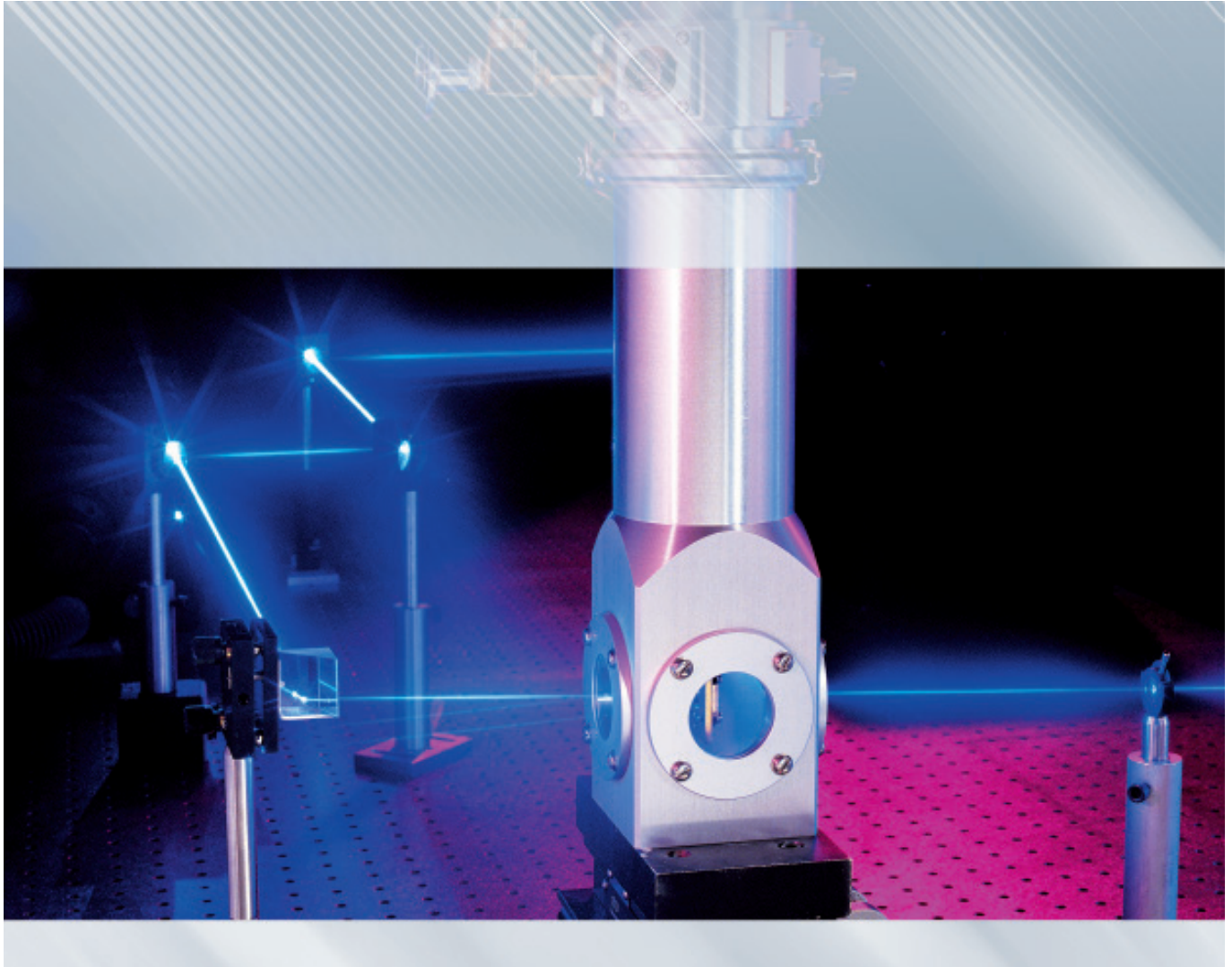


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# Cryogenic systems and capabilities

## Product overview



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## Product overview



*Janis Research Manufacturing Facility*

Incorporated in 1961, Janis Research Company, Inc. is recognized as one of the foremost suppliers of cryogenic equipment in the world. Through the years, Janis Research has been continually dedicated to the design, fabrication and delivery of the best systems and components in the industry. Using state-of-the-art CAD/CAM systems, Janis Research has developed the broadest range of cryogenic products in the business. With an installed base of over 8,000 systems and a staff of highly skilled scientists, Janis Research has the experience and the expertise to supply the system best suited to meet your cryogenic requirements.

