
COMTECH
SYSTEMS, INC™

Comtech Systems, Inc.

- Subsidiary of Comtech Telecom (CMTL-NASDAQ)
- Provide communications systems integration and networks around the world
- Established 1959, Based in Orlando FL

We are the world leader in Tropospheric Scatter (“Tropo”) Communications: Long Range, Non-satellite, high data rate communications

Key Takeaway: Right now we have the smallest, most advanced long-range microwave communications system on the planet- COMET as part of our systems integration tool kit.

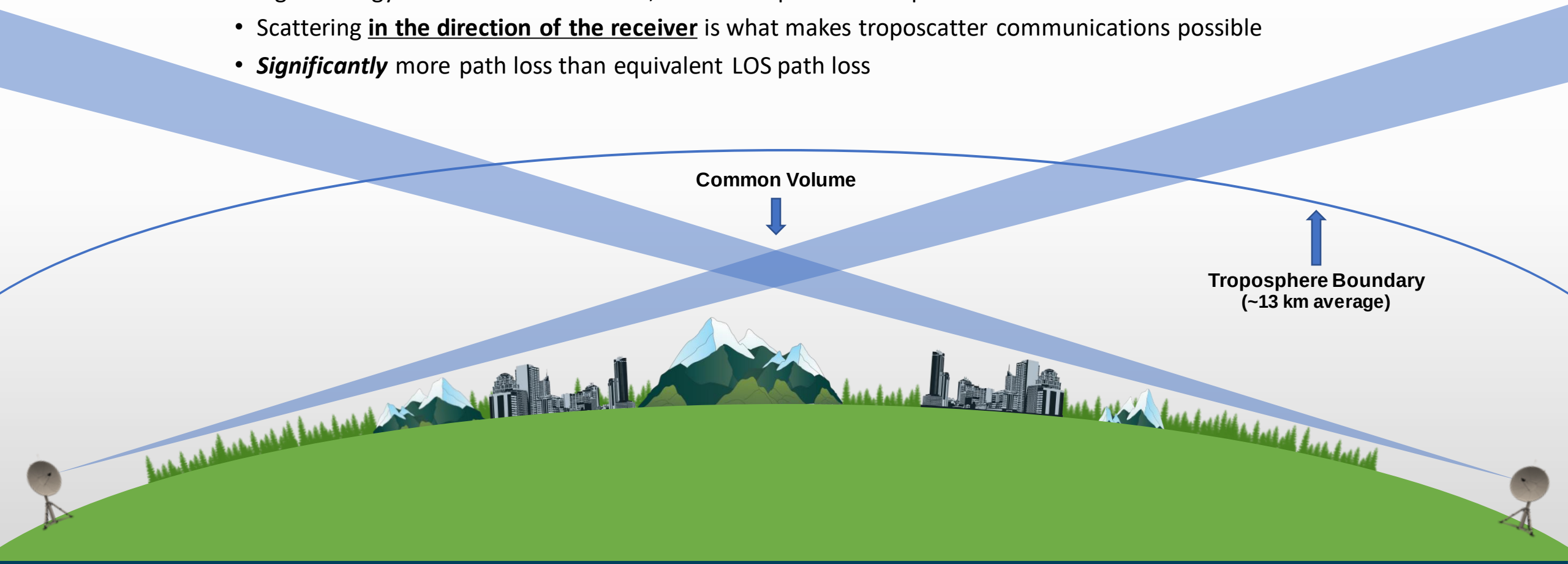
Comtech Systems Key Capabilities

- Provides communications and networks to remote areas or locations where infrastructure is disrupted or destroyed
- Space denied, secure communications technology
- Provides high date rate comms connection (including Full Motion Video) over the horizon without a mast
- Bounces signal off sky, bends over mountains, and refracts through buildings
- Difficult to detect or intercept, functions when transmitting very low power.
- Smallest systems are airline checkable. Draws less power than a desktop computer.
- Works over land or sea
- Roadmap- airborne platform capable for satellite independent video and data transmission

