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↘ The AMAS electric sweep is a clip-on sweep requiring no external power source.

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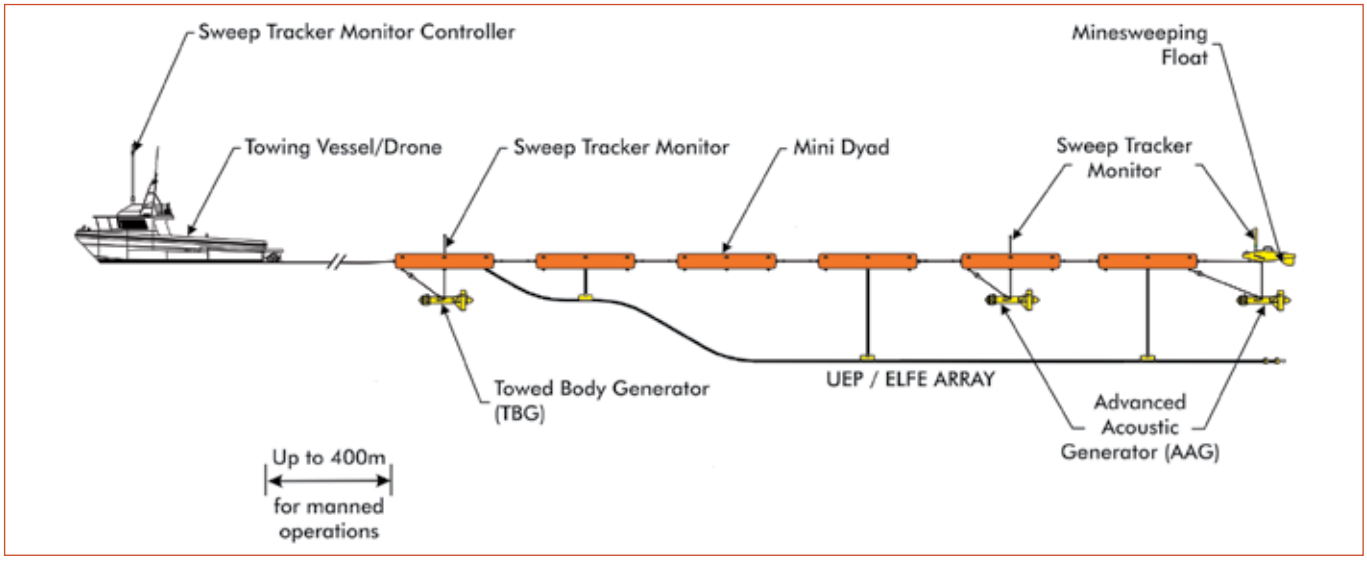
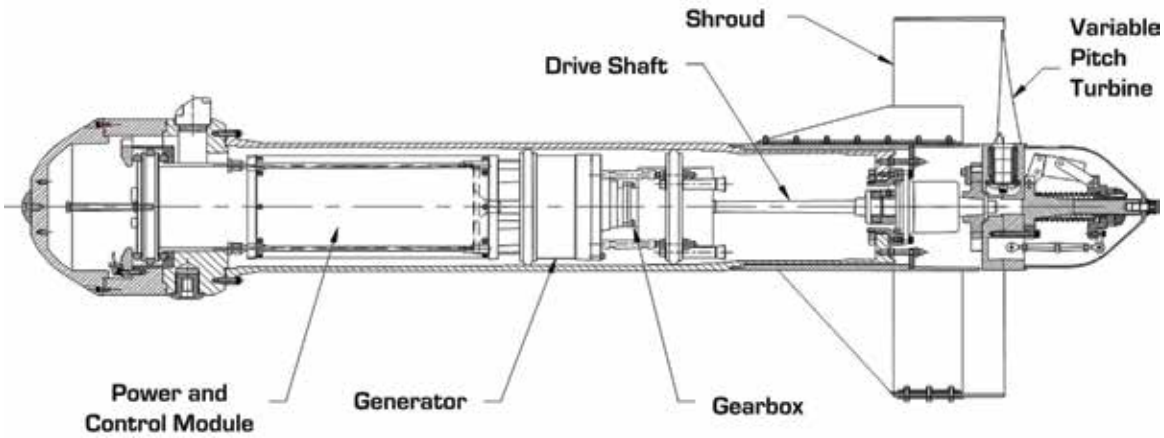
AMAS ELECTRIC SWEEP



