

RBR

Welcome, the RBR Webinar will begin shortly...



A decorative graphic consisting of several parallel diagonal lines in shades of gray, extending from the left side of the slide towards the right, partially overlapping the text area.

Using waves and power efficient loggers for autonomous profiling

Greg Johnson, Drew Lucas

Future Webinars



Ping the President - Getting the most out of your RBR instrumentation Q&A

Greg Johnson (RBR)
Sep 24 at 11AM AEST



[Past & Future Webinars - https://rbr-global.com/about-rbr/webinars](https://rbr-global.com/about-rbr/webinars)

RBR



Outline

Sensor system – RBRconcerto CTD++

Mechanical system – DMO WW

Data & Telemetry system – RBRcervello, datahosting

Science



C.T.D.+
≤ 7
Channels



C.T.D.+
≤ 2
Channels



C.T.D



Compact
Logger



Sensors



Product Family

Compact instrument

- RBRsolo T/D/DO/PAR
- RBRduet T.D
- tide and wave variants
- Up to 30M readings on any AA battery

Standard instrument

- RBRvirtuoso (1 channel)
- RBRduo (2 channels)
- RBRconcerto (3-5 channels)
- RBRmaestro (6-10 channels)
- Up to 240M readings on 8x any AA battery
- External Comm options

RBR

One app to rule them all: Ruskin



RBR

Greg Johnson

RBR Ltd



RBR

Sensor	Accuracy
Conductivity	± 0.003 mS/cm
Temperature	± 0.002 °C
Depth	$\pm 0.05\%$ FS

RBRconcerto³ C.T.D

240 million readings, up to 32Hz sampling

750m, 2000m, and 6000m ratings

USB-C download

Twist Activation and Wi-Fi

Direction dependent sampling

Any AA

USB-C



RBR



RBRconcerto³

C.T.D.++

240 million readings, up to 16Hz sampling

750m, 2000m, and 6000m ratings

USB-C download

Twist Activation and Wi-Fi

Direction dependent sampling

Any AA

USB-C

Up to 2 additional sensors (e.g. Tu, DO, PAR, Fl, etc.)

RBR



RBRmaestro³

C.T.D++

240 million readings, up to 16Hz sampling

750m, 2000m, and 6000m ratings

USB-C download

Twist Activation and Wi-Fi

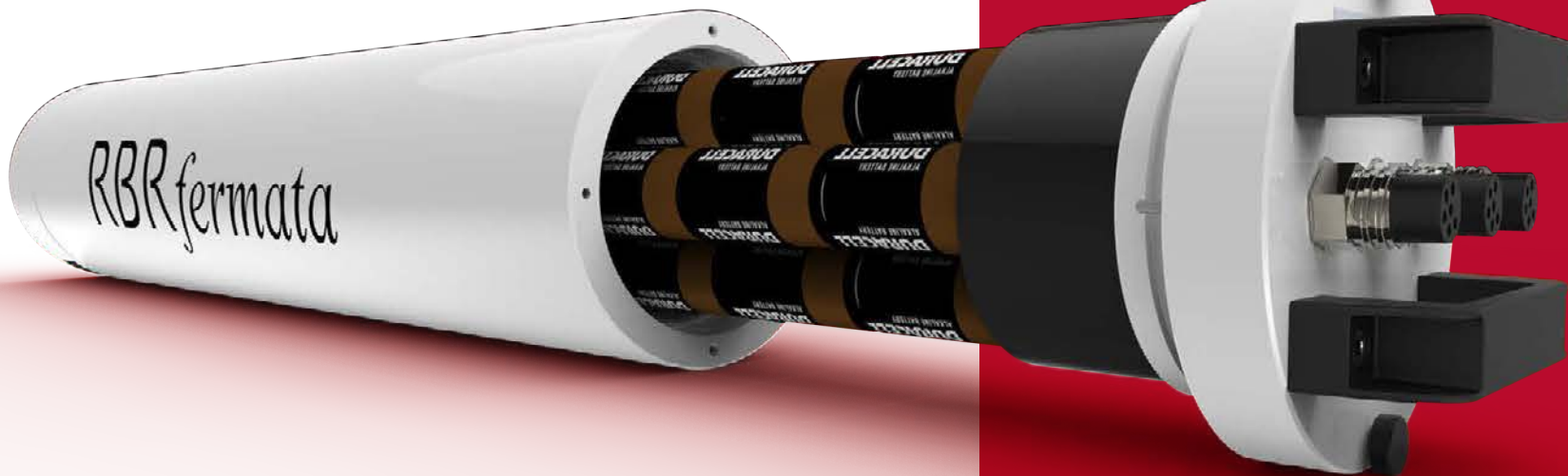
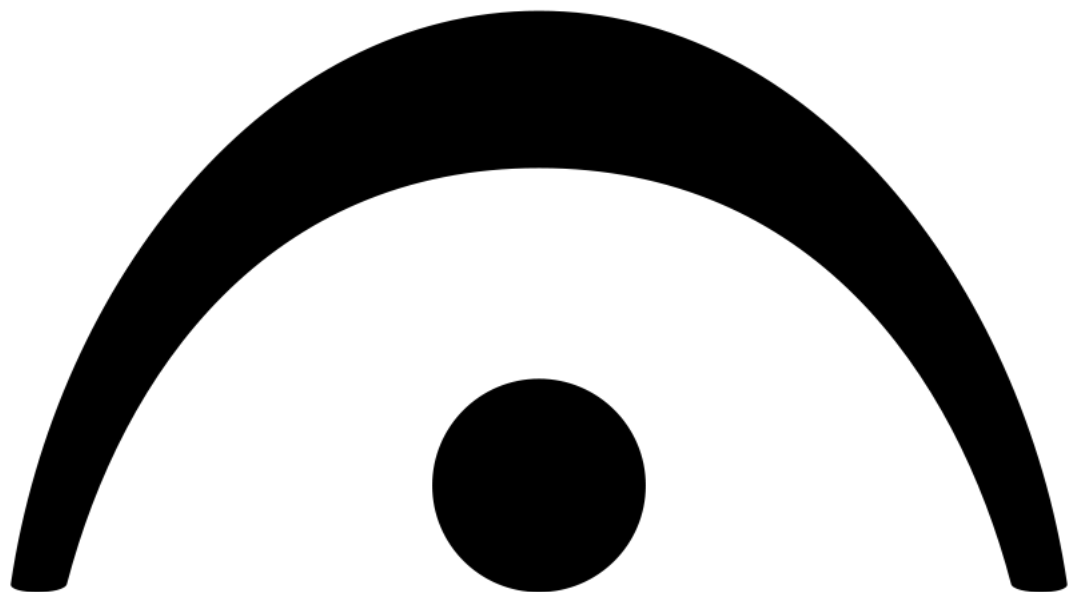
Direction dependent sampling

