



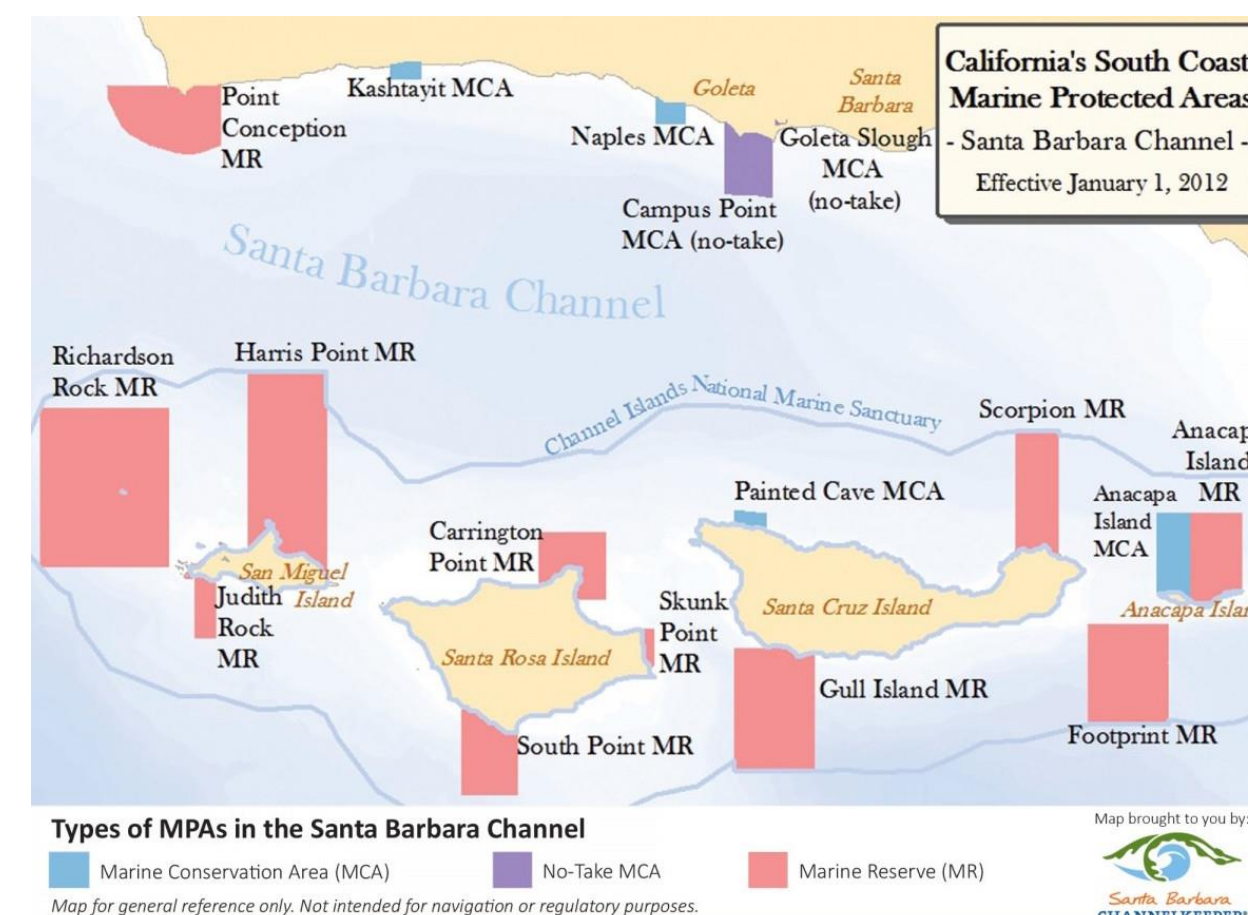
Universal Marine Monitoring Radar Trailer

Christopher Weis | Haydon Stapleton | Daniel Pekin | Aaron Frankel

Background

In 2002, the California Fish and Game Commission established a network of Marine Protected Areas (MPAs) around the coasts of the Channel Islands as a conservation effort for local marine wildlife. While their remoteness has allowed the islands to thrive on their own, it limits the ability to monitor and protect the sanctuaries from poachers and careless visitors.

The goal for our project was to monitor the MPAs by installing an autonomous radar system on Santa Cruz island. Since the system will be located in a remote area, it must be robust, self powering, easily transportable, and able to transmit data back to UCSB. Our project builds on the success of an existing radar system which we upgraded to be able to function at any point on the Channel Islands. In addition, a new radar system tailored to the Coal Oil Point reserve with hardwired power and data connections was designed and implemented to replace the upgraded trailer system being moved to the islands.



