SPACEFLIGHT OF THE COSMIC DANCER SCULPTURE

IAA.8.2.-93-773
Presented at the 44th Congress of the International Astronautical Federation
October 16-22, 1993 Graz, Austria

Arthur R. Woods & Marco C. Bernasconi
The OURS Foundation, Switzerland

Abstract

On May 22, 1993, the «Cosmic Dancer» a painted sculpture created by the author (the Swiss-American artist Arthur Woods) was launched to the Russian Mir space station on a Progress rocket from the Baikonur Cosmodrome in Kazakhstan. Freed from the force of gravity which causes any sculpture on Earth to rest or be positioned in a certain way, the «Cosmic Dancer» was allowed to slowly spin and freely float in the weightless environment of the Mir space station. The cosmonaut crew evaluated the contribution and importance of having art in their environment and they made a photographic and a video documentation of this experiment. In June, TV images of the «Cosmic Dancer» sculpture were broadcast from the Mir space station to the spaceflight control center. The original photo and video documentation were delivered in September.

The «Cosmic Dancer» is one of the very few artworks to be specifically conceived for and officially realized in the space environment. As such, its conception and implementation encompasses many of the issues related to ”art-in-space” such as the artistic, environmental, political and financial aspects as well as to those issues related to communicating to a potential global audience. Thus, its relevance is to the role that art and artists have in establishing human civilization in space: 1.) by adding a space dimension to terrestrial art and 2.) by adding a cultural dimension to space development. The paper outlines the background of the project, documents its development and realization in space with an emphasis on these issues.

1.0 The Cosmic Dance

The *exploration of the sub-atomic world in the twentieth century has revealed the intrinsically dynamic nature of matter It has shown that the constituents of atoms, the sub-atomic particles, are dynamic patterns which do not exist as isolated entities, but as integral parts of an inseparable network of interactions. These interactions involve a ceaseless flow of energy which give rise to the stable structures of the material world, which do not remain static, but oscillate in rhythmic movements. The whole universe is engaged in endless motion and activity: in a continual cosmic dance of energy. The Eastern mystics have a dynamic view of the universe similar to that of modern physics. They, too, have used the image of the dance to convey their intuition of the Universe. The dance of Shiva, the Hindu god of creation is the dancing universe symbolizing the cosmic cycles of creation and destruction and the daily rhythm of birth and death. "(Capra, 1975)*

"Present day developments in cosmology suggest rather insistently that everyday conditions could not persist but for the distant parts of the Universe, that all of our ideas of space and geometry would become entirely invalid if the distant parts of the Universe were taken away. Our everyday experience down to the smallest details seems to be so closely integrated to the grand-scale features of the Universe that it is well-nigh impossible to contemplate the two being separate." (Hoyle, 1955)

2.0 Gravity and the Art of Sculpture

Gravity is a very powerful force in the Universe. As a terrestrial environmental factor this cosmic force, the "gravity constant", is hardly considered as essential to the creation of art, yet it has profoundly influenced and determined both the conception and the perception of sculpture since its beginnings. Because they are created in a terrestrial civilization, all sculptures have a "resting point" - a point of contact in which their mass interacts with the gravity of the Earth. Sometimes sculptures are fixed to a base so that their appearance seems natural in our gravity dominated environment. Others stand, rest or are fixed to some supporting structure. Even "balloon" or air-filled sculptures that may float in the air are positioned by the forces of gravity.

Consciously or unconsciously, artists conceive and carry out their sculptural creations with the gravity constant determining the eventual resting point of the work, and, by so doing, they pre-determine how the sculpture will

eventually be perceived and appreciated by the public. This gravity constant has much to do with our perception and appreciation of sculpture - as our response to its aesthetic "lightness" is based on our own experiences in our terrestrial environment.

When imagining human civilization extended into outer space, it is obvious that the art of this civilization will take advantage of its new environment. The qualities specific to this environment will have a fundamental effect on both the conception and perception of the artworks in it - much like the gravity constant has had on the evolution of terrestrial art. In the zero-gravity (zero-G) environment of outer space, the gravity constant disappears - sculptures become weightless. As a consequence, the conception, perception and appreciation of an artwork will be altered in such an environment. A sculpture floating in a zero-G environment could be viewed from an infinite number of perspectives or angles.