Any AA

USB-C

Up to 7 additional sensors (e.g. Tu, DO, PAR, Fl, etc.)

RBR



RBR*fermata*

“to prolong beyond the normal duration”

56 D-cell pack

1kWh alkaline

3kWh lithium

drawings included for your own pack construction

RBR

Drew Lucas

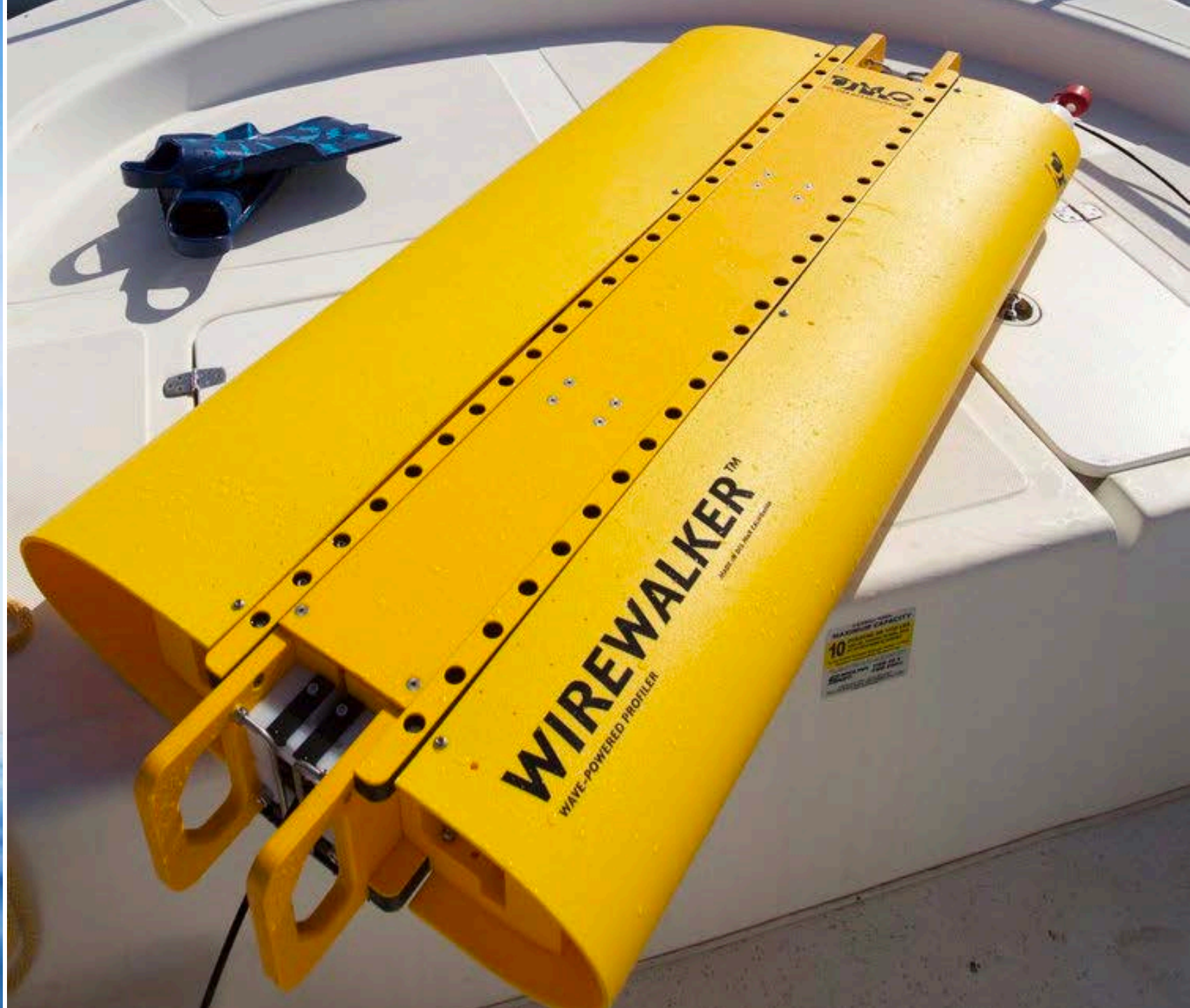
SCRIPPS / DMO



RBR

