

Netted RF Sensors

Michael F. Otero, Ph.D.

781-271-7171 • motero@mitre.org

MITRE Sponsored Research

The logo for the MITRE Technology Program, featuring a stylized graphic of stacked blocks in yellow, orange, and blue to the left of the text.

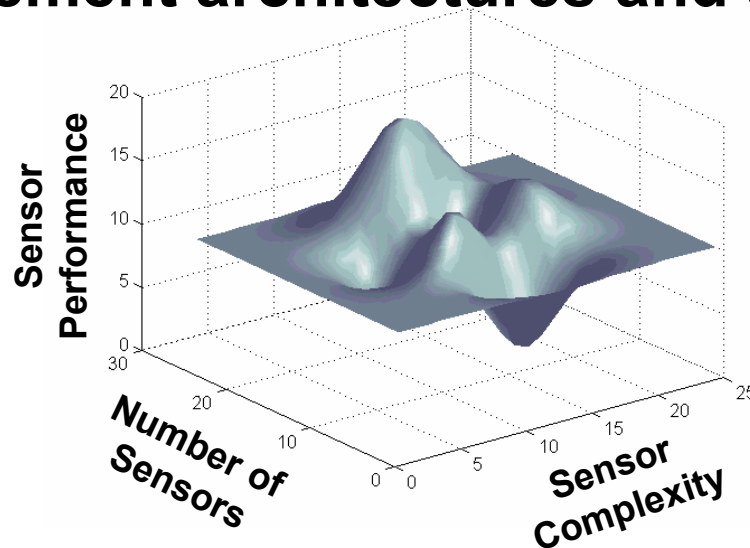
MITRE
Technology
Program

Problem

- **The validity of the assertion that a network of sensors provides greater performance than the performance of a single large sensor or the sum of the individual sensors' performance is unknown.**
 - **No general theory to validate that this supposition exists.**

Background

- **Netted sensor research seems to be focused on the development of individual sensors, networking, communications, and resource management architectures and algorithms.**



Reality: The topology of the trade space is not known.

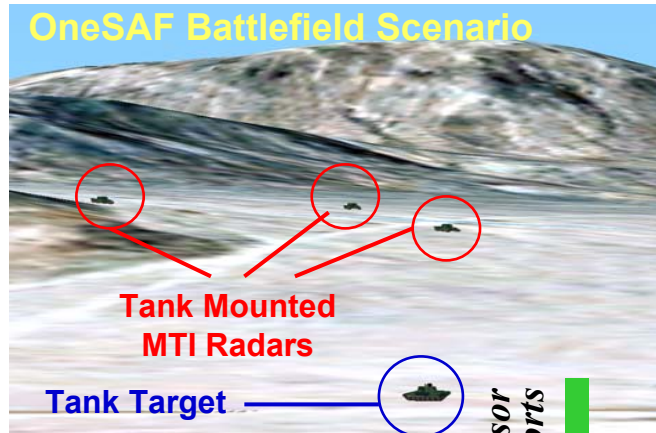
Objective

- The objective of this research program is to develop principles for **optimizing the performance of netted sensors**.
- Focus on the sensor and data exploitation aspects of the netted sensor problem through the use of RF sensors
- Explore the trade space of the problem using modeling and simulation and experiments
- Extend observations to include a wider class of DoD sensors that perform sensing at a distance
 - Electro-optic, IR, seismic, acoustic, magnetic, RF

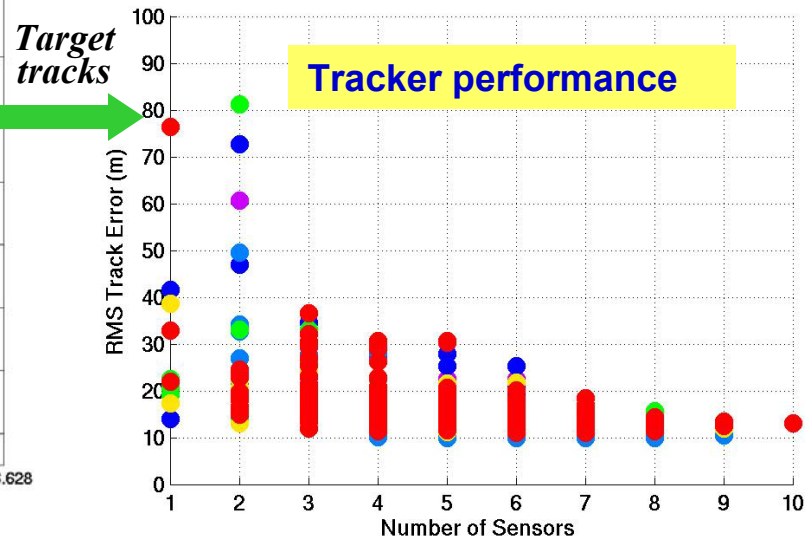
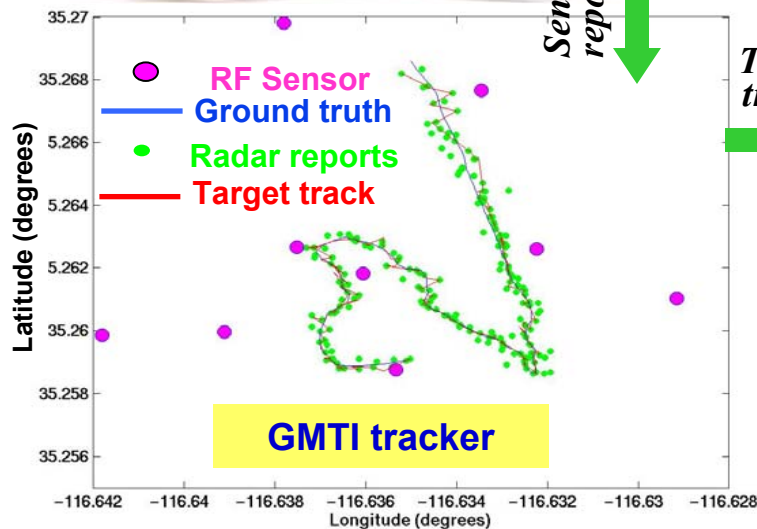
Activities

