

SPACE CEMETERIES  
– A CHALLENGE FOR THE LEGAL REGIME OF OUTER SPACE

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Abstract

On December 1999, *Celestis 03* was launched successfully. Aboard, it carried the remains of 36 people. Their urns of a size of several centimetres will circulate the Earth for more than 50 years. The next flight is scheduled for first quarter 2001. In the longer perspective, it is envisaged to establish a routine funeral service on a commercial basis. Presently, the costs of a space burial amount to some \$ 5.000. This new service raises several questions as to its compatibility with the principles and legal rules embodied in the 1967 Outer Space Treaty, as well as in the 1975 Registration Convention: Special attention should be given to the compatibility of these activities with the rules of Art. VIII of the Outer Space Treaty on the jurisdiction and control of space objects. Concerning the Registration Convention, the interpretation of the term “space object” constitutes an interesting issue. This paper seeks to analyse these problems, especially on the basis of the results of the discussions on the legal regime of space debris. In this context, the criterion of the intensity of these activities is also taken into account.

I. Introduction

The commercialisation of space activities reached a new stage: They are not any longer only concerned with the generation of new materials, the discoveries in the field of biology, and the preparations for travelling into the space; now, also funeral activities have reached outer space. The leading role in this developments is played by the company *Celestis* which expanded its services from the United States to several other countries such as Japan, the Netherlands and Germany.

This firm offers three types of funeral space services: The “*Earthview Service*”, introduced in 1997, is now a nearly routine service which places the cremated remains into Earth orbit. The price of this service amounts to \$5,300<sup>1</sup>.

The “*Lunar Service*” began in 1998 with the launching of NASA's *Lunar Prospector* satellite to the Moon. Aboard, in a *Celestis* flight capsule, was a symbolic portion of the cremated remains of Dr. Eugene Shoemaker, the co-discoverer of the Shoemaker-Levy Comet. The *Celestis Lunar Service* places the cremated remains

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in Lunar orbit or on the Lunar surface. The price of this service is \$12,500.

The “*Voyager Service*” plans to launch the cremated remains into deep space on an infinite journey among the stars. The first *Voyager* mission is scheduled aboard the encounter 2001 spacecraft. The price of this service is also \$12,500.<sup>2</sup>

The next *Celestis* launch, *Earthview 04*, is scheduled for first quarter 2001. Reservations for this launch are being accepted now, as well as for the *Voyager Service* deep space launch in 2002. *Lunar Service* reservations are also being accepted, although no specific launch date is currently set.<sup>3</sup>

Having no doubt about the good purpose of these activities – a part of the profit of the company has been transferred into a budget of a foundation which supports various beneficial activities – in connection with “space funerals” several legal questions occur: Who, and in which form, performs the supervision of the firm? If the container with the remains collides with another space object, who bears the liability for the damage? In case of a larger scale of the *Celestis Lunar Services*, how can be secured that the environment of the Moon is not changed adversely by the introduction of extra-environmental matter? From and to which moment are the cremated remains “space objects”? Do these activities still represent “the use of outer space for the benefit and in the interests of all countries”?

Some of these questions have been partly answered on the homepage of *Celestis* already, some of them have not been mentioned yet. Their overview, however, might serve as an example for a very specific form of commercial space activities and perhaps contribute to the

discussion on the content of the “space benefits” principle.

## II. Compatibility of the Extra-terrestrial Funeral Services with the Law of Outer Space

### 1. Registration, Jurisdiction and Control

According to Article VIII of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies of 1967<sup>4</sup> (Outer Space Treaty) a State Party on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object while in outer space or on celestial bodies. According to the *Celestis* homepage, its launches “...comply with the Office of Commercial Space Transportation of the U.S. Federal Aviation Administration which licenses each mission after consideration of the relevant issues”<sup>5</sup>. Most probably, the role of the State of registry is, therefore, performed by the United States, although – according to Article I (a), ii of the Convention on Registration of Objects Launched into Outer Space (Registration Convention)<sup>6</sup> – also other States could fulfil this role: The term “launching State”, i.e. the State which is obliged to register a space object launched into Earth orbit or beyond (Article II(1)), could mean not only a State which launches or procures the launching of a space object, but also a State from whose territory or facility a space object is launched. In such case, such States should jointly determine which one of them shall register the object (Article II(2) of the Registration Convention).

