



Sonar Transducers and Arrays

About MSI

MSI of Littleton, MA, designs and manufactures custom sonar transducers and arrays for commercial and defense customers. MSI's piezocomposite technology offers extremely broad bandwidth, high receive sensitivity, high source levels, conformability for curved arrays, and reduced side lobes. This technology has enabled several of the most advanced sonar systems available today.

MSI has a staff of experienced design engineers ready to help you with your transducer design. Our process of engaging our team early in the design process allows customers to maximize performance capabilities while also minimizing the total cost.

MSI's manufacturing capabilities are designed to assure you receive the highest quality products. Our advanced manufacturing and testing capabilities allow us to turn raw materials into finished assemblies that are ready for system integration.

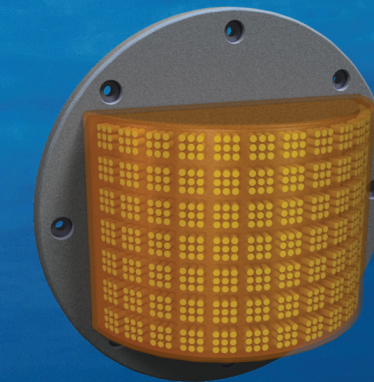
Whether you need a custom designed product or just looking for a source to build your existing design, MSI is the right choice.

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DESIGN • MANUFACTURE • TEST

...from concept to production

Sonar Transducers and Arrays

MSI offers a wide range of transducer design and manufacturing capabilities to handle simple to complex requirements.

- **Custom Solutions**—MSI specializes in working with you on your custom solution. Whether you have a conceptual idea or a full blown specification, our engineering team is ready to help develop your product.
- **Manufacture your Products**—MSI’s robust manufacturing process is there to help build your designed products, and if needed, help scale up your products for highly repeatable production.
- **Standard Products**—Our standard products are designed to be easily customized to meet your needs, or can be used to support your initial testing or development.



Design

MSI uses many different sophisticated design tools to aid in the design of your product.

- 1D (i.e. KLM) Model for simple transducer designs.
- 3D Finite Element (PZ Flex) for complex designs.
- Directivity models for curved and planar arrays.
- CAD (Solidworks) for mechanical design.



Prototype

MSI’s prototyping capabilities allows for rapid development of your product, while maintaining the flexibility to iterate the design.

- Subscale transducers to prove out acoustic performance while minimizing the cost risk of building a complete unit.
- Intermediate prototypes to mitigate risk while testing and developing your system in a test environment.
- Complete prototypes to deploy in your final application.



Test

MSI’s extensive test capabilities allow for in-process testing as well as final in-water testing.

- Impedance, Capacitance, Dissipation, Electromechanical Coupling, and Insulation Resistance.
- Pressure Testing, Vibration, and Thermal Cycling.
- Three in-water test tanks using NIST Traceable standards for directivity, TVR, RVS, and high-power testing.



Production

MSI utilizes a highly configurable manufacturing environment to produce production level products.

- Universal build cell that supports one to fifty units.
- Configurable cells that can support thousands of units per year.

Why MSI

- A True Partner in your Product Development
- Strong Engineering Support
- Design Flexibility
- Advanced Performance
- Efficient Manufacturing
- Advanced R&D Development
- Proven Manufacturing Capability in Commercial and Navy products

MSI’s Vertical Integration

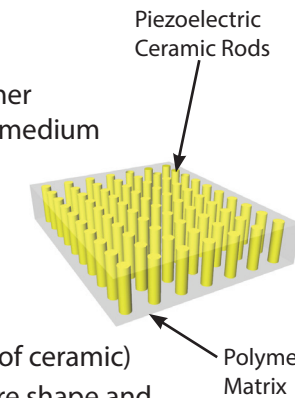
MSI starts with making our own ceramic powder...



...and ships a complete, tested unit.

1 - 3 Piezocomposite

- Piezoceramic rods in a polymer matrix act as homogeneous medium
- Many more design variables than solid ceramic to optimize performance
 - Ceramic material
 - Polymer material
 - Volume fraction (amount of ceramic)
 - Electrode pattern (aperture shape and array configuration)



MSI’s Design Advantages

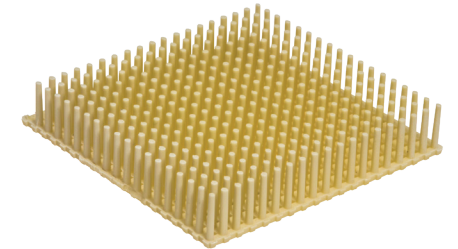
- Broad Bandwidth
- High Sensitivity
- High Source Levels
- Conformability for Curved Arrays
- Reduced Side Lobes
- Complex Shading Patterns
- Full Ocean Depth Capability
- Cost Effective Solutions

MSI’s Applications

- Acoustic Communications (ACOMMs)
- Diver Detection
- Sidescan Arrays
- Multibeams (Bathymetry, Bottom Mapping)
- Curved Receivers and Projectors
- UUV Sensors
- Synthetic Aperture Sonars
- Forward Looking Sonars

MSI’s Injection Molded Piezocomposite

- High manufacturing rate – 30x faster than conventional dicing
- Excellent piezoelectric uniformity
- Standard pre-forms cover 17 kHz to 600 kHz



MSI, who is best known for piezocomposite solutions, is also actively developing and delivering transducers utilizing the following materials:

**Single Crystal • Textured Ceramics
Porous Ceramics • PVDF • Solid Ceramics**