Janis Research recognizes that obtaining a cryogenic system represents a long-term commitment for most scientists; therefore, we are devoted to providing you with the highest level of quality and customer support. Just a few of the ways we accomplish this are:

- Sales and service are provided through a worldwide network of trained and knowledgeable representatives.
- A dedicated Janis Research sales engineer is responsible for each system from conceptual design through post-installation support.
- A stable workforce draws on decades of combined service, and applies this experience to the assembly of each cryogenic system.
- Customer approval of the final design drawing is obtained for all customized systems.
- Records on all systems, modifications and design improvements are meticulously maintained for the reference of any future user.
- Turnkey systems are supplied by offering a full line of cryogenic accessories.
- Each system is fully integrated and tested before shipping.

Janis Research offers systems for a broad range of applications, with cooling provided by liquid nitrogen, liquid helium, or mechanical refrigerators. Each cooling mechanism has distinct advantages and preferred applications, and a Janis Research engineer can assist in choosing the best cooling method for your application. Some of our key products include:

- Helium-3 systems
- Dilution refrigerators (DR)
- Adiabatic demagnetization refrigerators (ADR)
- Custom engineered cryogenic solutions
- Superconducting magnet systems
- Cryogenic and vacuum micro-manipulated probe stations
- Continuous flow and reservoir cryostats, using liquid helium or liquid nitrogen
- 10 K and 4 K mechanical closed cycle refrigerators (CCR)
- Low vibration pulse tube refrigerators

Janis Research continues to innovate, creating new products and enhancing existing ones as new applications requiring cryogenic equipment are developed. The most detailed and up-to-date information on Janis Research products and applications (including specific performance specifications and key physical dimensions) can always be found on our website. Our ongoing commitment to research and development is helping to keep Janis Research positioned at the leading edge of cryogenic equipment technology.

*"Thanks so much for all your help... getting such good product support for an 18-year old piece of equipment is remarkable!"*  
- Danielle Chamberlin, Agilent Technologies, Palo Alto, California USA

# Cryogenic systems and capabilities

## Product overview



Vibration-isolated Continuous Flow Probe Cryostat



Mechanically Cooled Cryogenic Cold Trap

### Custom Engineered Cryogenic Systems

From our earliest days, Janis Research has been committed to the design and supply of custom cryogenic systems to support the specialized needs of the low temperature community. Our customized designs have resulted in two NASA Public Service Group Achievement Awards and an R&D 100 Award for systems that were developed and manufactured at our facilities. With in-house engineering analysis, computer-optimized designs and comprehensive manufacturing capabilities, our experienced physicists and engineers are readily available to discuss your special requirements for nearly any type of cryogenic application. Typical examples of custom engineered projects include:

- Ultra high vacuum cryostats and superconducting magnet systems for scanning probe, atomic force and scanning tunneling microscopes
- Ultra low loss cryostats and continuous transfer systems, for operation at very low (nanometer) vibration levels
- Cryogenic cold traps with single or multiple chambers for adsorption of noble gases from geological samples, or various oxygen isotopes from meteorites and polar ice caps
- Cryostats for neutron or X-ray beam lines with or without superconducting magnets
- Cryogen-free vibration-isolated superconducting magnet systems with variable temperature inserts
- Balloon-borne helium cryostats with solid neon shielding for ultra long hold times, for cosmic microwave background observations
- Ruggedized cryostats designed for space shuttle micro-gravity experiments in superfluid helium
- Wide range cryostats operating down to the milliKelvin range and up to 800 K or higher

New and enhanced systems are continuously under active design and construction. Please contact us with your requirement.



*"In collaboration with [a design engineer] from Janis Research Co., Inc. we were able to design a liquid helium capillary cryostat that allowed a novel marriage of two well-known chemical analysis techniques important to understanding the type of DNA damage caused by carcinogens. The technology won an R&D 100 Award in 1998 and is used for on-line identification of closely related analytes."*  
- Ryszard Jankowiak, Senior Scientist, Ames Laboratory USDOE, Ames, Iowa USA

# Cryogenic systems and capabilities

## Product overview



Optical Split Pair Magnet



Cryostat for Scanning Probe/Force Microscopy



Micro-manipulated Probe Stations

### Superconducting Magnet Systems

These systems feature designs that fully integrate the cryostat, magnet, automatic temperature controller and magnet power supply, complemented by a complete line of ancillary equipment. Janis Research's renowned SuperVariMag, OptiMag and SuperOptiMag systems offer temperatures between 1.5 K and 325 K (with options to 475 K or higher), and can be supplied with or without optical access. The Janis Research SuperMag series can achieve base temperatures to 0.3 K (He-3) or into the milliKelvin range (dilution systems). Our NbTi systems offer magnetic fields between 5 and 9 Tesla with optional Lambda point refrigerators for reaching higher fields, while our Nb<sub>3</sub>Sn magnets offer fields of 17 Tesla and beyond. Ultra low loss variable temperature systems are offered for temperatures between 0.3 K to 300 K. Existing Janis Research magnet system designs include:

- Standard top loading systems with samples in helium vapor
- UHV compatible systems with split magnets and solenoids
- Systems for Scanning Probe, Atomic Force and Scanning Tunneling Microscopy
- Vector Field systems with multiple split magnets
- Systems for X-ray and Gamma ray diffraction
- Room temperature (vertical and horizontal) bore systems

### Cryogenic & Vacuum Micro-manipulated Probe Systems

Janis Research (and its subsidiary RMC) offers a comprehensive line of vacuum and cryogenic probing systems for chips, wafers and packaged devices. Janis Research/RMC systems are used by government laboratories, industry and universities around the world, in various fields including semiconductors, MEMS, superconductivity, electronics, ferroelectrics, materials science, physics and optics.

Standard cryogenic probing systems and custom designed units are available to match your specific requirements. They include an ultra high efficiency continuous flow cryostat system, which utilizes liquid helium or liquid nitrogen and offers fast cooldown without introducing vibrations to the sample. Standard systems offer temperatures from below 3 K to 325 K (or 450 K), and include an automatic temperature controller for excellent control of the cold stage temperature throughout the entire range. The probes are manipulated using high precision ball bearing or crossed roller bearing linear stages, resulting in a typical probe placement resolution of 3 μm (with optional 0.3 μm resolution available).

Several different probes are available for use with signals ranging from DC to microwave, and a combination of both low and high frequency probes can be supplied with a single system. Designs with four probes are the most commonly supplied configuration, though two, six or more probes can be included. The modular design offers the advantage of using the same cryostat in a variety of experiments, including LCC, fixed probe, probe cards, DLTS, optical and magnetic field dependent studies.

*"...Janis developed a hardware solution for a critical cryogenic component.... Starting with a blank sheet of paper Janis was able to deliver production units in less than 90 days at a cost of less than 10% of the original item.... The units were found to perform more efficiently than the original item.... This has been the typical result in all of our dealings with Janis Research Co., Inc."*

*- Doug Lands, Chief Sensor Engineer, Special Operations Forces, Robins AFB, Georgia USA*

# Cryogenic systems and capabilities

## Product overview

### Typical Applications

FTIR, ESR, optical microscopy, Mössbauer, NMR, VSM, UVVISINIR, Hall measurements, matrix isolation, neutron scattering, x-ray diffraction, nanoscale measurements.

## Cryostats for Spectroscopy and Electrical Measurements

Janis Research manufactures a comprehensive range of products specifically designed for spectroscopic measurements. Cooled by liquid helium, liquid nitrogen or a closed cycle refrigerator (CCR), a Janis Research cryostat is available for most spectrometer-based applications. In addition, electrical access and suitable sample holders add the capability for resistivity and Hall measurements, and other electrically-based techniques.

### LIQUID HELIUM COOLED SYSTEMS

#### Continuous Flow Cryostats

Janis Research SuperTran (ST) sample in vacuum and SuperTran-VP (STVP) sample in flowing vapor systems are reliable and flexible tools for reaching low temperatures in the laboratory. These continuous flow cryostats offer quick sample cooldown, compact designs and maximum LHe efficiency. (ST and some STVP systems can also be operated with LN<sub>2</sub> when lower temperatures are not required.)

The SuperTran series (ST) sample in vacuum models cover the temperature range from <2 K to 800 K. In addition to general-purpose systems, Janis Research builds ST systems designed for specific applications including FTIR, ESR, NMR, UHV, Hall effect, atomic force, microscopy and more.

The SuperTran-VP series (STVP) provides sample in vapor cooling from 1.5 K to 300 K and higher, and includes a top loading sample probe. Rapid sample changes are possible, and samples with poor thermal characteristics (i.e., liquids and powders) or irregular shapes can easily be cooled. Application specific models include NMR, ESR and FTIR.



FTIR Cryostat with Motorized Sample Manipulation



Low Vibration Microscopy Cryostat



Sample in Vapor Continuous Flow Cryostat

#### Reservoir Cryostats

The SuperVariTemp cryostat has long been a recognized standard in research labs and institutes around the world. Key features include sample in dynamic helium gas, rapid sample exchange, long hold time, and excellent sample temperature stability.

Other reservoir cryostat models include the VariTemp system, available in either static helium gas or vacuum sample environment, and VSRD helium vapor shielded research dewars for use in conjunction with superconducting magnets, variable temperature probes, and ultra low temperature inserts.



