INFLATABLE SPACE STRUCTURES COME OF AGE

Can You Imagine . . .

. . . an inflatable space antenna that is 100 times cheaper than an equivalent mechanically deployed system.

Upon reaching orbit, satellites typically use complex mechanical systems to unfold large communications antennas stowed onboard. Unfortunately, these bulky systems increase the cost and mass of satellites. Also, if rocket launch vibrations exceed upper limits, the antennas could become damaged so that they cannot be fully deployed. L'Garde, Inc. (Tustin, CA), addressed these problems using BMDO-funded technology that inflates structures like a balloon.

L'Garde pioneered the use of inflatable space structures, which can reduce the cost and mass of future spacecraft. This inflatable technology is 10 to 100 times less expensive than mechanically deployed systems, because of its much smaller mass and stowed volume. Also, because an inflatable structure incorporates no moving parts, excessive launch vibrations may not damage it.

The company tested its most complex and precise inflatable space structure in an experiment carried onboard the space shuttle *Endeavor*. L'Garde built the inflatable antenna experiment (IAE) under a $9-million contract from NASA's In-Space Technology Experiment Program. Goddard Space Flight Center integrated IAE into its Spartan 207 spacecraft. *Endeavor*'s astronauts used a robotic arm to release Spartan into free flight, which set the stage for deploying the IAE.

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The IAE achieved its proper configuration, and pictures taken from *Endeavor* gave ground control personnel a spectacular sight. However, before L'Garde considers the IAE operational, it must resolve some apparent glitches in the deployment and conduct further testing. Despite these problems, the IAE demonstrated many advantages of inflatable structures. The antenna stowed away in a 7 x 3 x 1.5 foot box, but inflated to the size of a tennis court; the whole deployment system weighed only about 132 pounds; and it cost 100 times less than an equivalent mechanically deployed system.

The IAE is just one example of the many space structures that could benefit from L'Garde's inflatable technology. Other possible inflatable structures include solar arrays, solar concentrators, support struts, and sunshades. The Defense Advanced Research Project Agency funded L'Garde to develop and test the first inflatable solar array with an output of 200 Watts and power density of 90 to 100 Watts per kilogram.

Having worked with space inflatables since 1971, L'Garde has tested more than 100 inflatable structures for government clients. The company developed much of the basic technology that underlies all of its inflatable systems in several BMDO projects to build decoys of ballistic missiles for sensor and interceptor studies.

ABOUT THE TECHNOLOGY

L'Garde's inflatable systems can be packaged in compact containers; a gas inflates the clear or metallic structural film. Inflatable structures do not need the mechanical parts that conventional systems do—an important feature on a spacecraft, where any mechanical difficulty can ruin a mission. When required, structures can be made rigid through several methods, including the use of ultraviolet (UV) light-sensitive epoxy upon inflation. When exposed to plentiful UV rays in space, the epoxy hardens. Once hardened, the support struts act as one solid structure, holding the structure fast without the need to maintain inflation pressure.

■ The IAE experiment, shown here following its deployment from the space shuttle *Endeavor*, will lay the groundwork for future technology development in inflatable space structures.