Semi-Automated Underwater Video Mapping System

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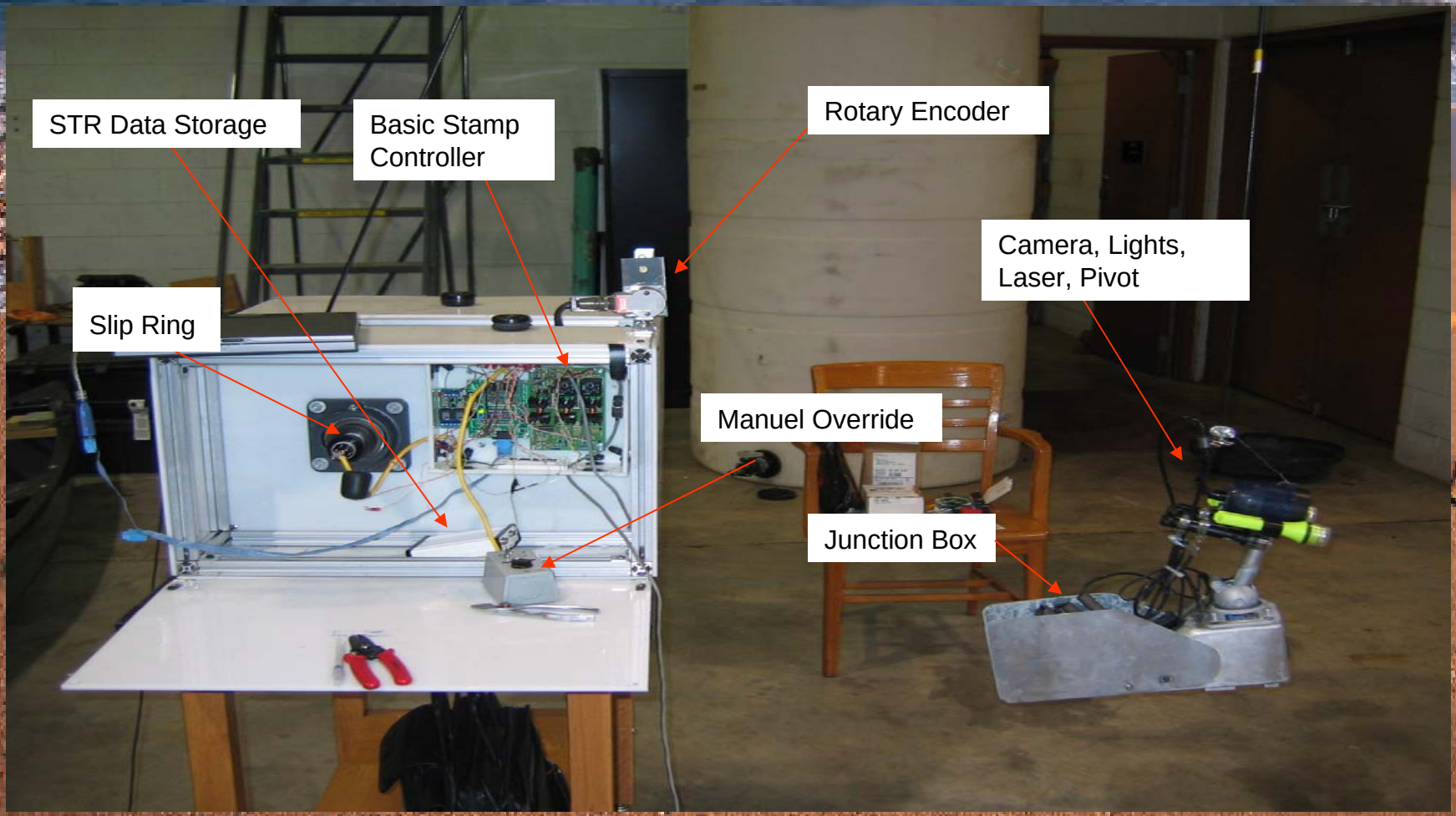
Underwater Habitats

