The Successful Development of a Through Ice Micro ROV

Moss Landing Marine Laboratories

Project SCINI in Antarctica

NSF

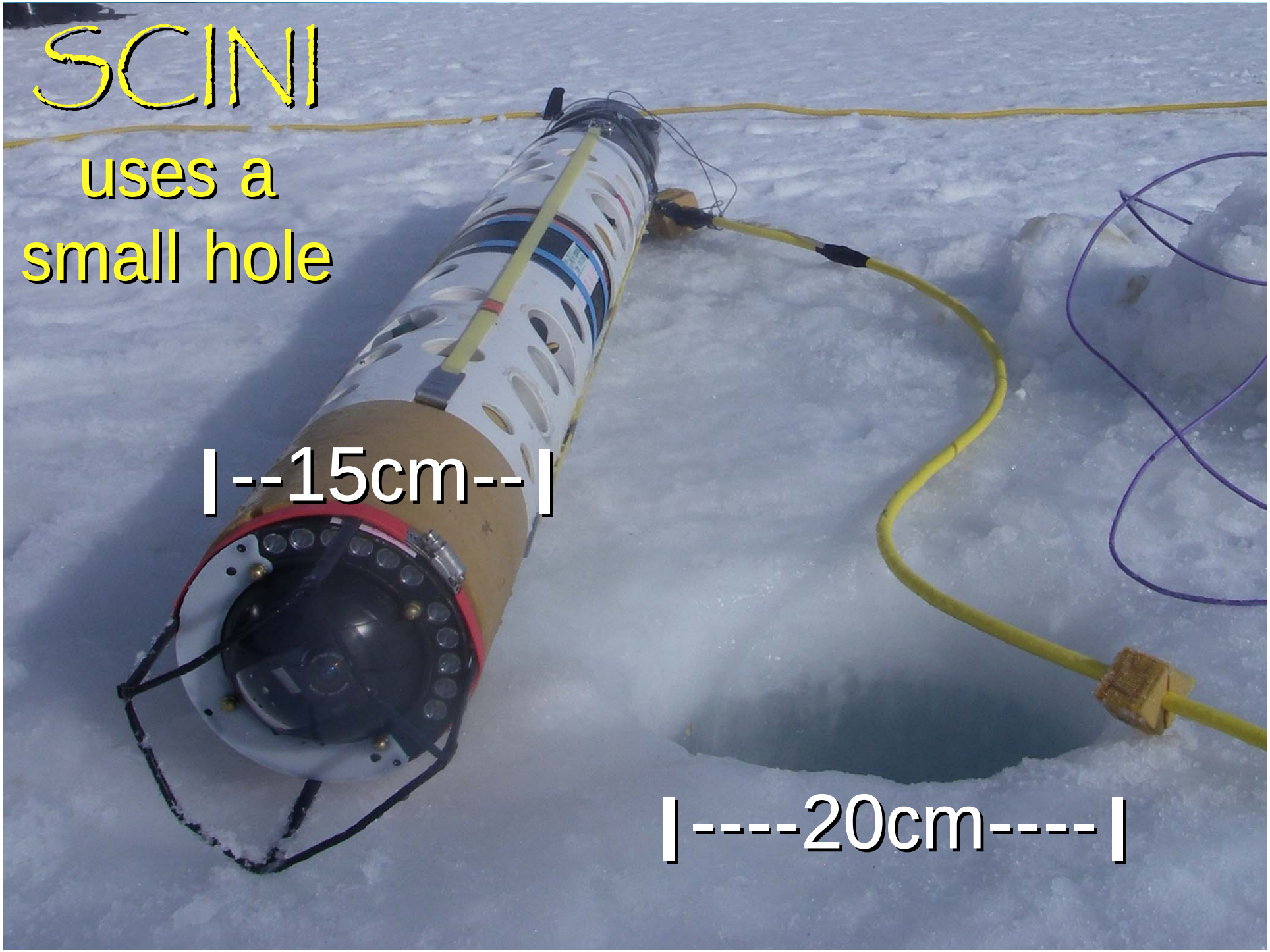

SCINI
Submersible Capable of under
Ice Navigation and Imaging

Overview of Presentation

- Why do we Need SCINI
- The Anatomy of SCINI
- Navigation Under Water
- SCINI Performance
- The Future of SCINI
- Scientific Research
- Questions? with a movie

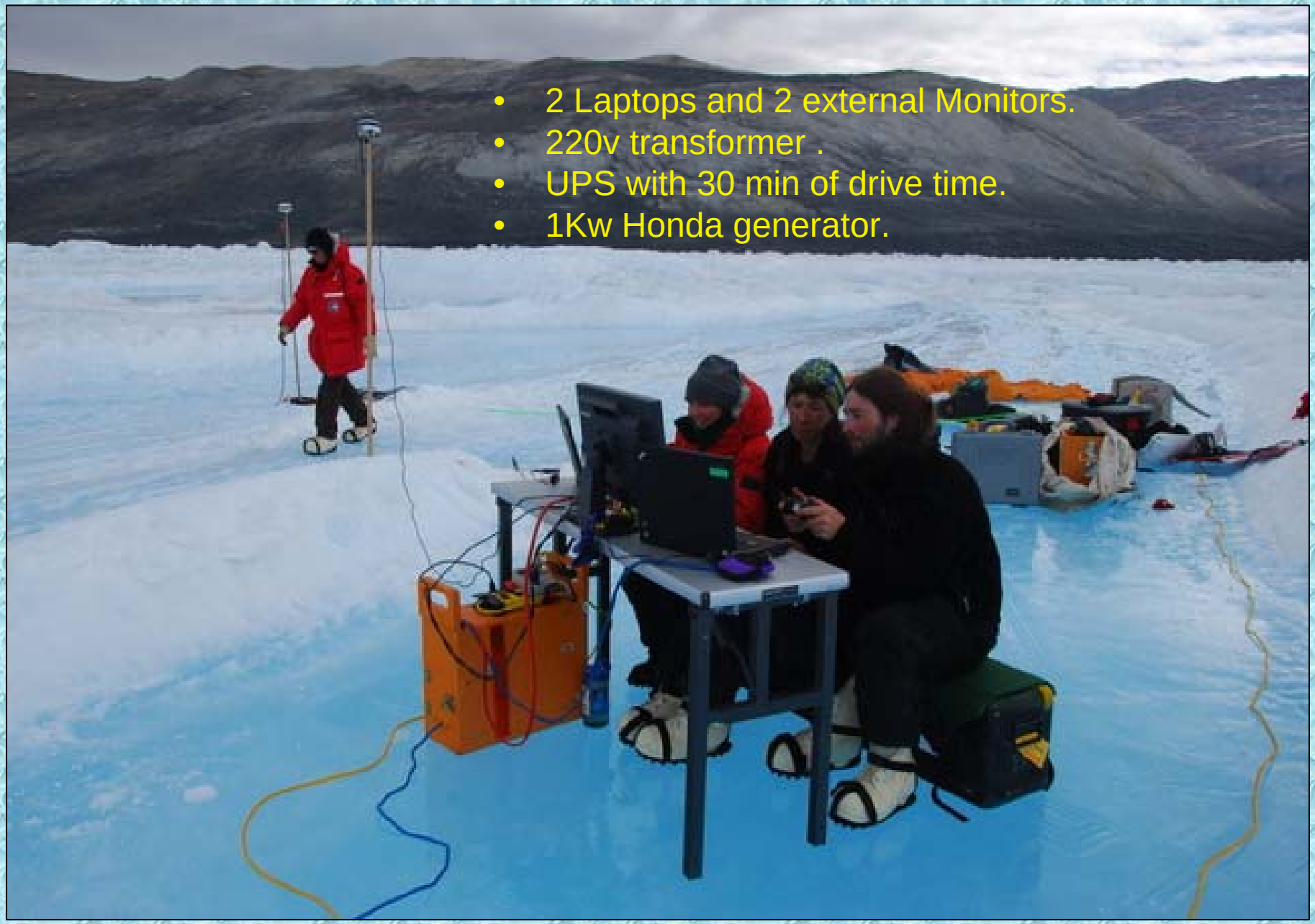
The Need for SCINI

Existing technology limits access to the liquid sea.


SCINI
uses a
small hole
|--15cm--|
|----20cm----|


1. 4m
SC
IN
I

300kgs deployment weight.
Fits into a Helicopter.
Or Man hauls nicely.

