

MBARI's UAS program



Project team

- Ben Erwin (pilot and engineer)
- Bryan Schaefer (pilot and engineer)
- Tom O'Reilly (engineer)
- Rob McEwen (engineer and pilot)
- John Ryan (scientist: mammals and ocean color)
- Steve Haddock (scientist: jellies and surveys)



Monterey Bay Aquarium Research Institute (MBARI)

- Non-profit founded in 1987 by David Packard
- Located at head of Monterey Canyon
- Emphasizes collaborative relationships between scientists and engineers



the David &
Lucile Packard
FOUNDATION



S.F.

L.A.



Monterey Bay Aquarium
Research Institute



Monterey Bay Aquarium



La Salvia Beach

Watsonville

Pacific Grove

Las Lomas

Elkhorn

Mass Landing

Prunedale

East Garrison

152

Salinas

East Garrison

Pacific Grove

San Luis

Monterey

Del Norte State Forest

Del Norte State Forest

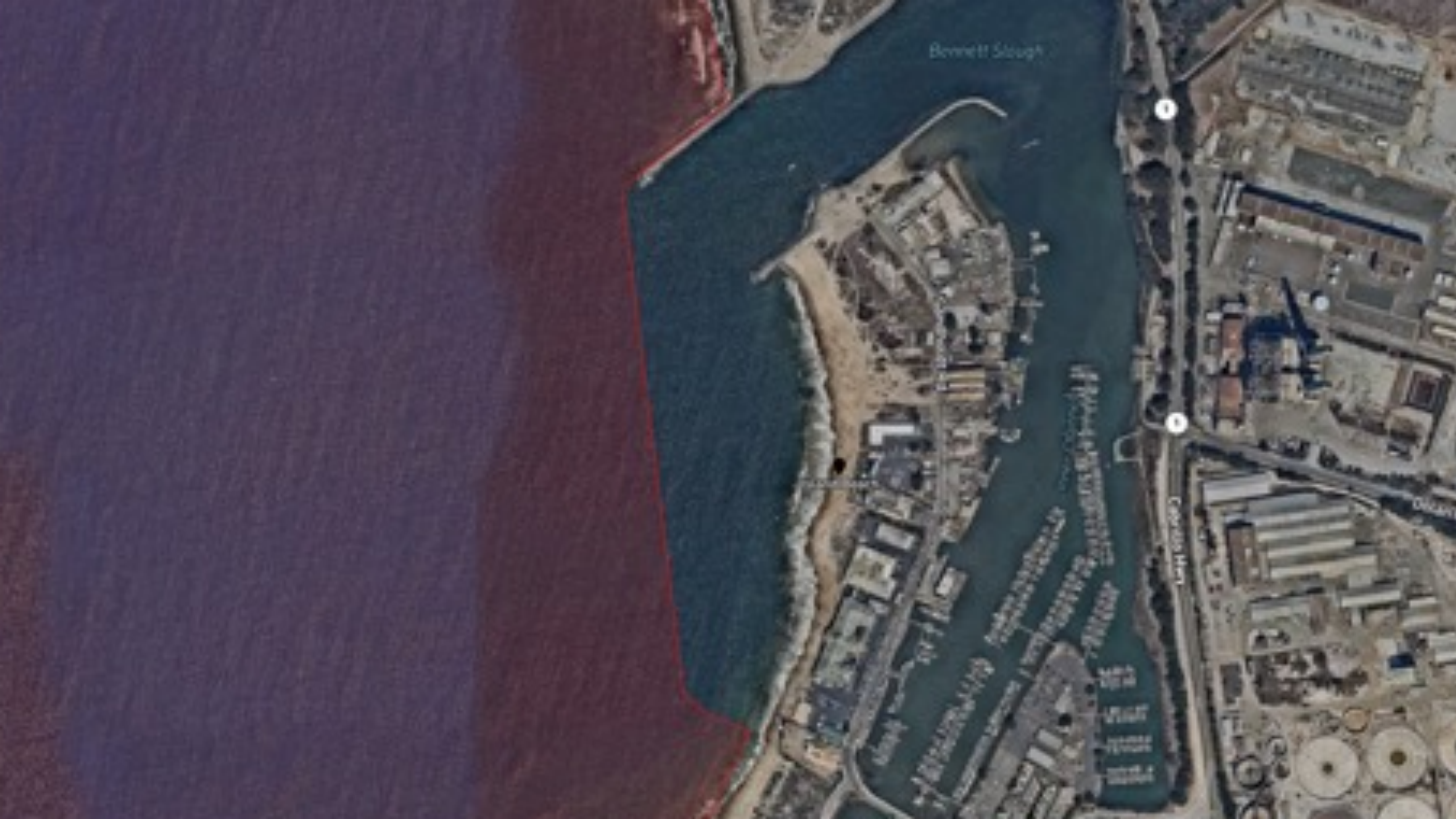
Carmel

Sequoia Canyon
State Marine
Conservation Area

Portuguese Ledge
State Marine
Conservation Area


Monterey Bay
National Marine
Sanctuary





Bennett Slough

Cassidy Hwy

A photograph of an orange FlightWave Edge VTOL drone in flight against a blue sky with light clouds. The drone is shown from a low angle, highlighting its long, slender wings and the tilt-pod rotors. The top surface of the wings is white, and the bottom surface is orange. The drone is flying towards the right of the frame.

FlightWave Edge

VTOL with Tilt-pod rotors

- Endurance: 45 min/38 km
- Payload: 300g
- Max windspeed: 15kt
- Biotransects, ship-launch

MBARI drone choices

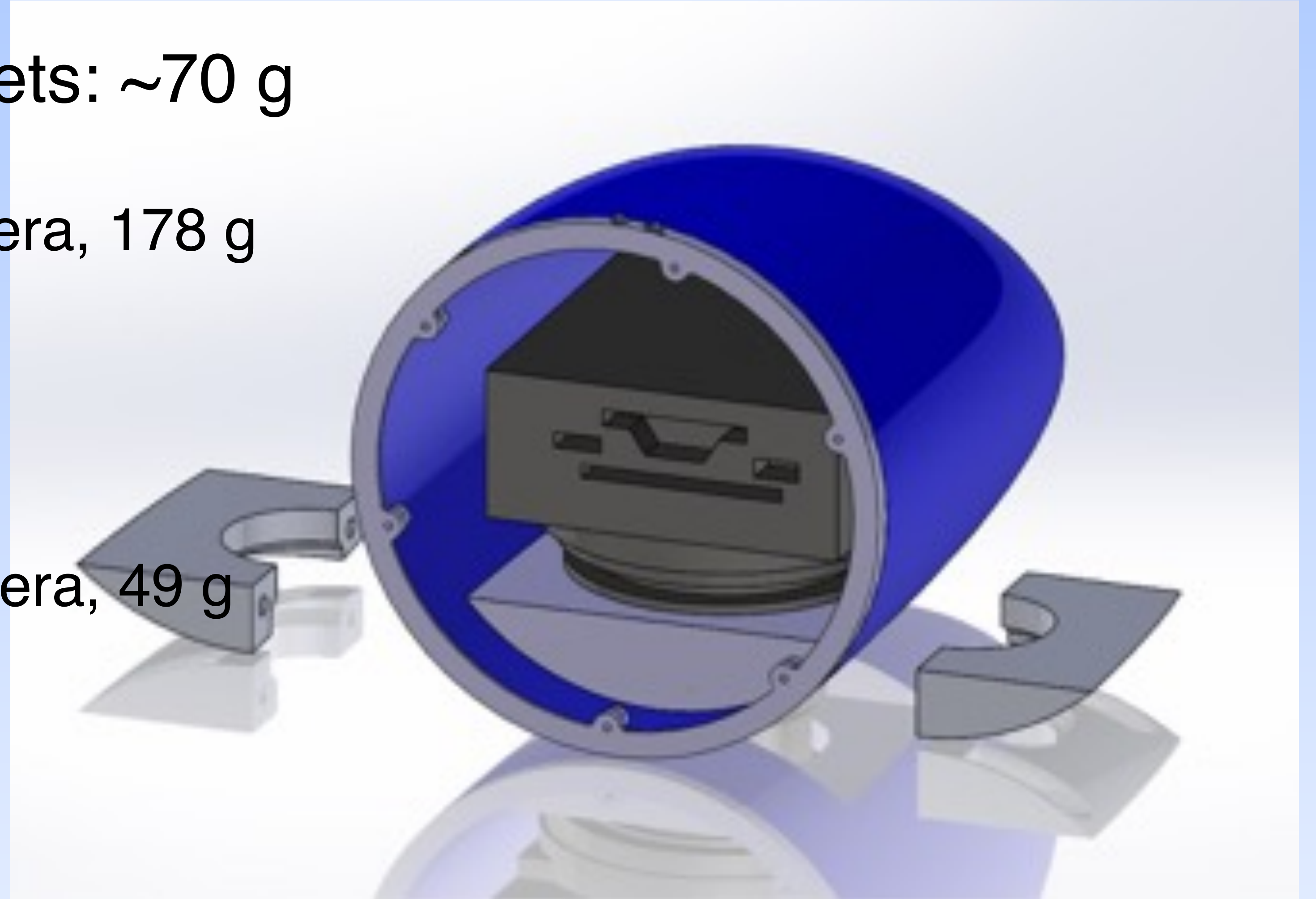
FW *Edge* VTOL tests (2017)