3.0 The Cosmic Content in the Art of Arthur Woods

Since 1977, Woods has been making art inspired by a description of the Universe found in both Eastern religion and in modern physics research. This has led him to produce a variety of art forms, mostly paintings and sculptures, that have attempted to express this information in both subject matter and through artistic technique. The subject matter has ranged from geometric and symbolic abstraction to his current form of hyper-realism with terrestrial landscapes and the Earth as seen from space as the main themes. The artistic technique for these artworks has consisted of using points of colour as their basic visual element -thus becoming a painterly metaphor for all the material making up the Universe. Subsequently, all of the works executed in this period have been characterized by some variation of this pointillistic technique.

In 1981, Woods commenced a series of sculptures called the «Cosmic Dancers» that are characterized by their twisted geometric shapes and by their surface finish which are painted as mentioned above. The geometric form of these sculptures enabled them to be positioned in different ways. This aspect allowed the sculptures to be viewed from different perspectives and, in relation to their surroundings, the same sculpture could appear to be a unique three dimensional form as a result of its varied positions. Depending on the complexity of the sculpture, usually between four and eight resting positions could be found for each sculpture, the "gravity constant" being the ultimate determining factor (Fig. 1).

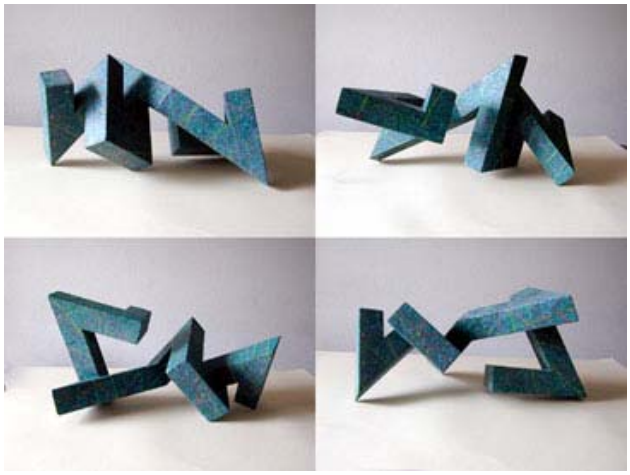

Figure 1.
Four resting positions of the same sculpture.

In 1984, Woods began to consider and develop concepts for artworks specific to the space environment. The first of these was the OURS - the Orbiting Unification Ring Satellite proposed for the year 2000. This sculpture was designed to have a diameter of approx. 1 km and should have been visible to much of the world's population as a "circle in the sky" symbolizing planetary unity (Woods, 1987). A later project, the OUR - Space Peace Sculpture was proposed as a space art event to be realized during the International Space Year (ISY). Designed to be a symbolic celebration of international cooperation in space and a call for world peace, a 6 m in diameter sculpture in the form of the astronomical symbol of the Earth was developed and a test model was constructed. This sculpture was to have been deployed from the Mir space station with its deployment televised to Earth. (Woods and Bernasconi, 1989; Woods and Bernasconi, 1990)

4.0 A «Cosmic Dancer» in Space

Building on the experience gained in the development of the above space art projects, Woods decided to further develop the «Cosmic Dancer» sculpture series by introducing one of these sculptures into the weightless environment of space. By freeing a sculpture of the gravity constant, it would be possible for the sculpture to be viewed from an infinite number of perspectives. Furthermore, such an activity could also investigate: how human beings living and working in space would react to having such an artwork share their environment, how a sculpture would react in a pressurized and weightless environment, and how the project would be evaluated in the context of other human activities in space.

The first step to the realization of this project was to describe the project in its context to the history of sculpture and to outline a development plan for its realization. This was done in the form of a paper called *"The Cosmic Dancer - Sculpture and the Absence of Gravity"* that was presented at the 1st European Space Art Symposium held in Montreux, Switzerland in March 1992. (Woods, 1992) For the objectives to be achieved, it was deemed that a crewed environment would be necessary, thus a proposal was formulated to launch a «Cosmic Dancer» sculpture into space utilizing either the U. S. space shuttle or the Russian Mir station.

