mmWave Channel Sounding and Modeling for Aviation Scenarios

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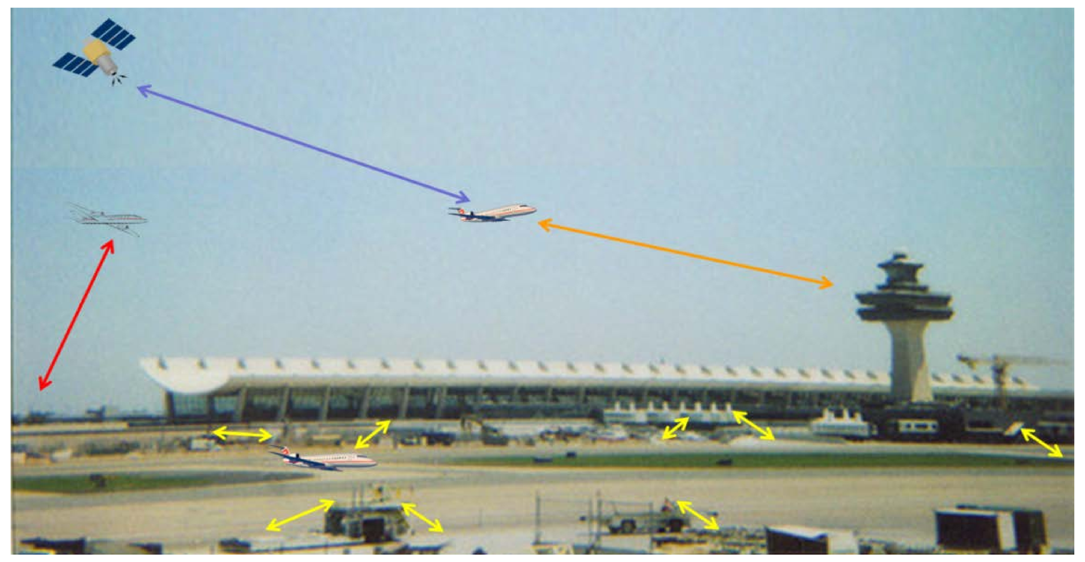
Motivations

- Broad range of frequency bands will be investigated for aviation communications applications
- The NASA University Leadership Initiative project on Hyper Spectral Communications and Networking

Numerous airport communication links



90 GHz Band (Univ. of South Carolina)

- Based upon a **Rohde and Schwarz** dual-RF arbitrary waveform signal generator (SG) and 43 GHz signal analyzer
- QuinStar mmWave up-converting and down-converting mixers, active frequency multipliers, and the second SG RF output.
- Bandwidth=500 MHz, SISO

60 GHz Band (Boise State Univ.)

- **Keysight** setup: An arbitrary waveform generator and a E8267D PSG Vector Signal Generator
- Keysight up and down converters
- DSOV000-808 oscilloscope
- Bandwidth=2GHz, 2x2 MIMO

Acknowledgements

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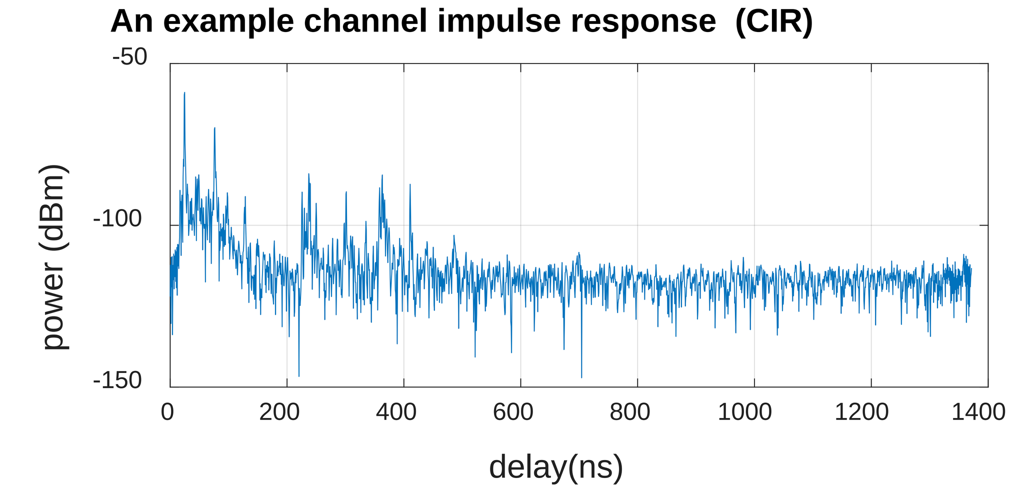
30 GHz Band (North Carolina State Univ.)

