G-38, G-39 AND G-40
ART IN SPACE – A DIVERGENT EXPLORATION

Joseph W. McShane
Sculptor/Payload Manager
Marshall-McShane, Prescott, Arizona

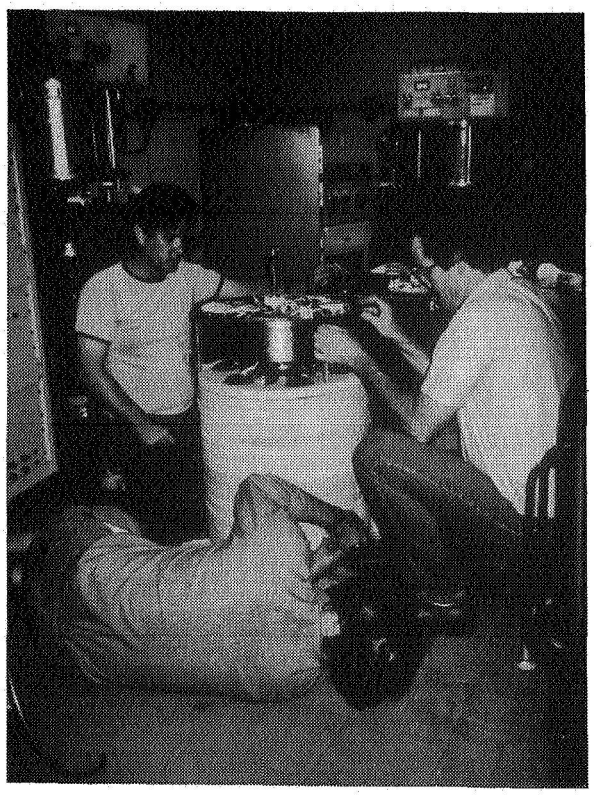
A report on: (1) The results of GAS Arts-Science payload G-38, processed in orbit on board the Space Shuttle Challenger during mission 41-G STS 17, October 5 to 13, 1984. (2) An overview of future GAS payloads G-39 and G-40.

"The most beautiful experience we can have is the mysterious.
It is the fundamental emotion which stands at the cradle
of true art and true science." Albert Einstein

Payload G-38 generates a new definition of space art, as art created in and about space. The artist can now use the tools and processes of space technology to participate in and comment on man's adventure in space. G-38 was created as a unified Arts-Science payload that simultaneously explored the process of vapor deposition in the vacuum and weightlessness of the shuttle environment and created a series of space sculptures utilizing this process; seeking to experience the mysteries of space.*

The methods and results of G-38 supply useful data for simplified coatings of large antennae, heat shields, solar collectors and optical mirrors in space; where size is not limited to the confines of a vacuum chamber.

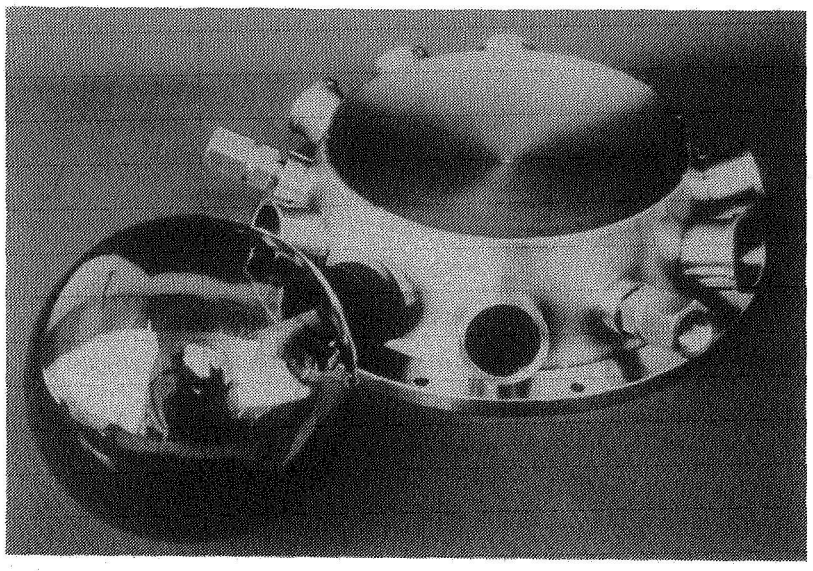
* For more specific information on vapor deposition and the operation of payload G-38, please refer to "G-38, 39 and 40/An Artist's Exploration of Space", 1984 Get Away Special Experimenter's Symposium Handbook, NASA C.P. 2324.



