Pipeline Leak Detection System at Chuandongbei Project

中国石油 Chevron Unocal East China Sea, Ltd.

川东北天然气项目
Chuandongbei Gas Project

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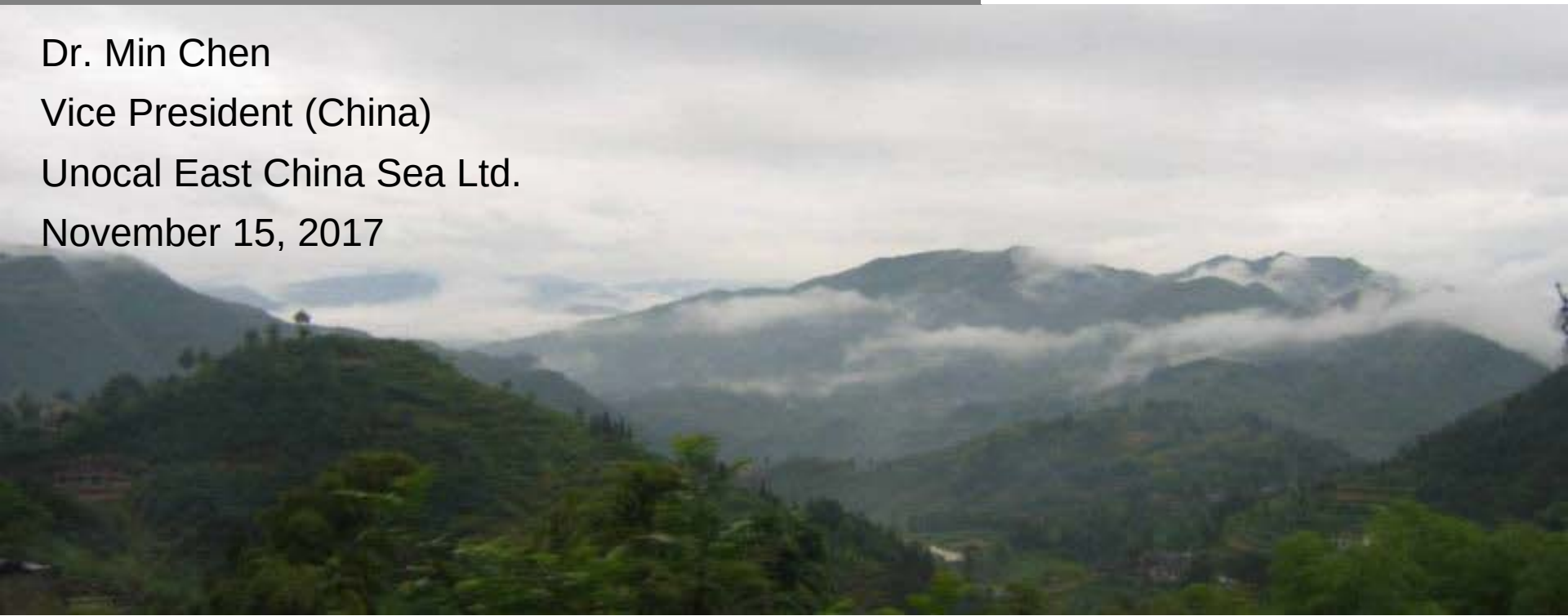
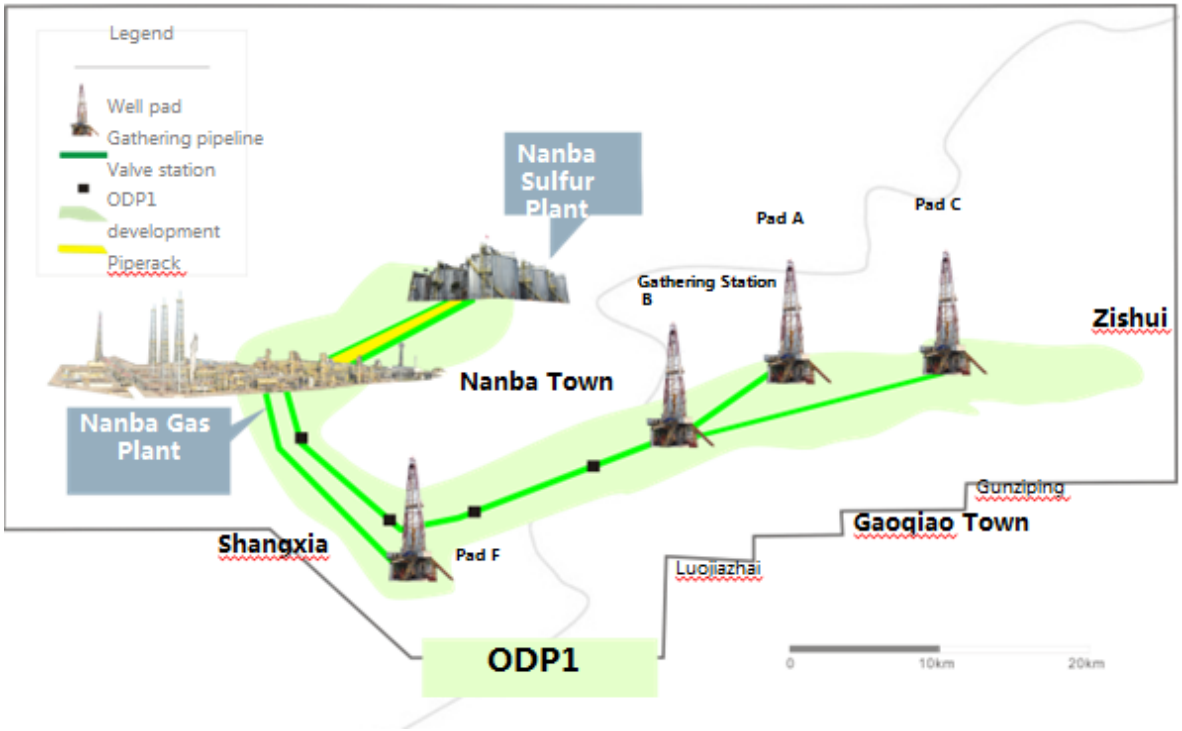


