

American Society of Civil Engineers, San Diego Section
Historic Civil Engineering Landmark
PALOMAR OBSERVATORY



Story by Phil Kern

In 1928 astronomer George Ellery Hale secured the largest scientific grant to date from the Rockefeller Foundation to construct the world's largest telescope. This would be the fourth time Hale had built the world's largest optical instrument. Since founding Caltech he had organized the construction of the 40 inch refracting telescope at Yerkes Observatory and the 60 and 100 inch reflecting telescopes at Mt. Wilson. The amount of the \$6 million grant for building a new 200 inch reflecting telescope was kept quiet to avoid attracting promoters and shady operators, and this project would turn out to be exponentially more complex than the previous efforts to see even deeper into the reaches of the universe.

In December 1934, after one failed casting the second 20 ton blank for the 200 inch mirror was cast out of molten Pyrex glass at the Corning Glass Works in New York. After being cooled in a specially controlled oven for ten months, the 17 foot diameter disk was shipped in March 1936 on a special rail car to Caltech in Pasadena for "figuring".

The selection of the site for the new observatory was the next issue. In the 1930s Mt. Wilson was already starting to suffer from light pollution from the LA metropolitan area, and East Coast astronomers were campaigning for a location convenient for their needs. After evaluating several sites, Hale settled on a remote mountaintop roughly halfway between LA and San Diego known as Palomar Mountain. Owned by ranchers, visited by weekend campers and accessible only by a narrow winding mountain road, the site took advantage of the favorable atmospheric conditions of Southern California and was thought to be far enough from population centers to eliminate light pollution, but was only a half day drive for the expected cadre of astronomers and researchers. The foundation for the circular, domed observatory building was laid in 1935. The piers for the telescope mounting were sunk 22 feet to bedrock, while the dome structure was founded seven feet deep into granite. The rotating portion of the dome alone weighs 1,000 tons. The equatorial mounting of the 530 ton telescope allows for both east-west and north-south movements, as well as tracking to compensate for the earth's rotation on long exposures. The specialized castings for the mounting had to be very finely machined and balanced to eliminate the slightest possibility of vibration ruining the extremely sensitive optics as the telescope tracked the stars. Some of the components for the mount were so large and heavy they had to be machined at Baldwin Locomotive Works. The observatory building and dome were essentially complete and ready for the mirror by 1939. Due to unforeseen circumstances it would be almost ten years before dome and mirror would be joined together.

The roadway up the mountain in 1935 (today known as Nate Harrison Grade) was marginal for construction deliveries, and certainly would not accommodate delivery of

the world's largest mirror. Hale and his supporters convinced San Diego County Supervisors to build a wider, less tortuous road up the southeast ridge of the mountain at County expense. Known as the "Highway to the Stars", the curves were specially designed to accommodate the mirror on its dolly and the train of truck tractors needed to haul it up the grade.

The laborious polishing of the mirror came to a halt with the bombing of Pearl Harbor in December 1941. The giant mirror was set aside and Caltech staff and resources were directed toward manufacturing periscopes and other wartime optics. Polishing of the giant concave glass disk was finally completed in October 1947, and it was carefully crated and loaded on a 16 wheeled trailer hauled by the Belyea Truck Company. The first day the precious cargo made it the 126 miles from Pasadena to Escondido at an average of 11 miles an hour. Crowds of onlookers clustered along the route, the sensitive load was monitored for undue vibrations and guards were posted during nighttime stopovers to prevent damage to the valuable cargo. At the base of the mountain additional tractors were brought into play, one at the front and two at the rear, and the mirror was delivered four hours ahead of schedule despite deteriorating weather on the mountain.

Operational testing, calibration and aluminizing the mirror took place from November 1947 to June 1948. The first "official" light through the world's largest telescope was a photographic plate exposed by Edwin Hubble on January 26, 1949. The Hale telescope at Palomar greatly extended the range of astronomers and has vastly expanded our understanding of the universe. Although today exceeded in size by other instruments, the "Big Eye" has been instrumental in validating cosmic expansion (the Hubble constant), advancing knowledge of stellar evolution, facilitating the discovery of quasars several billion light years away and many other celestial firsts.

The Palomar Observatory was recognized as a local Historic Civil Engineering Landmark by the San Diego Section of ASCE in 1986.