- Based on National Instruments (NI) mmWave transceiver system
- Sampling rate of 3.072 GS/s, Bandwidth: 2GHz, SISO
- 60 dB ADC resolution, can measure up to 185 dB of path-loss
- Rubidium clocks for synchronization

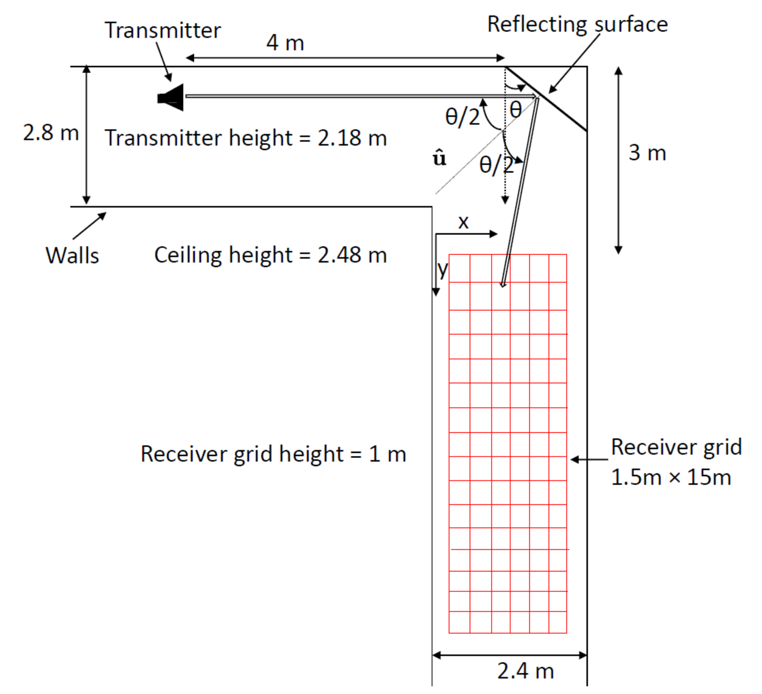


