



**GeoSpectrum Technologies Inc**  
Customizing Acoustics

# ACOUSTIC SUBSYSTEMS & COMPONENTS

We deliver solutions. We design to your spec. We have capacity for your need.

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Misago Co., Ltd.  
E-mail: [sales@misago.co.jp](mailto:sales@misago.co.jp)  
<http://www.misago.co.jp>

*“Optimizing underwater acoustics since 1994, GeoSpectrum has decades of experience in the design and manufacturing of hydrophones and transducers. Often imitated, never duplicated”*



NATO security classification



ISO: 9001 certified



ITAR free systems

Based in Dartmouth NS – “Atlantic Canada”

Optimized' cutting edge systems, subsystems & components for underwater acoustics.

Surveillance and monitoring & communication systems & solutions.

Defense, commercial & scientific markets.

Part of Elbit systems LTD

*We provide underwater acoustic sensing and communication solutions for diverse applications.*

**DEFENCE**

**SECURITY**

**SCIENCE/R&D**

**ENERGY**

**ENVIRONMENTAL  
MONITORING**

**OCEANOGRAPHY/  
HYDROGRAPHY**

**FISHERIES**

**HIGH PERFORMANCE | RELIABLE | COST-EFFECTIVE**

# Acoustic subsystems & components

## HYDROPHONES



## VECTOR SENSORS



## SOUND SOURCES



Sold in dozens of countries in all continents

Transducer SME support

> 100 customers

## ACOUSTIC ARRAYS



## LOW FREQUENCY SOURCES



Delivering to world leading underwater science institutes

Very high rate of repeat orders

Full-service commitment

# Hydrophones

- Pre-amplified hydrophones
  - Selectable signaling, gain, and band pass filters (on order)
  - Hydrophone packaging customization for required application
  - Auxiliary equipment (case, cables, connectors, etc).
- Un-preamplified streamer hydrophones
- 1000/day capacity



# Hydrophones (cont'd)

M36	Wide-band omni-directional hydrophone for marine observation. Pre-amplified output of 0 to 35 dB (selectable on order) with single ended voltage, current, or differential signaling
M5	medium frequency hydrophone for streamers. Low cost when produced in high volume.
M14	Electrical & size equivalent of the Benthos AQ2000®. Its primary use is for very deep bottom cables.
M15	High sensitivity, medium frequency hydrophone for streamers. Low cost when produced in high volume

Model Number	Unamplified Sensitivity (dB re V/ $\mu$ Pa)	Max Depth (m)	Max Frequency (Hz)	Element Capacitance (nF)
M5-360	-195	1700	20000	2
M5-900	-195	900	20000	2
M14-360	-200	3500	20000	5
M14-900	-200	900	20000	8
M15-360	-190	1700	15000	1
M15-900	-190	900	15000	1
M36-100	-200	2500	250000	1.5
M36-900	-200	900	250000	1.5

# Directional sensors & unattended data collection systems

- Wide frequency band single sensor directional sensing including low frequencies
- Pressure and accelerometer based directional sensors
- DIFAR, particles motion/velocity
- Measure 2 & 3-D particle motion & pressure in a broad range of environments
- Can be deployed for long term unattended detection & recording of passive detection including bearing & signature data
- Acoustic surveillance, ocean environmental monitoring, offshore oil and gas monitoring mammal detection, air-gun characterization



Current or differential signaling gain and sensitivity optimized to user's requirements

