

SMART

Oil Spill Response Fluorometry



C3 Submersible Fluorometer & SMART Protocol

Special Monitoring of Applied Response Technologies (SMART) is a cooperatively designed monitoring program for dispersant use.

The SMART program is designed to determine if dispersants are effective in dispersing the oil and how quickly dispersants are working. SMART recommends three options, or Tiers.



Tier I

A trained observer, flying over the oil slick and using photographic job aids or advanced remote sensing instruments, assesses dispersant efficacy and reports back to the Unified Command.

Tier II

Provides real-time data from the treated slick. A sampling team on a boat tows a C3 fluorometer in a C-ray tow body configured with SMART software to continuously monitor for dispersed oil one meter under the dispersant-treated oil slick. The team records and conveys fluorometer data to the scientific support team which forwards it with recommendations to the Unified Command. In addition, water samples are collected for later analysis at a laboratory.

Tier III

Expands the monitoring effort and provides information on where the dispersed oil goes and what happens to it: (1) two C3 fluorometers in C-ray tow bodies are used on the same vessel to monitor at two water depths; (2) monitoring is conducted in the center of the treated slick at several water depths, from one to ten meters; and (3) a portable water laboratory provides data on water temperature, pH, conductivity, dissolved oxygen, and turbidity.

Optical Sensors

Crude Oil optics are required for SMART. Up to 2 additional optical sensors can be installed in the C3 to expand its capabilities

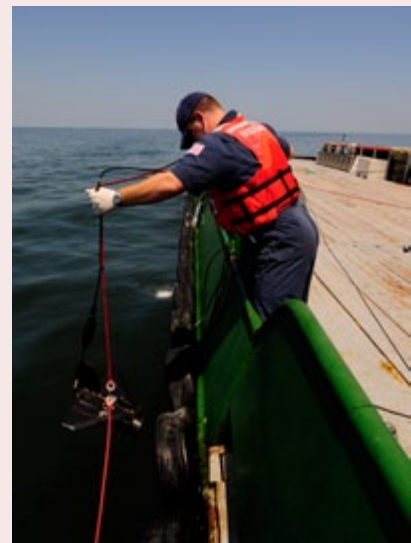
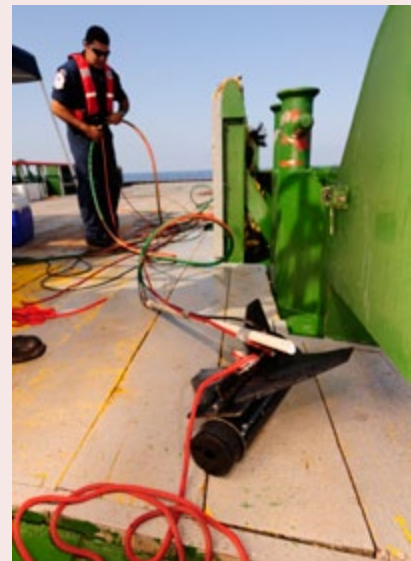
Available Optical Sensors

- Blue Green Algae
 - Phycoerythrin (marine)
 - Phycocyanin (freshwater)
- CDOM/FDOM
- Chlorophyll *in vivo*
 - Blue excitation
 - Red excitation
- Fluorescent Dye Tracing
 - Fluorescein
 - PTSA
 - Rhodamine
- Hydrocarbons
 - Crude Oil
 - Refined Fuels
- Turbidity
- Wastewater Monitoring
 - Optical Brighteners
 - Tryptophan

Contact us for Custom Optics

Highlights of the C3 SMART Package

- Integral to SMART Tier II & Tier III monitoring
- Automatically creates 3-dimensional model
- Software fully loaded
- Compartmentalized Transport Case



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Application	Minimum Detection Limit	Linear Range
CDOM/FDOM	0.1 ppb** 0.5 ppb***	0-1,500 ppb** 0-3,000 ppb***
Chlorophyll <i>in vivo</i>		
Blue excitation	0.03 µg/L	0-500 µg/L
Red excitation	0.3 µg/L	0-500 µg/L
Fluorescein Dye	0.01 ppb	0-500 ppb
Oil - Crude	0.2 ppb***	0-1,500 ppb***
Oil - Fine	3 ppb*	0-3,500 ppb*
	10 ppm****	0-30 ppm****
Optical Brighteners	0.6 ppb***	0-2,500 ppb***
Phycocyanin	2 ppb ^{PC}	0-4,500 ppb ^{PC}
Phycocerythrin	0.1 ppb ^{PE}	0-750 ppb ^{PE}
PTSA Dye	0.1 ppb***	0-650 ppb***
Rhodamine Dye	0.01 ppb	0-1,000 ppb
Tryptophan	3 ppb	0-5,000 ppb
Turbidity	0.05 NTU	0-1,500 NTU

* 1,5 Naphthalene Disulfonic Disodium Salt
** Quinine Sulfate
*** PTSA (1,3, 6, 8 - Pyrenetetrasulfonic Acid Tetrasodium Salt)
**** BTEX (Benzene, Toluene, Ethylbenzene, Xylenes)
^{PC} Phycocyanin pigment from Prozyme diluted in Deionized water
^{PE} Phycocerythrin pigment from Prozyme diluted in Deionized water

Physical Specifications

Total Weight in Air	9 kg; 20 lbs
Total Length	37.8 cm; 14.9 in
Total Width	49.8 cm; 19.6 in
C-ray Inside Diameter	10.4 cm; 4.1 in
C-ray Housing Material	Powder Coated Low Carbon Steel
C-ray Wings Material	High Strength Plastic
C3 & C-ray Shade-Cap Material	Delrin Plastic
Operating Temperature	-2 to 50 degrees C

Electrical Specifications

Minimum Power Supply	8 - 30 volts; 5 watts
Output	Digital (ASCII string)
Interface	RS232
Minimum Sample Interval	1 Second
C-ray Towing Speed	1 to 5 knots*
Maximum Current Draw @ 12 volts	
- operational	200 mA (C3)
- sleep mode	3 mA

*Recommended deployment speed depending on water conditions

Required SMART Package Components

C3 Submersible Fluorometer with Crude Oil optics
C3 Pressure Sensor (factory-installed)
Oil Spill Firmware (factory-installed)
SMART Toughbook Computer with associated Hardware & Software
C-ray Towed Deployment Body
C-ray Shade Cap
25 meter Extender Cable
Boosters
12 VDC Power Supply Adapter
Continuous Data Cable

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