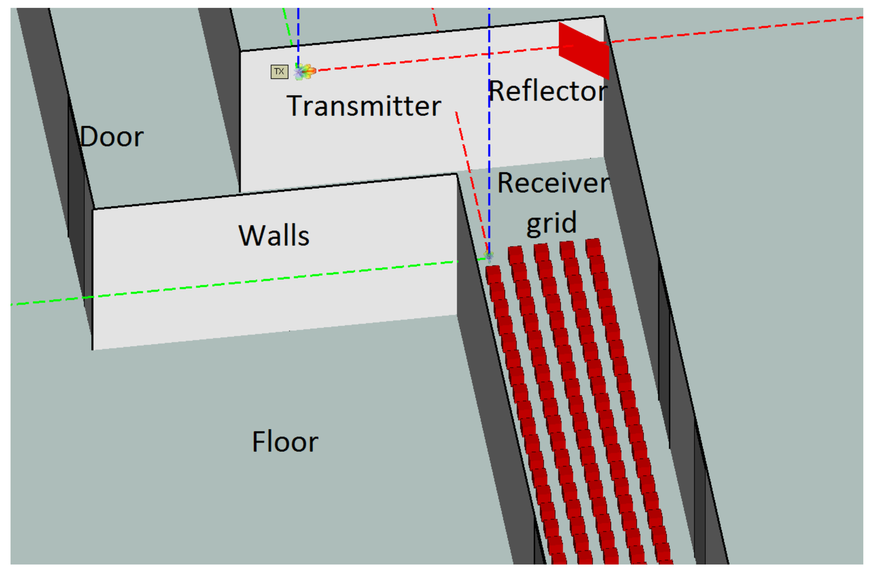
NI PXI mmWave system

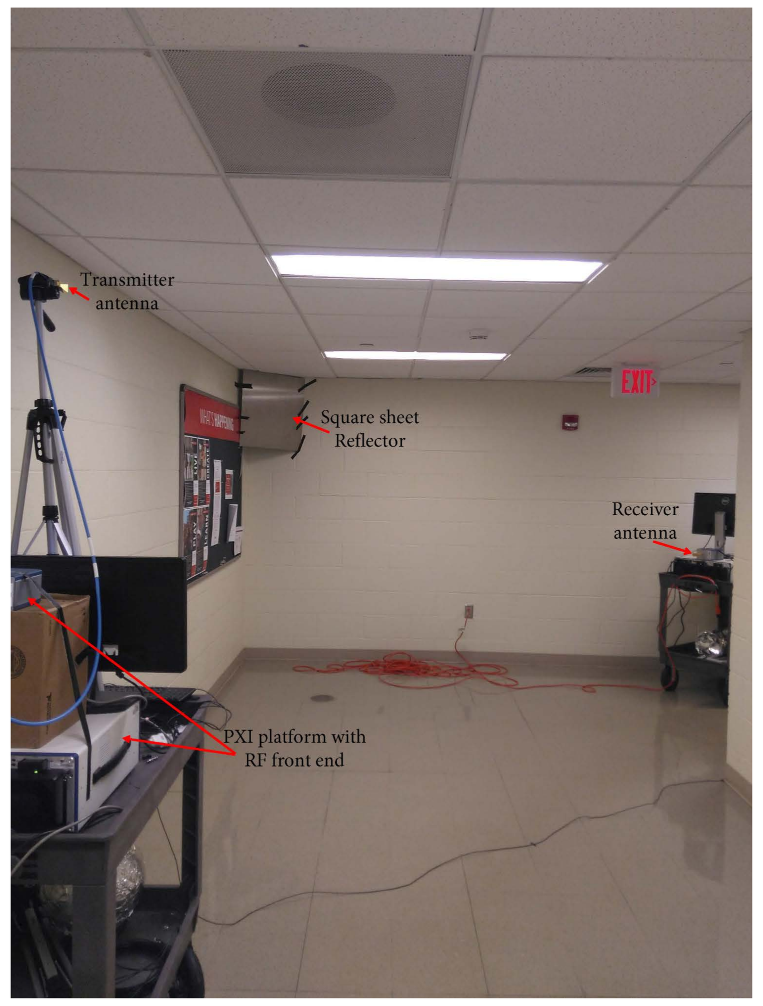
Initial Results

- High path loss at at mmWave frequencies reduce the coverage
- We study the effects of using passive reflectors to improve coverage for non-line of sight (NLOS) situations

