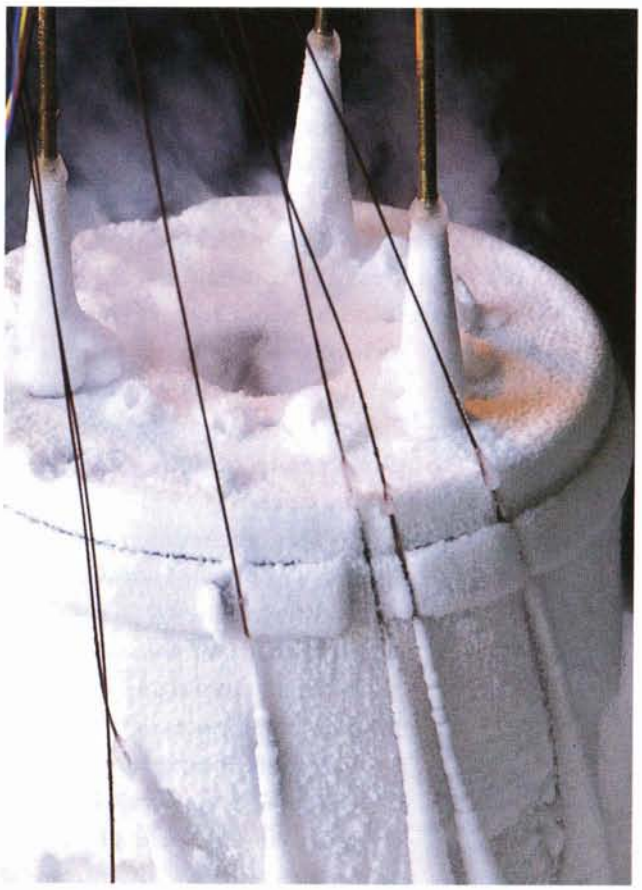
Low Current Magnet

A low current superconducting magnet, developed under NASA contract by Cryomagnetics, Inc., Oak Ridge, Tennessee, is now being marketed by that company as a commercial product for medical and industrial applications. The low current feature offers several advantages over conventional high current magnets.

The NASA development was initiated by the Cryogenics Section at Goddard Space Flight Center to meet a need to cool sensors aboard the Advanced X-ray Astrophysics Facility (AXAF), the third of NASA's Great Observatories series of astronomical satellites, planned for initial service in the late 1990s. The superconducting magnet is employed in a Goddard-designed AXAF subsystem known as the ADR (Adiabatic Demagnetization Refrigerator). **At left**, Cryomagnetics president Michael Coffey displays one of the magnets.

In the AXAF application, a bath of liquid helium is used to cool the ADR to 1.5 degrees Kelvin, which corresponds to about 450 degrees below zero on the Fahrenheit scale. The ADR will then cool the observatory's X-ray sensors further, down to 0.1 degrees Kelvin, almost absolute zero; that greatly increases the sensitivity of the X-ray detectors.



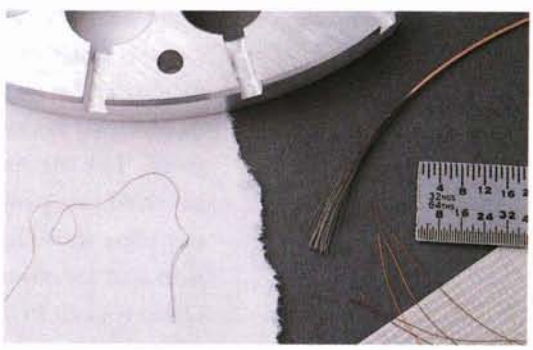
The liquid helium bath that cools the ADR also cools the superconducting magnet's electrical leads. The conventional high current magnet requires thick electrical leads, which cause high heat flow into the helium bath and rapid boiloff of the helium. Such depletion of the helium supply shortens the useful life of the instruments. **Above,** a low current magnet is being supercooled. At **right below** is a close-up of the electrical lead, much finer than human hair.

Cryomagnetics' low current magnet was developed as a means of reducing the rate of helium consumption to extend the mission lifetime of the AXAF's X-ray Spectrometer. The low current feature enables use of thin electrical leads, which reduces the electrical heating of the helium bath to an acceptable level.

In Earth applications, low current magnets offer a way to reduce operating costs through smaller, less expensive power supplies and reduced use of coolant. There is further advantage in some applications, such as hospital operation of an MRI system, which employs a magnetic field and radio waves to create inner body images from which radiologists can extract diagnostic information.

When high current magnets are used, a common way of curbing the heat in helium coolant baths is to remove the magnet leads when they are not in use. That could pose a safety problem among, for example, hospital workers engaged in MRI activities who are not thoroughly familiar with safety procedures for handling extremely low temperature materials, due to the fact that the leads are in supercold condition.

The low current magnet obviates the need for removing electrical leads, thus it not only makes MRI operation safer and more convenient for medical workers but also provides a bonus in lower maintenance requirements since there is no need for frequent removal and replacement of the leads. •



AN OFFSHOOT OF SPACE INSTRUMENTATION TECHNOLOGY, A NEW LINE OF MAGNETS OFFERS ADVANTAGES IN MEDICAL AND INDUSTRIAL APPLICATIONS