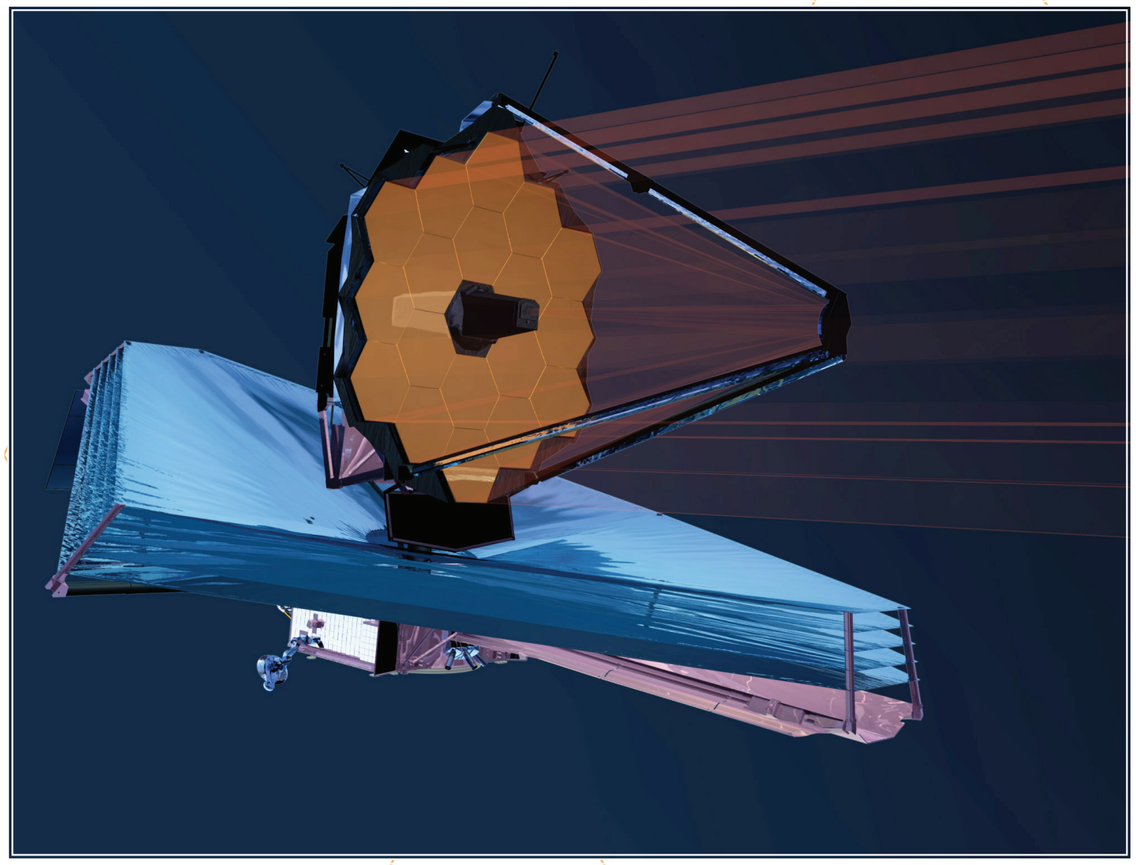
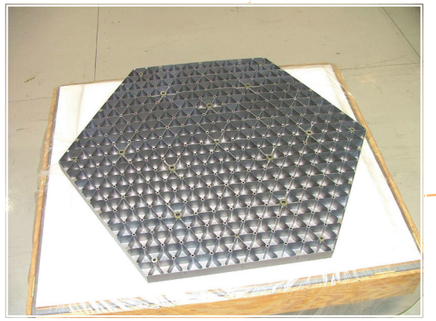


A Cross-Country Journey of Mirror Making:

NASA's James Webb Space Telescope

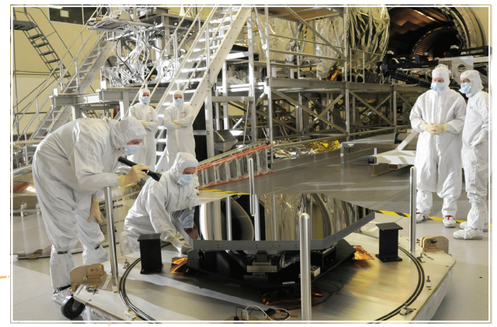
The James Webb Space Telescope is the next-generation premier space observatory that will explore deep space phenomena from distant galaxies to nearby planets and stars. The Webb Telescope will give scientists clues about the formation of the universe and the evolution of our own solar system, from the first light after the Big Bang to the formation of star systems capable of supporting life on planets like Earth. The telescope is scheduled to launch in 2014.