Measurement Setup



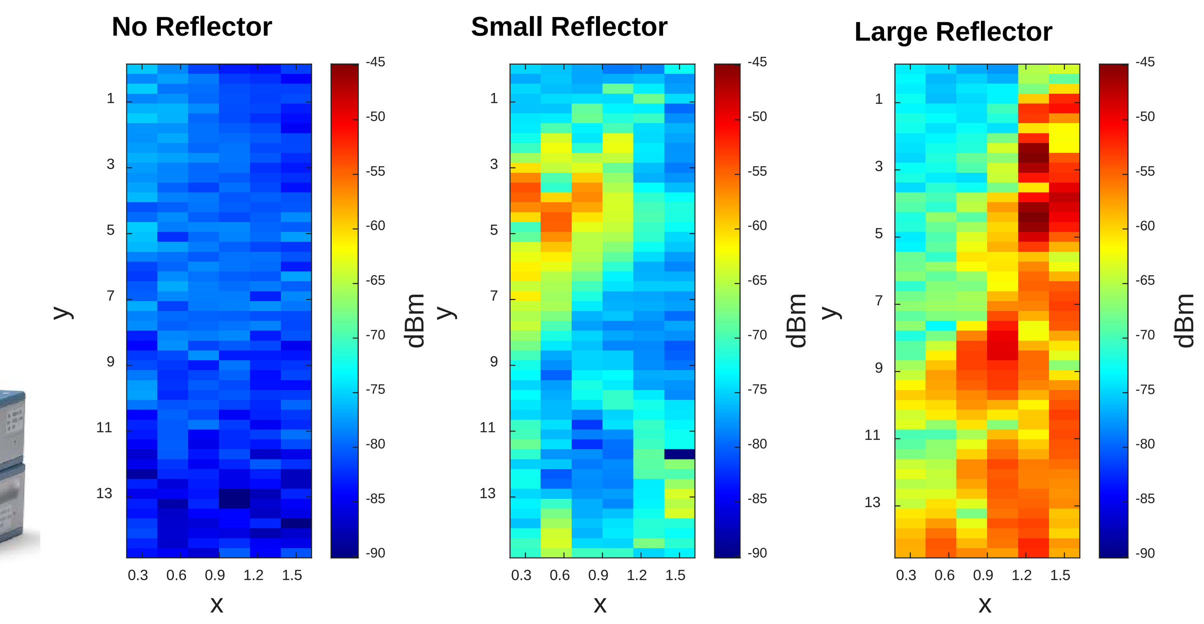




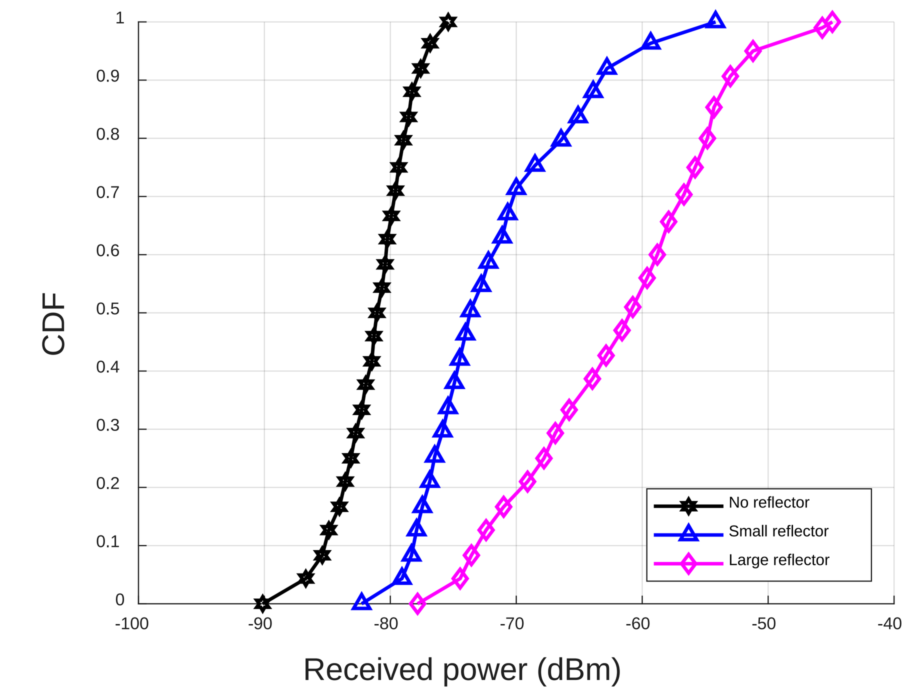
- Antennas used: 17 dBi gain rectangular horn antenna
- Transmitter location and power is fixed.
- Receiver location is changed and CIR is measured at each location
- Total received power is calculated by summing up powers in the CIR taps above the noise floor

Received Powers for 3 Scenarios

- Small Reflector: 12 x 12 inch^2 aluminum sheet
- Large Reflector: 24 x 24 inch^2 aluminum sheet



CDF of Received Powers



Obtained Gains

	Median Power	Gain
No Reflector	-61 dBm	0 dB
Small Reflector	-73 dBm	12 dB
Large Reflector	-81 dBm	20 dB

Conclusions

- Overview of channel sounders to be used at different bands for aviation scenarios
- Initial results at 28 GHz show that significant gains are possible by using passive reflectors to improve coverage at NLOS locations