The duty and right of the States Parties to retain jurisdiction and control over a registered space object arises in the

moment of the launching and extends through the period of its stay in outer space or on a celestial body till its dismantling or other disposal. Provided that *Celestis* payload is registered in the United States, the particular character of these activities raises the question until what moment of time the performing of jurisdiction and control is envisaged and practicable? In other words, from and to which moment can the *Celestis* payload be considered an “object” launched into outer space?

The homepage of *Celestis* explains that during its missions, each 7-gram sample of cremated remains is enclosed in a personalised flight capsule. The capsules for a given flight are placed in a flight container that is attached to the upper stage engine of an Orbital Sciences Corporation rocket. When the rocket is launched into outer space, it is the upper stage engine that takes the rocket's primary payload, such as a communication satellite, into Earth orbit. Once in orbit, the upper stage engine separates from the primary payload. The primary payload continues to orbit the Earth. But so too does the upper stage engine - with the *Celestis* flight container attached. Thereafter the *Celestis* memorial satellite re-enters Earth's atmosphere and “harmlessly vaporizes, blazing like a shooting star in final tribute”.

The relevant information seems to be the fact that the container with the samples is considered a secondary payload of the launcher, in the terminology of the Outer Space Treaty and the Registration Convention most probably a “component part of a space object” (Article VII, Article VIII of the Outer Space Treaty, Article I(b) of the Registration Convention). It acquires this quality from the moment of the launching or attempted launching into outer space<sup>7</sup> and keeps it till its re-entry into the Earth's atmosphere which causes

its extinction. It is interesting, however, to determine what is the extent of the term “thereafter”, connected with the dissolution of the object and the termination of the respective jurisdiction and control duties:

For example, the *Celestis* 02 spacecraft orbits at an average altitude of 828 km/518 miles, and is projected to orbit Earth for approximately 240 years. *Celestis* 01, which orbits Earth at a much lower altitude (565 km/353 miles), should have a total orbital lifetime of less than a decade. For all these period, the State of registry should maintain – at least theoretically - its jurisdiction and control.

The other offer of *Celestis* services, the *Voyager Service* spacecraft, should “travel harmlessly and eternally through the vastness of space”. The indefinite duration of this mission results, therefore, in the temporally indefinite duty of jurisdiction and control of the state of registry. The third alternative, the *Lunar Service* spacecraft, “may impact the Moon's barren surface”<sup>8</sup>, since the container is supposed to remain on the surface of this celestial body. Also in this situation, the State of registry is obliged to perform the control of this object during its whole stay on the Moon and retains the jurisdiction over the object for all this period.

## 2. State Responsibility, Authorisation and Supervision

The traditional, pre-1989 outer space law would inevitably raise the questions as to who bears international responsibility for the activities of *Celestis*, as well as who performs the supervision of the company under Article VI of the Outer Space Treaty? According to this Article, States Parties to the Treaty shall bear international responsibility for national

activities in outer space; the activities of non-governmental activities require authorisation and continuing supervision by the appropriate State Party to the Outer Space Treaty.

Because of the reference on the *Celestis* homepage to the Office of Commercial Space Transportation of the U.S. Federal Aviation Administration,<sup>9</sup> and provided that *Celestis* activities can be defined as “national activities” according to Article VI the Outer Space Treaty, most probably the United States as its State Party are supposed to bear the international responsibility for these activities. The same can be anticipated as regards the performing of the “authorisation and continuing supervision by the appropriate State Party to the Treaty”.

In this context, however, it could be mentioned that, in scholarly circles, the question of the normative content of Article VI of the Outer Space Treaty is presently under discussion. It is generally known that the provision of Article VI resulted from an initiative of the then socialist Soviet Union. Pursuant to its demands, private organisations were to bear the title of “non-governmental entities” and should be continuously supervised by the state or states to which they belong.<sup>10</sup> With the dissolution of the former Soviet block and its space programme, and – as a consequence thereof – the increase of commercial activities in the former socialist states, trends emerged to apply this position less rigidly. It has already been suggested to adapt at least its interpretation to the changed socio-political situation<sup>11</sup>.

