planetary resources on the one side and astronomers as planetary environmentalists on the other. In case planetary exploiters do not fully address the environmental disruptions they will impose, all essential *in situ* evidence on the origin and evolution of planetary bodies will be denied future generation astronomers. (Phobos, the Martian moon serves as an example.) What can science do with this difficult problem? My view is that the task of present generation planetary scientists would be to survey and evaluate all existing planetary environments with regard to their scientific value (or even uniqueness). Based on such a survey a value list of the most important planetary environments should be compiled. The protection of the selected preserves would need, however, an effective legal framework, otherwise space exploration (may be by private firms!) and large scale industrial activity could raise detrimental effects even before anybody can react. Planetary environments in question are usually unchanged since ages and the damage caused by human intervention would be practically irreversible.

Introduction

Just ten years ago on the 40th IAF congress in Malaga, Spain, I have presented a paper [1] putting the following question to participants of the Symposium on Safety and Rescue: "Do we need 'environmental protection' in the Solar System?" My answer was "yes, we do". In spite of the fact that during the past decade several authors emphasized the necessity of an environmental protection policy belonging to the space exploration program, no official standpoint was formulated. Frankly speaking even the existence of the problem was not acknowledged. It is a certain satisfaction that this year IAA and IISL decided to devote the usual Scientific-Legal Round Table to the discussion of this "non-existing" problem.

What was suggested 10 years ago? Space industrialization needs a well-considered strategy and scientists should form an opinion on environmental problems in the Solar System and give a warning in due time. Any permanent base (on a celestial body) can be a source of pollutants that could destroy or degrade *in situ* research. Some kind of environmental protection policy is needed using strictly scientific methods and considerations. If the size of a celestial body is comparable to that of a large base, the industrial activity may lead quickly to the complete and irreversible destruction of the environment.

The problem of cautiously preserving Solar System environment is called *astroenvironmentalism*, which according to *Miller*[11], could provide a conscience to

the plans of planetary exploration and exploitation. There is a fundamental conflict between the interest of future exploiters of planetary resources on the one side and astronomers as planetary environmentalists on the other. Namely in case planetary explorers do not fully address the environmental consequences of their activity and do not protect the pristine surface of celestial bodies, all essential *in situ* evidence on the origin and evolution of planets, asteroids and satellites will be denied future generation astronomers. As *Sterns* and *Tennen* formulated [2] already in 1989: "A balance must be found between the impact of any mission and the scientific results or other benefits which may be obtained thereby. Furthermore, certain activities may be sufficiently detrimental to the environment to require restrictions and prohibitions thereof, regardless of any benefits which otherwise may be realized."

Classification of the problem

Solar System environment can be divided in four categories according to the level of protection supposed by the general public opinion:

- *the Earth:* it is our home planet. In an era of growing global consciousness the protection of the Earth is a global concern.
- *the environment of the Earth:* although there are no strict rules, the protection of the immediate environment of the Earth (the upper atmosphere is particular) is already considered a problem (space debris).
- *other celestial bodies:* they seem to be far away and not exposed to any danger (at least this is the general opinion)
- *outer space:* seem to be infinitely large and not vulnerable at all.

To evaluate in a realistic way the proper relationship of mankind to these basic categories of our cosmic environment, the necessity of the putting together of a fundamental or intrinsic *value-system* was suggested by *Lupisella* [7]. Do planets or space have really a value? People naturally accept a value-system of decreasing order: Earth and its immediate environment (e.g. the geostationary orbit) have a high, even commercial value, but the further the celestial body or territory is from us the smaller the value can be. (There was a similar traditional opinion among people of previous centuries: if a territory is far away, then it has no value and it might be conquered by anybody. Nowadays even remote corners of the Earth can represent a treasure, since travel and transport are highly developed activities on present Earth. A similar tendency is obvious with respect to space and our cosmic environment.)

The applicability of ethical views to celestial bodies is an uneasy problem. *Lupisella* in his cosmocentric ethic system assigns a significant degree of intrinsic value to non-living entities like Valles Marineris or Olympus Mons, but admitting that there may be several difficulties to establish such a system.

Classification of activity

- *research* - also *in situ* research is producing some kind of pollution. Williamson emphasizes that only product and not pollution should be delivered to the celestial bodies and the Earth's environment in general.
- *industrial activity*, - mining in particular - may destroy smaller celestial bodies. A photomontage of Phobos, the small satellite of Mars, with a superimposed aerophoto of an open mine in Hungary (reduced to the same scale) is a clear demonstration how the surface of an entire celestial body can be modified and destroyed by a medium range surface mining activity (*Fig. 1*). As mentioned earlier [1] Phobos with its special system of surface grooves is probably unique in the Solar System. *Williamson* [8] reminds also that if mankind decides to mine the Moon or colonize Mars, the environmental impact will increase by at least an order of

magnitude. As terrestrial experience has shown, when exploration becomes exploitation the environment tends to suffer.