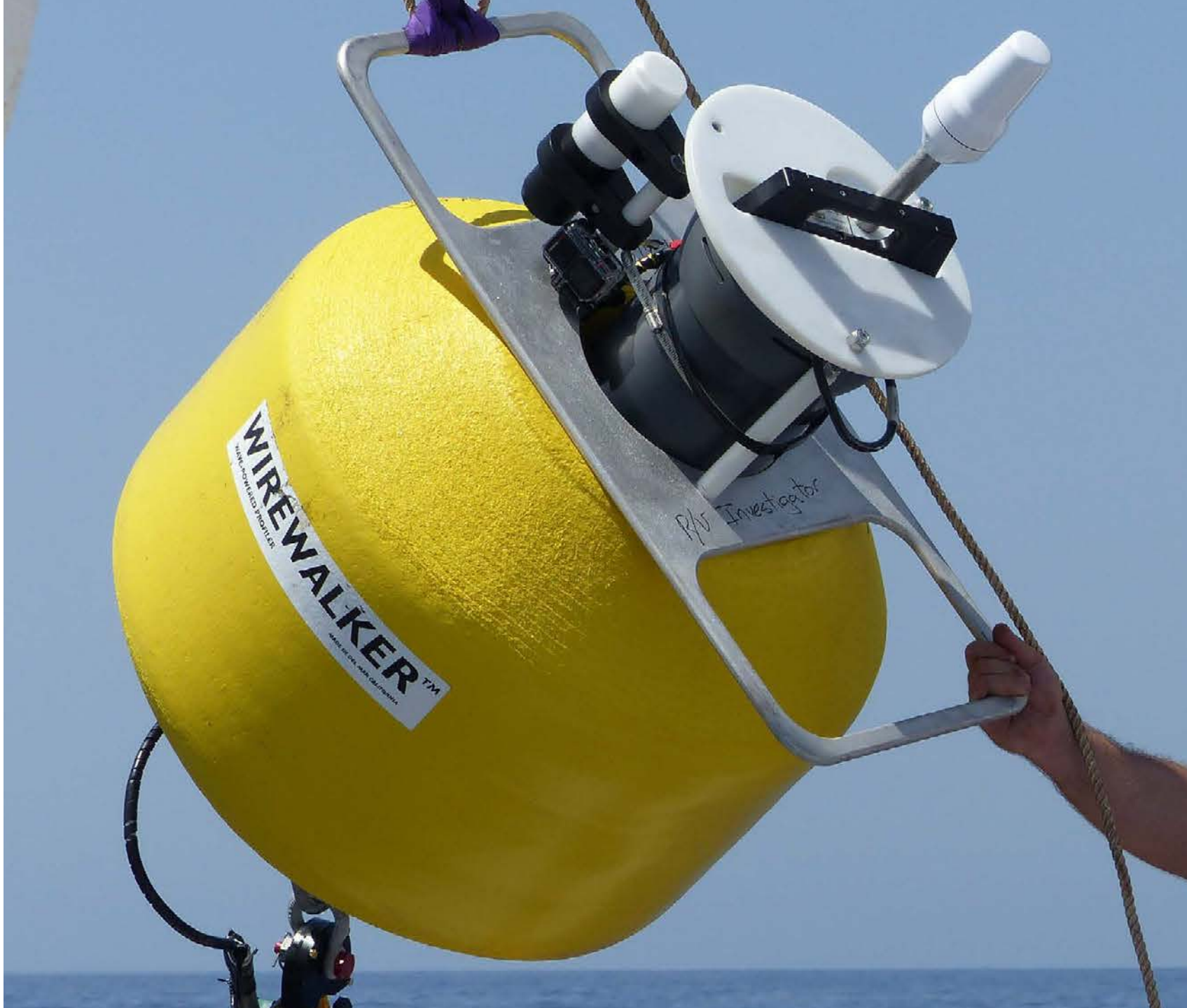
THE WIREWALKER

AN INTRODUCTION TO
WAVE POWERED
PROFILING



SURFACE BUOY

36" (0.9m) Diameter
600lb (275kg) of
Buoyancy
10" (0.25m) Dia. Well
GPS Beacon
Flasher



JACKETED WIRE ROPE

3/16" (5mm) Diameter
Wire Terminations
Standard or
Hammerhead
Turnaround Stopper
Assemblies