Chuandongbei (CDB) Project Overview

- 30-year Production Sharing Contract (PSC) signed between Unocal East China Sea, Ltd. (“Chevron”) and China National Petroleum Corporation (CNPC) in 2007
- Co-developed by Chevron (Operator) and CNPC
- 49% participating interest by Chevron, and 51% by CNPC
- Over 800 square kilometers in Sichuan Province and Chongqing Municipality in southwest China

ODP-1 Luojiazhai Development



- 2 Well pads
- ~38-km pipeline network
- 3-train sour gas processing plant
- Sulfur plant

Safeguards at CDB

Apply Operational Excellence to deploy overall safety strategy and comprehensive safeguards under challenging operation environment with focus on

- Personal safety
- Leak prevention
- Leak detection
- Emergency response

CDB Pipeline Leak Detection Drivers

- CDB produces sour gas - H2S content ~10%-15% and CO2 ~7.12%
- The sour gas pipeline are installed in 38.5 km extremely steep grades and rugged terrain
- Population centers are close proximity to the pipeline
- Early detection is important to ensure the safety of local communities should a loss of containment occur.

Pipeline GCI Detection Camera Pilot

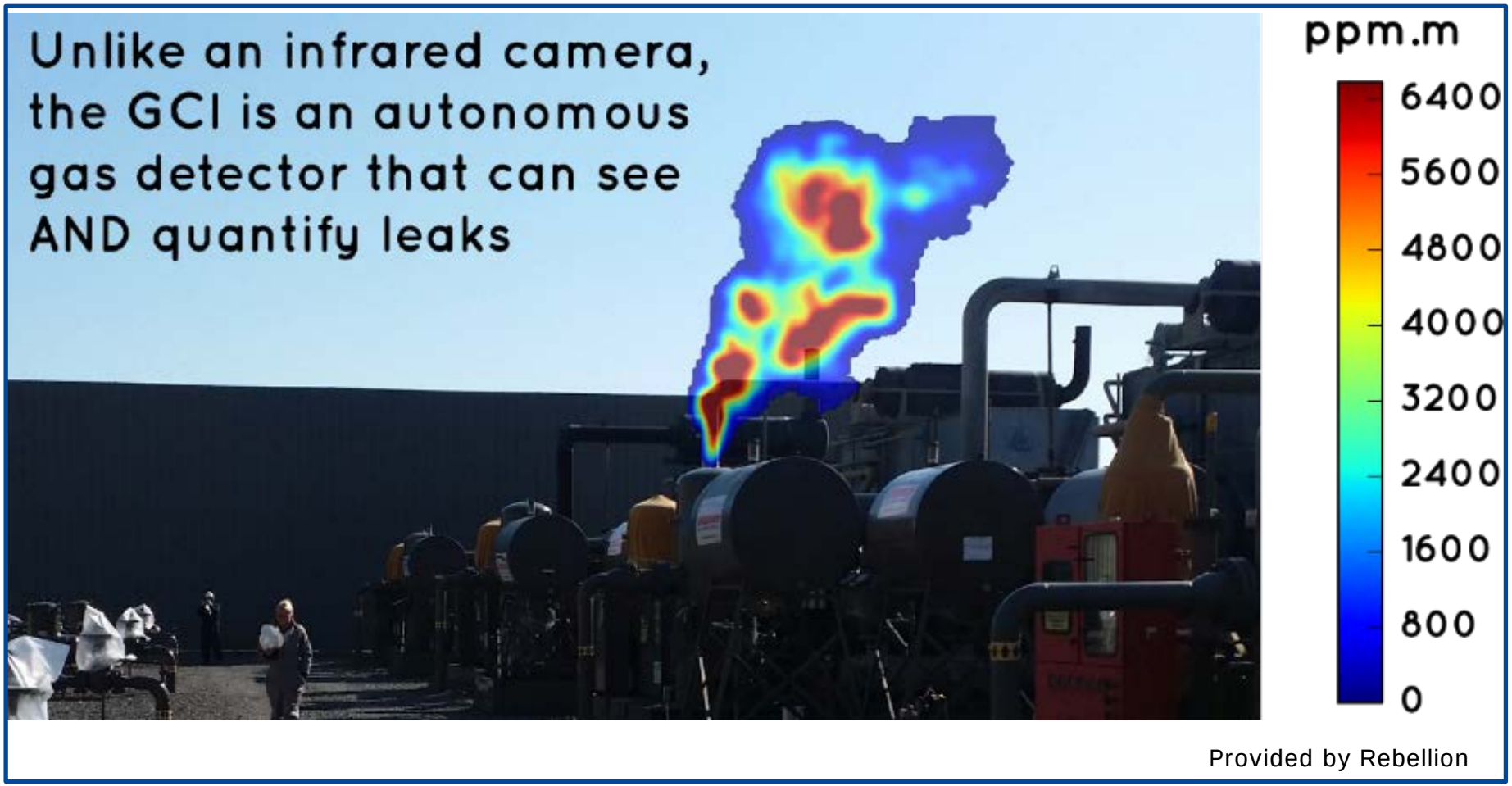
Gas Cloud Imaging (GCI) Camera

- New technology is now available for provision of long distance gas detection.
- Cameras are configured to rotate to defined “views” of areas where leak detection is required
- Fully automated, autonomous leak detection and alarming capability for very large areas