### 3. Liability

According to Article VII of the Outer Space Treaty, each State Party that launches or procures the launching of an object into outer space, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space. Article II of the Convention on International Liability for Damage Caused by Space Objects<sup>12</sup> (Liability Convention) provides that a launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the Earth or to aircraft flight. In case a damage was caused elsewhere than on the surface of the Earth to a space object of one launching State by a space object of another launching State, the latter shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible (Article III).

On the *Celestis* homepage, the question of how likely it is that a satellite could survive re-entry and harm somebody on Earth has been answered – with reference to pertinent literature<sup>13</sup> – as follows: “According to NASA, during the past 40 years an average of one catalogued piece of debris has fallen back to Earth each day. No serious injury or significant property damage has been confirmed as caused by re-entering debris. It should be noted that the *Celestis* “satellite” is so small that it cannot survive a re-entry. Predicting exactly where a satellite will re-enter the atmosphere is extremely difficult to do. The obvious exception is the controlled re-entry of a spacecraft, such as when the space shuttle returns to Earth. However, most LEO satellites – including the *Celestis* memorial satellites – will re-enter the

atmosphere as a consequence of the natural decay of their orbits, resulting from the friction process described above. Predicting exactly what day, time and location of satellite re-entry, then, is almost impossible.”

Despite of the expected low probability of harm caused by *Celestis* satellites, there can be no doubt that, in case a damage occurs as a consequence of *Celestis* activities on the surface of the Earth or to aircraft flight, the launching State shall be absolutely liable for the damage.

Provided that the United States are the launching State, and in case damage was caused elsewhere than on the surface of the Earth to a space object of one State by *Celestis* space object, the United States would be liable only if the damage would be due to their fault or the fault of persons for whom they are responsible. This alternative is unlikely, but cannot be fully excluded: One of the services offered by *Celestis*, the *Lunar Service* spacecraft, “may impact the Moon's barren surface”.

#### 4. Harmful Contamination, Space Debris

According to Article IX of the Outer Space Treaty, States Parties to the Treaty shall conduct exploration of the outer space, the Moon and other celestial bodies as to avoid their harmful contamination.

Concerning the doubts of those who tend to see in these activities an uncontrolled source of contamination of outer space, the *Celestis* homepage has reacted by the following arguments:

“In fact, most rocket launches involve leaving one (or more) spent rocket stages in Earth orbit. As of 1998 over 1,500 upper stage engines were orbiting Earth.

Furthermore, of the approximately 9,000 man-made objects orbiting Earth that are tracked by *NORAD*, only about seven percent are operational satellites. The remainder are rocket bodies, inactive satellites and fragments of other spacecraft. Furthermore, scientists estimate that there are 100,000 objects orbiting Earth that are between one and ten centimeters in size, and an additional ten million smaller objects orbiting Earth. While some of these objects are meteoroids from asteroids or comets, most are manmade objects, referred to as "orbital debris" or "space junk", such as flecks of paint from older spacecraft or solid rocket propellants that have escaped from spacecraft. (The *Celestis* flight container is designed so as to prevent the release of flight capsules into space, which would otherwise contribute to the orbital debris problem.)”<sup>14</sup>. The *Lunar Service* spacecraft, “may impact the Moon's barren surface, but extreme surface conditions on the Moon help to assure there is no contamination from Earth.”<sup>15</sup>

The most significant part of this statement seems to be the one contained in the brackets, i.e. that the prevention of the release of flight capsules could be technically guaranteed. The question remains, however, whether this is sufficient in order to fulfil the - albeit vague - obligation to avoid harmful contamination according to Article IX of the Outer Space Treaty? Should not also the containers or the debris arising during the final burning of the object in the Earth atmosphere be considered sources of pollution?

The awareness of the intensified pollution and space debris problem led to the statement of the General Assembly resolution 54/67 of 11<sup>th</sup> February 2000 that “space debris is an issue of concern to all

nations”<sup>16</sup>. The Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space (UNCOPUOS) which at this 37<sup>th</sup> session continued the consideration of the debris issue on a priority basis, came to the conclusion that Member States should pay more attention to the problem of collision of space objects with space debris. The Member States should make available to all interested parties the result of their research, including practices adopted that proved effective in minimizing the creation of space debris<sup>17</sup>.

