

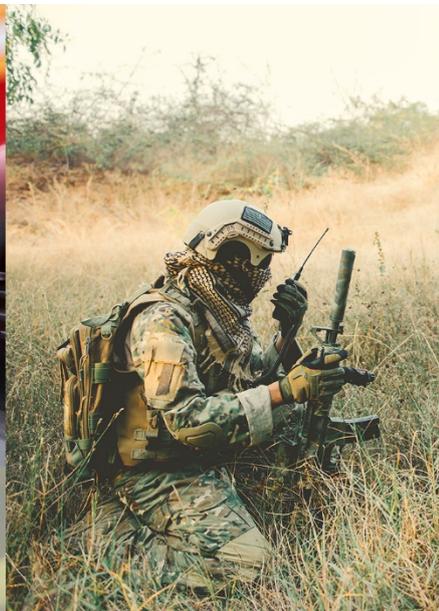


CISTECH
SOLUTIONS

Interoperability Specialists

ADVERSE TERRAIN MPU5 DEMONSTRATION

AUGUST 2019



1. THE SCENARIO

Due to the mountainous terrain encountered during training and operations through difficult regions, a demonstration was requested to show the capabilities of the Wave Relay® MPU5 radio to deploy in such arduous terrain. Figure 1 below shows the location of the demonstration, and the areas to which communications was required.

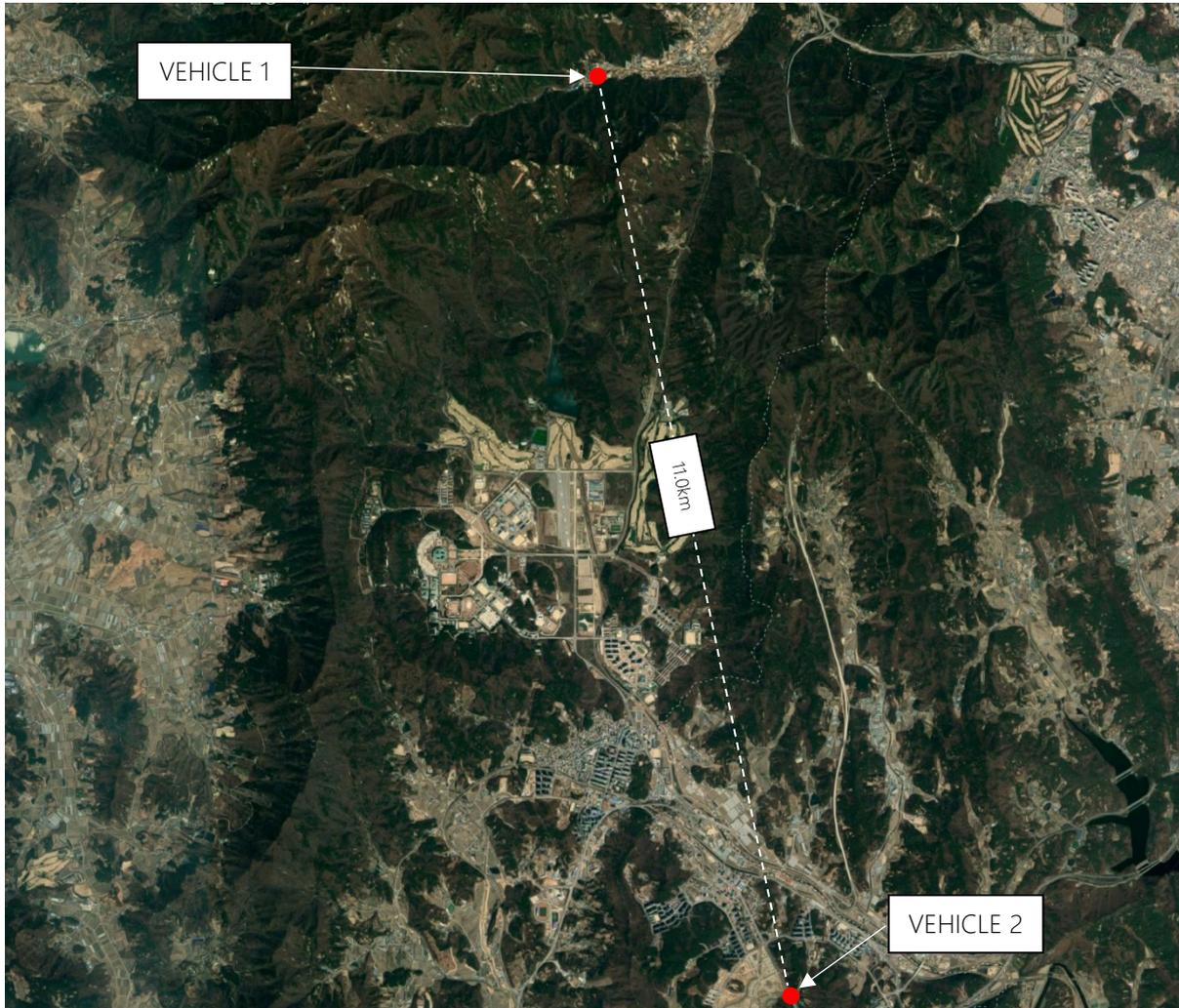
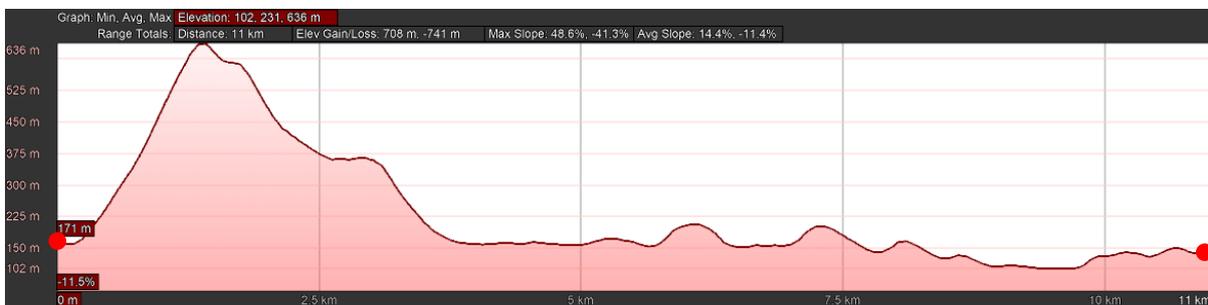