- Payloads: FLIR Vue Pro,
 - Foxeer Legend 16 MP RGB camera
- Launched/landed on *RV Paragon*
 - chased drone in flight
- Flew ~8 km transects at 60 m altitude thermal front



Payload design and fabrication

- Nose cone + plastic brackets: ~70 g
 - FoxTech Map-02 25 MP camera, 178 g
 - Total weight: 248 g
- Payload B
 - FLIR Duo R, 84 g
 - Foxeer Legend-1 16 MP camera, 49 g
 - Total weight: 203 g



Believer airframe

Long-endurance fixed wing



MBARI drone choices

- Endurance: 4+ hour
- Payload: 2kg.
- Up to 60 kt speed
- Long range surveys

Believer recovery options

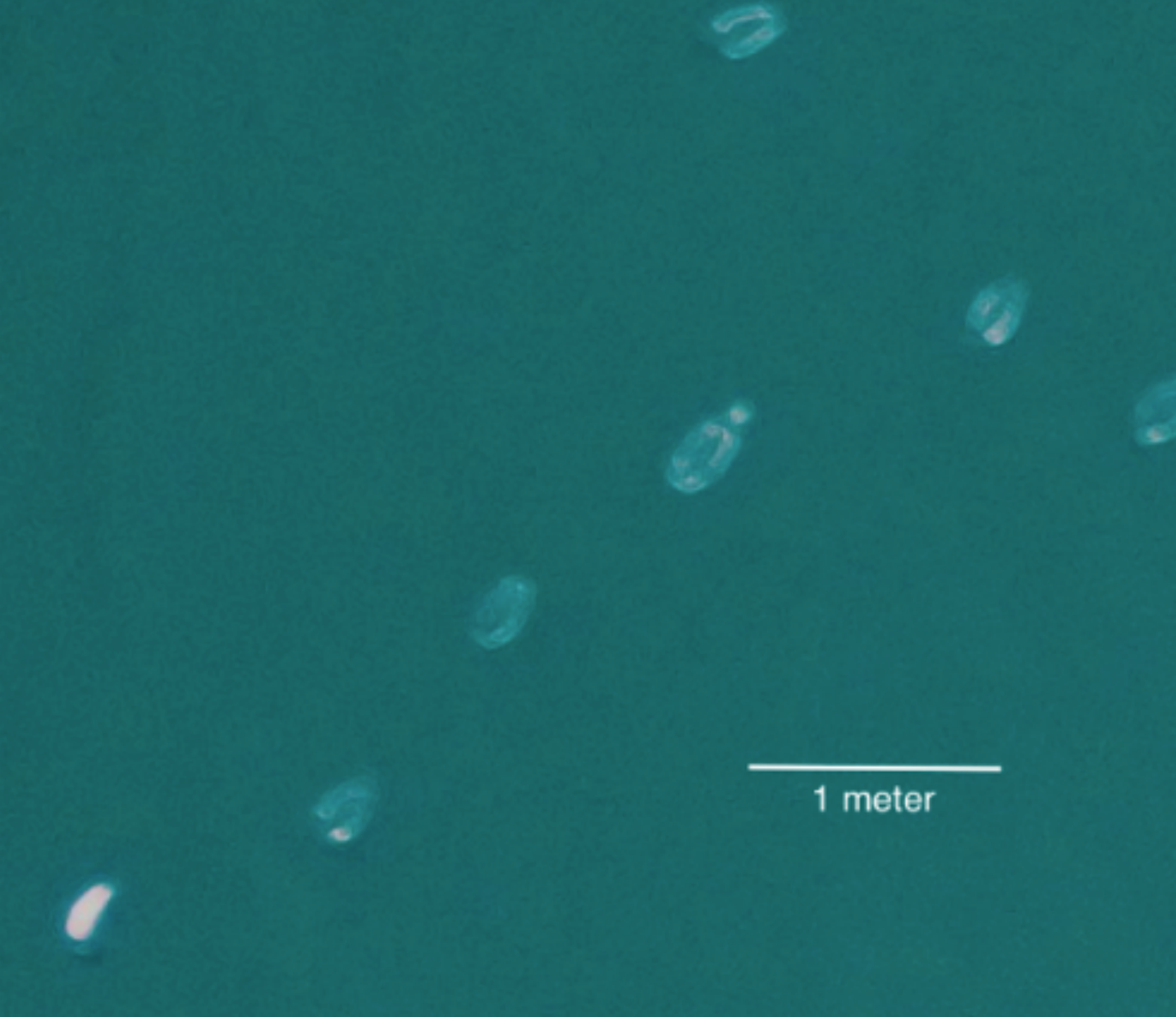
- Ground landing
- Water landing
- Net capture
- Parachute

