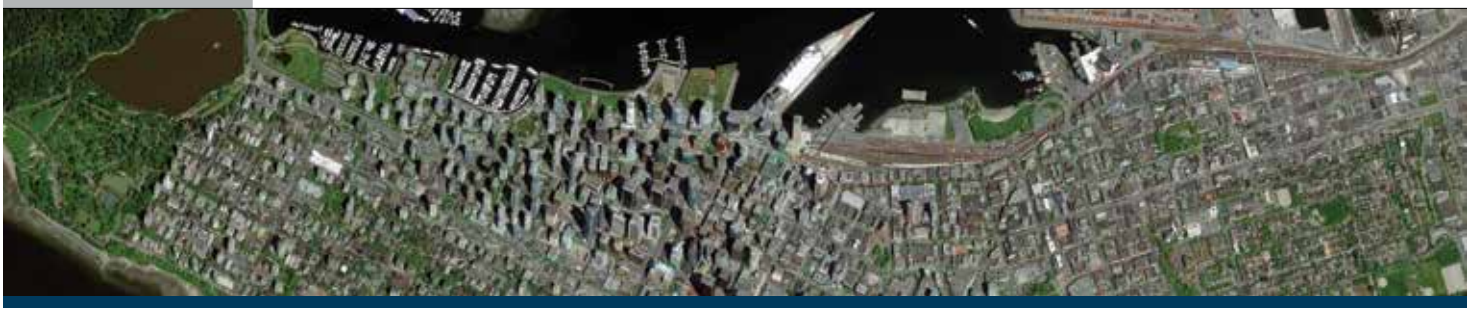
CASE STUDY

Product solution for: Ground Movement Monitoring for Midstream

DigitalGlobe™



Ground Movement Monitoring Service Detects Sub-Centimeter Deformation

Satellite-based radar data acquisition and analysis conducted on a periodic basis by Spatial Energy and 3vGeomatics (3vG) are allowing a midstream gas pipeline operator to accurately assess the risk posed by ground movement in a densely populated urban area where geologic hazards may exist. Deliverables in the form of image data, surface deformation maps, and written reports enable the operator to take corrective action before a potentially disastrous pipeline rupture occurs.

Reducing the Risk of Pipeline Operations

Whether subsidence or uplift, ground movement of just a few centimeters can create serious risk for energy pipelines. Undetected stress on the pipe structure can result in a small leak or major rupture, either of which can cause potentially catastrophic consequences for the nearby population and surrounding ecosystem. The risk of ground movement increases where the geology is unstable or subsurface fluid extraction or injection occurs. This risk compounds with population density and pipeline age.

The midstream natural gas distributor with pipelines throughout the United States identifies safe operations as its number-one priority. This company takes a proactive approach to finding and mitigating risks before accidents occur. In the U.S. Midwest, the operator became aware of unstable surface geology in the vicinity of a 60-year-old gas pipeline that passes for several miles through an urban area surrounded by houses, schools and office buildings.

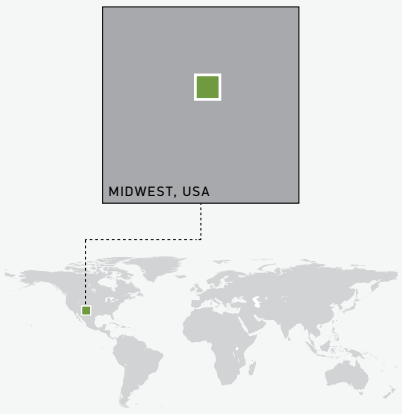
The operator met with Spatial Energy and 3vG to discuss how the InSAR subsidence monitoring service – already deployed at oil fields worldwide – could be used to detect ground movement around the urban pipeline. Spatial Energy designed a program involving monthly acquisition of X-band synthetic aperture radar (SAR) by the TerraSAR-X satellite followed by quarterly InSAR analyses of multiple overlapping data sets to detect and measure vertical and/or horizontal ground movement of less than a centimeter.

The Benefits of InSAR

Pipeline operators have very few options for monitoring surface deformation that can threaten the structural integrity of their lines. One solution sometimes

Company information

A midstream pipeline operator contracted Spatial Energy, a DigitalGlobe company, to monitor ground movement in and around an existing natural gas pipeline corridor traversing a densely populated urban area in the U.S. Midwest. Spatial Energy, in partnership with 3vGeomatics of Vancouver, B.C., Canada, performed periodic wide-area analyses of sub-centimeter ground movement using satellite-based interferometric synthetic aperture radar (InSAR).



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deployed in the oil patch is the use of in-situ GPS-based tiltmeters. While accurate, these devices only measure surface movement at the point where they are installed. This may be suitable for a relatively small drill site or well pad, but thousands would have to be placed throughout the corridor of a pipeline to provide adequate wide-area measurement of movement near the line.

The InSAR Ground Movement Monitoring service offers several advantages over the tiltmeter. Most importantly, the radar data acquired by the TerraSAR-X satellite and other SAR platforms cost-effectively measures elevation at millions of surface points as small as one square meter in and around the pipeline corridor with just one image, detecting even subtle ground movement wherever it occurs. In addition, InSAR data is extremely accurate, able to identify and measure ground movement in any direction to within a few centimeters over time. Radar imagery can be acquired in darkness and through clouds.

Spatial Energy selected TerraSAR-X data for the urban pipeline monitoring project because this satellite captures SAR data in the X-band of the electromagnetic spectrum. X-band operates in a wavelength that accurately measures ground elevation in addition to imaging the size, shape and positions of man-made structures, such as pipeline supports, homes and buildings, which is valuable data for the operator to have in considering the risk of ground movement.

Although not used in this project, Spatial Energy and 3vG also acquire L-band SAR data using other commercial radar satellites. The shorter L-band data is capable of penetrating vegetation and overgrowth, making it preferable for monitoring pipelines in rural locations.

Staying Ahead of Risk

After a year of continuous monitoring, the client was pleased to learn there was no ground movement in the pipeline area. This monitoring has created a solid baseline data set for future observations, which – due to geologic hazards – will continue but at a lesser frequency.

INDUSTRIES

- Oil and Gas

USES

- Monitor ground movement
- Assess the risk posed by geologic hazards
- Detect sub-centimeter deformation and uplift
- Reducing the risk of pipeline operations

PRODUCTS USED

- TerraSAR-X Radar Satellite Imagery
- 3V Geomatucs InSAR Ground Movement and Monitering services

Challenge	Reduce the risk of a gas pipeline rupture caused by ground movement through remote detection of sub-centimeter subsidence or uplift before it can put significant stress on the pipe structure.
Solution	By tasking the TerraSAR-X satellite to acquire repeated radar data over the pipeline corridor and then analyzing the overlapping data sets for phase changes that indicate ground movement, movement at millions of points in and around the area of interest is measured with centimeter accuracy.
Results	Spatial Energy and 3vG have provided monthly measurements with quarterly ground deformation reports to a midstream gas pipeline operator to mitigate the risk associated with geologic hazards along the pipeline corridor.

3vGEOMATICS

CS-GMM 02/15