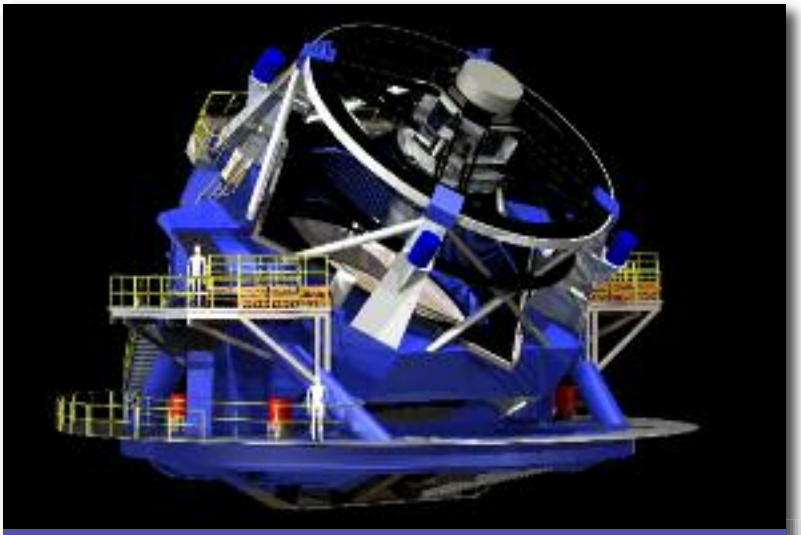
OMEGA Has Starring Role in the LSST 8.4 Meter Telescope Mirror

The Large Synoptic Survey Telescope (LSST) is a new kind of telescope that will combine a huge 8.4 meter primary mirror with the world's largest digital camera, boasting 3.2 billion pixels. This combination will permit the detection of faint objects with exceptionally short exposure times, twenty times faster than is currently possible. These short exposure times and the LSST's very wide field of view will give it the ability to survey the entire sky twice each week. Each night more than 30 terabytes of data will be generated, processed, and stored. The LSST is scheduled to get its first look at the sky in 2015 from a mountain top on Chilean Andes, and to go fully operational in 2017.



The Large Synoptic Survey Telescope

With an exposure time of only 15 seconds, the LSST can record hundreds of images each night, actually resulting in a movie of the sky. One important use of this capability is the detection and tracking of near earth objects that might be potential collision threats. Another is the capture of short-lived cosmic events that can be missed by conventional telescopes. Ultimately, the LSST will be used to create a 3D map of the universe in unprecedented detail that scientists and astronomers hope to use to locate dark matter and to characterize the properties dark energy, both of which, for now, remain theoretical.

By far, the most physically impressive element of the LSST is the huge 8.4 meter mirror. This unique structure incorporates both the primary and tertiary mirrors of the telescope in a single piece of glass and will give the LSST many of its extraordinary optical properties. Grinding of the mirror surfaces, which has already begun, involves the removal of over 11,000 pounds of material and will take more than two years, with a scheduled completion date of January 2012.

The 8.4 Meter Mirror in the Polishing Cell

Because of the large size of the mirror, expansion and contraction from temperature differentials in various sections of the glass can have a seriously detrimental effect on the ultimate precision of the grinding and polishing operation. Since this process takes over two years, any errors would be catastrophic. It was in overcoming this problem that Omega Engineering was able to make a significant contribution to ensuring a successful outcome.

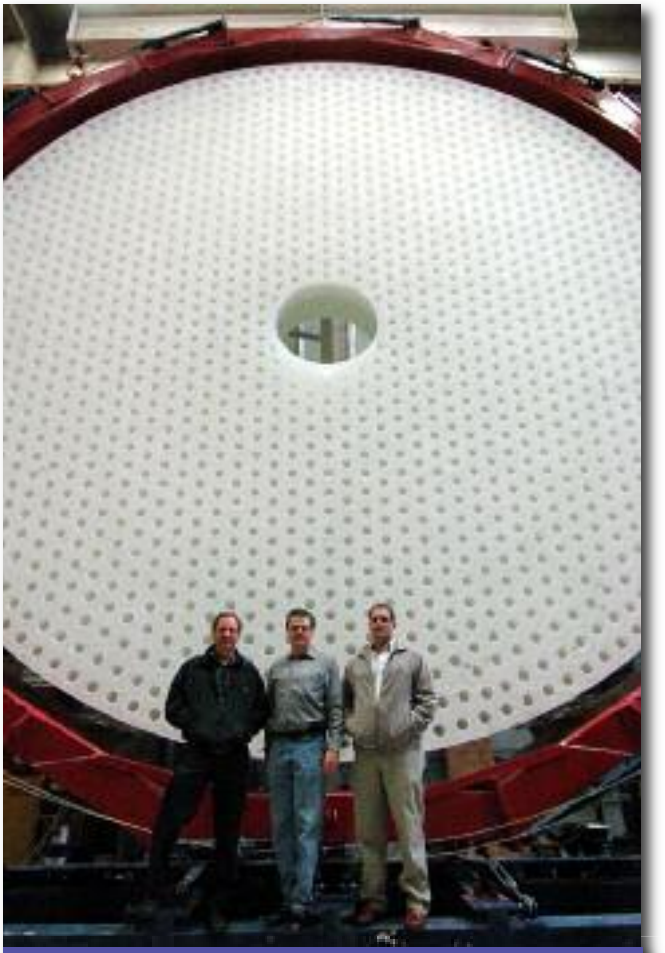
The LSST design team wanted to use a custom thermal control system installed on the back surface of the mirror to maintain a uniform temperature throughout the structure at all times. Precision thermocouples were to be bonded to the

mirror front, back and mid-plane at 146 locations. A temperature difference between any of the monitored locations would cause the temperature control system to react to correct it. The specification required differential temperature measurements to be repeatable and accurate to 0.1 degrees Celsius. The best way of achieving such high performance is by using high quality thermocouples all made with wire from the same lot. Unlike other suppliers contacted by the LSST team, Omega Engineering was ready and willing to meet this and other special requirements of this application. With its large insulation extrusion operation, it had significant quantities of same-lot thermocouple wire readily available. After a review of Omega's production capability and quality assurance procedures, the go-ahead was given and the project undertaken.

The thermocouples supplied were standard Omega® 5TC Series products, except that they were made from a single lot of special limit of error thermocouple wire. In addition, they were given special handling and special packaging as mandated by the LSST team specification. The leads on all units were terminated with Omega's strain relief connectors and they were coiled in large rolls. Supplying the product in this way allowed for a very high uniformity between the numerous thermocouples, greatly improving temperature measurements and tracking at the large number of locations involved. The end result: The LSST team reports that the temperature monitoring system, using the Omega® thermocouples, performs to the 0.1 degree Celsius system requirements.

When the telescope is finally completed, these same thermocouples will be used for ongoing thermal monitoring of the mirror. This data can be used by the digital processing package to compensate for distortion caused by expansion and contraction of the mirror in real world conditions during use.

Because of the success of this project, Omega has been asked to supply additional same-lot thermocouples for test and measurement applications on other phases of the project.



Back Surface of the 8.4 Meter Mirror

Omega Engineering is pleased to have a significant role in ensuring a successful grinding and polishing operation for the LSST 8.4 meter mirror. This application is a good example of the Omega commitment to do what it takes to provide the products and services needed by its customers. Extensive custom engineering capability and vast experience in fulfilling special customer needs has made Omega the go-to choice for test and instrumentation applications.