Overview

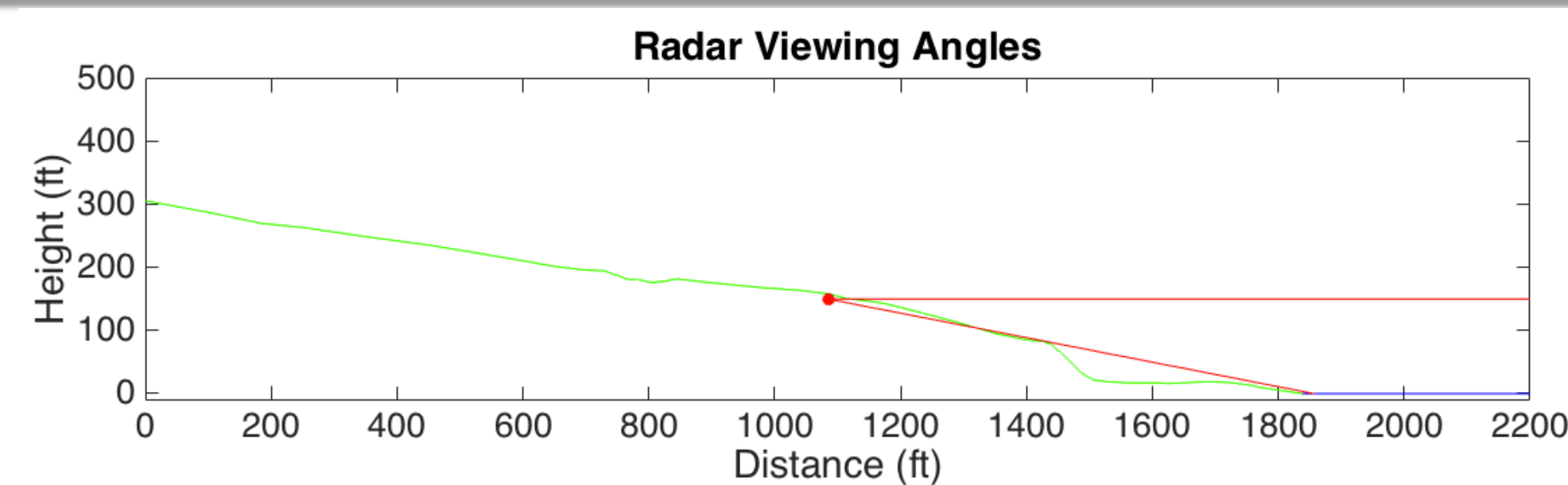
Santa Cruz Island System

To monitor various MPAs located around the Channel Islands, a universal system that could collect data and transmit it back to UCSB from any point on the Channel Islands was created. With this system being located in remote areas, the final product needed to be robust, self powering, and self resetting in the event of a power loss. To move the system around easily and inexpensively, a lifting harness and attachment points for the 2400 lb trailer were created. Finally, to be sure that our system withstands the harsh marine environment but does not affect local wildlife, the trailer would need to be both weather proofed and critter proofed to ensure system success for years to come.

