

**NOTE:** Page numbers used in this Index refer to the FIRST PAGE of the referenced article published in the proceedings. To view the referenced article, go to the Table of Contents and click on the article with the referenced page number located to the left of the paper title.

## Cryocoolers 15 Subject Index

- ADR (*see* Magnetic refrigerators)  
Aerospace Corp., load shifting technique, 89  
AIM Infrarot Module GmbH:  
    miniature flexure-bearing cryocooler, 133  
Air Force Research Lab (AFRL):  
    analysis of hybrid Brayton/Stirling cooler, 479  
    exergy efficiency model for regenerators, 353  
    LM RAMOS PT cooler characterization, 39  
    numerical sim. of flow in inertance tube, 261  
    prognostic health management system, 637  
    Raytheon cooler maturation programs, 31  
    thermal management system needs, 647  
Air Liquide DTA (France):  
    20K PT coldfingers for space, 71  
    status of 40-80K space PT cryocoolers, 115  
AIRS cryocoolers in-space performance, 613  
Ames Research Center (NASA):  
    distributed cooling for boil-off reduction, 631  
Applications of cryocoolers (*see* Integration with cryocoolers)  
Atlas Scientific:  
    distributed cooling for boil-off reduction, 631  
BAE Systems, AIRS instrument, 613  
Ball Aerospace coolers:  
    hybrid Stirling/J-T for variable loads, 545  
    microplate recuperator, 373  
Boil-off reduction systems, 631  
Brayton cryocoolers (*see* Reverse-Brayton coolers)  
Carleton Life Support Systems:  
    Stirling coolers for 3rd-gen. platforms, 139  
CEA/SBT (France):  
    2-stage PT coldfinger for 70K/140K, 63  
    20K PT coldfingers for space, 71  
    50mK ADR coupled to  $^3\text{He}$  sorption cooler, 505  
    H<sub>2</sub> & Ne gas-gap heatswitch, 553  
    nitrogen cryogenic loop heat pipe, 525  
    pocket dilution cooler, 497  
    thermal-mechanical heat switch, 561  
CEFITEC, portugal, gas-gap heat switch, 553  
CERN (Switzerland), PT vibration, 687  
CFD Modeling, 241, 251  
CFIC-Qdrive, PT oxygen liquefier, 681  
Chesapeake Aerospace, 55  
Chinese Academy of Sciences, Cryogenics Lab:  
    300 Hz 80 K PT cryocooler, 227  
nitrogen cryogenic loop heat pipe, 525  
thermally coupled 2-stage PT cryocooler, 79  
two PTs for a single compressor, 201  
Clever Fellows Innovation Consortium (*see* CFIC-Qdrive)  
CNES (French Space Agency):  
    70K/140K 2-stage PT coldfinger devel., 63  
    20K PT coldfingers for space, 71  
Compressors:  
    activated by piezoelectric elements, 289, 441  
    AIM miniature flexure-bearing compressor, 133  
    diaphragm pressure wave generator, 309  
    proton conductive membrane compressor, 299  
Creare:  
    65 K-100 K 2-stage turbo-Brayton for space, 461  
    drive electronics for tactical cryocoolers, 597  
    drive electronics for turbo-Brayton cooler, 471  
    fluid loop heat transport system, 533  
    J-T cooler for distributed microcooling, 433  
Cryomech, Syracuse, NY:  
    diaphragm pressure wave generator, 309  
    extracting cooling from 4K PT and regen., 177  
Cryo Wave Adv. Technology, Inc.:  
    thermoacoustic expander for J-T systems, 451  
Diaphragm pressure wave generator, 309  
Dilution refrigerators:  
    CEA/SBT pocket dilution cooler, 497  
    with direct PT precooling, 491  
Dutch Space, He/H<sub>2</sub> sorption cooler, 23  
Electronics, cooler drive:  
    Air Liquide, CDE for space PT, 115  
    for 2-stage turbo-Brayton cooler, 471  
    Raytheon low-cost space (LCSCE), 125  
    Raytheon for Stirling & PT coolers, 607  
    universal for tactical coolers, 597  
European Space (ESA/ESTEC) activities:  
    20 K PT coldfingers for space, 71  
    50mK ADR coupled to  $^3\text{He}$  sorption cooler, 505  
    on-chip detector cooling with MEMS J-T, 405  
Exergy flows (*see* Pulse tube theory and invest.)  
