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## **Jet Induced Trenching Operations: Mechanisms Involved**

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### **Abstract**

The paper examines the response of sandy sea beds undergoing trenching by steadily moving underwater jets as mounted on jet trenching machines.

While much can be learned from trencher operation data, visualization of the sediment motion is difficult in field conditions. This motivates the use of small-scale laboratory experiments. The focus is to examine the trenching process and post-trenched sand bed. The processes observed include erosion and entrainment by the jet-induced longitudinal current, infill due to the breaching of the trench walls, and overspill resulting from lateral escape of the turbulent flow out of the trench. These processes are expected to act as well in the field where they may control burial depth and sediment loss from the trench.

The experimental observation were used developed a model based on the gravity- and jet-driven turbidity currents theory. This model describes the flow of a turbulent layer of water and suspended sand along the sea bottom. It incorporates the following physical processes:

- entrainment of ambient water and sediment particles into the current;
- damping of turbulence by stratification associated with the sediment suspension;
- interaction of the current with sloping topography.

Combined with a breaching model simulating the lateral infill of the trench, this model is able to assess the trench depth and the likely shape of the trench based on the tool travel rate, pump pressure and soil type.

The results of the above work will permit a better understanding of the mechanisms controlling the performances of pipeline burial operations by jet trenching. The proposed model will help the engineers in assessing the performance of the jet trenching machines.

### **Introduction**

During the last years, the offshore industry has used more and more often the jetting power to create trench in the seabed. The objective of these operations was generally to bury cables or pipelines under a protective layer of sand.

There exists different configuration of these tools. It could be a high power jet moving above the seabed or a ROV (remotely operated vehicles) equipped with jetting swords liquefying the seabed. The 'product', cable or pipeline, is first simply laid onto the sea bottom. The vehicle then uses the jetting system to inject high-speed water into the sand bed (see Figure 1). The jets scour a temporary trench, travelling with the vehicle, which allows the cable or pipeline to descend into the sea bed before being buried under the re-depositing sand further downstream of the trencher.