SIEMENS
Ingenuity for life

Aerospace and defense

Astroscale

Astroscale develops without prototypes using Siemens PLM Software solutions

Product

Femap

Business challenges

Achieve fail-safe designs with limited resources

Support faster product development

Collaborate with multiple companies

Keys to success

Implement a cost-effective and easy-to-use CAE solution

Apply Femap for design verification of an artificial satellite

Use pre- and postprocessors that support multiple types of CAD data from joint development partners

Results

Easily created analysis models from 3D CAD models to perform efficient analysis

Implemented the required analysis with high performance and efficiency

Achieved high cost-efficiency by using primary 3D CAD data for analysis

Femap with NX Nastran supports cutting-edge space development

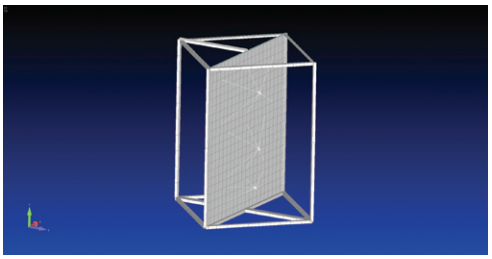
Reducing the risk of development in space

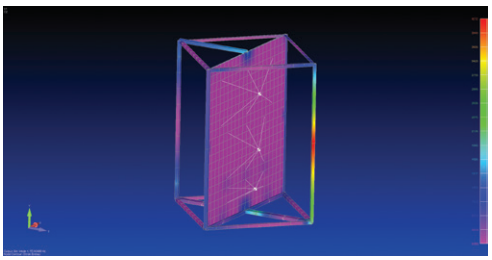
Commercial space development has advanced in recent years both domestically and overseas, and interest in the effective use of outer space is growing. With the growing interest, the danger of space "trash" or space debris is gaining attention. There already is much debris in the Earth's atmosphere: more than 20,000 objects with a size of 10 centimeters or more, and more than 100 million objects that are 1 millimeter or smaller. These unmanaged objects represent a significant risk, not only for manned missions but also for devices such as artificial satellites.

Astroscale was founded in Singapore in 2013 with the goal of removing space debris to reduce the risk of space development. Subsequently, Astroscale Japan Inc. was established in Tokyo in February, 2015, as a research and development site. With a staff of 10 engineers, the company is taking advantage of the latest technologies to conduct efficient technology development, including using Femap™ with NX™ Nastran® software from product lifecycle management (PLM) specialist Siemens PLM Software.

Astroscale's Representative Director Miki Ito explains, "The company was established in February 2015, but the actual development started in April. The purpose of our first satellite, called IDEA OSG 1, is to gather debris data, and the launch is scheduled for the second half of 2016. We need software with superior structural analysis capabilities in order to develop at a speed to reach practical use within two years."

The starting point for the new satellite was research conducted at various universities, with the basic technology elements having already been established. But there are many hurdles to overcome in order to combine those technologies for practical use and send them to outer space as a satellite. In addition, it is no easy matter to get everything ready for launch within the short time period specified in the project plan. Physical prototypes and tests are challenging for both time and cost reasons, so Astroscale's major weapon is computer-aided engineering (CAE) using Femap.





"The mesh creation feature of Femap is easy to use, and its operation is straightforward and intuitive. You can create high-quality meshes with the automatic mesh creation tools and easily adjust them manually. It's also easy to create surface elements from the imported CAD data, and if needed you can use the Femap geometry editing feature to avoid the unnecessary work of editing the original CAD data."

Yuta Araki
Engineer
Astroscale Japan Inc.

From the initial development, the design itself was done in 3D computer-aided design (CAD). "The CAE was previously outsourced," says Yuta Araki, an Astroscale engineer. "However, because the costs kept increasing and we considered this a key technology for development, we decided to set up an in-house analysis environment. We installed Femap with NX Nastran in June of 2015. Femap and Nastran are tools with a long track record in the aerospace industry, and we were aware of their high reliability. We decided to implement the software without hesitation, because it suited our purpose."

Based on his extensive experience with analysis software, Araki appreciates just how easy it is to use Femap. "The 3D CAD that we use is also equipped with analysis tools, but they can only analyze extremely simple objects, so it did not support our requirements," Araki says. "The use of Femap satisfies complex analysis needs, and more importantly, I feel that its ease of use is amazing. I have used various types of structural analysis software tools in the past, but Femap is especially easy to use and extremely helpful."

Superior mesh creation contributes to faster development

Before operating in the harsh environment of space, an artificial satellite is first subjected to massive acceleration and vibration during the rocket's launch. CAE is essential for evaluating performance under launch conditions. To prevent the satellite from resonating with the vibrations during launch, engineers must increase the natural frequency of each component, in addition to reducing the weight and equipping it with the required strength. Astroscale's challenge is to create the optimal design in an extremely limited time frame while complying with regulations and balancing conflicts between strength, weight, and natural frequency.

"Directly analyzing a 3D CAD solid model requires significant calculation resources," Araki says. "For the current satellite analysis model, the large sections are modeled with shell elements, while solid elements are only used for sections that require complex shapes. The analysis model includes approximately 100,000 node points, but at this scale even the typical engineering workstation can produce results at extremely high speeds."