Flexure bearing springs (*see* Compressors)  
Flow loops (*see* Remote cryogenic loads, cooling of)  
Friedrich-Schiller-Universität, Jena, Germany:  
    coldhead vibration of coaxial PT, 687

- Gas-gap heat switches (*see* Heat switches)
- Georgia Institute of Tech.:
- CFD modeling of PT refrigerators, 241
  - hydrodynam. parameters of regenerators, 335, 343
- Gifford-McMahon Cryocoolers:
- effect of regenerator material config., 317
- Goddard Space Flight Center (NASA):
- characterization of ABI 2-stage PT, 55
  - superfluid He PT driven by magnetic pump, 519
- Heat exchangers (*see* Recuperators)
- Heat pipes:
- nitrogen cryogenic loop heat pipe, 525
- Heat switches:
- CEA/SBT thermal/mech. heat switch, 561
  - H<sub>2</sub> & Ne gas-gap heat switch, 553
- High temperature superconductor applications (*see* Integration of cryocoolers with)
- HTS applications (*see* Integ. of cryocoolers with)
- Hybrid multistage coolers:
- ADR coupled to <sup>3</sup>He sorption cooler, 505
  - Ball hybrid Stirling/J-T for variable loads, 545
  - dilution with direct PT precooling, 491
  - hybrid Brayton/Stirling cooler, 479
  - NGST MIRI hybrid PT/J-T 6K cooler, 7
  - Raytheon hybrid PT/Stirling, 31
- Hydrides (*see* Sorption cryocoolers)
- Hypres, Inc. 4K 4-stage PT cooler evaluation, 657
- Indian Institute of Science, Bangalore:
- numerical study of PT configurations, 271
- Indian Institute of Technology:
- PT with screen vs. tapered-fin HX, 185
  - PT with inline vs. 'U' configuration, 209
- Industrial Research Ltd., New Zealand:
- diaphragm pressure wave generator, 309
- Inertance tubes (*see* Pulse tube theory and invest.)
- Integration of cryocoolers with:
- aural undetectable imagers, 587
  - cryogenic boil-off reduction, 631
  - cryogenic loop heat pipe, 525
  - cryosurgical probes, 387
  - drive electronics (*see* Electronics, cooler drive)
  - flow loops (*see* Remote cryogenic loads)
  - infrared focal planes, 405, 695
  - oxygen liquefier for aircraft carrier, 681
  - remote loads (*see* Remote cryogenic loads)
  - space instruments (*see* Space instruments)
  - superconducting magnet, 167, 665
  - twin-screw extruder for solid deuterium, 671
  - variable loads, 545
- ITT Space Systems:
- Characterization of ABI 2-stage PT, 55
  - Space qualification of ABI 2-stage PT, 49
- Jackson & Tull, turbo-Brayton electronics, 471
- J-T cryocoolers:
- 2-stage mixed-gas J-T cryoprobe system, 415
  - Ball hybrid Stirling/J-T for variable loads, 545
  - Creare J-T for distributed microcooling, 433
- on-chip detector cooling for space, 405
- mixed-refrigerant J-T microcooler, 425
- NGST MIRI 6K cooler devel., 7
- thermoacoustic expansion valve for, 451
- performance study of miniature J-T cooler, 379
- recuperators for (*see* Recuperators)
- Japan Aerospace Exploration Agency (JAXA):
- 2-stage 20K Stirling cooler for space, 13
- Jet Propulsion Laboratory (NASA):
- MSL/CheMin cryocooler system, 621
  - AIRS cryocoolers, 6 years in space, 613
- Johnson Research and Development:
- proton conductive membrane compressor, 299
- Joule-Thomson Cryocoolers (*see* J-T cryocoolers)
- Korea Basic Science Inst.:
- cooling for superconducting magnet, 665
- Korea Adv. Inst. of Science and Tech. (KAIST):
- PT geometry effect on dynamic behavior, 217
  - PCHE-type recuperator with bypass, 363
- Korea Electric Power Research Inst. (KEPRI), 217
- Korea Univ., J-T cooler study, 379
- Korea Inst. of Machinery and Materials, 379
- L-3 Cincinnati Electronics coolers, 143
- Lockheed Martin ATC (Palo Alto):
- 4K 4-stage PT cooler evaluation, 657
  - 75K/130K RAMOS 2-stage PT cooler, 39
  - low-mag-field ADR for 100 mK sensors, 513
- Magnetic refrigerators:
- 50 mK ADR coupled to <sup>3</sup>He sorption cooler, 505
  - low-mag-field ADR for 100 mK sensors, 513
- Massachusetts Institute of Technology:
- superfluid He PT driven by magnetic pump, 519
- Materials (*see* Regenerators)
- Mezzo Tech., microchannel recuperator, 397
- MIRI 6K hybrid PT/J-T cryocooler, 7