Troposcatter: How it Works

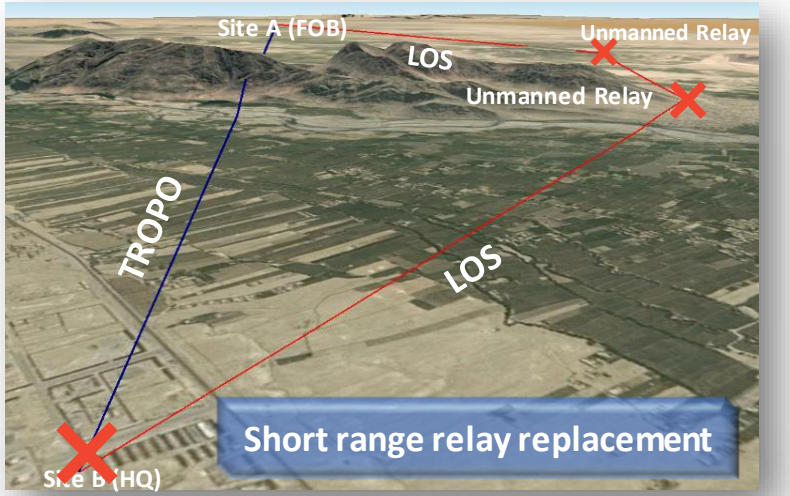
Troposcatter Communications uses the properties of the troposphere to complete a Beyond Line-of-Sight Link

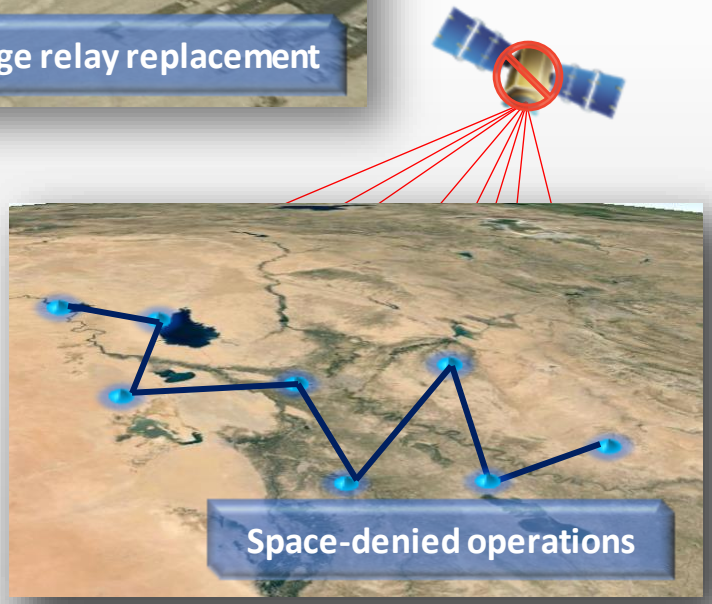
- Signal energy scatters in all directions, much of it passes into space
- Scattering **in the direction of the receiver** is what makes troposcatter communications possible
- ***Significantly*** more path loss than equivalent LOS path loss