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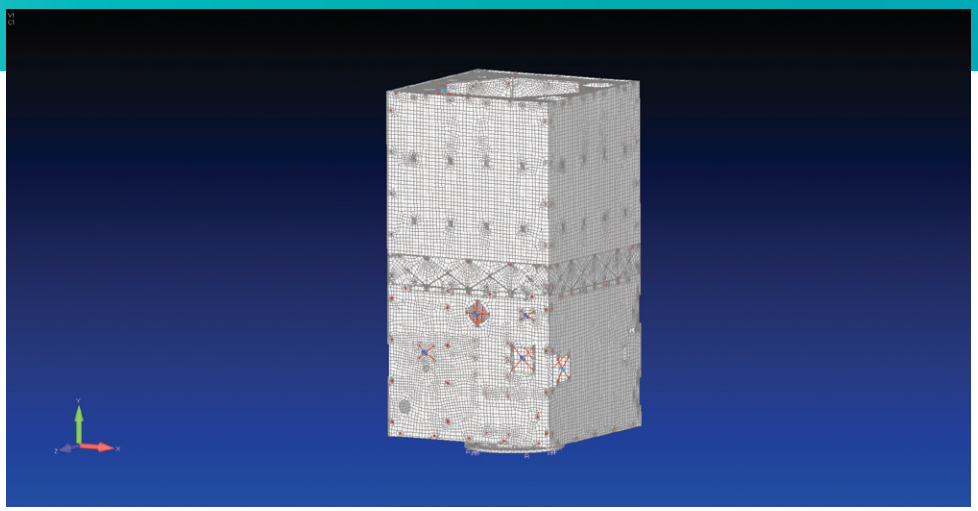

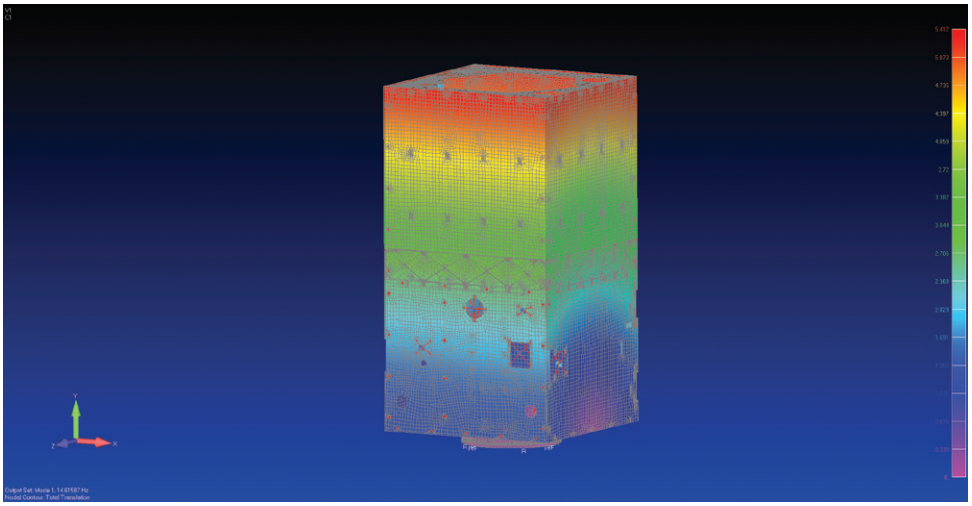

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Flexible interface facilitates collaborative development

Astroscale's satellite projects are collaborations with ongoing research conducted at multiple companies and over 10 universities. The various components used in the satellite are being outsourced, with Astroscale handling the system design, satellite assembly and additional testing.

An important element in this collaboration is the ability to work directly with the design data that is outsourced to external organizations. Femap not only supports the geometry data of intermediate formats such as the Initial Graphics Exchange Specification (IGES) and Standard for Exchange of Product Data (STEP), but also supports the primary CAD formats as well. Regardless of the format of the imported CAD file, Astroscale can edit the model as needed with no changes in usability, enabling the company to seamlessly analyze the data even if it is created externally. This capability is very important to Astroscale. For example, an eigenvalue problem must certainly be analyzed for the entire system, but individual components must also be considered. Femap makes it possible to analyze the satellite as a system.

Solutions/Services

Femap with NX Nastran
www.siemens.com/plm/femap

Customer's primary business

Astroscale was founded in 2013 with the objective of developing innovative solutions to counter the growth of space debris. The company's mission is to actively contribute to the sustainable use of the space environment by crafting scalable and cost-effective on-orbit technologies, and to safely remove the most threatening pieces of debris.
http://astroscale.com/about

Customer location

Tokyo
Japan

Structural analysis and simulation are crucial to Astroscale, and the company plans to pursue analysis technology in the future. "Mastering structural analysis may further condense the development process," says Araki. Astroscale is attempting to use data from testing to update the analysis model, and trusts that the accumulation of this technology will yield additional efficiencies in the future. "We must create three actual models with different roles by the launch of the artificial satellite," says Ito. "There is the structural model, the engineering model and, finally, the flight model. However, it may be possible to trim the structural model as we investigate the structural analysis. If we can trim the structural model, then there is a chance to reduce the two-and-a-half year development period by six months. This would have an extremely large impact on reducing the cost."

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Miki Ito
Representative Director
Astroscale Japan Inc.

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