In September, 1992 a proposal to take a «Cosmic Dancer» into space aboard the Space Shuttle was sent to the authorities at the National Aeronautics and Space Administration (NASA). NASA officials responded that there was no current program for "non-scientific payloads" to fly on the orbiter. Simultaneously, a proposal to launch a «Cosmic Dancer» sculpture to the Russian Mir station was submitted to NPO Energia via their joint partner in Germany - Kayser-Threde GmbH of Munich.

In September 1992, an offer to launch a «Cosmic Dancer» to the Mir station was made by Kayser-Threde GmbH. Subsequently, in November a "Letter of Intent" was signed and negotiations for the launch date and the determination of the technical specifications commenced. In December, a contract between the OURS Foundation and Kayser-Threde GmbH was signed to launch the sculpture to the Mir station on a Progress supply vehicle with launch opportunities in March or May of 1993.

5.0 Technical Specifications and Launch Preparations

For its integration in the Mir station a «Cosmic Dancer» sculpture would have to be both compact and lightweight. A weight limit of 1 kg and approximate dimensions of 35 x 35 x 40 cm were agreed to. Several prototype sculptures were constructed by Woods out of wood to these dimensions and painted in his colour spot technique. One of these prototype sculptures was delivered to NPO Energia for cosmonaut training purposes in December 1992. A training exercise with the sculpture was conducted by cosmonauts Gennadi Manakow and Alexander Polishchuk at the Mir station mock-up located at the cosmonaut training facility at Star City, Russia. These cosmonauts simulated the «Cosmic Dancer» in the Mir station by spinning the sculpture that was suspended with a nylon monofilament line from the ceiling. A video recording and photographs of this exercise were made and delivered in January, 1993 (Fig. 2). These two cosmonauts were launched to the Mir station in January for a six-month tour of duty.

Figure 2.
Cosmonauts A. Polischuk and G. Manakov shown training with a
model of the «Cosmic Dancer» in the Mir mock-up facility at Star City, Russia

Standard water-based acrylic polymer artists' paints were proposed for the surface finish. The paint to be used had to satisfy toxic out-gassing standards for the Mir environment and samples of each colour were sent to NPO Energia for testing and these were subsequently approved (Lascaux Studio Acrylic Paints). In addition, the sculpture would have to be sterilized by submersion in an alcohol solution prior to launch. As acrylic paint reacts negatively to alcohol, a suitable varnish that could support the sterilization procedure and not affect the acrylic paint had to be utilized. A two-component epoxy varnish was found that satisfied this requirement.

To minimize flammability and to ensure structural stability during the launch phase, hollow 40 mm square aluminum tubing with a wall thickness of 2 mm was chosen as a material and a contractor was selected for its construction. The material was cut to the exact dimensions of the wooden prototype sculpture. To meet the weight requirements of 1 kg, the aluminum tubes had to be reduced by 20% of their original thickness. This was done by magnetic sanding all sides of the tubes in the necessary manner: The pieces were then assembled by welding.

The colour scheme selected for the flight sculpture was based on the following criteria: (1) The sculpture had to have sufficient contrast with the Mir environment in order to insure that good images could be obtained on film and video and, (2) it should offer an "aesthetic" contribution to the cosmonauts living quarters. With these two considerations as a guide, a dominant green colour scheme for the flight sculpture was chosen. This decision was reached after viewing photographs and video tapes of the Mir station interior which indicated a somewhat drab, technical environment crowded and cluttered with equipment, tubes and cables. In contrast, from the view portals, the cosmonauts could observe the blackness of space and the blue and white of the Earth. Green was also considered because of its association with terrestrial plants and the psychologically calming effects that associations with nature are reported to induce. In the photographs of the Mir interior made available by NPO Energia, there appeared to be very little of this colour in its brighter intensities in the Mir station environment.

Figure 3.
Preparing the «Cosmic Dancer» for spaceflight at the Kayser-Threde GmbH Facilities in Munich, Germany.