SUSPENDED WEIGHTS

2 x 45lb (20kg) weights

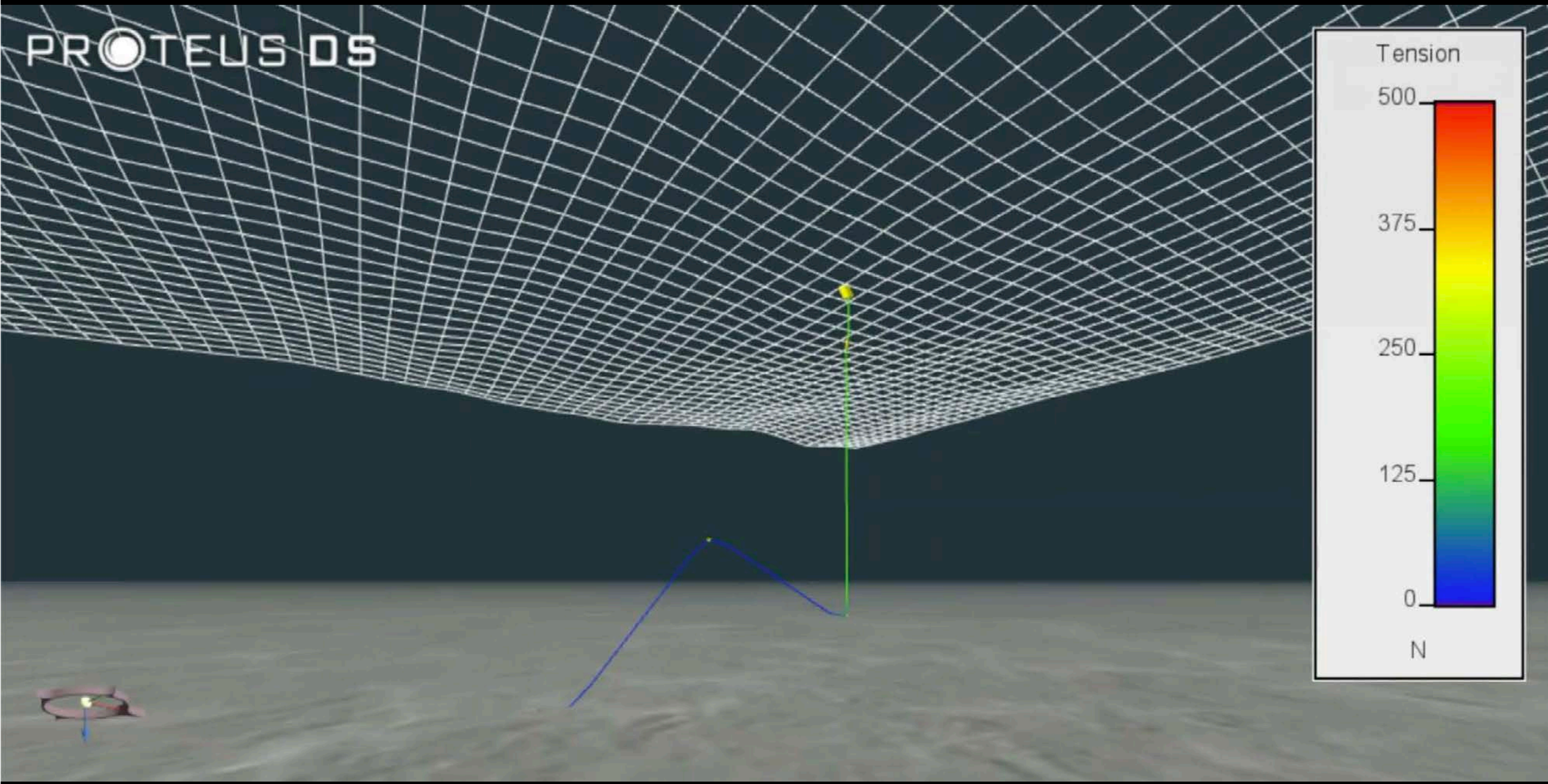
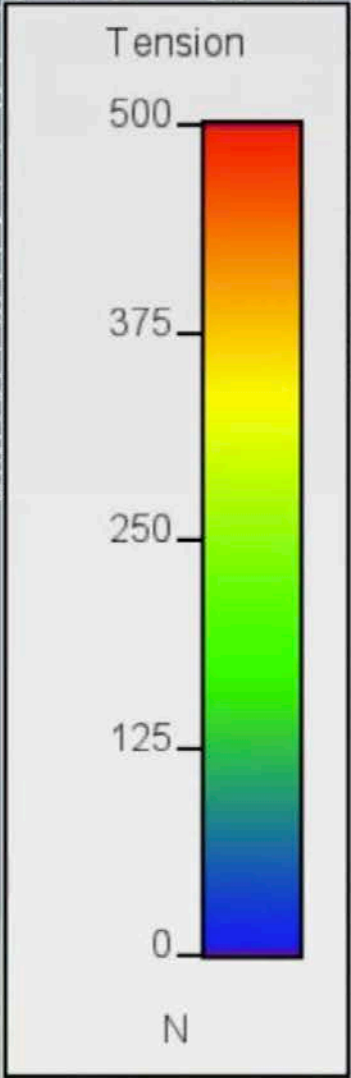


WIREWALKER PROFILER

Dims: 62" x 24" x 6.5"
Rapid Profiling
Zero Power
Decoupled on Ascent
Free-Drift or Moored
Protective Cowlings



