

Modern Leak Detection Technologies

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History of Leak Detection Technology

- Vegetation Leak Surveys – 1930's to early 1990's
- Bar-Hole Leak Surveys (CGI) – mid-1940's to early 1960's
- Mobile FID Leak Surveys – late 1950's to present
- Portable FID Leak Surveys – late 1960's to present
- Portable Catalytic / Thermal Conductivity / Electro-Chemical Technology (CGI) – late 1980's to present
- Mobile Optical Methane Detector (OMD) late 1990's to present
- Remote Methane Leak Detector (RMLD) mid-2000's to present
- Portable & Mobile Optical / Infrared Technology mid-2000's to present.
- Imaging Cameras – mid-2000's to present
- Aerial Detection – Helicopter & Fixed Wing Optical / Laser Technology – early 2000's to present.

Vegetation Leak Surveys

- Natural Gas displaces oxygen and moisture in the soil.
- Results in dead or dying vegetation.
- Once used as a means of DOT 192 Compliance.
- Early 1990's eliminated as a means of DOT 192 regulatory compliance for leak survey.



Vegetation Leak Surveys

- More prevalent during growing season
- Better results when main & services located under grass.
- Practically useless when main & services located under concrete or asphalt.
- Currently a lost “art” but definitely gas company employee’s should be aware of affects and respond accordingly.

Vegetation Damage



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Bar-Hole Leak Surveys

- No longer used for leak survey with the exception of heavier than air gases like propane
- Now used to confirm / grade / pinpoint leakage.
- Labor intensive
- Risk damage to underground structures
- Extremely accurate in determining leak location



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**Confirming
Leak
Indication
with
Combustible
Gas Indicator**



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Mobile FID Technology

- Early versions permanently mounted in vehicle.
- Later versions could be removed for portable applications.
- Total hydrocarbon detection including false positives like car exhaust / gasoline and atmospheric contaminants.
- Requires external fuel and calibration gases
- External sample pump and tubing maintenance
- Detection capabilities of 1 ppm to 10,000 ppm or 1% gas by volume.

Mobile Flame-Ionization (FID) Leakage Surveys



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Early Versions – 1960's



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Early Versions – 1980's



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Current Flame-Ionization Technology



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Portable FID Technology

- Portable access to main & service lines and rear easement applications inaccessible to a vehicle.
- Requires external fuel and calibration gases.
- A “total” hydrocarbon detector.
- Detection capabilities of 1 ppm to 10,000 ppm or 1% gas by volume.
- Internal sample pump

Portable FID Technology

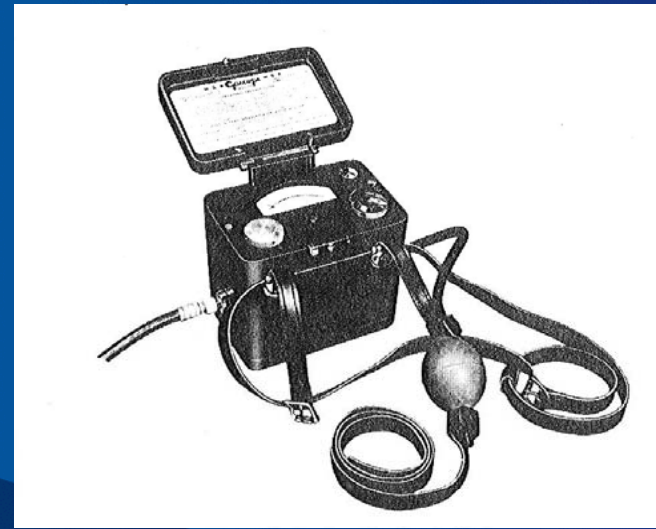
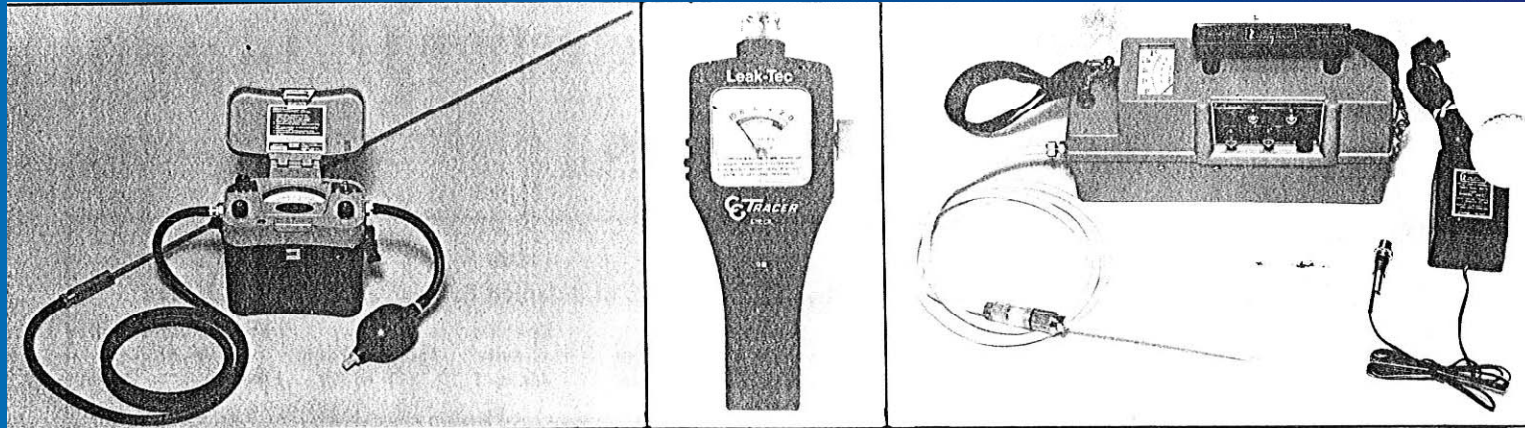