Figure 1. Two Vehicle Locations



VEHICLE 1

Figure 2. Elevation Profile Between Vehicle 1 and Vehicle 2

VEHICLE 2

The elevation profile between these two locations can be seen in Figure 2. Vehicle 1 sits at 181m above sea level, and Vehicle 2 sits at 138m above sea level. The feature that blocks the two vehicles from being Line-of-Sight peaks at 636 above sea level, 455m above Vehicle 1's location.

2. THE EQUIPMENT

Due to the Wave Relay® MPU5 MANET (Mobile Ad-hoc Network) capabilities, high-speed networks can be created over multiple hops and through difficult terrain, providing voice, video, situational awareness and data throughout a Beyond Visual Line-Of-Sight (BVLOS) area of operations.

The Wave Relay® MPU5 is the world's first smart radio. The MPU5 is the most advanced, most scalable, and most efficient Mobile Ad Hoc Networking (MANET) radio in the world. Built to create powerful, secure networks anywhere, the MPU5 unites all your critical data sources in real time – giving you and your team the confidence to make difficult decisions in the heat of the moment. Data, video, voice, and a fully integrated Android™ computer system makes the MPU5 the world's first Smart Radio.

MPU5 Key Features include:

- Android Computer – 1GHz Quad Core CPU, 2GB RAM, 128GB Storage
- Integrated HD Video Encoder – 3G-SDI, Composite, HDMI Inputs
- HD Video Decoder – Hardware-based H.264 decoding
- 16 Channels of Push-To-Talk Voice
- RoIP Radio Interface – Tether legacy radios into the MANET network
- Full Duplex voice communication
- 3 x USB Ports
- 10/100 Ethernet
- IP68 Rated to 20 metres of depth for 30 minutes
- Wide Temperature Range -40°C to 85°C
- Integrated GPS Module
- Four times the range of the previous generation Wave Relay® product range
- Over 100 Mbps throughput
- One radio chassis – multiple interchangeable radio modules
- 3 x 3 MIMO Technology
- Up to 10W output power



Figure 3. Wave Relay®

Cloud Relay™ functions in conjunction with Persistent Systems Wave Relay® MPU5 to provide situational awareness, video and voice to any location in the world. Using BLOS bearers like SATCOM, 3G/4G or ADSL, you can extend your MANET network seamlessly to anywhere it needs to be accessed. View your video, access your voice TalkGroups, and contribute to planning remotely or in transit using Cloud Relay™'s Layer-2 extension functionality. Requiring simply a KLAS Route Module and an MPU5 radio, your Cloud Relay™ nodes can be tactically deployed without transporting multiple server stacks forward to the tactical edge.

