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DTRC-91/002 January 1991
Technical Conference Proceedings

Proceedings of the Sixth International Cryocoolers Conference

Plymouth, Massachusetts
October 25–26, 1990

Volume I & II

Edited by
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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	January 1991	Conference proceedings

4. TITLE AND SUBTITLE

Proceedings of the Sixth International Cryocoolers Conference

5. FUNDING NUMBERS

6. AUTHOR(S)

Geoffrey Green and Margaret Knox, Editors

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

David Taylor Research Center
Annapolis, Maryland
21402–5067

8. PERFORMING ORGANIZATION REPORT NUMBER

DTRC–91/002

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This document contains the proceedings of the Sixth International Cryocoolers Conference, held October 25–26, 1990, in Plymouth, Massachusetts. About 260 people attended, representing many government and private laboratories (both foreign and domestic) as well as numerous universities and industrial companies. Fifty-four papers were presented.

The speakers described advances in many areas of cryocooler technology, mostly in the temperature range below 80 K. Topics included advanced regenerators, pulse tube and sorption coolers, and Stirling, Joule–Thomson, magnetic, and hybrid coolers. The discussions also covered a broad range of applications and component technologies.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Cryocoolers, cryogenics, cryopumps, Gifford-McMahon coolers, helium, infrared detectors, Joule-Thomson coolers, magnetic coolers, pulse tube coolers, rare earths, refrigeration, regenerators, sorption coolers, space coolers, Stirling coolers, superconductors.	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

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FOREWORD

These two volumes contain the proceedings of the Sixth International Cryocooler Conference (ICC), held in Plymouth, Massachusetts, on October 25–26, 1990. Peter J. Kerney of CTI-CRYOGENICS was the conference chairman; Geoffrey Green of the U.S. Navy's David Taylor Research Center served as program committee chairman.

The first cryocooler conference, held in 1980, was designed to stimulate interest and discussion in the scientific and engineering community about the latest developments and advances in refrigeration for cryogenic sensors and electronic systems at temperatures below 20 kelvin. Since then the ICC has been held every second year, and the topic has been expanded to include scientific and technological developments in small, closed-cycle refrigerators and components operating at temperatures up to about 80 K.

This year, close to 260 participants gathered from all over the world. They represented numerous universities, private companies, and government and commercial laboratories, both foreign and domestic.

Fifty-four papers were presented. The speakers described advances in many areas of cryocooler technology. The discussions included advanced regenerators, Gifford McMahon systems, pulse tube and sorption coolers, Stirling, Joule-Thomson, magnetic, and hybrid coolers, and a broad range of applications and component technologies.

The development of a small, compact, reliable and efficient cryocooler continues to be priority for cryogenics. We are pleased to present these proceedings, which we believe show further significant progress in the field.

—The Editors

ACKNOWLEDGMENTS

The Sixth International Cryocooler Conference Board would like to thank the following corporations, whose generous support contributed to the success of the 1990 Conference:

Arthur D. Little, Inc.

Creare Inc.

Cryomech, Inc.

CTI-CRYOGENICS, Division of Helix Technology Corporation

Janis Research Corporation

Lake Shore Cryotronics Inc.

Leybold Vacuum Products Inc.

Magnavox Electro-Optical Systems

MMR Technologies Inc.

Nichols Research Corporation

In Memoriam

The world of cryogenic engineering and small cryocooler technology was saddened by the death on August 5, 1990, of Dr. Howard O. McMahon, former President of Arthur D. Little, Inc., and a member of the Board of Directors of Helix Technology Corporation. He was 75 years old.

Dr. McMahon's pioneering efforts in the field of cryogenics made possible important contributions to the advancement of science and technology. In the late 1940's and 1950's, Dr. McMahon was responsible for developing and commercializing the Collins-ADL Helium Cryostat. The first commercial helium liquefier permitted universities and research laboratories throughout the world to conduct experiments at low temperatures and make important advances in the fields of chemistry, physics, biology, metallurgy, electronics and astronomy.

It was in the late 1950's at Arthur D. Little, Inc., that Dr. McMahon and William E. Gifford invented the Gifford-McMahon cryogenic refrigeration cycle—a unique method of reliably providing closed-cycle refrigeration at temperatures below 10 degrees kelvin. Initially, Gifford-McMahon cryogenic refrigerators were used for a variety of applications including the cooling of infrared detectors, low-noise ground-based receivers for satellite communication networks and experiments in low-temperature spectroscopy at long wavelenths.

With the birth of the microelectronics industry came the need for processing silicon wafers in clean, high-vacuum chambers. The ability to achieve ultra-clean conditions in vacuum processing chambers using Gifford-McMahon cryopumps has had a significant impact on the development of the complex high-speed, high-capacity integrated circuits of today. Subsequently, the Gifford-McMahon cryogenic refrigeration cycle became the industry standard refrigeration cycle for cryopump applications in the rapidly growing semiconductor industry.

A native of Alberta, Canada, and a naturalized citizen of the United States, Dr. McMahon received his B.A. and M.A. from the University of British Columbia in 1935 and 1937, and his Ph.D. in Physical Chemistry from the Massachusetts Institute of Technology in 1941. In 1943 he joined Arthur D. Little, Inc. and in 1964 became President, continuing as a Director until 1978.

Dr. McMahon was the author of many technical papers and held 22 patents on a wide variety of inventions. In 1979, Dr. McMahon was awarded the S.C. Collins Award in recognition of his outstanding technical contributions and dedicated service to the cryogenic community.

Dr. McMahon's inspiration and influence reached into many aspects of cryogenic engineering, especially into the advancement of small cryogenic coolers for commercial applications. In grateful recognition of his contributions, the Proceeding of the Sixth International Cryocooler Conference is dedicated Dr. Howard O. McMahon.

Dr. Howard O.McMahon