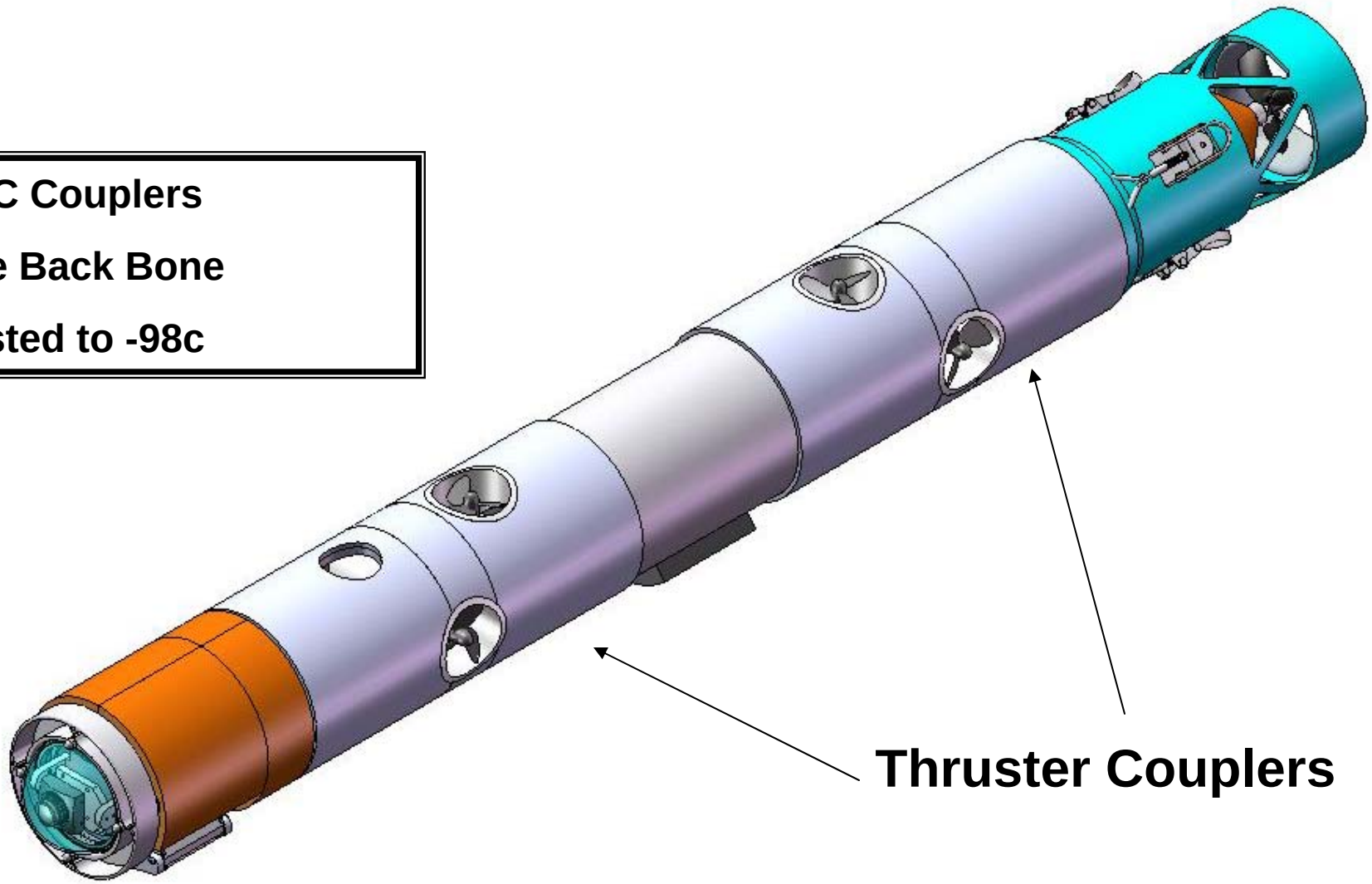

• 2 Laptops and 2 external Monitors.
• 220v transformer .
• UPS with 30 min of drive time.
• 1Kw Honda generator.

SCINI External Anatomy

PVC Couplers

The Back Bone

Tested to -98c

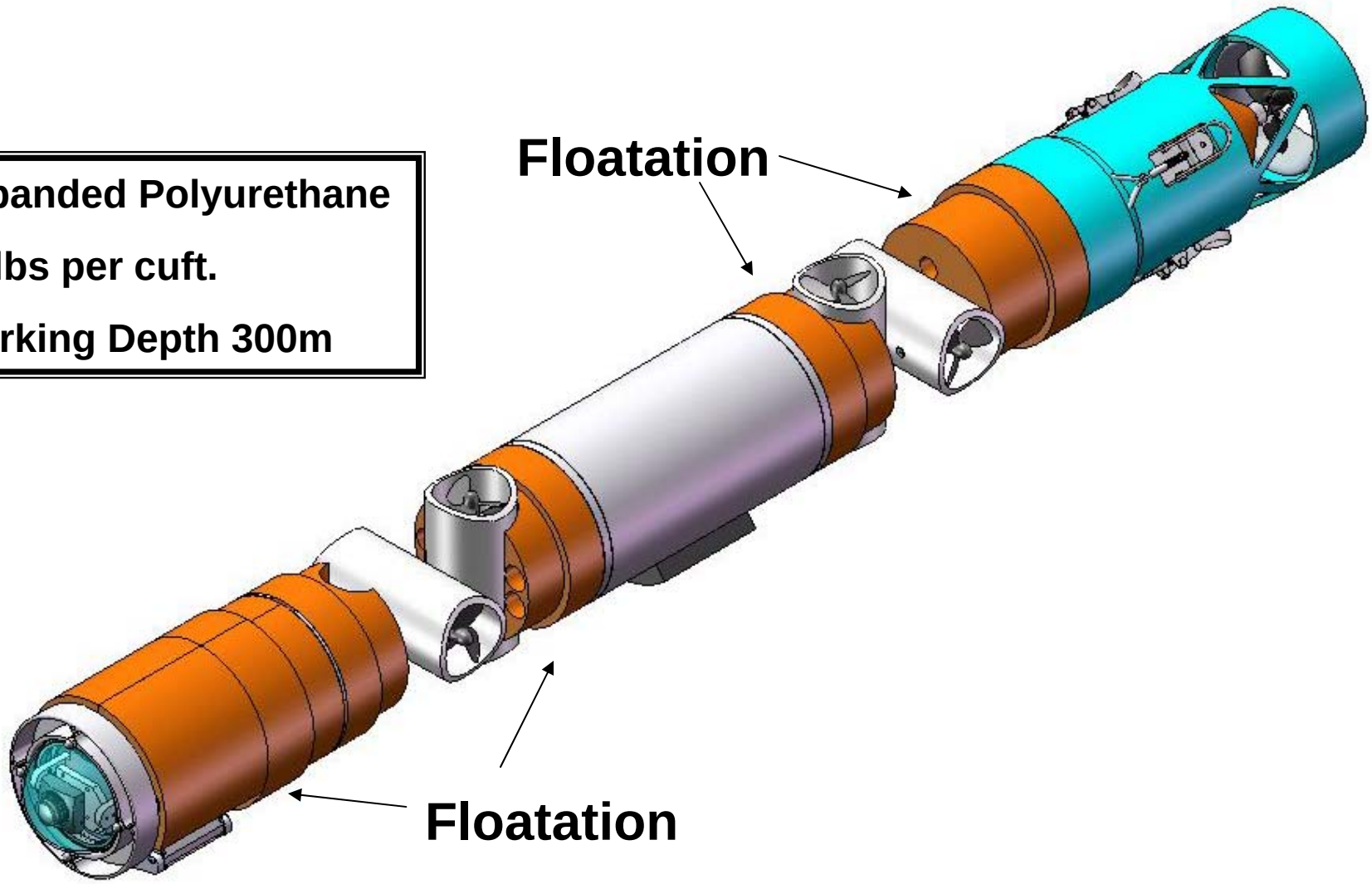


SCINI External Anatomy

Expanded Polyurethane

18 lbs per cuft.

