Chapter 4

Structure and Materials

Chapter 4: **Structure and Materials**

Stories From Real Life: *Trieste*

Chapter Outline

1. **Introduction**
   - 1.1. The Technical Chapters
2. **Structural Overview**
3. **Structural Performance Criteria**
   - 3.1. Strength and Stiffness
   - 3.2. Weight
   - 3.3. Compatibility with the Underwater Environment
4. **Other Structural Design Considerations**
   - 4.1. Ease of Construction, Maintenance, and Repair
   - 4.2. Cost and Availability of Parts and Raw Materials
   - 4.3. Safety
   - 4.4. Aesthetics
5. **Good Structural Shapes**
   - 5.1. Good Shapes for Pressure Hulls and Canisters
   - 5.2. Good Shapes for Frames
   - 5.3. Good Shapes for Fairings
6. **Good Structural Materials**
   - 6.1. Metals
   - 6.2. Plastics
   - 6.3. Other Structural Materials
7. **Other Useful Materials**
   - 7.1. Syntactic Foam
   - 7.2. Non-Structural Metals
   - 7.3. Teflon
   - 7.4. Potting Compounds
8. **Metal Corrosion**
   - 8.1. Galvanic Corrosion
   - 8.2. Electrolytic Corrosion
   - 8.3. How to Control Corrosion
9. **Fabrication and Assembly**
   - 9.1. Obtaining Tools
   - 9.2. Obtaining COTS Parts
   - 9.3. Obtaining Raw Materials for Custom Parts
   - 9.4. Suggestions for Your First Vehicle Structure
10. **Chapter Summary**

Chapter Learning Outcomes

- Describe the typical shape and purpose of each of the following functional subsystems of an underwater vehicle's structure: frame, pressure hull (or canisters), and fairing.
- Select appropriate building materials (shapes and substances) to use for the structure of a small ROV or AUV and describe methods for fabricating and assembling the required parts.
- Explain the causes and consequences of metal corrosion and discuss methods to control it.

***Figure 4.1.cover: Exacting Structure for* Nereus**

Working at full ocean depth requires a structure that is strong, lightweight, and able to handle the intense pressure of 15,751 psi, or more than 1000 times the atmospheric pressure at sea level. This photo of the ROV/AUV Nereus *under construction shows WHOI senior welder Geoff Ekblaw tackling the critical weld quality of the vehicle's aluminum structure. For the highly successful* Nereus *project, he combined more than 30 years of welding experience with specialized equipment.*

Image courtesy of Tom Kleindinst, Woods Hole Oceanographic Institution