PROTEUS DS

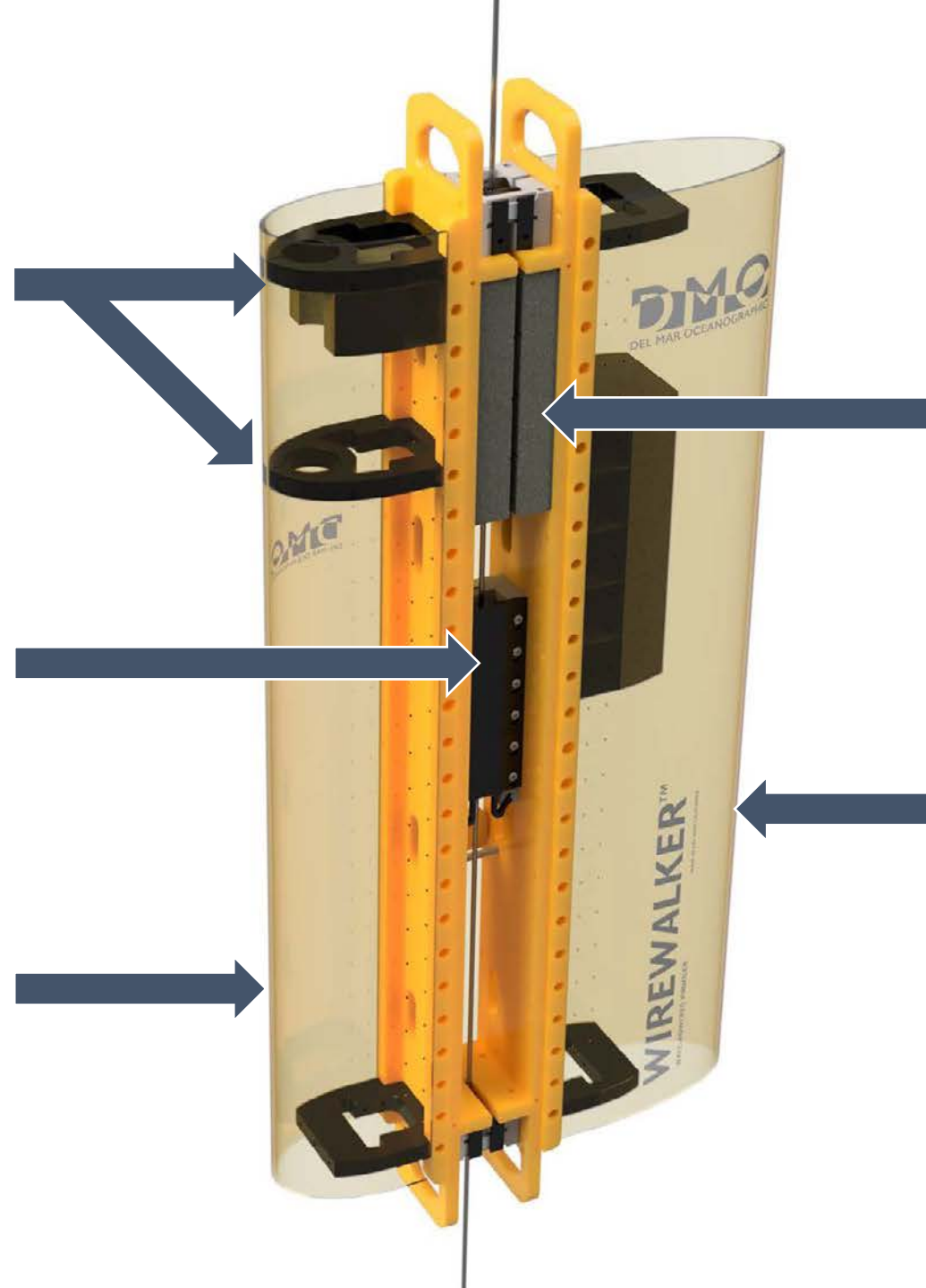


Wirewalker Animation | By Melissa Omand and Colleen Durkin

Customized
Instrument
Clamps

Profiling
Cam

Leading Edge
Cowling



Wirewalker
Buoyant Foam

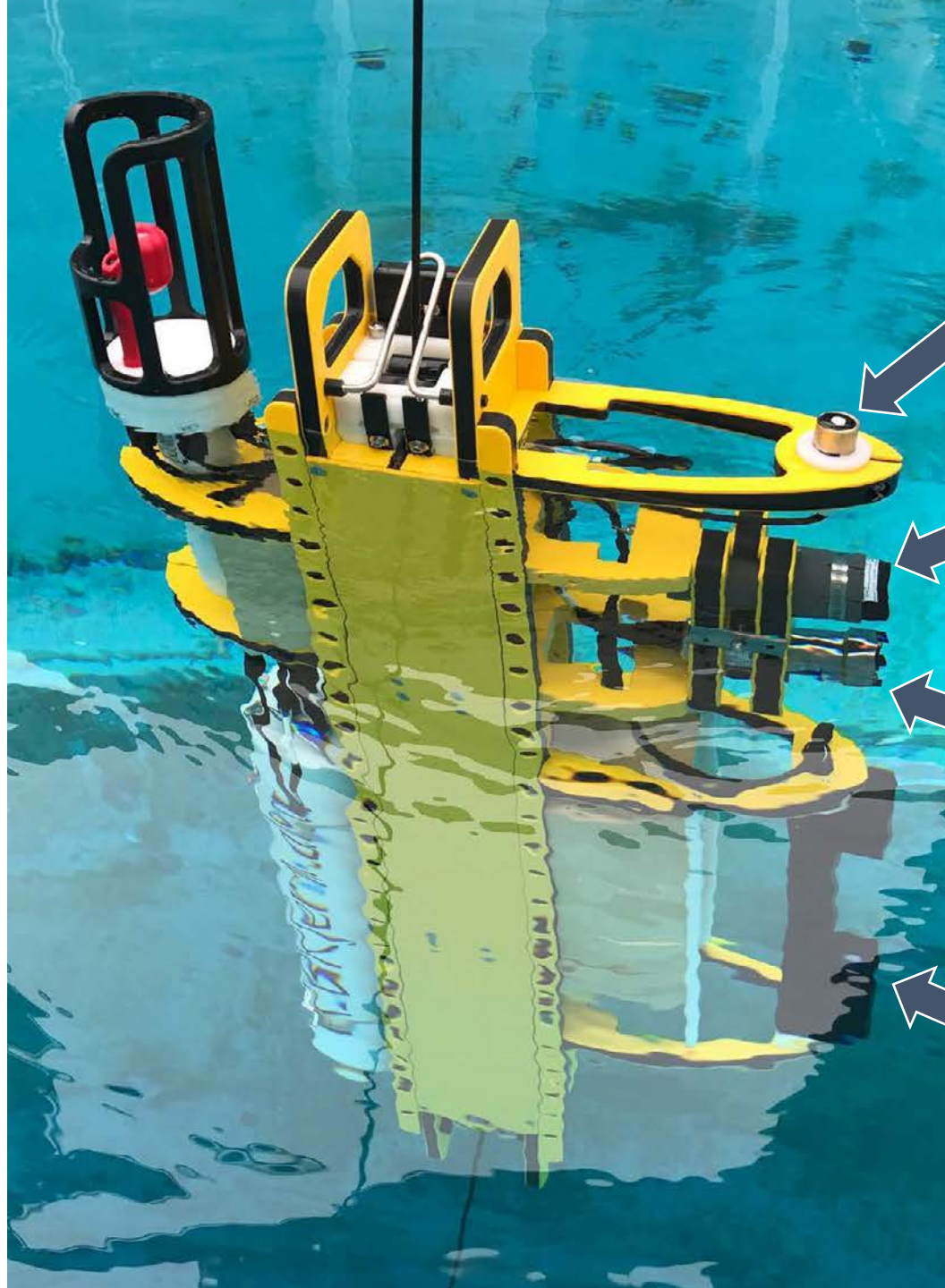
Trailing Edge
Cowling

Wirewalker
Buoyancy

RBRfermata
(Batteries)