The flight sculpture was thus painted in this colour scheme, finished with the approved epoxy varnish and delivered to Kayser-Threde in March, 1993. Kayser-Threde carried out the sterilization procedures, dried the sculpture in an exhaust oven and vacuum-packed it for delivery to NPO Energia (Fig. 3). NPO Energia was responsible for the construction of a packing system necessary for its integration into the Progress launch vehicle.

6.0 Evaluation and Documentation of the «Cosmic Dancer» on the Mir Station

The cosmonauts were instructed to make a photographic and video documentation of the «Cosmic Dancer» in the Mir station. Live television images of the sculpture were planned to be broadcast to the mission control center in Moscow. To ascertain the cosmonaut's reaction to having the «Cosmic Dancer» sculpture in their environment a questionnaire was prepared, translated into Russian and delivered with the sculpture to the Mir station. The questionnaire and the original video and photographic material was scheduled to be returned to with the cosmonauts in July 1993.

<u>Questions for the Cosmonaut Crew.</u>

1. Name: (optional)
2. What is your professional background?

3. Have you studied art? Are you interested in art?
4. What is your reaction to having the «Cosmic Dancer» sculpture in the Mir station?
5. How does this free floating sculpture react within the pressurized and weightless environment, especially in terms of the effects of spacecraft movement and airflow? Does it remain stationary or does it move about without assistance? Should it be attached?
6. What are the positioning characteristics of the sculpture in weightlessness? Does the sculpture find it own "best" position?
7. Are there any "problems" associated with having the «Cosmic Dancer» sculpture freely float in the crew quarters?
8. What was your reaction to the choice of colour?
9. Did viewing the sculpture from all possible perspectives have any significance for you?
10. In your opinion, what would be the best music to accompany the «Cosmic Dancer»sculpture in space?
11. Will you be available for further questioning after your return to Earth?

At the time of this writing, the answers to this questionnaire have not yet been received by the OURS Foundation, but will be included in a later updated version.

7.0 Launch of the «Cosmic Dancer» Sculpture: May 22. 1993

Officials from NPO Energia prepared the Cosmic Dancer sculpture for spaceflight by attaching it to a specially manufactured aluminum base-plate and placing it into a sack. This package was integrated into the faring of a Progress rocket at the Baikonur Cosmodrome in Kazakhstan. On May 22, at 10:43 a.m. (Moscow time), the Progress rocket was launched to the Mir space station where the capsule carrying the «Cosmic Dancer» sculpture, supplies and other equipment arrived two days later.

On June 2, the «Cosmic Dancer» sculpture was unpacked by cosmonaut Manakov and allowed to freely float in weightlessness for the first time inside the Progress capsule. Manakov then transported the sculpture by pushing it in front of him throughout the various working compartments of the Mir station allowing the sculpture to spin and float in a variety of ways (Fig.4). The cosmonauts also seemed to have become "inspired" by the dancing sculpture and mimicked its spinning actions. The cosmonauts examined different methods of attaching the «Cosmic Dancer» sculpture to the wall when it was not freely floating. A session was conducted with a globe of water (approximately 2 dl) floating next to the sculpture. An attempt was made to film the sculpture in front of a portal showing the Earth in the background. The sculpture was also filmed in the spacesuit storage compartment.

Figure 4.
Four photos of the «Cosmic Dancer» inside the Mir space station in Earth orbit.

Floating and spinning freely in weightlessness, the «Cosmic Dancer» sculpture "danced" its own dance in the cosmos. This enabled the sculpture to be seen and appreciated from an infinite number of perspectives.

Cosmonaut Polishchuk made photographs and filmed these activities with a Sony BETACAM camera. A total of 26 photographs, 9 color slides and a 28 minute video film were made. A 12 minute video transmission was

broadcast from the Mir station to the ground control center in June. A video copy of this transmission was delivered to the artist in July.

