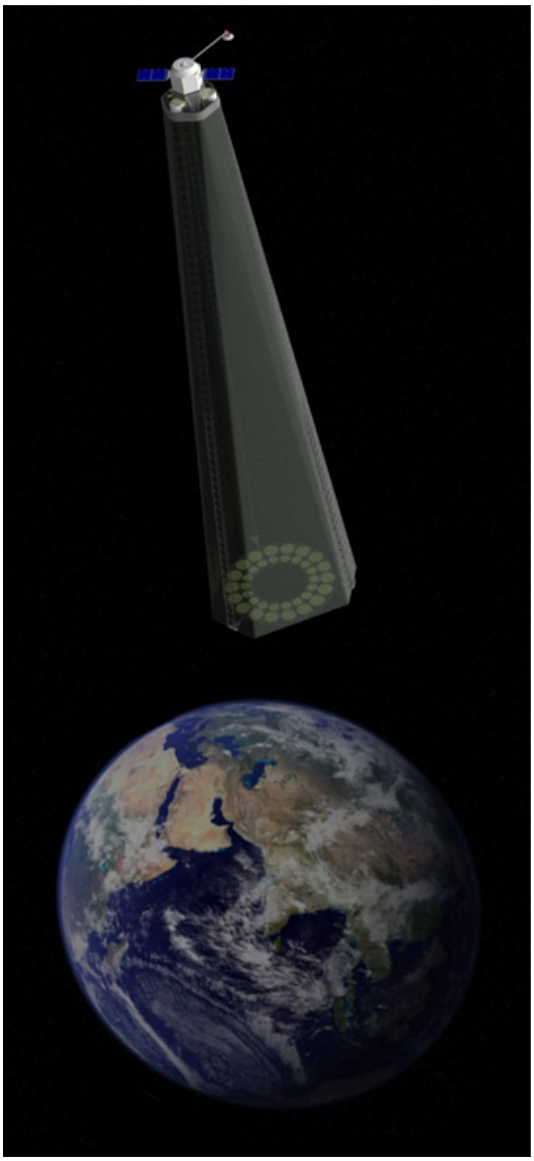
REPLICATED DIFFRACTIVE OPTICS



GO BEYOND WITH BALL.®

Ball Aerospace is revolutionizing the way we think of large aperture telescopes in space. Using lightweight, replicated diffractive optics, we developed an affordable, game-changing approach for constructing extremely large aperture telescopes that can easily fit in today's launch vehicles.

OVERVIEW

The space-based missions of the future will demand telescopes with increasingly large apertures. But launch vehicle size, cost constraints and development time limit aperture size.

That's why we developed a revolutionary way to construct telescopes with apertures more than 20 meters in diameter. By using replicated diffractive optic technology, we can meet narrow-band, space-based remote sensing sensitivity and resolution requirements while increasing the aperture size and reducing cost and mass.

The primary optical element of our telescope concept employs extremely thin (less than 1/1000th of an inch or the diameter of a human hair), transparent membranes etched with diffraction gratings used to focus light. These gratings can be customized to meet any mission where narrow wavelength regions are practical for performing science or imaging missions. The design can also be rapidly manufactured, significantly reducing cost and schedule as compared to traditional reflective systems.

QUICK FACTS

- Membrane telescope apertures could reduce mass by a factor of seven and cost by a factor of 10, compared to conventional systems
- The replicated diffractive optic manufacturing technique can work with a number of substrates, including low coefficient of thermal expansion thin film membranes and various forms of glass
- Replicated diffractive optics enable a 20-m primary mirror compared to the Hubble Space Telescope, which is 2.4 m, and the James Webb Space Telescope, which is 6.5 m
- Ball has a role on all four great observatories, and delivered the optical element for the Webb, the largest telescope set to fly in space
- Ball completed the MOIRE DARPA risk reduction project in four years

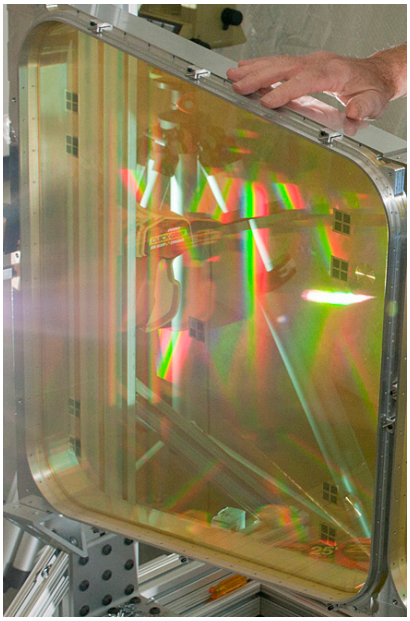
OUR ROLE

Ball's technology development for large, lightweight apertures is rooted in our Membrane Optical Imager for Real-Time Exploitation (MOIRE) program that was developed for the Defense Advanced Research Projects Agency (DARPA).

As the prime contractor for the MOIRE program, we designed, built and tested a 45-degree segment of a five-meter-diameter annular segmented telescope, demonstrating a complete end-to-end telescope design and increasing the technology readiness level for many applications.

We also validated several key aspects of the primary manufacturing process, including patterned large diffractive membrane optics, precision hinges with repeatable deployment characteristics, an environmentally-tested stable composite back-structure, robust deployment schemes, and integration of all of these elements into our overall system.

Our technology can be customized to meet the needs of any mission, in Earth observation, Earth science, optical communications or exoplanet characterization.



Showing the transparent membranes etched with diffraction gratings used to make each optic segement

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