CTD
*Facing Up



PAR

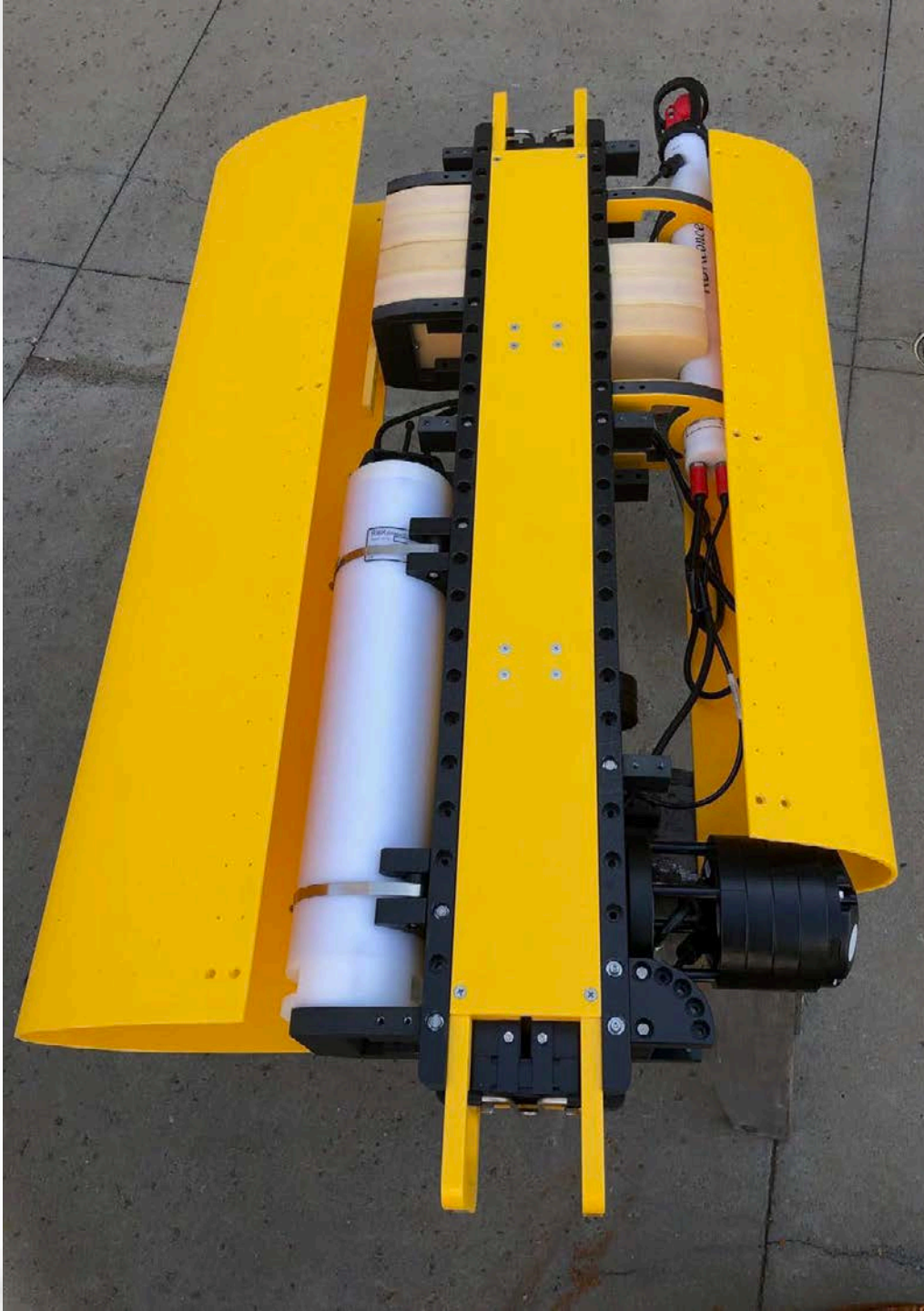
Optical
Fluorometer

Dissolved
Oxygen

Trans-
missometer



Photo: Karin Björkman, UH Manoa



WIREWALKER SUMMARY

Zero Power
Rapid Profiles
Decoupled on Ascent
Flexible Payload
Numerous Scientific
Applications



APPLICATIONS

- Biophysical Interactions
- Biogeochemistry
- Ocean mixing
- Microstructure
- Internal Waves
- Harmful Algal Blooms
- Oil Response & Science
- Plume Monitoring
- Aquaculture
- Tactical Oceanography
- Limnology

Greg Johnson



RBR



Surfacing the data

Inductive modem to get the data from WW to buoy

4800 baud

Transparent modem

Robust to intermittent drop-outs (damaged cable)