The Webb Telescope primary mirror is made up of 18 hexagonal segments made of lightweight beryllium. The below images show Webb's mirror segments in various stages of production. The latest image from the mirror production process (bottom right) shows several segments being loaded into a test chamber in the X-ray & Cryogenic Facility at NASA's Marshall Space Flight Center in Huntsville, Ala. There, the segments are subjected to temperatures reaching minus 414 degrees Fahrenheit - ensuring they can withstand the extreme temperatures of space.



The back of a beryllium mirror blank is machined with precision so it will be lightweight yet structurally sound. (AXSYS Technologies)

The uncoated front side of one of Webb's mirror segments. (AXSYS Technologies)



Engineers from Ball Aerospace inspect the first mirror segment upon its arrival at Marshall Space Flight Center for cryogenic testing. (Ball Aerospace)

Three mirror segments about to undergo cryogenic testing at Marshall Space Flight Center. (Ball Aerospace)

The James Webb Space Telescope is a joint project of NASA, the European Space Agency and the Canadian Space Agency.

For more information about James Webb Space Telescope please visit:
www.jwst.nasa.gov

www.nasa.gov

NP-2010-1-118-GSFC

The Journeys:

Follow the beryllium mirrors across the country!

NASA's James Webb Space Telescope's 18 special lightweight beryllium mirrors have to make 14 stops to 11 different places around the U.S. to complete their manufacturing. The 18 mirror segments will form the Webb telescope's huge primary mirror. There are 18 segments, because it takes a large mirror to look back farther in time than ever before. They come to life at beryllium mines in Utah, and then move across the country for processing and polishing. In fact, the mirrors make stops in eight states along the way, visiting some states more than once, before journeying to South America for lift-off and the beginning of their final journey to space. This graphic shows the different places they have to travel, and what is accomplished at each location.

Journey 1: From Brush Wellman Inc.'s mine in the Topaz-Spor Mountains of Utah, beryllium powder is mined and shipped to Brush Wellman's facility in Elmore, Ohio, where it is sifted and purified into an extremely uniform optical mirror blank.

Journey 2: To Axsys Technologies in Cullman, Alabama, where the back of each "blank" is made into a honeycomb structure to lighten it, and they also provide general shaping of the front of the mirror.

Journey 3: To L3 Communications, Tinsley Laboratories in Richmond, California, where segments are ground and polished to a smooth and exact shape, then tested at room temperature.

Journey 4: To Ball Aerospace & Technologies Corp. in Boulder, Colorado, where mounts and actuators are attached to the mirror segments, and vibration and optical testing are done.

Journey 5: To the X-ray and Cryogenic Facility (XRCF) in Huntsville, Alabama, where Ball conducts cold (cryogenic) vacuum optical testing of segments in order to generate a map of cold distortions provided as a map to Tinsley Labs.

Journey 6: Back to Ball Aerospace & Technologies Corp., Boulder, Colorado, to remove mount and actuators.

Journey 7: Back to L3 Communications, Tinsley Laboratories at Richmond, California. Where each mirror is fine-tuned by polishing in the opposite of the surface error values derived from the XRCF's super-cold testing. Now, distortion that occurs in space-cold should actually perfect the mirror.

Journey 8: Back to Ball Aerospace & Technologies Corp., Boulder, Colorado, to clean mirror segments to prepare for coating.

Journey 9: To Quantum Coating, Inc., Moorestown, New Jersey, where gold is evaporated over the segments in vacuum chamber and it forms a very thin coating on the smooth mirror surface.

Journey 10: Back to Ball Aerospace & Technologies Corp., Boulder, Colorado, to reassemble the mirror segments with mount and actuators. Final vibration testing is done.

Journey 11: Back to the XRCF in Huntsville, Alabama, where Ball performs final cryogenic acceptance testing on the segments.

Journey 12: To NASA Goddard Space Flight Center, Greenbelt, Maryland where personnel from the ITT Corporation, Rochester, New York, assemble the telescope and attaches it to the instrument module. Acoustic and vibration tests are performed.

Journey 13: To NASA Johnson Space Center, Houston, Texas for final cryogenic testing of the whole telescope.

Journey 14: To Northrop Grumman, Redondo Beach, California for integration of the assembly with the spacecraft and sunshield.

Journey 15: To the Guiana Space Centre, Kourou, French Guiana, for lift-off on an Ariane 5 rocket… and the beginning of the Webb telescope's million-mile journey to its final destination in space!