



GEOFORCE DEEP-TOW HIGH RESOLUTION SUB-BOTTOM PROFILING SYSTEM

The evolution of the Geoforce DTS™ boomer/sparker sub-bottom profiler over more than four decades is an important case study in successful Canadian Government/ Private Sector collaboration (McKeown et al, 2014). It demonstrates how a survey tool can retain its competitiveness in global seafloor mapping through continuous improvements building on a solid core technology. This presentation illustrates examples of sub-bottom profiles obtained with the Geoforce boomer/sparker, often under harsh conditions, building on the close collaboration between the originators Hunttec '70 Limited (Hutchins et al, 1976) and two government agencies at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia.

Geoforce DTS™ Today

The Geoforce DTS deep-tow boomer/sparker system is a high-resolution sub-bottom profiler incorporating the boomer and sparker sub-systems in a single tow fish. The system has been designed for use in the world's toughest offshore environments, where reliability, ease of operation, accuracy and optimal data resolution are of paramount importance.

In excess of 260,000 line-km of DTS data have been collected by the Geological Survey of Canada in Atlantic, Arctic and Pacific waters, while Geoforce has conducted a comparable amount of surveys for offshore industry clients in most of the world's oceans, including in Antarctica.

A COMPARISON: Geoforce DTS sparker data with airgun data

During the 2008 survey season off Labrador Canada, Natural Resources Canada collected data utilizing Geoforce DTS™ and Sercel GI Guns simultaneously. The figures below depict the resolution of the Geoforce/Hunttec Data compared with the Sercel GI Guns used in conjunction with Teledyne 48 element 28420 Streamer

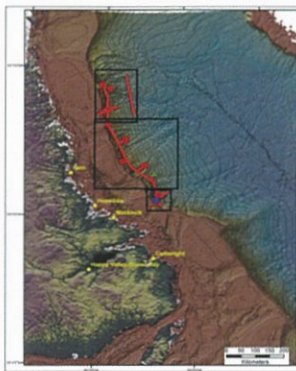


Figure 1: Labrador survey 2008 location

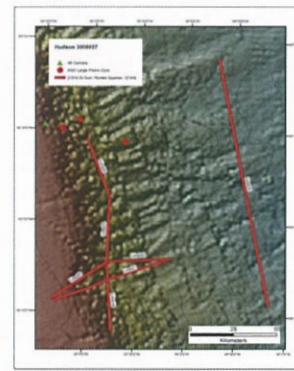


Figure 2: Inset- Northernmost survey area from Figure 1.

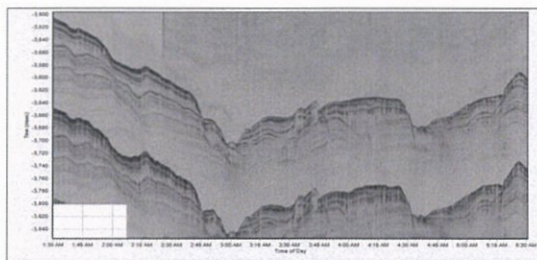


Figure 3: High Resolution Geoforce DTS sparker data recorded in water depths of 3000 meters

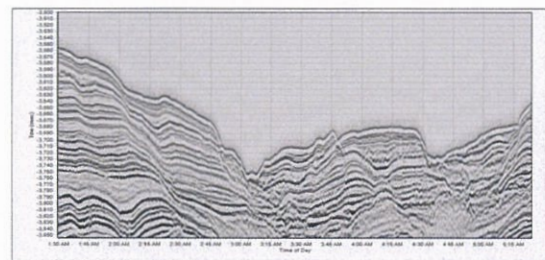


Figure 4: Sercel GI gun record

Data Courtesy of Dr. David C. Mosher, Geological Survey of Canada - Atlantic, Natural Resources Canada

FEATURES AND CAPABILITIES:

- Tow speeds up to 10 knots maximum.
- Maximum DTS towing depth 500 metres.
- Results in water depths from 20 metres to 4500 metres.
- Penetration of up to 100 metres in soft sediments, 40 meters in sand when in boomer mode.
- Penetration up to 80 metres in sand when in sparker mode.
- Layer resolution at the seafloor of 10 cm.
- Horizontal resolution equal to elevation of Tow Fish above bottom.
- Adjustable firing rates and source energy to meet a wide range of survey requirements and geological situations.
- Energy Storage Unit contained in Tow Fish, thus eliminating cable transmission losses.
- Boomer pulse shape and intensity independent of depth due to automatic depth compensation.
- Unique Body Motion Compensator allows operation in up to Beaufort Sea State 7-8.
- 540 joule/1000 joule sparker option allows greater survey flexibility.
- Can be run with one channel dedicated to resolution data, the other to penetration data.

SPECIFICATIONS:

FUNCTIONAL

Maximum Tow Depth	500m
Maximum Profile Results	4500m
Sediment Layer Resolution	10cm - 20cm depending on substrate
Spectrum Source Input	500Hz - 10 kHz
Energy Source	60J - 540J or 120 - 1080J at 0.11ms duration
Characteristics	217dB/1µPa at 1m
Source Firing Rate	Typically 1 to 2 shots/sec.
Time Variable Gain (TVG)	Spreading correction and adaptive sediment attenuation
Body Motion Compensation	Removes effective heave motion
<i>Options:</i>	
Sparker Source	Multi-tip electrode, 500J - 1000J output
Winch	300m, 600m or 900m cable capability

POWER REQUIREMENTS

Systems Console	115V/230V AC, 100W,50/60Hz, single phase
Power Control Unit (PCU)	230V AC, 3kVA, 50/60Hz, single phase