Despite of the reluctance of some States to introduce the space debris issue into the programme of the Legal Subcommittee of the UNCOPUOS, both the Report of the Chairman of the Legal Subcommittee to the UNISPACE III Conference in Vienna in 1999 and the discussion at the UNISPACE III reflected the extensive interest in the examination of legal aspects of space debris in the Legal Subcommittee<sup>18</sup>. As a basis for its work, the Subcommittee could take as starting point the 1994 Buenos Aires International Instrument on Space Debris elaborated in the framework of the International Law Association.<sup>19</sup>

For the consequences of *Celestis* and similar services, the scope of the regulatory function of the above mentioned ILA document seems to be too narrow: Its Article 1(c) describes its scope – space debris – as man-made objects in outer space, other than active or otherwise useful satellites, where no change can reasonably be expected in these conditions in foreseeable future. The precondition of this definition – the “usefulness” of the space object – does in case of *Celestis* differ sharply from the purpose of a scientific satellite: it can be easily maintained that its

purpose does not cease to exist until the extinction of the containers.

Despite of the fact that several space states have introduced measures with a view to mitigate space debris – and the United States of America are considered to have the longest space debris mitigation experience<sup>20</sup> – the continuous awareness of avoiding harmful contamination and adverse changes in the environment of the outer space remains imperative.

The urgency to cope with the consequences of activities similar to *Celestis* depends on their intensity: In the present scale, they are most probably not harmful enough. It is not difficult, however, to envisage scenarios in which – because of the scarcity of place on the Earth – each technically capable funeral institution will be able to offer such services in outer space, creating “shooting stars” and intensifying the danger of collisions. As such, these activities should already represent a breach of the obligation of Article IX of the Outer Space Treaty.

Would it not, therefore, be possible to consider placing the funeral containers in graveyard orbits in which they cannot cause any harm? From the technical point of view, such solutions have been tested already – e.g. on the basis of the ITU recommendation of 1993 on debris in geostationary orbit.<sup>21</sup> And would it not be possible – as a preventive measure – to discuss the question of regulating and coordinating such activities?

## 5. Space Benefits Principle

Article I of Outer Space Treaty provides that the use of outer space shall be carried out for the benefit and in the interests of all countries. The discussion in the UN -

Outer Space Committee (UNCOPUOS) and its Legal Subcommittee<sup>22</sup> which culminated in approving of a Declaration on International Co-operation in the Exploration and Use of Outer Space for the Benefit and in the Interests of all States Taking into Particular Account the Needs of Developing Countries<sup>23</sup> has confirmed the programmatic and interpretative character of the “space benefits rule”. Similarly, in the literature, this principle is usually understood as not obliging a state to share certain specific space acquisitions, but serving as an emphasis on international co-operation.<sup>24</sup>

The consequence of this approach - not only for the space “funeral services”, but for commercial space activities in general - is that the State of registry is not under any legal obligation resulting from the Outer Space Treaty to share eventual tax or other profits from private space activities with other subjects of the law of outer space.

The question as to whether the space funeral service, with its market and advertizing, still corresponds the original idea of “the use of outer space for the benefit and in the interests of all countries”, shifts the problem onto a different, extra-legal level: At first sight, the answer is no. What is the difference, however, regarding the acceptability of space burials and the public approval of spy satellites? To find arguments in order to prove the “interests of all countries” in both cases is very difficult. Both of them were accepted, however, as a matter of fact.

### III. Conclusions

Services which provide the launch of a symbolic portion of the cremated remains

of a human being are a specific form of commercial activities in outer space.

However, according to the contemporary international law, the role of the State of registry of these activities, and that of the launching State, is not irrelevant: During the whole existence of such remains in outer space or on the Moon, the State of registry retains its jurisdiction and control upon these objects, as well as it remains responsible for these national activities and liable for potential harm caused by the respective space object.

