

## GEOPHYSICAL SURVEYS (Non-Acoustic Sources)

### WHAT ARE NON-ACOUSTIC SOURCE GEOPHYSICAL SURVEYS?

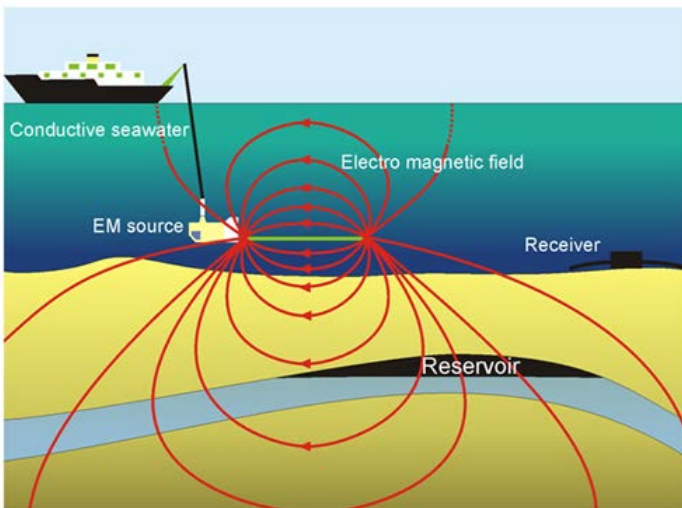
These are surveys that do not use an acoustic (sound) source to acquire subsurface geophysical data. They either induce an electromagnetic field in the subsurface or passively measure changes in the earth's magnetic field or gravity. These types of surveys include:

- **Electromagnetic**
- **Marine or Airborne magnetic**
- **Marine or Airborne Gravity**

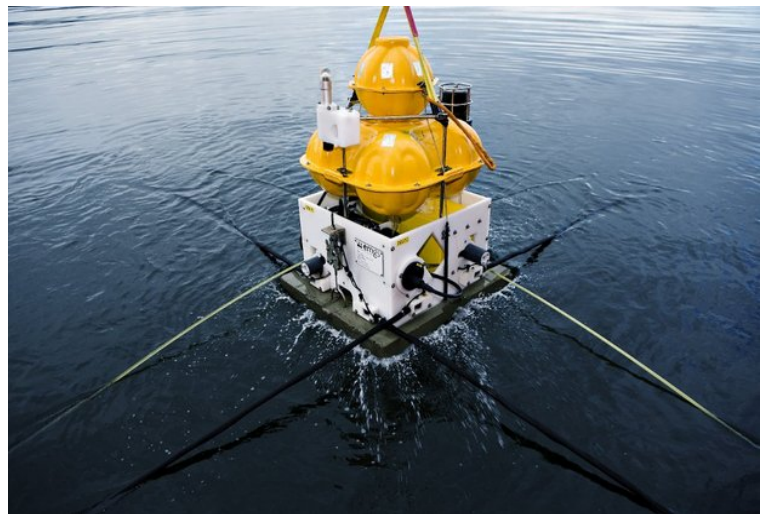
### WHAT IS AN ELECTROMAGNETIC SURVEY?

These surveys measure the earth's electromagnetic field. They are used to help map oil and gas resources by measuring changes in a magnetic field. There are two methods used to measure the electromagnetic field:

- **Controlled Source Electromagnetic Survey (CSEM)** - the electromagnetic source is typically towed behind the survey vessel. The equipment induces a very low frequency (typically less than 2 hertz [Hz]) electromagnetic signal into the seafloor. The signals are received by autonomous receivers that have been placed on the seafloor. When the survey is complete these receivers are retrieved and the data downloaded.



(National Oceanography Center; Natural Environment Research Council)

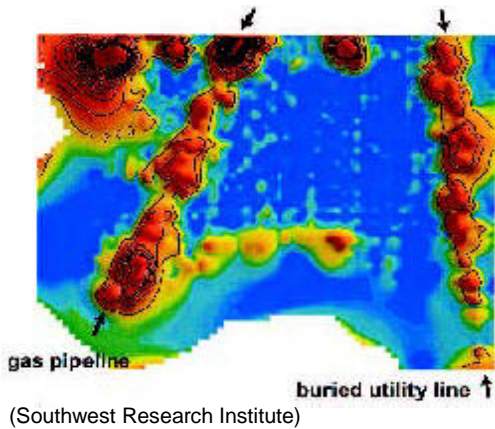


**Magnetotelluric Survey** – survey is a *passive* measurement of earth's electrical and magnetic fields. Ships deploy the autonomous recording device (similar to the ones use for CSEM) which is attached to a biodegradable anchor. The recording box is retrieved after it floats to the surface.

## WHAT IS A MARINE MAGNETIC SURVEY?

These surveys measure changes in the earth's magnetic field to determine the structure and sedimentary properties of subsurface geology or the presence of iron based metals. Magnetometer surveys are commonly also use to locate marine archaeological sites as well as buried pipelines or cables. This information is gathered by two methods:

- Marine Surveys
- Airborne Surveys



Example of a Magnetic Survey Used to Locate a Gas Pipeline and a Utility Line.



Photo: magnetometer – towed behind a marine vessel  
[http://www.epa.gov/esd/cmb/GeophysicsWebsite/pages/reference/methods/Marine\\_Geophysical\\_Methods/Marine\\_Magnetic\\_Methods.html](http://www.epa.gov/esd/cmb/GeophysicsWebsite/pages/reference/methods/Marine_Geophysical_Methods/Marine_Magnetic_Methods.html)



Airborne Magnetometer (USGS)

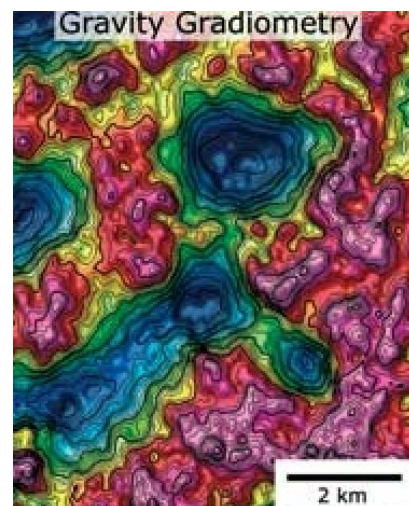
## WHAT IS A GRAVITY SURVEY?

These surveys measure the changes in rock density by measuring changes in the Earth's gravity. These data are also gathered by two methods:

- Marine Surveys
- Airborne Surveys

The Sensors and equipment are typically mounted inside the ship or airplane.

Map of a gravity survey showing changes in the earth's gravity resulting from differences in the subsurface deposits.



(Courtesy of Maurel et Prom.)