- Problems
  - Human Activity
    - **Over fishing**
    - **Costal Development**
    - **Increased Pollution**
  - Natural Environmental Issues
    - **Endangered and Invasive Species**
    - **Weather Phenomenon**

Final Design



Need and Goals

- Need
  - **Design a system to record spatially referenced, clear, and accurate video of underwater habitats**
- Goals
  - **Semi-automated camera height control**
  - **Compact, durable, and easily transportable**
  - **Cost Effective**
  - **Minimal environmental Impact**

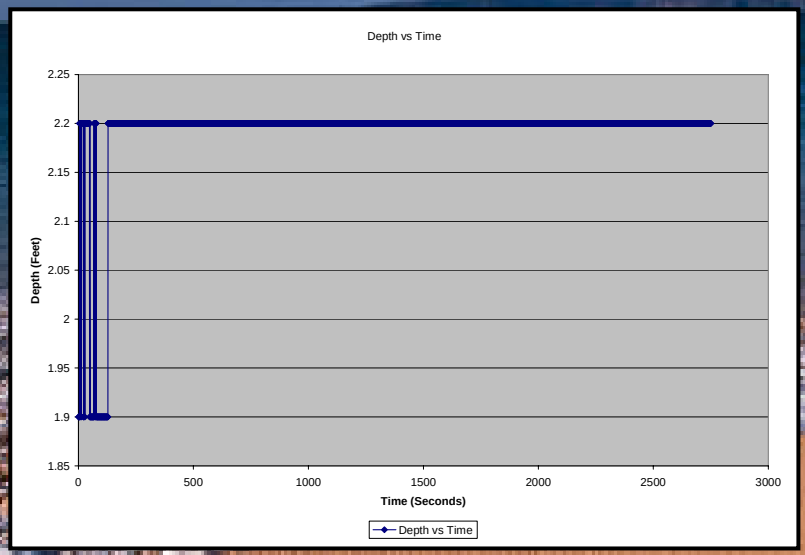
Design Objectives

- **Performance Objectives**
  - Electronically Controlled Height Control
  - Manual Override
  - Durable and Compact
  - Reduce Multiple Data Storage Locations
  - Spatial Reference of Underwater Video
- **Health, Safety, and Environmental Impact**
  - Minimize Substrate Damage
  - Transportable
  - Safe
- **Cost**
  - Minimize design cost
  - Minimize labor cost

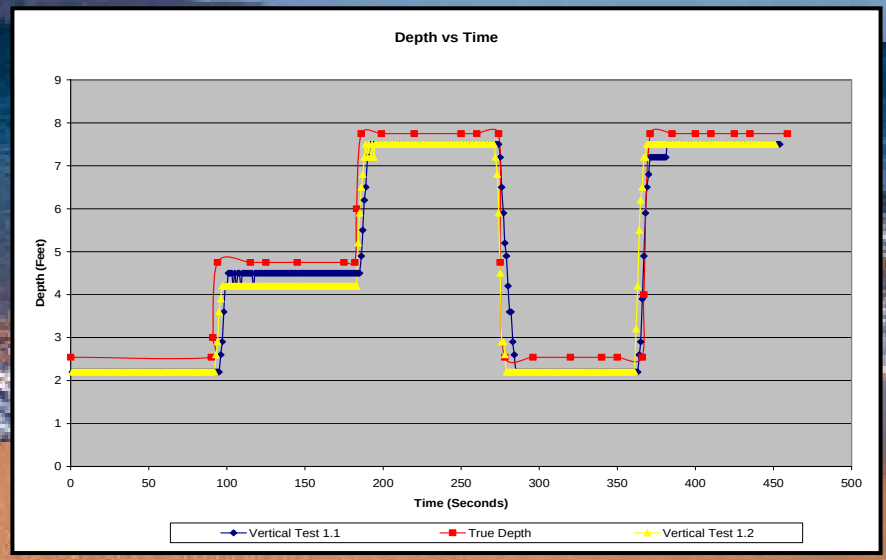
Electronically Controlled Height Control

