

Magnetic Anomaly Sensing for Landmine Alternative Systems

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**National Defense Industrial Association
2002 Mines, Demolition and Non-Lethal
Conference**

Tampa, Florida, June 3-5, 2002



Outline

- *SDT Sensor Competitive Requirements*
- *Comparative Technology*
- *SDT Technology Overview*
- *Applications of SDT Sensors To Anomaly Detection*

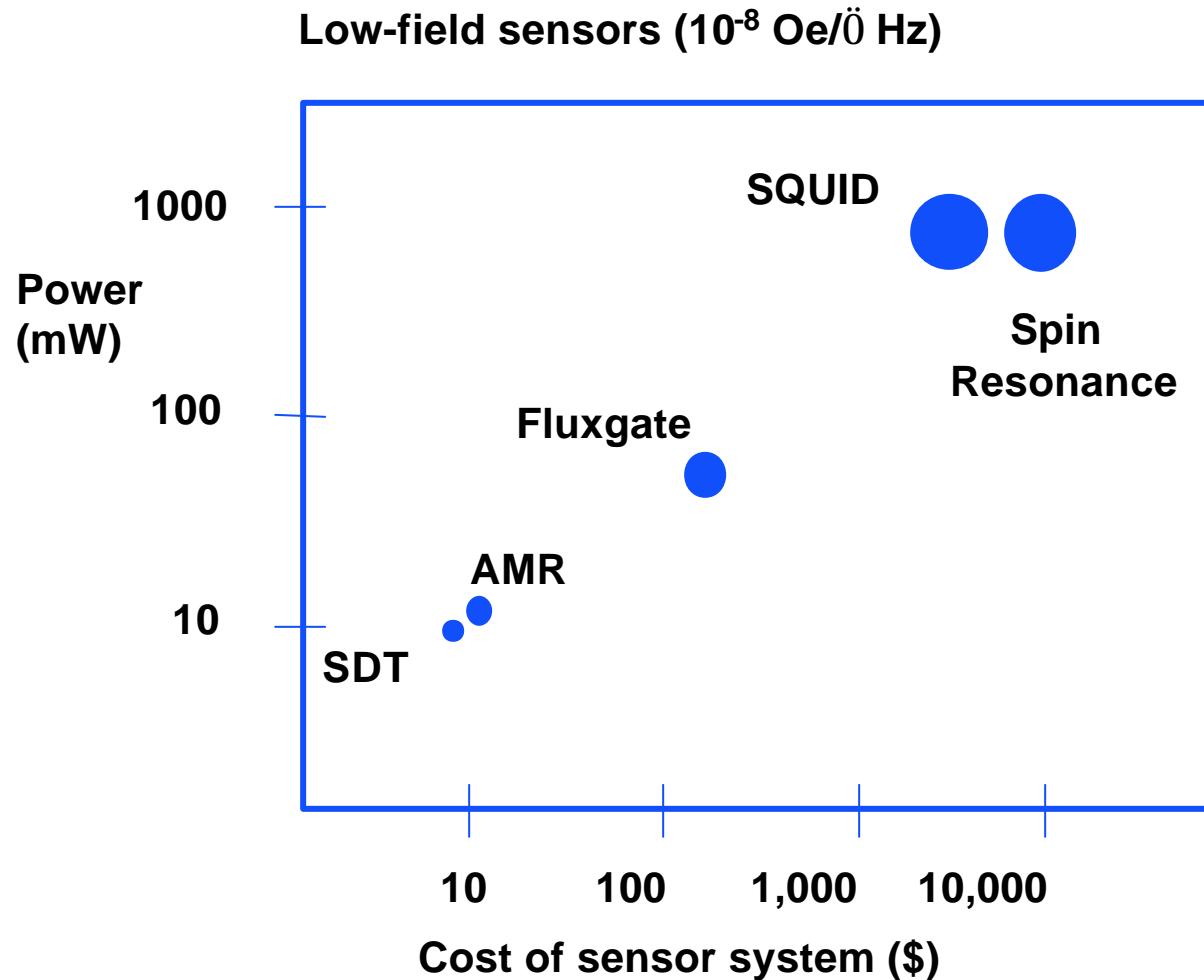


SDT Sensor Competitive Requirements

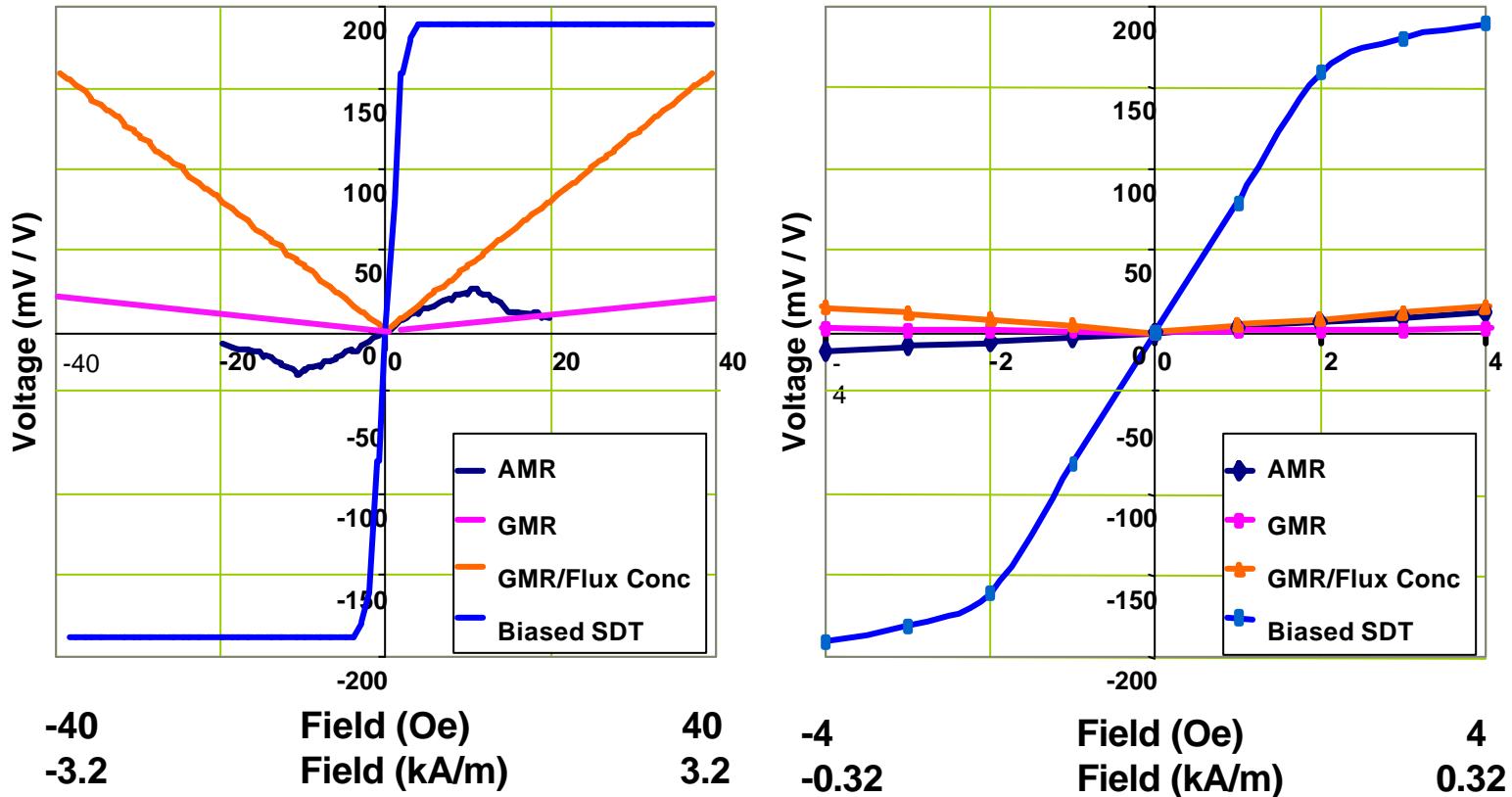
- *Sensitivity: 30pT/rtHz noise limit*
- *Resolution: 1nT @ 0.1Hz*
- *Power: 10's mW per Chip*
- *Size: Monolithic IC Packaging per Channel*
- *Cost: <\$10/chip*



