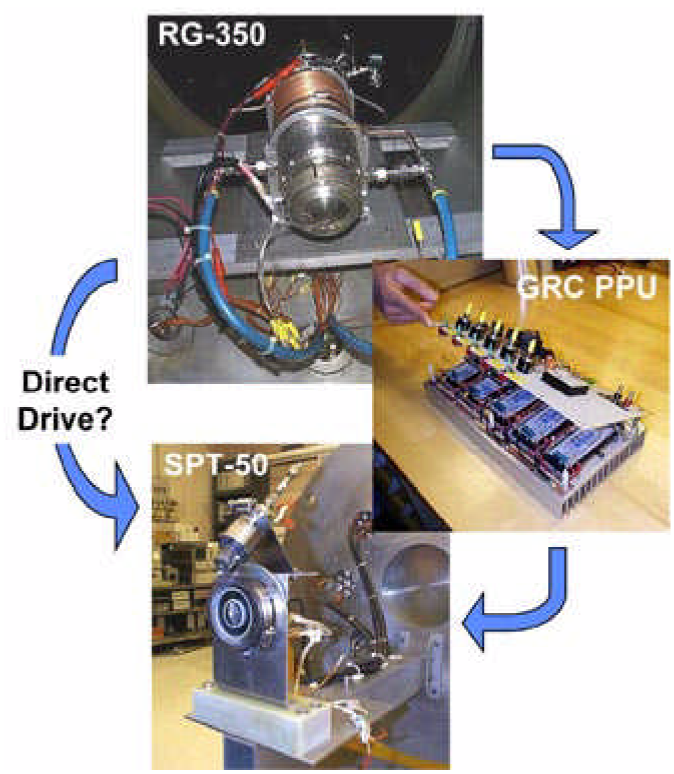
Integrated Stirling Convertor and Hall Thruster Test Conducted

An important aspect of implementing Stirling Radioisotope Generators on future NASA missions is the integration of the generator and controller with potential spacecraft loads. Some recent studies have indicated that the combination of Stirling Radioisotope Generators and electric propulsion devices offer significant trip time and payload fraction benefits for deep space missions. A test was devised to begin to understand the interactions between Stirling generators and electric thrusters. An electrically heated RG-350 (350-W output) Stirling convertor, designed and built by Stirling Technology Company of Kennewick, Washington, under a NASA Small Business Innovation Research agreement, was coupled to a 300-W SPT-50 Hall-effect thruster[1] built for NASA by the Moscow Aviation Institute (RIAME). The RG-350 and the SPT-50, shown in the figure, were installed in adjacent vacuum chamber ports at NASA Glenn Research Center's Electric Propulsion Laboratory, Vacuum Facility 8. The Stirling electrical controller interfaced directly with the Hall thruster power-processing unit, both of which were located outside of the vacuum chamber. The power-processing unit accepted the 48 Vdc output from the Stirling controller and distributed the power to all the loads of the SPT-50, including the magnets, keeper, heater, and discharge.



Stirling/Hall thruster integration at Vacuum Facility 8.

On February 28, 2001, the Glenn test team successfully operated the Hall-effect thruster with the Stirling convertor. This is the world's first known test of a dynamic power source with electric propulsion. The RG-350 successfully managed the transition from the purely resistive load bank within the Stirling controller to the highly capacitive power-processing unit load. At the time of the demonstration, the Stirling convertor was operating at a hot temperature of 530 °C and a cold temperature of -6 °C. The linear alternator was producing approximately 250 W at 109 Vac, while the power-processing unit was drawing 175 W at 48 Vdc. The majority of power was delivered to the Hall thruster discharge circuit operating at 115 Vdc and 0.9 A. Testing planned for late 2001 will examine the possibility of directly driving the Hall thruster discharge circuit using rectified and filtered output from the Stirling alternator.

Find out more about this research http://www.grc.nasa.gov/WWW/tmsb/ **.**

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