Working Depth 300m

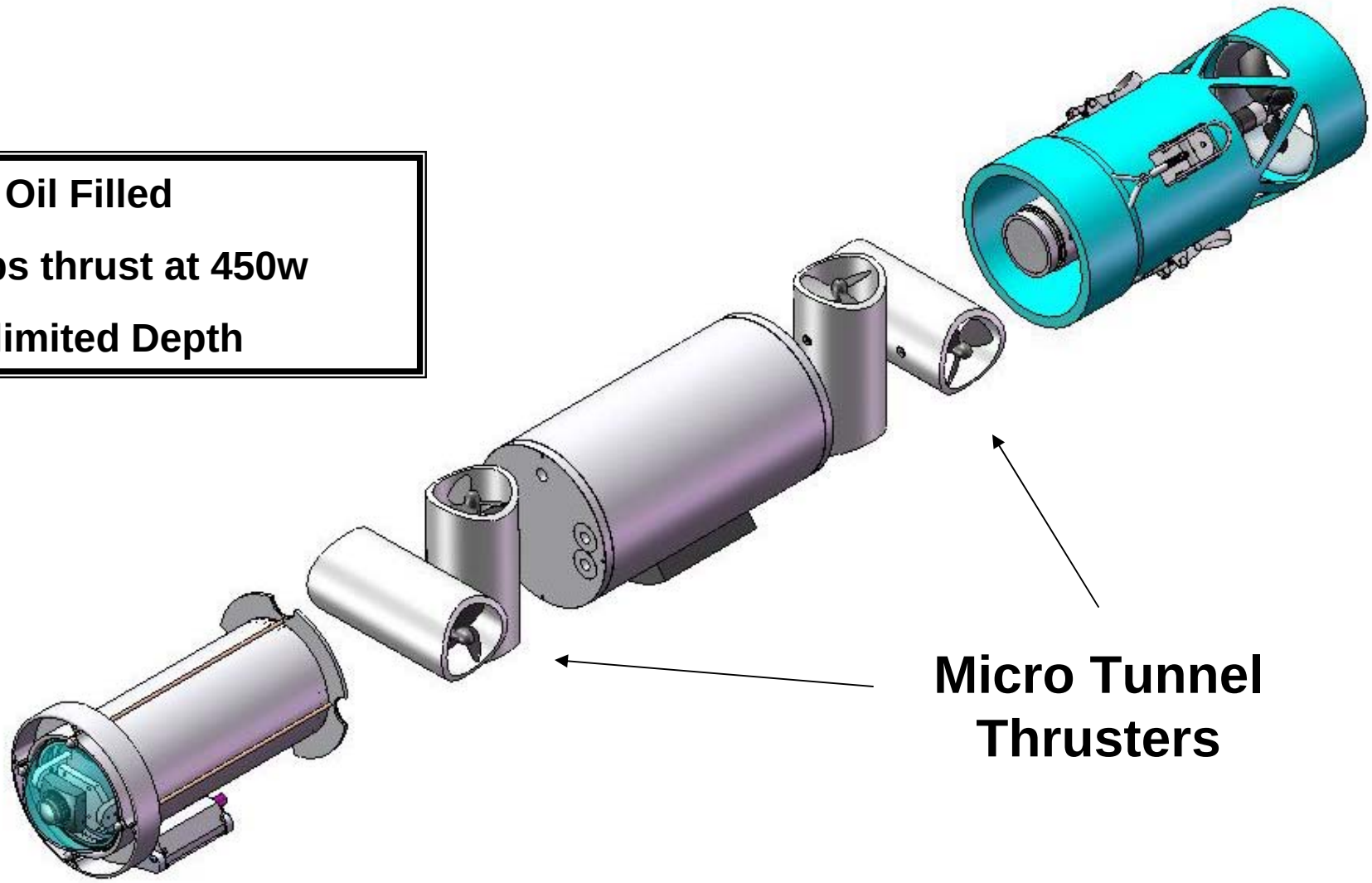


SCINI External Anatomy

PC Oil Filled

7 lbs thrust at 450w

Unlimited Depth

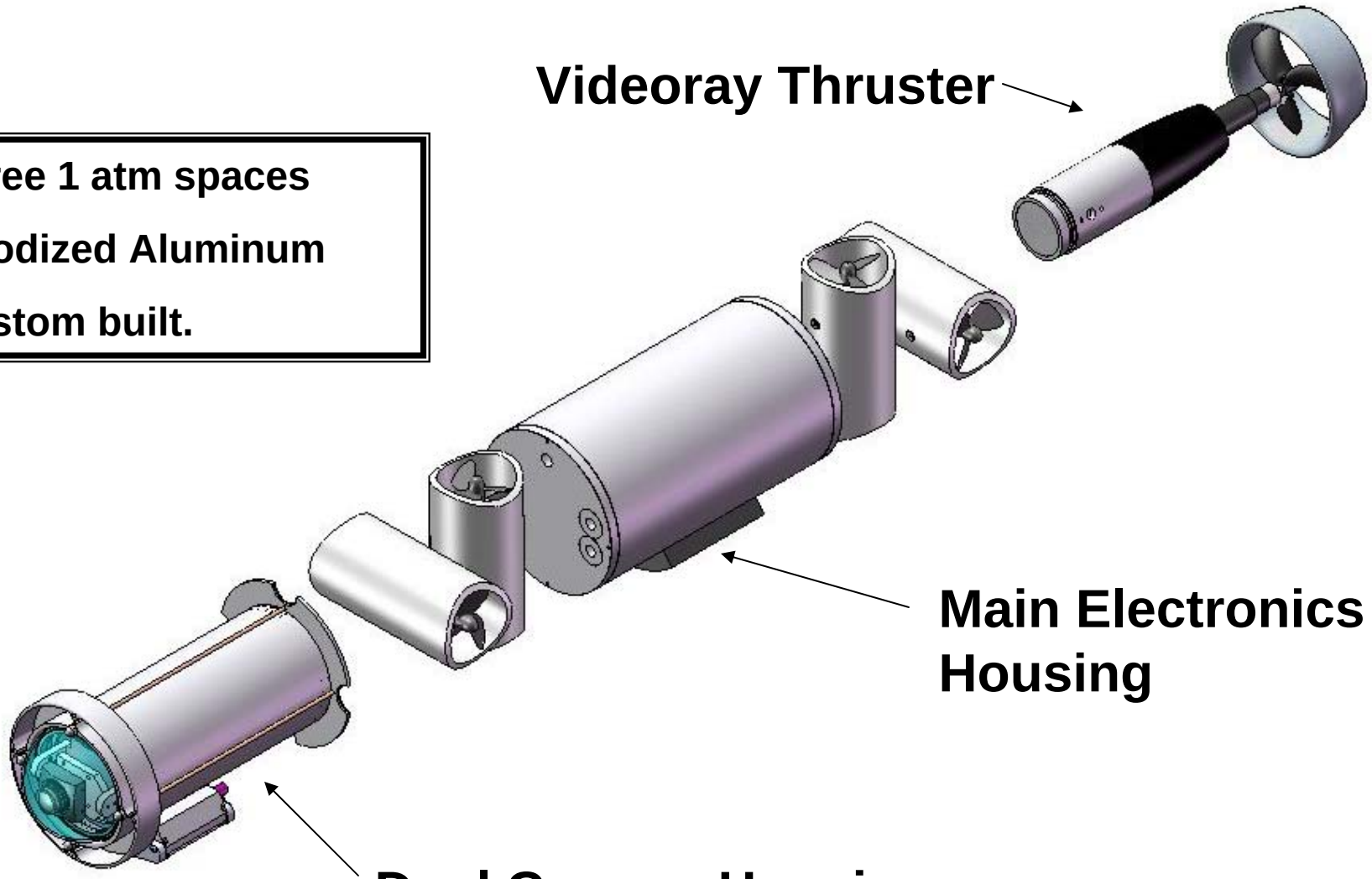


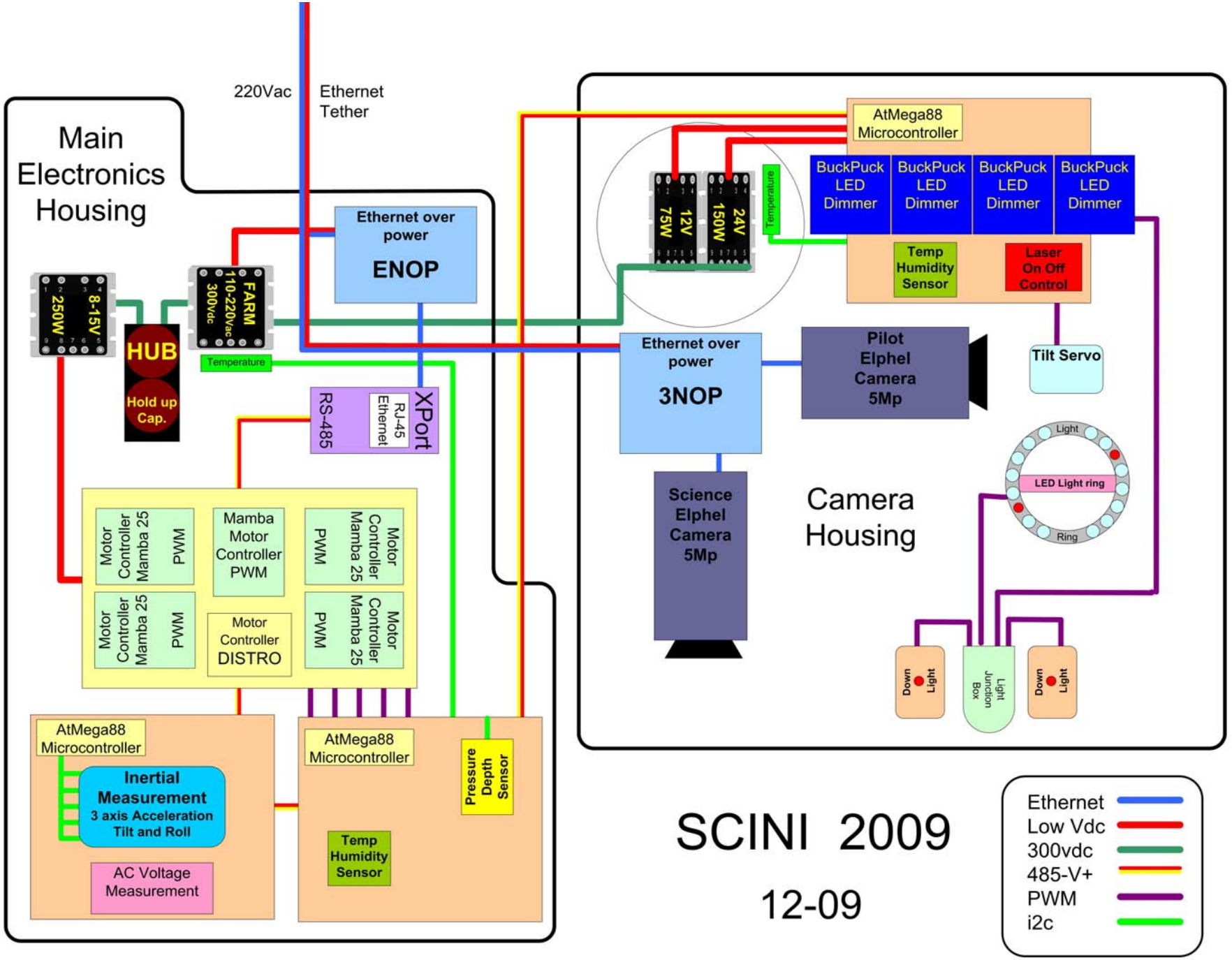
SCINI External Anatomy

Three 1 atm spaces

Anodized Aluminum

Custom built.




Main Electronics Housing
220Vac
Ethernet Tether
Ethernet over power
ENOP
250W
8-15V
HUB
Hold up Cap.
FARM
110-220Vac
300Vdc
Temperature
RS-485
RJ-45 Ethernet
XPort
Motor Controller Mamba 25
PWM
Mamba Motor Controller PWM
Motor Controller DISTRO
AtMega88 Microcontroller
Inertial Measurement
3 axis Acceleration
Tilt and Roll
AC Voltage Measurement
Temp Humidity Sensor