- *colonization and terraforming* - the result will be a large-scale transformation of the environment - it means reforming the environment of a planet to accommodate human life. Writing on the moral and ethical dilemma of terraforming Mars, *Jakosky* [10] poses several difficult questions: "Does Mars as a planet have any intrinsic value in and of itself? Is there less intrinsic worth in a planet that is devoid of life than in one with an active biosphere? Should we access and use the resources that are available there or should we leave them as they are?" According to *Briggs* [4], however, those concerned about Solar System environmental issues can reasonably leave the problem of terraformation for future generations to worry about, if and when it assumes a degree of reality.

- *free-for all* - whoever gets there first should have the right to do whatever they want with the materials they find. This could lead to destruction of some celestial bodies with possibilities of future investigations and future resources. *Miller* [11] is emphasizing that enormous damage and danger could be caused by a free-for-all in space. The lack of preservationist concern is widespread, it is like a missing element in space exploration. The time has come, however, for environmental concerns to be applied to developments in space. *Marshall* [6] states that "The 1979 Moon Treaty has a central premise the notion that no single nation or private entity has the right to appropriate commonly-owned resources (whether they remain intact with their parent body or are removed from it). The 'Common Heritage of Mankind' principle is the basis of this notion."

Two recent examples illustrates, however, that these principles are not respected everywhere: The private *Artemis Society* will organize lunar excursions to interested people. Business interest to the Moon will arouse without authorization and without being conscious of rights and obligation. *SpaceDev* will launch private space probes to investigate and eventually mine the resources of asteroids. Again there is no authorization and the private ownership of an asteroid is a real possibility in the future.

Classification of possible actions

- *The complete protection* of celestial bodies and interplanetary space is not a realistic requirement;

- *The protection of selected regions* seems to be, however, feasible. Some principles of compromise need to be found to allow the selection of sites of special astronomical interest. This corresponds to a suggestion by *Hartmann* [3]: "There would be a limited list of sites and objects open to scientific study, but closed to exploitation."

What can we do now? My view is that the task of present generation planetary scientists would be to survey and evaluate all existing planetary environments with regard to their scientific value (or even uniqueness), sensitivity to artificial interference, difficulty or ease of access by planetary missions etc. Based on such a survey a list of the most important planetary environments should be drawn up and these preserves legally protected. A classification system of territories with gradually decreasing interest for science should be established - making exploration and exploitation of resources on a number of planetary surfaces permissible. It is important to notice that many of the planetary environments in question are practically unchanged since ages and the damage caused by human interaction would be irreversible.

Such selected regions are called *space wilderness areas* by *Uhlir* and *Bishop* [5].

They are also convinced that "We ought to preserve space wilderness areas of special interest." in spite of the fact that "We have tried with mixed success to protect other vast

wilderness areas, especially the polar regions and the seas. The opportunity to protect space wilderness is before us in the next few decades."

Framework or mechanism for implementation of preservation of space environment

Considering the Moon, Mars and some other planetary bodies - or selected parts of them - as wildernesses that need to be protected safeguards are clearly needed to insure that there is no contamination of these celestial bodies. What is really needed is an environmental-protection treaty for the outer space wilderness.

As it is well known, the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space Including the Moon and Other Celestial Bodies (Outer Space Treaty) and the 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Treaty) are well-intentioned, but they provide insufficient protection for the space environment. *Williamson* [8] criticizing the Outer Space Treaty is coming to the conclusion "that it should be amended, supplemented or otherwise reinforced to offer a degree of environmental protection that is currently lacking." "There is no practical use of a law, however well written, if it cannot be applied in a given situation."

Consideration is given to the designation of areas of special scientific interest, or 'international scientific preserves' by several other authors as well. *Marshall* [6] writes that in constructing an adequate environmental legal regime for outer space prohibiting private ownership of wilderness areas is a fundamental wilderness principle. According to *Uhlir* [5]: "The existing body of space law regarding environmental protection and resource utilization is a hodge-podge of ill-defined or conflicting provisions and principles."

The realization of such a system needs, however, an effective legal framework, otherwise this kind of large-scale industrial activity could reach detrimental effects in the next century before anybody could react. In constructing an adequate environmental legal regime for outer space prohibiting private ownership of wilderness areas is a fundamental wilderness principle. Clearly an international environmental-protection treaty is needed for the "outer-space wilderness".

The standards implementing those principles have to be tailored to meet the needs of the specific environments that they are designed to protect. Some degree of flexibility is needed in order to make space exploration and even exploitation possible.