High Efficiency Variable Temperature Reservoir Cryostat

### LIQUID NITROGEN COOLED SYSTEMS

#### Pourfill Systems

The VPF sample in vacuum cryostat is an economical, variable temperature liquid nitrogen cooled system, with models covering the temperature range from 65 K to 800 K. VPF cryostats are simple to operate, and standard models offer *f*-1 optics. A compact tail extension is available for use with electromagnets, and a built-in sample manipulator can also be incorporated for use with FTIR spectrometers.

The VNF sample in flowing vapor cryostat is ideal for liquid or powder samples, which are difficult to thermally anchor in a conventional cold finger cryostat. The top loading sample positioner permits quick sample change without warming the cryostat. Like the VPF cryostat, the VNF can be equipped with compact tails for use with narrow gap magnets.



Liquid Nitrogen Pourfill Reservoir Cryostat

*"I have used Janis cryostats for 18 years, including continuous flow and SuperVariTemp models. My workhorse 10DT has been a gem; it never gave [us] any trouble, and the LHe and N<sub>2</sub> hold times were everything they were promised to be. I have been very pleased with it."*

*- Jim McWhirter, formerly at Union College, Schenectady, New York USA*

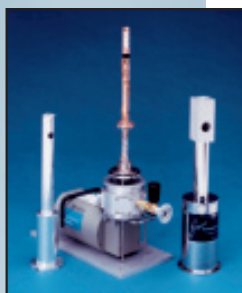
# Cryogenic systems and capabilities

## Product overview

### CRYOGEN - FREE SYSTEMS

#### Closed Cycle Refrigerators

Janis Research closed cycle refrigerator (CCR) systems provide low temperature environments (as low as 2.7 K) without the need for liquid helium or nitrogen. As a result, these systems are simple to operate and inexpensive to maintain. CCR models are available in both sample in vacuum and sample in exchange gas (top loading) configurations.



10 K Closed Cycle System for Magneto-optical Experiments

#### 7 K and 10 K Closed Cycle Refrigerators

Janis Research CCR designs begin with cryocoolers supplied by several of the world's leading manufacturers of cryogenic refrigerators. Unlike most other cryostat manufacturers, Janis Research is not restricted to a single cryocooler supplier, and can therefore suggest the most suitable cryocooler for any particular application. Janis Research has designed and built CCR systems for an extremely broad range of applications including VSM, Mössbauer, matrix isolation, Hall measurements, microwave device cooling, detector cooling, x-ray and neutron diffraction, and many more. Temperature ranges are available from 7 K to 800 K.



Original APD Cryogenics Cryocoolers



Top Loading 4 K Closed Cycle System

#### 4 K Closed Cycle Refrigerators

Janis Research 4 K CCR designs can be used as a direct replacement for liquid helium cooled systems. Depending upon the cost of liquid helium and hours of operation, typical annual cost savings can range from \$5,000 to \$50,000 or more. Janis Research offers a broad range of 4 K CCR systems, with cooling powers ranging from 0.1 to 1.5 watts @ 4.2 K. In addition to complete cold finger and exchange gas cooled cryostats, bare 4 K cryocoolers can be provided for use in cryostat shield cooling, helium recondensing, astronomical applications and more.



Compact Optical 4 K Closed Cycle System

#### Pulse Tube Refrigerators

Pulse tube refrigerators are available in single stage (to about 50 K) and two stage (to 3 K) designs, and are especially useful where vibrations must be controlled. Pulse tube refrigerators eliminate the moving internal regenerator found in most other types of cryocoolers, resulting in lower mechanical vibrations (especially as measured at the vacuum mounting flange). When combined with vibration-isolation techniques such as flexible thermal braids, pulse tube cooler displacements can be reduced to a level compatible with sensitive detectors and nanoscale devices.

*"We were able to sit down with the Janis technical staff to work out system details.... Working cooperatively we obtained the needed system on a fairly short time scale and at reasonable cost." - Gary S. Phipps, MPR Project Manager, Sandia National Laboratories, Albuquerque, New Mexico USA*

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# Cryogenic systems and capabilities

## Product overview

### Ancillary Products

Flexible Helium Transfer Lines

Liquid Helium Storage Dewars and Accessories

Liquid Nitrogen Storage Dewars

Mechanical Pumping Stations

High Vacuum Pumping Stations

Temperature Controllers

Liquid Helium and Liquid Nitrogen Level Indicators

Cryogenic Accessories and Supplies

*"The highly responsive and knowledgeable engineering support from Janis Research led to the development of a cryostat ideally suited to [our] application. The cryostat performed beautifully and was an integral part of a successful [NASA] SBIR project."*  
- David Grove, Principal Investigator, Luxel Corp., Friday Harbor, Washington USA

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# Cryogenic systems and capabilities

## Product overview