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Early Combustible Gas Indicator (CGI) Technology

- Early versions were LEL (catalytic combustion) only.
- Hand-aspirated sample draw
- Analog meter display
- Realistically 2 LEL or 1000 ppm detection capability.
- Used primarily for bar-holing and atmosphere testing.
- Manual internal calibration
- Limited application / modes of operation

Early Analog LEL / Volume Gas Technology Hand Aspirated

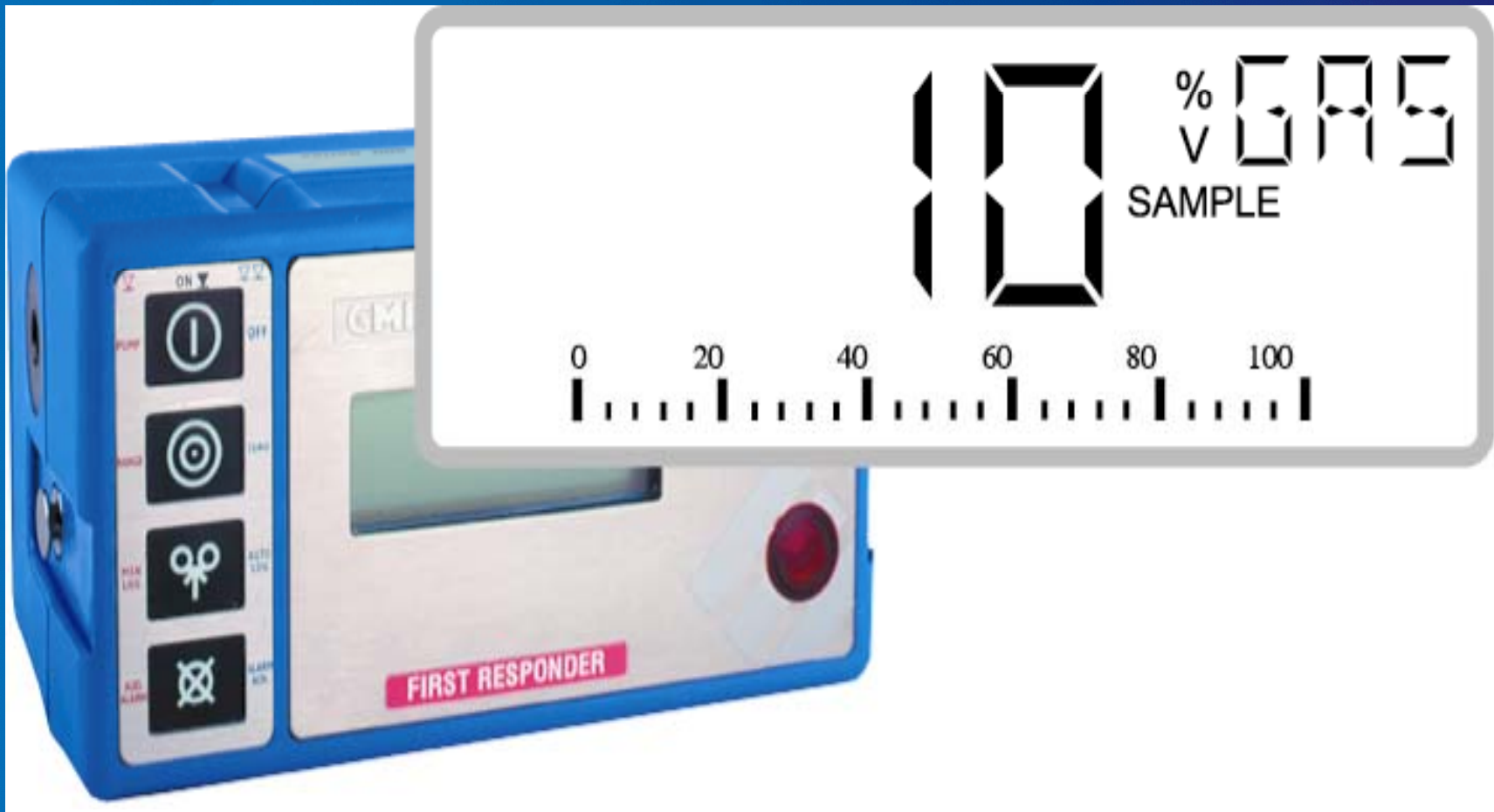


Early Analog CGI



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Current Digital CGI Instruments



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Latest Combustible Gas Indicator (CGI) Technology

- Internal sample pump
- Addition of semi-conductor (ppm) and thermal conductivity (volume gas) sensor technology.
- Addition of CO, O₂ and H₂S sensors
- Data-logging & alarm capabilities
- Microprocessor diagnostic design
- Automatic external calibration options
- Digital display
- Numerous application / modes of operation.
- Sensitivity from 50 ppm to 100% by Volume combustibles.

Ergonomic – Multi-Gas Technology



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Automated Calibration Stations



Optical Methane Detector (OMD)

- 1st mobile replacement for FID technology
- Infrared methane detection only
- No external sample pump or tubing
- No external fuel and calibration gases
- Increased speed of survey
- Less false positive indications
- Microprocessor technology with data-logging and GPS capabilities
- Sensitivity from 1 ppm to 10,000 ppm

Mobile Optical Methane Detector (OMD)



