SORP'I'1ON REFRIGERATION DEVELOPMENT AT JPL/NASA

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JPL has been involved in cryogenic refrigeration development for NASA since 1979, and with the help of NASA, Southern California Gas Company, Ford Automotive, and Aerojet General, wc have been spinning off this technology for commercial air conditioning since 1990. In all, JPL has fabricated and successfully tested the following sorption refrigerators: physical solid adsorption systems (helium, nitrogen, krypton, R22, R1 34a, and ammonia), chemical solid absorpt ions ystems (h ydrogen, nit rogen, and oxygen), and liquid absorption systems (ammonia and R] 34a). Two hydrogen chcmisorption systems for cooling to 10K (-263°C) and 25K (-248°C) arc presently flight qualified and ready to cool detectors for a NASA Shuttle Mission and a Balloon Flight.

All of these systems operate on the same basic principle of absorbing a refrigerant gas at a lower temperature, typically near room temperature, and then desorbing, or venting, the gas at a much higher pressure when heated an additional 100°C-200°C. Precooling and expansion of the gas then creates refrigeration with essentially no wear-related moving parts.

Of particular interest arc several commercial developmental projects. Onc system being built by Aerojet and licensed from JPL/Caltech, is a 7.2 ton solid adsorption air conditioner that will be installed on a subway train in Los Angeles. This system is projected to have a cooling COP of 0.75 and will bc powered by the waste heat from the train's clcctro-resistive braking system. Another project being pursued by Aerojet, the Southern California Gas Company, and JPL is the development of a three ton solid adsorption air conditioner for residential and commercial USC. The three ton developmental unit is scheduled for testing in 1995, and the subway air conditioner is scheduled for completion in 1996.

Another sorption project being pursued by Ford Automotive and the Southern California Gas Company at JPL is the development of high performance, compact liquid absorption systems that can bc powered by gas heat or automotive exhaust waste heat. Although the performance projections are not quite as high as those for the solid adsorption systems, the liquid RI 34a and ammonia absorption compression systems arc ext remel y simple, inexpensive, and light weight. Furthermore, the systems arc insensitive to gravity vector changes, thus potentially fitting some mobile heat-activated applications, where some performance can be sacrificed, but cost is critical.