- Depth Sensor
  - Cruzpro DSP Active Depth, Temperature Transducers DSP
    - DSP Active Depth Technology
    - NEMA 0183 Output
  - Testing
    - Static Test
    - Turbidity Test
    - Dynamic Vertical Test
    - Output Time
    - Horizontal Accuracy
    - Horizontal Object Identification
    - Angle Effect Test
    - Cone Angle Calculations
    - Cone Angle and Angle Optimization Calculations
    - Depth Sensor Interference Test

Sensor Testing Data



Static Test Results



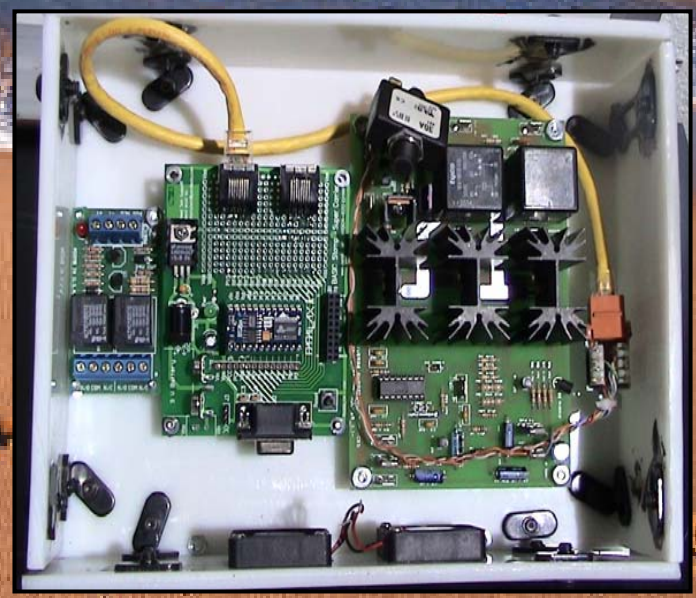
Dynamic Test Results

True Distance (Feet)	Horizontal distance (Feet)	Accuracy Average (Feet)	Standard Deviation	True Value error (Feet)	Number of Data Points
4	2	3.069	0.274	0.931	123
4	3	3.509	0.169	0.491	66
6	2	5.352	0.159	0.648	113
6	3	5.488	0.06	0.52	49
8	2	7.8	0.00	0.2	92
8	3	8.192	0.056	0.192	102