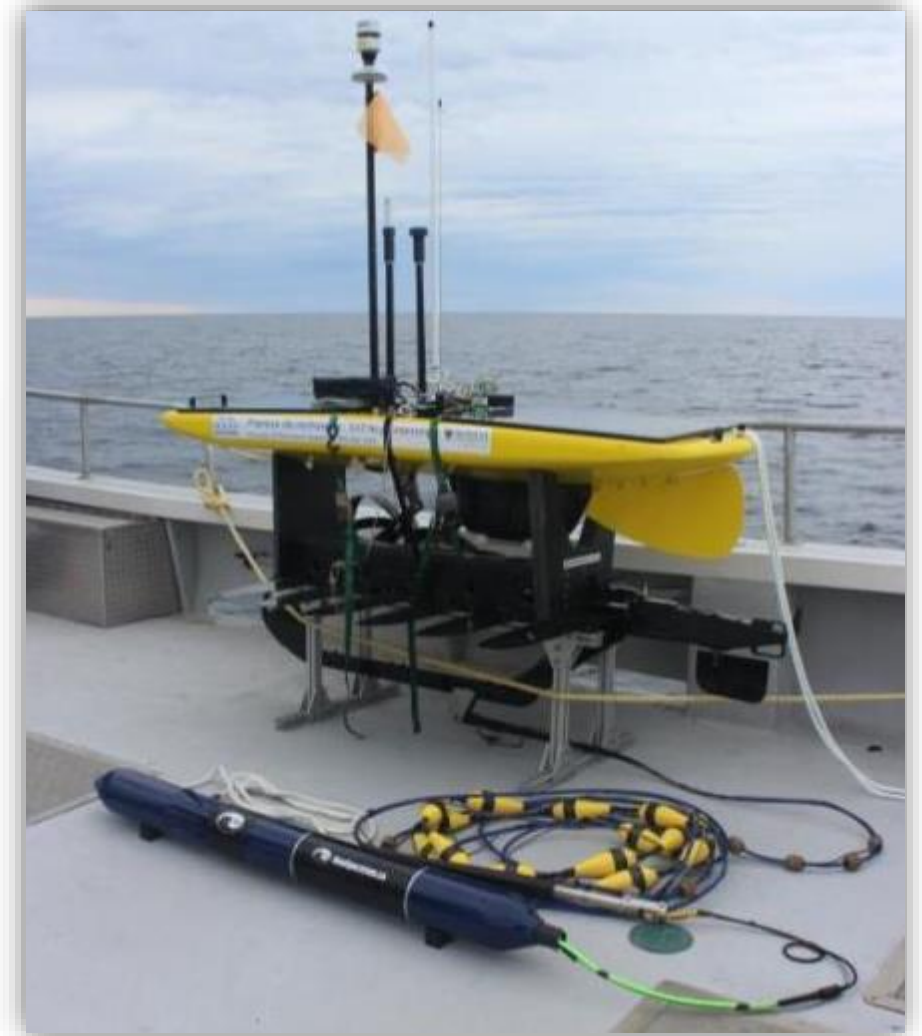
# Directional sensors & unattended data collection systems (cont'd)

Sensor	Directivity	Compass	Frequency Range	Depth Rating	Output signaling	Weight in air	Weight in water	Dimensions
Particle Motion Sensor								
M20-040	30	N	1 Hz – 3 kHz	300 m	Current			54 mm diam., 179 mm length
M20-105	30	Y	1 Hz – 3 kHz	1000 m	Differential voltage	3.4kg	1.0kg	127 mm diam., 155 mm length
M20-601	20	Y	1 Hz – 3 kHz	1000 m	Current, single ended voltage, differential voltage			107 mm diam., 120 mm length
Directional Sensor								
M35-300	20	N	100 Hz – 15 kHz	1000 m	Differential voltage or SE current-loop			127 mm diam., 157 mm length



