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FROM MICRO TO MEGA: DEVELOPING SPACE POWER SYSTEMS FOR AMBITIOUS MISSIONS

Abstract

Space exploration and discoveries are a reflection of humanity's desire to push boundaries. To enable humans to stay longer in space and make deeper explorations, robust and resilient space power systems are needed. As such, powerful space power systems are being developed for various micro, mini, and long-duration explorations for future space missions.

Space power systems range from micro and milli-watt power to megawatt power. In particular, power systems developed for nano, micro, and mini satellites have become an important topic in recent years. Although these satellites require less power due to their smaller sizes, they still require a powerful and long-lasting power system.

Space power systems can rely on various energy sources. These include solar panels, radioisotope thermoelectric generators (RTG), nuclear reactors, fuel cells, and thermal energy storage systems. Solar panels generate electricity by using energy from sunlight, making them the most common energy source for spacecraft and satellite systems. RTGs convert heat generated by radioactive decay into electricity. Nuclear reactors convert heat from nuclear fission into electricity. Fuel cells use energy generated by the chemical reaction between hydrogen and oxygen, while thermal energy storage systems store heat and use it to generate electricity later.

Long-duration space missions require a powerful and long-lasting power source. Nuclear reactors and RTGs are often preferred for such missions. NASA is planning to use nuclear reactors on Mars for long-duration missions. Such reactors can be used even in areas where sunlight is not available.

Space power systems also play a crucial role in future space utilization, such as a moon village. In such scenarios, the power systems must be capable of providing enough power for human habitation and various activities. Development of powerful and reliable power systems is necessary for future space exploration and colonization.

In conclusion, space power systems are critical for ambitious space missions and future space utilization. These systems range from small to large and rely on various energy sources. As humans continue to push boundaries in space exploration, the development of advanced and resilient space power systems will remain a key area of focus.