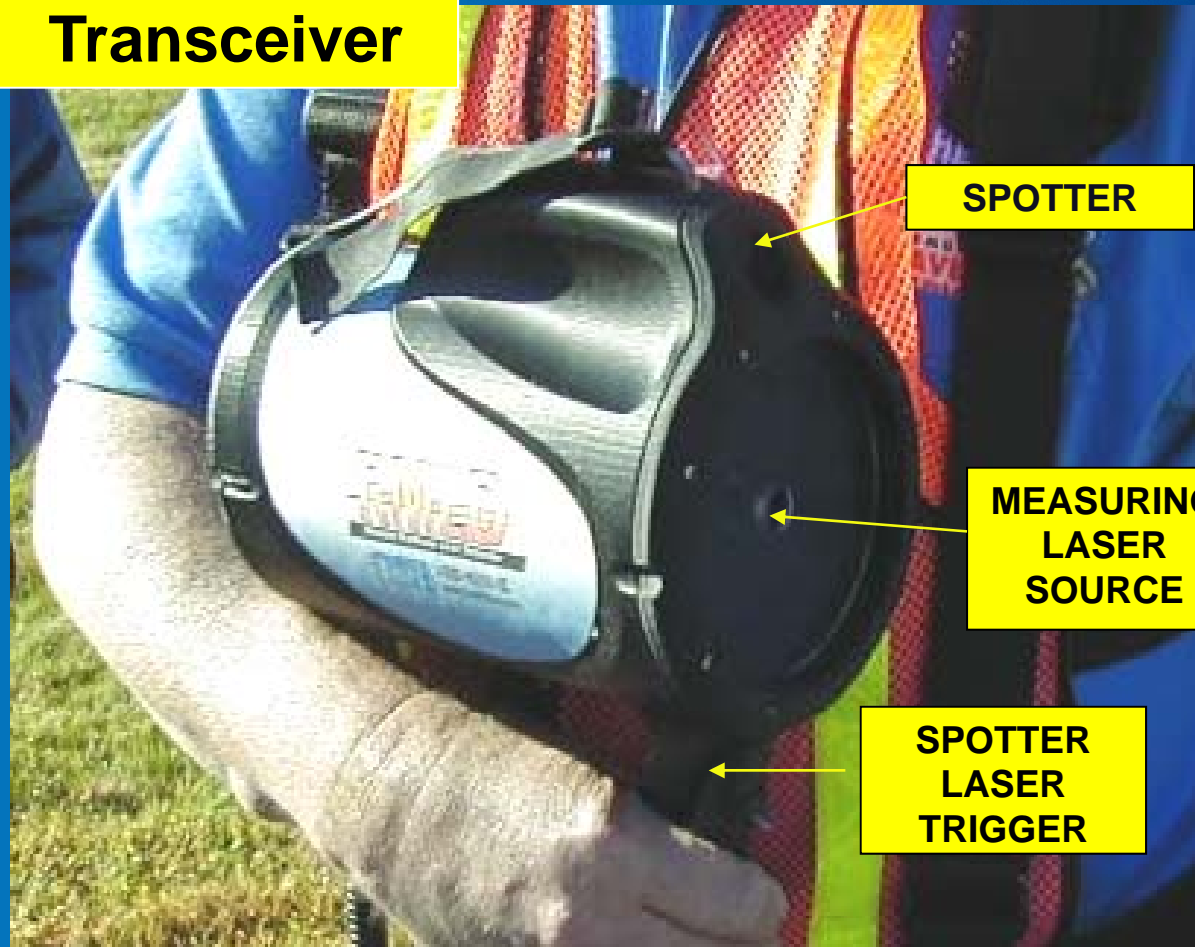
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Remote Methane Leak Detector (RMLD)

- 1st device to detect methane outside of the leak plume.
- Conventional technology had to be in the leak plume.
- Ability to reach inaccessible areas like behind locked gates, piping suspended from bridges, ceilings, fenced areas, etc.
- Excellent emergency response tool for rapid location of venting gas.
- Sensitivity from 5 ppm to 10,000 ppm
- Infrared Tunable Diode Laser Absorption Spectroscopy (TDLAS)

