



# Preparing Goddard's ADR Cooler for Commercial and NASA Use



Agreements between NASA Goddard Space Flight Center, Lockheed Martin (LM), and Lake Shore Cryotronics will prepare Goddard's Continuous Adiabatic Demagnetization Refrigerator (CADR) technology for use by NASA missions and other aerospace organizations. A Space Act Agreement (SAA) with LM will enable the company to design a CADR/cryocooler system to address potential temperature instability or performance issues between the CADR and cryocooler. In a complementary agreement, NASA has licensed a key component of the CADR technology to Lake Shore Cryotronics. The company plans to incorporate the technology's revolutionary cryogenic cooling capabilities into its existing product line and to build control electronics for marketable CADR units, benefiting NASA as well as the larger low-temperature physics research community.

[www.nasa.gov](http://www.nasa.gov)

## Benefits of Technology Transfer

- NASA will be able to purchase CADR units from Lake Shore at a more economical price point than would have been possible by manufacturing them in-house.
- NASA may also be able to use the units for other uses, including the study of critical phenomena, such as the study of the formation of solid helium in low-gravity.
- LM will apply the results of its CADR/cryocooler integration to the production of commercial systems for other areas of its business, particularly rocket-based research.
- Lake Shore plans to market the CADR units to research labs and universities, providing the company a competitive advantage and helping to further physics research.
- The production of CADR control electronics puts NASA, LM, and Lake Shore one step closer to developing a fully space-qualified cryogenic cooling system, offering potential benefits to many NASA missions.

tech transfer success

## On the Record

“Working with the personnel at Goddard on the ADR system will be very beneficial to Lockheed Martin in improving our understanding and knowledge of the requirements and issues relating to the integration of our cryocooler technology with NASA’s ADR system. This in turn will more efficiently prepare us for bidding on future work with NASA on satellite borne ADR systems, to the benefit of both NASA and LM. In addition, the IPP Office has been very helpful in working with us to resolve contract issues and modify the agreement.” - *Ted Nast, Fellow, Lockheed Martin*

“The IPP Office has been a pleasure to work with. Any questions we have are expeditiously addressed and we’ve had a free flow of information. Its clear that the IPP Office operates in the best interest of all parties involved.” - *Shane Hritz, Marketing Manager, Lake Shore Cryotronics*

## About the Partners

Headquartered in Westerville, Ohio, Lake Shore Cryotronics specializes in temperature sensing and control, magnetic field measurement, and materials property measurement. The company has been an international leader in the development of innovative measurement and control technologies since 1968. Based in Bethesda, Maryland, LM is principally engaged in aeronautics, space systems, and information technology (IT). The company is also a world leader in the development of space-qualified cryocoolers.

## Technology Origins

CADR is a revolutionary cryogenic cooling technology developed by Goddard researchers Drs. Peter Shirron and Michael DiPirro in response to the limited applicability of traditional ADRs for space-based applications. Goddard’s CADR is compatible with flight cryocoolers under development, and enables continuous cryogenic cooling of items to milliKelvin temperatures without the need for stored cryogenes. The technology also has no moving parts and is delivered at a smaller size and lower weight than competing technologies, making it ideal for space-based applications and other IR-based devices operating in very cool conditions.

## Technology Improvement through Collaboration

While Goddard’s CADR achieves the cooling power needed at the lowest temperatures required by space missions (about 50 mK), researchers were concerned about its ability to achieve necessary temperature stability, and also had concerns about using a mechanical cryocooler that could produce smaller temperature fluctuations. Through collaboration with both Lake Shore and LM, significant improvements will be made to the CADR control electronics (by Lake Shore) and temperature instability addressed through a new cryocooler system (by LM)—advances that would have been much more costly and time consuming for Goddard to achieve on its own.

## The Transfer Process

Licensing of the CADR technology to Lake Shore was initiated at the 2003 Cryogenics Engineering Conference attended by Dr. Shirron.

Goddard’s Innovative Partnerships Program (IPP) Office facilitated ongoing discussions between Goddard researchers and Lake Shore, and administered the license agreement for the patented components of the CADR technology, signed in 2006.

In the summer of 2006, LM approached Goddard to begin an effort with the eventual goal of building a demonstration CADR/cryocooler unit. The timing was ideal for Goddard to team with LM through an IPP Seed Fund proposal, securing the resources necessary to begin the work through an SAA.

## Looking Ahead

With a license in place, Goddard innovators are collaborating with Lake Shore to build prototype units in an effort to expedite the manufacture and marketing of the technology. Researchers will conduct intensive testing and optimization of a custom ADR controller built by Lake Shore. Concurrently, Goddard will modify the lowest temperature stages to improve their thermal “responsiveness” to take maximum advantage of the controller’s high bandwidth. Cryocooler experts at LM will lead the process of generating new cryogenic system designs for missions that will use ultra-low coolers. Subsequent commercial units for sale to aerospace organizations (including NASA), universities, and research labs will be Lake Shore’s first priority.

## For More Information

If you would like additional information about Goddard’s technology transfer opportunities, please contact:

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