



The **Gas Cloud Imaging (GCI)** camera uses snapshot hyperspectral imaging to visualize and quantify gas release in real-time, allowing you to fix problems before safety issues or environmental incidents occur.

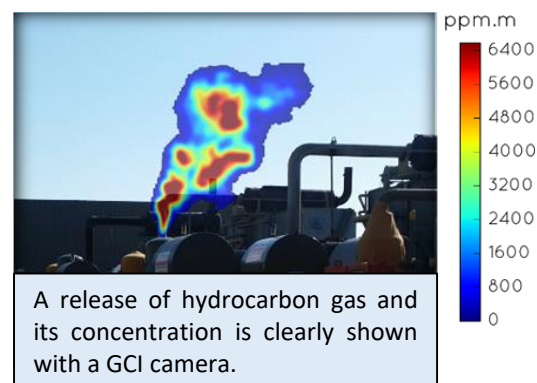
Product Specifications

Detection Approach	Snapshot Hyperspectral Infrared Imaging
Detection time	< 1 second
Field of View	<i>Long Range:</i> 10.0° x 5.0° <i>Wide Field:</i> 33.8° x 22.6°
Position Control	Pan +/-180° (360° full rotation), Tilt -45/+60°
Detection Range	<i>Long Range:</i> up to 1,700 m (5,577 ft) <i>Wide Field:</i> up to 660 m (2,165 ft)
Alert/alarm	Fully automatic alarm with live visual display, audible alert, email, and/or text message
False Alarm Rate	≤ 1%
DCS Integration	Modbus TCP/IP
Video Output	200 x 200 pixels (IR) / 600 x 600 pixels (Visible) at 15 Hz
Weather Conditions	Validated for all weather and light conditions
Temperature Range	-40°C to 55°C (-40°F to 131°F)
Electrical Requirements	Camera: 24 VDC, 10 A (peak), 5 A (continuous) Pan/Tilt: 24 VDC, 12 A (peak), 6.4 A (continuous) Analyzer: 24 VDC or 120/240 VAC (< 600 W)
Connections	3 Multi-mode Fibers, LC Connectors
Running time	Continuous (24/7, 365 days)
Self calibration	Every 5 minutes
Maintenance	No regular maintenance (except exterior cleaning)
Analyzer	Dual Xeon processor, 32 GB RAM, > 6 TB HD, LINUX OS
Analytics	Up to 10 simultaneously
Video Storage	Up to 5 million detection event videos with optional DVR



Popular Gas Species*	Minimum Detection Level (ppm-m)
Acetic acid	180
Ammonia	13.5
Benzene	125
Butadiene	125
Butane	250
Carbon Dioxide	1079
Ethane	250
Ethanol	15
Ethylene	250
Iso-Butylene	125
Iso-Pentane	40
Methane	250
Methanol	10
N-Pentane	20
Propane	500
Propylene	125
Sulfur Dioxide	20
Toluene	150
Vinyl Chloride	2.5
p- or m-Xylene	20

*Please consult with Sales Representative for a complete gas list. We will also work with you to develop custom gas analytics.



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Rebellion Photonics develops products for the oil and gas industry by leveraging a breakthrough in optics technology born out of Rice University that is capable of overcoming the limitations of conventional spectral imaging. The **Gas Cloud Imager**, Rebellion Photonics' flagship product for the oil and gas industry, is the first real-time continuous gas leak imaging system providing full field detection capability.

Rebellion Photonics is an award-winning, innovative company leading providing spectral imaging solutions to the oil and gas industry. Rebellion Photonics was named "Startup of the Year" by the Wall Street Journal and has won numerous awards. The company won the R&D 100 award in 2012 and was selected as a finalist for the 2011 Prism Award by Photonics Media and SPIE, which recognizes cutting-edge products. The company was also selected as the Grand prize winner of the 2010 Goradia Technology Innovation prize by the Houston Technology Center.