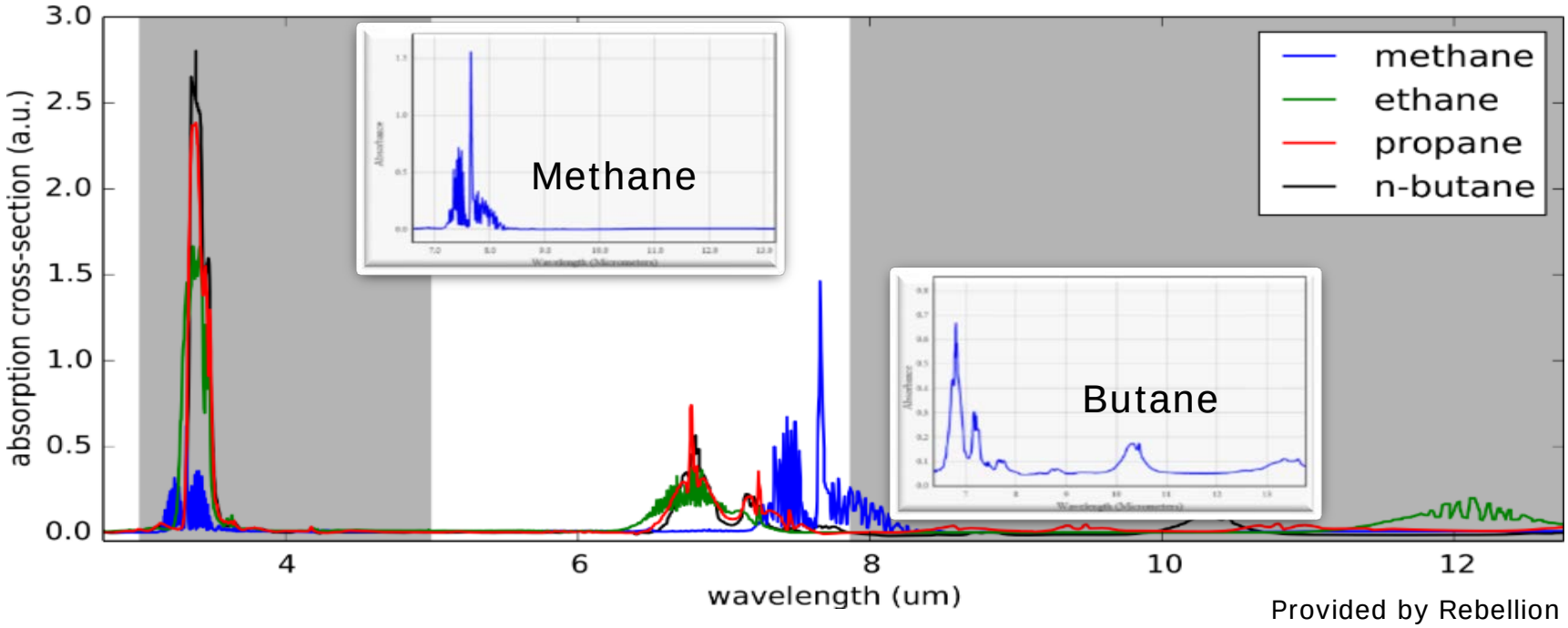
Pilot Objectives

- GCI Camera detection capabilities
- GCI Camera’s operational feasibility in CDB
- Learn and adopt a routine preventative maintenance, function test program, and training plan

GCI Camera


Unlike an infrared camera,
the GCI is an autonomous
gas detector that can see
AND quantify leaks
ppm.m
6400
5600
4800
4000
3200
2400
1600
800
0
Provided by Rebellion