Pressure Depth Sensor
75W
12V
150W
24V
Temperature
AtMega88 Microcontroller
BuckPuck LED Dimmer
Temp Humidity Sensor
Laser On Off Control
Ethernet over power
3NOP
Pilot Elphel Camera 5Mp
Tilt Servo
Science Elphel Camera 5Mp
Camera Housing
Light
LED Light ring
Ring
Down Light
Light Junction Box
Down Light
SCINI 2009
12-09
Ethernet
Low Vdc
300vdc
485-V+
PWM
i2c

Take Home Concepts

2wire Tether 220VAC and Ethernet.

EtherNet Over Power "ENOP".

2 Elphel 5Mp Ethernet Cameras.

Model Car Motor Controllers.

3 Axis Accelerometer + Tilt and Roll.

Distributed Processing 3 Controllers.

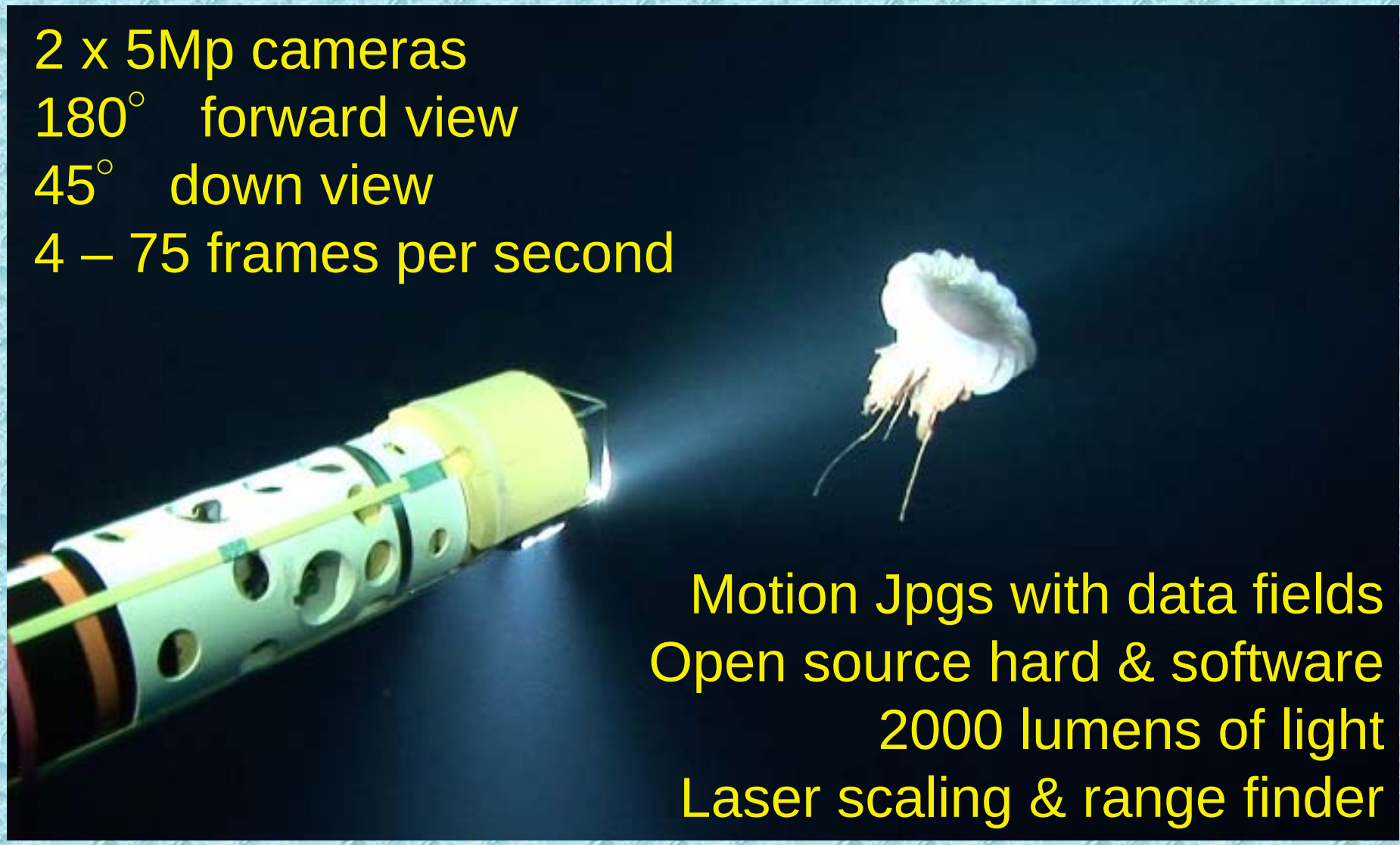
RS-485 and I2C Data Buses.

