

## When a Multi-National Design Team Looked to **S.O.A.R.**

### THE CUSTOMER

The **S**outhern **A**strophysical **R**esearch (SOAR) Telescope is a 4.2-meter, clear-aperture optical/IR telescope on Cerro Pachón in the Chilean Andes. Completed in July of 2002, the \$28 million dollar telescope produces images that rival the clarity of the Hubble Space Telescope. The SOAR telescope dome is a \$2 million dollar, 66-foot diameter, weatherproof structure weighing over 70 tons. The dome consists of an internal steel frame covered with lightweight glass composite panels, an over-the-top nesting shutter system, rotational friction drive, and overhead crane.

### THE CHALLENGE

The primary objective of the SOAR project: build a high quality, low cost telescope facility. The challenge facing engineers: design a domed enclosure that would be simple to implement, fabricate, and integrate on-site. To protect the sensitive instruments inside, the dome had to withstand a variety of internal and external loadings, including severe wind and ice conditions. The dome, shutter, and windscreen must also precisely "track" the telescope's movements and maintain a 5-meter square clear aperture around the line-of-sight. NE/Nastran was chosen to perform the finite element analysis of the entire internal structure and composite dome panels.

### THE SOLUTION

NE/Nastran was used to verify the overall structural adequacy of the dome under critical load conditions including wind, snow and ice. The internal steel frame and composite exterior panels were modeled together in NE/Nastran to take advantage of the substantial stiffening the panels provide. Structural deflections, stresses, and member loads were studied under both static conditions and the load path variations found during dome rotation. NE/Nastran was also used to determine interlaminar shear stress, stiffness, and laminate failure indices of the panels themselves.

### THE RESULTS

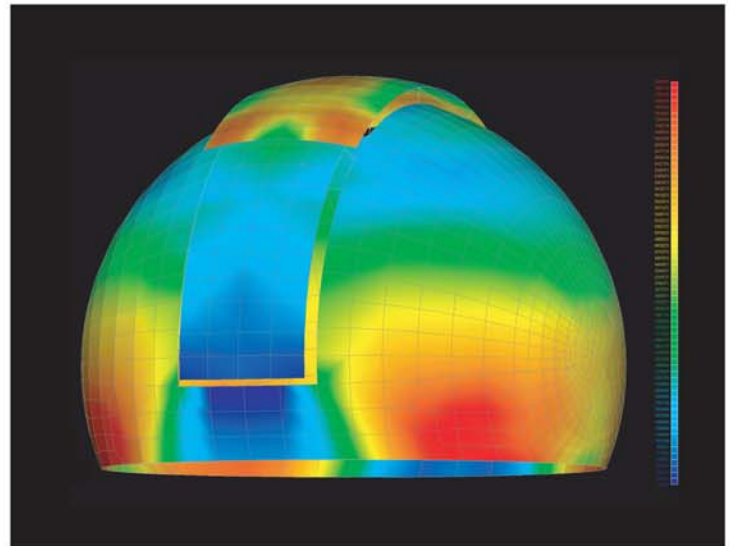
NE/Nastran completely verified the structural integrity of the composite dome and internal frame under a variety of critical structural and environment load conditions. Critical members were re-sized based on worst-case deflection results from the NE/Nastran analysis. Conclusion: the primary frame and exterior panels could withstand the various loads generated by and on the dome, while maintaining deflections within an acceptable range. NE/Nastran delivered a precise, accurate, and cost-effective solution to this critical scientific design challenge.

### CASE STUDY:

S.O.A.R. Observatory  
Cerro Pachón, Chile



SOAR Observatory - Cerro Pachón, Chile



NE/Nastran FEA Model - Dome & Shutter Assembly

They chose NE/NASTRAN  
..... why shouldn't you?

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