MBARI UAV applications

- Air-sea interface processes
 - Phytoplankton, including HABs
 - Animals – jellies, fish, birds, whales; behavior, population
 - Thermal structure
 - Ocean/atmosphere interactions (e.g. DMS)
 - Bioluminescence
 - Long (30+ km) monthly transects
- Public outreach
- Locate assets on surface
- Data transfer relay
- Water sampling



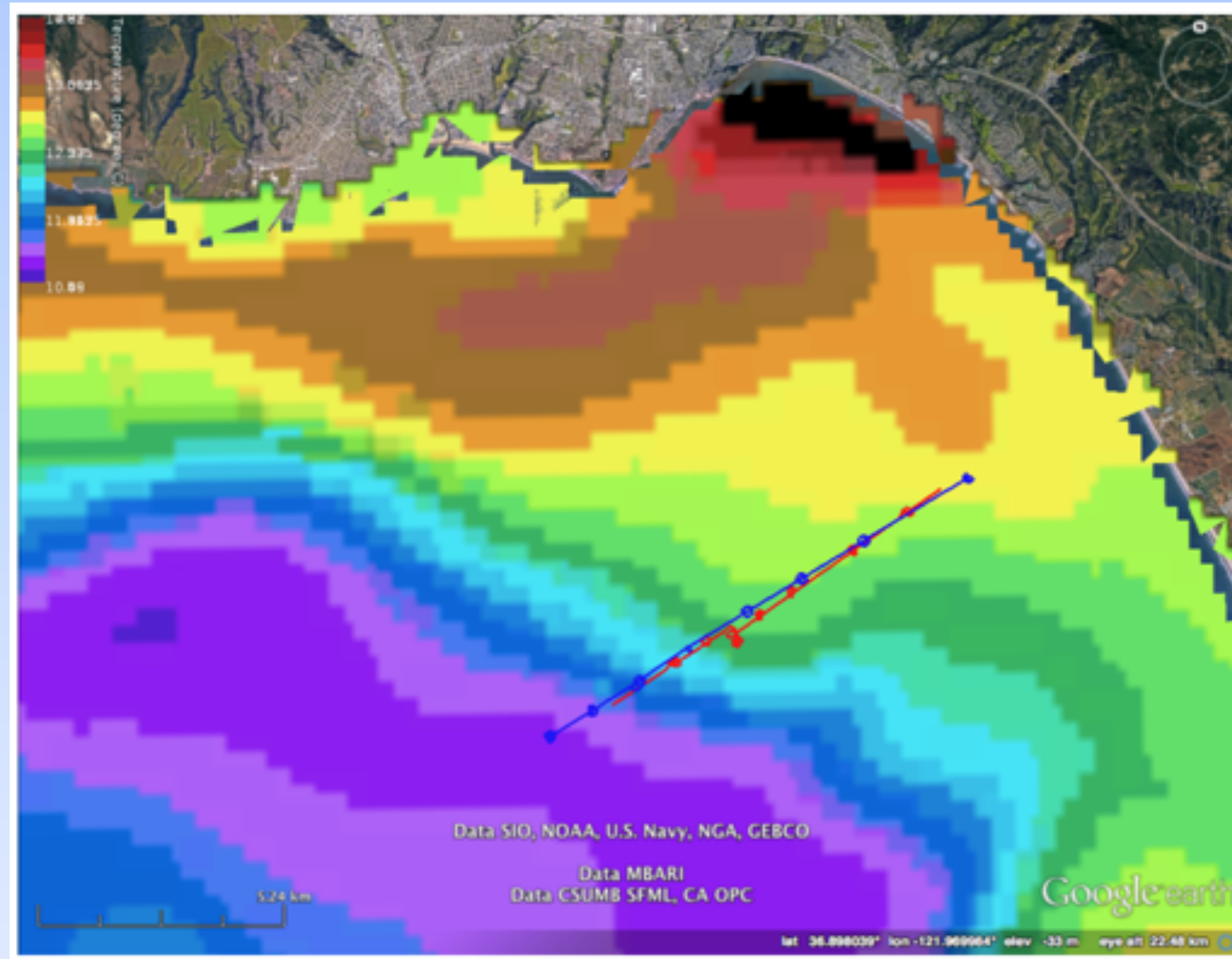
Jellies (likely *Aurelia aurita*)



