MASSA

GENERATIONS AHEAD IN SONAR & ULTRASONIC TECHNOLOGY

Some of the Low-Frequency, High-Power Transducers Developed and Manufactured By Massa

- M-1202 Broadband Autonomous Source (2,000's)
- TR-1426 (1990's)
  - Single-Sided Flextensional Transducer
- TR-1421 (1990's)
  - High Power Barrel Stave, Inverse Flextensional Transducer
- R-402 (1990's)
  - Double-Ended Electromagnetic Radiator
- TR-1411 (1980's)
  - Single-Sided Electromagnetic Radiator with a Mechanical Q <1
- TR-44 (1970's)
  - Spherical Electromagnetic Transducer
- ARTEMIS (1950's & 1960's)
  - Megawatt Electromagnetic Transducer

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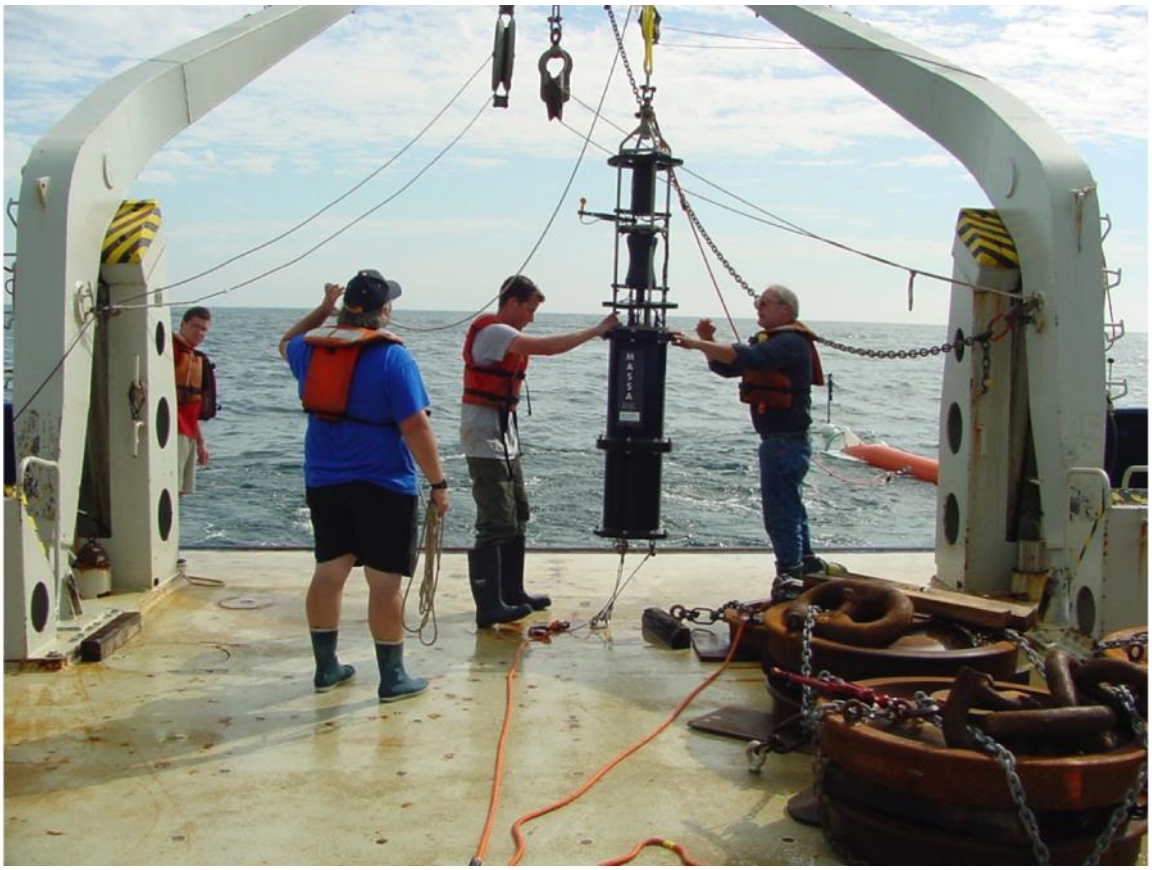
Massa M-1202 Broadband Autonomous Source During Sea Test Deployment



