Instrument Accommodation on the Pioneer Venus and Galileo Probes

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General Instrumentation Accommodation Requirements (1)

• Most instruments require “normal” housekeeping support from probe subsystems
  – Power
  – Thermal control
  – Telemetry and command functions

• Entry probes, with in-situ instrumentation, require additional support that may include some or all of the following services
  – Field-of-view through windows
  – Atmospheric ingestion and expulsion
  – Dynamic / static mounting requirements
  – Deployments
  – Magnetic cleanliness
  – Outgassing and contamination control
  – EMI/EMC analysis
  – Microphonics
General Instrumentation
Accommodation Requirements (2)

• Instrument accommodation complexity is driven by probe design philosophy
  – Pressurized probes, such as the Pioneer Venus Large and Small Probes, require the probe pressure vessel itself to provide the viewing and sampling access for the instruments  
  – A “vented” probe, such as the Galileo probe, allows instruments to incorporate external atmospheric sampling and viewing within the instrument

• With any entry probe design, instrument accommodation requires a continuing, design coordination between the probe science PI(s) and the probe engineers
Pioneer Venus Large Probe Design

- **Pressure Vessel**
  - 79 cm diameter
- **Aeroshell**
  - 142 cm diameter
  - 45° blunt cone
Pioneer Venus Small Probe Design

- **Pressure Vessel**
  - 47 cm diameter

- **Aeroshell**
  - 76 cm diameter
  - 45º blunt cone
Pioneer Venus Large Probe Instruments

LAS Atmospheric structures
LN Nephelometer
LCPS Cloud particle size spectrometer
LIR Infrared radiometer
LNMS Neutral mass spectrometer
LGC Gas chromatograph
LSFR Solar flux radiometer

Shelves 65 cm diameter
Pioneer Venus Small Probe Instruments

Descent

SAS Atmospheric structures
SN Nephelometer
SNFR Net flux radiometer

Shelves 39 cm diameter
## Pioneer Venus Window Summary

<table>
<thead>
<tr>
<th>Probe</th>
<th>Instrument</th>
<th>Windows</th>
<th>Material</th>
<th>Diameter (mm)</th>
<th>Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LP, SP</td>
<td>Nephelometer</td>
<td>2</td>
<td>Sapphire</td>
<td>33.8</td>
<td>8.0</td>
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<tr>
<td>LP</td>
<td>Cloud Particle Size Spectrometer</td>
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<td>Sapphire</td>
<td>38.6</td>
<td>6.2</td>
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<tr>
<td>LP</td>
<td>Solar Flux Radiometer</td>
<td>5</td>
<td>Sapphire</td>
<td>9.5</td>
<td>2.0</td>
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<tr>
<td>LP</td>
<td>Infrared Radiometer</td>
<td>1</td>
<td>Diamond</td>
<td>15.4</td>
<td>2.5</td>
</tr>
</tbody>
</table>
Large Probe LSFR Window
Large Probe LIR Window

BRAZE
ELECTRON BEAM WELD AND PLATE
INSTALL TEMP SENSOR
WINDOW ASSY
SHEAR PIN (2 PL)
GRAFOIL GASKET
TITANIUM FASTNER (8 PL)
TITANIUM PRESSURE VESSEL
Large Probe Pressure Inlet
Galileo Probe Major Elements

- **Descent Module**
  - 66 cm diameter
- **Aeroshell**
  - 126 cm diameter
  - 45° blunt cone
Galileo Probe Instruments

- LRD Electronics
- ASI Electronics
- NMS
- NEP Electronics
- LRD Sensor
- NEP Sensor
- HAD Interferometer
- ASI Atmospheric structures inst
- NEP Nephelometer
- HAD Helium abundance detector
- NFR Net flux radiometer
- NMS Neutral mass spectrometer
- LRD Lightning and radio emission detector
- EPI Energetic particle instrument
Conclusions

- Probe instrument accommodation requires a close working relationship between the PI(s), instrument designers and probe engineering team
- Early definition of mechanical interfaces is critical
- Key considerations are instrument accommodation and integration
- Extremely limited probe resources drive innovative solutions to resolve tough problems
- Future probe mission success must leverage lessons learned from past missions