Depth, Humidity, AC Voltage & Temperature

This Science Is All About Cameras

The Elphel Cameras

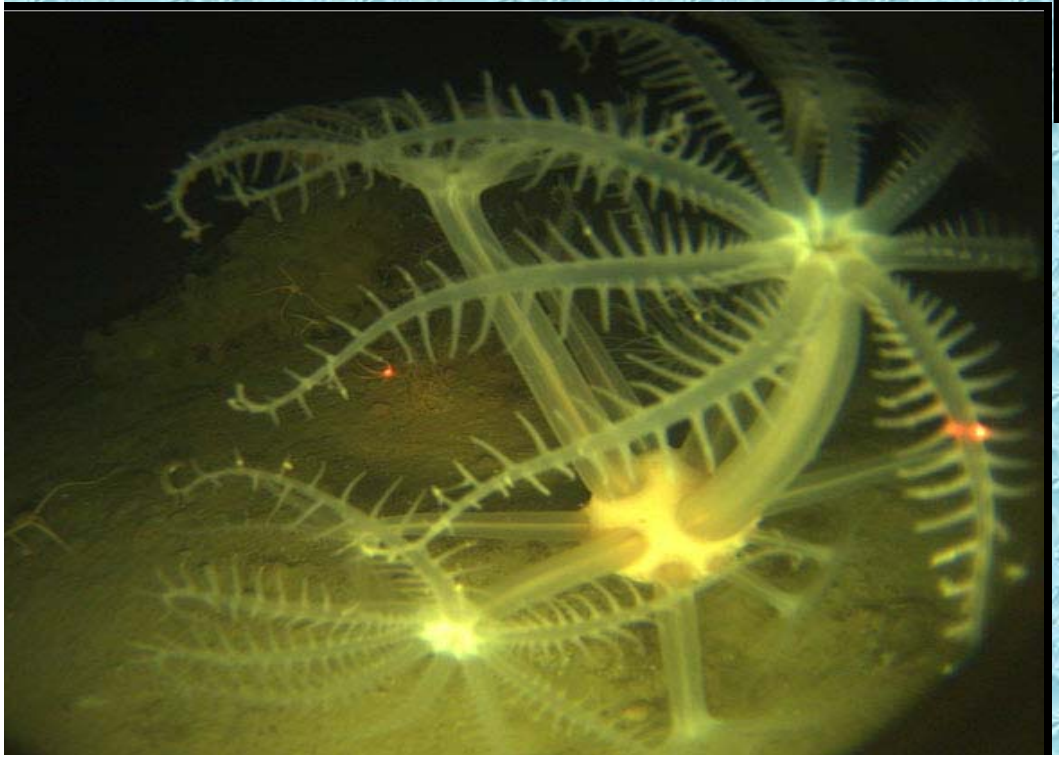
2 x 5Mp cameras
180° forward view
45° down view
4 – 75 frames per second



Motion Jpgs with data fields
Open source hard & software
2000 lumens of light
Laser scaling & range finder

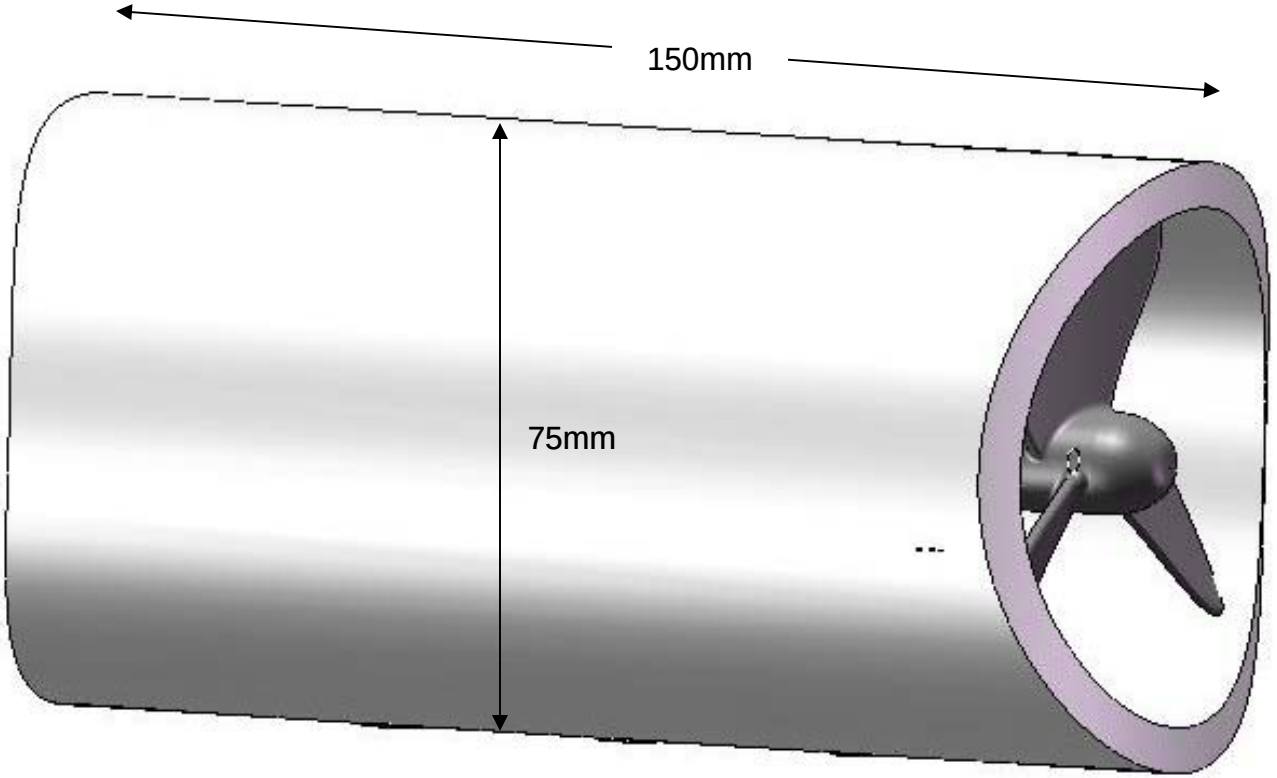
The first picture taken with the down looking camera.

Low distortion.

