ANGEL Service
Airborne Natural Gas Emission LIDAR

EPA Natural Gas STAR Program
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Engineered for life
## ITT ANGEL Service

*Taking Leak Surveys and Corridor Monitoring to New Heights*

<table>
<thead>
<tr>
<th>![Image]</th>
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<tbody>
<tr>
<td>✓ Differential Absorption LIDAR (DIAL) laser technology provides accurate leak detection and quantification.</td>
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<tr>
<td>✓ Captures survey-grade aerial orthophotography of right-of-way (ROW) and surrounding areas.</td>
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<td>✓ Captures color digital geo-video of ROW and surrounding areas.</td>
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<td>✓ Non-intrusive remote surveys.</td>
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<td>✓ GIS-ready datasets show exact scan locations. Assures leak survey was thoroughly completed.</td>
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![DIAL Scan Pattern](image) ![DIAL Results - Leaks Detected](image)
Leaks Detected using DIAL Technology from Aircraft

**ITT ANGEL Service**

**Differential Absorption LIDAR (DIAL) Laser Technology**

- Detects and measures natural gas pipeline leaks and facility emissions.
- Broad area coverage -- 400 times greater coverage than traditional walking methods. 3D coverage.
- GIS-ready datasets assures pipeline/facility was scanned. Provides auditable results.
- Operates over varying terrain and weather conditions.

**Airplane Platform**

**Cessna Grand Caravan 208B**

- Provides nationwide coverage with rapid deployment.
- Operates 120 times faster than traditional walking methods. Up to 1,000 miles of collection per day.
- Eliminates private property access issues by operating from public airspace.
- FAA approved aircraft and flight operations.

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Leaks Detected using DIAL Technology from Aircraft

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GIS Mapping Imagery

- Provides current, high-resolution imagery of your ROW and surrounding areas.
- Updates your GIS system with color, one-foot resolution, orthorectified and mosaic imagery.
- Digital sensor delivers 4,000 by 4,000 pixel images.
- Supports alignment sheets, HCA identification, threat identification, site permitting, engineering analysis, environmental studies, and emergency planning.

Digital Color Video

- Allows you to easily patrol any pipeline segment from your desktop computer.
- Encodes video data with GPS information, so precise locations can be identified.
- Play, pause, fast forward, rewind, and even print video frames from digital files.
- Provides permanent record of aerial patrolling, easement conditions, encroachment monitoring, intrusion detection, and problem areas.

Mapping Imagery Provides One-Foot Ground Resolution

Integrated Digital Video with Electronic Maps
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Example: Grass Field and Bare Earth – Controlled Releases – New York.
Example: Natural Gas Transmission Pipeline Route – Texas

DIAL Scan Pattern
- 3,000 laser samples per second
- 100-foot wide scan swath

DIAL Gas Detection and Measurement

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Example: Compressor Station – Natural Gas Transmission Pipeline – Texas

Controlled release of 8 scfm

Location D ANGEL Service Detection, 25 Jan 06 @ 10:16 AM

Release Tanks
Flow: 4 scfm
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The ANGEL Service is Fully Operational and Commercially Available.

- Completed field validations with numerous pipeline owners/operators.
  - Over 3,000 miles of DIAL leak surveys and corridor/facility monitoring.

- Successfully completed contracts with both US DOE and US DOT.
  - HALOS (Hazardous Liquids Lidar Observation Study) – September 2006
  - Rapid Emergency Response (through October 2007)