Magnetic Sensing Technologies



Comparison of MR Sensors

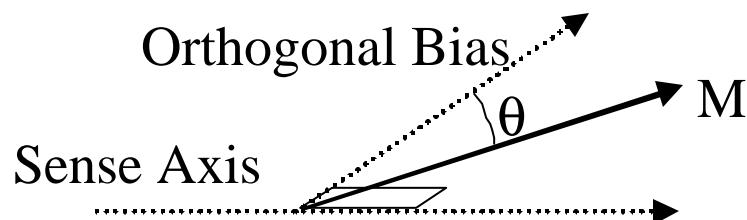
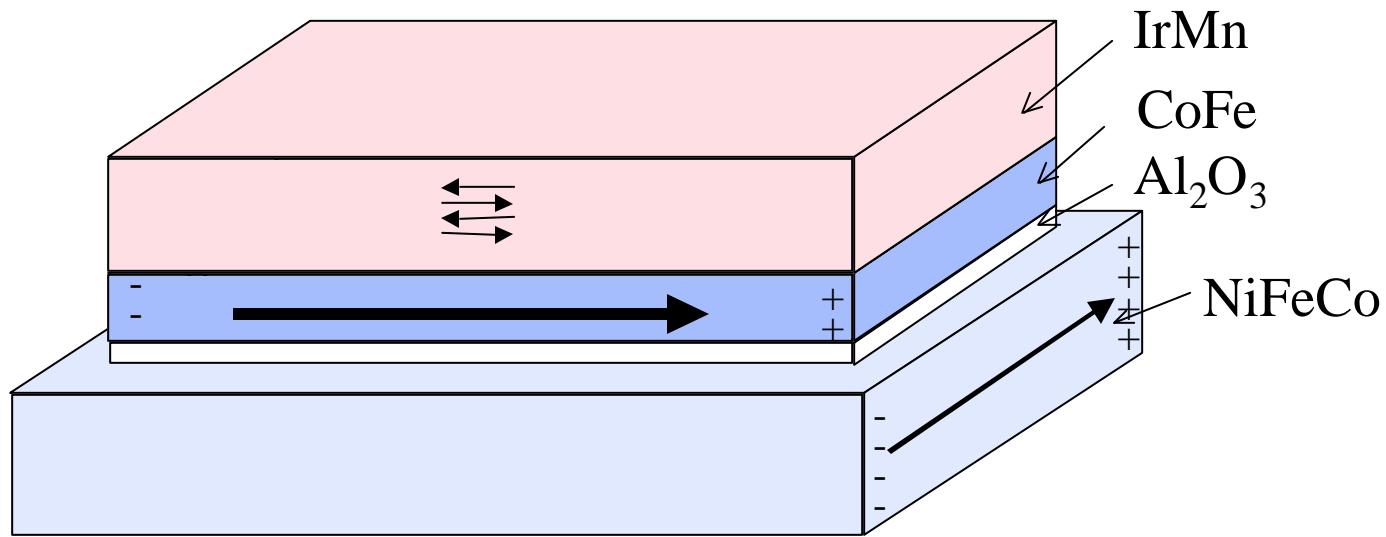


