

# Subject Index

- Absolut System SAS (France):
  - 40 K Turbo-Brayton cooler for space, 337
  - flight-like cryostat for 2-stg PT cooler, 407
- Active displacer, in PT cooler, 181
- Active magnetic regenerators (*see* regenerators)
- Active thermal management of coolers:
  - for CubeSats, 397
- Air Liquide:
  - perf. improvement of 15 K PT cooler, 7
  - qual status of LPTC PT cooler for MTG, 127
- Applications of cryocoolers (*see* Integration with cryocoolers)
- Ariel Univ. (Israel):
  - thermal efficiency of sorption compressor, 329
- Ball Aerospace:
  - low-vibration assembly for coolers, 447
  - qual test results for TIRS-2 35 K Stirling, 49
- BICEP array, sub-Kelvin cooling for, 347
- Brayton cryocoolers (*see* Reverse-Brayton coolers)
- California Institute of Technology (*see also* Jet Propulsion Laboratory):
  - BICEP array, sub-Kelvin cooling for, 347
- CAS, Chinese Academy of Sciences (*see* Tech. Inst. of Physics & Chemistry, Beijing *and* Shanghai Inst. of Tech. Physics)
- CEA INAC-SBT (Grenoble, France) (*see* Univ. Grenoble Alpes)
- Center National D'Etudes Spatiales (*see* CNES)
- Centre Spatial de Liege, Belgium, 387
- Circulation Systems (*see* Remote cryogenic loads)
- CNES (Toulouse, France):
  - demo of 3-stage PT cooler for space, 17
- Compressor:
  - <sup>3</sup>He circulation for dilution, 357
- Creare, LLC:
  - active magnetic regenerative cooler, 253
  - coated regenerator for 30 K cooler, 245
  - lightweight high-effect. recuperator, 279
  - micro-structured regenerator filler, 235
- Cryomech:
  - 1 K refrig precooled by 4 K PT cooler, 369
  - large 1-stg GM for 13-30 K cooling, 223
- Cryostats (*see* integration of coolers with)
- CryoTech (Israel):
  - dynamic IR integrated dewar assy, 465
- Cryowave, Inc, thermoacoustic expander, 317
- CU Aerospace (Champaign, IL):
  - J-T microcooler test results, 287
- Cubsats, integration of coolers with:
  - active thermal management system, 397
  - Iris cooler electronics, 87
- Dilution refrigerators (*see also* Sub-Kelvin coolers):
  - improved <sup>3</sup>He circulation compressor for, 357
- Drive electronics for coolers:
  - Iris micro-size for small PT coolers, 87
  - NGAS 50V Cryocooler Electronics (CCE), 109
- Electronics, cooler drive (*see* Drive electronics...)
- Erbium regenerator materials (*see* Regenerators)
- European Space (ESA/ESTEC) activities:
  - 40 K Turbo-Brayton cooler for space, 337
  - ESA cryogenic developments overview, 377
  - flight-like cryostat for 2-stg PT cooler, 407
  - perf. improvement of 15 K PT cooler, 7
  - radioisotope Stirling generator (ERSG), 387
- Florida State University, Tallahassee FL:
  - models for superconducting pwr sys., 427
- Georgia Institute of Tech.:
  - micro-structured regenerator filler, 235
- GM-style pulse tube coolers (*see also* Pulse tube cryocoolers)
- Gifford-McMahon cryocoolers:
  - cooler integration lessons learned, 417
  - large 1-stg GM for 13-30 K cooling, 223
  - operation below 2 K with helium 4, 217
  - SHI cold He circulation system for GM, 209
- Heat exchangers:
  - lightweight high-effect. recuperator, 279
  - tube-in-tube HX optimization for 4 K J-T, 271
- High temperature superconductor applications (*see* Integration of cryocoolers with)
- Holmium regenerator materials (*see* Regenerators, *see also* Gifford-McMahon cryocoolers )
- Honeywell Hymatic, UK:
  - CryoBlue, low-vibration Stirling cooler, 119
  - small scale 77 K Stirling cooler, 93
- Hybrid multistage coolers:
  - 1 K J-T refrig precooled by 4 K PT cooler, 369
  - hybrid PT w/ active magnetic regenerator, 263

- NIST 1.7 K hybrid JT/PT cooler, 295  
tube-in-tube HX for 4 K hybrid J-T, 271
- Inertance tubes (*see* Pulse tube theory and invest.)