Remote Methane Leak Detector

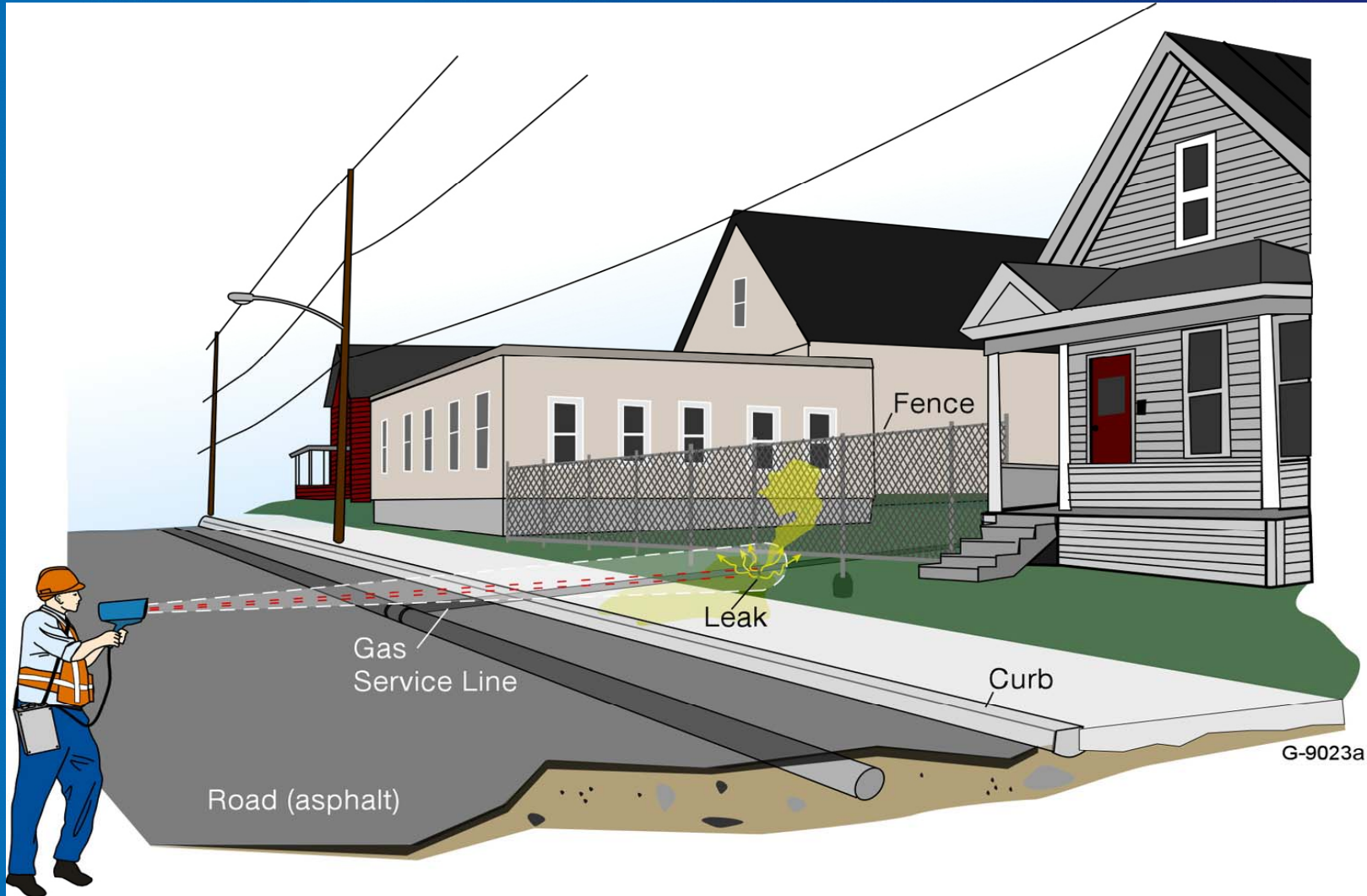
Transceiver



Control Unit and Harness

