Gamma Ray neutron Spectrometer MANGA versus MGNS

MANGA

Concept:

Gamma ray spectrometer:

Cryogenically cooled high purity Ge crystal.

Neutron spectrometer:

Scintillator detector

Resources stated in proposal:

Total mass:	**7.8kg**
Gamma ray part:	3.5kg
Cooler:	1.0kg
Neutron part:	1.8kg
Common electronics:	1.5kg

MGNS

Concept:

Gamma ray spectrometer:

LaBr Scintillator with LuAP backup.

Neutron spectrometer:

HEND

Resources stated in proposal:

Total mass:	**5.2kg**
Gamma ray part:	3.3kg
Neutron part:	1.9kg
(includes common electronics)	

Gamma Ray neutron Spectrometer

MGNS has been provisionally selected as the preferred solution

However

As $LaBr_3$ scintillator crystals have not yet been grown to the required size, the timely availability of the crystal and its compatibility with the performance requirements need to be demonstrated until October 2005 latest.

- **Growth of a $LaBr_3$ crystal that will meet the scientific performance specified in the proposal:**

Energy resolution: 3% (FWHM) at 662 keV
Peak detection efficiency: > 60% at 662 keV, > 16% at 6MeV

- **Characterization of $LaBr_3$ crystal at γ-ray energies**

⇒ **Early demonstration of crystal production is required.**

Gamma Ray neutron Spectrometer

MANGA has been selected to go through a feasibility demonstration

MANGA may serve as a back-up if

1. **MGNS fails to demonstrate its timely suitability**
2. **MANGA demonstrates the following until October 2005 (latest):**

- **Degradation of Ge crystal by radiation in Mercury orbit can be fully recovered through annealing in reasonable time periods (leaving sufficient time for measurements)**

- **Degradation of Ge crystal by radiation during cruise has been determined**
  => Demonstrate that degradation can be fully recovered through annealing after arrival

or => Provide annealing plan during cruise compatible with S/C constraints

- **Annealing will not cause detector failure (see Integral)**

- **Cooler lifetime is guaranteed by provider and is compatible with mission duration**

- **Vibrations introduced by cooler are above 3.5 Hz**

- **Physical resources, particularly mass, are compliant with instrument allocation**

Gamma Ray neutron Spectrometer

PRC recommendation for the case that the feasibility demonstration fails for MGNS and MANGA

At the very minimum, a neutron spectrometer and a classical scintillator should be flown, but this would have an important negative impact on the determination of the elemental composition.

Laser Altimeter: (BELA)

BELA has been selected –

- provided the 1-year feasibility demonstration will be successful

The key concerns relate to:

1. **Performance and reliability of various subsystems**
2. **Required resources (particularly 10 kg mass budget design goal)**
3. **Compatibility with baseline S/C performance**

Primary performance requirement:

➢ **10 m vertical accuracy averaged over a 100 km scale**

Specific Issues:

- **Laser pump diode qualification**
- **Reflective baffle (technology development)**
- **Receiver (range finder) detection performance analysis**
- **System study to consolidate conceptual design**
- **Physical resources**