SDT Magnetic Sensors

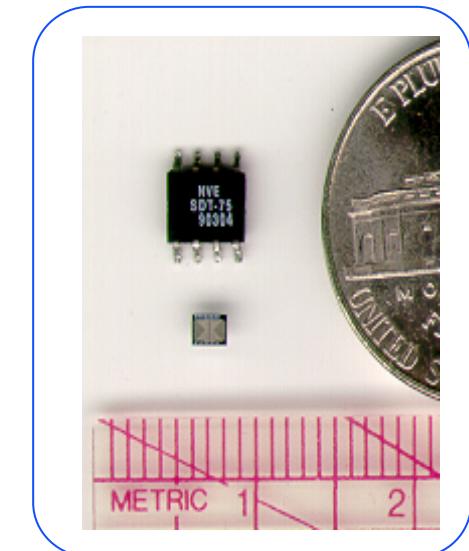
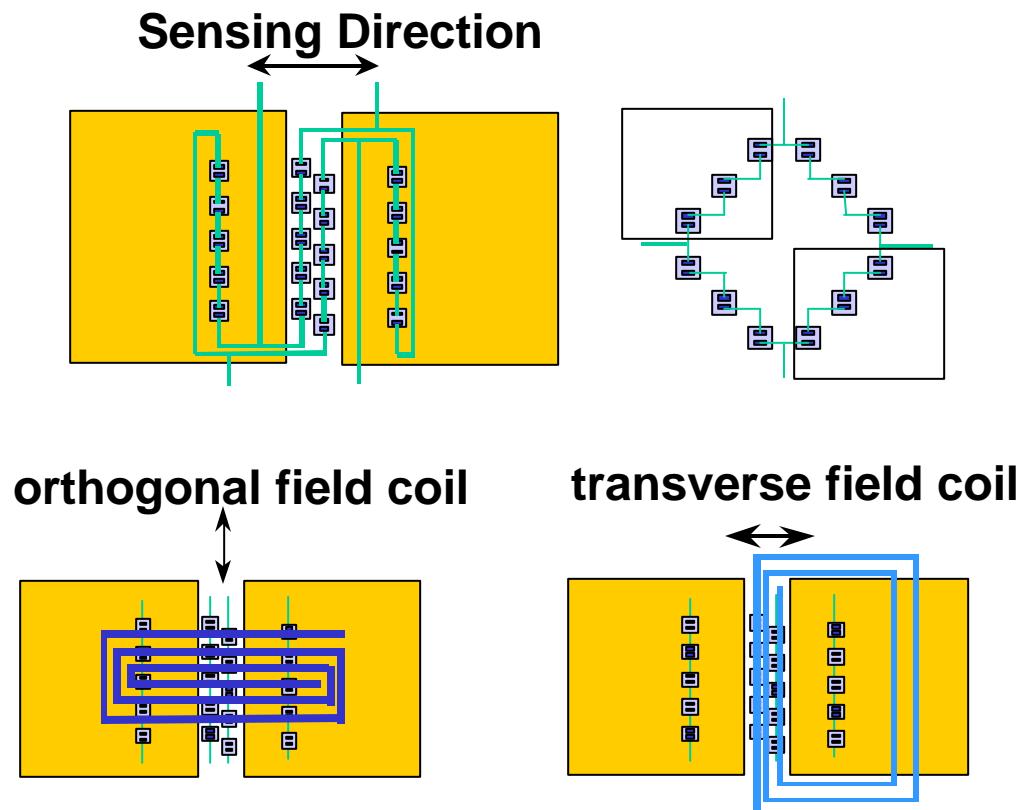
- *Quantum tunneling of electrons through a thin insulator between two magnetic layers*
- *Tunneling current is effected by the relative orientation of magnetic moment in layers*
- *One magnetic layer pinned and one layer free to respond to external fields*
- *All current passes through the interface-high GMR (high sensitivity)*
- *Extremely high resistance per unit area (low power)*



