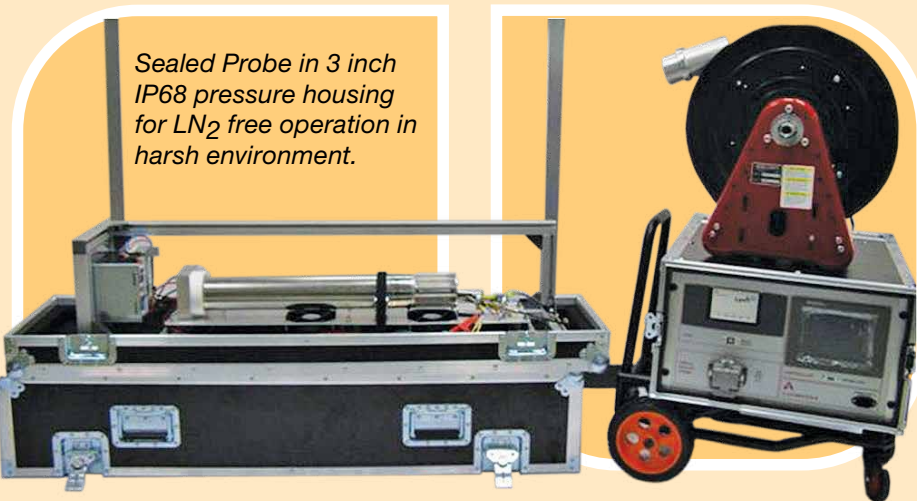
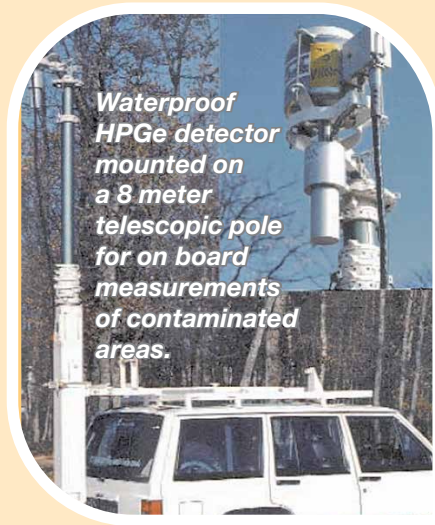


“ **Dedicated Solutions for Spectroscopy
in a Harsh Environment**



**Ruggedized Germanium
Detector Systems**

CANBERRA

➔ Germanium detectors represent the best choice when high resolution gamma spectroscopy is required for accurate nuclide identification and quantification.

However, some potential problems can compromise the use of these technologies when the spectroscopy system is intended to be used in harsh environments such as:

- > Shock and vibration (transportation by trucks, separation of space launcher stages)
- > Industrial use in sites where liquid nitrogen is not available for detector refilling
- > Extreme climatic conditions (underwater operation, very high or low temperatures, etc.) in industrial or space environments

The combination of CANBERRA's extensive experience with the evolution of new technologies (encapsulation, ultra high vacuum, waterproof design, shock absorption devices) make us the world leader in scientific and special applications involving HPGe detectors.

CANBERRA's expertise allows our specialists to deliver outstanding and reliable detection instruments for the most demanding industries and research centers. Researchers have come to depend on these specialized instruments for their most critical experiments and studies.

» Features

- > Hardened design, shock and vibration resistant
- > Adapted cooling devices (electrical coolers)
- > Multiple references in space missions (Integral, Mars Orbiter, Selene...)
- > Encapsulation techniques allowing easy exchange of each individual detector when mounted in arrays
- > Dedicated shapes and materials for cryostats (hexagonal cutting, titanium light weight capsules, telescope mount, etc.)
- > Large choice of N-type detectors and associated annealing accessories for on-site repair after radiation damage
- > Ultra High Vacuum for the best reliability
- > Waterproof design for outdoor use
- > Easy to decontaminate

» Applications

- > Space
- > Environment
- > D&D
- > Industry

➔ Significant examples:

» HPGe Detectors for Space: The Mars Odyssey Mission

(ref.: Intespace – Toulouse, NASA, University of Arizona)

The goal of this mission consisted of launching a satellite to detect the presence of water (ice) on the planet Mars by using (n,γ) reactions.

DETECTOR TYPE

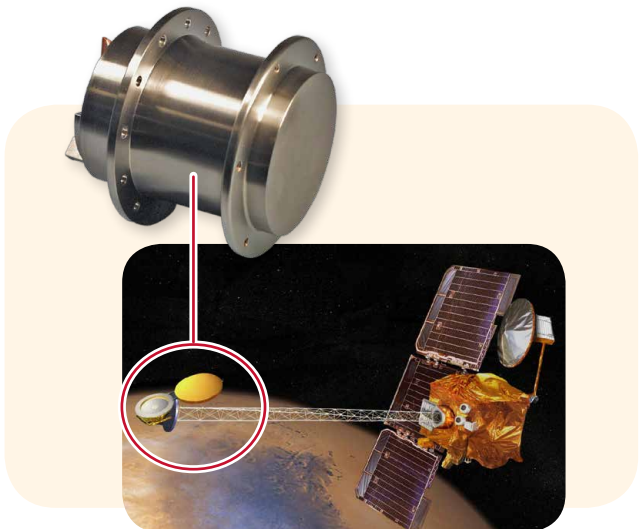
Coaxial HPGe, N-type, titanium encapsulated efficiency 50%.