The final assembly of G-38, showing stainless steel control housing and expanded polyimide foam support structure encasing glass spheres.

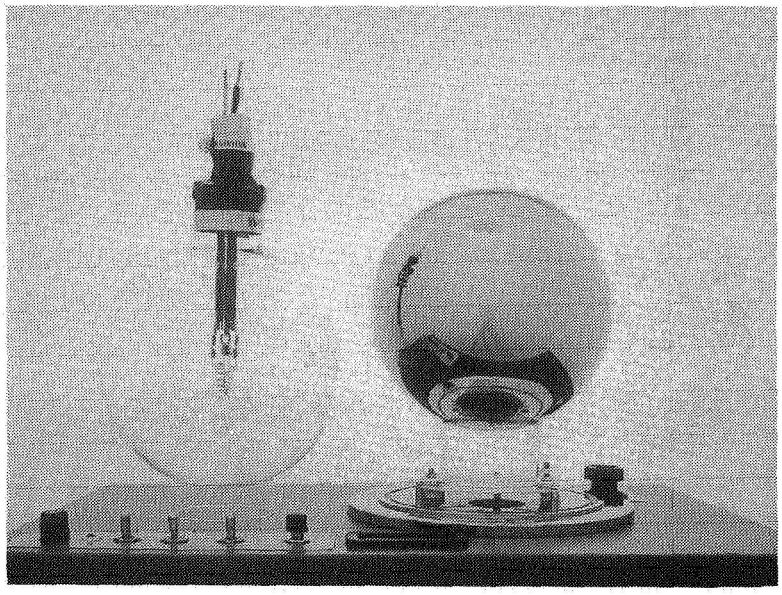
Two separate and distinctly different thin film deposition processes were used in G-38. First, a sputter deposition process was performed on the interiors of five 500ml glass spheres. By accelerating positively charged argon ions into the surface of a negatively charged metal target mounted in the center of each sphere, target molecules were ejected by the impact of the argon ions and formed a coating on the inside of each sphere over a period of hours.

The purpose of the experiment was to test the sputter deposition process in space and to create five subtle spherical sculptures with metallic coatings of gold, silver, platinum and chrome. These five experiments all functioned in the expected manner but did not create coatings as dense as anticipated. This was traced to apparent arching in the vacuum manifold during the ionization process, which limited the charge being transmitted to the target. Thus, sculptures that were intended to have metal coatings applied in space ranging from opaque to semitransparent, returned with all semitransparent coatings instead; an unexpected but not unpleasing result.



Partially coated sputter deposition sphere with target, mounted on the vacuum manifold of payload G-38.

