

Topic: N101-092

TRS Ceramics, Inc.

Low Cost Single Crystal Transducer Design and Fabrication for Common Low Frequency Projectors

TRS has developed single crystal technology that can be applicable to fabricate novel next generation shear projector technologies that are low-cost and low frequency and capable of operating at depth. The transducer with a resonance frequency less than 1 kHz employs a unique face shear mode of the piezoelectric single crystals and an overall size less than 3 inches in diameter. TRS Technologies is a world leader in piezoelectric and dielectric materials technology. TRS's innovative manufacturing techniques enable the production and manufacturing of compact single crystal low frequency transducers, rated for depth performance and suitable for integration into Navy submarine and surface ship combat sonar systems. TRS's single crystal transducer design enhances the low frequency regime in Undersea Warfare (USW) sonar systems.

Technology Category Alignment:

None

None

None

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SYSCOM: ONR

Contract: N00014-12-C-0176

This company is not exhibiting at or presenting during the FST. They are not available for 1-on-1 meetings. Please refer to their contact information above.

WHO

SYSKOM: ONR

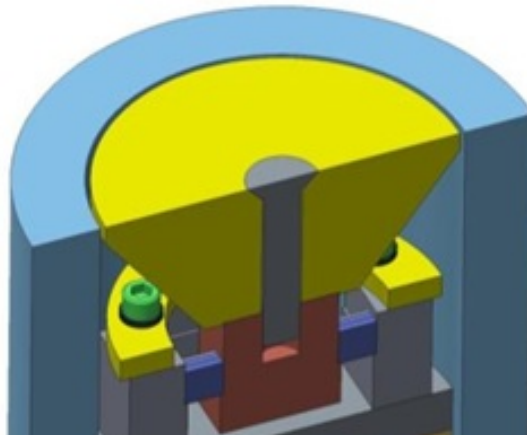
Sponsoring Program: PMS-415
Undersea Defensive Warfare
Systems, Office of Naval Research

Transition Target: ONR Future
Naval Capability (FNC) Submarine
and TB-29A Thin Line Arrays

TPOC:
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Other transition opportunities:
Navy surface, subsurface, and UUV
SONAR systems: countermeasures,
mine hunting, torpedoes, acoustic
modems, towed arrays, moored
arrays, and sonobuoys using single
crystal low-frequency transducers
requiring survivability, compactness,
and lightweight designs.

Notes: TRS' lead magnesium
niobate-lead titanate (PMN-PT)
single crystal elements are capable
of operating at-depth and face shear transducers allow for compact low frequency transducers



Low Frequency Transducer using Face Shear Mode,
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WHAT

Operational Need and Improvement: Employment of broadband crystals sonar in NAVY systems improves littoral combat operations, obstacle avoidance, mine hunting and marine mammal effects mitigation. Low frequency shear transducers can be used for applications such as air launched sonar and deep ocean sonar as acoustic source.

Specifications Required: a) Depth survivability > 1000 ft; Operation at < 1 kHz
b) Broadband transmission and receipt of sonar signals and beamforming processing
b) Realized on the Navy's largest sonar systems: submarine and surface ship combat sonars
c) System level cost reductions through transducer commonality and multi-functionality
d) Reduced size and weight of transducers (<3" Diameter)
e) Reduced electrical power requirements

Technology Developed: TRS has teamed with Ultra Electronics Ocean System in this program. Computer modeling and simulation of the face shear Tonpilz projector has been performed using drive stacks based on d36 mode single crystals of lead indium niobate-PMN-PT (PIN-PMN-PT) and Manganese doped (Mn:PIN-PMN-PT). High compliance and field stability of face shear mode allows for design of compact low frequency transducers. Computer modeling and simulations have been performed to understand projector performance like transmitting voltage response (TVR), source level (SL), and Impedance.

Warfighter Value: The uniqueness and innovation of the low frequency transducer stems from the use of ternary single crystal piezoelectrics as the active component, shear mode resonance to reduce the resonance frequency and a flexensional design to further reduce the resonance relative to size. Compact size and light weight leads to next generation SONAR transducers for sonobuoys, and other acoustic underwater systems.

WHEN

Contract Number: N00014-12-C-0176

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Materials Characterizations for Shear Mode	Low	Done	4	April 2015
Transducer mounting and pressure compensation	Low	Done	4	June 2015
Transducers and arrays performance modeling	Low	Done	4	October 2015
Final prototype build and tests	Low	In progress	4	January 2016
Depth performance testing	Low	In progress	5	May 2016

HOW

Projected Business Model: Prime contractor strategic alliances are required to successfully transition the developed technology, since transducer components are a part of larger systems. TRS is currently working with Ultra Ocean Systems (UEOS) who is a defense contractor for A2RF (communications buoy), Minehunting UUVs, NGCM, etc. TRS maintains a close working relationship with systems manufacturers like Ultra and other developers like the Applied Research Laboratory (ARL), Penn State University. TRS has performed transducer development for various Navy SONAR systems and has considerable knowledge of single crystal piezoelectric sensor employment in current SONAR systems. As this work transitions, TRS will function as a component supplier to Navy prime contracts like UEOS, L-3, Northrop Grumman, Raytheon, Lockheed Martin and other contractors involved in Navy Undersea Warfare and Defensive System programs.

Company Objectives: TRS Technologies is a world leader in piezoelectric and dielectric materials technology. We collaborate closely with you to provide tailored high performance, custom solution for applications. Our PMN-PT family of materials (PMN-PT, PIN-PMN-PT, and Mn doped PIN-PMN-PT) offer 4-5x the strain performance of traditional Type II PZT materials. With this revolutionary material, we are enabling a new generation of technologies, including medical ultrasound systems with higher resolution and high performance and compact sonar systems.

Potential Commercial Applications: Using single crystal transducers with low frequency band that have good depth survivability, compactness, and lightweight allows for applications related to many submarine, UUV, and other Navy systems. Wideband projector with high power and bottom functioning sonar systems enhances the capabilities for many NAVY missions. Other commercial applications include applications that require deep ocean acoustic sources for underwater cables, oil rigs, buried object detection, arctic navigation system, underwater cameras, etc.

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