

# **Cyclops Integrator - CI**



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## **Turner Designs**

- Established in 1972
- Based in Sunnyvale, CA
- Focused on filter fluorometers for environmental & industrial markets
- Customers in >50 countries
  - University Researchers
    - Oceanographers, Limnologists, & Marine Biologists
  - Environmental Agencies & Consultants
  - System Integrators
  - Drinking Water & Waste Water Plants
  - Fisheries
  - Industries tracking Treatment Chemicals
- Customer rating 9.4 out of 10





## Introduction















#### Fluorescence

#### > Physical Process

- Light absorption at a wavelength
- Instantaneous light emission at another wavelength

### > Specific

•No two molecules excite and emit at the same wavelength combination

### ≻Simple

•No reagents are necessary, direct in situ measurement

#### ≻Quick

•Measurements are real time





## **Filter Fluorometer**





## **How Cyclops Integrator Started**

- C3 Submersible Fluorometer introduced 2008
  - Configurable with 1, 2 or 3 optical sensors
- Very popular for long-term deployments
  - Internal datalogging, battery pack, noncorrosive, anti bio-fouling





## **C3 deployed for Oil Spill Tracking**

#### Deepwater Horizon Oil Spill April, 2010

- USCG SMART protocol specified C3 for tracking
  - Crude Oil, TBD, TBD
- Liquid Robotics integrated C3 into WaveGlider
  - Refined Fuels, Crude Oil, Chlorophyll





# **Liquid Robotics PacX**

- ➤ 4 Vehicles departed SF in November, 2011
  - 2 to Japan, 2 to Australia
  - Papa Mau arrived Australia, Nov 2012
  - Benjamin arrived Australia, Jan 2013



- Guinness world record for longest journey of autonomous surface vessel voyage
- Collected and streamed data for >1 year until arrival
  - Crude Oil, Chlorophyll, Turbidity
  - Particularly exciting was the chlorophyll signal detected by one glider in the middle of the Pacific Ocean on June 20 and confirmed by its partner following behind on June 26.



latitude	longitude	time c1	c2	c3	pres	sure ure	r	ntifier
-0.47686	5 -170.066	1.34E+12	37.88	141.76	37.76	0	28.75	513
-0.47728	3 -170.066	1.34E+12	40.36	139.8	37.88	0	28.73	513
-0.47756	5 -170.066	1.34E+12	39.8	143.24	37.64	0	28.73	513
-0.47789	9 -170.066	1.34E+12	37.88	138.28	39.24	0	28.74	513
-0.47835	5 -170.066	1.34E+12	36.52	138.48	37.76	0	28.73	513
-0.47877	7 -170.065	1.34E+12	40.56	147.6	38.12	0	28.71	513
-0.47922	2 -170.065	1.34E+12	39.68	138.4	38.04	0	28.63	513
-0.47982	1 -170.065	1.34E+12	37.2	134.48	38.24	0	28.68	513



#### **Optimized for Integration**

#### Small

- 3" (7.7cm) diameter x 1.625" (4.1cm) deep
- > 1000m depth
- Anodized aluminum
- Quick power up: 3 seconds to 1<sup>st</sup> data output
- Fixed 1 second data output interval
- Housing is optional (3.15"/8 cm deep)







# 1,2, or 3 Optical Sensors

- Chlorophyll in vivo
  - Blue or Red excitation
- CDOM/FDOM
- Dyes
  - Fluorescein, Rhodamine, or PTSA
- > Oils
  - Refined or Crude
- Blue Green Algae
  - Phycocyanin or Phycoerythrin
- Optical Brighteners
- Tryptophan
- > Turbidity





# **Specifications**

Application	MDL	Physical	Physical			
Chlorophyll <i>in vivo</i>		Diameter	<3in; 7.7cm			
Blue excitation	0.025ug/L	Height	1.625in; 4.1cm			
Red excitation	0.5ug/L	w/housing	3.2in; 8.13cm			
Turbidity	0.05NTU	Temperature	-2 to 50C 0 to 1000m			
CDOM/FDOM	0.15ppb QS	Depth				
Phycocyanin	2ppb					
Phycoerythrin	0.15ppb					
Oil - Crude	0.2ppb PTSA	Electrical				
Oil - Fine	10ppm BTEX	Output	RS232 1 sec 8-30V; 3W ~1W			
Optical Brighteners	0.6ppb PTSA	Sample Interval				
Tryptophan	Зррb	Power Supply				
Fluorescein Dye	0.01ppb	Power Draw				
PTSA Dye	0.1ppb					
Rhodamine Dye	0.01ppb					



## **Type of Data**

Rutgers Slocum Glider



derwin Transect 01: 2012-09-07 15:04 - 2012-10:22 15:06 GMT







## Where Used

#### Easy integration into moving vehicles











# **Simple Accessories**

- Sealed Housing
  - · If installing in an unsealed area
- Calibration Check Cap
  - UV, Visible
- Cables
  - Pigtail Interface
  - PC Calibration







## **Solid Design**

#### Survived extreme temperature & pressure tests

- Helium Leak
- Temp range = -20 to +50C
- Pressure = thousands of cycles to 1800psi





### **Questions to answer**

- Into what vehicle are you integrating?
- > What depth do you require?
- > Will it be installed in a sealed area?
- > What optics do you need?









## Thank you



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