BOEM
Bureau of Ocean Energy Management

FACT SHEET

HIGH-RESOLUTION GEOPHYSICAL (HRG) SURVEYS
(Small Airgun and Non-Airgun Acoustic Sources)

WHAT IS AN HRG SURVEY?

- HRG surveys are focused on the seafloor or shallow subsurface and use a high frequency acoustic source.
- The energy source is typically electromechanical but a small airgun (20-90 cu in) may be used on occasion.
- Survey equipment is either mounted to the ship, towed behind a survey vessel or is contained in an Autonomous Underwater Vehicle (AUV).

WHAT ARE HIGH-RESOLUTION GEOPHYSICAL DATA USED FOR?

- Locating seafloor biological communities and habitats
- Identifying archaeological resources
- Seafloor bathymetry
- Locating geological hazards
- Seafloor engineering
- Locating marine minerals
- Scientific research

TYPES OF HRG SURVEYS/EQUIPMENT

- **Depth/Echo Sounders**: These come in two basic types: 1) single beam, a typical depth recorder; and 2) multibeam echo sounders, which can be used to map the seafloor. Sensors are typically hull mounted.

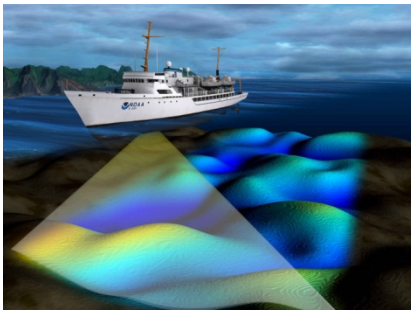
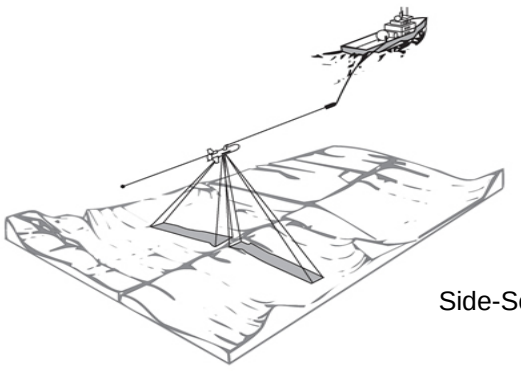


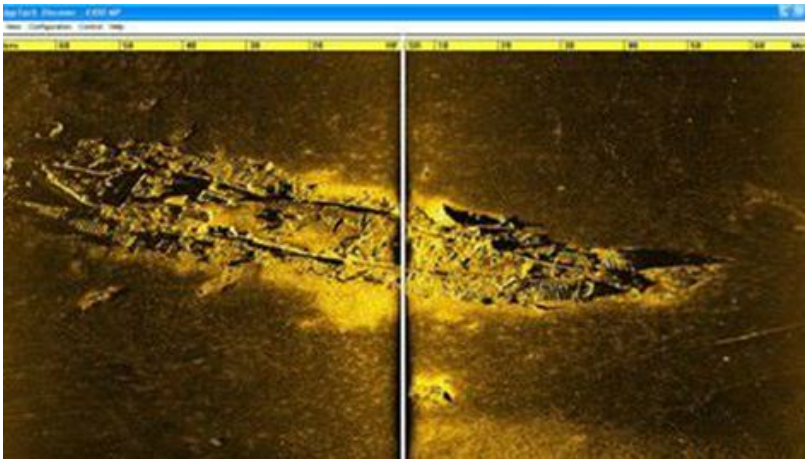
Image of a HRG multibeam echosounder survey (NOAA, 2014) Photograph credit from the National Office of Atmospheric Administration (NOAA), Coast Survey. 2014. Multibeam Survey Image. Accessed from website: https://noaacoastsurvey.wordpress.com/about/

- **Side-Scan Sonars**: Like other sonars a side-scan transmits sound energy and then receives and processes the return signal (echo) that has reflected off the seafloor or other objects. Side-scan sonar is a specialized system for detecting objects on the seafloor and mapping the surface of the seafloor, seafloor habitats, and surficial sedimentary texture.



(Oceanic Imaging Consultants)

Side-Scan Sonar



(EdgeTech)

- **Subbottom Profilers**: This technology is used to image the shallow subsurface and consists of three general types of equipment:
    - **Boomer:** The boomer is a broad-band sound source. This system is commonly mounted on a sled and towed behind a boat. A separate hydrophone array (receivers) is used for receiving reflections from the shallow subsurface sediment layers. Dependent of the subsurface material types, the resolution of a boomer system ranges from 1.5 to 3 ft. and typically penetrates the subsurface from 75 to 175 ft.