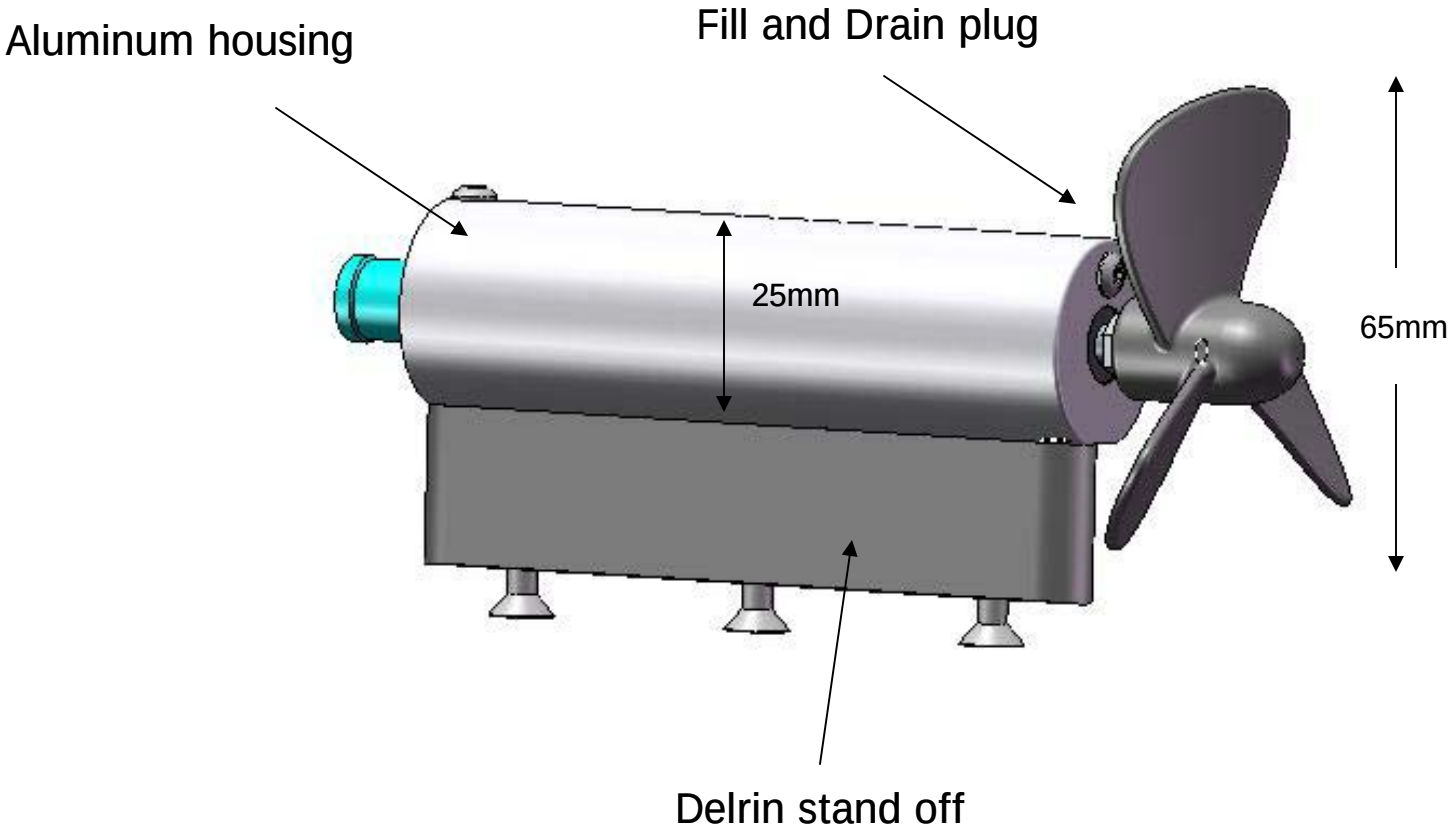


Fish eye forward view
200m deep
Under the McMurdo shelf
Rare shallow Octocoral
Note the scaling Lasers

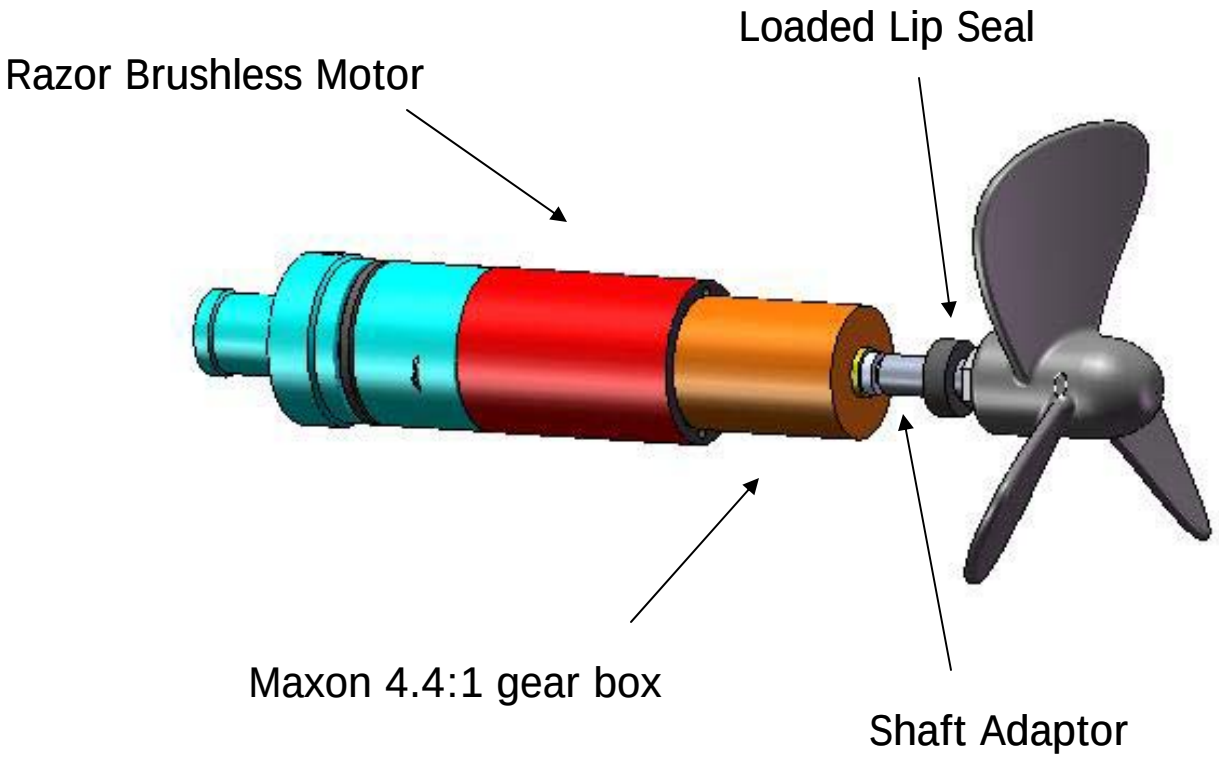
Micro Tunnel Thrusters



Model Boat Props



Model Helicopter Motors

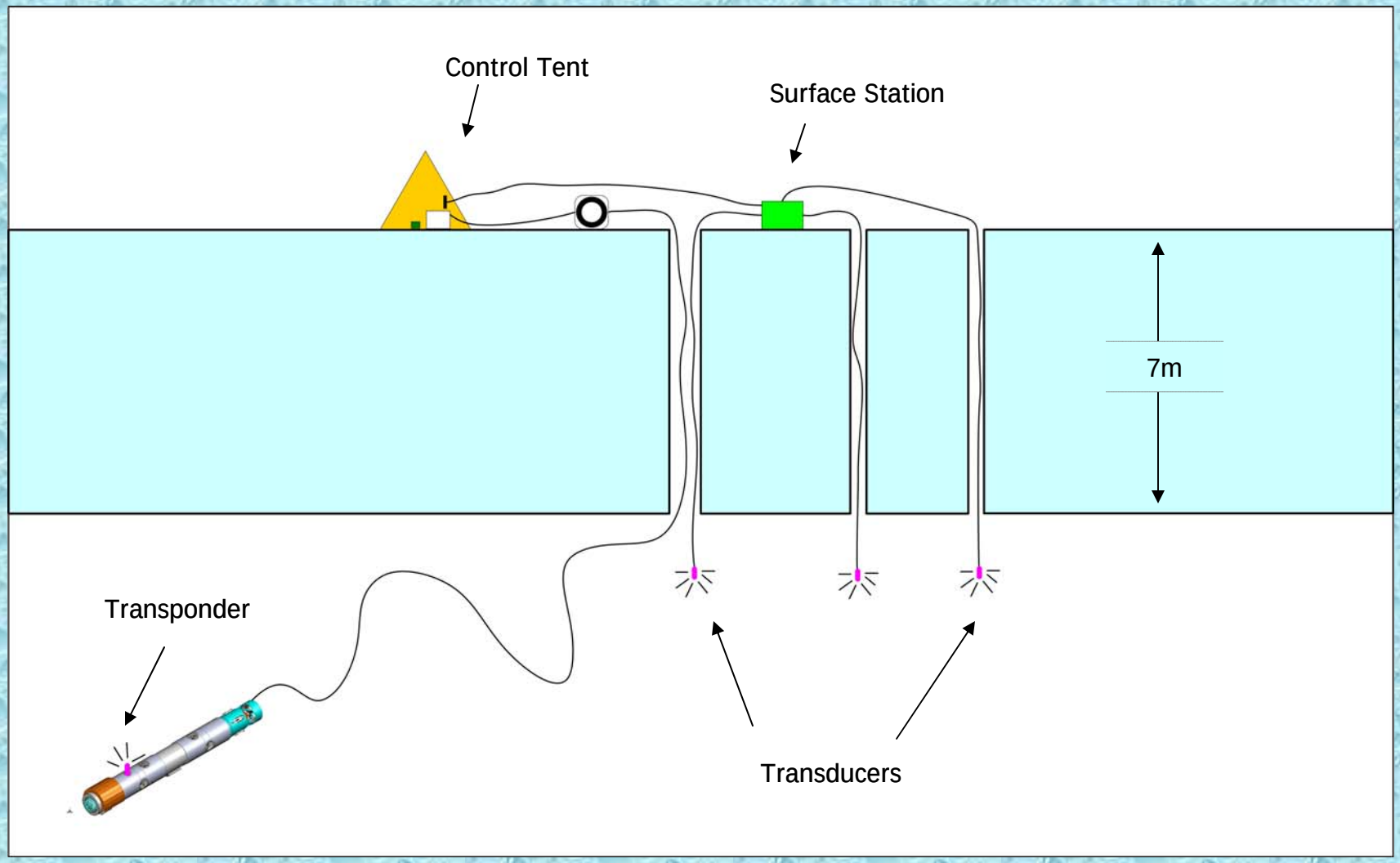


Thruster Specifications

- 3 phase sensor less brushless
- 450 watts = 7lbs thrust
- Soon to be sold by Videoray

