



# A Helping Hand

## Challenges of Single Range

## Over-the-Horizon Support

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# Challenges

Addressing and overcoming the challenges of a single range supporting over-the-horizon with innovative solutions

- Communication Range**
- Signal Strength and Quality**
- Data Latency**
- Data Integrity**
- Costs and Resources**



# Communication Range

Major constraint in airborne telemetry capabilities

## LOS Limitations

Obstructions can lead to signal attenuation, reflection, diffraction

## Altitude and Extended Distance

As TX-RX distance extends, communication range decreases

## Power Limitations

Government regulations can restrict power output of telemetry transmitters



# Signal Strength and Quality

Secondary issues that can greatly impact data integrity

## Environmental Conditions

Weather patterns can vary across regions

## Diverse and Unique Topologies

Terrain such as mountains, hills, and buildings

## Aircraft Flight Patterns

Momentary signal dropout or reduced signal strength

# Data Latency

Signal distance increases leads to increased data latency

## Propagation

Delays caused by the time it takes the TX signals to the RX

## Transmission

Caused by various factors including network congestion, physical distance

## Processing

Time required for data to be processed and analyzed

## Congestions and Queuing

High volume of data being transmitted or processed



# Data Integrity

Noise, interference, or corruption

## Unwanted Signals

Cause data loss, corruption; evident in 5G cell signals

Antennas being pulled off of a signal

*Tracking errors*



# Cost and Resources

Range testing is *expensive!* Who will pay for it?

## Resources

May require new, specialized equipment and/or mobile systems may need deployment

## Manpower

Limited availability, expertise may vary, and travel to remote range locations may be required



# In Closing...

Addressing these challenges often involves employing advanced communication techniques and technologies , such as employing error correction code (LDPC) optimizing antenna designs, implementing signal process algorithms to mitigate interference and improve range.



# Questions?

