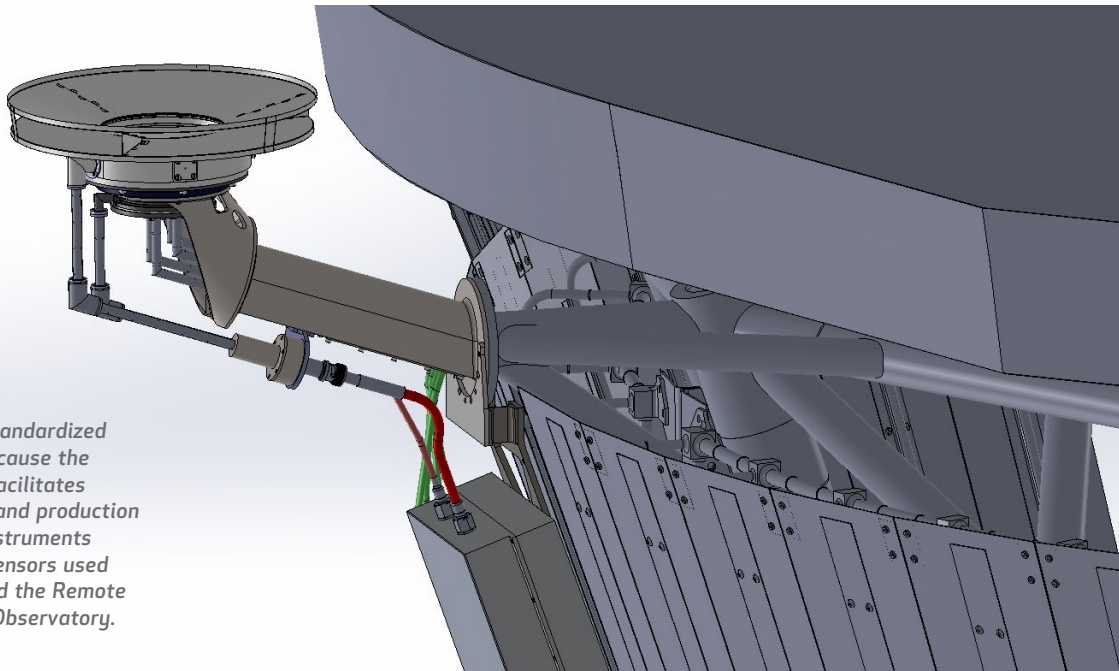


SMITHSONIAN ASTROPHYSICAL OBSERVATORY

Innovating advanced astrophysical research systems with SolidWorks solutions



SAO's Engineering Group standardized on SolidWorks solutions because the integrated design system facilitates development, prototyping, and production of cutting-edge research instruments and systems, such as the sensors used for the Solar Probe Plus and the Remote Environmental Monitoring Observatory.

The Harvard-Smithsonian Center for Astrophysics (CFA) combines the resources and research facilities of the Harvard College Observatory and the Smithsonian Astrophysical Observatory (SAO) under a single director to pursue studies of the physical processes that determine the nature and evolution of the universe.

Some 300 Smithsonian and Harvard scientists cooperate in broad programs of astrophysical research. SAO's Engineering Group collaborates with astrophysicists and scientists on the development of cutting-edge research instruments and systems.

According to Project Engineer David R. Caldwell, SAO once used a variety of CAD tools to develop research systems. However, in 2005, SAO engineers began the transition to standardize on a single 3D development platform.

"We act as a skunkworks on research ideas formulated by principle scientists," Caldwell explains. "When a scientist has an idea, we sketch out, design, and build the systems required for the project." In this environment, using an integrated design system can facilitate development, prototyping, and production.

"We'd tried other CAD programs but decided to standardize on SolidWorks®," Caldwell says. "We chose SolidWorks for many reasons. The software is easy to use, provides access to integrated analysis tools, and is better for creating visual representations for technical papers. SolidWorks also integrates directly with MasterCAM® machining software and handles diverse types of CAD data. With SolidWorks, we can better communicate designs to scientists and can design and build systems more efficiently and cost-effectively."

