Undersea Vehicle Operations

“USV Systems and Sub-systems”

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Main Topic Areas:

- Vehicle Structure
- Vehicle Electrical & Electronic
- Hydraulic System
- Propulsion
- Lighting

- Camera Systems
- Manipulators
- Umbilical
- Control Van
- Pilot's Control Console
- Handling System
- Power Supply System
Objectives

For You to be able to:

- Classify and categorize USV Components
- Describe the Function and Features of each system and subsystem
Vehicle Structure

- **Frame**
  - Aluminum Tubing (most common)
  - Glass Reinforced Plastic (GRP)
  - Protected with Wood

- **Buoyancy**
  - Syntactic Foam used for floatation
  - Fixed Lead Ballast used for trim
  - Variable Ballast Tanks are possible
    - Soft Tanks Open to ambient
    - Hard Tanks Closed Pressure Vessels
Vehicle Electrical & Electronic

- Power Distribution Chassis or Junction Box
- Sensors/Pressure Vessels
  - Compass
  - Depth Gauge
  - Altimeter/Echo-sounder
  - Sonar
  - Multiplexer or MUX Unit
Hydraulic System

- **Hydraulic Power Unit (HPU)**
  - Electric Driven Onboard vehicle

- **Thruster Control Unit (TCU)**
  - Manifold w/ Servo-Valves for each thruster

- **Hydraulic Control Unit (HCU)**
  - Manifold w/ Servo-Valves for auxiliary functions
Propulsion System

Thrusters are used in the X, Y and Z plane

- **Fixed**
  Various Configurations

- **Slewable**
  Accomplished Hydraulically

- **Electric**
  Precision Control/more maintenance

- **Hydraulic**
  Efficient, Powerful, less maintenance
Thruster Configuration 1
Thruster Configuration 2
Thruster Configuration 3
Lighting System

- **Incandescent**
  - Quartz/Halogen
  - 80% of Energy is Heat  20% is light
  - Variable Intensity
Lighting System (cont.)

- **Arc Tube Type**
  - No filament, expensive, 75-80% light, max. penetration
  - Requires Warm up
  - Fixed Intensity
  - Metallogen (OSRAM) HMI/ HID (high intensity discharge) lighting is best quality today
  - Also referred to as Metal Halide lighting
Lighting System (cont.)

- Reflectors - Control Beam Pattern
  - Open or Closed
  - White or Reflective metallic
ROV System Components (cont.)

Main Topic Areas:

- Camera Systems
- Manipulators
- Umbilical
- Control Van
- Pilot's Control Console
- Handling System
- Power Supply System
Video Camera System

- Mounted on Pan & Tilt for Max. View
- Color or Black and White
- Solid State
  - CCD (Charge Coupled Device)
  - ICCD (Intensified Charge Coupled Device)
  - 3 Chip Broadcast Quality
Video Camera System (cont.)

- SIT (Silicon Intensified Target) B&W Hi-res.
- Wide Angle Lenses used
- Zooms available
  - Bulky
  - Focusing difficult
Manipulators

- **Rate Type Electric or Hydraulic**
  - On/Off
  - Multiple or single function
Manipulators (cont.)

- **Spatially Correspondent/Force Feedback**
  - Uses a Master and Slave Unit
  - Expensive, Dexterous

- **Single Arm or Dual**
  - Five or Seven Functions are standard
Umbilicals

- Direct Tether/or Caged
  Provides Electrical Connection
  - Power lines
  - Video lines
  - Signal Lines
  - Fiber Optics
Umbilicals (cont.)

- Provides a means of lifting
  - Doubled Armored contrahelically wound
  - Tapered Termination
  - Abrasion resistant- Urethane, armor,

- Diameter is biggest Drawback
  - Drag
Control Van

- House Pilot’s Control Console
- Power Distribution Unit (PDU)
- Spares/Workshop
- Needs separate power source
- Explosion Proof for hazardous areas
- Portable
- Comfortable
- Integrated Comm system essential
Pilot’s Control Console

Data Display using rack mounted equipment

- VCR’s audio/video editing
- Video Monitors
- Power Unit
- Joysticks
- Sonar Console- Laptop or RGB Monitors
- Surface Navigation
- Subsea Tracking
Handling System

- **Lifting Apparatus**
  - Crane
  - A-Frame

- **Tether Management**
  - Traction Winch
  - *Storage drum for deepwater systems*

- **Skid Mounted/Transportable**

- **Provide Access for R&M of ROV**
Power Supply System

- Vessel or Shore Power
- Independent Generator Power
- Must be stable and clean
- Secondary Switchover
- Must be adequate for watts drawn
Summary Of Main Points

Vehicle Structure
Vehicle Electrical & Electronic
Hydraulic System
Propulsion
Lighting
Camera Systems
Manipulators
Umbilical
Control Van
Pilot's Control Console
Handling System
Power Supply System
Key Points

- Aluminum is a common material on ROVs. It must be protected by anodizing or with anodes.
- Electrical Sensors used on ROVs are primarily for subsea navigation.
- Hydraulics are used with Workclass ROVs and use servos to control flow.
- Thrusters are generally fixed in a variety of configurations.
- Incandescent light is 80% heat and not nearly as effective as arc tube or metal halide lighting.