



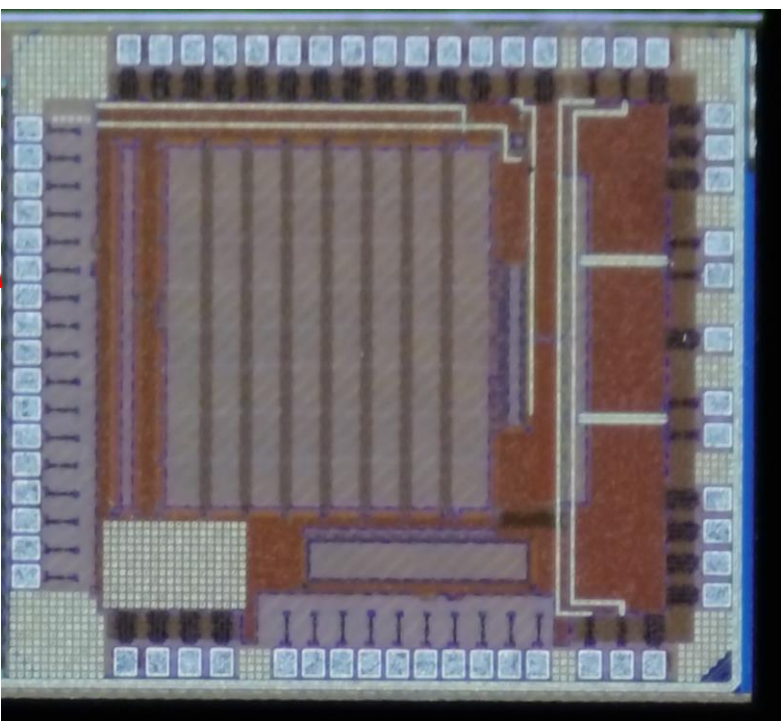
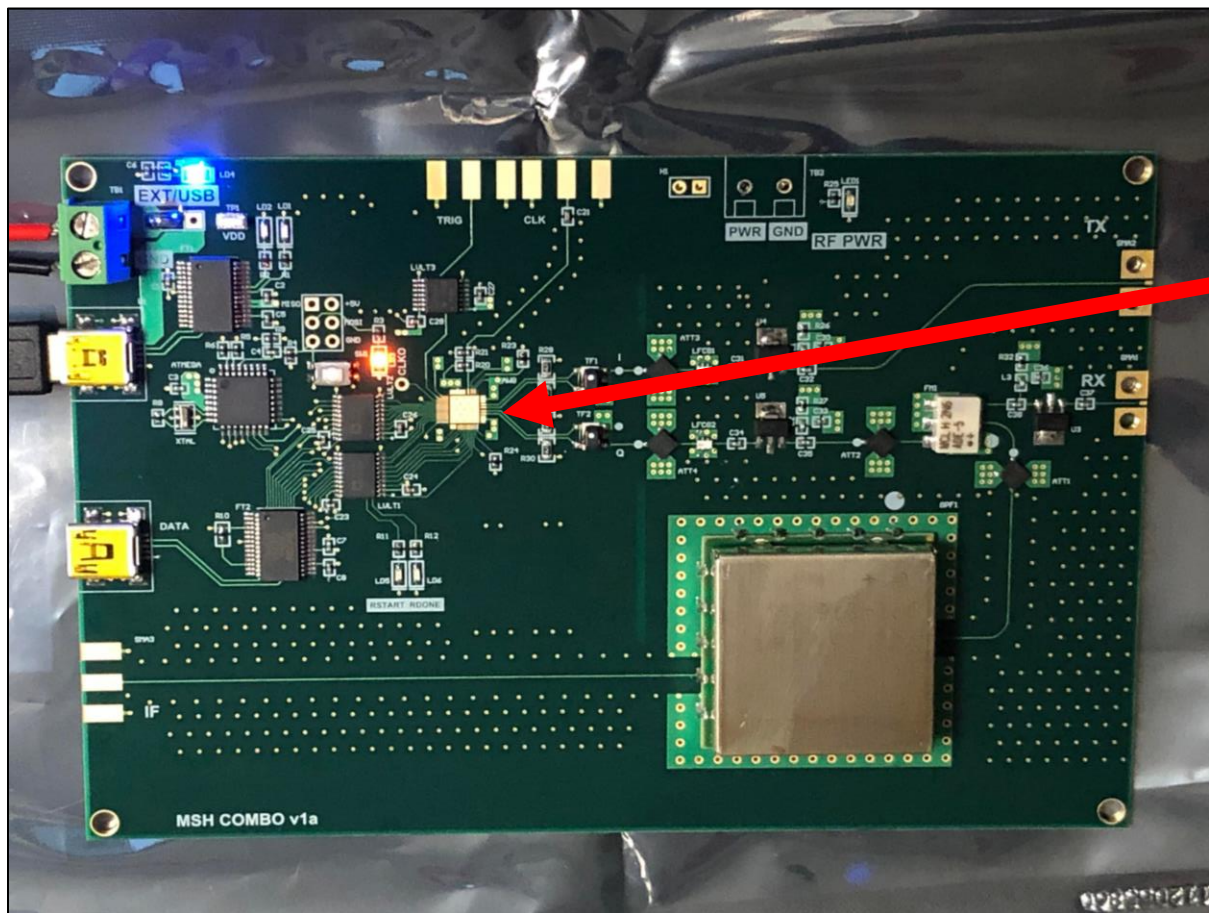
FY24 Strategic Initiatives Research and Technology Development (SRTD)