- **Develop a modeling and simulation testbed**
 - **Simulate battlefield scenarios with multiple RF sensors detecting ground vehicles**
- **Conduct experiments with commercially available, low cost, low power RF sensors**
- **Evaluate netted RF sensor performance and explore the trade space**
- **Extend the domain-specific observations to more general domains**

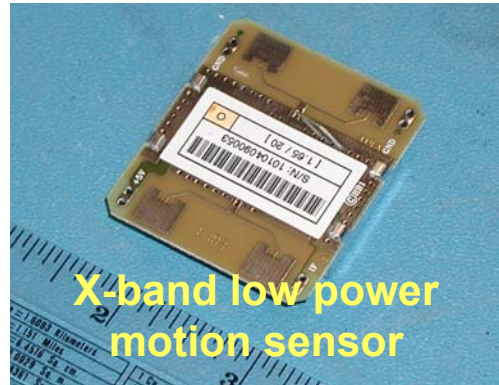
Highlight



Modeling and simulation testbed can model battlefield scenarios with multiple, distributed RF sensors. Testbed incorporates accurate terrain features, vehicle motion characteristics, and RF propagation effects. Data is processed with a GMTI tracking algorithm. Tracker performance is used to gauge overall performance of the sensor network.

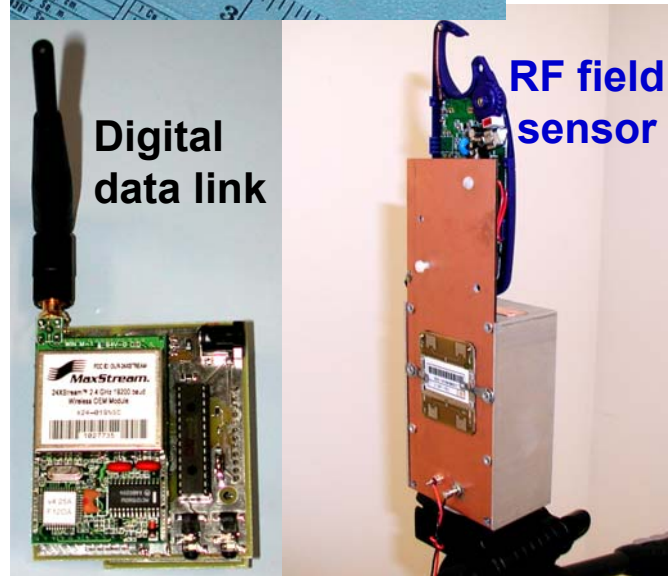


Demonstration



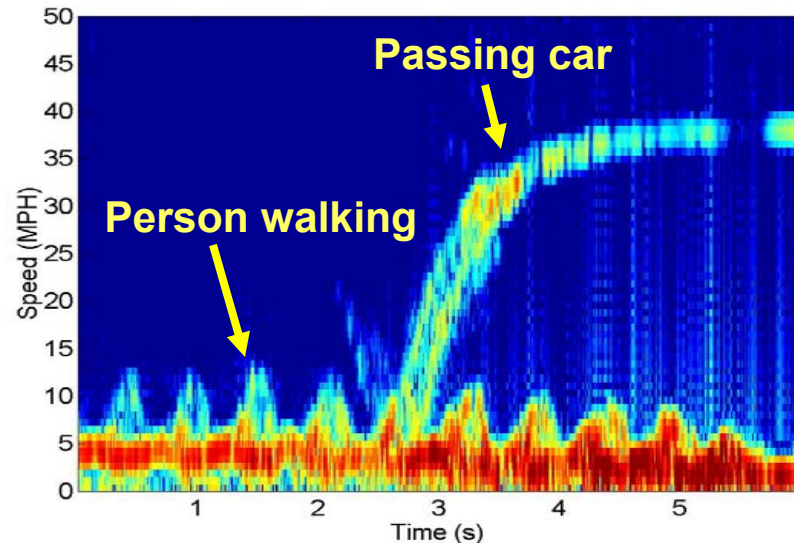
X-band low power motion sensor

Experiments with low-cost commercial hardware being conducted to demonstrate the performance of RF sensors for detecting and tracking moving entities. Self-contained RF field sensors include power supply, X-band motion sensor, digital data processor, and spread spectrum digital data communication link.



Digital data link

RF field sensor



Impacts

- The results and “lessons learned” from MITRE’s Netted RF Sensors MSR program will have a significant impact on a number of our sponsor’s programs that are currently making use of, or planning to make use of, netted sensors.
- Domain specific transition opportunities include
 - Army Future Combat Systems
 - Air Force Deep-Strike Mission
 - Navy Expeditionary Grid
 - DARPA MULti-function EW System (MULES)

Future Plans

- **Combine the sensor and data exploitation aspects of this MSR with efforts from other MITRE Sponsored Research programs**
 - **Management of ad-hoc re-configurable networks**
 - **Management of system resources**