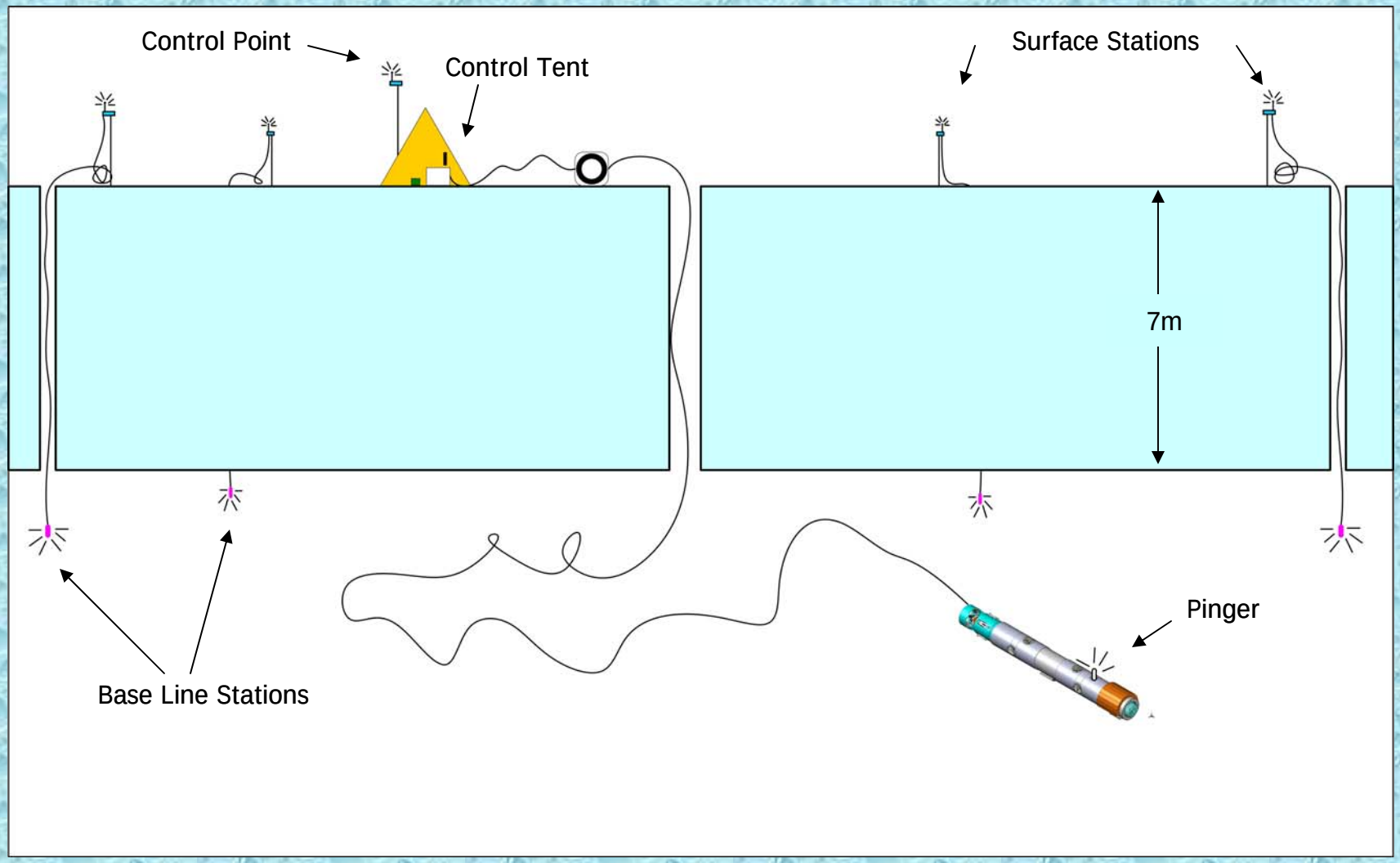
Pilot SBL Navigation System

by Desert Star Systems

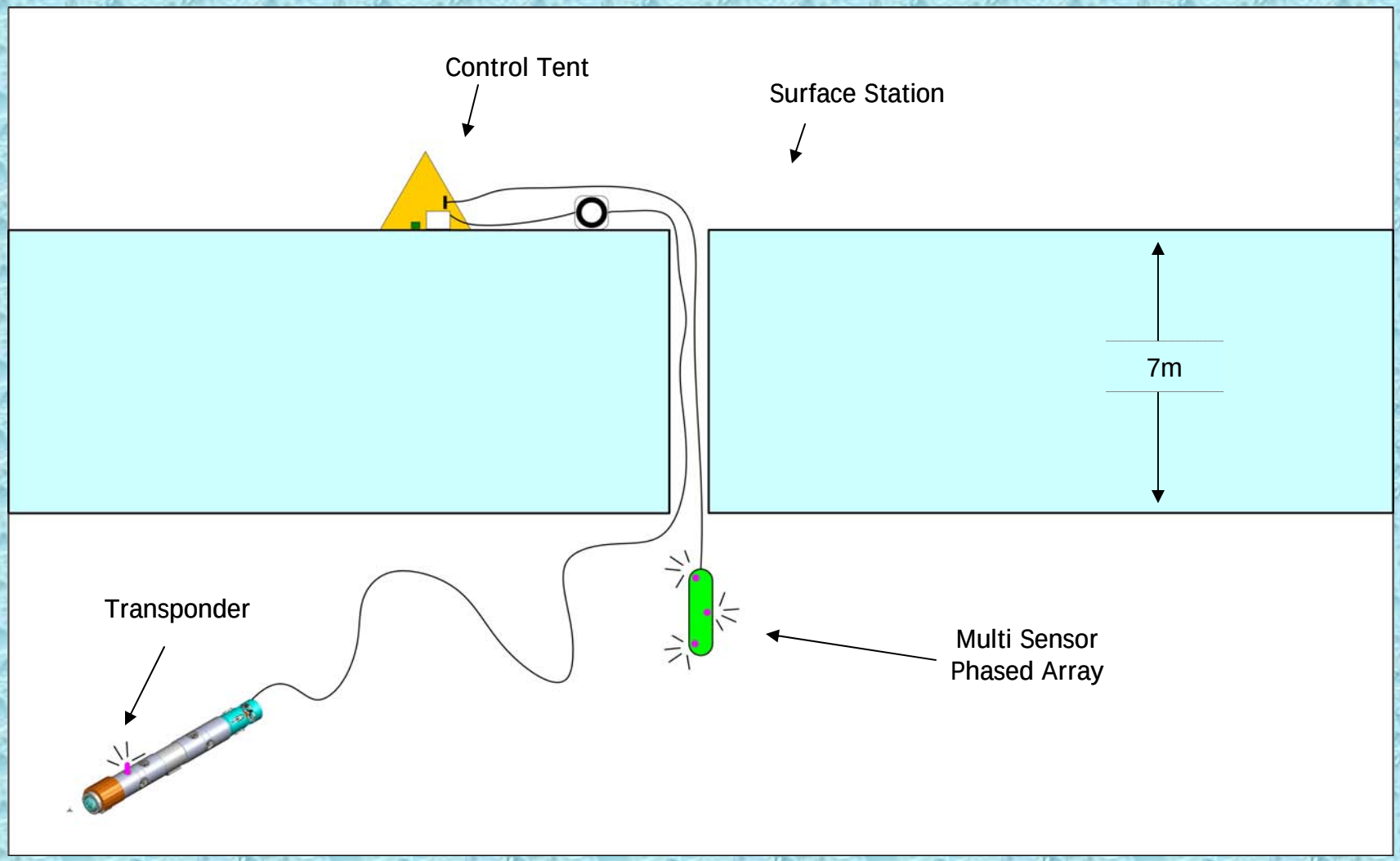


South Star SBL Navigation System

by Desert Star Systems



USBL Navigation System



Navigation

We prefer wireless SBL “South Star”

