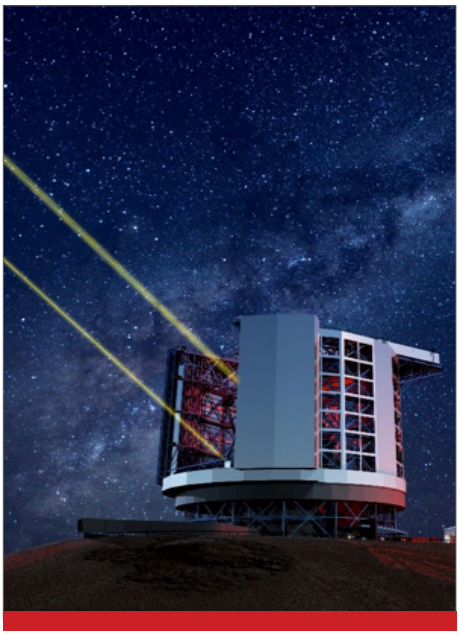
Case Study: **Giant Magellan Telescope**

MSC Software Helps Giant Magellan Telescope Discover the Universe

Based on an interview with: Paul Rasmussen, Telescope Structural Engineer at Giant Magellan Telescope

Overview

Where did our universe come from? Since the beginning of time, astronomers and physicists such as Galileo, Copernicus, and Einstein have dedicated their life's work to this timeless question. Even today, investigating the universe's origins remains hotly debated. To help answer this, the team at the Giant Magellan Telescope is building a 200 foot-high telescope that will help scientists uncover what has plagued scientists and science fiction enthusiasts alike: Are we alone? How did the first galaxies form? What is the fate of the universe?



The GMT is uniquely poised to answer these questions due to its ability to collect more light than other telescopes and to its' uniquely high resolution (which will be the highest ever achieved in a telescope). The project is sponsored by Astronomy Australia Limited, Carnegie Observatories, Harvard University, and other leading universities and research institutions from around the globe. Due to the complexity of the structure, placement of mirrors, and movements that will occur during operation of the telescope, the engineering team at GMTO used MSC Software's simulation tool, MSC Apex, to simplify and shorten their design and simulation workflow.

"It is easy to see how I would use MSC Apex just for the whole integrated aspect of it – importing geometry, prepping, meshing, to analysis, and post-processing in one integrated tool at the level MSC is working toward is absolutely impressive."

Paul Rasmussen, Telescope Structural Engineer at Giant Magellan Telescope

Challenge

The GMT will be housed in the Las Campanas Observatory, located on a mountaintop in Chile. The mountaintop has a very remote and dry climate, but at night reveals one of the darkest skies on Earth. The unique darkness and the elevation make the Observatory the perfect place to gain a clear view into the sky.

Despite the unobstructed view the Chilean mountaintop provides, the country's frequent and substantial earthquakes presented a challenge for the engineers working on the telescope. The 22 story building that the telescope will be placed in has to be able to withstand earthquakes that can exceed an 8.0 on the Richter scale, which means that precise and accurate structural testing is crucial. Additionally, the mountaintop's elevation means that the force of high-speed winds also needs to be considered.

In addition to environmental concerns, the design of the telescope itself makes design and testing uniquely difficult. The GMT will be composed of dynamic, moving mirrors of different sizes. The primary mirror will be a 25 meter diameter dish, and the additional mirrors will cover almost 4,000 square feet. It will also have a dome shape, which means that high winds will push the primary and secondary mirrors around. During these high winds, the large structure needs to remain stable in order to allow the Optics system to remain accurate, despite wind and temperature conditions.

Solution/Validation

"It is easy to see how I would use MSC Apex just for the whole integrated aspect of it – importing geometry, prepping, meshing, to analysis, and post-processing in one integrated tool at the level MSC is working toward is absolutely impressive. It's very easy and very quick," said Paul Rasmussen, Telescope Structural Engineer at Giant Magellan Telescope.

The group of engineers working on the design and product development of the GMT needed a Finite Element Analysis tool that was robust and powerful in order to address load problems caused by earthquakes and other environmental hazards. At the same time, the tool had to be easy to learn and use for quick implementation. The GMT team chose MSC Apex as their design and analysis tool.

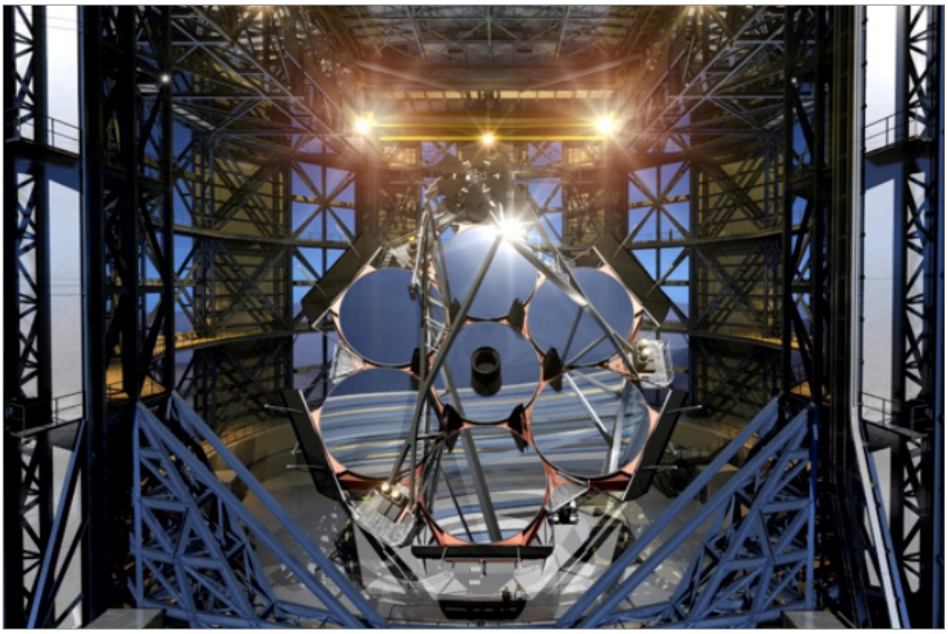
Key Highlights:

