# Parallel Thermal Analysis on LLSC

Technology Office | Lincoln Laboratory

To create the next generation of high-performing space systems, Laboratory staff will need access to more powerful modeling, simulation, and computing (MS&C) tools than ever before. The ability to search through broad ranges of computationally demanding designs faster and more comprehensively than contemporary approaches will offer drastic advantages to the Laboratory's engineering teams. The Lincoln Laboratory's Supercomputing Center (LLSC) is an ideal accelerator for this capability. However, benchmarked tools for solving radiation-dominated thermal models, which are critical to the design of space systems, were not previously available on the platform.

The completed Engineering Research Technical Investment project has integrated three key components for space systems design: a powerful thermal solver, Lincoln Laboratory's Integrated Modeling and Analysis Software (LLIMAS), and computing resources on the LLSC platform. LLIMAS is a modeling, simulation, and supercomputing framework developed in Group 74 that enables data exchange; hybrid-platform supercomputing; and design exploration across multiple disciplines, between commercial and government codes, and often on terabyte-class models. Aria is the standard thermal solver developed at Sandia National Laboratories (SNL) for approximating linear and nonlinear
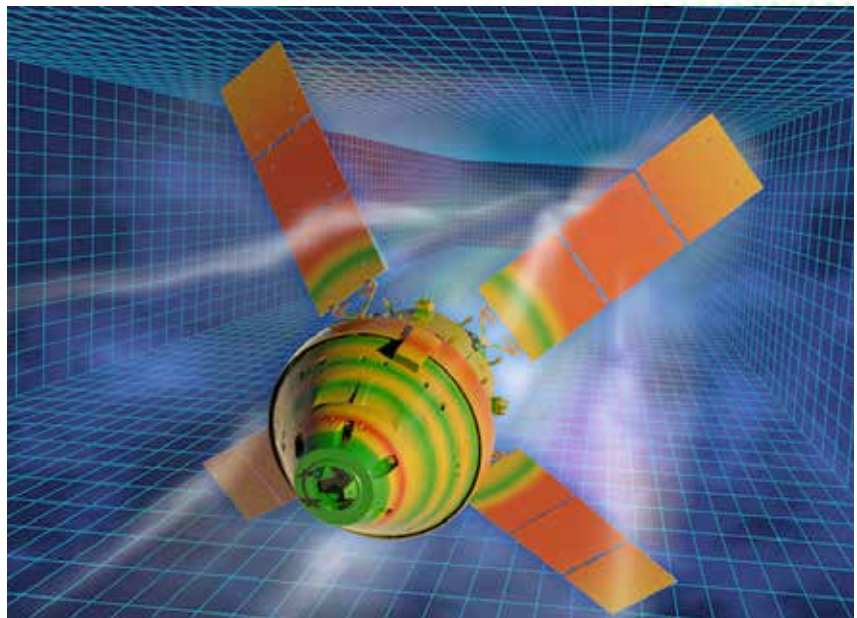
The LLSC is exploring more designs and solving larger space thermal models using the supercomputing workflow developed in this project.

models of heat transfer and benefits from the support of an active user-developer community across multiple FFRCs. Aria's highly parallel design allows jobs to utilize thousands of computing cores simultaneously enabling large-scale design and analysis that was not previously possible.

The deployment concept for this technology is well-suited for transfer to government agencies and approved contractors. Now that Aria has been vetted for use in relevant space-domain applications, it can be bundled with previously demonstrated structural and fluids solvers in SNL's Sierra simulation family with LLIMAS's client-server framework and delivered as a full-stack, pre-configured, MS&C solution. This follows the Laboratory's previous experience delivering similar software packages to mission partners where commercial license-based environments are not viable solutions due to constraints such as cost, security, or the need to maintain technical independence.

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