The answer to the question as to whether such activities are capable to breach the obligation to avoid harmful contamination of outer space and the Moon, seems to depend on their intensity: If - in the future - space cemeteries should become a common way of exploiting outer space, new forms of regulation and co-ordination should be looked for. From a technical point of view, it could be discussed, as an alternative, whether it would be possible to consider placing the funeral containers in special graveyard orbits.

It seems also that the “space benefits principle” does not require any special obligation from the State of registry of *Celestis*. It must be admitted, too, that there are no specific arguments to support a statement that such activities contradict this rule, since it is generally not possible to mix legal and extra-legal argumentation. Only based upon the latter one, it would be possible, though, to maintain that not only the “fathers and mothers” of space law would wonder, what, nowadays, might be understood as serving the “benefit and interest of all countries”.

<sup>1</sup> According to the homepage of *Celestis*, the company has launched a symbolic portion of the cremated remains of approximately 100 people into orbit around the Earth. *Celestis* 01, the Founders Flight, was launched April 21, 1997 and contains 24 samples. *Celestis* 02, the Ad Astra Flight, was launched February 10, 1998 and contains 30 samples. *Celestis* 03, the Millennial Flight, was launched December 20, 1999 and contains 36 samples.

<sup>2</sup> <http://www.Celestis.com/services.html>.

<sup>3</sup> <http://www.Celestis.com/faq.html#1>.

<sup>4</sup> GA Resolution 2222 (XXI), annex.

<sup>5</sup> <http://www.Celestis.com/faq.htm#1>.

<sup>6</sup> GA Resolution 3235 (XXIX), annex.

<sup>7</sup> See the convincing argumentation of *B. Cheng*, *Studies in International Space Law*, 1997, 498-499.

<sup>8</sup> <http://www.Celestis.com/faq.html#1>.

<sup>9</sup> <http://www.Celestis.com/faq.htm#1>.

<sup>10</sup> *N. M. Mateesco – Matte*, *Aerospace Law*, 1969, 308-309.

<sup>11</sup> S. e. g. *B. Cheng*, *Comments to the Subject "Review of Space Law Treaties in View of Commercial Space Activities"*, *International Law Association, London Conference (2000)*, p. 7.

<sup>12</sup> GA Resolution 2777(XXVI), annex.

<sup>13</sup> *N. L. Johnson*, *Monitoring and Controlling Debris in Space*, *Scientific American*, August, 1998. <http://www.spacecom.af.mil/norad/satcat.htm>  
<http://sn-callisto.jsc.nasa.gov/faq/>  
<http://www.sunspotcycle.com/>  
<http://sn-callisto.jsc.nasa.gov/faq/faq.html>.

<sup>14</sup> *Ibidem*.

<sup>15</sup> <http://www.Celestis.com/faq.html#1>.

<sup>16</sup> A/RES/54/67, 11 February 2000.

<sup>17</sup> A/AC.105/736, 25 February 2000.

<sup>18</sup> Proposed Resolution No. 34/2000 of the 69<sup>th</sup> Conference of the International Law Association, *Space Law*, p.3.

<sup>19</sup> ESA/IRC (96), 16, Annex 3.

<sup>20</sup> See *N. Jasentuliyana*, *International Space Law and the United Nations*, 1999, 337 ff.

<sup>21</sup> Recommendation ITU-R S.1003. UN Doc. A/AC.105/C.1/CRP.4, 9 February 1995.

See *L. Perek*, *Legal Aspects of Space Debris*, *Proceedings of the 38<sup>th</sup> Colloquium on the Law of Outer Space*, 1995, 53 ff.; *J. M. de Faramiñán Gilbert*, *Space Debris: Technical and Legal Aspects*, in: *G. Lafferranderie, D. Crowther (Eds.), Outlook on Space Law over the Next 30 Years*, 1997,

<sup>22</sup> *M. Benkö, K.-U. Schrögl*, *Article I of the Outer Space Treaty Reconsidered after 30 Years*, in: *G.*

*Lafferranderie, D. Crowther (Eds.), Outlook on Space Law over the Next 30 Years*, 1997, p. 67 ff.

<sup>23</sup> UN Doc. A/AC.105/L.211 of 11 June 1996.

<sup>24</sup> *C. Q. Cristol*, *Space Law*, 1991, 69 ff.