Ultra-compact & Ultra-Wide-Band CMOS System-on-Chip Based Ground Penetrating Radar for a Mars Science Helicopter

Principal Investigator: Adrian Tang (386); Co-Investigators: Emmanuel Decrossas (337), Mark Haynes (334), Yonggyu Gim (334), Christine Gebara (355), Mau-Chung Chang (UCLA)

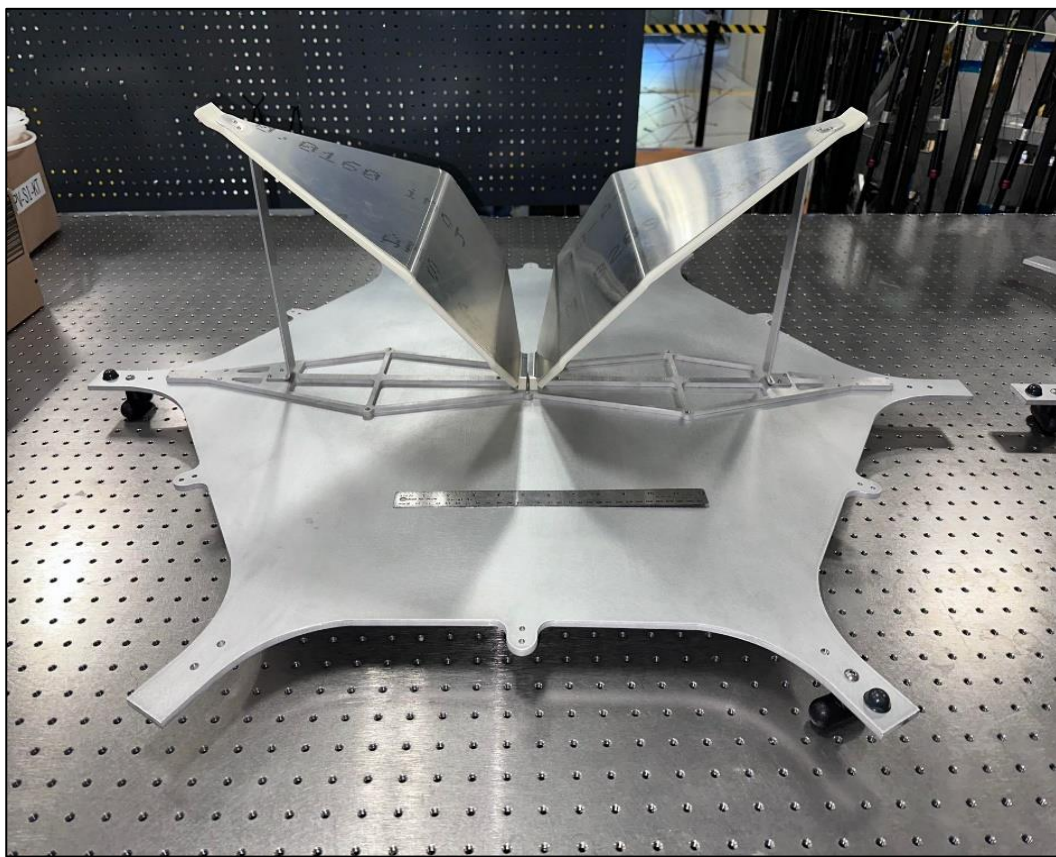
Strategic Focus Area: Micro Instruments for Mars Helicopter and Small Spacecraft Missions | Strategic Initiative Leader: Yonggyu Gim

