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In China, Active Thermal Management Technologies have Recently been Developed for the Construction of Energy-Efficient Aerospace vehicles

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Several profound and dramatic transformations in the growth of the global aerospace industry have recently been observed: (A) the More Electric Aircraft (MEA) of All Electric Aircraft (AEA) design principle has been applied to a number of new-generation atmospheric vehicles1 such as the F-22, F-35, Airbus A380, and Boeing 787; (B) operated by the Integrated Vehicle Energy Technology project. With the development of reusable and hypersonic technology, the idea of Energy-Optimized Aircraft (EOA) has been proposed; (C) marked by the efficient operation of the X-37B, the boundaries between space and aviation vehicles have become blurry, accelerating the historic integration of the trans-atmospheric vehicles.

It is a significant step forward from the MEA/AEA project to the "INVENT" project, in which the whole energy supply will be viewed as an organic unity. The use of primary energy can be reduced while the operational range is increased thanks to the optimization of the energy management system, making it easier to integrate space and aviation systems. The rapid development of aerospace brings thermal management challenges for various air or space vehicles. The Thermal Management System (TMS) is a spacecraft subsystem that keeps on-board thermal properties including temperature, temperature differential, and humidity within the design parameters.

The TMS is an important device for a space vehicle since the vehicle's outer space is a vacuum with only radiative heat transfer, which does not meet the heat removal criteria even for early space-oriented equipment. Early aeroplanes, on the other hand, did not have the TMS because the added cold air could cool the heated components. The TMS is becoming an important subsystem of atmospheric vehicles as the power system, propulsion system, and high-performance avionics grow.

Space-based TMS and air-based TMS have several similarities. For example, an airplane's fuel cooling loop can be compared to the single-phase Mechanically Pumped Fluid Loop (MPFL), which has been used as an active liquid-based TMS in many spacecraft.

Coating technology was also proposed for use in hypersonic vehicles as a passive thermal control technique to improve radiative heat transfer in spacecraft. It means that, unlike other subsystems such as the propulsion and control systems, the TMSs of both atmospheric and space vehicles share many properties and face many of the same problems.

Cronin of Lockheed proposed the MEA or AEA model in the 1970s, in which electric power would be the primary or single secondary power rather than a multi-energy system with electric, hydraulic, and pneumatic power. As previously said, with the development of micro-electro-mechanical systems, the F-22, F-35, Airbus A380, and Boeing 787 are popular models of new generation MEAs. With the rapid development of MEA or AEA technology, a low-carbon flight can be realised due to the high energy conversion of electrical fuel. However, issues arise in the construction of the MEA/AEA project when a growing number of conventional hydraulic, pneumatic, and mechanical components are replaced by electrical components, such as electro-driven actuators, resulting in an explosive increase in power requirements.

The equipment cabin in the F-22 can have a peak heat load of up to 50 kW, and the total heat load of the F-22 can be up to 100 kW. To ensure high operating performance and avoid overheating-induced destruction, all electric/electronic devices should be controlled within an appropriate temperature range. The majority of power-electronics, according to Murshed and de Nieto, can operate at temperatures below 85 °C. According to another post, most Insulated Gate Bipolar Transistors (IGBTs) should not be controlled above 125 degrees Celsius.