Advanced Cycle Environmental Control Unit

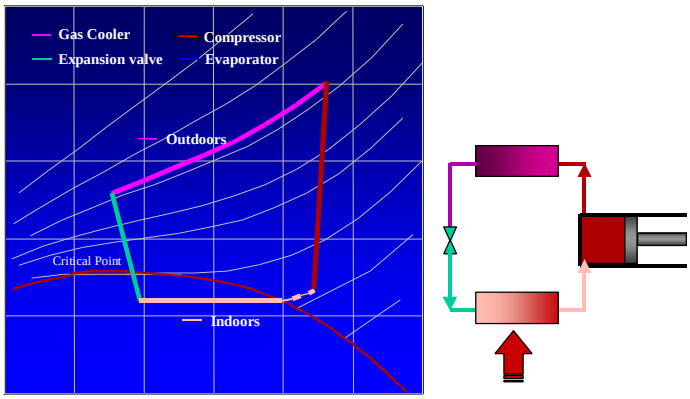
A Collaborative Effort between the US Air Force Research Laboratory (AFRL/MLQ) and Industry

THE PROBLEM:

As one of five essential infrastructure elements, Bare Base Environmental Control Units (ECUs) protect personnel, vital aircraft support systems, and sensitive C^4I equipment in harsh climates. Current ECUs are based on 1960's technology, drafting 40 percent of all mobile electric power (MEP) and accounting for more than ten percent of the initial and follow-on deployment weight.

THE SOLUTION:

By using a high efficiency compression cycle, the Advanced Cycle Environmental Control Unit (ACECU) provides both heating and cooling in one lightweight package. The ACECU does not need fragile, bulky evaporator and condenser coils. Unlike existing ECU refrigerants, the ACECU CO_2 refrigerant is environmentally benign, inexpensive, and does not experience decomposition during extended times of storage or inactivity.



ACECU Flow Diagram

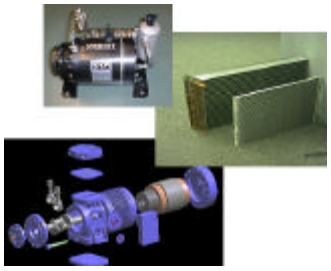
BENEFIT:

The ACECU will contribute significant gains toward the Air Expeditionary Force (AEF) goal of 6000NM 24hr deployment capability. Significant operational benefits include: 250-300lb weight reductions per unit; 2-4kW less MEP load; and the elimination of ozone-depleting compounds (ODC) refrigerants.

A prototype of the ACMHP system will be developed. Current research efforts have shown potential increase in COP by 20%. The cumulative benefits of weight reduction per unit and increased efficiency and capacity will allow 1100 man Harvest Falcon detachments deploying 240 ECUs to reduce airlift weight by 60,000 to 72,000lbs. This is the equivalent of two C-141 sorties.

PRODUCT OF RESEARCH:

The product of this innovative research initiative is the development of a dual heating and cooling ECU to comply with tomorrow's environmental mandates. The unit will provide added operational effectiveness through better performance and reduced airlift "footprint." The ACECU has a high commercialization potential for domestic and automotive use.



ACECU Component

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