Fast enough to get 8Hz five channel data up

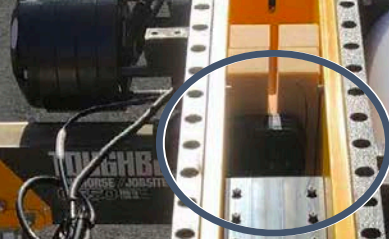
Jacketed mooring line

Hammerhead



RBR

ADCP



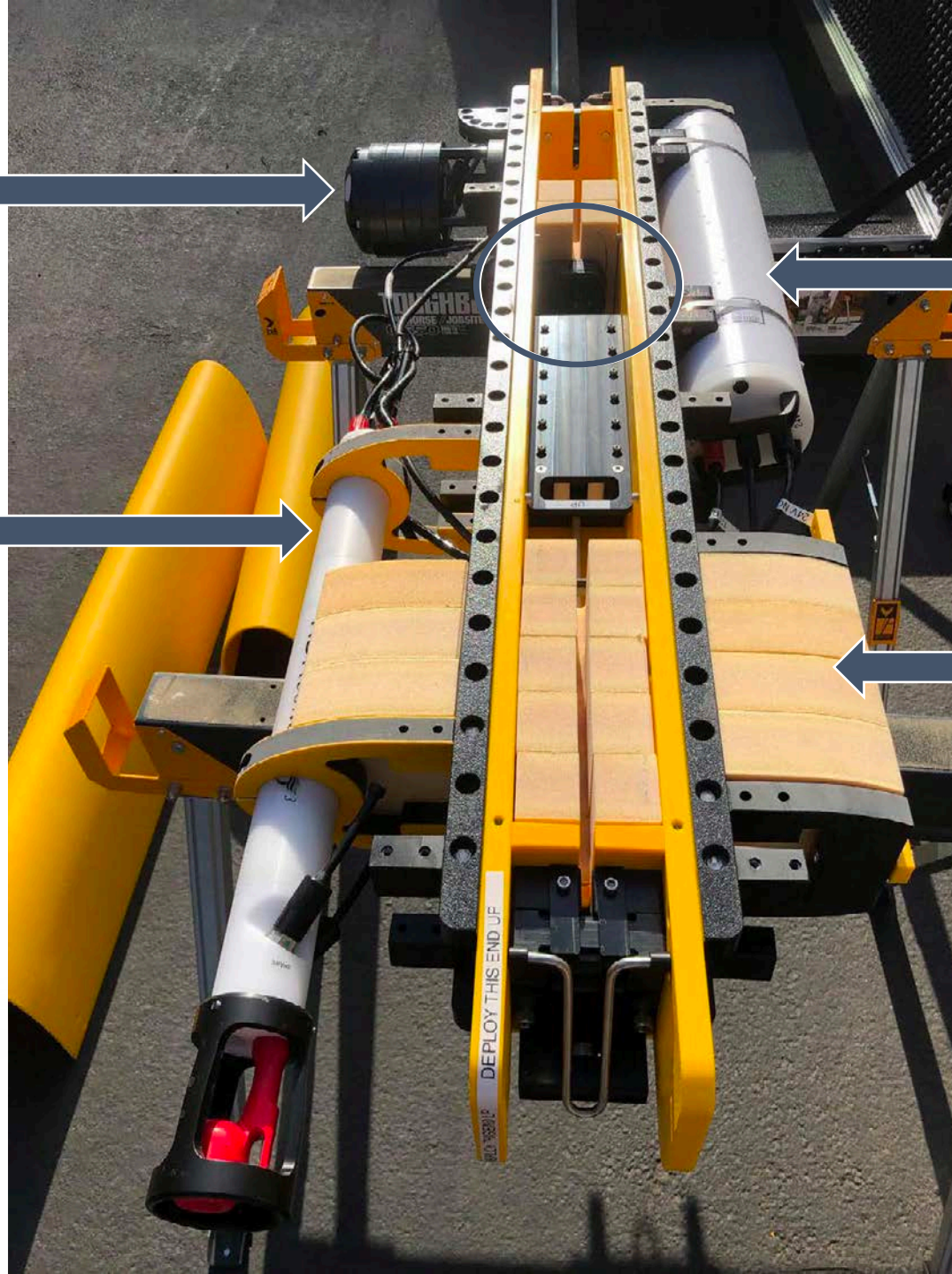
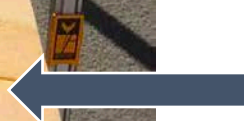
RBRfermata
(Batteries)



RBRssm
attached to
RBRconcerto



Wirewalker
Buoyancy



Buoy induction





Topside

RBRcervello – the brains of the operations

Hands off operation – power and go

Internal storage

USB stick transfer for download

USB stick transfer for deployment changes

GSM when in range

Iridium when not

Debug port

Inductive test loop included



R

Autonomy Engine

Predict your deployment length

Online access from anywhere

- Getting started
 - Required tools
 - Airtime
 - Configuration
 - Bench testing
 - Deployment calculator
- Features
 - Deployment management
- USB interface
 - Retrieving data
 - Applying firmware updates
 - Data Hosting
- Troubleshooting
 - Debug port
 - MLM troubleshooting
- Telemetry troubleshooting
 - GSM

RBR *cervello* Deployment Calculator

Parameters you'll likely want to change are shown in **bold**. Calculated/output values are shown in *italics*. Constant/measured values unlikely to change are shown in grey.

Instrument

Instrument deployment lifetime is calculated separately in Ruskin. However, in order to calculate the modem duty cycle (a prerequisite for estimating its power consumption), we must know some basic information about the instrument to know how much data it will produce.

Sample rate: 8 Hz

Number of channels: 3

Direction-dependent sample reduction: 50 %

Efficacy of direction-dependent sampling depends on configuration and deployment conditions. See [the Logger3 command reference](#) for details.

Data rate: 80 bytes/second

Mooring Line Modem

Whether a HEM is included in the system, and its means of attachment to the inductive loop, have a significant impact

GPS

Interval: 600 seconds

Activity duration: 60 s; power consumption: 0.15 W

Average power consumption: 0.04 W

Telemetry

Interval: 1800 seconds

Telemetry compression reduction: 80 %

The default reduction value – 80% – is based on empirical data collected across multiple deployments. It encompasses the effects of not only compression, but also real-world telemetry overhead from the messaging protocol (connection metadata, diagnostic data, message delimiters) and any repeated data transmitted due to telemetry drops/outages. Strictly speaking, the actual compression (quantization + differential encoding) is significantly more effective, but to show only the compression ratio would be a misrepresentation of the true amount of data transferred.