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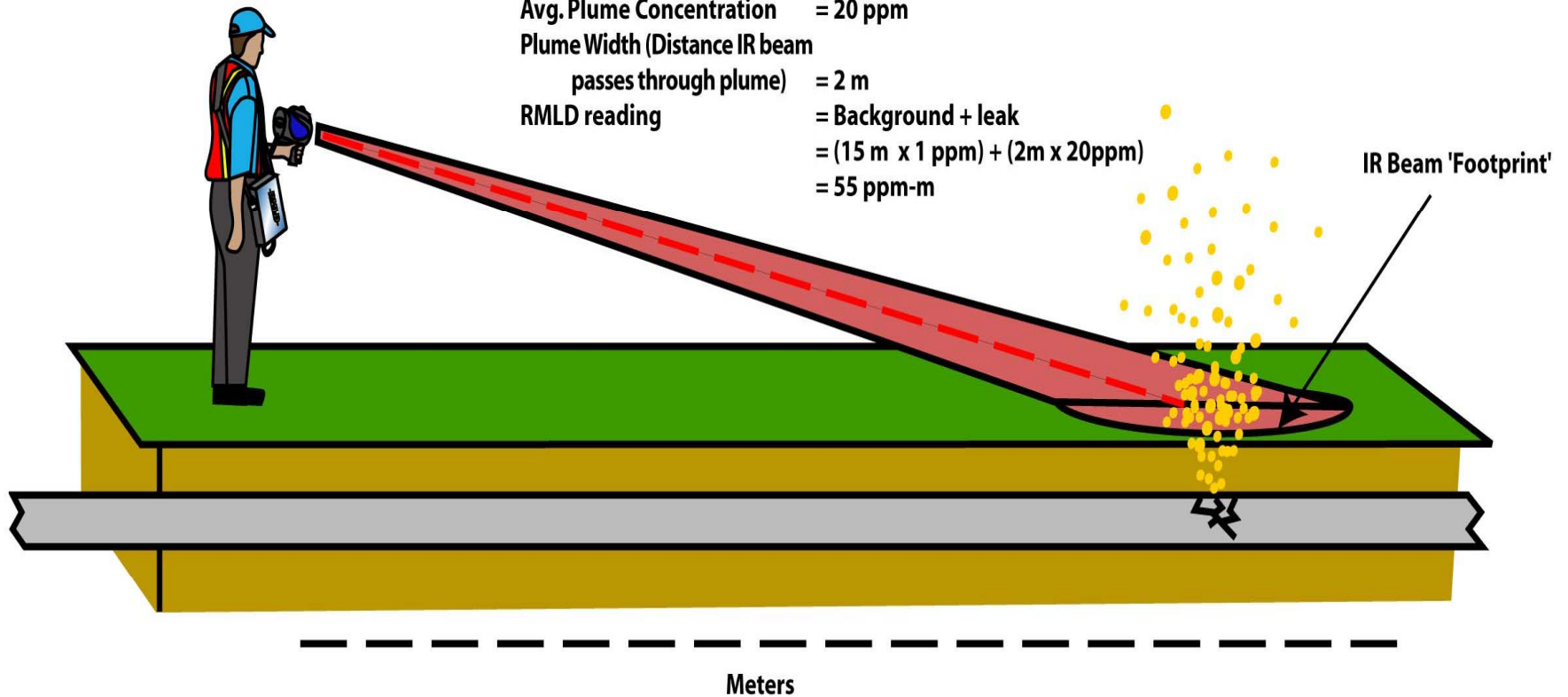
RMLD