SINUSOIDAL VIBRATION

2 octaves per minute 1 g from 10 to 100 Hz on the 3 axis.

RANDOM VIBRATION

- > 0.01 g²/Hz @ 20 Hz
- > 0.06 g²/Hz @ 80 Hz
- > 0.06 g²/Hz from 100 Hz to 250 Hz
- > 0.01 g²/Hz @ 2000 Hz



Encapsulation offers sealed ultra-high vacuum conditions, therefore long life and the possibility to anneal the detector from radiation damage without pumping or opening to the deep space environment.

The technology developed also offers light weight sensors, a very important criterion for devices in space. The use of titanium offers another important asset: aluminum would conflict with gamma rays of interest.

» Integral SPI Project

(ref.: Intespace – Toulouse)

This mission consists of the equipment for a satellite in orbit around the Earth to study supernova, black holes, and other emitters of gamma bursts.

DETECTOR TYPE

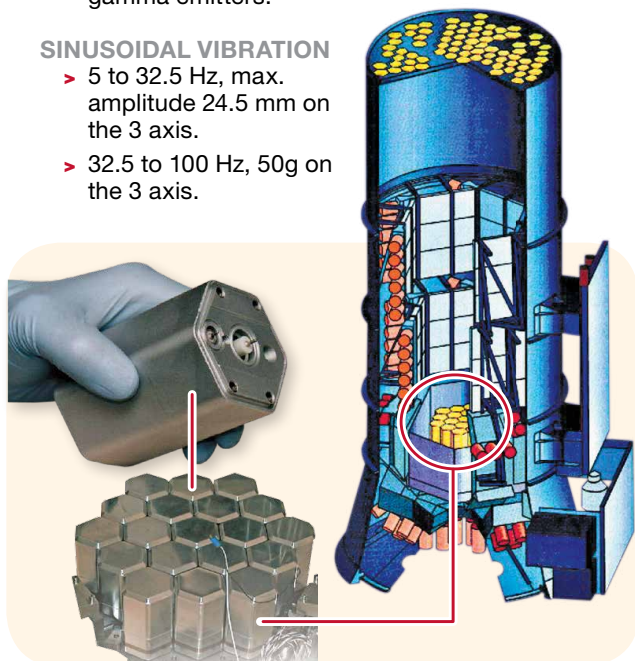
- > Compact array of 19 encapsulated coaxial HPGe detectors 40% efficiency each.
- > Special mount with coded mask allowing an accurate cartography of gamma emitters.

RANDOM VIBRATION

- > +6 dB/octave from 20 Hz to 100 Hz.
- > 0.2 g/Hz from 100 Hz to 500 Hz.
- > -6 dB/octave from 500 Hz to 2000 Hz.

SINUSOIDAL VIBRATION

- > 5 to 32.5 Hz, max. amplitude 24.5 mm on the 3 axis.
- > 32.5 to 100 Hz, 50g on the 3 axis.



» Detectors Built for Aircraft

GROUND CONTAMINATION CONTROL/France

- > Quick identification of natural or artificial radionuclides and fast activity measurements on areas of up to several hundred square meters.
- > P-type HPGe coaxial detector on helicopter and Beechcraft.
- > Vibration: 500 Hz to 1000 Hz.

» Other Space References



CLAIRE BALLOON

- > Stratospheric balloon flight Cosmic ray measurements nine coaxial HPGe detectors 15 x 15 x 50 mm.
- > Birmingham University (United Kingdom).

CESR (France) DIOGEN

- > Encapsulated Ge telescope.
- > 1 planar, 2000 mm² area.
- > 1 coaxial 30% efficiency.
- > Vibration: 10 g sinusoidal, 50 g during 0.5 ms.



SELENE

- > Lunar orbiter mission.
- > Encapsulated coaxial HPGe detector.
- > 60% efficiency.

» Detectors Built for Ships

POLARFORSCHUNG-BREMERHAVEN/GERMANY

- > Well type HPGe detector, P-type, electrical cooler, associated lead castle.

CHARLES DE GAULLE AIRCRAFT CARRIER/France

- > 40% efficiency HPGe detector, N-type, electrical cooler.
- > 1.8 keV FWHM @ 1.33 MeV.
- > Acceleration: 3 g vertical, 1.5 g horizontal.
- > Vibration: 2 Hz with 0.5 mm amplitude peak to peak.
- > 10 Hz with 0.1 mm amplitude peak to peak.
- > Shock: 7 g on the 3 axis.

CANBERRA



Nuclear Measurement Solutions for Safety, Security and the Environment

For more information please visit: www.canberra.com C39851 - 02/2017