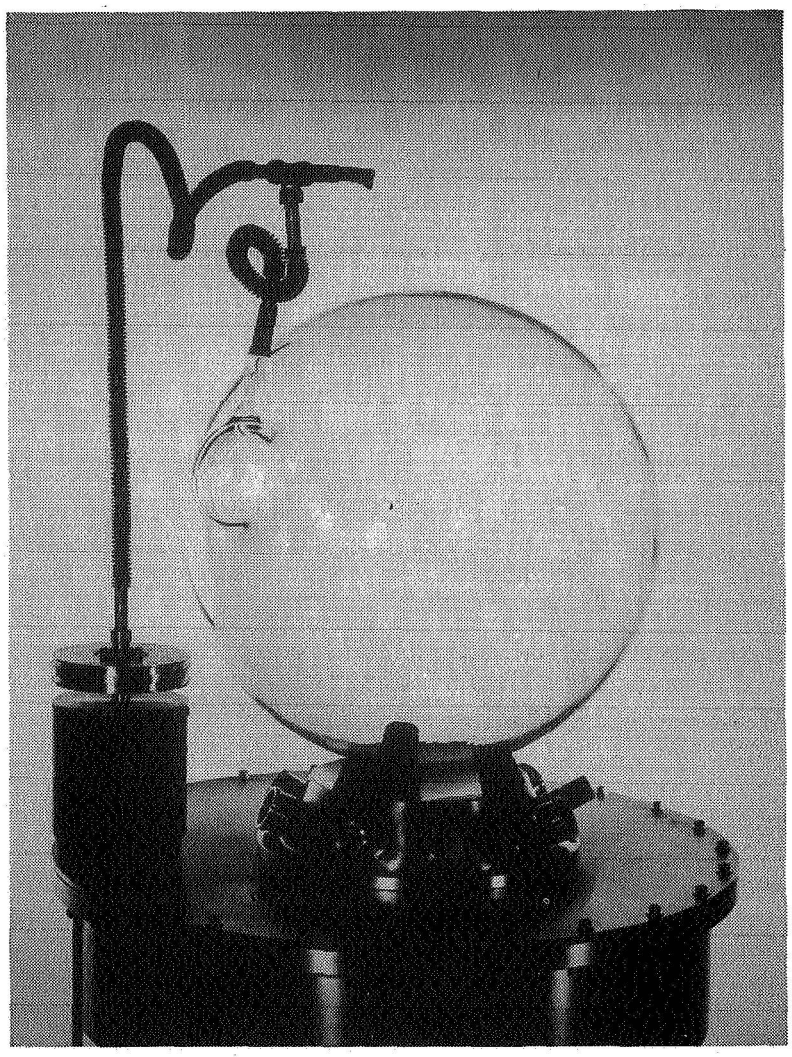
The second deposition process used was the more widely known vapor deposition, where a tungsten filament, coated or wrapped with a metal, is heated in a vacuum, causing the metal to vaporize, instantly covering the substrate of the object being coated. This process was performed inside of three 3,000ml glass spheres.



Uncoated sphere and filament in pre-evaporation configuration and completed sculpture with gold deposition.

The three vapor deposition experiments performed as expected, creating two sculptures with very clean opaque coatings of gold and aluminum and one sculpture with a coating deposited from a two stage filament coated with aluminum and silicon monoxide, creating an iredescent effect.

The ninth and largest sphere (22,000ml) served as a sampling system, allowing the measurement of the working vacuum when the payload returned to earth. This sphere was connected to space via a high vacuum valve. Over a three day period the interior of the sphere attained an equilibrium with the vacuum of the shuttle orbit, becoming one with the vacuum of space. A copper tube connecting the sphere to the valve was cold welded, permanently sealing the sphere, creating the sculpture "S.P.A.C.E.". Attached to the sphere is a Baratron capasitance manometer, a vacuum gauge capable of a digital reading of the vacuum forming the sculpture inside the sphere.

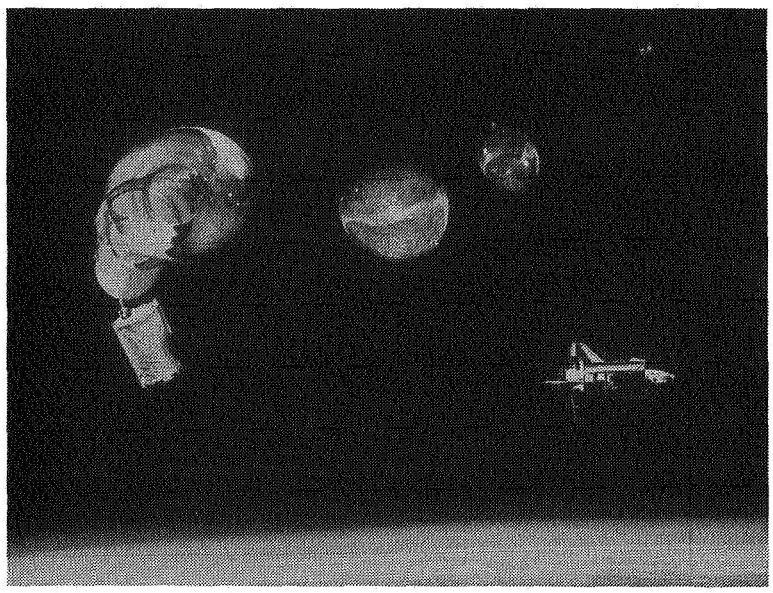


The sculpture "S.P.A.C.E.", with sphere and attached capasitance manometer.

