The scientific satellite "HALCA", equipped with a 8 m diameter precision deployable antenna, is now in the earth orbit and is operating as an orbiting radio-telescope. The satellite has a dual purpose. It is the experimental satellite dedicated to the research and development of high precision large deployable antennas. It is also the first astronomical satellite dedicated to Very Long Baseline Interferometry (VLBI). The antenna design is based on the concept of tension truss antenna to meet with the requirement of VLBI mission, such that it can be used within the frequency range of 1.60-1.73GHz, 4.7-5.0GHz and 22.0-22.3GHz. The successful observations obtained by the VLBI space observatory program have proved the excellent performance of the antenna. This is one of the milestones of large space structure technology. Figure 1 shows the tension truss antenna deployed on the ground before the packaging.

As far as the theoretical concept is concerned, it is observed that some of the recent proposals for large deployable antenna structures belong to the family of the tension truss antennas invented almost 12 years ago. It seems timely to revisit the original concept and review it from a different viewpoint. This is the purpose of this paper.
The paraboloid of revolution, used as the geometric surface of the reflector, is a surface of positive Gaussian curvature. The Gaussian curvature is defined by the product of the principal curvatures $1/r_1$ and $1/r_2$ as $K = 1/r_1 \times 1/r_2$. However, an idealized membrane supported by an arbitrary closed boundary, its shape should constitute a minimal surface described by the equation, $H = (1/r_1 + 1/r_2)/2 = 0$. Therefore, the principal curvatures must have different signs at any point of the membrane surface, that is, the surface is convex in one direction and concave in the other. It means that the Gaussian curvature is negative. If the reflector surface is composed of a number of facets supported along their boundaries, on the parabolic surface, the facet shape forms a surface of negative Gaussian curvature. No membrane structure can escape from this strict constraint unless it is pressurized.

To avoid this inherent difficulty, Fichter proposed a method of changing the boundary shape so that the total rms accuracy may be improved [5]. He showed that if the boundary geometry of the facets is optimized the rms error for the case of equilateral triangular facets is

$$\delta_{rms} = 0.0138\lambda^2 / \rho$$

where $\lambda$ is the edge length of the triangular facet, $\rho$ is the radius of curvature of a sphere simulating the paraboloid of revolution. This gives an improvement of about 55% in comparison with the standard best fit triangular facet. However, the use of curved edge membrane supports would be likely to introduce additional difficulties in the design and fabrication as well as packaging of the reflector.