- System developed for the Government to measure attenuation for different frequencies over long distances in the ocean
- Buoy deployed and operates autonomously for 48 hours by transmitting programmable pulses of different frequencies and pulse widths
- System self-measures and records depth, bearing, roll & pitch, transmit frequency and start time, SPL, battery and transducer voltage
- Operates from 200 Hz to 10 kHz at up to 170 dB Source Level

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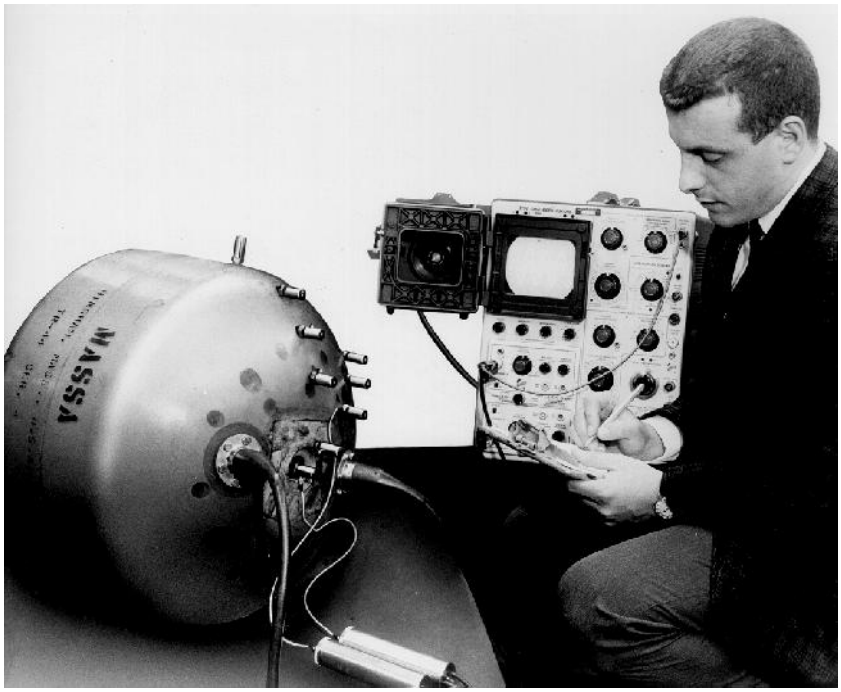
Massa TR-1421 Barrel Stave Transducer

- Developed under subcontract to a major prime contractor
- Operation
  - 80% efficient
  - Q=4
  - 50 KWatts

Massa TR-1426 Single-Sided Flextensional Transducer

(Array Testing At Seneca Lake)

- Can be driven to radiate from either side only or omnidirectional
- Operation
  - 80% Efficient
  - Q=4
  - 25 KWatts