AMAS MAGNETIC/ACOUSTIC SWEEP EQUIPMENT	UEP/ELFE SWEEP EQUIPMENT
Mini Sweep Tow Line	UEP/ELFE Towed Body Generator (TBG)
Mini Dyad (magnetic sweep)	UEP/ELFE Electrode Array
AAG #1 (acoustic sweep)	2 m Depth Pendant
AAG #2 (acoustic sweep)	5 m Depth Pendant
Australian Minesweeping Float	Weight (7kg submerged)
	Drogue Assembly
	Winch Bridge
	Programming Unit

The adjustable length, UEP/ELFE Array is powered by the Towed Body Generator (TBG)



TBG	
Overall body length	2,050 mm (nominal)
Maximum body diameter	350 mm (nominal)
Turbine shroud diameter	750 mm (nominal)
Weight in air	200 kg
Weight in seawater	89 kg

UEP / ELFE ARRAY	
Minimum length	24 m
Maximum length	192 m
Segment lengths	3m, 6m, 12m , 24m
Maximum number of active electrodes	8

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AMAS ELECTRIC SWEEP

Clip-on sweep requiring no external power source

The Underwater Electric Potential (UEP)/Extremely Low Frequency Electromagnetic (ELFE) Sweep is an electrical influence sweep capable of generating both static and alternating underwater electrical fields for minesweeping applications in littoral waters.

UEP and ELFE signatures are accurately emulated in a spatial relationship to a target ship while underway.

The UEP/ELFE Sweep is designed to be used with Mini Dyads and Advanced Acoustic Generators (AAGs) and comprises a Towed Body Generator (TBG), an Electrode Array and rigging to suspend the Electrode Array at the correct depth below Mini Dyads. The drogue ensures that the Electrode Array stays taut.

The UEP/ELFE Sweep requires no external power and can be easily deployed by vessels of all types, including craft of opportunity and remote control drones, without any need for modification to the deploying platform.

THE UEP/ELFE SWEEP CAPABILITY

The sensors available to some modern sea mines include electrodes and coils. With the help of on-board microprocessor signal processing, these sensors are capable of reading a warship's static electric field, or UEP, and a warship's alternating electric and alternating magnetic fields by analysing the low frequency (ELFE) components of those fields.

Ships operating in relatively shallow littoral waters are likely to encounter mines with impressive target selectivity, seeking to analyse and compare a target's combined magnetic, acoustic and UEP/ELFE signatures. To be accepted as a valid target by modern mines, a minesweeping system must be able to accurately emulate these signatures in shape, intensity and spatial relationship.

For example, electrode sweeps may be rejected by modern mines equipped with UEP sensors due to the sweeps excessive UEP signature. Closed loop sweeps emit no UEP signature and may also be rejected by modern mines equipped with UEP sensors.

To answer the need to provide a mine warfare commander with the option to include UEP/ELFE emulation in a multi influence sweep, the Australian Defence Science and Technology Organisation (DSTO) and Thales Australia have developed a 'clip on' UEP/ELFE sweep for use with the AMAS magnetic and acousitc sweeps.

THE TOWED BODY GENERATOR (TBG)

The TBG uses a turbine to power an on board electronic control module. When towed through the water above 6 knots, the TBG delivers programmed power to the array electrodes to achieve the desired emulation.

EMULATING A WARSHIP'S UEP SIGNATURE

A warship's static electric field, or UEP, is generated by a ship's passive or active cathodic protection systems. Emulation is achieved by providing programmable steady current to up to eight active electrodes along the sweep array in the same relative positions as the ship's emissions.

UEP SIGNATURE RANGE RESULTS

Figure 1 shows an actual UEP ranging result. Note that the grey trace in Figure 1 is the output predicted by the UEP/ELFE software.