MECHANICAL

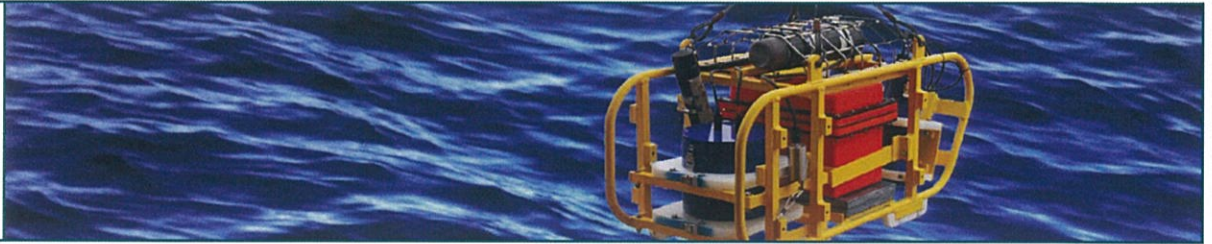
Tow Fish Assembly Dimensions	168cm x 113cm x 52cm
Weight	400 kg
Power Control Unit (PCU) Dimensions	56cm x 46cm x 60cm
PCU Weight	93kg
Systems Console Dimension	49cm x 31cm x 14cm
Tow Weight	12kg
Cable	14-Conductor cable; diameter 1.64cm (0.645in.)
Weight in Air	83.33kg/100m (560 lb. /1,000ft)
Minimum Recommended Sheave Diameter	56 cm (22in.)

ENVIRONMENTAL

Ships Electronics	0 to 45° C (32 to 113° F)
Tow Fish	0 to 45° C (32 to 113° F)
Storage	-50 to 150° C (-58 to 302° F)

REFERENCES:

- McKeown, D.L., P.G. Simpkin, G.B.J. Fader, D.R. Parrott, and D.C. Mosher. 2014. *The Hunttec Deep-Tow Seismic system: a revolution in high resolution profiling*. Pages 337 - 341 in *Voyage of Discovery: Fifty years of Research at Canada's Bedford Institute of Oceanography* (D.N. Nettleship, D.C. Gordon, C.F.M. Lewis, and M.P. Latremouille, Eds.), Bedford Institute of Oceanography-Oceans Association, Dartmouth, Nova Scotia, Canada.
- Hutchins, R.W., D.L. McKeown, L.H. King. *A Deep Tow High Resolution Seismic System for Continental Shelf Mapping*. 1976. Geoscience Canada, 3-2: 95-100.



GEOFORCE 4K DEEP-SEA DROP CAMERA SYSTEM

Geoforce Group Limited introduces the ultimate digital stills drop/drift camera system optimized for cost-effective seafloor ground-truthing during deep-sea surveys. Geoforce acquired a licence to commercialize the system from the Geological Survey of Canada – Atlantic (GSCA) at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia.

FEATURES AND CAPABILITIES:

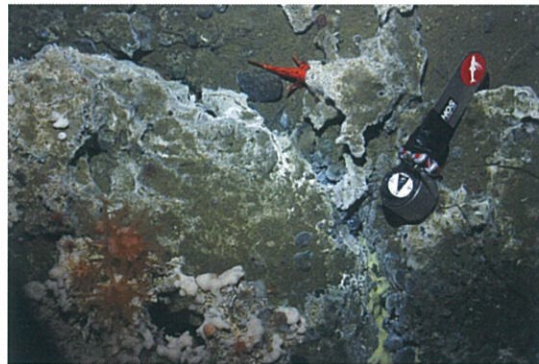
- Engineered for reliability and to achieve best data capture under challenging operating conditions, the camera system consists of high-quality commercial-off-the-shelf components that are packaged in sturdy pressure cases and a compact deployment frame.
- The camera and dual flash units are powered by a high-capacity lead-acid battery, permitting continuous data collection for 12 hours and longer.
- The image capture device is a Canon DSLR that can be exchanged with newer models as they become available.
- A high-quality Canon wide-angle lens, a dome port for in-water correction and dual flashes for even illumination yield thousands of seafloor images on one battery charge.
- The versatile DSLR with exceptional sensor resolution, large range of light sensitivity and the lens' optical properties form an outstanding workhorse tool for environmental baseline studies, geomorphological seafloor documentation and much more.

SPECIFICATIONS

Camera	Canon EOS Rebel SL 1 (18.0 Megapixel CMOS – APS-C Sensor) ISO Range – 100-12800; Canon DIGIC 5 Image Processor
Flash	Two Canon 430EX E-TTL Speedlites with rapid recycling
Battery	DeepSea Power and Light SB-12/80; c/w quick smart charger. The 80 Amp/h rating permits up to 5000 images in one deployment
Trigger	Benthos-type contact closure with trigger weight, scale and compass
Size	-60cm (W) x -60cm (H) x -120cm (L)
Weight	-90kg (~200lbs); up to 4 x 40 lbs lead plates can be added
Depth Rating	Pressure tested and rated for 4000m

SAMPLE SEAFLOOR IMAGES

Images are courtesy of NRCan Pacific Geoscience Centre



Water depth: 992m - Western Haida Gwaii Margin (BC, Canada)

Cold seep biological communities typical near methane vents at continental margin. Thick carbonate crust on cobble rich substrate. Deep sea corals, white encrusting sponges, red *Shortspine Thornyhead*, and bacterial mat of *Beggiatoa* sp.



Water depth: 1001m - Western Haida Gwaii Margin (BC, Canada)

Side of mud volcano; moderately sorted angular cobble and boulder lag. Encrusting anemones on sandy seabed with small shrimp. Gravel lag indicates very low sedimentation rate in area of deeper continental slope.