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# Distributed power in space systems

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Distributed power systems offer many benefits to system designers over central power systems such as reduced weight and size. Distributed systems also allow the designers to control the quality of power at different loads and subsystems, since DC-DC converters allow close regulation of output voltage under wide variations of input voltages and loads. Distributed power systems also provide a high degree of reliability because of the isolation provided by DC/DC converters; it is very easy to isolate system failures and provide redundancy. These systems are also very flexible and easily expanded.

This talk will address the DC distributed power system of the International Space Station, which is a specific case of this kind of distributed system. It is a channelized, load following, DC network of solar arrays, batteries, power converters, switches and cables which route current to all user loads on the station.
The completed architecture consists of both the 120-V American and 28-V Russian electrical networks, which are capable of exchanging power through dedicated isolating converters.

The presence of DC/DC converters required special attention on the electrical stability of the system and in particular, the individual loads in the system. This was complicated by complex sources and undefined loads with interfaces to both sources and loads being designed in different countries (US, Russia, Japan, Canada, Europe, etc.). These issues, coupled with the program goal of limiting costs, have proven to be a significant challenge to the program.

As a result, the program used an impedance specification approach for system stability. This approach is based on the significant relationship between source and load impedances and the effect of this relationship on system stability. It is limited in its applicability by the theoretical and practical limits on component designs as presented by each system segment. Consequently, the overall approach to system stability implemented by the ISS program consists of specific hardware requirements coupled with extensive system analysis and hardware testing.

Highlights of both experimental and analytical activities will be shown, as well as some lesson learned during the development and operational phase of Modules and payloads.

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