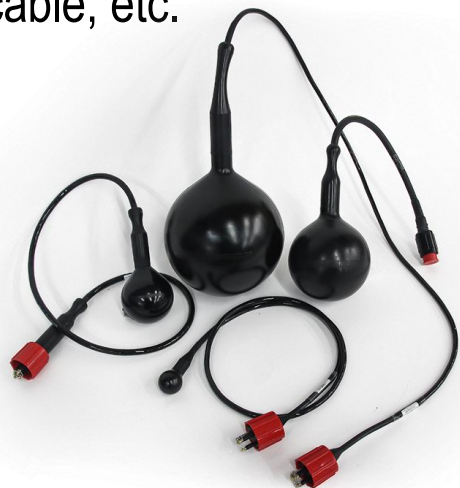
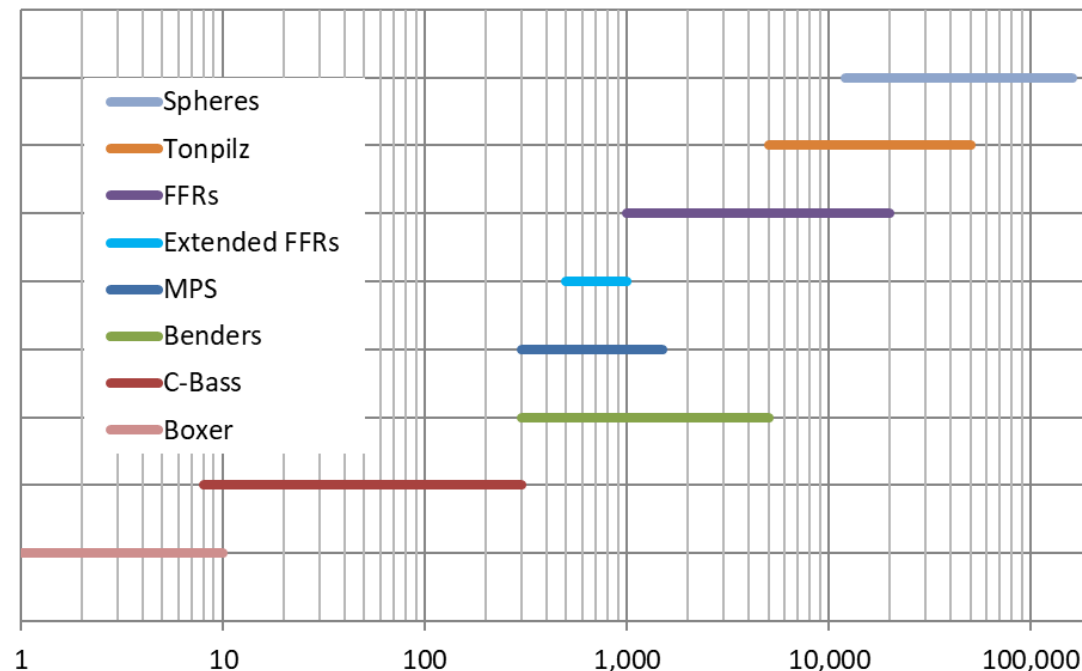
# Towable M20-601 (M518)

- Noise-cancelling directional Hydrophone
- Low drag
- Tow depth 100 m
- On-board processing generates alerts
- Phone home via comms link
- Months of persistence



# Sounds sources - overview

- FFRs, Spheres, and Benders
- Tonpilz with built-in tuning for active/passive operation for HMS
- Packaging can be customized for desired application (transducer stack)
- Applicable for active sonar transmissions and underwater communications
- Optional auxiliary equipment such as power amplifier, cable, etc.



# Free Flooded Ring (FFR) Transducers

- Ideal for unlimited depth and high-power applications
- Very suitable for broad band low frequency sound sources.
- Frequency range from 530 Hz to 20 kHz
- Toridal or hemispheric beam pattern
- Individual rings or built as array tailored to meet frequency & power requirements
- Radially poled and circumferentially poled (segmented) FFRs
- For active sonar transmission, sonar target source and communication applications
- FFRs can be customized to customer specifications