CMOS Electronics



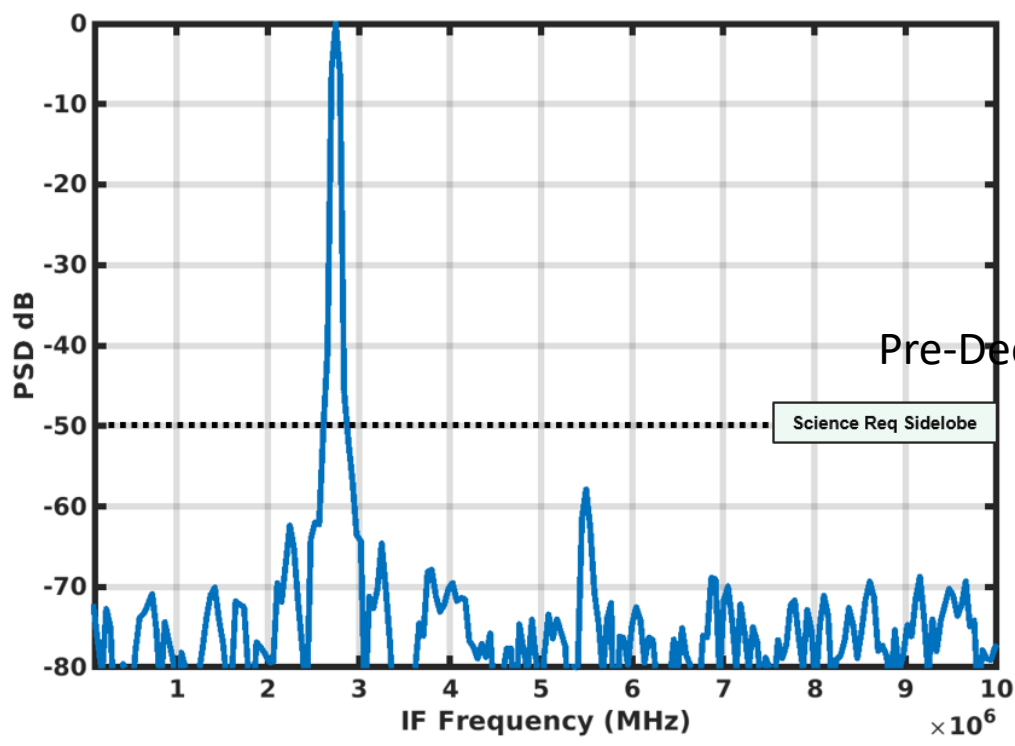
Custom GPR Chip with: DAC/ADC Waveform Memory, Demodulator and Receiver DSP.