British Geological Survey (BGS)

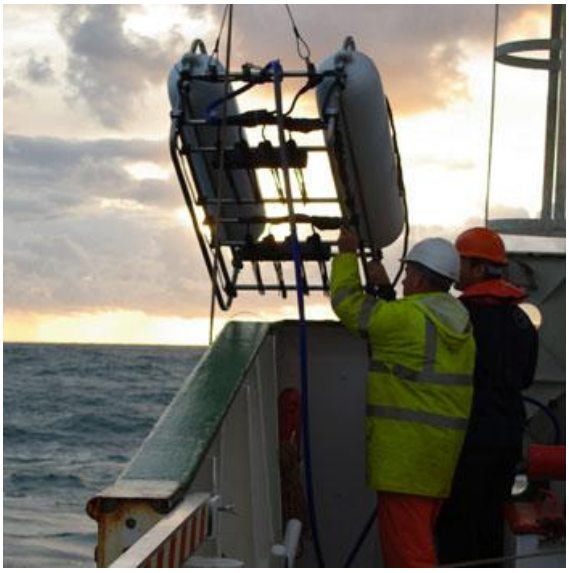
Surface Tow Boomer

    - **Chirp**: Chirp systems are commonly towed behind the survey vessel and enable high-resolution mapping of relative shallow deposits. Newer chirp systems are able to penetrate to comparable levels as the boomer, yet yield extraordinary detail or resolution of the subsurface. Penetration depths can range from 10 to 650 feet.

(A2 Marine Solutions)

Edgetech Chirp System

- **Sparker**: Sparkers can generate a signal that can penetrate several hundred meters into the subsurface. Resolution is on the order of several feet. These systems are also commonly towed behind the survey vessel.



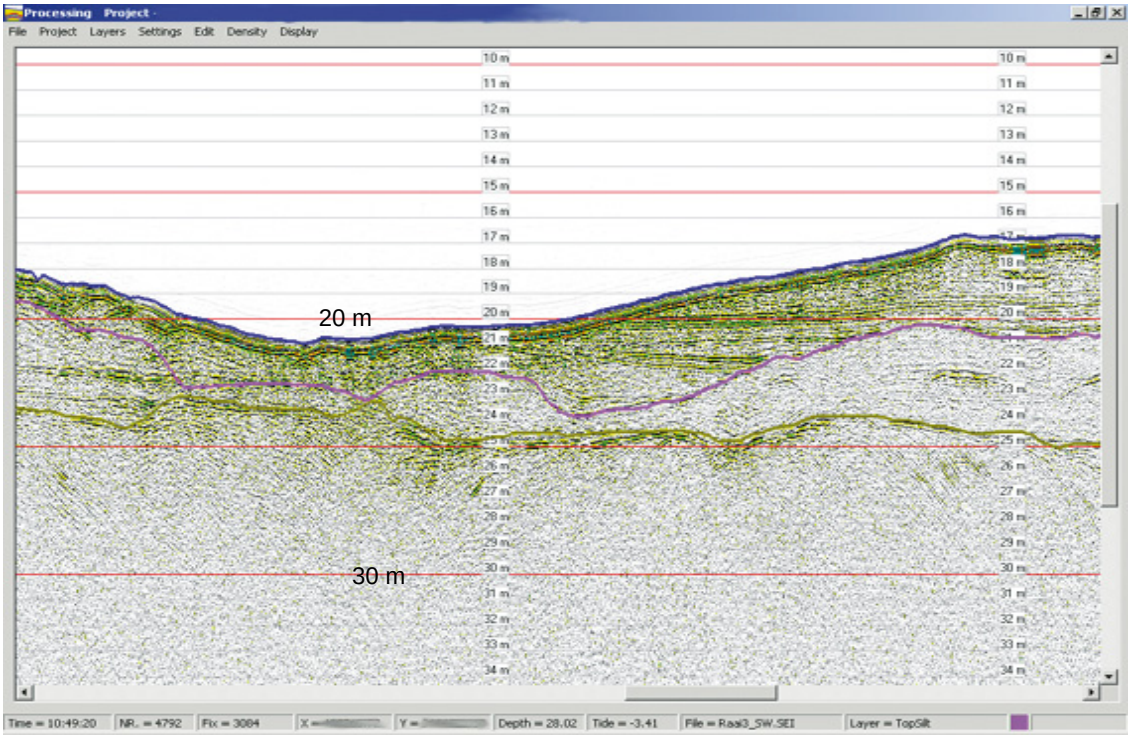
Sparker

(Applied Acoustics)

- Today, HRG surveys often combine tools, such as multibeam echosounder, side-scan sonar and sub bottom profiler into one subsurface package; an Autonomous Underwater Vehicle or AUV. The AUV is operated approximately 150 feet above the seafloor.

(Fugro)

Typical Subsurface Data Set from a HRG Survey



(Stema Systems)