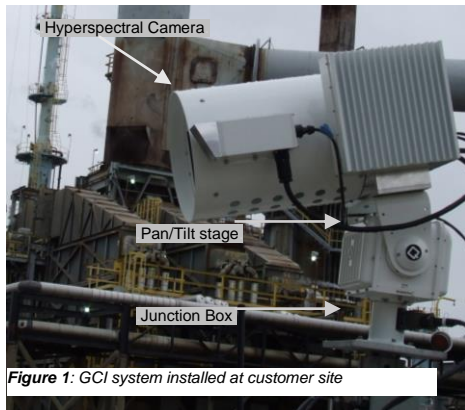


Figure 1: GCI system installed at customer site

Key Advantages of the GCI

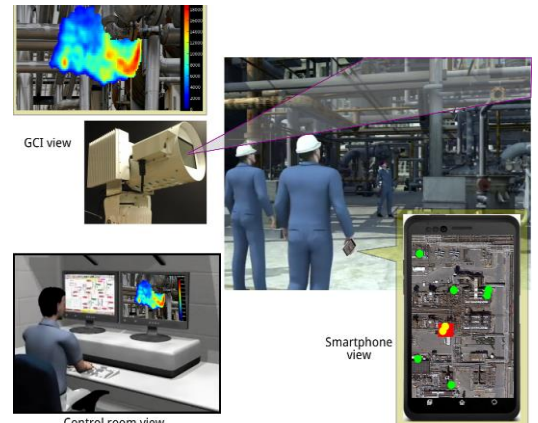
- Speciation capability (20+ gases)
- Self-calibration
- Low annual maintenance
- Quantification capability
- Fully automatic operation
- Continuous monitoring (15 fps)
- 2000 foot radius for detection
- No need to hire additional labor

The Gas Cloud Imager (GCI), shown in Figure 1, is an **automated leak detection camera**. It is capable of monitoring a large area, selectively detecting gas plumes, and sending real-time alerts and video of the leak to the control room and the operator's email (see diagram below).

The system uses advanced hyperspectral infrared imaging technology, engages advanced detection algorithms, and employs powerful data storage and transmittal technology. The GCI is different from other leak imagers because **leak detection is automated, identification and quantification are possible, and wide areas can be monitored.**

The GCI has the potential to **catch leaks early** and helps operators avoid walking into a hazardous cloud. It will also aid operators when making process safety decisions to avoid leak escalation that can lead to "low-frequency, high-consequence" incidents. The GCI is capable of **differentiating among over 20 types of gases** (Table 1) and it can be deployed in a variety of applications and environments in oil and gas drilling, completion, and production with customers in upstream, midstream and downstream. Operators can expect to see cost savings due to reduced expenses, lower downtime, and improved safety and environmental performance made possible by the GCI.

How it works: The GCI camera is based on snapshot hyperspectral infrared imaging technology which is the combination of



IR imaging and IR spectroscopy at the pixel level. When a hydrocarbon gas is present, the GCI camera "sees" the gases unique absorption IR spectrum and automatically matches it with a library of gas spectra to determine the gas type and its concentration. If concentration is above a certain, configurable level, the GCI camera sends out an alarm without any dedicated labor for operation. The GCI is capable of **continuously monitoring** large areas and is inherently more reliable than any single point detection or sensor network and has the added

Table 1: GCI Sensitivity Minimum Detectable Leak Rate	
Species	SCFH
Methane	0.49
Ethane	0.49
Propane	0.64
Butane	0.49
Ethylene	0.25
Propylene	0.32
Iso-Butylene	0.25

Other detectable gases: Ammonia, Benzene, Butadiene, Chlorobenzene, Ethane, Ethanol, Ethylene, Hydrazine, Hydrogen Sulfide, Methanol, Propylene Oxide, Toluene, Vinyl Chloride, p- or m-Xylene, Iso-Butane, Iso-Pentane, Neo-Pentane, N-Pentane, 1,1-dichloroethane, 1,2 dichloroethane

*Verified by AES and BP tests

benefit of **reduced false positives** because of the ability to infer abnormal conditions. The bottom picture shows output from a GCI with color video overlay. The operating capabilities of the GCI have been verified by third parties and the company has published in conjunction with leading oil and gas companies.