- Integration of cryocoolers with:  
cryogen boil-off reduction system (*see* Liquefaction of gases)  
cryostats, 407, 417, 465  
CubeSats, 397  
flow loops (*see* Remote cryogenic loads)  
IR detectors, 49, 57, 143, 149, 407, 465  
liquefaction of gases (*see* Liquefaction of gases)  
QWIP detectors, 407  
remote loads (*see* Remote cryogenic loads)  
superconducting magnets, lessons learned, 417  
superconducting nanowire photon detectors, 295  
superconducting power systems, 427  
vibration sensitive applications (*see* Vibration)
- Iris Technology Corp:  
maturation of LM Micro 1-2 cooler, 81  
micro-size cryocooler controller for space, 87
- Japan Aerospace Exploration Agency (JAXA):  
improved <sup>3</sup>He comp. for dilution cooler, 357
- J-T cryocoolers:  
1 K J-T refrig precooled by 4 K PT cooler, 369  
JT cooler for mixed gas optimization, 305  
Lockheed J-T microcooler test results, 287  
tube-in-tube HX for 4 K hybrid J-T, 271
- Jet Propulsion Laboratory (NASA/JPL):  
active thermal management of CubeSats, 397  
BICEP array, sub-Kelvin cooling for, 347  
characterization of LM Micro 1-2 cooler, 71  
low-temp char. of cooler mech. isolators, 455  
maturation of LM Micro 1-2 cooler, 81
- Joule-Thomson Cryocoolers (*see* J-T cryocoolers)
- KAIST (*see* Korea Adv. Inst. of Science & Tech.)  
Korea Adv. Inst. of Science & Tech., Daejeon, Korea:  
hybrid PT w/ active magnetic regenerator, 263  
PT with cold comp. & cold phase control, 187
- Lawrence Berkeley Laboratory:  
cooler integration lessons learned, 417
- Liquefaction of gases:  
lessons learned with cooler integration, 417  
zero-boil-off system trades, 439
- Lockheed Martin, Palo Alto, CA:  
J-T microcooler test results, 287  
micro 1-2 cooler, JPL characterization of, 71  
micro 1-2 cooler, LM maturation of, 81
- Los Alamos National Lab (LANL):  
jet-induced phase errors in compliance press, 201
- Loughborough Univ. (UK):  
dynamic IR integrated dewar assy, 465
- Magnetic refrigerant materials (*see* Regenerators)
- Materials:  
refrigerants (*see* J-T cryocoolers)  
regenerator (*see* Regenerators)
- Mixed refrigerants (*see* J-T cryocoolers)  
Moog CSA, low-vibration mount for coolers, 447
- NASA Glenn Research Center:  
zero-boil-off system trades, 439
- NASA Goddard Space Flight Center:  
qual test for Ball TIRS-2 Stirling cooler, 49
- NASA/JPL (*see* Jet Propulsion Laboratory)
- NASA Marshall Space Flight Center:  
zero-boil-off system trades, 439
- Nat'l Inst. of Standards and Tech. (*see* NIST)
- NIST:  
1.7 K cooler for nanowire photon detectors, 295
- Northrop Grumman (NGAS)—*previously* TRW:  
50 V cryocooler electronics (CCE), 109  
coaxial HEC cooler performance, 109  
low-vibration mount for coolers, 447  
MinicoolerPlus performance, 109
- Ofttech, UK:  
40 K Turbo-Brayton cooler, 337
- Pressure Wave Systems, Munich, Germany:  
3D printed He-based regenerator for 4 K, 231
- Propellant liquefaction and densification (*see* Liquefaction of gases)
- Pulse tube cryocoolers:  
1 kg miniature PT cooler, 103  
5 W at 60 K PT cooler for IR sensors, 149  
10 K gas-coupled 2-stage PT cooler, 1  
15 K 3-stage PT cooler for space, 17  
15 W at 80 K Coaxial PT cooler, 155  
20 K U-type 2-stg PT cooler, 35  
35 K single-stage for space IR detectors, 57  
Air Liquide 15 K PT cooler for space, 7  
Air Liquid LPTC PT cooler qual status, 127  
drive electronics for (*see* Drive Electronics)  
Lockheed Martin Micro 1-2 cooler, 71, 81  
NGAS coaxial HEC cooler perf., 109  
NGAS MinicoolerPlus performance, 109  
SITP/CAS 150 K-220 K PT cooler, 143
- Pulse tube theory and investigations:  
coated regenerator for 30 K cooler, 245  
hybrid PT w/ active magnetic regenerator, 263  
jet-induced phase errors in compliance press, 201  
perf. improvement of 15 K PT cooler, 7  
PT optimization with active displacer, 181  
PT with cold comp. & cold phase control, 187  
regenerator studies, generic (*see* Regenerators)  
VM-type PT cooler operating below 10 K, 195
- QWIP detectors (*see* Integration of coolers with)
- Radioisotope Stirling Generator (ERSG), 387
- Rare earth compounds (*see* Regenerators)
- Recuperative heat exchangers (*see* Heat exchangers)
- Refrigerants (*see* J-T cryocoolers)
- Regenerators:  
3D printed He-based regenerator for 4 K, 231  