In July, two new Russian cosmonauts, Vasily Tsibliyev and Aleksander Serebrov and the French cosmonaut Jean Pierre Haignere were launched to the Mir station. During a live TV. interview between Haignere and the Prime Minister of France which was broadcast on French national television, the «Cosmic Dancer» could be seen installed in the background. On July 22, cosmonauts Polishchuk, Manakov and Haignere returned to Earth. The photographic and video documentation was brought back with them and delivered to the OURS Foundation in September, 1993. At the time of this writing the «Cosmic Dancer» sculpture is still on the Mir station.

8.0 Project Costs and Financing

As mentioned earlier, in September 1992, Kayser-Threde GmbH offered to arrange the spaceflight of the «Cosmic Dancer» sculpture to Mir station and a "Letter of Intent" was signed. The cost of this service including the launch, testing, the filming of the sculpture on the Mir and the return of this documentation to Earth was set at 150,000 DM (US $100,000).

With the earliest launch opportunity less than four months away, the OURS Foundation began an intensive search for a corporate sponsor to offset these costs. Potential corporate sponsors were contacted directly by the foundation as were several Public Relations agencies. Though some serious interest in the project was found, in the end, sponsorship did not materialize.

From this experience, it was determined that the slow economic situation, the short lead time and the basic cost of the project were major obstacles to obtaining sponsor support. In discussions with various Public Relations agencies, the authors also discovered that, even though no art project of this nature had ever before occurred, "space" itself was no longer generally perceived of as an interesting means of corporate communication (at least to the *P*. R. agencies).

From some of the interested potential sponsors that the authors contacted directly, there was also found to be a tendency for them to suggest alterations to the project in order for the «Cosmic Dancer» sculpture to become a more direct publicity item associated with a company name or product rather than their corporate image. For the authors, this situation had the potential of compromising of the artwork, the project s content and its eventual perception by the public. Therefore, the sponsoring approach was canceled and a more traditional approach to funding the project was initiated.

This approach entailed the creation by Woods of a "limited edition" of the «Cosmic Dancer» sculpture and marketing this edition to space enthusiasts and art collectors. The same metal working firm that built the flight sculpture was commissioned to assemble 99 versions of the «Cosmic Dancer». These sculptures were the same size as the flight sculpture and were painted by Woods in his pointillistic technique with each sculpture being finished in a different color scheme. Thus each one of the 99 versions of the «Cosmic Dancer» sculpture is a unique and original artwork.

These sculptures were then offered to the public through various art galleries and through advertisements in the print media. The video film and documentation of the project are included with each sculpture. The sculptures were made available through the OURS Foundation at US $2,950 each. The documentation materials were also offered separately.

These production and marketing costs for the limited edition of the «Cosmic Dancer» sculpture are estimated to add another 50,000 DM to the project costs bringing the total to approximately 200,000 DM or US $133,000.

9.0 Publicity

The signing of the contract for the spaceflight of the «Cosmic Dancer» sculpture in December 1992, resulted in more than 50 press articles before the sculpture was launched. Most of these articles appeared in the Swiss print media. Articles about the project also appeared in several space oriented journals. Swiss national television (DRS) reported the project in their evening news report on the day of the launch. *LEONARDO* - the journal of the Int. Society for the Arts, Sciences and Technology accepted the original paper about the project for publication in its August, 1993 issue.

Efforts to have a documentary produced about the project by either a private or public film company were not successful due to the short time-frame, the substantial costs and the difficulties of obtaining permission and visas, etc. in Russia and Kazakhstan. Likewise, efforts to have video footage of the launch and the later broadcast of the live transmission of the sculpture on the Mir station via Russian television also proved to be too difficult to arrange from Switzerland or through our contractor's office in Moscow. On the day of the launch, 80 press releases were faxed to newspapers and news services in Europe and the U S. -most of which had received previous information. Even though the «Cosmic Dancer» sculpture is one of the very few art objects ever launched into to space, one that is the personal creation of a private person, and the fact that this person is a U. S. citizen and the project took place on a Russian space station - all factors that the authors assumed would excite the interest of the media -almost no publicity about the project has resulted since the launch. The authors were particularly surprised that even though considerable effort was spent on informing the U. S. print and broadcast media, almost no report has appeared in the mainstream U. S. press.