The sculpture "S.P.A.C.E." is not the glass, but the outer space contained within. The sphere serves only to keep the one-g earth atmosphere from

intruding on the space within, creating an anomaly of our common experience; a sculpture to observe and stimulate wonder about the nature and meaning of space, a sculpture to touch and know that only an 1/8" of glass separates one from space.

Payload 3-39 will explore space with sculptural concepts, creating art on a scale not previously accessible; using materials and processes in a way specific to, and possible, only, in the vacuum and weightlessness of the shuttle orbit. Two separate methods of forming structure in space with inflated objects are being considered for payload G-39. One method will use thin polyimide films coated by vapor deposition with a reflective aluminum coating and ejected from the shuttle and inflated in orbit. A series of inflated aluminized shapes have been created and tested on earth for use as structure in space. When used in Space Art exhibitions this past year these forms have been filled with helium so they float. To draw attention to the Get Away Special program, they have, in addition to their reference as Space Sculptures, been referred to as "GAS" Sculptures. The second method would be a continuing exploration of the technology created and being developed by Gilbert Moore for the formation of inflated polymer bubbles in space as structure. This would allow the continuation in space of a series of bubble sculptures that I have blown for years on earth and for the eventual metallic coating of these forms in space, utilizing vapor deposition processes explored and developed in payload G-38.



Moore Stars in Space

Photo collage depicting the inflation of bubbles in orbit. Titled in honor of the creator of the space bubble process.

As sculpture either process is intended to create a subtle reordering of our sense of scale and place; the sculpture being not the objects themselves, but conceptually the 30,000 mile circumference of the orbit they travel, creating a sculpture on a scale not achievable on earth. The earth will form the center of this art work and instead of our walking around a sculpture resting on a base, the sculpture will orbit around us and we will exist inside of it and look out at it. G-39 is intended as a peaceful celebration of man's venture into space; an art work possessed by no one and equally accessible to all.

G-40, like the other payloads, is designed to prompt viewers to toss out old definitions of space and distance and to permit terrestrial observers to experience space in as direct a way as possible. The purpose of this experiment is to test new concepts of signal transmission and directional stabilization for orbiting transmitters.

The transmitter, designed for ejection from a GAS canister, will be activated in orbit and transmit signals to a series of ground based receiving sculptures. These receivers, located at selected sites around the earth, will establish a symbiotic relationship with the transmitter. The receivers simultaneously monitor the signal from the satellite and serve as objects that permit the viewer to experience the passing of the satellite and the nature of its orbit. As the transmitting satellite/sculpture comes into range of a receiving sculpture, the viewer will see the receiving sculpture slowly come to life with light and sound. This observable change in the status of the receiver will increase in intensity as the satellite approaches the receiver, reaching a crescendo at the moment the satellite is closest to the receiver and then diminishing until the satellite is out of range. Like the sensation experienced when observing a train passing in the night, the viewer will experience the passing of the satellite through the phase change in the receiving sculpture; similar to the observation of a Doppler effect as an object moves toward or away from the earth in space. A few minutes after the signal diminishes from a receiving sculpture in New York, the phenomenon will be experienced by the viewers of a receiving sculpture outside the

Beaubourg in Paris, and so on around the earth in correlation with the satellite's orbit, connecting observers around the earth in a common experience; a traveling exhibition about spatial relationships that circumnavigates the earth every 90 minutes.

During this past year I participated in a Space Art show in Paris with two French artists, Pierre Comte and Jean Marc Philippe, both preparing art payloads for flight on board the European space rocket. I would hope that they, Joe Davis (also preparing a GAS payload) and others will soon join in the creation of art in space; a new and humanistic perspective seeking understanding of man's journey.

"Science explains the world,
but only art can reconcile us to it."
Stanislaw Lem

In conclusion I would like to express my appreciation to everyone involved with the GAS program that I have worked with during the past eight years. All have provided invaluable assistance.