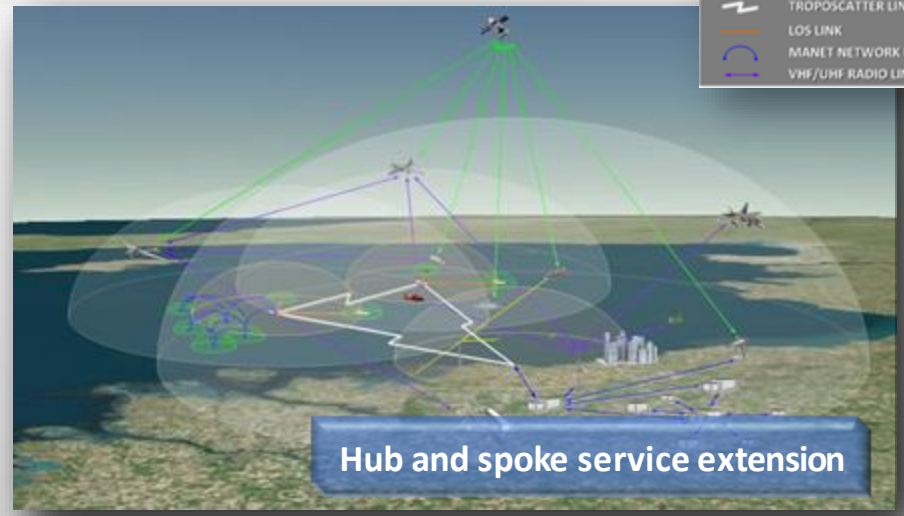


Real World Use Cases for Troposcatter

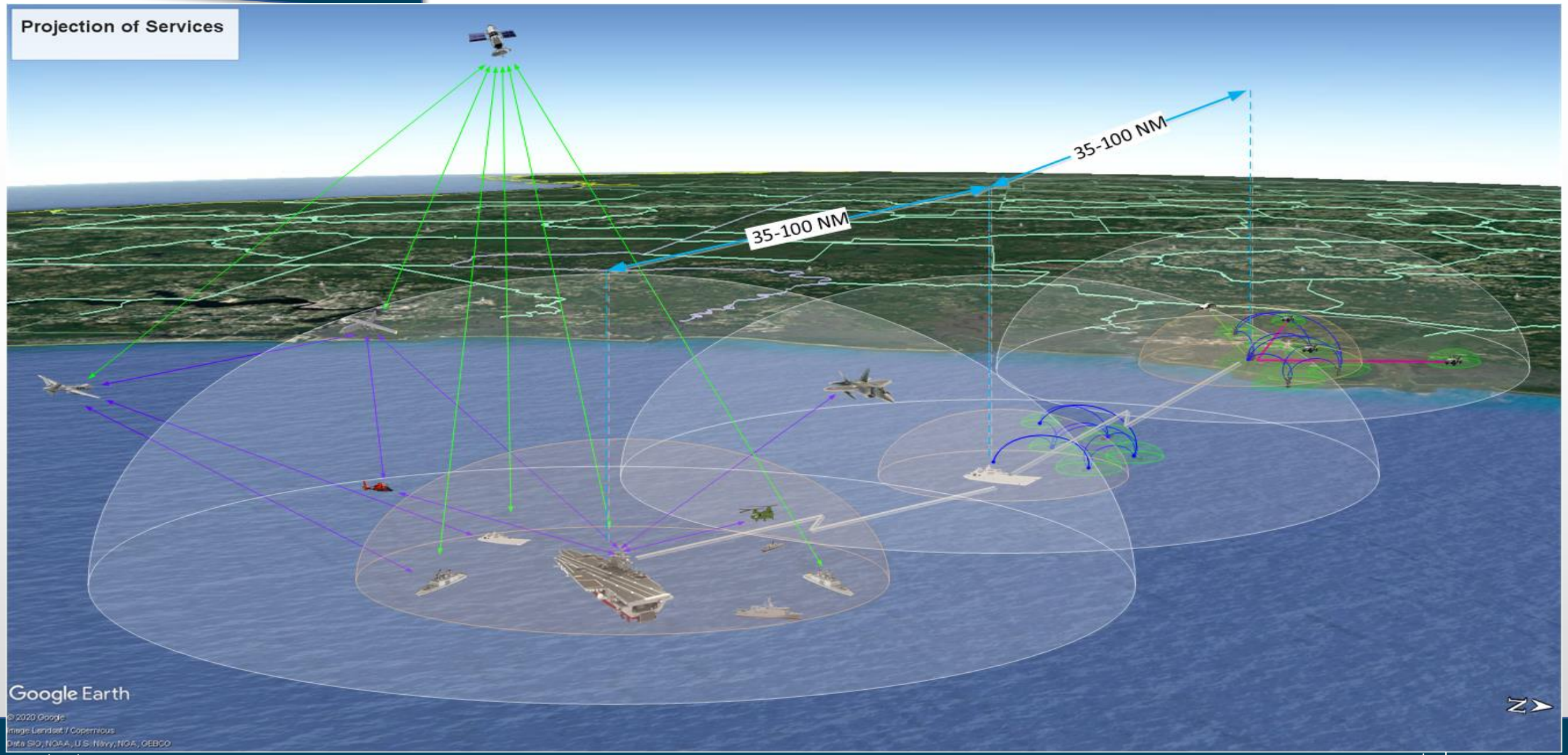
Multi-Mission







Over the Horizon Communications & Projection of Network Services

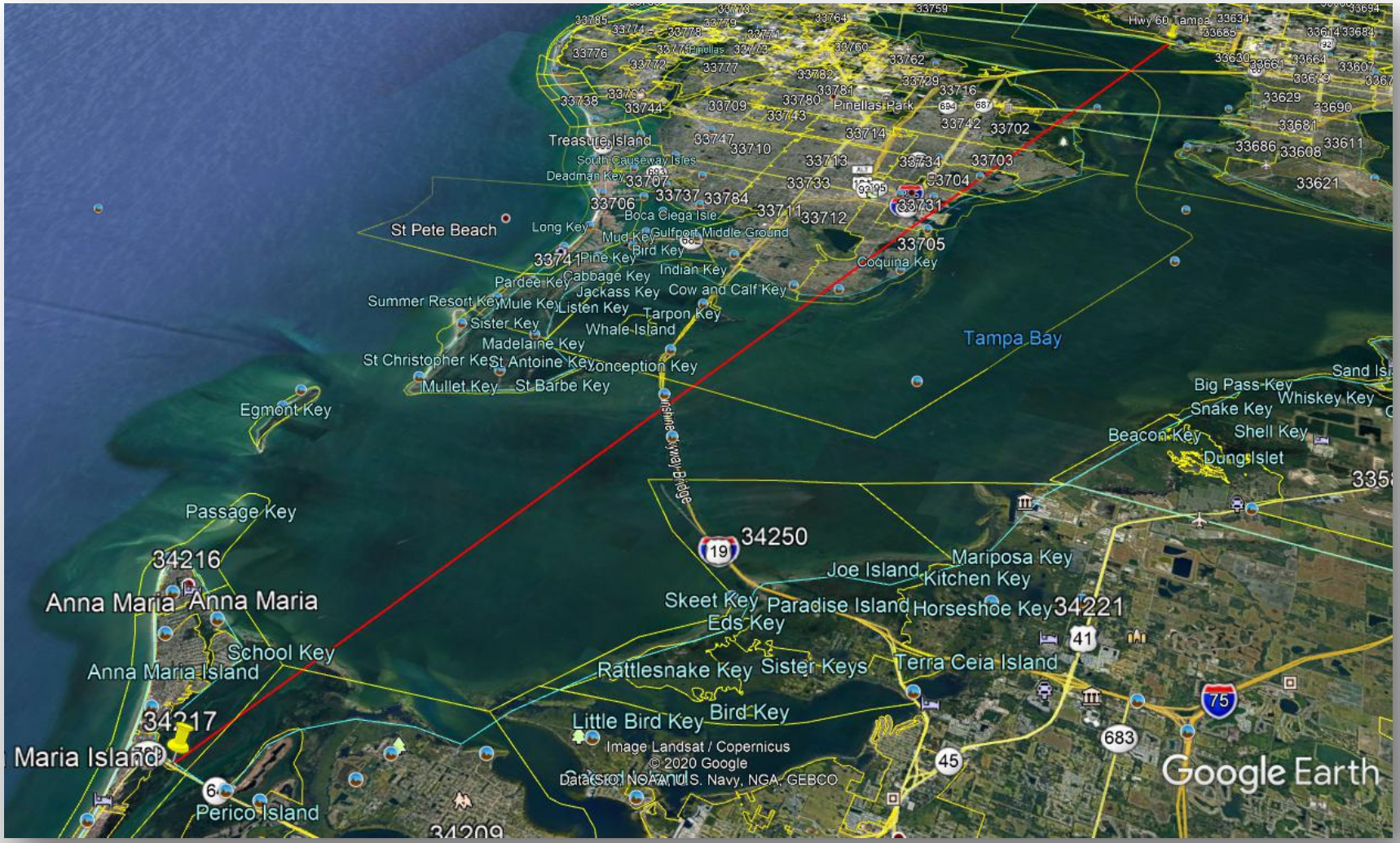



COMET®
One-Person 15 Minute Setup
COMTECH SYSTEMS, INC

COMET Demo 10/7/2020- Joint Communications Support Element, Tampa FL

- **Site A:** Whiskey Joes, 7720 W. Courtney Campbell Causeway, Tampa, FL 33607
- 27.969184° -82.575294°
- AZ: 199.15 EL: 0