Figure 1:
Measured output DC voltage gradient using 6 electrodes as depicted in Figure 2

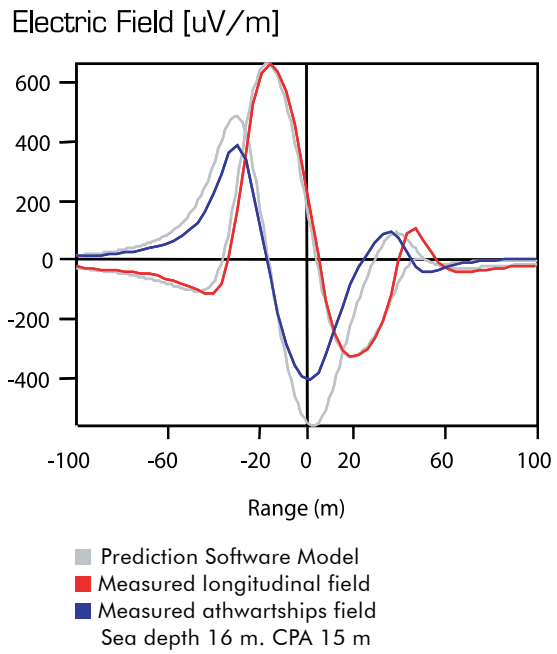
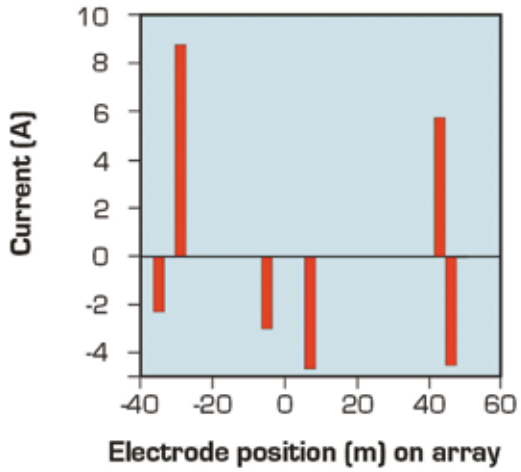


Figure 2:
Programmable input current distribution



EMULATING A WARSHIP'S ELFE SIGNATURE

A warship's alternating electric and alternating magnetic fields arise from sources such as a ship's AC power supply and corrosion current modulated at propeller shaft rotation frequency.

Emulation is achieved by providing programmable alternating current to at least two active electrodes along the sweep array in the same relative positions as the ship's emissions. Each electrode can output either DC current or AC current or both AC and DC simultaneously.

ELFE SIGNATURE RANGE RESULTS

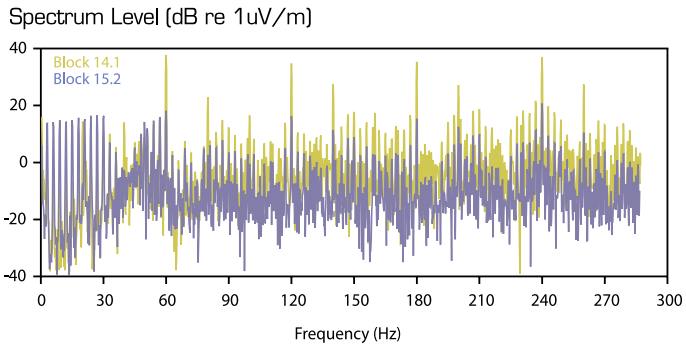
The ELFE setting was programmed as a ship like signature, producing both 60 Hz hotel electrical power related frequencies (amidships) and 3 Hz shaft related frequencies in the vicinity of the stern.

The fundamentals and their corresponding harmonic frequencies are shown in Figure 3. The shaft harmonic series is particularly prominent from 3 to 30 Hz, and hotel power is shown at 60, 120, 180, and 240 Hz. The following results were recorded by the Royal Australian Navy's signature analysis range.

PROGRAMMABLE ELFE INPUT

- Yellow trace: ELFE (hotel power) on electrodes 3 and 4 at 60 Hz @1A, square wave.
- Blue trace: ELFE (shaft frequencies) on electrodes 7 and 8 at 3 Hz @1A, square wave.

Figure 3:
Measured output, alternating electric field, calibrated. CPA approx 15m. 16384 FFT



SUMMARY

- A joint Thales/DSTO development.
- The array of titanium electrodes spans the length of the sweep (the ship) for spatial accuracy
- The power and control unit is housed within a turbine powered Towed Body Generator (TBG)
- No external power is required for this 'clip-on' addition to AMAS magnetic and acoustic sweeps.

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