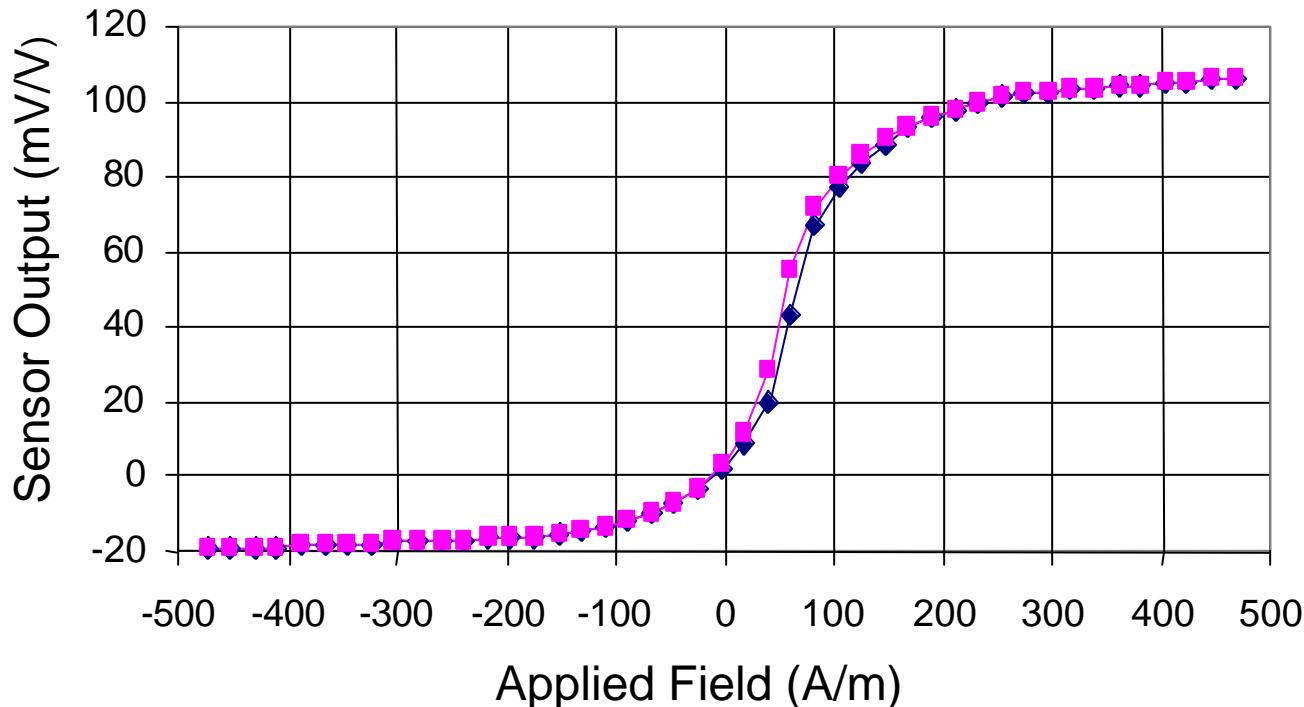
SDT Layer Structure



SDT Sensor



SDT Sensor Response

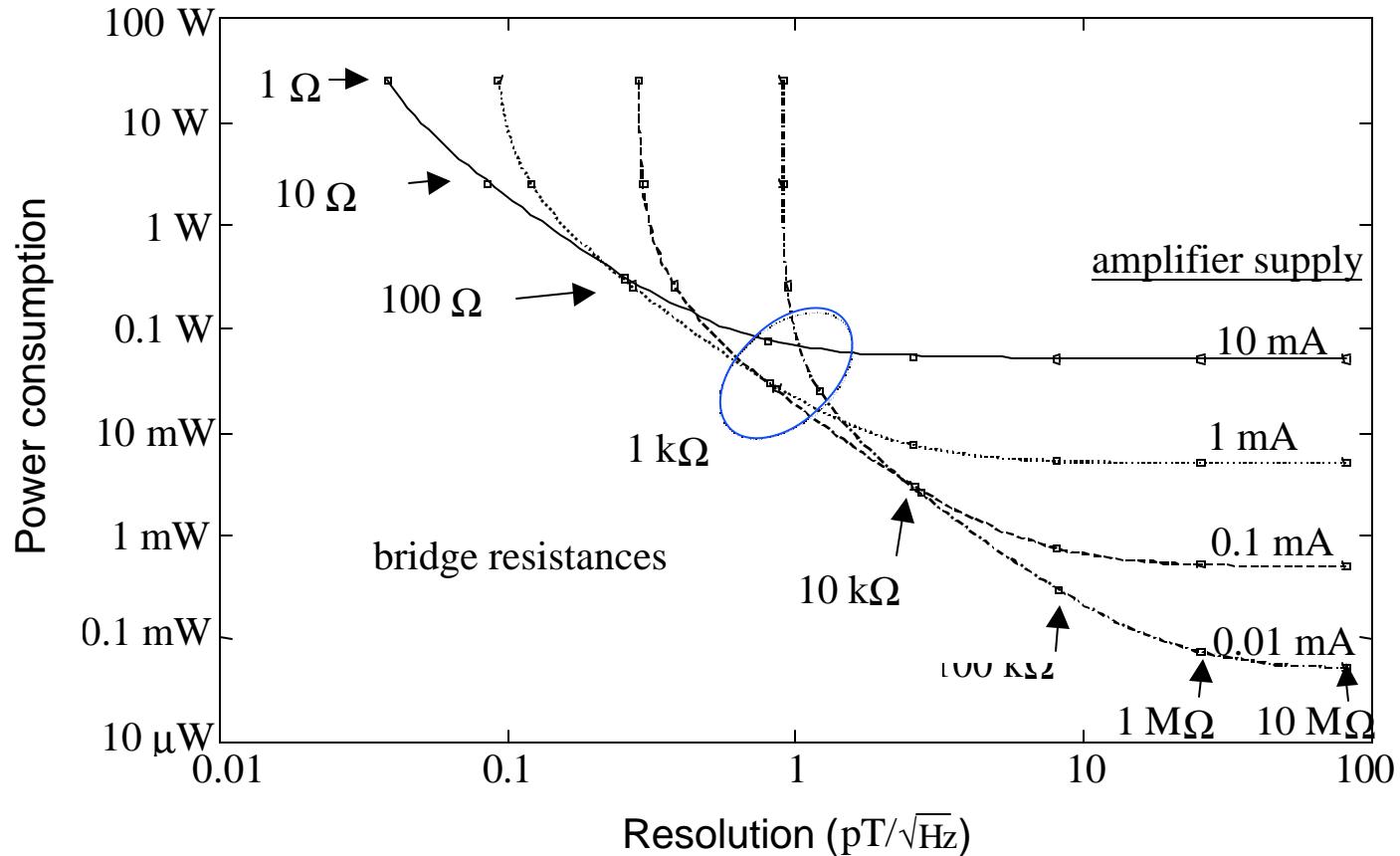


Output of prototype SDT Wheatstone bridge sensor.
Maximum slope 1.25 (mV/V)/(A/m) (100 (mV/V)/Oe)



