Chapter 6

Buoyancy, Stability, and Ballast

Chapter 6: **Buoyancy, Stability, and Ballast**

Stories From Real Life: *Ben Franklin*

Chapter Outline

Figure 6.1.cover: **UT-1** ***Ultra Trencher***

Soil Machine Dynamics (SMD) has built the world's largest underwater robot for CTC Marine Projects, a UK contractor. The Ultra Trencher UT-1 *is the size of a small house and weighs in at 60 tons. Huge blocks of syntactic foam (yellow) at the top of the frame provide flotation to offset its weight and keep the vehicle upright.*

This gigantic trencher has the capacity to bury oil and gas pipelines up to 1 meter in diameter in tough soils, working at a depth of 1.5 kilometers.

Image courtesy of SMD Ltd., Newcastle upon Tyne

Chapter Learning Outcomes

- Explain why things in water sink, float, or tip over and how ballast systems can be used to control these processes.
- Describe the difference between positive, negative, and neutral buoyancy and explain why the designers of most underwater vehicles strive for near-neutral buoyancy.
- Know why and how to use a simple weight statement table to design a vehicle with the desired degree of buoyancy.
- Describe how some active ballast systems function and explain why most ROVs and AUVs rely on the simpler static ballast approach.