SAO engineers rely on SolidWorks and SolidWorks Premium design software, SolidWorks Simulation Premium analysis software, and SolidWorks Enterprise PDM (EPDM) product data management software to develop flight and ground-based research systems, such as those used for the Solar Probe Plus (SPP) and the Remote Environmental Monitoring Observatory (REMO).

Challenge:

Accelerate scientific research system development and enhance design visualization to improve collaboration with astrophysical scientists and researchers.

Solution:

Implement SolidWorks and SolidWorks Premium design software, SolidWorks Simulation Premium analysis software, and SolidWorks Enterprise PDM product data management software solutions.

Results:

- Reduced development and machining time and costs
- Shortened nonlinear analysis time from one week to half-hour
- Cut system weight while ensuring performance
- Improved design visualization

Streamlining development and machining

Since implementing SolidWorks, SAO has accelerated the design, prototyping, and manufacturing of next-generation sensors and research systems, saving time and money. Using SolidWorks design and SolidWorks Simulation Premium analysis tools, SAO engineers can model and visualize designs as well as conduct nonlinear buckling, vibration, thermal, and frequency analyses to virtually refine project designs.

SolidWorks Simulation tools allow CFA engineers to effectively perform technical analyses during the proposal and conceptual design phases, which enhances the technical validity of concepts. After design optimization, it's faster to set up machining in the SAO machine shop because SolidWorks serves as the geometry engine for MasterCAM.

"Working on an integrated platform saves time at every step," Caldwell stresses. "I can solve a nonlinear simulation problem that used to take a week in a few hours. With that kind of speed, I can quickly optimize and deliver a design that will perform. Then, when we need to machine prototypes or final parts, our machinists save additional time. They can go backwards in the SolidWorks feature tree—to understand the jigs and fixtures required—without losing associativity and while maintaining revision control."

Getting closer to the sun than ever

SAO leverages SolidWorks to tackle some of the most difficult engineering challenges, such as mankind's first visit to a star. The U.S. National Aeronautics and Space Administration (NASA) Solar Probe Plus (SPP) will launch in 2018. The car-sized spacecraft will plunge directly into the sun's atmosphere. SAO's role is to develop the Solar Wind Electrons Alphas and Protons (SWEAP) payload, including a Faraday sensor that will measure the properties of electrons, protons, and helium ions in the solar wind. What makes the project so challenging is that the sensor resides on the exterior of the spacecraft, where it will be subjected to intense heat and radiation.

"The sensor operates in an environment so extreme that we have to use integrated analysis tools," Caldwell notes. "We recently ran prototype tests at the Solar Wind Facility at the Marshall Space Flight Center, and the sensor performed as predicted by our simulations."

"With space flight systems, weight is critical," Caldwell adds. "SolidWorks Simulation Premium gives us the information we need to change thicknesses or materials and truly optimize our designs."

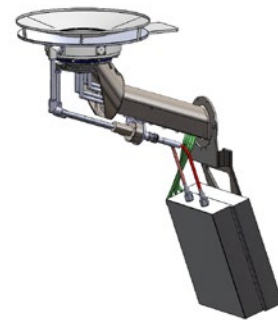
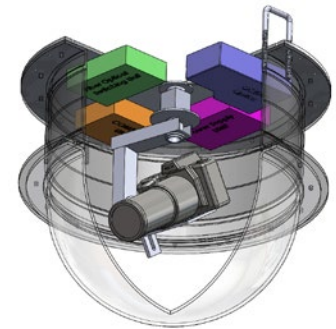
Monitoring the planet's health

In addition to tackling space-related projects, SAO also uses SolidWorks on projects closer to home, including REMO, a spectral and digital imaging sensor system located on observatory towers that will monitor valuable ecosystems and provide information on our planet's health.

"Whether we are developing systems that seek answers about the origins of the universe or those that provide insights into the health of our environment, we use SolidWorks tools to efficiently and cost-effectively create designs that perform at a high level and help quench mankind's thirst for knowledge."

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David R. Caldwell
Project Engineer



With SolidWorks design and SolidWorks Simulation Premium analysis software, SAO engineers use analysis and visualization tools to optimize the performance of sophisticated instrument designs.



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