Deployable Antenna

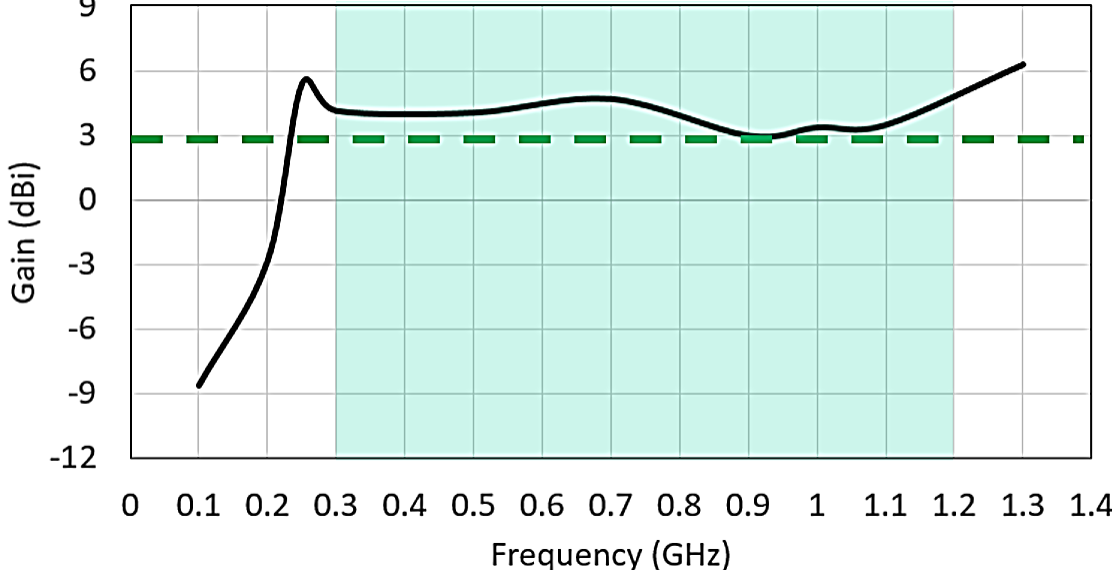


Integrated GPR System

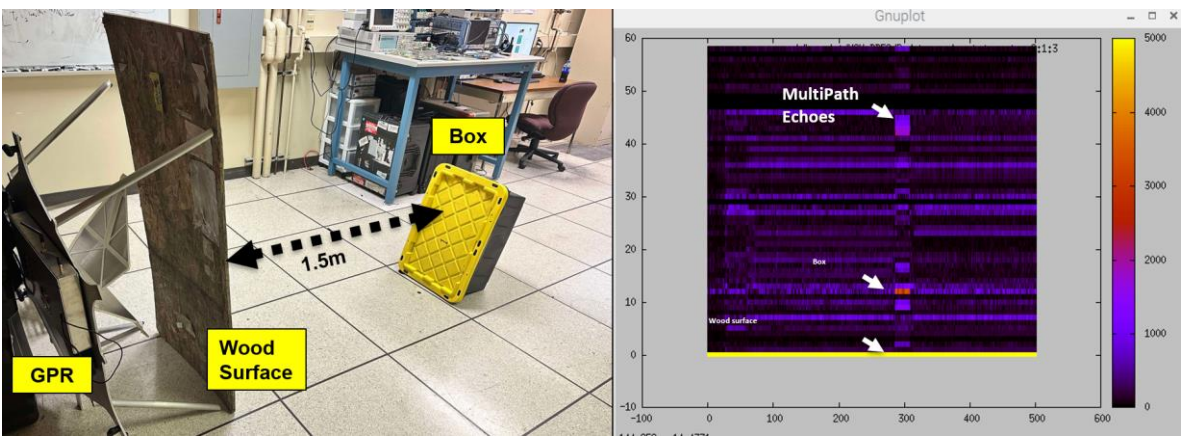
