Case Study: **TEN TECH LLC**

MSC One Provides TEN TECH LLC Access to MSC's Complete CAE Platform

Based on an interview with: William Villers, CTO & Director of Engineering at TEN TECH LLC

Overview

MSC Software pioneered many of the technologies that are now relied upon by the Aerospace industry to analyze and predict stress and strain, vibration & dynamics, acoustics, and thermal analysis in their flagship product, MSC Nastran. Similarly, MSC Marc and MSC Adams are highly regarded as industry-leading applications for non-linear simulation and kinematics, respectively.

TEN TECH LLC, a Los Angeles based engineering consulting firm, conducts complex engineering Finite Element Analysis. As subject matter experts in shock, vibration and thermal analysis for the Aerospace & Defense Industry, TEN TECH LLC relies heavily on MSC solutions. The types of products and applications TEN TECH is involved with share a common characteristic: field failure is never an option. To validate these designs, complex multi-physics analyses and high-performance solvers that provide great accuracy are required. TEN TECH LLC being a Small Business, high-end CAE software procurement is always a delicate balancing act as high performance and accuracy comes at a hefty premium. At least it did until now: enter MSC One.

MSC One is an expanded products token system that allows companies to take advantage of the breadth and depth of MSC Software's simulation portfolio within a flexible token-based licensing system. Offered on an annual subscription basis, MSC One provides efficient implementation and access to a suite of multidisciplinary engineering software tools.

For TEN TECH LLC, the ability to easily access the extensive MSC One product portfolio, including all of MSC's core products such as MSC Nastran, Adams and Marc, but also Sinda and SC/Tetra for thermal and CFD analysis was an easy choice. Access to such a variety of tools through a "check-in, check-out" token system, allows the team at TEN TECH to solve a multitude of their clients' vibration, non-linear, thermal and CFD problems for a fraction of the cost typically incurred.

Recently, TEN TECH LLC's Structural Mechanics Group has been actively involved in the development of telescope structures, providing Finite Element Analysis expertise for the
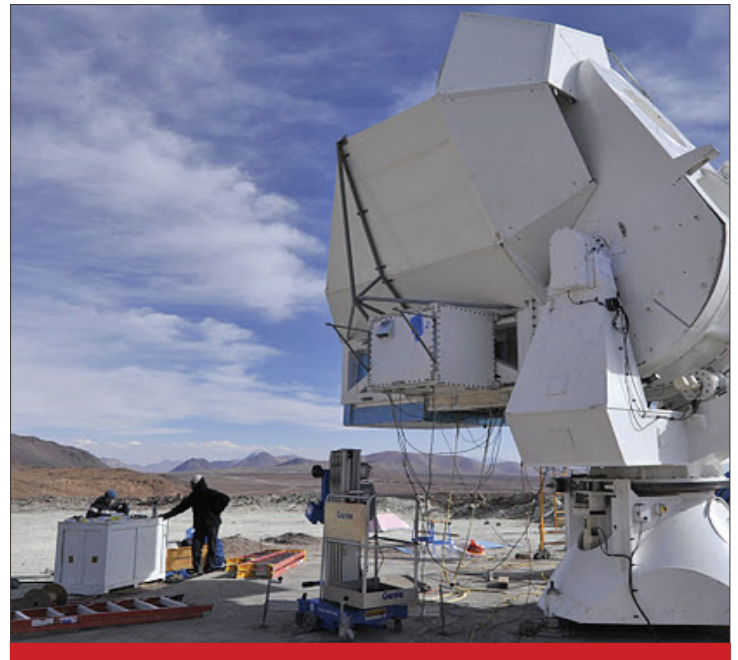
design validation of the telescope structure supporting the Polarization of Background Radiation telescope array experiment (POLARBEAR-2).

Funded by the Simons Foundation, POLARBEAR-2 is an international collaborative effort including 8 countries, and 20 institutions. Based in Chile's Atacama Desert, the Simons Array, comprised of three polarization of background radiation telescopes, will probe the skies in search of proof of inflation, the hypothetical moment following the Big Bang.

"We heavily relied on MSC Apex and MSC Nastran to perform these complex structural analysis tasks. MSC One made our life much easier than with our traditional workflow" - William Villers, CTO & Director of Engineering at TEN TECH LLC.

> "I love the value MSC One brings to my team - one day we do dynamics analysis and the next day we do thermal analysis. It allows for so much versatility and gives my company access to solutions that I, as a small business owner, could not afford on an individual product basis."

-William Villers, CTO & Director of Engineering at TEN TECH LLC

Challenge

As the telescopes were entering the final design stage, TEN TECH LLC's engineers built high-fidelity finite elements analysis (FEA) models as well as large computational fluid dynamics (CFD) models to study the integrity of the telescope structure while subjected to the harsh environment of the Chilean desert, including extreme wind conditions and significant seismic events.

The TEN TECH team had to consider very harsh desert environments during the validation process, along with the requirements of very high precisions instruments. The initial objective of the design was to determine the dynamics characteristics of the structure, both in terms of self-induced vibration and jitter of its precision mechanism as well as environmental vibration such as seismic activity or simple quasi-static accelerations.