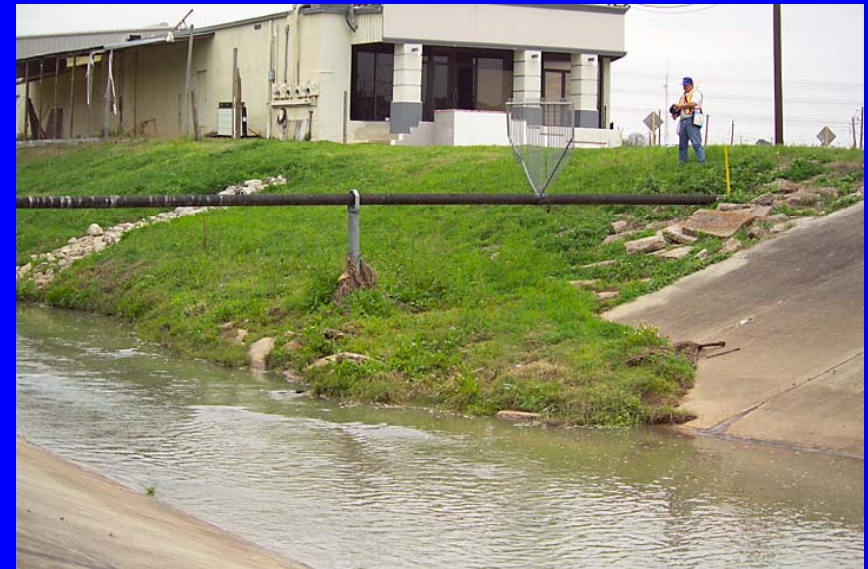
RMLD

Example

Scan Distance	= 15 m (50 ft)
IR Beam 'Footprint'	= 4.9 m (16 ft) x .3 m (11 inches) @ 15 m (50 ft)
Background Methane	= 1 ppm
Avg. Plume Concentration	= 20 ppm
Plume Width (Distance IR beam passes through plume)	= 2 m
RMLD reading	= Background + leak = (15 m x 1 ppm) + (2 m x 20 ppm) = 55 ppm-m