Sidelobe Performance



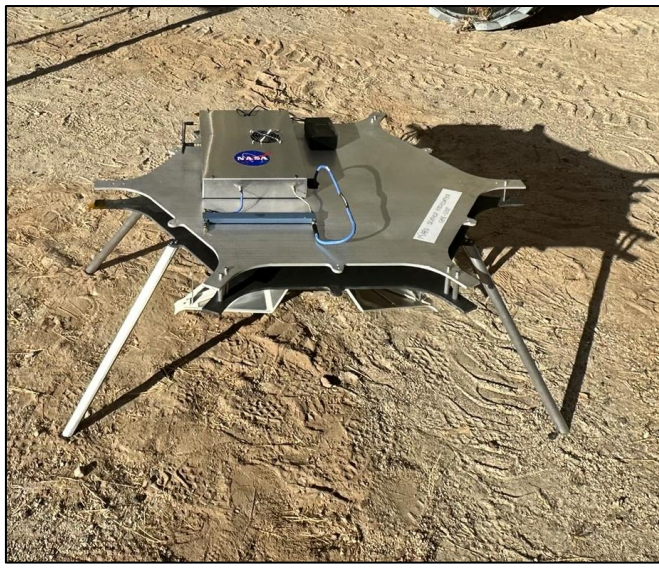
Antenna Performance



Indoor Testing