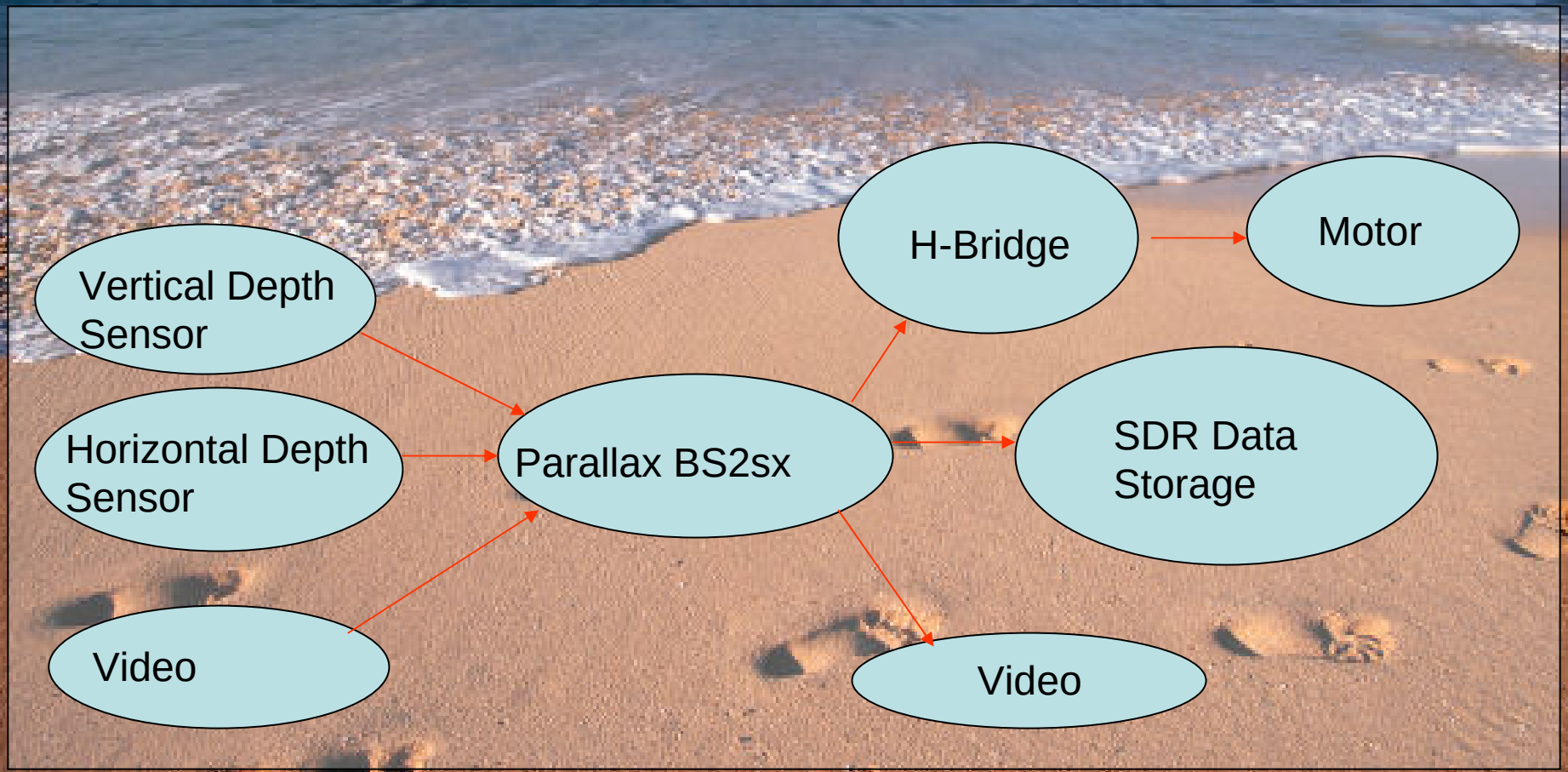
Horizontal Accuracy Results

Electronically Controlled Height Control

- Electronic Controller
  - Parallax BS2sx Microprocessor
    - **PWMPAL Module**
    - **MC7 H-bridge**
  - Design Process
    - **The microprocessor receives inputs from the sensors and switches and controls the camera height. The instructions from the BS2sx are converted to a pulse width modulated signal by the PWMPAL and then sent to the H-bridge. The H-bridge then controls direction and magnitude of the voltage sent to the winch motor.**



Electronic layout



Durable and Compact

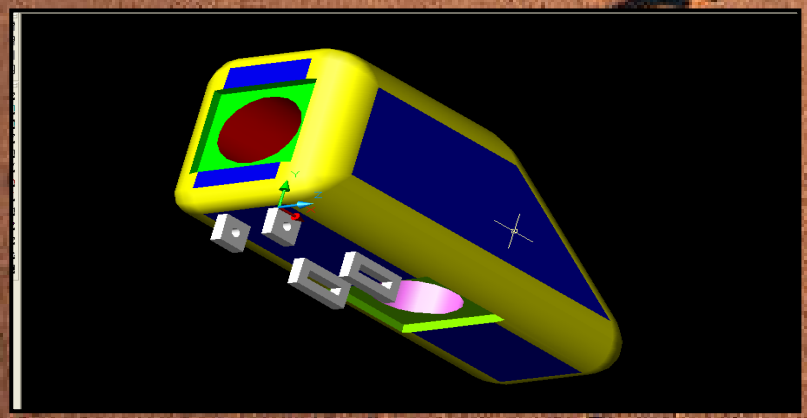
- Winch Housing
  - Compact and self-contained
  - Splash-proof
  - Safe guarded from foreign objects
- Camera Housing
  - Solid Aluminum
  - Impact Resistance