- MIT (*see* Massachusetts Institute of Technology)
- Mixed refrigerants (*see* J-T cryocoolers)
- NASA/GSFC (*see* Goddard Space Flight Center)
- NASA/JPL (*see* Jet Propulsion Laboratory)
- Nat'l Inst. of Standards and Tech. (*see* NIST)
- National Instruments, Israel, 569
- NIST:
- IR imaging for PT characterization, 233
  - miniature 150Hz PT cryocooler, 105
  - mixed-refrigerant J-T microcooler, 425
  - piezoelectric J-T microcompressor, 441
  - PT cooler for superconducting magnet, 167
  - regenerators at 4K with <sup>3</sup>He and <sup>4</sup>He, 325
  - test facility for PT energy flows, 191
- Northrop Grumman Space Tech. (*previously* TRW):
- 10K 3-stage PT performance, 1
  - 77K-1.3W micro PT cooler, 97
  - ABI 2-stage PT cooler, 49, 55
  - AIRS 55K PT cooler, 6 years in space, 613
  - MIRI 6K hybrid PT/J-T cryocooler, 7
  - remote cooling with the HEC PT, 541

- Piezoelectric activated compressor, 289, 441
- Pulse tube cryocoolers:
- 20K CEA/Air Liquide PTs for space, 71
  - 70K/140K 2-stage at CEA, 63
  - Air Liquide 40-80K space PT cryocoolers, 115
  - AIRS cryocoolers, 6 years in space, 613
  - CFIC-Qdrive, oxygen liquefier, 681
  - LM-ATC 4K 4-stage PT evaluation, 657
  - LM-ATC 75K/130K RAMOS cooler, 39
  - NGST 2-stage PT for ABI, 49, 55
  - NGST 6K MIRI hybrid PT/J-T cryocooler, 7
  - NGST 10K 3-stage PT performance, 1
  - NGST 77K-1.3W micro PT cooler, 97
  - NIST miniature 150 Hz PT cryocooler, 105
  - NIST 50W at 50 K for supercond. magnet, 167
  - Raytheon hybrid Stirling/PT, 31
  - Raytheon low cost space cryocooler system, 125
  - Thales 15 W at 80 K space PT cooler, 157
  - thermoacoustic-driven PT coolers, 227
- Pulse tube theory and investigations:
- 300 Hz 80 K PT cryocooler, 227
  - CFD modeling of PT refrigerators, 241, 251
  - coldhead vibration of coaxial PT, 687
  - exergy efficiency model for regenerators, 353
  - extracting cooling from 4K PT and regen., 177
  - geometry effect on PT dynamic behavior, 217
  - inline versus 'U' configuration, 209
  - IR imaging as a means of characterization, 233
  - modeling 2-stage PT performance, 55
  - numerical study of PT configurations, 271
  - numerical sym. of flow in ineriance tube, 261
  - proton conductive membrane compressor, 299
  - regenerator studies (*see* Regenerators)
  - screen vs. tapered-fin heat exchanger, 185
  - superfluid He PT driven by magnetic pump, 519
  - test facility for PT energy flows, 191
  - thermally-coupled 2-stage PT cryocooler, 79
  - thermocconductivity role in PT perf., 281
  - two PT coldheads driven by one compressor, 201
  - Zhejiang Univ. study of 1-stage PT cooler, 149
- Raytheon Space and Airborne Systems:
- analysis of hybrid Brayton/Stirling cooler, 479
  - CFD modeling of PT refrigerators, 241
  - drive electronics for turbo-Brayton cooler, 471
  - drive electronics for Stirling & PT coolers, 607
  - fluid loop heat transport system, 533
  - ground testing of space IR sensor, 695
  - hybrid Stirling/PT cooler devel. programs, 31
  - hydrodynam. regenerator parameters, 335, 343
  - low cost space cryocooler (LCSC) testing, 125
  - proton conductive membrane compressor, 299
  - test of 2-stage turbo-Brayton for space, 461
- Recuperators:
- Ball Aerospace microplate, 373
  - microchannel for reverse-Brayton, 397
  - micromachined for cryosurgical probe, 387
  - numerical study of J-T HX, 379
- PCHE-type with transverse bypass, 363
- Regenerators:
- effect of material config. on 4K GM, 317
  - exergy efficiency model for, 353
  - hydrodynam. parameters of regenerators, 335, 343
  - low-porosity at 4 K with  $^3\text{He}$  and  $^4\text{He}$ , 325
- Reliability analysis of cryocoolers:
- L-3 Cincinnati Electronics coolers, 143
  - prognostic health management system, 637
- Remote cryogenic loads, cooling of via:
- Ball hybrid Stirling/J-T, 545
  - Creare turbine circulator, 533
  - hybrid Brayton/Stirling cooler, 479
  - NGST HEC PT w/ flow loop, 541
  - NGST MIRI 6K hybrid PT/J-T cryocooler, 7
- Reverse-Brayton cryocoolers:
- 65K-100K 2-stage for space applications, 461
  - analysis of hybrid Brayton/Stirling cooler, 479
  - drive electronics for, 471
  - recuperators for (*see* Recuperators)
- Ricor, Ltd.:
- CFD modeling of PT refrigerators, 251
  - design of aural undetectable imagers, 587
  - K508 in MSL/CheMin instrument, 621
  - K535-LV for vibration-free applications , 569
  - miniature 150 Hz PT cryocooler, 105
- S2 Corp., Bozeman, MT:
- low vibration, low thermal noise system, 581
- Sest, Inc., prognostic health managm't system, 637
- Shanghai Jiao Tong Univ., 325
- Sorption cryocoolers:
- 4.5K 5mW He/ $\text{H}_2$  sorption cooler, 23
- Space instrument missions:
- ABI, 49, 55
  - AIRS, 613
  - AKARI, 13
  - MIRI (JWST), 7
  - MSL/CheMin, 621
  - NEXT, 13
  - SPICA, 13
  - thermal management system needs, 647
- Stirling cryocoolers:
- AIM miniature flexure-bearing cooler, 133
  - analysis of hybrid Brayton/Stirling cooler, 479
  - Ball hybrid Stirling/J-T for variable loads, 545
  - CLSS tactical coolers for 3rd-gen. platforms, 139
  - Japan 2-stage 20K cooler for space, 13
  - L-3 Cincinnati Electronics coolers, 143
  - load shifting technique for multistages, 89
  - Raytheon hybrid Stirling/PT coolers, 31
  - Ricor K508, 621
- Sub-Kelvin coolers:
- ADR coupled to  $^3\text{He}$  sorption cooler, 505
  - CEA/SBT pocket dilution cooler, 497
  - dilution with direct PT precooling, 491
  - low-mag-field ADR for 100 mK sensors, 513
- Sumitomo Heavy Industries:
- 2-stage 20 K Stirling cooler for space, 13
  - Superfluid He PT driven by magnetic pump, 519
  - Superconductor applications (*see* Integration of cryocoolers with)

- Switch, cryogenic thermal (*see* Heat switch)
- Technion, Haifa, Israel:
- CFD modeling of PT refrigerators, 251
  - IR imaging for PT characterization, 233
  - miniature 150 Hz PT cryocooler, 105
  - piezoelectric activated compressor, 289
- Thales Cryogenics:
- 15 W at 80 K space PT cooler, 157
- Thermac LLC, 55
- Thermal management system needs, 647
- Thermal switch (*see* Heat switch)
- Thermoacoustic coolers:
- 300 Hz 80 K PT cryocooler for, 227
  - thermoacoustic expander for J-T system, 451
- Throttle cycle (*see* J-T cryocoolers)
- Tokyo Inst. of Tech.:
- effect of regen. mat'l config. on 4 K GM, 317
- Toshiba Corp.:
- effect of regen. mat'l config. on 4 K GM, 317
- Transfer line (*see* Pulse tube theory and investigations)
- TRW (*see* Northrop Grumman Space Tech.)
- Turbo Brayton coolers (*see* reverse Brayton coolers)
- Univ. of Colorado, Boulder:
- mixed-refrigerant J-T microcooler, 425
  - piezoelectric J-T microcompressor, 441
- Univ. of Giessen, Germany:
- thermally-coupled 2-stage PT cryocooler, 79
- Univ. of Michigan, Ann Arbor:
- distributed cooling for boil-off reduction, 631
- Univ. of New Mexico,
- exergy efficiency model for regenerators, 353
  - numerical sym. of flow in inertance tube, 261
- Univ. of Tsukuba, Japan:
- 2-stage 20 K Stirling cooler for space, 13
- Univ. of Twente, The Netherlands:
- 4.5K 5mW He/H<sub>2</sub> sorption cooler, 23
  - on-chip detector cooling with MEMS J-T, 405
- Univ. of Wisconsin, Madison:
- 2-stage mixed-gas J-T cryoprobe system, 415
  - distributed cooling for boil-off reduction, 631
  - GM-cooled twin-screw extruder, 671
  - IR imaging for PT characterization, 233
  - micromachined HX for cryosurgical probe, 387
  - PT cooler for superconducting magnet, 167
  - study of 1-stage PT cryocooler, 149
  - test facility for PT energy flows, 191
- Veermata Jijabai Tech. Institute, India, 209
- Vibration and acoustic noise:
- coldhead vibration of coaxial PT, 687
  - design of aural undetectable imagers, 587
  - low vibration, low thermal fluctuation sys., 581
  - Ricor K535-LV vibration-free Stirling cooler, 569
- Virtual Aerosurface Tech.:
- CFD modeling of PT refrigerators, 241
  - hydrodynam. parameters of regenerators, 343
- Walther Meissner Institute, 491
- Zhejiang Univ.:
- miniature 150 Hz PT cryocooler, 105
  - study of 1-stage PT cryocooler, 149