Technology Based on Passive Absorption IR Spectroscopy

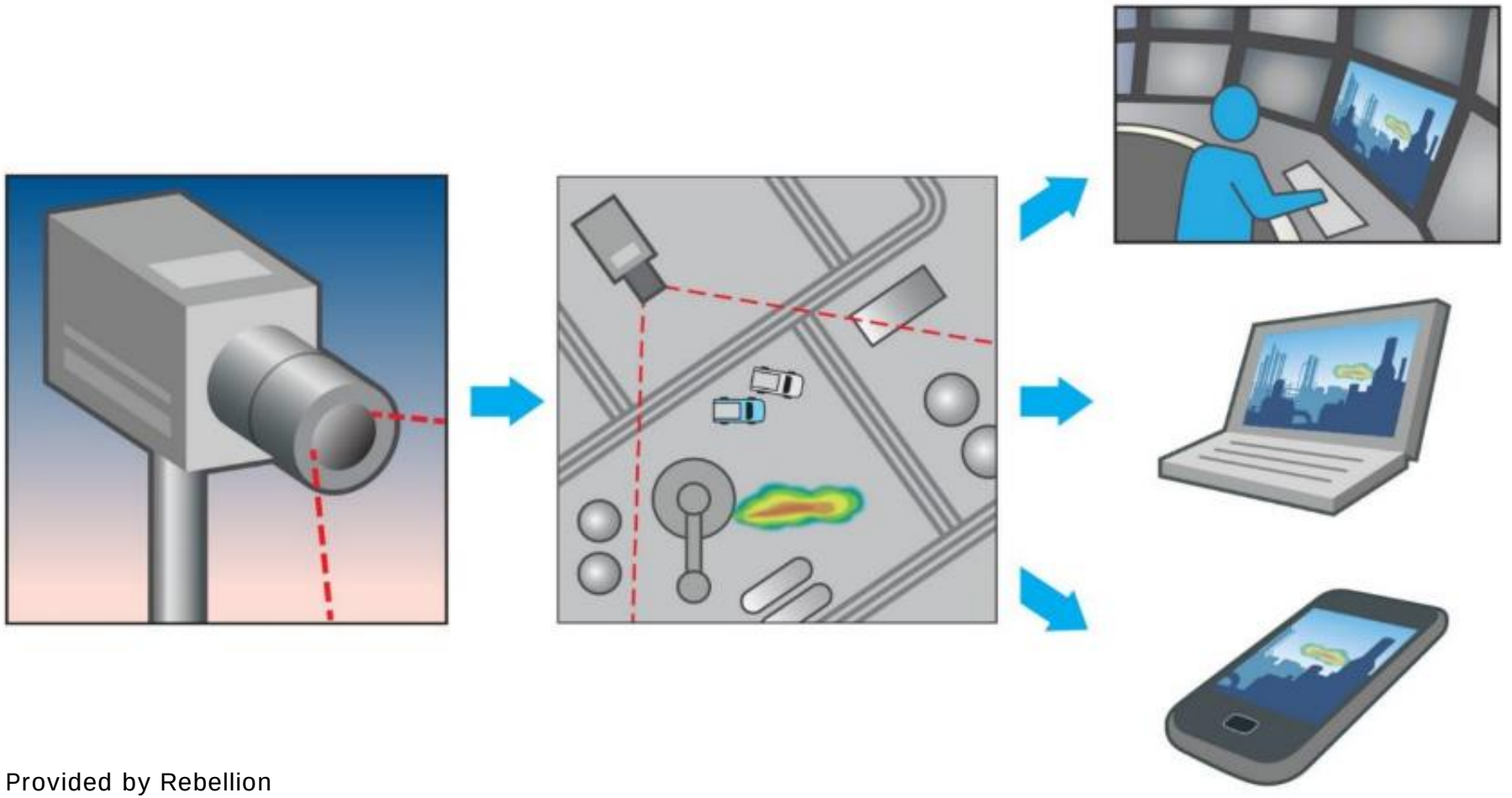


Provided by Rebellion

- Monitors and detects over 25+ different hydrocarbon gases
- Operates in the infrared spectral region
- No light source is required
- Self-calibrating, runs internal health checks every 5 and 20 minutes