Coal Oil Point System

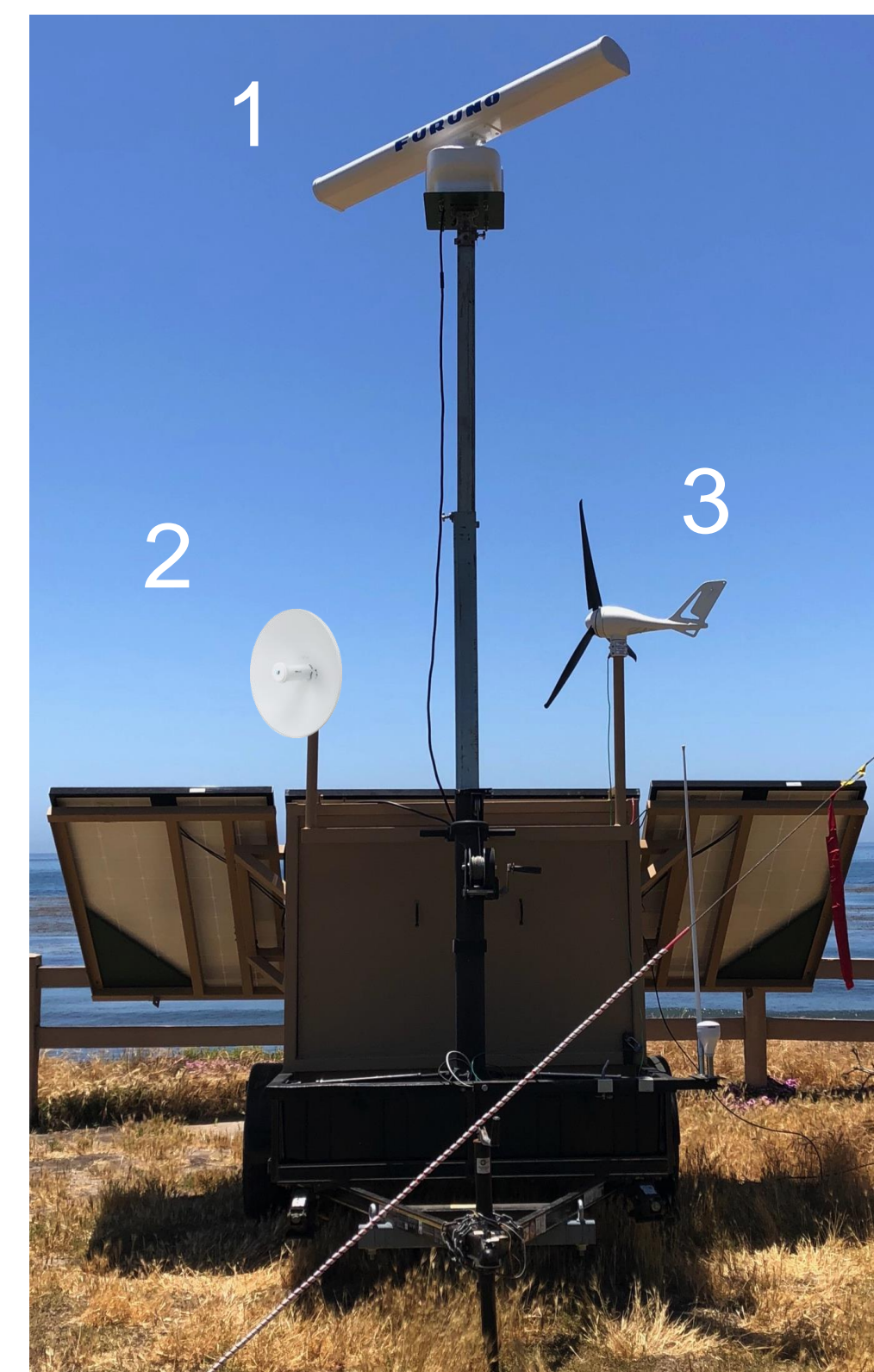
Additionally, a new non permanent system utilizing available resources was created to allow for continued monitoring of the Coal Oil Point Marine Reserve. The simpler system stemmed from reducing costs, build time, and connecting to available 120 VAC household power and an Ethernet cable to stream data back to UCSB. The structure was required to be non permanent yet rigid and stable to ensure that the tower would withstand high winds up to 100 miles per hour. The electronics for the system were located nearby in the Snowy Plover Shack for security and weather protection with the AIS antenna and GPS receiver being mounted on top of the Shack for better reception.

Site Selection Tools



- Adaptive MATLAB program (left) lets user know the effectiveness of potential locations.
- Coupled with tools from Google Earth (right), site selection based on transmission, sun coverage and view is streamlined.
- Tools eliminate need for costly site visits.

Santa Cruz Island System



- Trailer completely renovated to survive corrosion from marine environment.
- New power generation and data transmission capabilities were installed.
- Will be deployed to Santa Cruz Island by June 13th 2018.

SCI Hardware / Key Components



DRS25AX

Upgrading to a higher power 25 kW radar with a 6' open array, the new system will improve the system's range to 6 nm.



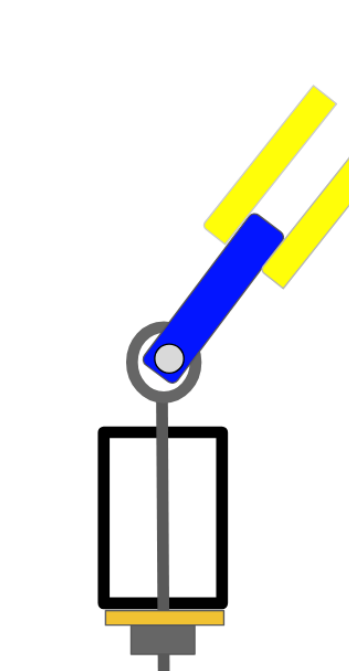
Ubiquiti PowerBeam AC Gen 2

Microwave data transmitter that features a 15 mile range, 24VDC power over Ethernet connection, 8.5W max power draw, and 450 MBPS transmission rate.



