FY23 Strategic Initiatives Research and Technology Development (SRTD)

## Mini Imaging Spectrometer for Mars Helicopter and Small Spacecraft Missions
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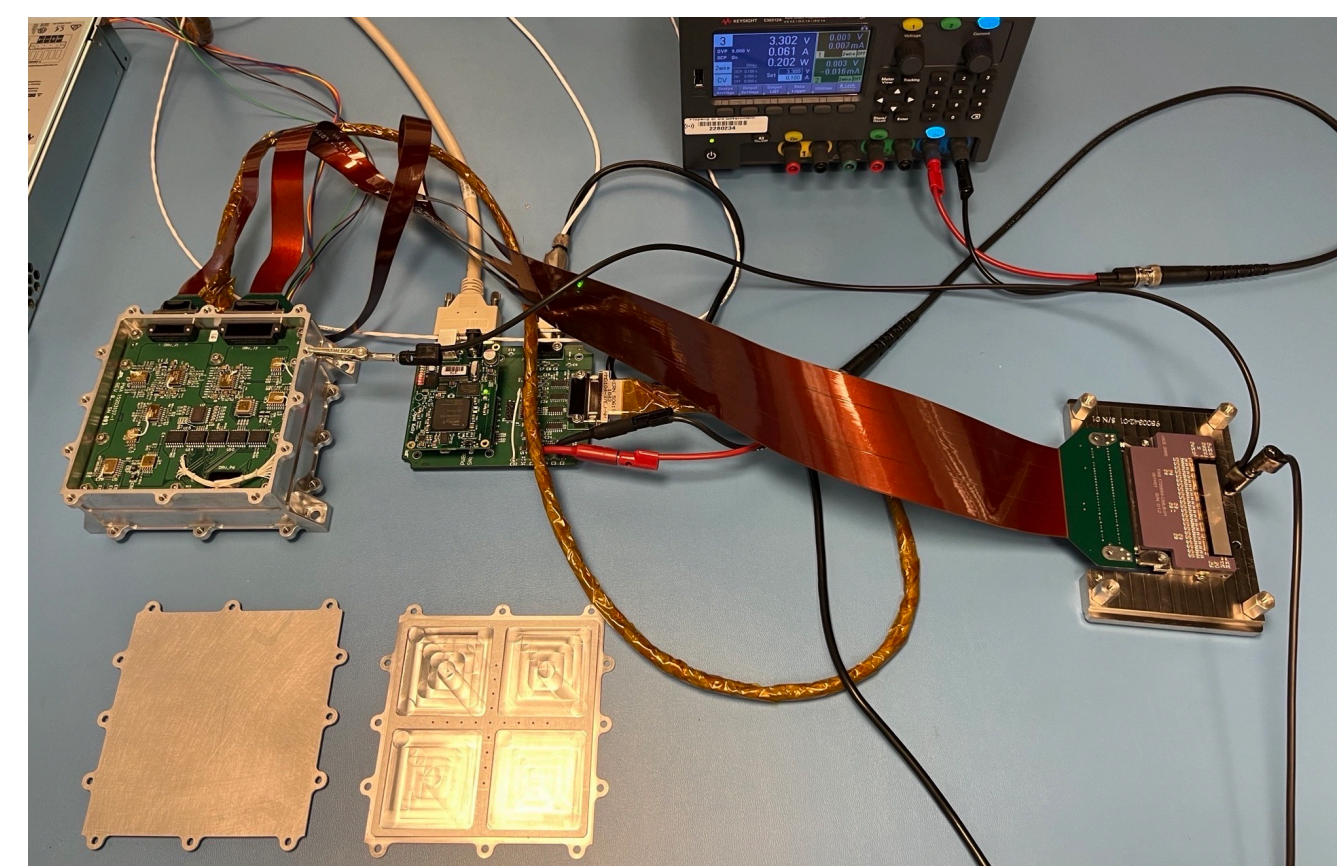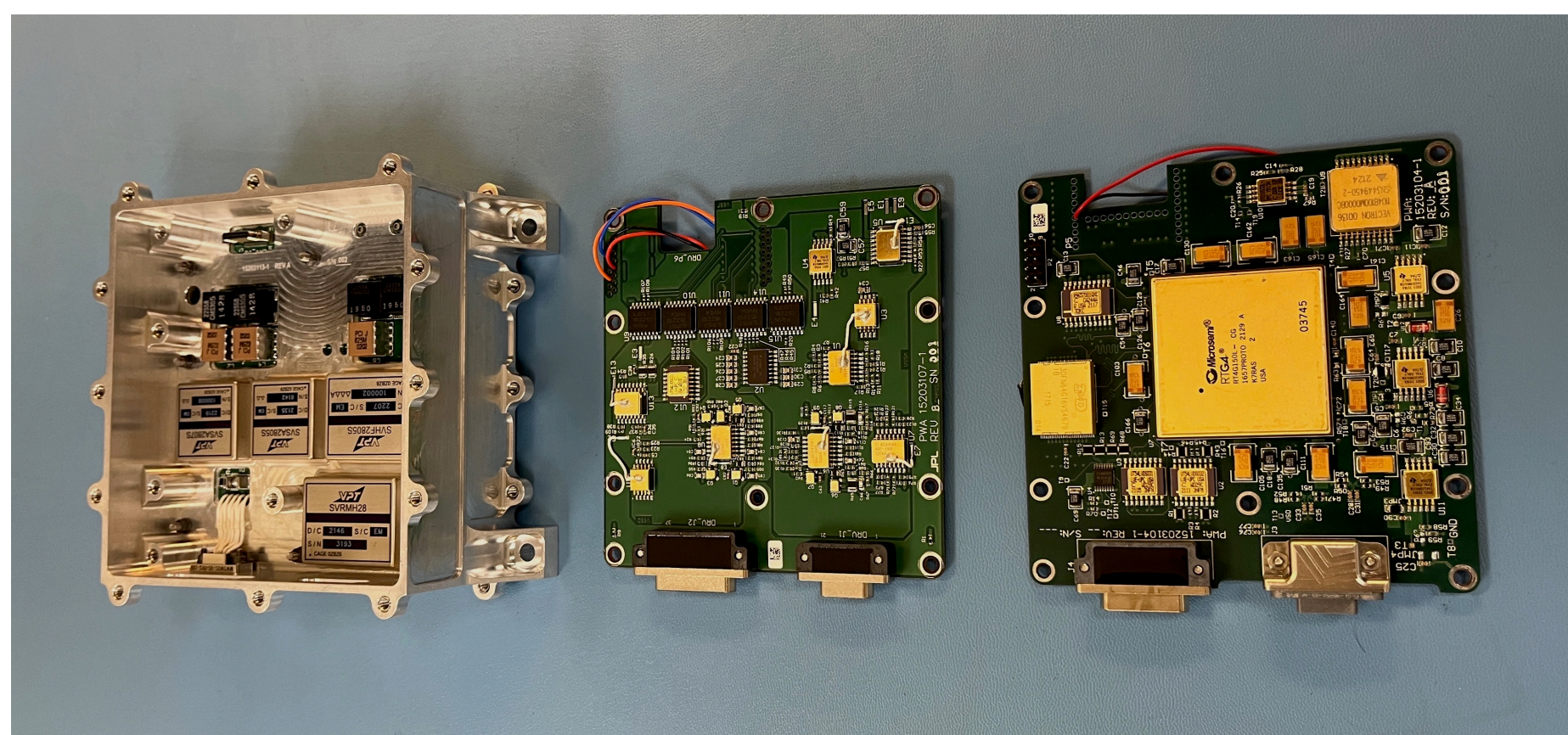
Strategic Focus Area: Micro Instruments for Mars Helicopter and Small Spacecraft Missions | **Strategic Initiative Leader:** Yonggyu Gim

