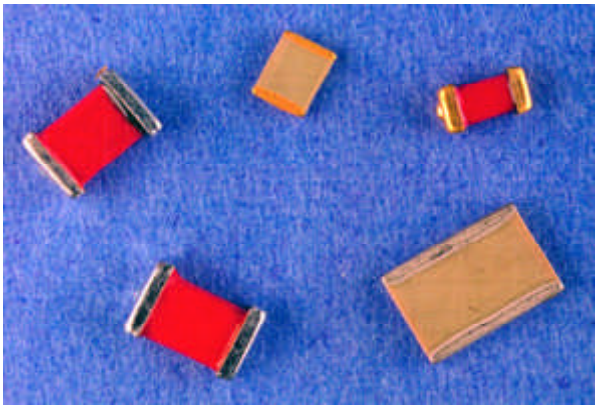
# Low-Temperature Electronic Components Being Developed

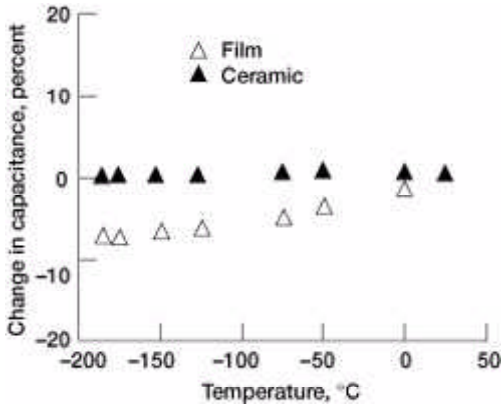
In many future NASA missions, such as deep space planetary exploration and the Next Generation Space Telescope, electrical components and systems must operate reliably and efficiently in extremely low temperature environments. Most modern electronic components cannot operate below moderately low operating temperatures (-40 to -55 °C).

The low-temperature electronics program at the NASA Lewis Research Center is focusing on the development and characterization of low-temperature components and the integration of the developed devices into demonstrable very low-temperature (-200 °C) power systems such as dc-dc converters. Such low-temperature electronics will not only tolerate hostile environments but also will reduce system size and weight by eliminating radioisotope heating units, thereby reducing launch cost, improving reliability and lifetime, and increasing energy densities.

Low-temperature electronic components will also have a great influence on terrestrial applications such as medical instrumentation, magnetic levitation transportation systems, and arctic and antarctic exploration. Lewis researchers are now performing extensive evaluations of commercially available as well as custom-made devices. These include various types of energy storage and signal capacitors, power switching devices, magnetic and superconducting materials, and primary lithium batteries, to name a few. The following photograph shows solid tantalum and ceramic capacitors that were recently evaluated for one of our customers. The components were subjected to screening and then to comprehensive characterization of parameters such as frequency, applied bias, temperature, and multistress conditions. The graph shows the capacitance of film and ceramic capacitors as a function of temperature.



*Solid tantalum (red) and ceramic capacitors.*




*Capacitance of film and ceramic capacitors at 20-kHz versus temperature.*

These research and development efforts are being carried out through collaboration with other government agencies, industrial and aerospace companies, and academia. The Low Temperature Electronics Program supports missions and development programs at the NASA Goddard Space Flight Center and the Jet Propulsion Laboratory.

**Find out more about Lewis' work with low-temperature electronics.** (Select "Low Temperature Electronics" at the bottom of the list on the left.)

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Programs/Projects: X2000 (JPL), Next Generation Space Telescope (Goddard), Low Temperature Electronics