- **Site B:** Hwy 64 Anna Maria IS.
- 27.497546° -82.702948°
- AZ: 18.95 EL: 0



COMET Demo 10/7/2020

Path Length

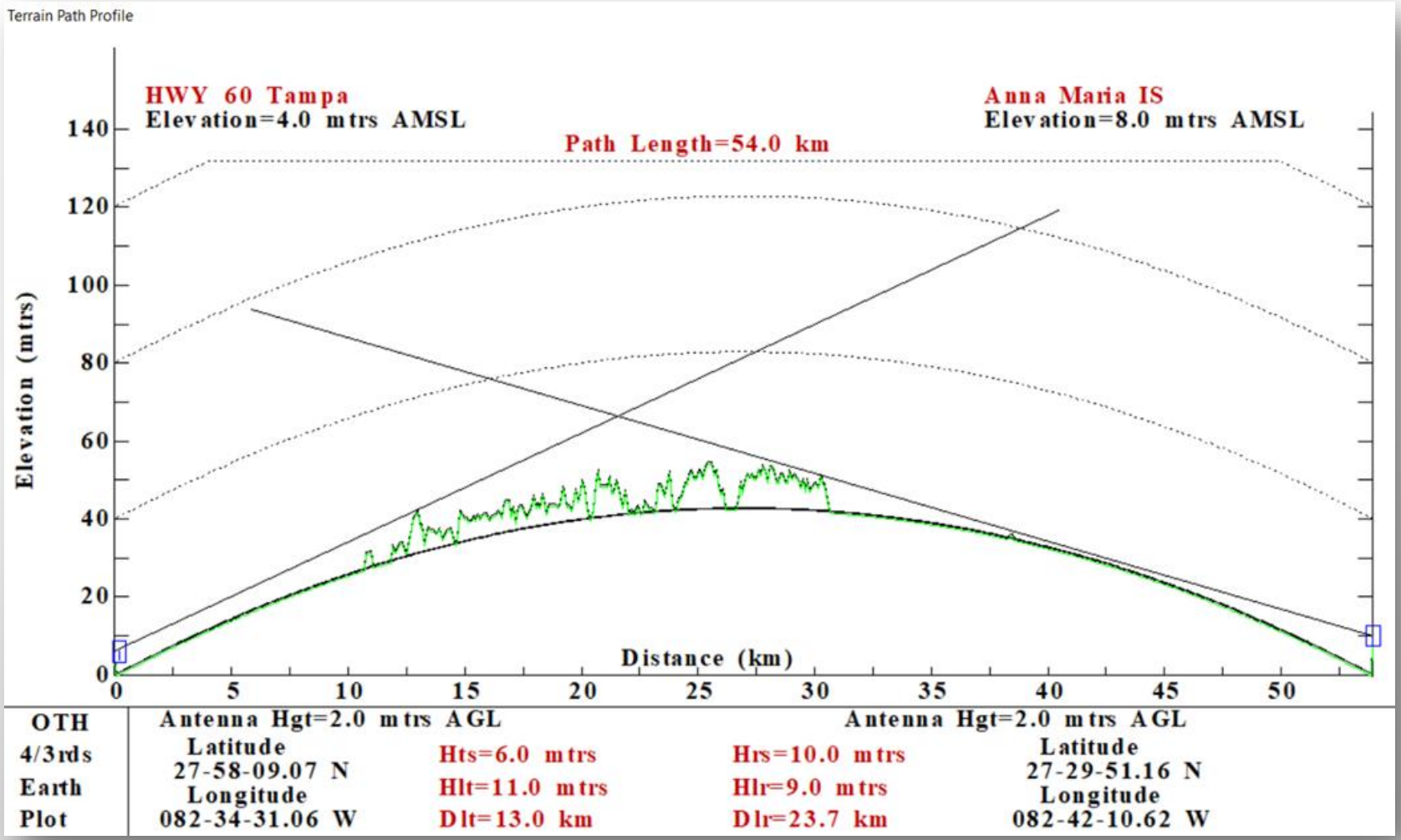
- 54 km/33.5miles

Terrain:

- Link crossed land, city of St Petersburg, and Tampa Bay.

Expected Throughput:

- 75 Mb/s Single Stream
- 100 Mb/s Dual Stream



COMET Link Results

- TX @ 4 Watts 150 Mb/s Data Throughput
- TX @ 1 Watt 100 Mb/s Data Throughput
- TX @ 0.1 Watt 50 Mb/s Data Throughput

Anna Maria IS.

Courtney Campbell Causeway

CS67PLUS Troposcatter Radio

- Industry's fully software defined troposcatter radio (SDR)
- Tunable from 950MHz to 5.9GHz with zero IF (Baseband to RF no intermediate frequency)
- Supports Single, Dual and Quad Diversity
- Modulation BPSK, QPSK, 8 APSK, 16 APSK, 32 APSK and 64APSK
- Four different Symbol Rates to control channel size
- Throughput up to 105 Mb/s Single Stream, 210 Mb/s Dual Stream
- Asymmetric throughput capability
- User chooses automatic Adaptive Coding Modulation (ACM) or Constant Coding Modulation (CCM)
- Low Density Parity Check (LDPC) and Forward Error Correction (FEC)
- Adaptive Link Power Control (ALPC)
- GZIP Data Compression (for unencrypted data)

CS67PLUS Troposcatter Radio

Environmental Characteristics

Operating Temp: -40 to +60 deg C
Storage Temp: -50 to +85 deg C
Humidity: MIL-STD-810F, Method 507.4
Altitude: 3000 m Operating, 12000 m Storage
Shock and Vibration: MIL-STD-810F
Salt/Fog/Fungus: As encountered in coastal regions

Physical Characteristics

Weight: 5.1 lbs / 2.3 kg
IP66 Outdoor Design
RF Input/Outputs: SMA(F)
Clock Inputs: SMA(F)
Dual/Redundant Radio Modules