# Free Flooded Ring (FFR) Transducers (cont'd)

## Booted FFR Transducers

Model number	Resonance frequency	TVR at resonance	Operating & survival depth	Maximum SPL at resonance	Diameter / max section width	Height	Beam pattern
M27-450 Booted FFR transducer	4.2 kHz	138 ±1.5 dB re 1 μPa/V @ 1 m	Unlimited	207 dB re 1 μPa @ 1m	18.4 cm	16.1 cm	Toroidal
M27-650 Booted FFR transducer	3.1 kHz	137 ±1.5 dB re 1 μPa/V @ 1 m	Unlimited	193 dB re 1 μPa @ 1m	20.8 cm	20.8 cm	Toroidal
M27-850 Booted FFR transducer	1850 Hz	138 ±1.5 dB re 1 μPa/V @ 1 m	Unlimited	204 dB re 1 μPa @ 1m	25 cm	24 cm	Toroidal
M27-890 Booted FFR transducer	975 Hz	135 dB re 1 μPa/V @ 1 m	Unlimited	201 dB re 1 μPa @ 1m	32 cm	53 cm	Toroidal

# Free Flooded Ring (FFR) Transducers (cont'd)

## FFR Transducers for communication systems

Model number	Resonance frequency	TVR at resonance	Operating & survival depth	Maximum SPL at resonance	Diameter / max section width	Height	Beam pattern
M27-930	7 - 17 kHz	> 130 dB re 1 $\mu$ Pa/V @ 1 m	Unlimited	> 200 dB re 1 $\mu$ Pa @ 1m	10.8 cm	9.1 cm	Hemispherical
M27-931	7 - 17 kHz	> 130 dB re 1 $\mu$ Pa/V @ 1 m	Up to 6000 m dependant on mounting configuration	192 dB re 1 $\mu$ Pa @ 1m	10.8 cm	8 cm	Hemispherical
M27-942	8 - 16 Hz	> 130 dB re 1 $\mu$ Pa/V @ 1 m	Up to 6000 m dependant on mounting configuration and base plate material	192 dB re 1 $\mu$ Pa @ 1m	10.8 cm	8 cm	Hemispherical

# Spherical transducers

## M18 Spherical Transducers

- Suitable for active/passive sonar, marine mammal detection (MMD), acoustic data transmission, and subsea communication
- Omnidirectional with high depth rating and bandwidth
- Low Q resonance
- Can be used as both a projector and a receiver.
- Variety of sizes
- Smaller M18s are perfect as broadband, high-frequency hydrophones.



# Spherical transducers (cont'd)

Model Number	OD (cm)	Resonance Frequency (Hz)	TVR @ Resonance (dB re $\mu\text{Pa/V}$ @ 1m)	OCV @1 kHz (dB re $\text{V}/\mu\text{Pa}$ )	Max Depth (m)	Weight (kg)	Capacitance (nF)
M18C-1.0	2.9	68000	148	-198.5	2500	0.1	10.2
M18C-1.5	4.4	47000	148	-195.0	2500	0.1	23.5
M18C-2.5	6.7	27000	148	-190.0	2500	0.5	42.5
M18C-4.0	10.8	16500	148	-186.5	2500	1.4	57.3
M18C-6.0	15.7	12000	148	-185.0	2500	4.8	80

# Benders

- Family of highly customizable flexural disc projectors (benders) projectors.
- Produce moderate power over a broad band or high power near resonance.
- Omnidirectional response
- Can be stacked into arrays, lowering their resonant frequency and increasing their source level for increased directivity.
- Can be used for a variety of different low-frequency applications, including but not limited to subsea communication, long range data transmission and active sonar
- Can be tailored to suit each customer's unique requirements.





# Sounds sources – bender specifications

Model #	Resonance Freq (Hz)	TVR @ resonance (dB re 1 $\mu$ Pa/V @ 1m)	Max depth (m)	OD (cm)	Weight (Kg)	Thickness (cm)
M21-254-400	400	138	80	26.4	5	3.8
M21-203-500	500	138	80	21.3	3.2	3.2
M21-203-600	600	138	110	21.3	3.3	3.4
M21-203-700	700	138	130	21.3	3.4	3.6
M21-254-800	800	138	210	26.4	8.3	4.8
M21-203-900	900	138	190	21.3	3.8	3.9
M21-203-1000	1000	138	200	21.3	4.0	4.0
M21-203-1200	1200	138	290	21.3	4.3	4.3
M21-203-1400	1400	138	400	21.3	4.6	4.6
M21-203-1600	1600	138	490	21.3	5.0	4.9
M21-203-2000	2000	138	270	11.0	0.8	2.6
M21-203-2500	2500	138	400	11.0	0.8	3.0
M21-100-3000	3000	138	540	11.0	0.8	3.2
M21-100-3500	3500	138	660	11.0	0.9	3.4
M21-100-4000	4000	138	840	11.0	1.0	4.0
M21-100-5000	5000	138	1200	11.0	1.2	4.5

