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# DESIGN AND ANALYSIS OF MEMBRANE BASED PARABOLIC SPACE REFLECTOR

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**ABSTRACT**

In this paper, we first present a brief update on a model of a parabolic reflector which is easy to comprehend and simple to implement. This model simulation related to Gossamer Spacecraft. A membrane based inflatable parabolic reflector is a reflective surface used to collect or project energy such as light, sound or radio waves. It has high directivity. It transforms an incoming plane wave travelling along the axis into a spherical wave converging towards the focus.

There are two types of reflectors dominate for satellite:-

- Rigid single piece Reflector (RF can'tpass)
- Deployable mesh Reflector or Canopy (RF can pass of 3.2 to 3.4 GHzfrequency)

The inflatable reflector is used for telescope, micro strip antennas, reflector antenna, array antenna, space based solar power collection, solar cell etc.

We make a reflector which is a sculpture constructed of a lightweight material. It is supported by the inflatable tours and strut. The torus opens and releases the sculpture membrane reflector which self inflates like a balloon. Sunlight reflects on to the sculpture and concentrates the sunlight on to the solar panel.

The mechanism and construction of such a model is explained with all the necessary details which are not explicit reported before. This model is applied in investigating the Gossamer spacecraft reflector. The parabolic reflector model is simulated and this result is discussed with reference to other reports in the literature.

Test show these inflatable reflectors to provide significantly higher gain characteristics as compared to conventional antennas. This would lead to much higher data rates from low earth orbits and would provide enabling communication capabilities for small satellites in deeper space. This technology is critical to lowering costs of small satellites while enhancing their capabilities.

Principle design challenges with inflatable membranes are maintaining accurate desired shape, reliable deployment mechanism and outer space environment protection. The present work tackles each of the mentioned challenges and provides an understanding towards future work. In the course of our experimentation, we have been able to address these challenges using building techniques that use a simple mechanism for inflation. To improve the reliability of the inflated shape, we use UV radiation hardened polymer support structures. The novelty of the design lies in its simplicity, low cost and high reliability. The design and development work provides an understanding towards extending these concepts to much larger deployable structure such as solar cells, inflatable truss structures for orbit servicing and large surface area inflatable for deceleration from hypersonic speeds when re-entering the atmosphere.

**Keywords:** Parabolic reflector, membrane shape, material property, finite element, frequency control