Field Applications



Field Applications



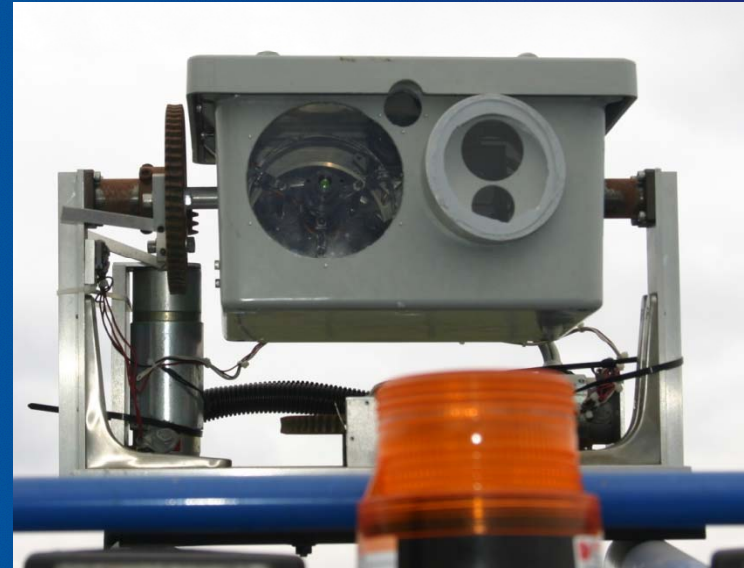
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Mobile RMLD

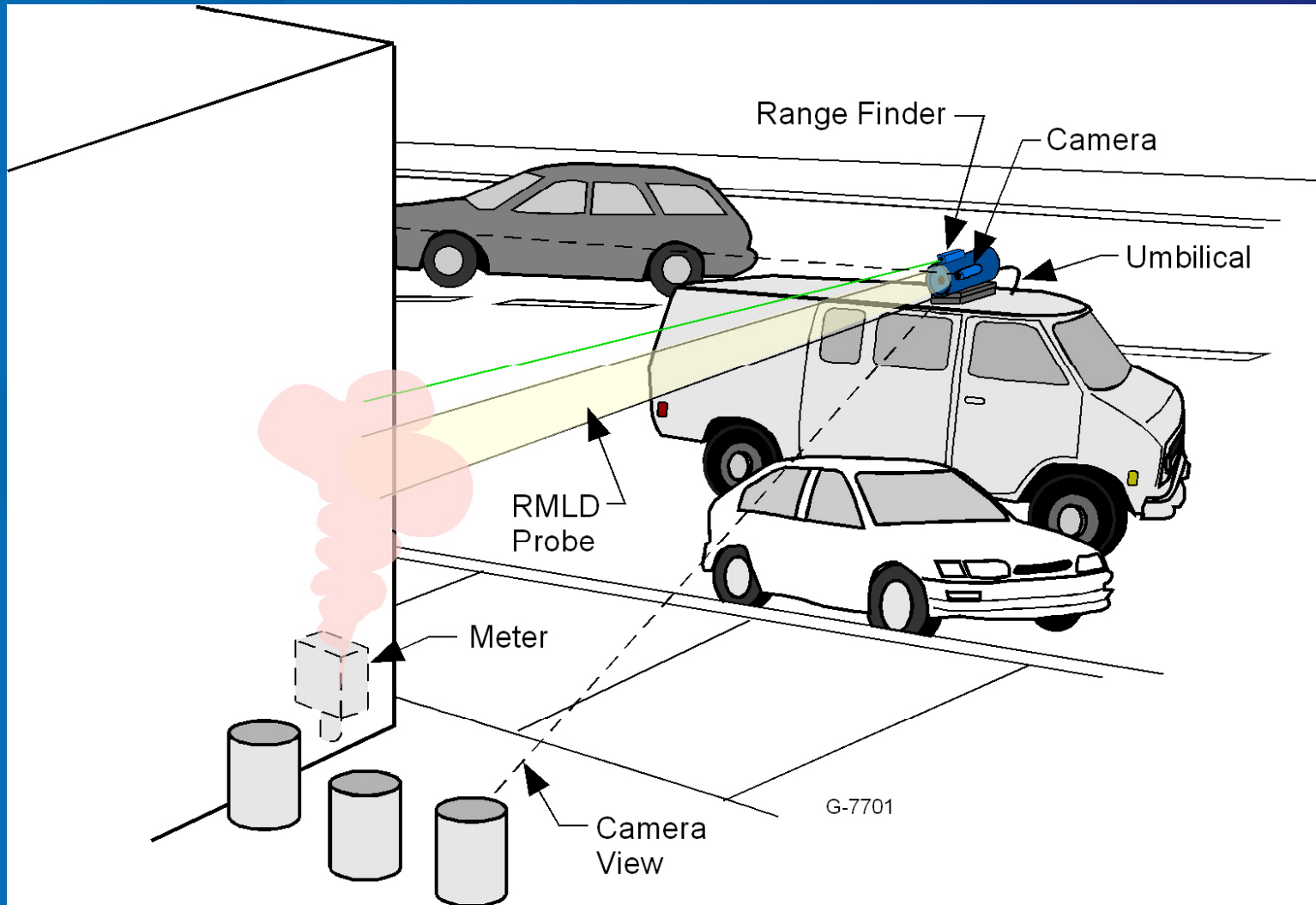
- Efforts currently under development for a mobile RMLD.
- Ability to mount RMLD on vehicle to survey mains and adjacent services.
- Video enhanced
- GPS / GIS application
- Application for gas gathering, transmission and distribution