# Tonpilz transducers

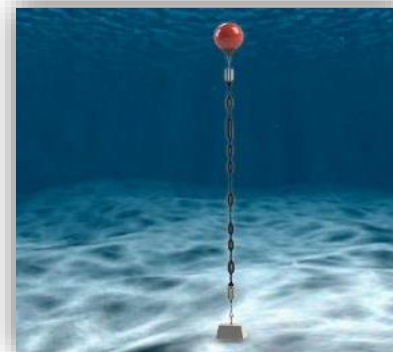
- Highly directional transducers with a conical beam pattern
- Can be used as transmitters and receivers
- Built-in tuning for active/passive operation
- Can be packaged in staves for Hull Mounted (HMS) & bow sonars

Model	Resonance Frequency (Hz)	TVR @ Resonance (dB re $\mu\text{Pa/V}$ @ 1 m)	Max Depth (m)	Length (cm)	Weight (kg)
M33-300 series	6500	151	up to 6000 m	19.5	3.5



# Acoustic arrays

- Towed and moored (sea-bottom or vertical line – VLA) arrays
- Can include hydrophones and/or sound sources
- Can be configured for
  - Digital or analog outputs
  - Autonomous or wired operation
- Can include omni-directional, 2-axis or 3 axis directional sensors
- Hosed or potted.
- Applications include
  - Submarine, torpedo and ship detection
  - Area and harbor surveillance
  - Marine mammal detection
  - Noise measurement ranges
- Low drag arrays for UUVs and low power USVs
- Turn-key solutions designed to customers specifications or requirements



# C-BASS Very-low frequency (VLF) sound source

- Patented, disruptive technology family of VLF sources
- Unprecedented SPL for form factor
- Significantly lower price
- Rugged design is intended for continuous use
- Versatile turn-key deployment & mounting solutions
- Pressure compensated for desirable depths
- Can be used individually, or in arrays to produce higher power systems with or without directivity
- 8.5" to 46" diameters
- 15 to 300 Hz resonance
- Applications include (but not limited too) – long range communications, target simulation, acoustic health monitoring & activation, and more



# C-BASS (cont'd)

100% reliability in year long deployment under Arctic ice.

Exhibited communication range of 2500 km in international research trial.



# C-BASS (cont'd)

## SIZE COMPARISON OF LEGACY SYSTEM VS. C-BASS



Mikhalevsky's 20 Hz, 195 dB source demonstrated transmission ranges exceeding 2,000km in 1994 and 1998.



GTI 35 Hz, 195 dB source at Seneca Lake, 2017 (1<sup>st</sup> generation)  
Now 200 dB at 20 Hz.

## TESTING AT GEOSPECTRUM



Shaking at 12-ton water tank

# C-BASS – Specifications

Model Number	Resonance Frequency (HZ @ 20m depth)	Maximum source level (dB re uPa @ 1m)	Max depth without pressure compensation (m)	Passive compensation max depth options (m)	Max depth active compensation	Diameter (cm)	Weight (kg)
M72-25	25	197	N/A	10	>300	118	402
M72-30	30	199	N/A	10	>300	102	355
M72-40	40	203	N/A	10	>300	118	402
M72-50	50	166	N/A	20	>500	68	157
M72-110	115	190	30	100; 200	1000	34	24
M72-230	215	195	30	100; 200	1000	34	24
M72-300	300	190	50	125; 250	1000	22	8



**GeoSpectrum Technologies Inc**  
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**Thank you**  
Please forward your questions/comments to:

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