Although the authors assume full responsibility for the quality, content and administration of the press relations activities and are willing to admit to certain lack of experience in this field, they were and still are somewhat perplexed at this situation. Neither the "space" press nor the "art" press has yet to actually embrace the project.

Compared with the press coverage between 1988 and 1990 associated with the OUR-SPS project which received much more media attention with the signing of the first agreement, the realization of the «Cosmic Dancer» project has gone almost unnoticed in the media. The authors attribute this current low reaction by the media to several factors. First, except for expensive failures or political initiatives, there appears to be a general disenchantment with space topics by the media. Indeed, one of the authors was told by a major U. S. television network that "space" was no longer considered to be particularly newsworthy. Secondly, there was not an established Public Relations or marketing agency handling the publicity. Third, as an artwork, the «Cosmic Dancer» sculpture was perceived by the art world to be outside the normal development of mainstream art and thus "anecdotal" to current art movements. This may have been due to the newness of this art concept. And lastly, the scale of the «Cosmic Dancer» project may not have been considered to be "spectacular" enough in terms of its impact on the public. This aspect will be commented on later.

However, when the project was reported, most journalists tried to give an in-depth report and generally placed the project in the context of space development. Indeed, several newspapers gave special attention to the discussion of the project bringing attention to the issue of the utilization of space resources for planetary purposes (Fig.5).

The effort to publicize the project with the original photographic and video materials is continuing. Besides making further press releases and writing articles, this will include the placement of advertisements in the art and space press.

Vision: Energie aus dem All

(hu) Die Verbindung von Arthur Woods zum Weltraum kommt nicht von ungefähr. Er ist in der Nähe des Kennedy Space Centers aufgewachsen und verfolgte die Entwicklung der Raumfahrt mit Interesse. 1985 lancierte er in der Schweiz ein erstes Weltraum-Kunstprojekt, den «Orbiting Unification Ring Satellite», dessen Anfangsbuchstaben auch der 1990 von Woods gegründeten «Ours Foundation» mit Sitz in Basel den Namen gab. Diese «Space Peace Sculpture» ist ein aufblasbarer Ring mit vier Speichen, der im Jahr 2000 im All schweben soll. Die Realisierung ist jedoch eine Frage der Finanzierung.

Hinter dem Ganzen steht die Philosophie, dass Raumfahrt nur dann sinnvoll ist, wenn sie neben dem wissenschaftlich-industriellen auch einen sozialen Aspekt hat. Etwa die visionäre Lösung des Energieproblems unter Zuhilfenahme des Weltraums. Wenn aber Menschen ins All vordringen und dort längere Zeit leben, so gehört auch unweigerlich die Kunst dazu als Teil des Lebens. Davon sind Weltraumexperte Marco C. Bernasconi von der Aerospace-Industrie und Mitglied der International Academy of Astronautics und der international anerkannte Pionier für Weltraumkunst Arthur Woods gleichermassen überzeugt.

Figure 5.
“Vision: Energy from Space” An excerpt from a press article about the project mentioning space resources (Der Landbote, 1993)

10. Public Response

Public response to the project has also been mixed. The question most often asked in exhibitions is: "Why does one put art in space?" The answer to this question usually provoked a discussion about "Why Space?" and the importance of continued space development for the future well being of humanity. The public was also somewhat awed by the costs of the project and the fact that the artist would be required to pay all of these costs. Most were amused by the fact that this project was possible to realize within the Russian space program and not possible to realize within NASA. A few people thought the idea was some kind of publicity "gag" or a way to make the artist famous.

On the other hand, most people were really fascinated by the discussion of the influence of gravity on the art of sculpture. Also, in each exhibition consisting of several versions of the «Cosmic Dancer» sculpture (5-20) many people assumed the sculptures were in fact completely different forms. When they realized they were looking at the same form resting or suspended in different positions an "a-ha" response occurred. Thus, also the terrestrial exhibition of the «Cosmic Dancer» sculpture showing its many variations and resting points stimulated viewers to consider all of the possible perspectives. Several buyers of the sculpture have installed their artwork by suspending it from a ceiling with a thin nylon line - giving an impression of the sculpture being suspended in weightlessness.