TEN TECH took a CAD-to-FEM approach, directly utilizing the large system-level 3D CAD assembly of the telescope (5000+ parts), which were composed of massive machined parts, support trusses, and thin structures.

Along with performing dynamics analysis, a detailed stress model was required for several other analyses. Given the complexity of the modeling task, a single, high-fidelity model approach was selected. The dynamics response analysis was performed on the same, very detailed, "stress" model. Needless to say, the modal analysis and dynamic response required a high-performance solver.

"We receive native 3D CAD geometry from multiple popular CAD software tools. Using Apex, we were able to import, clean and simplify geometry comfortably, even in the context of a very large assembly. MSC Apex provided our analysts with a much more streamlined workflow for geometry abstraction and mesh creation. Apex is a must-have for complex, large assemblies!" - William Villers, CTO & Director of Engineering at TEN TECH LLC.

Solution

The team first used MSC Apex to easily import the large Solidworks CAD assembly, while keeping the assembly structure. Conserving the product structure further allowed TEN TECH engineers to take a systematic assembly meshing approach.

The engineers at TEN TECH utilized Apex's de-featuring functions to easily simplify the massive parts of the telescope and mesh them using a combination of brick elements and Tetrahedral elements.

Springs and fastener connections between subassemblies were modeled, while welded parts were defined using glue joints. Apex's mid-surfacing abilities were put to the test with some very large and complex thin structures and passed with flying colors. Most mid-plane abstractions were performed automatically. In

1 of the 3 POLARBEAR-2 telescopes in Chile
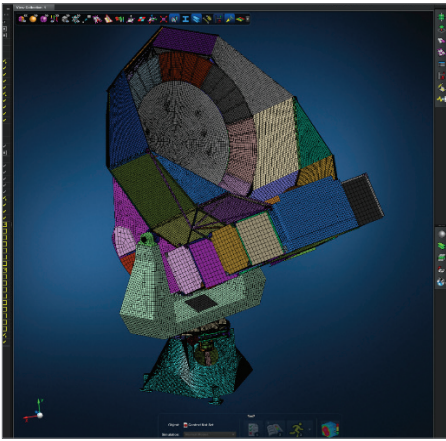
Apex's de-featuring functions easily simplified the massive parts of the telescope

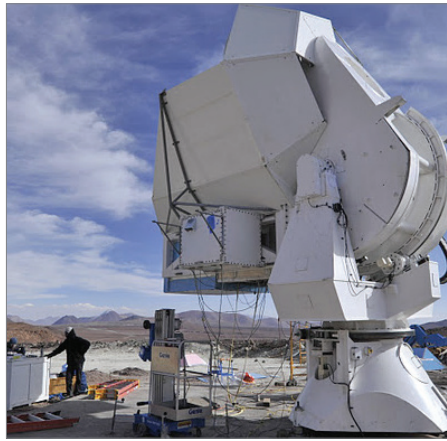POLARBEAR-2 telescope

Atacama Desert, Chile

the rare instances of an incomplete model, TEN TECH engineers were able to quickly correct the geometry by dragging edges and faces in place.

During the entire meshing process, each subassembly model was verified by analysis before moving on to the next level, thanks to the contextual analyses abilities of Apex. A final 12-million Degrees of Freedom top-level Finite Element Model was assembled to use for linear static and dynamics analyses using the MSC Nastran solver.

Results

The TEN TECH team was able to quickly mesh and run FEA on a very large and detailed model of a complex assembly, starting from native CAD files. Apex allowed the team to proceed with incremental analyses of subassemblies and build a very large and complex model "right the first time". With Apex, the engineers shortened their "CAD to FEM to Analysis" time by 25%-30% compared to their traditional workflow process. At the same time, they delivered a high fidelity, reliable model to their client.

MSC Nastran's high performance was highlighted throughout the entire project: through its ultra-fast iterative solver and

GPU-accelerated processing for linear statics, to Automated Component Modal Synthesis (ACMS) and Distributed Memory Parallel (DMP) solver for large dynamics problems, MSC Nastran performed flawlessly and delivered the highly accurate results required to achieve the proper confidence level in the design.

TEN TECH plans to further utilize MSC's products through MSC One, including Sinda, Adams, and MSC Nastran. The price of MSC One gives the TEN TECH team the financial freedom they need to use MSC Nastran and other products.

About TEN TECH LLC

TEN TECH LLC is an ITAR-registered an Engineering Consulting company headquartered in Los Angeles, CA providing Design, Test, & Analysis services as well as Software Sales, Training and Support.

TEN TECH LLC Engineering Services provides Subject Matter Expertise in the areas of Structural Dynamics, Fluid, and Thermal Analysis & Simulation through the use of advanced numerical techniques such as Finite Element, Finite Difference, Lattice Boltzmann and Boundary Element Methods.

TEN TECH LLC Software Solutions is one of the select MSC Apex Elite Partner as well as an authorized reseller for North America of the MSC One line of products MSC Software, including MSC Nastran, Adams, Marc, Sinda, Patran.

MSC One token system provides access to most of MSC's portfolio

For more information on MSC One and for additional Case Studies, please visit www.mscsoftware.com/product/msc-one