All your local Multicast data can be transported anywhere in the world and displayed as if you're right in the action. Smooth transition via Layer 3 networks such as the Internet or a private network (i.e. SATCOM) through which traffic is routed across to get it to another MANET in different parts of a city, state, country or even different parts of the world.



Figure 4. Cloud Relay™ Node using a Klas Voyager 1

3. THE SETUP

The scenario was completed using 7 Wave Relay MPU5's (1 x Operations Centre, 2 x Vehicles, 2 x Ridge Relay Nodes and 2 x Balloon Relay Nodes).

3.1. Operations Centre Setup

The Operations Centre radio was deployed as a static node, using a directional antenna to create a high-speed, long distance link between the radios deployed on the ridge.

Inside the Operations Centre, a Windows application developed by CISTECH Solutions, MaCE (MANET Command Environment) was being used to display Situational Awareness, monitor the status of the MPU5 network, stream live video from each of the vehicles, and access 16 voice TalkGroups from the MPU5 network. The ability to monitor the MPU5 network provides a visual representation of the signal strength between each radio and allows for advanced network planning from a single access point.



Figure 5. MPU5 with Directional Antenna

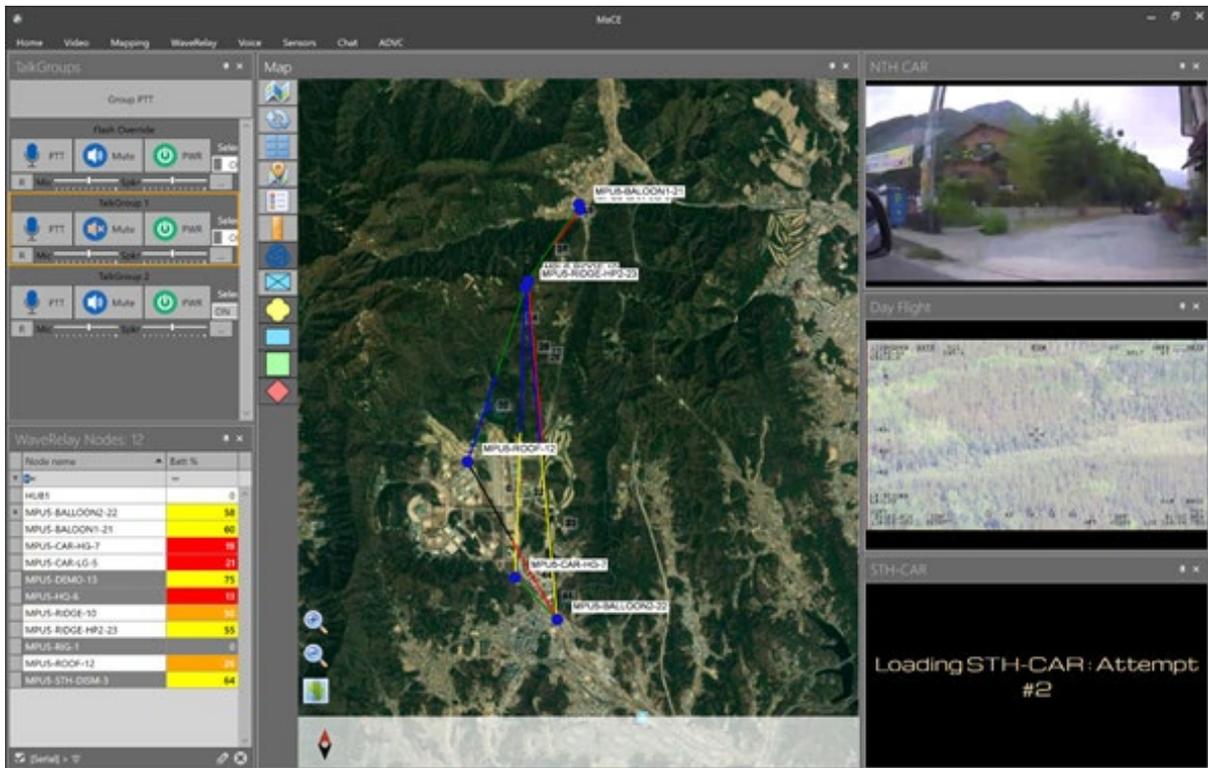


Figure 6. MaCE Screenshot during the Demonstration

3.2. Vehicles Setup

Each vehicle was equipped with an MPU5 and Klas Voyager 1 providing Cloud Relay capabilities. The Voyager 1 also provided Push-To-Talk and a Radio over IP integration capability while the MPU5 had a HDMI out to a touchscreen display. The attached touch screen allowed access to the Operating System running on the MPU5, viewing Situational Awareness and live video from other sources on the network.

For assured connectivity while the vehicle is stationary, the Voyager 1 and MPU5 was powered off a Revision Military Squad Power Manager, which can ingest power from multiple sources (in this case cigarette lighter and solar), use a variety of batteries as a ballast (in this case Li-Ion 6.8aH PRC-148 batteries) all while powering active devices. Should the car be turned off, the Voyager 1 would continue to run using its internal UPS as well as the PRC-148 ballast batteries providing top-up charge. Using this setup, the MPU5 and Voyager 1 could be powered for up to 6 hours with the car powered off.



Figure 7. Photo of a Vehicle with Klas Voyager 1 and MPU5 powered by SPM

3.3. Ridge Relay Node Setup

The Ridge Relay Nodes were placed at advantaged locations on top of the feature, to provide a link between the North and South sides of the feature.



Figure 8. MPU5 Placed as a Ridge Relay Node

4. THE SOLUTION

4.1. Using Wave Relay® MPU5s

The demonstration included a solution presented entirely using MPU5s over RF, using the following configuration:

Channel Frequency: 1372MHz
Channel Bandwidth: 10MHz
Link Distance: 8mi (12.8km)
Power: 3.3W per Chain
Encryption: 256-bit AES-CTR with HMAC-SHA-256 (Suite B)

The Balloon Relay Nodes were located 50m above ground level in their locations to provide coverage points behind knolls and around the built-up suburban areas. To provide coverage to the entire area of operations, two (2) MPU5s were placed at the top of the feature, extending coverage due to its advantaged location.

Vehicle 1 was free to move throughout the town to the North of the feature, and Vehicle 2 was free to move between the Operations Centre and the town to the South of Balloon Relay Node (South) without losing any connectivity, and streaming video and voice throughout.