The reaction to the video of the sculpture has proved to be very positive. Most viewers tend to watch the complete 28 minute film. Some people expected the sculpture to be placed in free space (outside the Mir) and were disappointed to see it only inside a space station. Several people thought that weightlessness could be simulated on Earth.

To date, the project has been exhibited in six art galleries in Switzerland and approximately 25% of the limited edition «Cosmic Dancer» sculpture has been sold to art collectors.

11.0 The Fate of the «Cosmic Dancer» Sculpture

The fate of the «Cosmic Dancer» flight sculpture was deliberately left open in the contract negotiations. Four scenarios were discussed.

1. After a certain period of time aboard the Mir station the «Cosmic Dancer» sculpture would be placed into a used Progress capsule along with other refuse and jettisoned into the Earth's atmosphere where it would be incinerated.

2. The «Cosmic Dancer» sculpture would be returned to Earth in the Soyuz capsule with returning cosmonauts and other experiments. Due to the limited space available, the charges for this service are almost as much as for the launch.

3. The «Cosmic Dancer» sculpture would be returned by NASA during the March 1995 space shuttle rendezvous with the Mir station.

4. The «Cosmic Dancer» sculpture would be deployed in free space by a cosmonaut during a spacewalk and this deployment would be filmed on video. This option would most surely incur additional costs and would have to be examined in the light of the environmental impact of the deployment.

A fifth scenario would have the «Cosmic Dancer» sculpture become a permanent fixture on the Mir station. This option may also be subject to additional costs. At the time of this writing, no decision has been taken.

The authors would like to see the flight sculpture be returned to Earth and be placed in a public museum. Option 3, if it could be arranged, would satisfy this wish. In the new climate of potential cooperation in outer space by the two former adversaries - Russia and the U. S., having the «Cosmic Dancer» sculpture returned on the space shuttle would bestow a symbolic value on this artwork. Politics will follow where art has gone before. If realized, this act would relate to and fulfill some of the objectives of the other OURS space art projects - the OUR - Space Peace Sculpture and the Orbiting Unification Ring Satellite.

12.0 «Cosmic Dancer II»

The realization of the «Cosmic Dancer» project described in this paper refers to the "Small-Scale Weightless Experiment" that was proposed in the original paper (Woods, 1992). Also mentioned in that paper was a "Large-Scale Free-Flight Experiment" which consisted of an inflatable «Cosmic Dancer» sculpture that would be deployed in space independently. This sculpture is now referred to as: «Cosmic Dancer II».

«Cosmic Dancer II» would be constructed out of reflective materials such as Mylar, Kapton and Kevlar and would be deployed by inflation directly into the space environment (Fig. 6). The sculpture would weigh less than 75 kg yet would measure up to 30 m in its largest dimension. If deployed in Low Earth Orbit (LEO) from the Mir station or the space shuttle, its presence in the space environment could also be recorded on video.

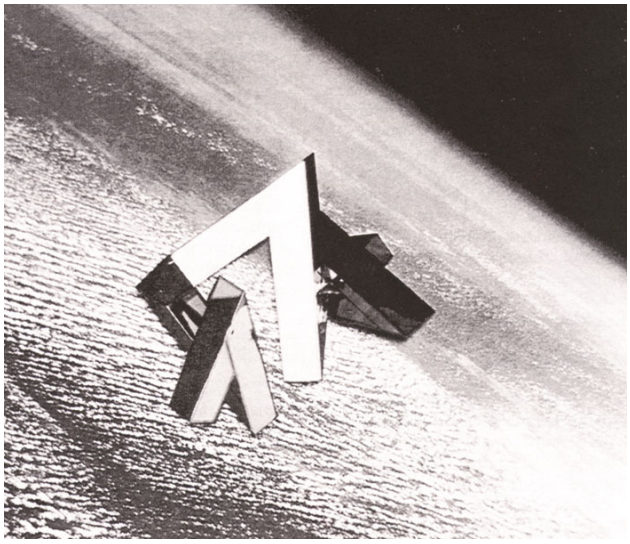

Figure 6.
«Cosmic Dancer II»

Due to its reflective qualities, «Cosmic Dancer II» would be visible to most people on Earth as a blinking star as it orbited the planet. At the orbital altitude associated with the above spacecraft, «Cosmic Dancer II» would de-orbit in a matter of days. It would also be possible to launch «Cosmic Dancer II» on an expendable launcher to a higher orbit where it would remain for a longer period of time.

