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Distributed Acoustic Arrays: Infrastructure Architecture and Performance

• Concept:
  A large number of sensor “nodes” cooperate. Each node has an acoustic and possibly other sensors. Each node has signal processing capability. Each node is small, lightweight and inexpensive. The nodes interact by wireless communications. The nodes are easily deployed and self-organizing. The nodes cooperate to provide low-power operation (hence longevity) to detect, localize and identify targets.

• Under the DARPA/ATO AWAIRS program, UCLA and the Rockwell Science Center have progressed toward achieving this system concept.
AWAIRS: Adaptive Wireless Arrays for Interactive RSTA for SUO
AWAIRS 1 PROTOTYPE NODE
Distributed Wireless Microsensor Network: Signal Processing Architecture for Low-Power Operation

- Continuous sample, HW filter, threshold compare
- Process single sensor
- Fuse multiple on-board sensors
- Query/corroborate with neighbors
- Fuse features with neighbors
- Beamformation

Alarms may be reported and awaken next layer

Increasing quality (decreasing false alarm rate, increasing detection rate)

cooperative autonomous
Distributed Microsensor Arrays: Wireless Communications Networking

We have developed a prototype system capable of:

- Synchronous streaming data collection from dispersed sensor nodes
  - Star radio topology to base station(s)
  - Each node samples at 1kHz
  - Internode sync within 100 μsec

- Realtime “detection network” where target decisions are derived on-board each node and exchanged with neighbors
  - Extending infrastructure to accommodate dynamic establishment of streaming circuits to support on-line beamformation