Hyperspectral Imaging Camera: Core of the GCI system

How the GCI System Works

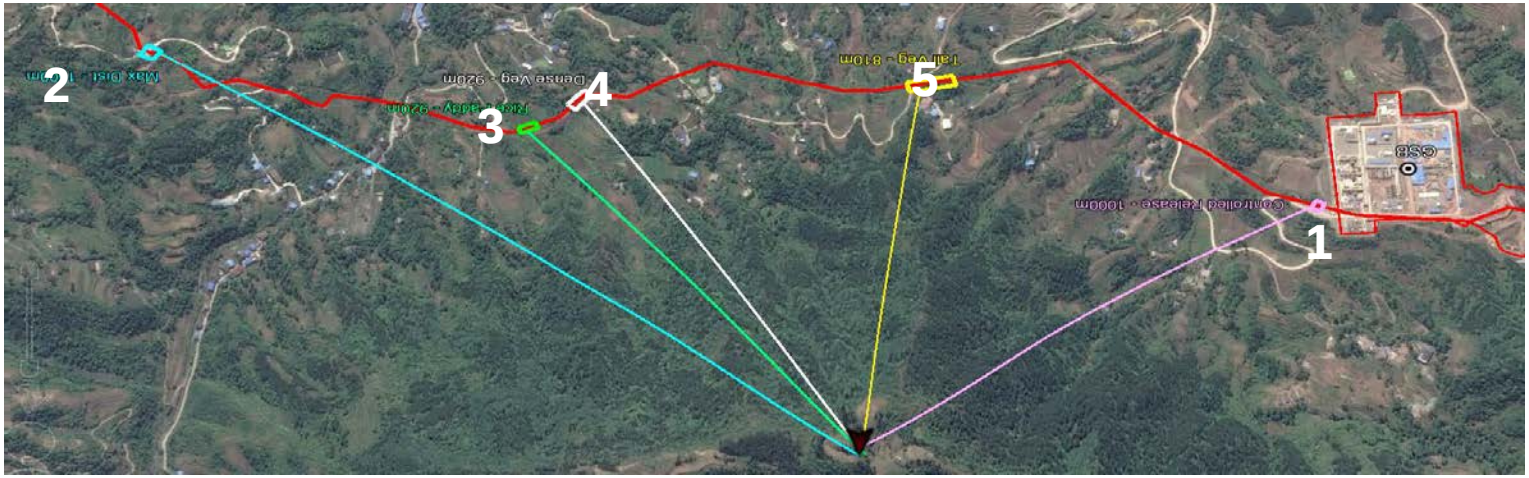


Provided by Rebellion

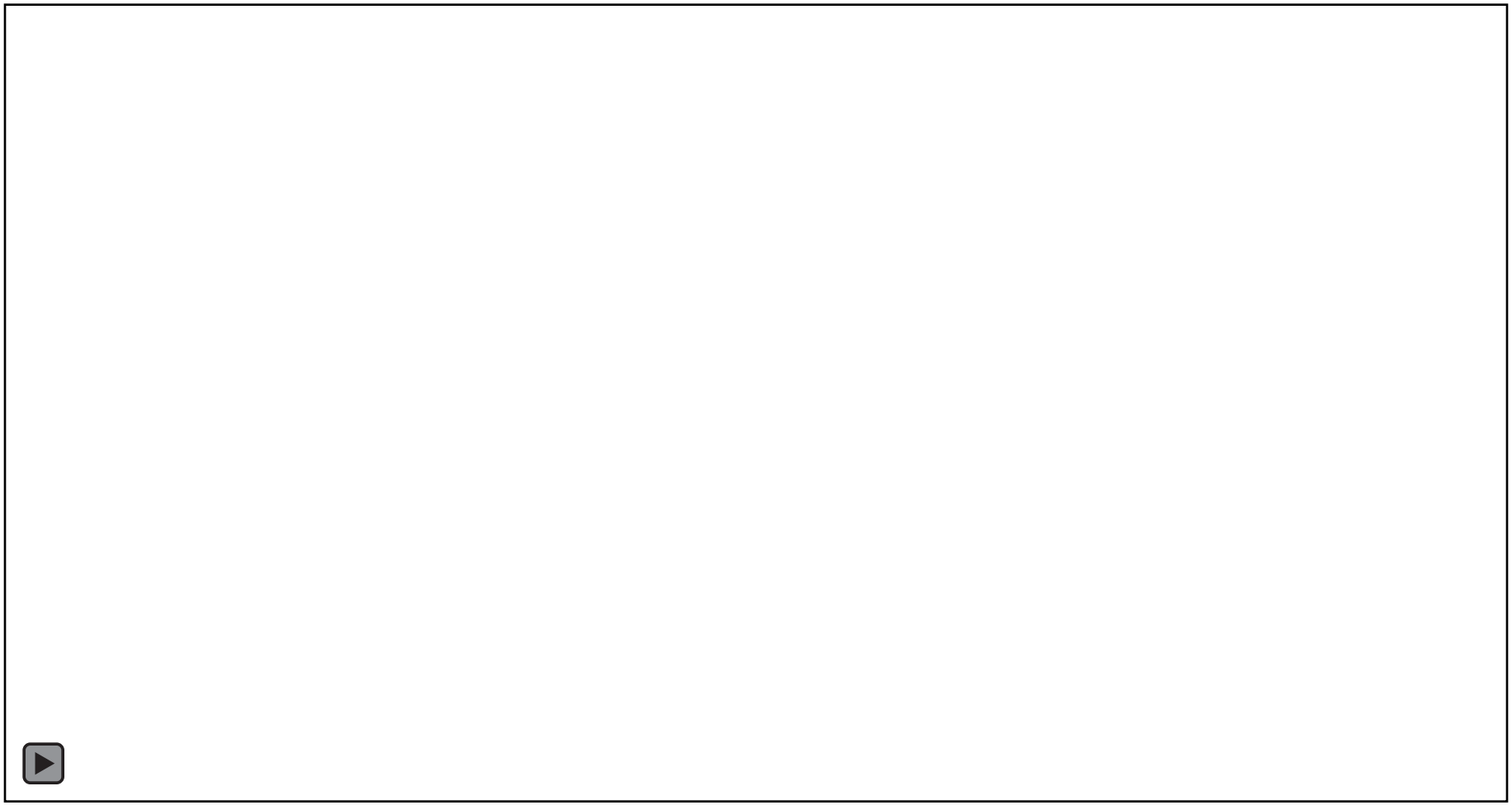
Field Pilot – GCI Technology

Large Pipeline Coverage (5Km) Provided by GCI system

~ 5 kilometers



1.5km Test Video



Control Room Equipment – Console with GCI Workstation

GCI Camera Pilot Conclusion

- GCI Camera System successfully passed Site Acceptance Test by detecting methane at all locations.
- GCI Camera System successfully completed background tests, and adequately detected a leak against the project site specific terrain.