Wired SBL “Pilot” has depth limitations

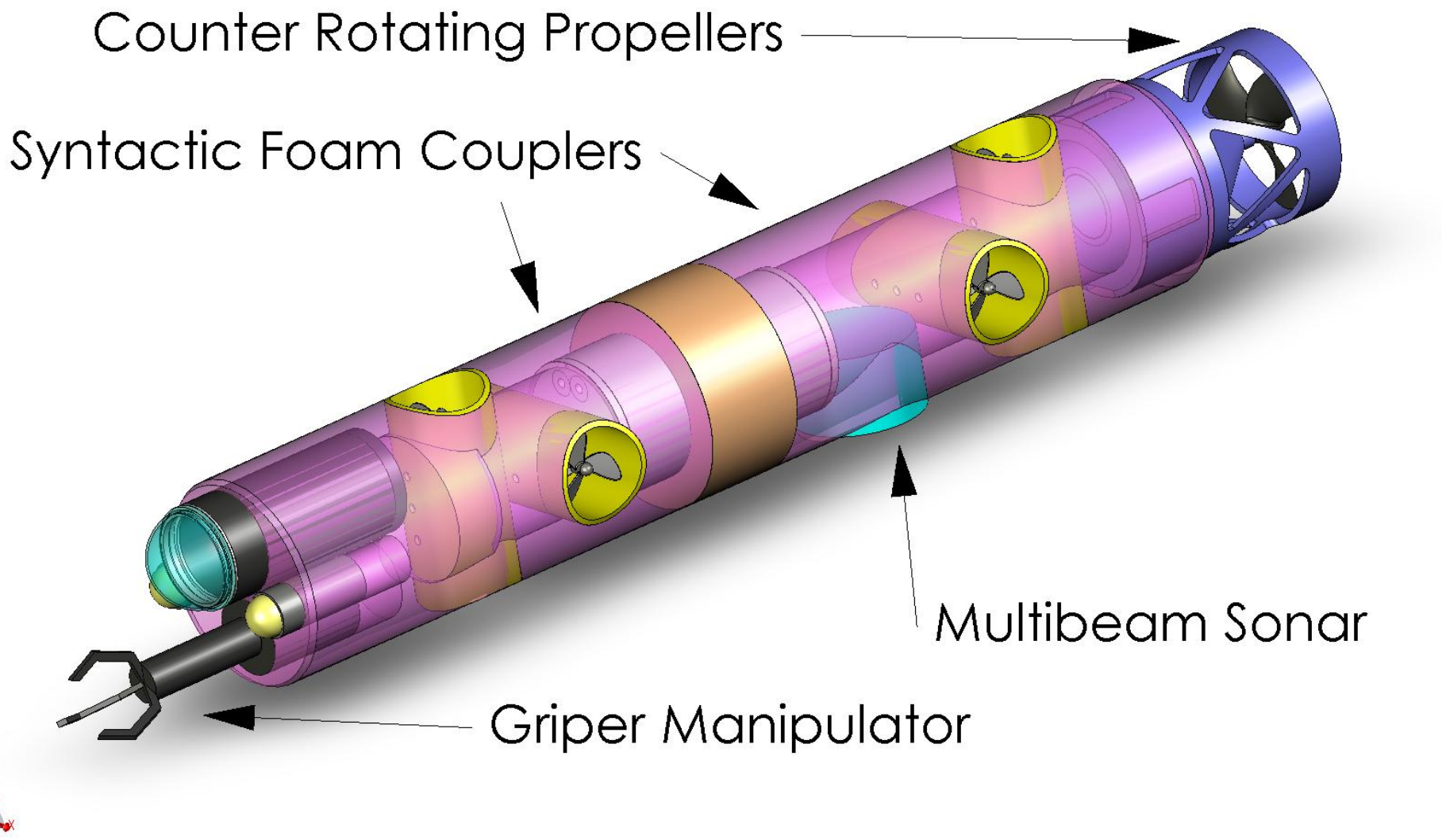
USBL relies on a compass, wont work!

Performance

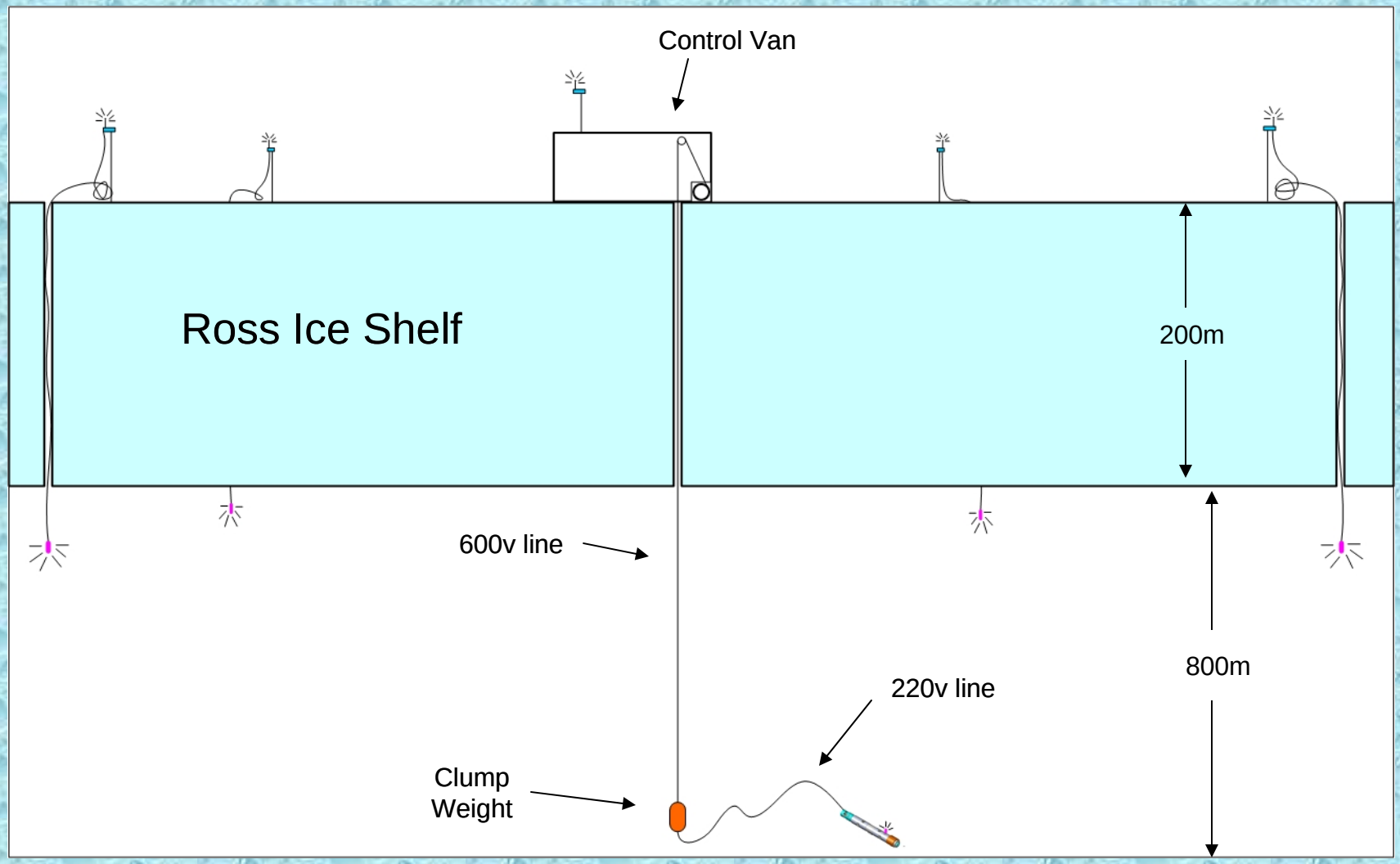
2 Complete units 3rd spare parts.
332m depth reached.
8.5 hour max dive time.
Penetrated 13m of sea ice.
And 90m glacier ice "crack access".
Located a lost experiment.
Documented Iceberg scours.
Found deep Crinoid habitats.
Transected at 22 sites at 8 depths each
Under ice shelf habitat photos.
Chased by 2 Antarctic Cod.
90 pilots in training "open house"

2008 Perfect Season

The Future of SCINI??



SCINI Deep


Control Van
Ross Ice Shelf
200m
600v line
800m
220v line
Clump
Weight

SCINI Goals

To locate new research sites and assess their suitability with minimal logistic costs.

To quantify depths below SCUBA diving limits.

To locate the lost experiments

Research questions

- What lives here, especially in deeper waters? New species are still being discovered!
- How do humans impact this environment?
- How do communities change over time - with and without human impacts?

The Lost Experiments

- Begun in the early 1960s by Dr. Paul Dayton from Scripps.
- Experiments located at depths up to 60 m.
- Experiments were not completed because diving safety limits of 40 m were later established.


Thank You!