Durable and Compact

Minimize Substrate Damage

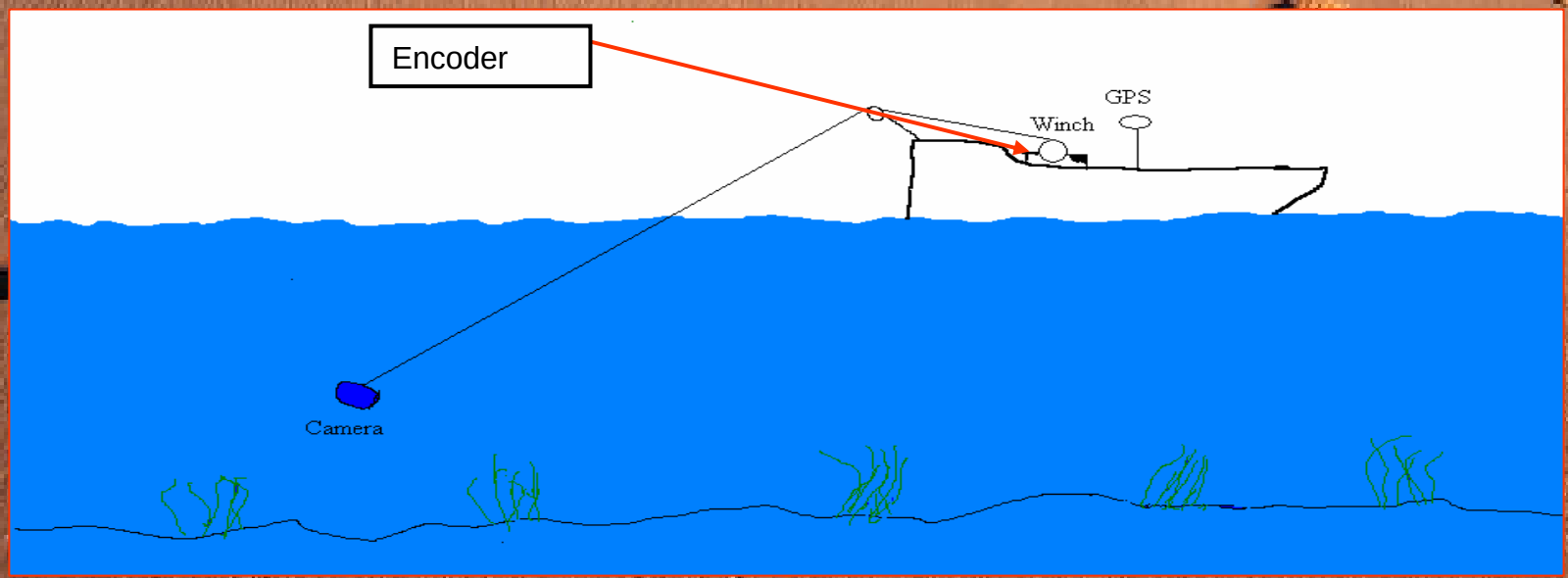
Camera Housing

- Concept Drawings created and analyzed
- Modeled using Mechanical Desktop 6
- Size and component analysis
- Load analysis (23X Datalogger)
- Drag analysis (23X Datalogger)



Spatially Referenced Video

- Rotary Encoder
  - BEI H20 incremental encoder
  - Pulse output per revolution
- Global Positioning System
  - Trimble Ag-132
  - NEMA 0183 string



Final System

- Final System Picture From Norris

Second Generation Suggestions

- Motor
  - Noise Interference
- H-Bridge
  - Optical Isolated upgrade


Questions ?