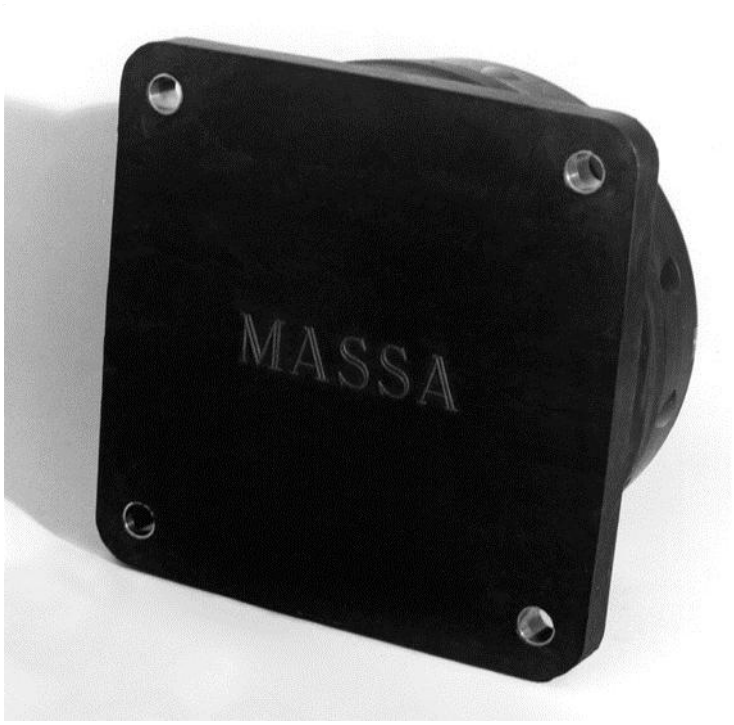


Massa TR-44 Dipole Electromagnetic Transducer

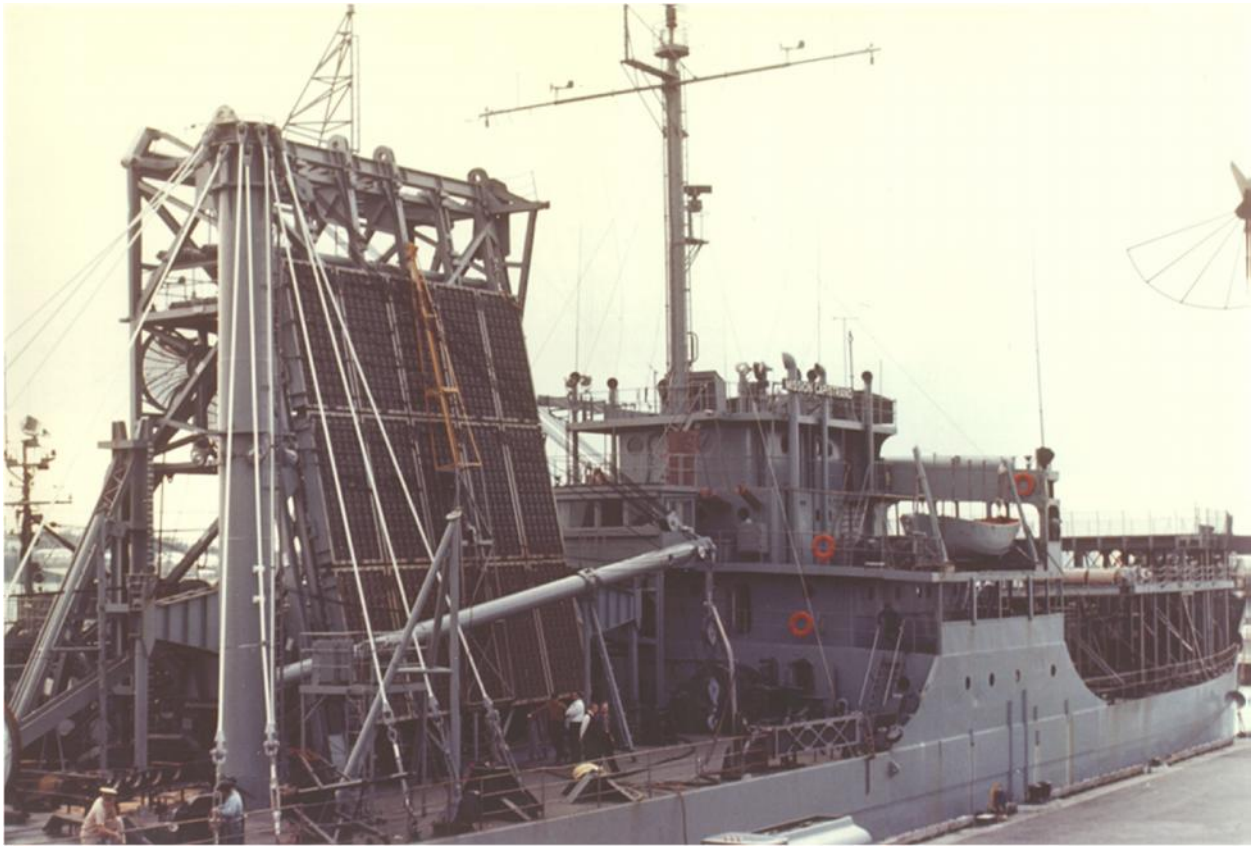
- Operates to full ocean depth
- Can be Designed to operate at any frequency between 200 Hz and 1,000 Hz

Massa TR-1411 Electromagnetic Transducer

- Easy to configure into any type of array because there is negligible back radiation
- Can be Designed to operate at any frequency between 200 Hz and 1,000 Hz
- Transducer array has extremely low mechanical Q of less than 1



World's Largest Sonar Projector
Project Artemis



- Megawatt transducer weighed 300,000 lbs., and operated at 450 Hz
- Original transducer produced by another company delaminated under full-power operation
- Massa designed, manufactured and shipped the entire array containing over 1,400 elements in less than one year
- Manufactured ten mile long receiving array
  - 200 towers 80 feet tall deployed in 5,000 feet of water