Network Characteristics

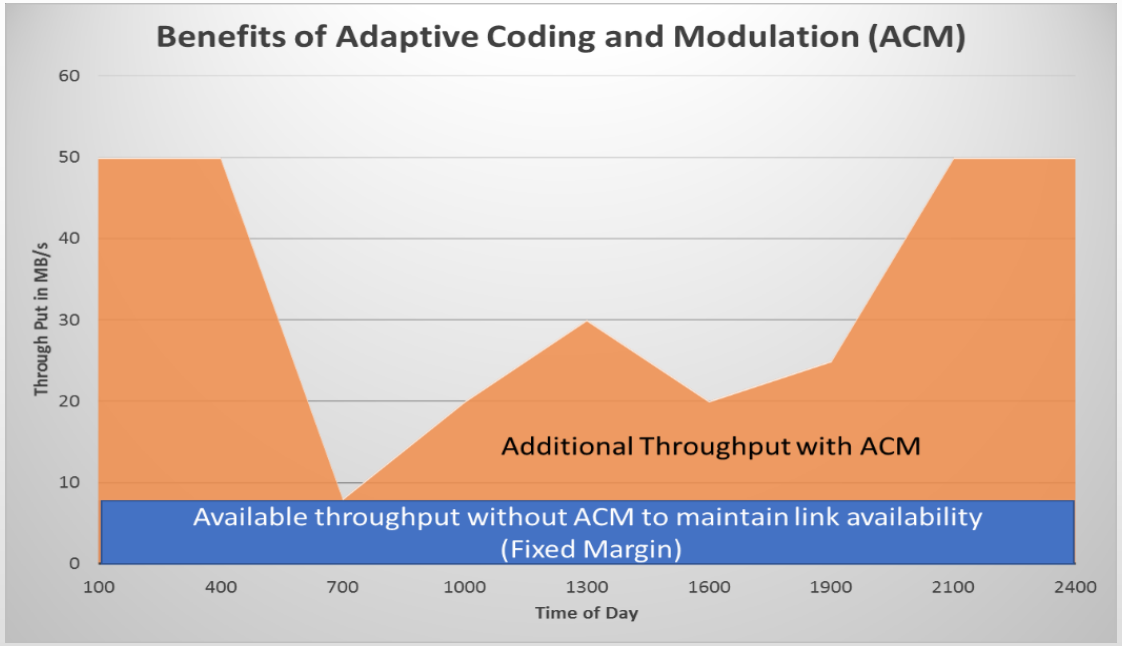
10/100/1000 Ethernet Interfaces
Layer 2 Protocol aware
IEEE 802.1Q
SNMPv3
M&C and User traffic separation by VLAN
Provides interface for GUI

Electrical Characteristics

Tuning Range: 950MHz – 6.0 GHz
Adaptive Link Power Control
Adaptive Coding and Modulation (with AI)
Adaptive Equalization
Diversity Combining
AES Encryption Capability

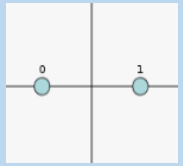
CS67PLUS Adaptive Coding Modulation (ACM)

- Traditional Troposcatter design is based on throughput during worst-case conditions - additional link margin is available at least 95% of the time
- ACM takes advantage of the additional link margin to increase data throughput of troposcatter links
  - **Link will support higher data rates most of the time**
  - **ACM takes advantage of available SNR margin**
- With the ability to maximize throughput under all conditions ACM achieves the maximum throughput, network efficiency, and availability.



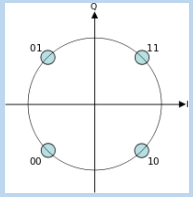
CS67PLUS Unique Modulation ("M"-ary APSK)

BPSK
1 bits/symbol



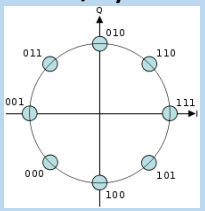
Up to 19 Mb/s

QPSK
2 bits/symbol



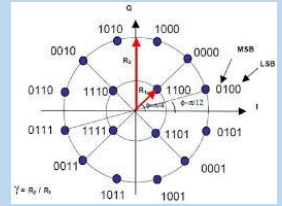
Up to 29 Mb/s

8 PSK
3 bits/symbol



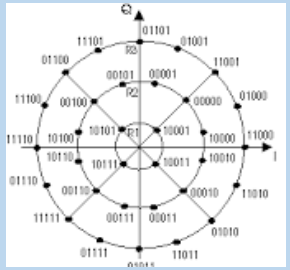
Up to 43 Mb/s

16 APSK
4 bits/symbol



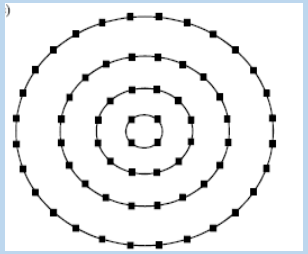
Up to 62 Mb/s

32 APSK
5 bits/symbol



Up to 87 Mb/s

64 APSK
6 bits/symbol



Up to 105 Mb/s

CS67PLUS achieves high data rates with an amplitude/phase modulated single carrier.

Thank You!