SPROVER
Surf Profiling Remotely Operated Vehicle
TEAM MEMBERS

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Original ROV was designed to obtain a beach profile

Never passed original pool test
FLAWS IN OLD DESIGN

Housing designs
- Instrumentation Housing
- Motor Housing
- Transmission design
  - Shaft connections
  - Hub connections
- Electrical design
  - Inadequate tether for power transmission
OBJECTIVES

- Design and manufacture instrumentation and motor housings
- Create instrumentation to assist in the data collection of a beach profile
- Obtain a beach profile
INSTRUMENTATION HOUSING

- SPROVER’s cranium
- Cylindrical Shape
- Accessibility and convenience
- Room for future instrumentation
INSTRUMENTATION HOUSING
BODY SPECIFICATIONS

- 6”, 2 ft section of PVC piping as shell
- Optimal diameter and length for buoyancy and instrumentation purposes
- Body wrapped in carbon fiber for waterproof seal at flange/body surface and strength
FLANGE, O-RING & BOLTS

- 10.5” outside diameter—allows room for o-ring groove and bolt holes
- Bolt holes threaded with steel inserts
- 3/8-16 stainless steel bolts
- PTFE Dash # 442 O-ring
- Cast Acrylic End—transparency
- Waterproof connectors
HOUSING SUPPORT CAGE

- Constructed out of two 3” x 72” x ¼” sections of sheet metal
- Rigid design with easy usage
- Strap to hold housing in place; enough strength to create neutral buoyancy effect
MECHANICS

- Design and Manufacturing of Shaft and torque connections
- Design and Manufacturing of Motor housings
- Rectification and modification of current shaft housings and wheel hubs
SHAFT DESIGN

- Designed to rotate freely without the use of bearings
- Manufactured using Aluminum to prevent corrosion
- Designed with hub and coupling connectors for transmission of torque
- Designed with a factor of safety of 3 to prevent shearing of transmission
MOTOR HOUSING DESIGN

- Designed to:
  - Allow rotation of motor shaft
  - Allow easy assembly and disassembly of housings
  - Fit on the existing vehicle
MOTOR HOUSING

Static O-ring for motor protection

Flange design for easy assembly
CROSS-SECTION VIEW

Dynamic shaft seal

Static O-ring for safety
COMPLETE TRANSMISSION ASSEMBLY

Shaft coupler

Shaft housing holster

Housing connection
Electronics were divided into 2 parts:

- Control systems: obtained from previous teams
- Instrumentation: design and construction
CONTROL SYSTEMS

- 7000 watts generator
- Tether: 500 ft – stranded
  - Provides 110 V to the electric motors
- Data cable: 500 ft – 6 conductor
  - inclinometer
  - BW camera
  - motors controls
INSTRUMENTATION

- BW camera
  - to “see” where the SROV’er is going
  - observe sea life

- Laser range finder
  - to obtain the distance of the ROV from the beach
  - can measure up to 800 yards
  - 3 foot precision

- GPS
  - Provides a way to position the vehicle
INSTRUMENTATION

- Inclinometer
  - gives the tilt and heading of the ROV

- 3-axis compass
  - x-y axis sensor
  - z-axis sensor

- 2 axis accelerometer
INCLINOMETER

- Board designed using Eagle 6.1 software
- Board manufactured by Advanced Circuits
- Components added to the board
- Microcontroller programmed using C language
INCLINOMETER BOARD

- 1-axis sensor
- 2-axis sensor
- Accelerometer
INSTRUMENTATION

- All electronics were designed to fit in the housing
CONTROL SYSTEM

- Motors
- Motors controls
- Inclinometer
- Camera
- Control box
- Computer
- TV set
3 tests were performed to meet the design objectives

- Pool Test
- Ocean Test
- Beach Profile Test
POOL TEST

- Primary goal was to assure that mechanical aspect of the vehicle would work in a water environment

- Results:
  - Instrument Housing had no leaks
  - Motor housing had no leaks
  - Transmission of electrical data to motor was successful with no short circuits or power loss
Objective was to test the ROV under the exact conditions that it would face when obtaining a beach profile.

Results:
- All components work great together
Objective was to test the ability of the vehicle, equipped with instruments, to obtain a beach profile.
PROCEDURE FOR BEACH PROFILING

- Attach a survey stick to the mast and set up survey scope
- Record height values and inclinometer data every ten feet
- Interpret the data
DATA INTERPRETATION

- We are able to obtain a rough measurement of the beach profile based solely on the use of the scope readings.
- Using a correction based on the inclination of the vehicle, we are able to make necessary corrections to determine the actual beach profile.
CORRECTIONS

Since the vehicle is inclined, the angle of inclination must be known to determine the actual height of the vehicle.
Profile of Beach 1 Mile South of Melbourne Beach
The vehicle is proven to take accurate and efficient profile up to 500’ from the shore. Using the inclinometer along with a GPS system the position of the vehicle within ± 1ft. Provides a research platform for the study of biological, chemical, physical, and geological properties of the surf zone.
LOCAL IMPACTS ON ROV

- Ready for use in the surf zone to begin mapping the Brevard coastline
- Can assist ecologists and engineers in the study of beach erosion along our coastline
- May also be used to gain a better understand of the movement of sand through the different seasons and years in the Brevard area
TESTING VIDEO
Questions
Next up is:

TEAM LOMAC