SONIC DRILLING

“An Efficient Way to Drill”
The concept of sonic drilling technology was born approximately 100 years ago by Romanian civil engineer George Constantinesco.

In 1930, Romanian engineer, Dr. Ion Basgan continued Constantinesco’s methods and applied sonic vibrations to the drill pipe string of a conventional drill rig which resulted in increased drill depth and speed.

American inventor, Albert Bodine, continued research in the 1940’s through the Drilling Research Institute.

In the early 1970’s Hawker-Siddeley, a British aerospace company, assigned the next generation of research to one of its Canadian offices.

In the 1980’s Ray Roussy continued work on the Sonic technology resulting in a number of patents and the successful method of what we use today.
A soil penetration technique that fluidizes porous materials.

The sonic head contains mechanisms that allow the rotation and oscillation of the drill stem, which causes a high frequency force to be superimposed on the drill stem. The drill stem/drill bit physically vibrate up and down in addition to being pushed down and rotated.

By using a sonic head, drill casing and rods are brought to a vibration frequency of 100-200 Hz, which is within the range of human hearing.

These waves are transmitted through the drill string to the end of the casing and reflected, causing the casing to stretch and thin, and to shorten and thicken 100-200 times per second.

This intense vibration causes a very thin layer of soil directly around the drill rods to fluidize. The fluidized soil zone extends a maximum of 5 millimeters from the rod. The soil in the influenced area behaves like a fluid, which dramatically reduces the friction between the drill rod and the surrounding soil, allowing very rapid penetration.

The same friction reduction applies to the inner surface of the soil sampling tool, and enables collection of very long sample cores (up to four meters).

The movement of the eccentric weights brings the casing into a purely vertical vibration. With low pull-down or pull-up force, the casing can be driven and retrieved.
What Is A Sonic Drilling Head?

- Not a new concept
- Basics
  - Counter Rotating Eccentrics
  - Direct coupled to rod string
  - Isolated from the drill rig
Applications for Sonic Drilling

- Soil Boring Installation/Sampling
Applications For Sonic Drilling

- Monitor, Air Sparge, & Recovery Well Installation
  - Single, Nested, Clustered, Double/Triple Cased

![Diagram of Sonic Drilling Applications](image)

Figure 1
(a) Multilevel System, (b) Well Nest and (c) Well Cluster
Applications For Sonic Drilling

• Abandonment of Wells
  • Overdrilling of Wells
  • Fully grouting to well depths inside casing

• Injection Points
  • Permanent or Temporary Cased
  • Angle Drilling

• Water Well
  • Soil Sample to Verify Screen Interval (300 to 500 foot efficiency range)
Applications For Sonic Drilling

- Geotechnical Investigations
  - Split Spoon and Shelby Tube
  - Equipped with Automatic Hammer
Applications For Sonic Drilling

• Aggregate Explorations
Applications For Sonic Drilling

- Geothermal
  - Installation of Geothermal Loops
Angle Sonic Drilling Capabilities
Offshore Drilling Capabilities
Sonic Work Footprint
SONIC & SAFETY

- Pinch Points
- Automated Controls
- Automatic Rod Handling
- Less Physical Contact
- Break out jaws tighten and loosen pipe joints
  - Reduces the amount of hand injuries
- Less Labor Intensive
  - Less spoils to shovel and contain
  - Pipe is moved and loaded using a skid steer
  - Tooling
Advantages of Sonic Drilling

- Provides longer, larger, better continuous core samples for observation/logging
- Reduction in time spent drilling vs Hollow stem auger, wet rotary techniques
- Reduces the possibility of cross contamination
- Provides cleaner and more effective wells by building wells inside the casing and elimination of heaving sands/collapse of borehole
- Use of telescoping method instead of setting permanent surface casings reduces costs
- Reduces the drill cuttings by 50-70%
- Reduces disposal costs of drill cuttings on environmental projects
- Fully cased holes for installation of Geothermal loops
Advantages of Sonic Drilling

- Reduced decontamination time and well development time
- Various Applications
- Although the technology is expensive, the reduction of drill time and reduced spoil disposal generally make this technology cost competitive with other drilling technologies.
- Use of ATV units allow access to remote locations
Disadvantages of Sonic Drilling

- Expensive start up and maintenance cost.
- Requires a water source for most sites.
- Limited use on setting permanent surface casing.
- Requires a relatively large work footprint.
- Reduction in soil cuttings return may require soil sampling for water well installation.
- Replacement of sonic rig parts may not be readily available.
- Drill casing failure.
How does Sonic Drilling compare to Direct Push?
Questions