ABSTRACT
We demonstrate two-dimensional (2D) position/location sensing using magnetoquasistatic (MQS) fields for non-line-of-sight (NLoS) tracking applications. Magnetoquasistatic fields are not significantly perturbed by line-of-sight (LoS) blockage due to lossy dielectrics and hence can operate in an NLoS and heavy multi-path environment. Position sensing of a mobile transmitter (TX) is enabled by measuring the transmitted magnetoquasistatic fields at one or more receivers (RX) located within the measurement zone. Meter-class position sensing is expected for measurements spanning a zone covering at minimum 20x20m (>1 RX) or up to ranges greater than 20m from a single RX. Three-dimensional (3D) position sensing using the MQS technique can be achieved, but will need additional systems and algorithms that require further development, which is the focus of future work.

Keywords
Magnetoquasistatics, localization, radio position measurement.

1. DESCRIPTION OF SYSTEM
The magnetoquasistatic system operates by generating and sensing low-frequency quasistatic magnetic fields using coil antennas, and by inverting the quasistatic fields for position of the mobile field generator or source [1]. To enable a closed form and linear position or location solution, the source and sensing coils require orthogonal antennas. The source coils are excited by a MQS field at a frequency between 60-400 kHz, depending on accuracy, range, and NLoS penetration requirements. Each axis of the source is excited by a unique field to distinguish each source coil field from the other. The receive coils enable sensing of all source fields. Closed-form inverted quasistatic field theory is used to invert the measured fields for position of the source [1]. The technique can enable 2D positioning of the TX using a single RX, however higher accuracy is obtained using >1 RX systems.

2. CURRENT LIMITATIONS
Present development of the technique and system is limited in multiple ways. The system is currently limited to 2-axis source and sensing coils, which limits the solution to 2D positions only. Three-dimensional (3D) position sensing can be achieved in this technique, but would require 3-axis coils, and new RF systems and algorithms. The 3D development is the focus of future work. The current system is also constrained to a maximum range of about 20-30m from the single RX, or to an area of about 20x20m for >1 RX infrastructure. Furthermore, the present hardware is at an early development stage and is physically large. The TX and RX coil system is as large as 30x30x30cm, in addition to source and receiver electronics which are of comparable to smaller size.

3. ACKNOWLEDGMENTS
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4. REFERENCES