Birds in flight

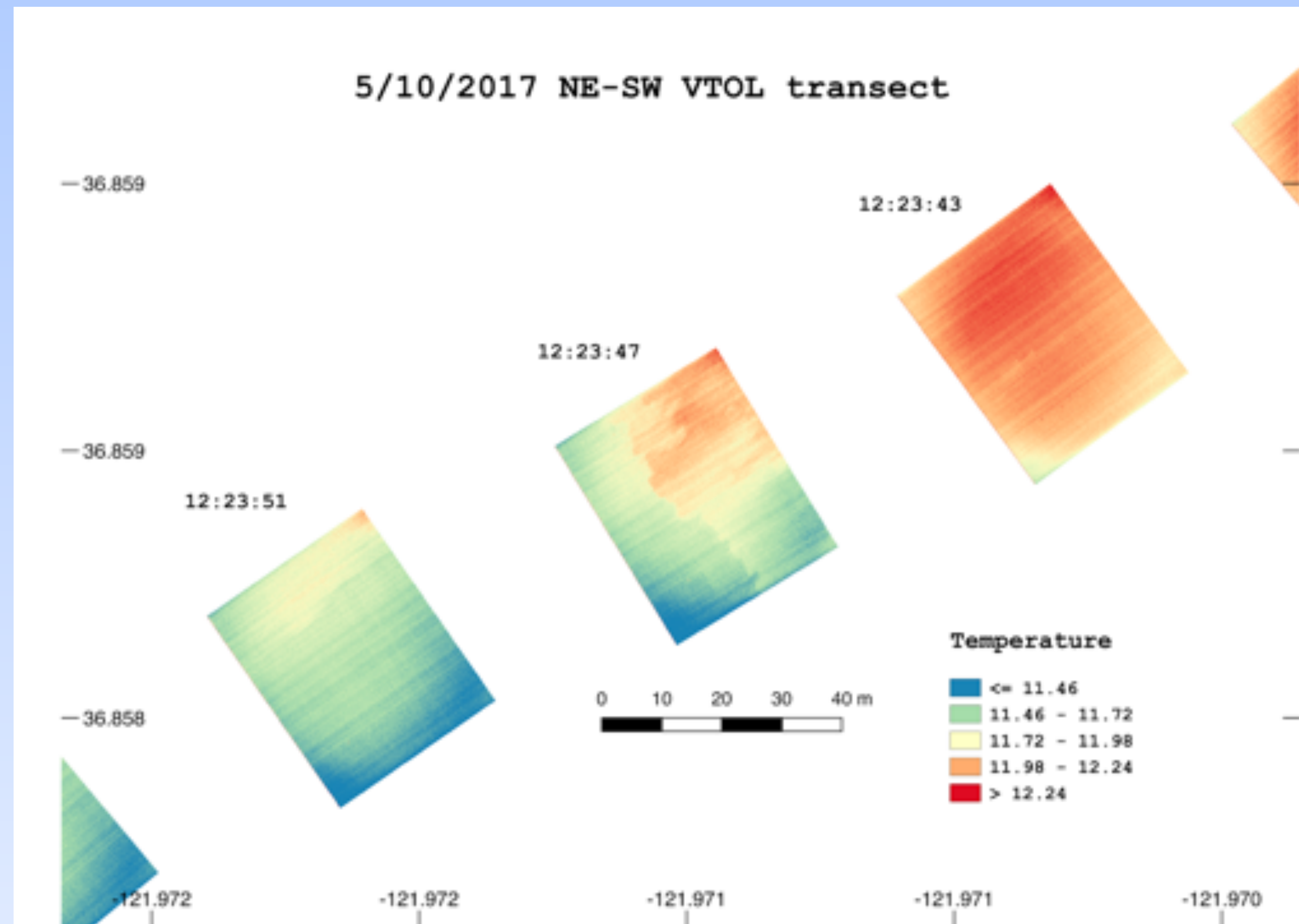


FW Edge transects

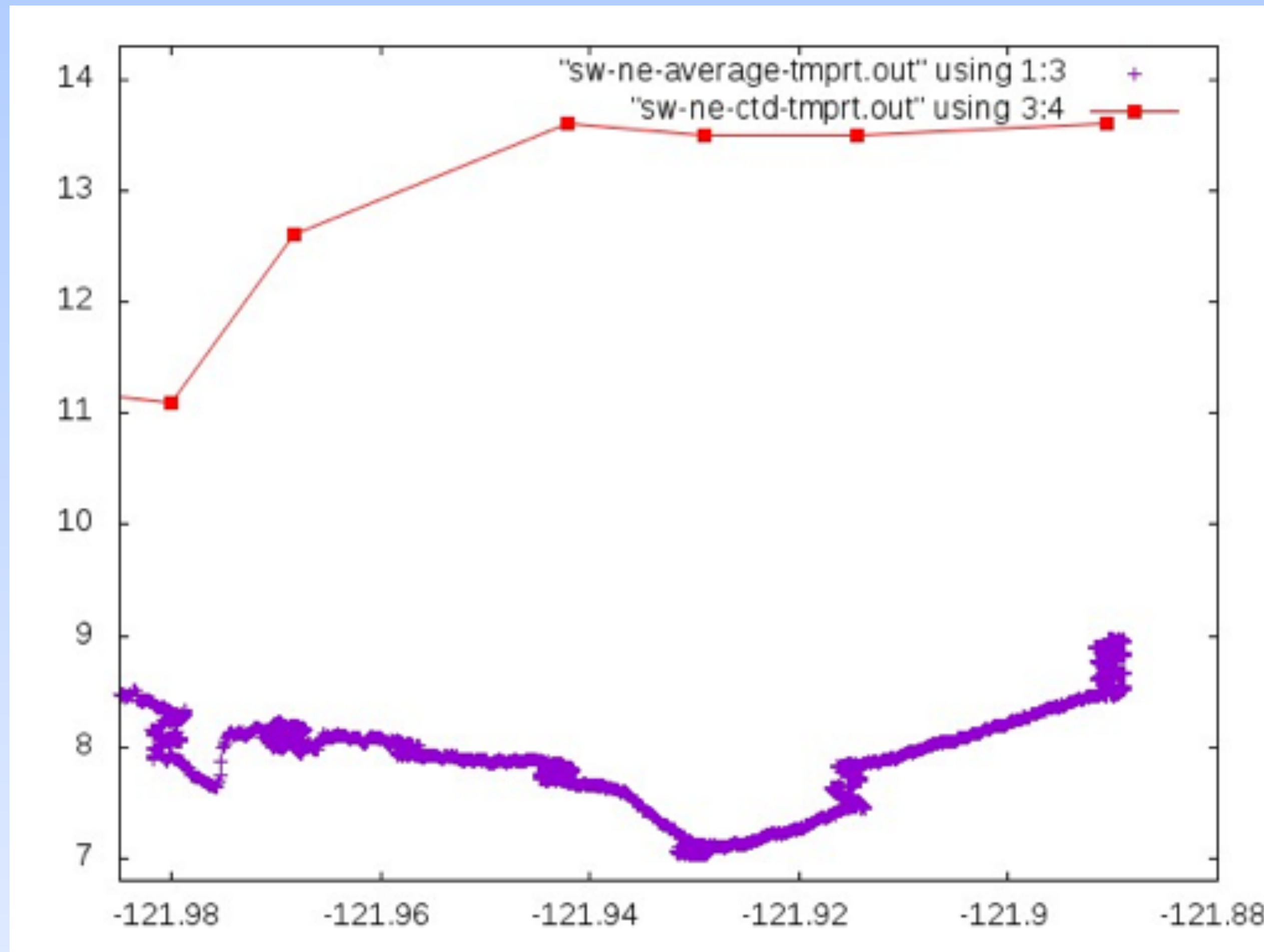


FW Edge transects overlaid on JPL ROMS SST nowcast,
5/10/2017

Thermal front in FLIR images



FLIR vs CTD temperature: SW-NE transect





Fluoroscein dye tracking experiment, 10/2018
RV Paragon (left) and *Long Range AUV* (yellow object on right)

Data post processing

- Embedding metadata
- QGroundControl
- BIN to ULOG conversion