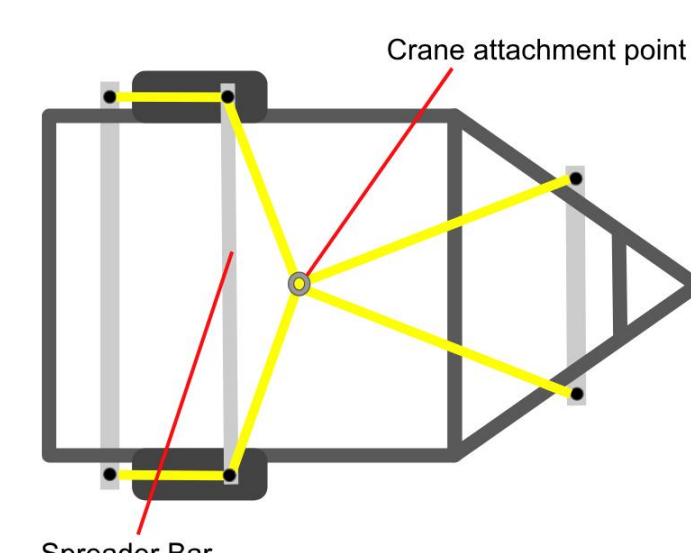
Coleman 400W Wind Turbine

Marine grade wind turbine with a 7 mph cut in speed and 400W maximum output. Features an integrated charge controller set to 14V and automatic braking mechanism.



Lifting Bars and Connections

Welded to the underside of the trailer frame, the 3 X 2 X 0.188 inch steel lifting bars give structural supports for the 3/4 inch shoulder eye bolts to mount to. Anchor shackles rated for 3.25 tons connect the nylon lifting straps to the eye bolts. Each assembly is rated for 5000 lbs.



Spreader Bar

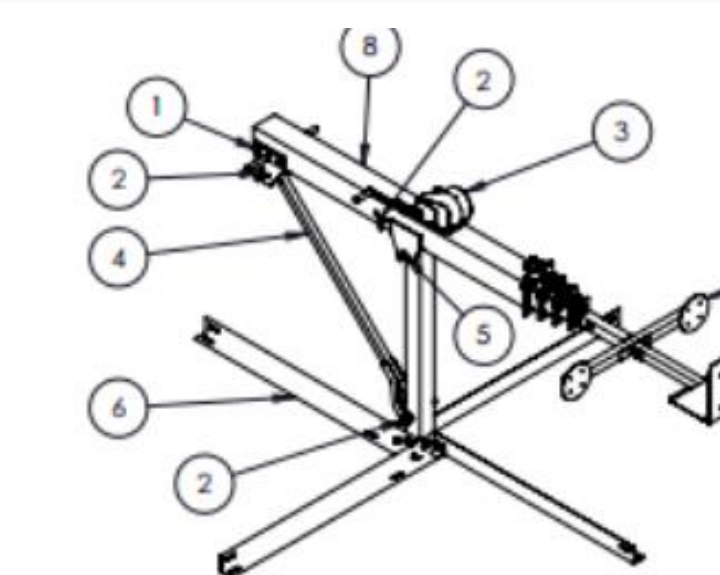
Designed to lead the lifting straps around the solar panels, this spreader bar was made from half inch thick steel end plates, grade 8 fasteners, and heavy duty 2 inch steel square stock with a quarter inch wall thickness to give a maximum working load of 5 tons.

Coal Oil Point System



- Fully installed Coal Oil Point System monitoring Campus Point MPA.
- Cables run over the roof, then into the Snowy Plover Shack to reach the Electrical Box.
- Both Tower and Radar are grounded to protect from electrical surges.

COP Hardware / Key Components



Tower

Outsourced to Floatograph and made of marine grade aluminum. The telescoping tower holds the radar 25' high and has two mounts for future sensor upgrades.



Tower Supports

To anchor the tower and prevent it from tipping over due to wind loading, 4 guy wires running from the top of the tower to stakes in the ground and 24 sandbags on the base of the tower were added.



Electrical Box

Located in the Snowy Plover Shack to protect the system's electronics from the surrounding marine environment, this box holds similar electronics to those in the Santa Cruz Island System including the Furuno Touch Screen, computer, tablet, AIS receiver, and power equipment.

Conclusion

Currently, the system at Coal Oil Point is up and running, collecting and transmitting data as we speak. The island system is being tested at Coal Oil Point, and will be moved to and installed at Christy Ranch on Santa Cruz island on June 13th.



Acknowledgements:

Sean Hastings, Gregory Dahlen, Brendan Tougher, Anthony Nelson, Virgil Zetterlind, Dennis Long, Tyler Susko, Steve Laguette, Roger Green, NOAA, Anthropocene Institute, UCSB Mechanical Engineering Department, Morgan Family Foundation