Vienna Declaration of UNISPACE III [12]

On a technical forum of the recent UNISPACE III conference called *"Leaving Planet Earth"* future plans of space exploration were discussed. In an official presentation by NASA, plans for the next century including lunar bases, manned exploration and even terraforming of Mars were outlined. Preservation of the Solar System environment was not even mentioned. After a vivid discussion point *(h)* was added to the recommendations of the Technical Forum. This point, however, had no chance to be considered as a recommendation of the UNISPACE conference, and in the so called Vienna Declaration only space debris is mentioned as a threat to "near and outer space environments". For the sake of accuracy here is the relevant paragraph of the Vienna declaration:

III. Advancing scientific knowledge of space and protecting the space environment

Action should be taken:

(b) To improve the protection of the near and outer space environments through further

research in and implementation of mitigation measures for space debris.

Here is also a shortened version of the draft of the conclusions and proposals of the *Technical Forum on Space Activities in the Twenty-first Century* including the most important recommendations concerning space exploration and exploitation:

V. Leaving planet Earth in the twenty-first century

B. Recommendations

9. Humans should prepare to follow their inexorable drive to explore and gain knowledge and understanding beyond Earth by:

(e) Developing space-based energy sources, including in situ fuels for use in space or transfer to Earth;

(f) Further developing, adapting and applying tools already developed for use on Earth for use on extraterrestrial bodies, in particular the Moon;

(g) Determining the resources required for long-term migration beyond Earth;

(h) Defining roles for the protection and preservation of the planetary and space environment and establishing a framework for implementation;

(j) Establishing biospheres beyond Earth and establishing pilot space settlements, thereby learning to live away from the Earth's biosphere;

(k) Encouraging the development of space tourism.

Conclusions

I am convinced that the "protection and preservation of the planetary and space environment" will be a major concern on UNISPACE IV, the next UN space conference, to be held within ten or twenty years. As Mark Williamson expressed it, it is inevitable to consider "the future of scientific and commercial exploration and exploitation of the planetary bodies, in both ethical and pragmatic terms, with a view to a sustainable balance between the productive activities of mankind and the desire to retain the purity of the space environment."

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10. Bruce Jakosky: *The Search for Life on Other Planets* (Cambridge University Press, 1998 p.160)

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12. UNISPACE III Draft Report of the Plenary

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Technical Forum. V. Leaving planet Earth in the 21st century

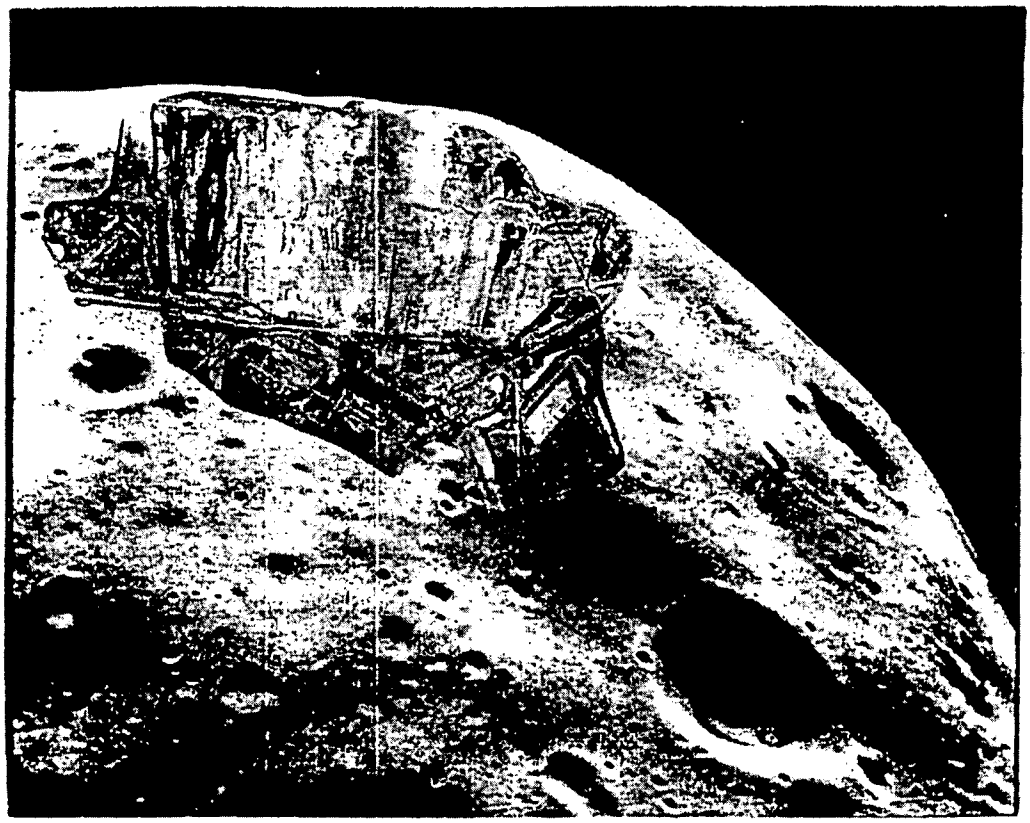

Fig. 1 Viking image of a part of Phobos complemented by an aerial view of a Hungarian factory and open mine reduced to the same scale. Photomontage by A. Gesztesi.