Title
Optimizing Offshore Operations with a Low Frequency Source Solution

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Introduction

The Tuned Pulse Source (TPS) is a low-frequency seismic source designed to generate high-quality seismic data in complex geological settings. The TPS has been successfully deployed in various locations, including the Gulf of Mexico, where it has provided detailed images of the subsurface. This abstract presents the results of a study that demonstrates the feasibility of deploying a triple TPS source configuration using a single-source vessel with standard compressor capacity, highlighting practical solutions to improve shot spacing and increase flexibility while keeping acquisition cost-effective.

Method to reduce the refill time

The TPS is a low-frequency source that can generate a robust broadband seismic signal, making it ideal for use in complex geological settings. The triple TPS source configuration consists of three TPS units deployed in a synchronized manner to increase the shot density and improve the signal-to-noise ratio. The in-sea Pressure Regulation System (PRS) was developed to address the challenges of deploying a triple TPS source configuration, including the need for a high-capacity air supply system and the potential for overpressure (figure 1).

Figure 1 *Pressure Regulator System.*

Field trial results: refilling a triple TPS source

A triple TPS source configuration was successfully tested at sea with Viridien. Each TPS was equipped with a PRS regulator and deployed with a 133 m lateral separation. The three SAPS 62 compressors operated at a maximum output of 186.8 m^3/min. The test consisted of two parts: Part 1 in flip-flap-flop mode, shot time interval = 9 s, with +/-2 s dither, and Part 2 in flip-flip-flip mode, shot time interval = 27 s, with +/-3.5 s dither.

The minimum shooting time for a full refill was determined to be 9 seconds, resulting in a complete refill of 31.1 m^3 of air. The vessel's speed of 4.5 knots yielded a shot point interval (SPI) of approximately 20.9 m. The test demonstrated that a triple TPS source enables an efficient survey with a 28000 cu.in shot every 25 m. The refill time of approximately 11 seconds resulted in a compressor load of 85%, yielding an SPI of 25 m at 4.6 knots. This configuration could reduce survey costs by increasing the distance between sail lines. With larger vanes, a 200 m source separation could be achieved, further increasing efficiency. The results of this test are promising for future surveys, and the triple TPS source configuration is expected to become a valuable tool in the industry (figure 2).

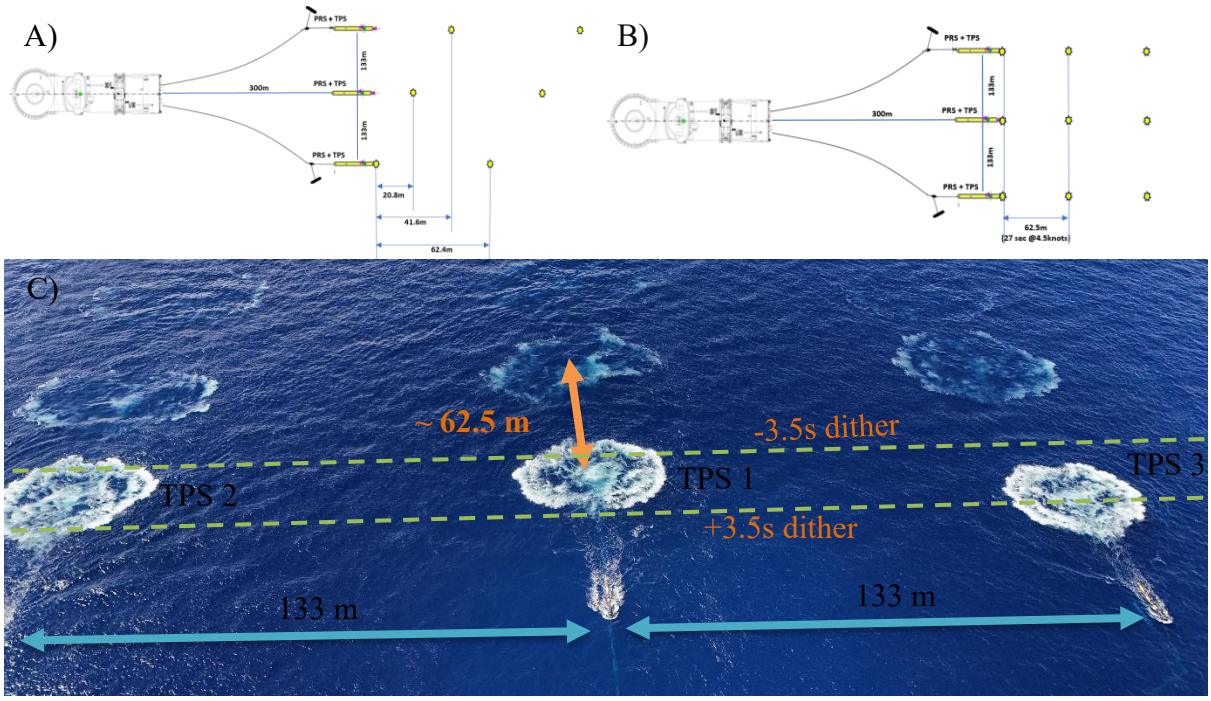

Figure 2 *TRIPLE TPS test from LACONIA survey in GoM.*
A) Flip-flop-flap, shot time interval = 9 s, dither +/-2 s
B) and C) Flip-flip-flip, shot time interval = 27 s, dither +/-3.5 s

Operational solution to deploy a Low Frequency Source

The Tuned Pulse Source is a game-changer for seismic surveys with source on-demand, offering improved data quality and increased productivity. When combined with an Integrated Float System (IFS), the TPS can be deployed from a single boat with standard compressor capacity, making it a cost-effective solution. The IFS provides improved depth stability in difficult environment, allowing for the deployment of the TPS in shallow water and deep water. The TPS can be used in combination with conventional airguns to achieve a wider bandwidth, and can acquire high-quality seismic data. The Pressure Regulator System (PRS) is used to optimize the TPS shot point interval. Furthermore, TPS solution enables flexible and cost-effective operations in shallow water, allowing for the use of a boat with containerized systems, which can be easily mobilized and demobilized, making it an ideal solution for a wide range of seismic survey applications (figure 3).

Figure 3 *Tuned Pulse Source with an Integrated Float System. Deployed from a fully containerized vessel.*

Conclusions

The results of these various case study demonstrate the potential of the TPS to improve the quality and efficiency of seismic surveys, particularly in complex geological settings. The use of a triple TPS source configuration, combined with the stability and flexibility provided by the Integrated Float System (IFS), and the in-sea Pressure Regulator System (PRS), can help to increase shot density with a low frequency source, minimized the environmental impact, and reduce survey costs.

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