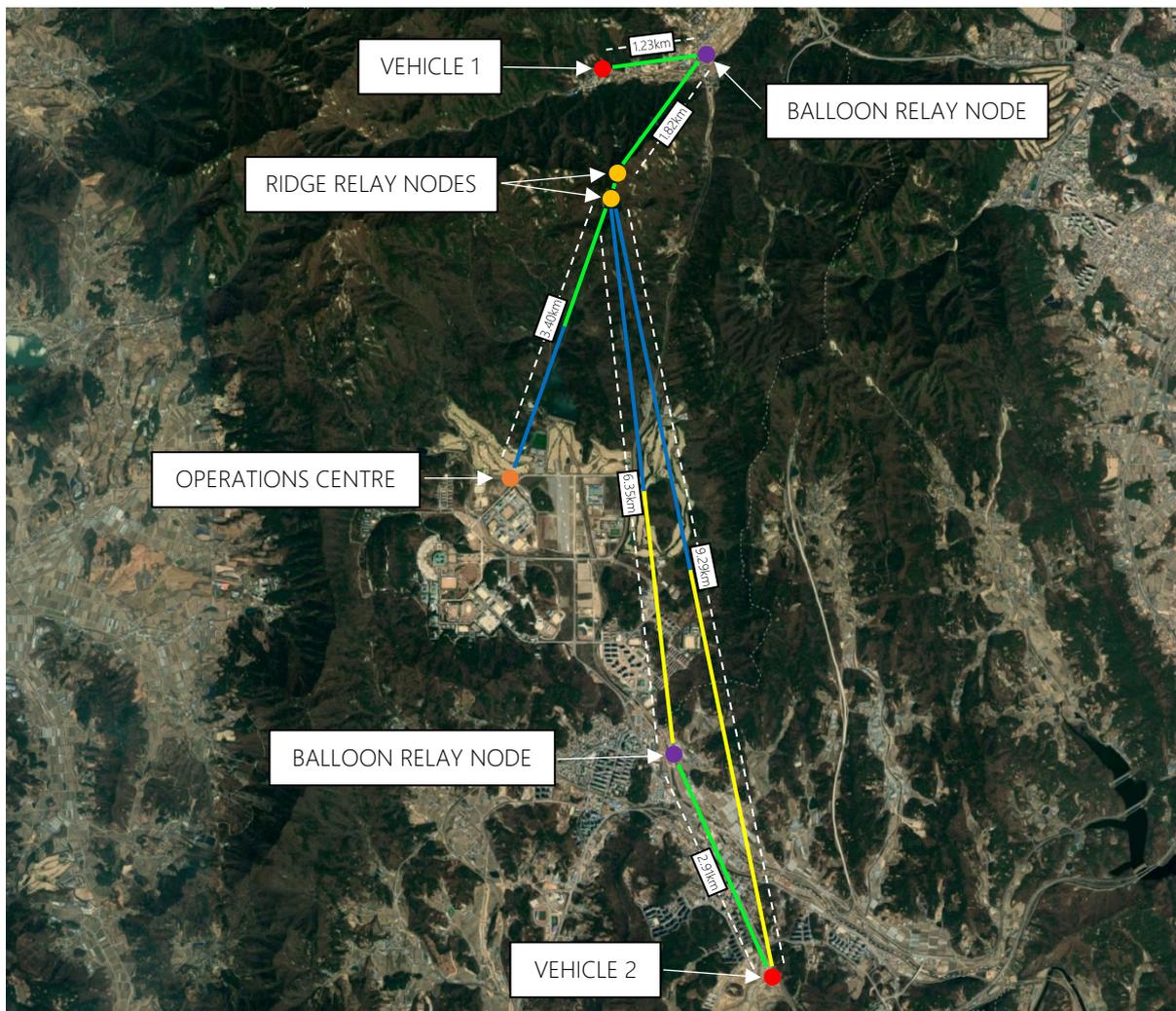


Figure 9. Overview of MPU5 Solution showing Interconnectivity

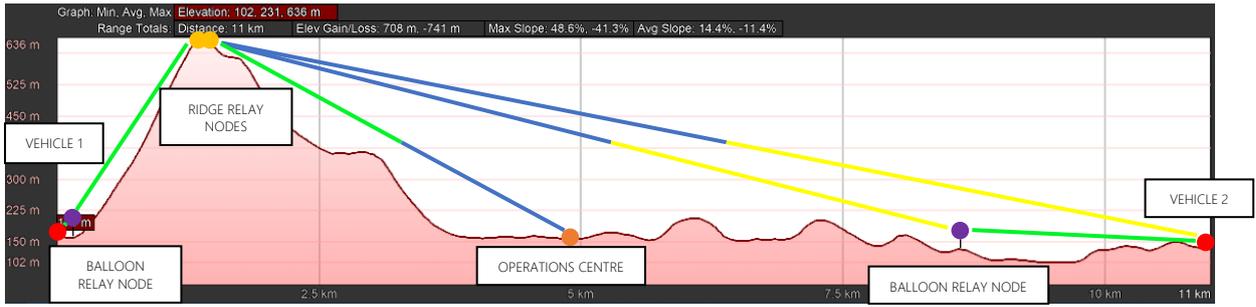


Figure 10. Elevation Profile of MPU5 Solution



Figure 11. Capture of Video from Vehicle 2



Figure 12. Capture of Video from Vehicle 1

4.2. Using Wave Relay® MPU5s and Cloud Relay™

While the vehicles were transiting to reach their final location, there were sections of road which were blocked from all other MPU5 radios, which when using legacy equipment would place the user in a no communications area. When integrating the MPU5s with Cloud Relay™ and leveraging off a strategic backhaul bearer (3G/4G, ADSL, TACSAT etc), the users can now remain connected during transits and difficult communications areas.

The nodes below circled in white have Cloud Relay™ installed and are using 3G/4G to communicate when not within RF range of another MPU5.

As you can see below, Vehicle 1 has passed between two ridgelines and blocked its line-of-sight to Balloon Relay Node (North) and Ridge Relay Node. It has seamlessly transitioned to Cloud Relay™ and continued to transmit its location, video and voice. Vehicle 2 is in transit to its Southern location before Balloon Relay Node (South) has been raised. It has transitioned to Cloud Relay™ to ensure continuous Command and Control. When the Southern Balloon Relay Node has been deployed, Vehicle 2 will transition back to using high-speed RF for its voice, video and data transmissions.