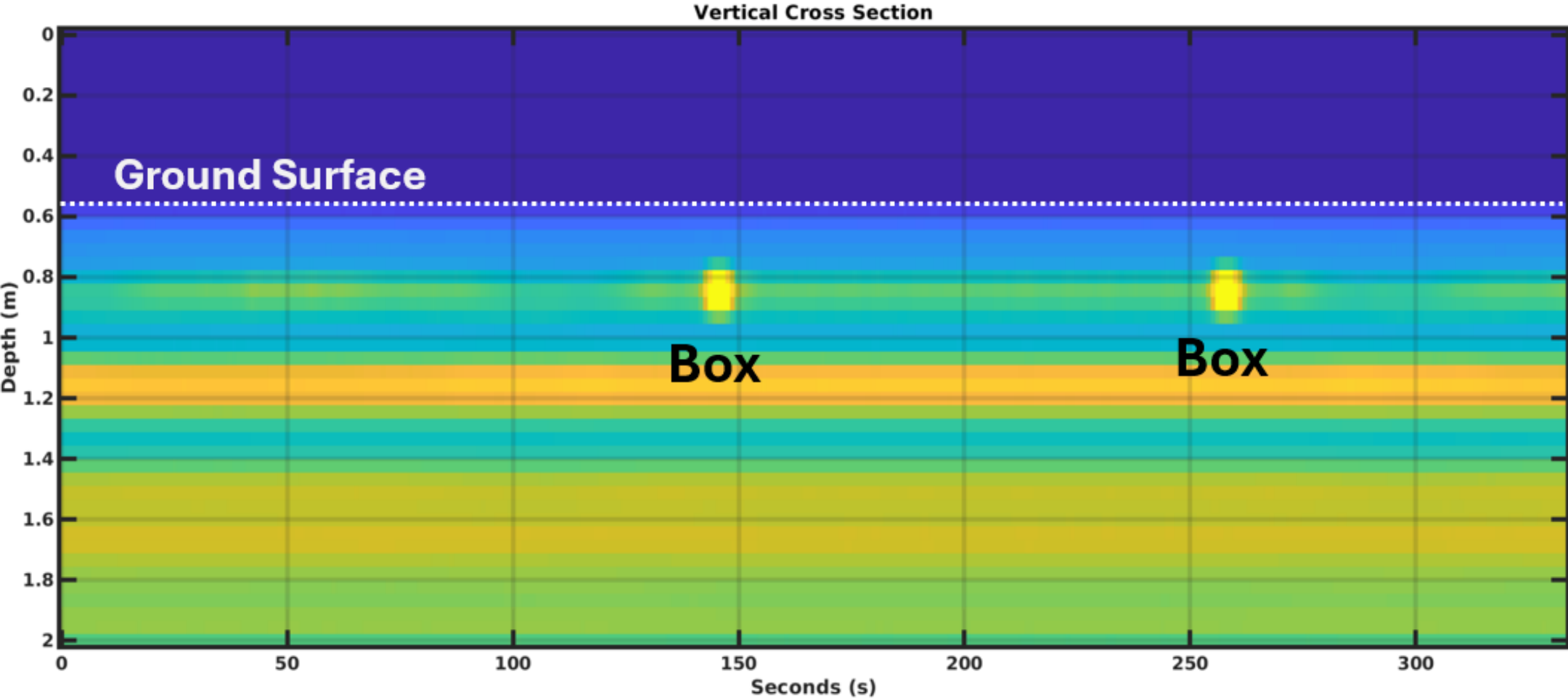
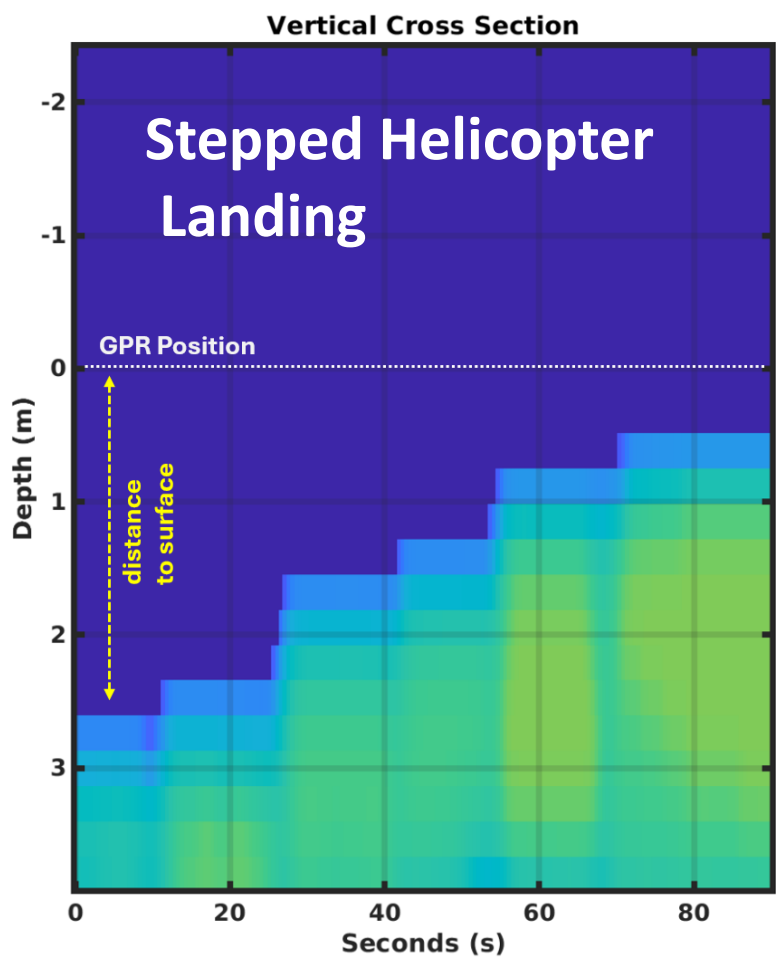
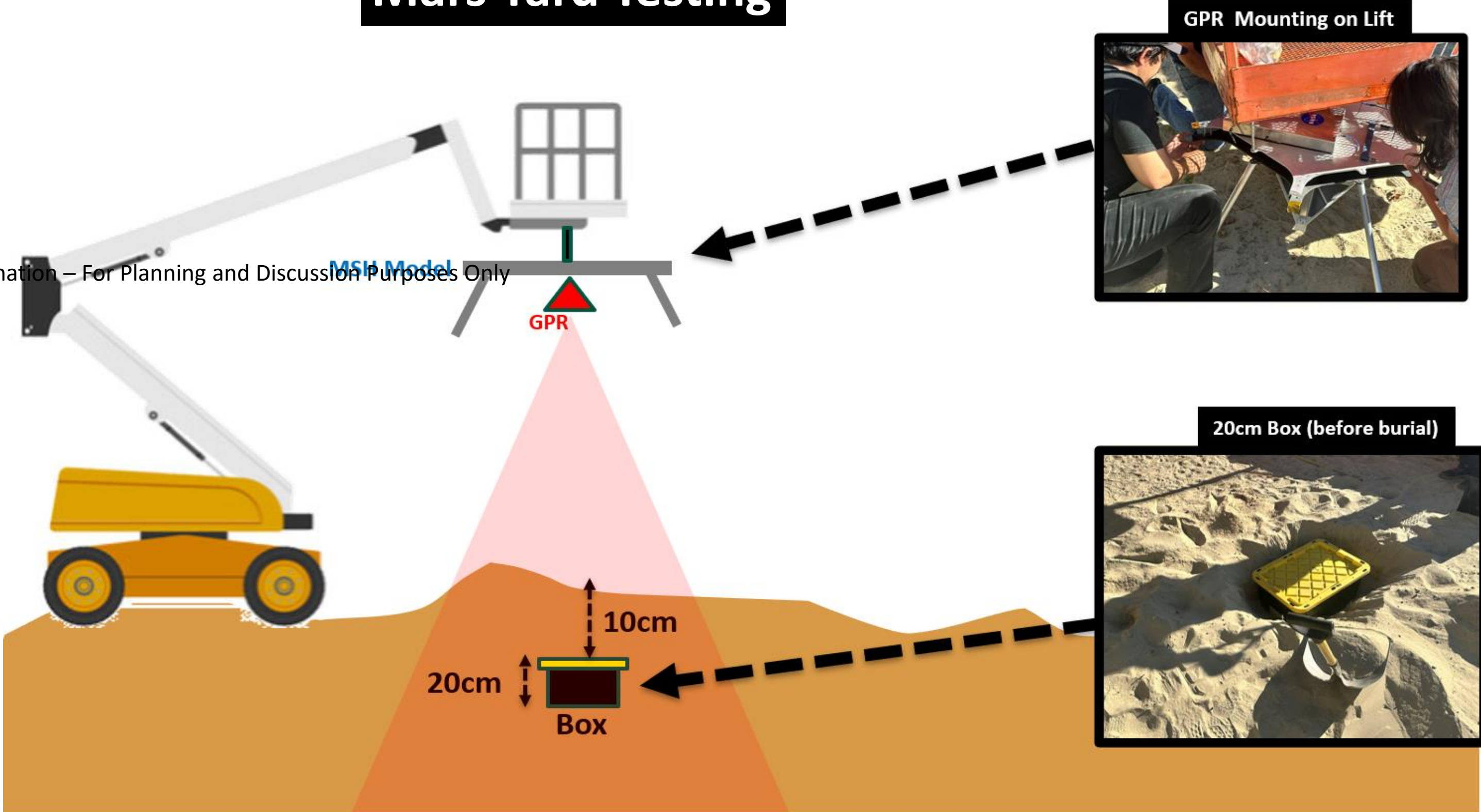
GPR System Summary



