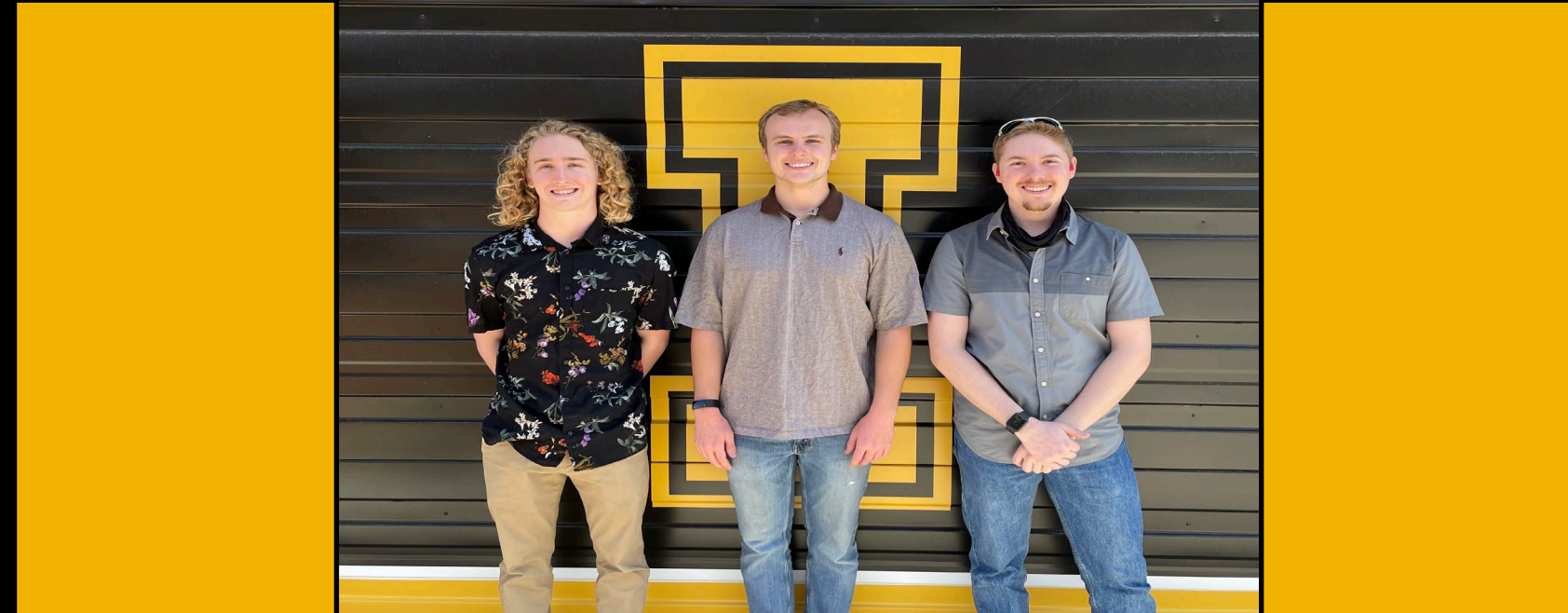




(Left to right) Cade Knott (EE), Steven Haener (ME), and Ethan Morris (EE)

OBJECTIVE:

A research barge move around. Its directional antenna must maintain alignment of an on-shore omnidirectional antenna.

OVERVIEW:

Naval Acoustic Research Detachment has a research barge out on Lake Pend Oreille.

- Directional antenna transmits data atop a Naval research barge
- Barge moves around and needs maintained alignment between directional antenna and an on-shore omnidirectional receiver

Currently directional antenna is manually reoriented

VALUE PROPOSITION:

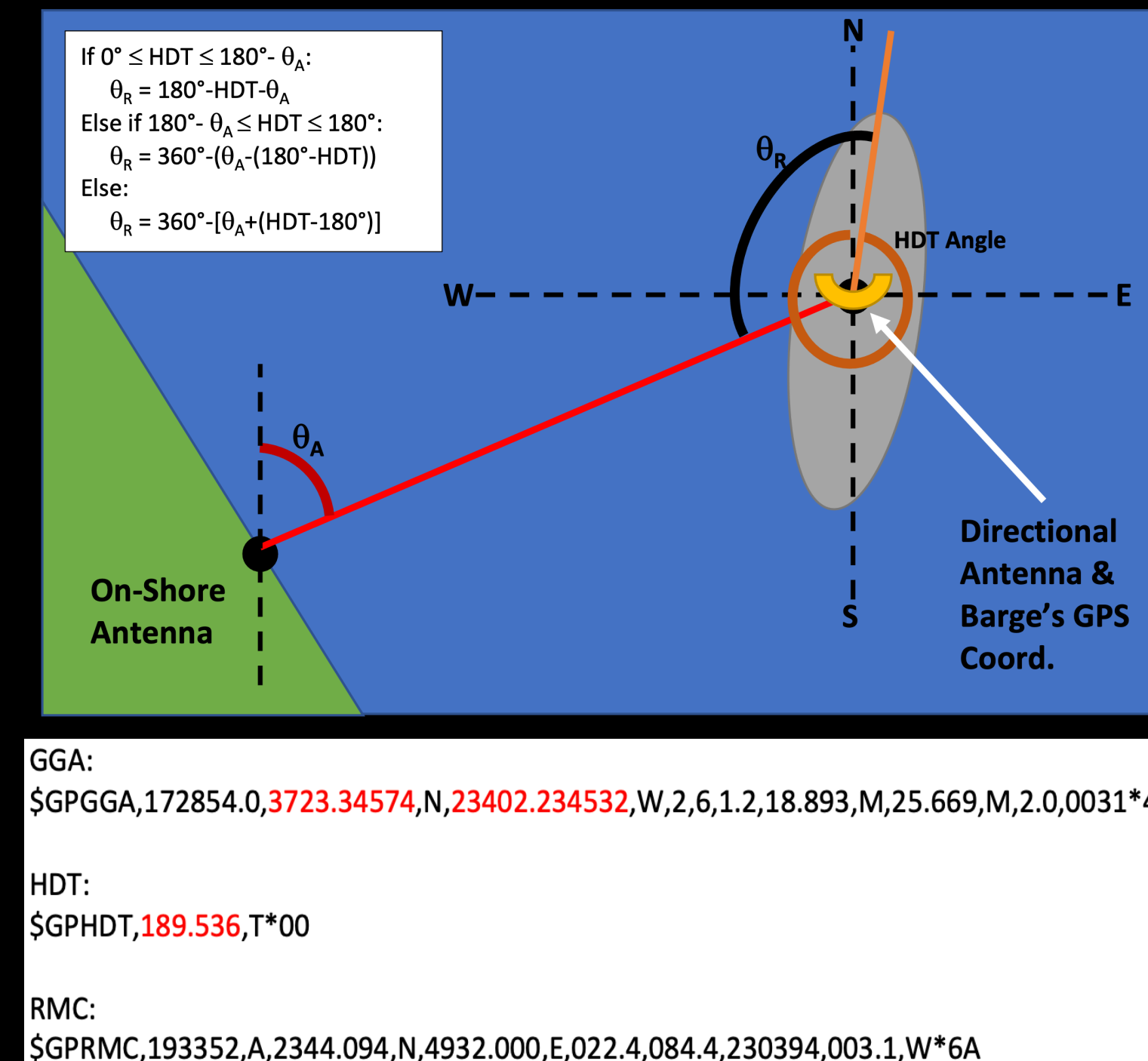
- Saves time to align
- Provides more accurate alignment
- Automatically maintains alignment while barge is in motion

DESIGN SPECIFICATIONS:

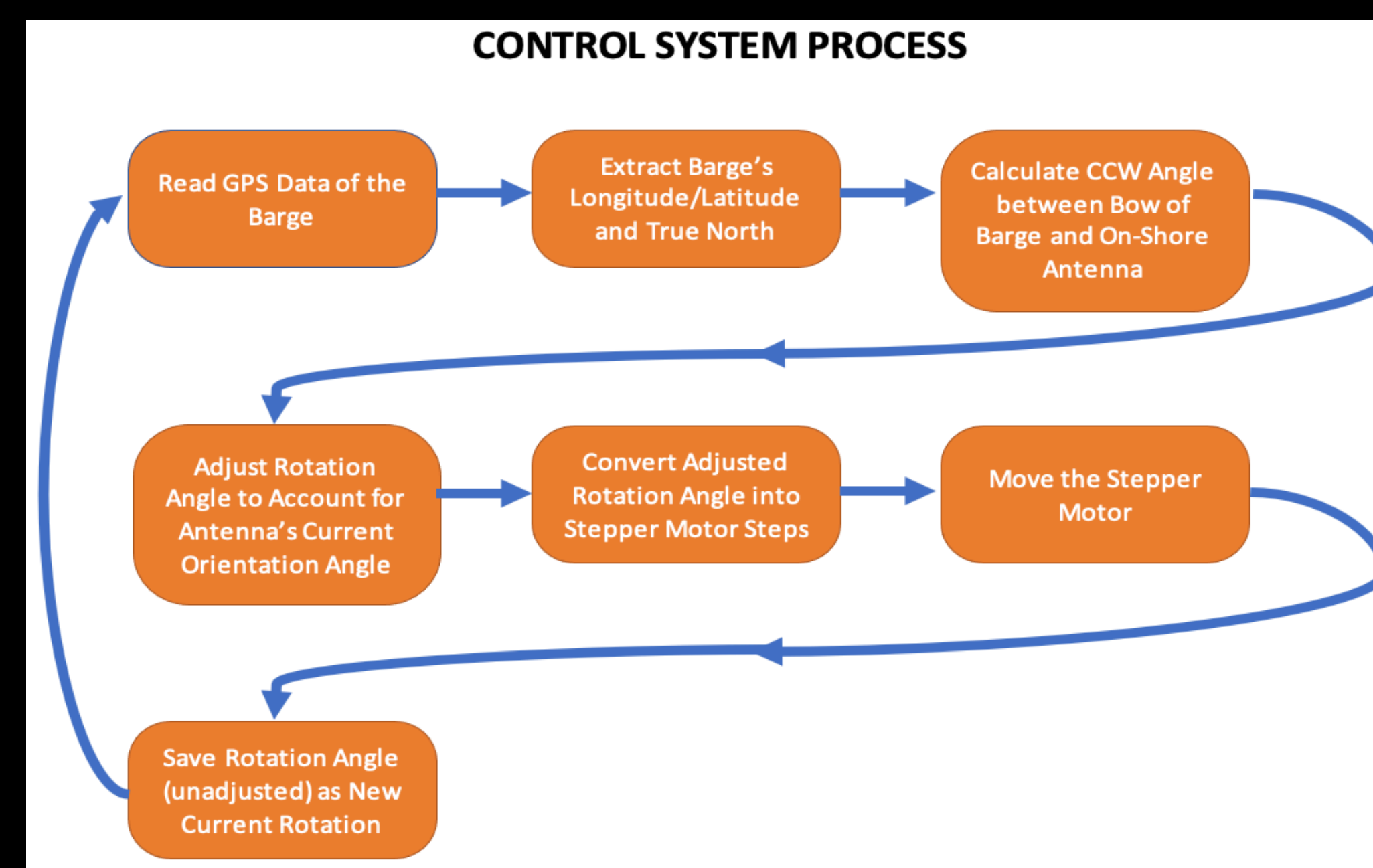
- Size: Approx. 320x320x320 mm
- Operating Temp: 0-50 °C
- Weatherproof (water, heat, cold, etc.)
- Aligns within a minute
- Develop with \$1000

CONCEPT DEVELOPMENT:

Use GPS positioning of the barge to determine rotation of antenna (given from mounted GPS transceiver)



FINAL DESIGN:



- Use a smart relay to power on/off entire system using a momentary switch with LED indicator
- Use a closed-loop stepper motor and motor driver to handle lost steps
- Reads GPS messages through RS232 communication between Raspberry PI and GPS transceiver
- Antenna resets to face bow of barge during shutdown or reboot of control system
- Use cylindrical waterproof housing to protect electronics



System is confined in a weatherproof dome

VALIDATION:

- Inside of housing remained dry during water testing
- Temperature inside housing remained below 37.78 °C during "hot car" test
- Calculated ~0.6 dBi loss through acrylic shield
- Ran GPS read and calculation code for 12 hours with set GPS coordinates. Resulting angles matched calculated ones.
- Could not verify Control System due to Motor Driver powering issue

RECOMMENDATIONS:

- Consider different 3D printer filament for parts
- Use two separate power systems for Raspberry and Motor Driver
- Use a stronger fan to ensure proper ventilation inside the housing

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