active magnetic regenerator, 253, 263

- coated regenerator for 30K Stirling cooler, 245
- micro-structured regenerator filler, 235
- Re-Liquefaction of gases (*see* Liquefaction of gases)
- Remote cryogenic loads, cooling of via:
  - AMRR system for 2 K space applications, 253
  - cold He circulation system for GM, 209
  - $^3\text{He}$  circulation compressor for dilution, 357
- Reverse-Brayton cryocoolers:
  - 40 K Turbo-Brayton cooler for space, 337
  - lightweight high-effect. recuperator for, 279
- Rutherford Appleton Lab—RAL (UK):
  - CryoBlue, low-vib 50 K Stirling cooler, 119
  - Radioisotope Stirling Generator (ERSG), 387
  - small scale 77 K Stirling cooler, 93
- SemiConductor Devices—SCD (Israel):
  - ruggedizing cryocooled IR detectors, 465
- Shanghai Inst. of Tech. Physics / CAS (China):
  - 35 K single-stage PT for space IR detectors, 57
  - devel of 150K-220K PT cooler, 143
- Sorption cryocoolers:
  - thermal efficiency of sorption compressor, 329
- Space cryocooler development overviews:
  - ESA cryogenic developments overview, 377
  - synergies between tactical & space coolers, 171
- Stirling cryocoolers:
  - 30 K 1-stage free-piston Stirling cooler, 41
  - coated regenerator for 30K cooler, 245
  - CryoBlue, low-vib 50 K Stirling cooler, 119
  - qual test for Ball 35 K TIRS-2 cooler, 49
  - RAL small scale 77 K cooler, 93
  - simulation of 2-stg 20 K Stirling cooler, 27
  - Sunpower DS 30 cooler development, 135
  - Thales miniature rotary Stirling cooler, 63
  - Thales linear for extreme ambient temps, 161
- Sub-Kelvin coolers:
  - for BICEP Array project, 347
  - improved  $^3\text{He}$  comp. for dilution cooler, 357
- Sumitomo Heavy Industries (SHI):
  - GM operation below 2 K with  $^4\text{He}$ , 217
  - mobile cryogenic system for GM, 209
- Sunpower, Inc.:
  - coated regenerator for 30 K Stirling cooler, 245
  - DS 30 cooler development, 135
  - low-vibration mount for coolers, 447
- Superconductor applications:
  - models of superconducting power sys., 427
  - superconducting magnets, lessons learned, 417
  - superconducting nanowire photon detectors, 295
- Technical Inst. of Physics and Chemistry, CAS:
  - 1 kg miniature PT cooler, 103
  - 5 W at 60 K PT cooler for IR sensors, 149
  - 10 K gas-coupled 2-stage PT cooler, 1
  - 15 W at 80 K Coaxial PT cooler, 155
  - 20 K U-type 2-stage PT cooler, 35
  - 30 K 1-stage free-piston Stirling cooler, 41
  - simulation of 2-stg 20 K Stirling cooler, 27
  - tube-in-tube HX optimization for 4 K J-T, 271
  - VM-type PT cooler operating below 10 K, 195
- Thales Alena Space UK:
  - CryoBlue, low-vibration Stirling cooler, 119
  - Radioisotope Stirling Generator (ERSG), 387
  - small scale 77 K Stirling cooler, 93
- Thales Cryogenics (The Netherlands):
  - flight-like cryostat for 2-stg PT cooler, 407
  - miniature rotary Stirling cryocooler, 63
  - Stirling cooler for extreme ambient temps, 161
  - synergies between tactical & space coolers, 171
- Thermoacoustics:
  - simulation of open-cycle cooler expander, 317
- TRW coolers (*see* Northrop Grumman)
- Turbo alternator (*see* reverse Brayton coolers)
- Turbo Brayton coolers (*see* reverse Brayton coolers)
- Univ. of Chinese Academy of Sciences (*see* Technical Inst. of Physics and Chem, CAS)
- Univ. of Grenoble Alps, CEA INAC-SBT (France):
  - BICEP array, sub-Kelvin cooling for, 347
  - demo of 3-stage PT cooler for space, 17
  - flight-like cryostat for 2-stg PT cooler, 407
  - perf. improvement of 15 K PT cooler, 7
- Univ. of Oxford (UK):
  - PT with active displacer, 181
  - Radioisotope Stirling Generator (ERSG), 387
- Univ. of Sussex (UK), 181
- Univ. of Tsukuba (Japan):
  - improved  $^3\text{He}$  comp. for dilution cooler, 357
- Univ. of Wisconsin:
  - JT cooler for mixed-gas optimization, 305
- Utah State Univ, Space Dynamics Lab (SDL):
  - active thermal management of CubeSats, 397
  - low-vibration mount for coolers, 447
- Vantage Partners, zero-boil-off system trades, 439
- Vibration:
  - Ball low-vibration assembly for coolers, 447
  - dynamic IR integrated dewar assy, 465
  - low-temp char. of cooler mech. isolators, 455
- VM compressor for driving PT cooler, 195
- West Coast Solutions:
  - micro-structured regenerator filler, 235
- Zero-boil-off cryogen storage (*see* Liquefaction of gases)