Objectives: Develop a miniaturized pushbroom infrared imaging spectrometer that can operate within the resource constraints of the Mars Science Helicopter (MSH) and other small platforms. It must have a total mass <3 kg while maintaining a signal-to-noise ratio >200 across the spectral features of key minerals. We have designed an instrument incorporating the optical and thermal components in order to create a functioning prototype. In addition, we have implemented prototype detector interface electronics <0.8 kg and power consumption <9 W to maximize flight time.
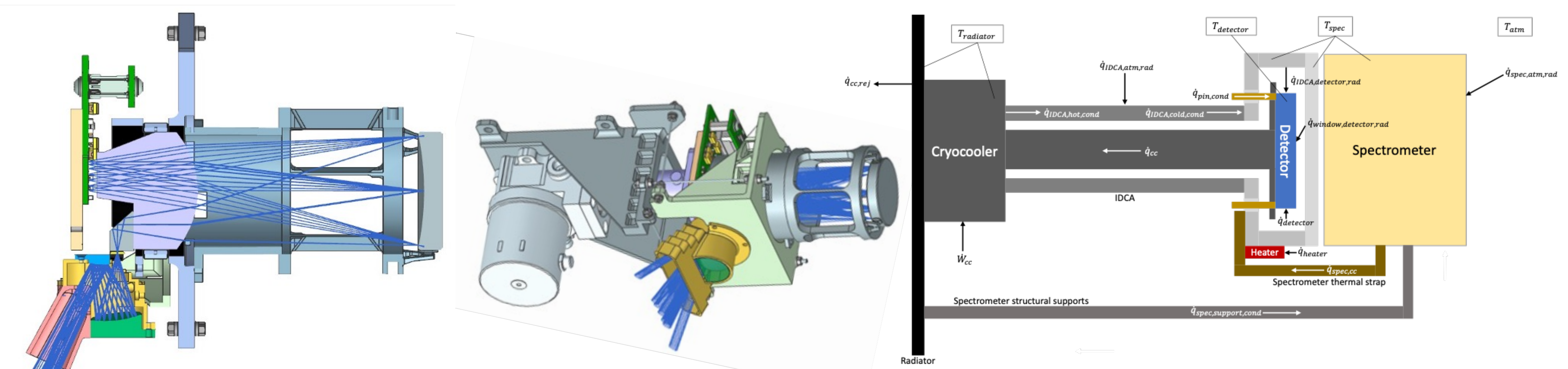
Above: Opto-mechanical layout (left) of the f/1.9 spectrometer with 60-degree swath. Shown with the cryocooler (center), which has been modeled to show robust performance in the Mars surface environment (right).

Below: Electronics that interface the digital-output detector array with the host vehicle consist of three circuit boards in one compact chassis (left). They have been assembled and tested with a representative detector array (right) to demonstrate low-noise performance can be achieved.

Publications:
P. Sullivan et al, "A Comparison of Imaging Subsystems for Analog-versus Digital-Output Detector Arrays," IEEE Aerospace Conference, 2023, doi: 10.1109/AERO55745.2023.10115911.

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