The cost of constructing and space-qualifying «Cosmic Dancer II» by an aerospace firm is estimated to range from $2-5 million. Deployment from the US space shuttle could cost approx. $1 million utilizing NASA's CAP (Complex Autonomous Payload) program. The cost of deployment from the Mir station is considered to be less. A piggy-back launch and deployment from the Ariane launcher is estimated to cost $250,000.

The feasibility of this project rests with the ability to have it financed. Like the small-scale experiment this would be done initially through the sale of project related artworks and, due to the higher costs involved, perhaps some form of corporate sponsorship will be solicited. The main obstacle however, is to find the necessary interest, cooperation and support from the launching agencies. Without this cooperation, it would be difficult to realize such an artwork in the space environment even if the funding was available.

The small-scale experiment has created a precedent for such cooperation which, hopefully, will lead to the realization of the large-scale experiment and/or to similar art-in-space projects. As «Cosmic Dancer II» would be visible to most of the world's population, it should easily qualify as "spectacular" and be the subject of much controversy and subsequent interest. Its realization could take place as soon as 1996.

13.0 Conclusion: Linking the «Cosmic Dancer » Sculpture to the Future of Space Development

"Visual artists and writers have created fictional images and scenarios on the development of space. Such visions are the primary way that the general public is introduced to ideas about space exploration. Artists and writers, in

fact, lay the foundation which makes future space activities understandable by the general public and thus secures the necessary political support." (Anon., 1993)

After more than nine years of intense work pursuing the “Art-in-Space” concept, the authors have derived much satisfaction seeing the «Cosmic Dancer» sculpture actually dance in the weightless environment of the Mir space station. There appears to be a very aesthetic quality to its movements in weightlessness. The motions seem elegant, unhurried and very "ballet-like". The significance of this characteristic deserves more research.

The impact on terrestrial art of having a sculpture freed of the "gravity constant" for the first time remains to be seen. The importance of gravity on the development of the art of sculpture, found to be significant by the authors, has probably never been discussed or professionally considered in mainstream art circles. Yet, having once seen the «Cosmic Dancer» sculpture floating in weightlessness, any sculptor (or museum curator) who must artificially suspend a three-dimensional artwork from a ceiling or other support, will surely reflect on this quality. To be able to view a three-dimensional artwork from all possible perspectives in a continuous changing manner is something to be savored.

Whether the «Cosmic Dancer» sculpture will be considered an anecdote or a significant development to the art of sculpture will ultimately depend on humanity's comprehension of the importance that continued space exploration and exploitation will have on its future. However, the authors are convinced of this importance and, in an era of declining support for further space development, have undertaken other activities to make what we have called: *The Space Option* known to a broader public. (Bernasconi and Woods, 1993) The «Cosmic Dancer» project fits within this plan and has provided a new forum for such public discussion.

Thus, the authors hope that the «Cosmic Dancer» sculpture will be perceived and understood from a variety of perspectives other than its physical ones. These include: its relationship to humanity's present understanding of the micro and macro cosmos; its incorporation of gravity - the most powerful force in the Universe, adding a space dimension to terrestrial art, and perhaps most importantly, as a cultural artifact associated with the eventual evolution of the human race into a spacefaring species.

The «Cosmic Dancer» sculpture is the first space artwork to be specifically conceived and officially realized for a human audience - in the space environment. Hopefully it will not be the last.

14..0 Acknowledgments

The authors would like to acknowledge the vision, patience and support of Reiner Klett, Gerd Braunig and especially that of Claudia Kessler at Kayser-Threde GmbH in Munich, without which the «Cosmic Dancer» sculpture would never have gotten off the ground.

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