Mobile RMLD



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Mobile RMLD



Optical / Infrared (IR) Technology

- Ability to operate in both portable and mobile applications.
- Methane detection only
- Internal calibration
- Detection from 1 ppm to 100% by volume.
- Combination search instrument and CGI tool in one
- Data-logging / GPS / Bluetooth technology
- Infrared Controlled Interference Polarization Spectrometer
- Internal sample pump

Portable / Mobile Survey / Pinpointing Infrared Technology



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Imaging Cameras

- Not specific to methane but images temperature differential as well as wide range IR light band
- Non-quantitative
- Not capable of detecting low volume indications.
- Application for hard to reach areas.

Imaging Cameras



Imaging Cameras



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Aerial Laser / IR Technologies

- Capable of methane only detection
- Must have unobstructed line of site
- Application for gathering and transmission rather than distribution
- Generally can fly fixed wing / helicopter at 500 – 1000 feet above the ground.
- Ability to incorporate aerial photography / video for ROW of maintenance / compliance.

Aerial Laser / IR Technologies



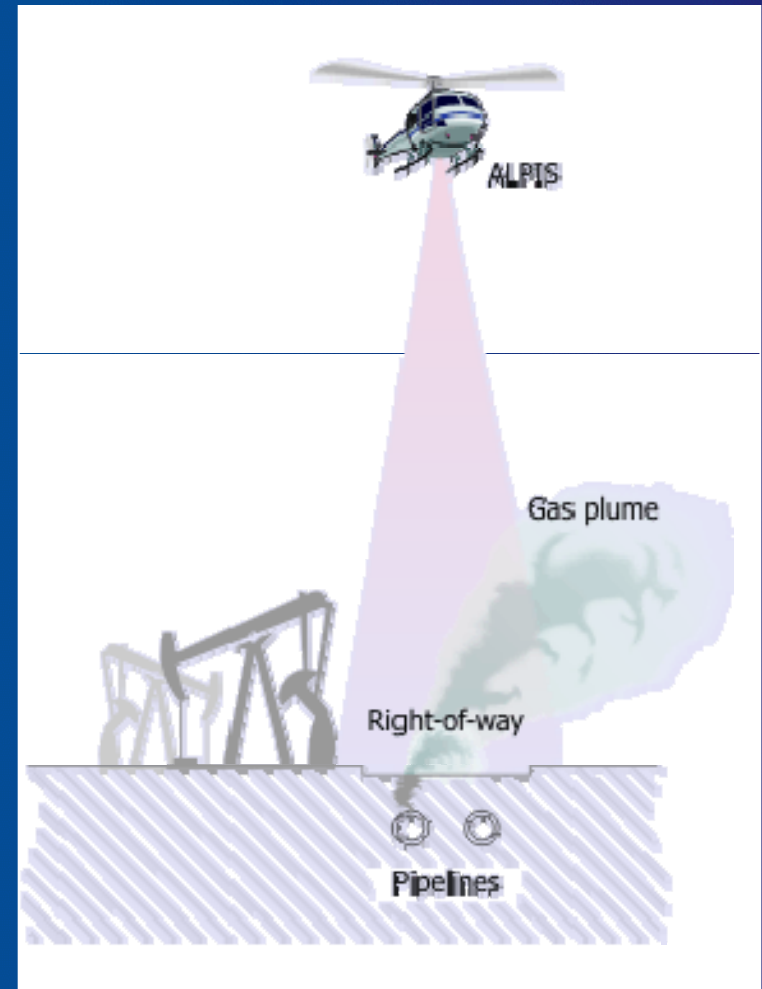
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Aerial Laser / IR Technologies



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Aerial Laser / IR Technologies



QUESTIONS?

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