

EXPANDING THE DEFINITION OF “PLANETARY PROTECTION”: ETHICAL SPACE EXPLORATION FROM AN ENVIRONMENTAL AND SOCIO-CULTURAL PERSPECTIVE. J. St. P. Walsh¹, M. Trüniger², V. A. Fernandes³.

¹Dept. of Art, Chapman Univ., Orange, CA, USA, jstpwash@chapman.edu. ²Inst. Social Sciences, Univ. Lisbon, Lisbon, Portugal, monica.truniger@ics.ul.pt. ³Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Univ. zu Berlin, Berlin, Germany, veraafernandes@yahoo.com.

Introduction: For several decades, scientists have been voicing concern over “planetary protection” (PP). To an outside observer unaware of this term’s nuances, the phrase could easily be taken to include problems related to environmentalism, such as preservation of the natural landscape and natural resources. Instead, the term, as it is used today, refers only to practices intended to minimize biological contamination – of the Earth by extraterrestrial life, and vice-versa. The emergence, on the one hand, of private industries interested in exploiting space-based resources (e.g., mining the Moon for ³He) and the growth, on the other hand, of broad public support for environmental protections here on Earth, together suggest that the time is ripe to re-consider the full range of possible impacts caused by human activity in space before irreparable harm is caused to the cosmic environment. This paper aims to unpack the concept of planetary protection, identifying its primary limitations and addressing these shortcomings through cross-fertilization with literature concerning sustainable development [1]. The final result is a proposal for a broader definition of PP. This reconceptualization is useful for framing new space policies, strategic plans, and programs in a manner that anticipates the future challenges of space exploration within a context of competing interests.

Present Need to Expand the “Planetary Protection”

Concept: There are both scholarly and ethical motives for expanding the concept of “planetary protection” beyond biological contamination. Several fields of study are aided by a pristine cosmic environment. For example, regolith on the lunar surface has been accumulating for >4 Ga., and thus that material holds a wealth of information for the Moon’s and Earth’s geologic history. The alteration, damage, or destruction of the lunar surface could have profound effects on geologists’ ability to understand how planetary bodies formed and evolved. Likewise, scientists who use radio telescopes to study cosmic radiation as evidence for the earliest history of the universe have argued for keeping the farside of the Moon entirely free from human occupation, since that is where the least interference can be found from terrestrial radio transmissions [2]. These scholars advocate reserving the far lunar landscape for the placement of an instrument to be used in their research. Even archaeologists are interested in protecting heritage sites such as Tranquility Base from damage.

From an ethical perspective, several more points need to be considered in relation to space exploration. First, ethical treatment of the environment has become increasingly important to the global public since the 1960’s. The cosmic environment is currently free from human impact in many respects, especially outside low-Earth orbit and a small number of landing sites on the Moon, Mars, and a few other bodies. Given the limits of present knowledge of the space environment, it is difficult to predict the physical consequences of many possible human actions. Experience on Earth, however, suggests that humans can have a dramatic effect on the environment, and that until recently, protection, preservation, and mitigation have historically been low priorities, if not an afterthought. Before embarking on the exploitation and destruction of non-renewable resources in space – a category which would even include ³He, since it has only been collected in potentially significant quantities in the lunar soil over a period of billions of years – it would therefore be worthwhile to consider an ethical management program that includes principles for sustainable development.

Equally important, though perhaps not so tangible, are the socio-cultural consequences associated with space exploration. Humans of all cultures – not only those currently dominant – have attributed meanings to natural phenomena observed in the sky. Cosmic bodies (the Moon, the Sun, the Earth, and other celestial bodies like stars, comets, and galaxies) have been integrated into human culture and mythology since the dawn of our species. Looking up to the sky has allowed humans to imagine alternative futures to those they might experience on Earth. Some of these alternate futures articulate “a sort of common-sense utopianism,” that is, a feeling of “leaving Earthly problems behind and start anew” [3]. The development of space for scientific or economic reasons may therefore conflict with the belief systems of many groups that have not previously been consulted regarding priorities for its use. Some past and current religions and spiritual groups rely heavily on images and representations of space and on the perceived “constancy” and “perennity” of cosmic bodies to perform their rituals and celebrations. Any future alterations to such bodies (disturbing the balance of their ecosystems, geomorphological states or biological processes) for fostering capitalist ventures into space are likely to raise socio-cultural concerns. These reactions might escalate into social conflict, especially if

future space resources or access to space is unequally distributed, or perceived to social unfairness and injustice. Following the principle enshrined in the Outer Space Treaty that “the exploration and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development,” these concerns with the “unchanging” nature of space are significant.

At the same time in contemporary secular culture, interest in space is more vibrant than ever, with individuals consuming and collecting space memorabilia (science fiction blockbuster movies, novels, cartoons, magazines, and more), visiting space museums in enormous numbers (the Smithsonian Institution’s National Air and Space Museum, for example, is the most visited historic collection of any kind in the world), or even “buying” land on the Moon through Internet sites. Growth in space exploration programs launched by emergent spacefaring countries (e.g., China and India) together with private attempts to democratize space for the masses (e.g., space tourism, such as that offered by Virgin Galactic et al.) will bring several challenges to a notion of PP that is concerned only with biological cross-contamination. Space and its exploration are subjects with “contemporary resonances in popular culture, frontier capitalism, and the restructuring of superpower status in the coming century” [3].

Proposal for an Expanded Notion of Planetary Protection: The authors suggest an expansion of the concept of “planetary protection” to include a range of elements that currently seem to be absent. Important additions include:

- environmentally sound protocols for mining and extraction of mineral resources;
- avoidance of disruption to geologic and biological processes of planetary surface evolution;
- preservation of planetary heritage such as archaeological sites;
- attention to global socio-cultural concerns with space;
- human health protections related to activities on planetary bodies (e.g., inhalation of lunar dust or radiation exposure).

In accordance with the development of PP, new forms of space governance that are based on sustainability principles will need to be developed. Since the 1990s, the field of geo-ethics has combined several of these concerns in ways that can make significant contributions to our efforts [4]. The geo-ethical approach safeguards scientific integrity while emphasizing awareness of both abiotic and living features of planetary bodies [4]. Despite this valuable body of work, however, geo-ethics lacks elements beyond

those concerning the fields of planetary geology and astrobiology. It is therefore important that the concept of planetary protection be widened even further, to include in a holistic way the principles of sustainable development (SD), first enshrined in the United Nations (UN) World Commission on Environment and Development report, *Our Common Future* [1]. In that document, SD was defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” One section of the report was fully dedicated to space matters, with regulation of space debris and nuclear materials in Earth orbit were strongly recommended. Since the publication of *Our Common Future*, much progress has been made to increase the sophistication of the concept of SD by means of sharp critical appraisal. In this abstract we propose to broaden PP through cross-fertilization both with the current scholarly consensus regarding SD, by exploring some of SD’s most important aspects – cultural vitality, economic health, environmental responsibility and social equity – and by adding some further developments of our own, such as the preservation of natural beauty. We argue that such an exercise, informed by the latest literature on the limits and advantages of making SD operational, will enrich the PP concept. Such an endeavor will be useful for innovative space policy development of strategic plans and programs that anticipate future challenges in space exploration.

Summary: Whatever positives might be pursued by humans as part of their exploits in space, the desirability of such pursuits should be measured against the possibility of adverse effects. Such effects might not be as obvious as those posed by mining operations. The present work suggests that there are a variety of important reasons for expanding the concept of “planetary protection” to include contemporary ethical approaches to the environment that will enable mitigation of possible future impacts.

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