A Case Study in GIS Usage for Pipeline Leak Detection Process Improvement and Efficiency
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Reasoning for Helicopter Based “Sniffer” LDS:

- Approx. 6000 Miles of Active Pipeline (Eastern)
- 11400 Miles Total US
- Vintage range from 1890’s to Present
- Terrain, Canopy (lack of visibility in leaf-cover), Accessibility Issues
Apogee Leak Detection System

An innovative infrared-based method for detecting leaks from hydrocarbon liquids and gas pipelines, production and storage facilities, landfills, and coal-seam seeps.
LDS – 3rd Generation

- High Speed – High Sensitivity Three Gas Detector for Mobile applications
  - Methane
  - Total Hydrocarbons
  - Carbon Dioxide
- GPS with real time mapping system
- Integrated Geographic Information System (GIS)
Truck Mounted LDS
ATV Mounted LDS
Helicopter Mounted LDS
LDS Operating Software

[Image of a software interface showing a map and graphs with data readings for Methane, HC, CO2, and other parameters.]
Dry Gas

- Mostly methane, small amount of HC, No CO2
  → Dry Gas leak
Rich Gas

- Methane and HC, No CO2
  \(\rightarrow\) Rich Gas leak
Non-Methane Hydrocarbon Gas

- HC, no methane or CO2
  → Propane or other HC leak
Vehicle Exhaust

- Methane, HC, and CO2
- Exhaust Gas – Not a leak
Landfill Gas

- Methane and CO2, No HC
  → Landfill or Sewer Gas

![Graph showing methane, HC, and CO2 levels over time.]

- Methane
- HC
- CO2
LDS Database

- All LDS data is stored in a database file
- Data can be exported into Excel or other format
LDS Leak Report

Leak ID: L-1208
Project Name: SW
DateTime Found: 06/25/2008 11:15
Max Methane Conc: 1.98 PPM
HC:CH4 Ratio: 6.29 R2 = 0.99
Address: Not Found
Lat: 37.82716
Lon: -82.302766
Altitude: 816 ft.
Vehicle Speed: 23 mph
Operator: Marpat
Comments:

Report generated on 7/15/2008

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Summary of Detections To-Date

• 1st Demo Flight in December 2007
• Over 1150 Leak Detections (Not including discounted leak detections, etc. Also missing data from 09’ SW Flight)
• Over 400 leaks verified
• Approximately 2,178.6 mcf/d recovered
• More than 3,000 miles of pipeline flown in SE, SW and North Districts
Example of Operational Cost Savings

- Sept. 2008 Flight in SE District was approx. 616 Miles
- To cover the same area with ground patrol:
  - 2 Crews (4 Total men)
  - 6 Hours / Day
  - Average 6 Miles / Day Total
  - Equals 100 days, 3200 man hours, not including 2 vehicles and fuel for these 5 months
- 299 Tags (CHK, Foreign, Natural (Mine Cracks))
- Flight time was 64 hours
- Savings not only in time, but in recovered gas carried over the time frame saved by not using ground patrols.
GIS Input to Cost Savings

- GIS interprets the detection findings via CH4/HC ratio and graph to eliminate false positive interpretation by field personnel.
- Utilizing ESRI PLTS extension, individual maps for each detection can be generated with extreme efficiency and time savings yielding a user friendly output.
- Field maps can be distributed by Superintendents to the various crews for each area and they have a coordinate and map to help locate the detection on ground (direct location).
- Similar to Operations cost savings, the recovered gas carried over the time frame saved by not using standard ground patrols, and utilizing GIS to streamline the data analysis and dissemination to the field, has a very large ROI.
Additional Benefits of Aerial Patrols

- Manpower Savings
- Time Savings
- Point of Interest Collection (Customizable List)
  - Blasting Near RoW
  - Buried Line Exposed
  - Construction Near RoW
  - Debris
  - Liquid Spill
  - Missing Line Marker
  - Power Line
  - Recent Excavation
  - RoW Needs Cleared
  - Slip
  - Stream Crossing Exposed
  - Structure on RoW (Encroachment)
Exposed Pipeline
Exposed Pipeline In Road Crossing
Possible Future Project Expansion

• Using gyro mounted high-def camera and external drive storage for digital record of patrols (with gps time frame stamp), hyperlinked to pipeline segments in GIS
• FLIR use in conjunction around compressors and dense facility groups like meter manifolds, multiple valve settings, etc.
• Explore possibility of using this as a method of meeting DOT line patrol requirements
Q & A