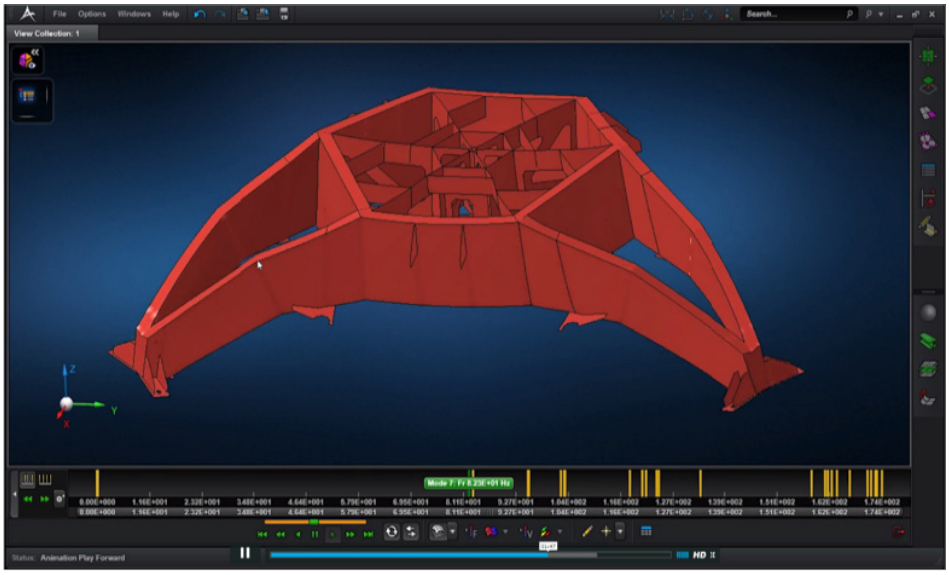
Product: MSC Apex

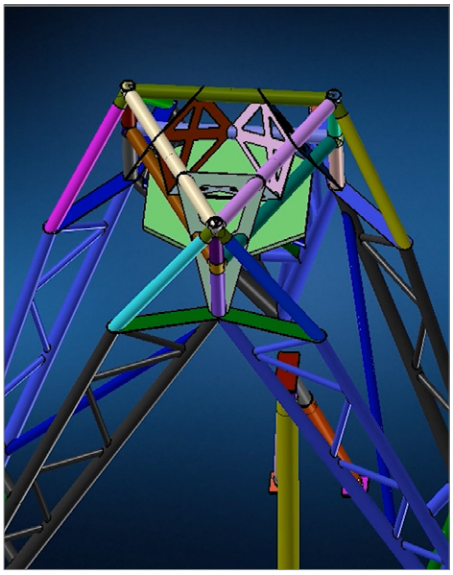
Industry: Aerospace

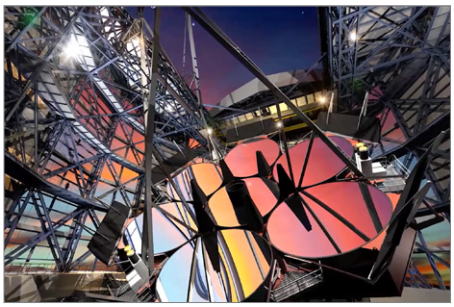
Challenge: Designing the structure of the telescope to withstand harsh environmental conditions

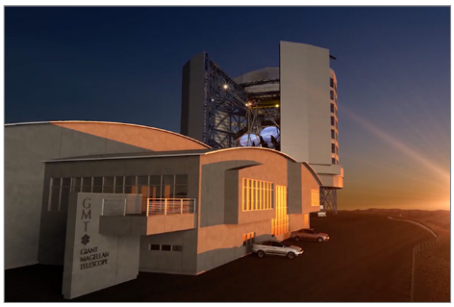
Benefits: Increased productivity by utilizing MSC Apex Fossa to save time during the design process

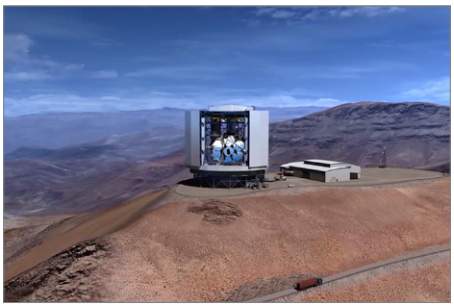












Results

MSC Apex's dynamic components for design, specifically its importing utility and meshing features, were instrumental in the design and analysis of the GMT. The software was essential in helping to identify particular wind dynamics issues during the design process, which allowed developers to save time and increase productivity. MSC Apex became a critical tool in the GMT's design process due to its easy user interface and customized meshing and simulation features.

With the aid of MSC Apex, engineers at GMTO will be able to answer some of the toughest questions faced by mankind in a more streamlined, efficient way than ever before.

About Giant Magellan Telescope

Giant Magellan Telescope (GMT) is a non-profit organization that is joining the ranks of other aerospace industries in building the next class of giant ground-based telescopes. The GMT has a unique design that is composed of segmented mirrors. GMT's goal is to discover and collect data from the solar system to help scientists gain more insight on the perplexities of the universe.

For more information on MSC Apex and for additional Case Studies, please visit **www.mscsoftware.com/mscapex**

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