Mass: 1.3 Kg
Power: 2.6W
SNDR: 85dBTx
Res: 20cm
Pen: >25m*

*assumes dry Mars soil

Mars Yard Testing



Publications:

1. Yanghyo Kim , Arhison Bharathan , Caleb Romero , Nacer Chahat , Gaurangi Gupta , Hans-Peter Marshall , Nicole Lin , Josh Gier , Goutam Chattopadhyay, Adrian Tang, "Close-In Dynamic Range Considerations in Up-converted and Frequency Multiplied FMCW Radars at Ku-Band", IEEE Microwave Magazine July 2024.
2. Arhison Bharathan, Adrian Tang, Frank Chang, "A 10-Bit DAC 3GS/s Interpolating DDFS for Distortion-Limited Long Acquisition Time FMCW Ground Penetrating Radars", International Microwave Symposium June 2024.
3. Adrian Tang, Emmanuel Decrossas, Yonggyu Gim, Rob Beauchamp, Stanislav Culacii, "A 300-1300 MHz Single Antenna Digital-FMCW Ground Penetrating Radar for the Mars Science Helicopter with Switched-Gain Calibration to Improve Dynamic Range" IEEE International Microwave Symposium 2022.

PI/Task Mgr. Contact Information:

Adrian Tang a7tang@g.ucla.edu / 818-354-2835