For GSM, use "-5%": no compression is used, but there is still protocol overhead which increases the payload size.

Data rate: 28800 bytes/telemetry session

Modem: Iridium RUDICS

Single-board Computer

Average power consumption: 0.60 W

Overall

Battery capacity: 1080 Wh

- RBR#0007569: 1080 Wh
- RBR#0002854: 360 Wh

Deployment life: 39.21 days

Average power consumption: 1.16 W

```
curl --location --remote-name --remote-header-name --compressed
'http://data.rbr-global.com/rbr/download/080296?from=2016-09-
08&to=2016-09-09'
```

Data at home

RBR data hosting service

GSM or Iridium feeds

Cloud hosting (both in North America and China)


Simple daily charts

API to pull data

curl example

shell scripts for periodic sync

easy to get all data to ship during cruise



Wirewalker Del Mar Oceanographic

RBRconcerto³ #066128 (IN2019_V06)

In use with [RBRcervello #202608](#) on [YMC](#) cruise [IN2019_V06](#).

Latest reading taken at 2019-11-08 05:35:05 (166 days 9:07:51 ago).

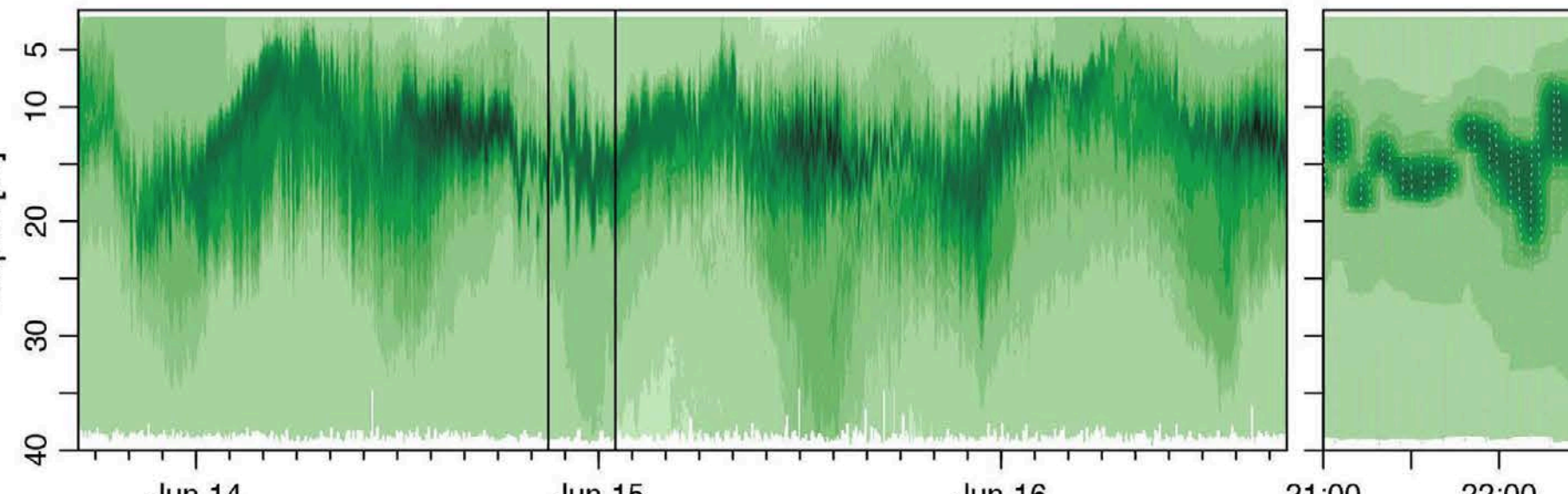
CTD		Other	
Channel	Reading	Channel	Reading
Conductivity	36.8929 mS/cm	Chlorophyll a	1.02 µg/L
Temperature	8.9339 °C	Dissolved O ₂ concentration	121.912 µMol/L
Pressure	436.978 dbar	Temperature (Conductivity correction)	8.6371 °C

Charts

01. Conductivity 02. Temperature **04. Chlorophyll a** 05. Dissolved O₂ concentration CTD

Other

RBRconcerto³ #066128



```
gotosvdata.sh
5 # Copyright (c) 2019, 2020 RBR Ltd. Distributed under the terms of the Apache
6 # License v2.0.
7 #
8 # 2017-01-10 1.0.0: Initial release.
9 # 2018-02-05 1.1.0: More help, macOS compatibility, Output file option.
10 #
11 # SCRIPT VERSION: 1.1.0
12
13 # Usage:
14 #   rbr <customer> <serial> <start> <end> [output]
15 #   Pull a CSV export of instrument data from an RBR data hosting instance.
16
17 # If the output filename is not provided, output will be written to
18 #   RBR-<instrument>.csv.
19
20 # Example: $0 rbr 110099 2017-09-05 2020-12-31
21 # USAGE
22 #   exit 1
23
24 # Which data hosting instance are we retrieving data from?
25 if [ -z "$DH_INSTANCE" ]
26 then
27   DH_INSTANCE="https://data.rbr-global.com"
28 fi
29
30 # How frequently we expect new instrument data to arrive; how frequently we'll
31 # repoll/replace the output file.
32 if [ -z "$UPDATE_PERIOD" ]
33 then
34   UPDATE_PERIOD=600 # seconds
35 fi
36
37 CUSTOMER="$1" # customer URL slug
38 INSTRUMENT="$2" # serial number
39 DEPLOYMENT_START="$3" # ISO-8601 date
40 DEPLOYMENT_FINISH="$4" # ISO-8601 date
41 OUTPUT="$5" # filename
42
43 if [ -z "$OUTPUT" ]
44 then
45   OUTPUT="RBR-$INSTRUMENT.csv"
46 fi
```


Drew Lucas



RBR



Thank You

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RBR