



"It is very cold in space."

So noted Khan Noonien Singh
in *Star Trek II: The Wrath of Khan*.

Frigid temperatures in space can
wreak havoc on electrical components
used to run the equipment aboard
deep-space probes such as Voyager
and Cassini and the Mars rovers named
Spirit and Opportunity. To address this
issue, the Plutonium-238 Science and
Engineering Group has developed heat
sources for radioisotopic thermoelectric
generators (RTGs).



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MARTIAN NIGHTS
ARE FRIGID, WITH
TEMPERATURES REACHING
-80°C. TO KEEP ELECTRONICS
WARM AND FUNCTIONAL,
THE MARTIAN ROVER,
SPIRIT, HOLDS EIGHT SMALL
HEAT SOURCES THAT EXTEND
THE LIFE OF ROVER BATTERIES
FROM 20 TO 90 DAYS. EACH
HEAT SOURCE CONTAINS A
PLUTONIUM PELLETT (INSET)
THAT GENERATES 60 TO
65 WATTS OF THERMAL POWER.

DEEP SPACE

HEATING THINGS UP IN SPACE

EXPLORATION

The isotope plutonium-238 generates heat
as it decays. Los Alamos scientists have
harnessed this heat to keep critical
components warm in deep-space probes
and to power electrical generators that run
experimental equipment aboard planet-
exploring vehicles. Los Alamos is the only
facility in the Department of Energy complex
to handle plutonium-238 oxide, metal, and
solutions in substantial quantities of
unencapsulated forms.

Heat sources developed at Los Alamos have
been used on space missions for more than
30 years, with RTGs traveling to the Moon, Mars,
Jupiter, Saturn, and beyond our solar system. As
probes venture deeper into space, Los Alamos
scientists will continue to improve upon heat-source
technology by drawing on a number of unique
capabilities, such as processing plutonium oxide
fuel powders, fabricating and sintering fuel forms,
specialized welding, and metallurgical and
ceramographic examinations.



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ABOARD THE CASSINI
SPACECRAFT ARE 216 LARGE
HEAT SOURCES, ALL OF
WHICH WERE FABRICATED
AT LOS ALAMOS (THE INSET
SHOWS A PLUTONIUM PELLETT,
THE "HEART" OF A HEAT
SOURCE). CASSINI IS ON ITS
WAY TO SATURN, WHERE IT
WILL EXPLORE THE PLANET'S
RINGS AND SUBSEQUENTLY
RELEASE THE HUYGENS PROBE,
WHICH WILL LAND ON TITAN,
SATURN'S BIGGEST AND
MOST INTRIGUING MOON.

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