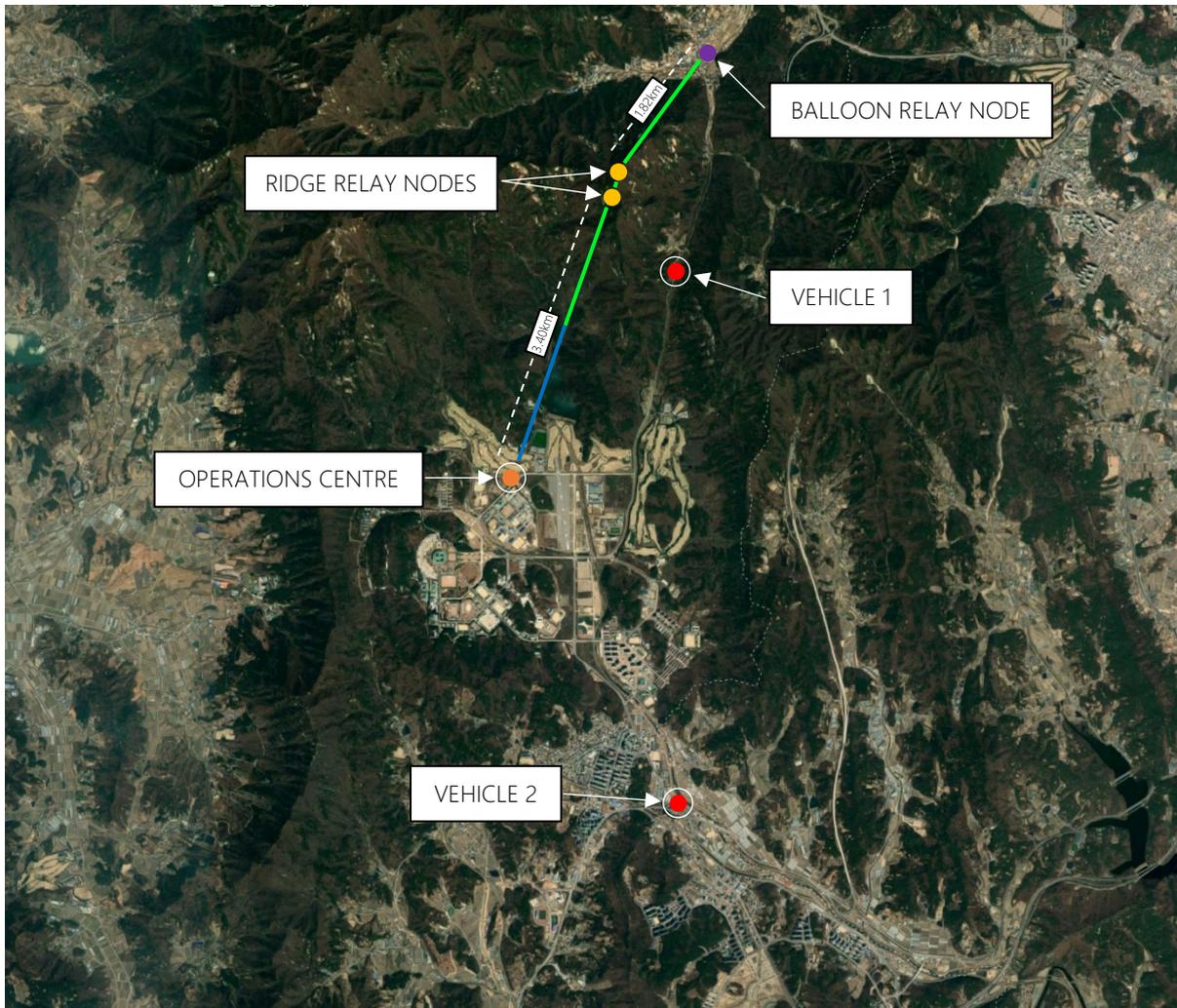


Figure 13. Overview of Cloud Relay™ Solution

THIS PAGE HAS BEEN LEFT INTENTIONALLY BLANK



1300 300 340
www.cistechsolutions.com