- GCI Camera performs automatic gas detection with a very low false positive.
- System is configured to monitor 5 km with single camera and takes about 4 minutes. Once full network of cameras has been deployed the entire pipeline (~ 38.5km) will be monitored with re-visit times of < 2 minutes。

GCI Camera Full Field Deployment Plan

Pipeline leak detection

- 24 units gas cloud imaging detection cameras
- 190 H_2S Point detector, 40 Remote Terminal Unit, and Fiber Optic Cable

Facility Perimeter gas leak detection

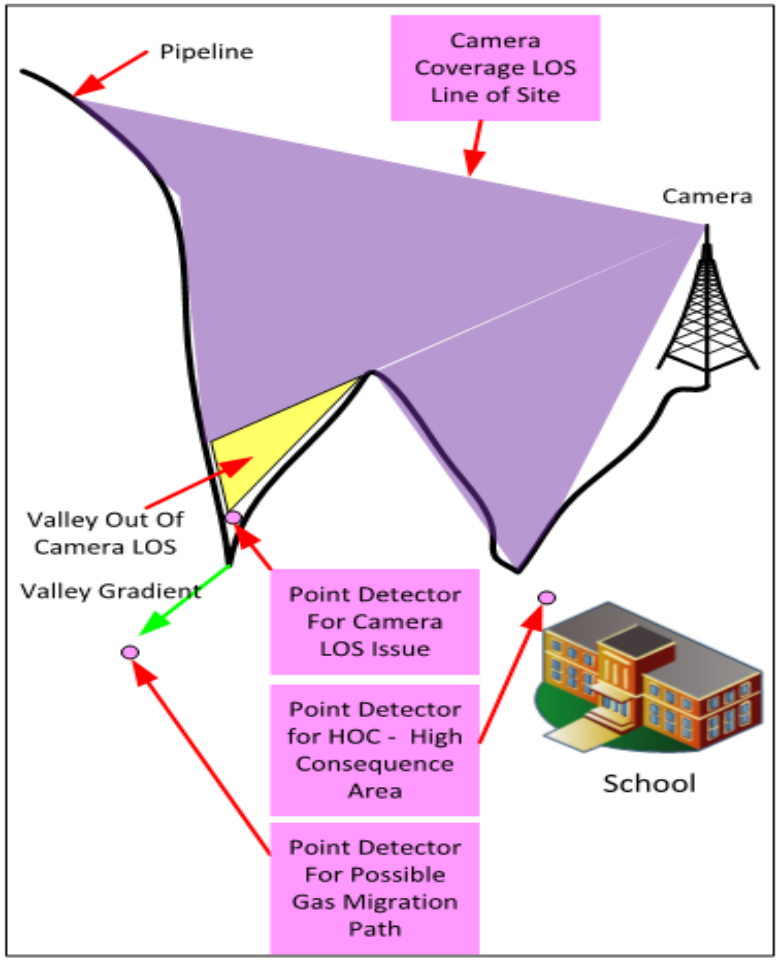
- 4 units Gas Cloud Imaging detection cameras at WPA, WPC, GSB and NGP

Integration

- Integrate and centralize all PLDS technologies to facilitate analysis, decision making and reaction during an event
- Establish of dedicated PLDS Operator Station at Nanba Security Control Center for 24/7 monitoring

Future Field Pipeline Leak Detection Coverage

- GCI cameras and point detectors will work together to achieve 100% coverage.
- Step by step deployment:
  - Priority 1 to address high population density areas;
  - Priority 2 for main facility areas;
  - Priority 3 for rest of pipeline.



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Q & A