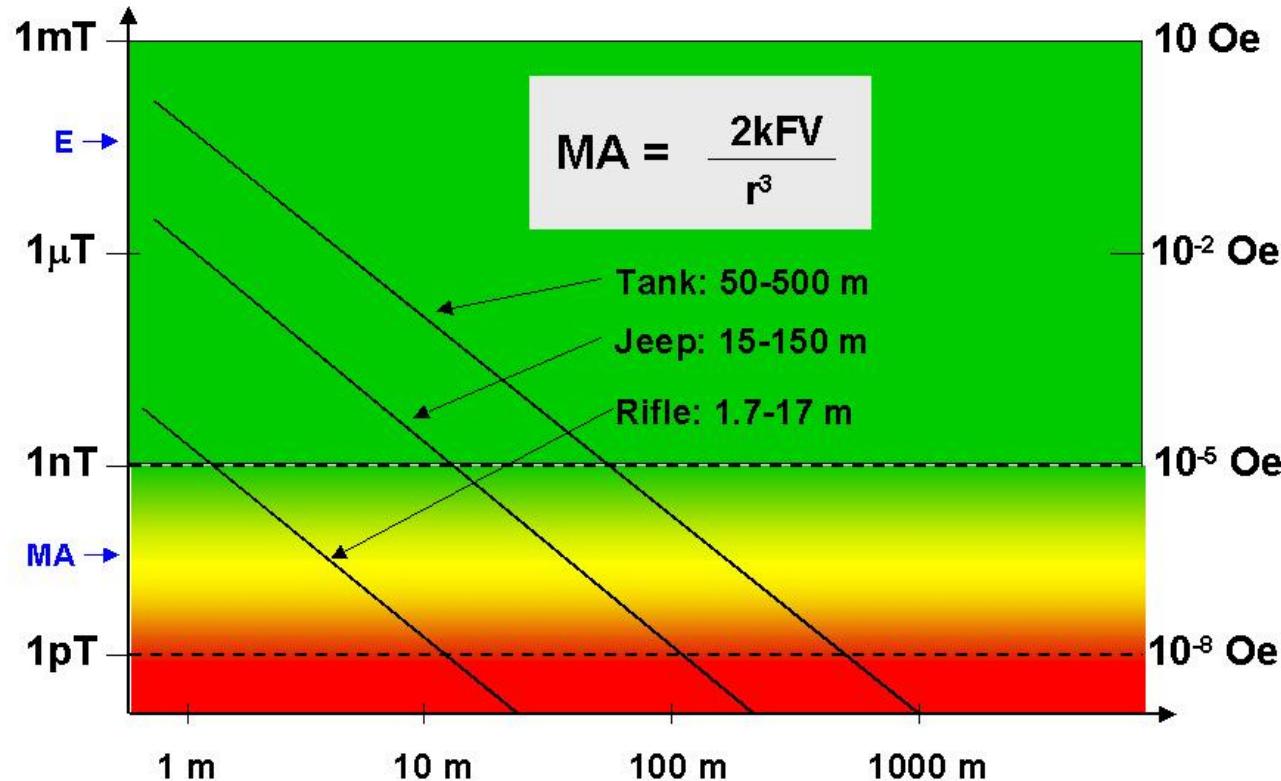
Low Power SDT Sensor

Power Consumption Versus Resolution - 5 Volts



Applications for Anomaly Detection

Unattended Sensor Network Systems



TAB Review - 24 Aug 1999

D. Hull - Micromagnetic Sensors - Approved for Public Release

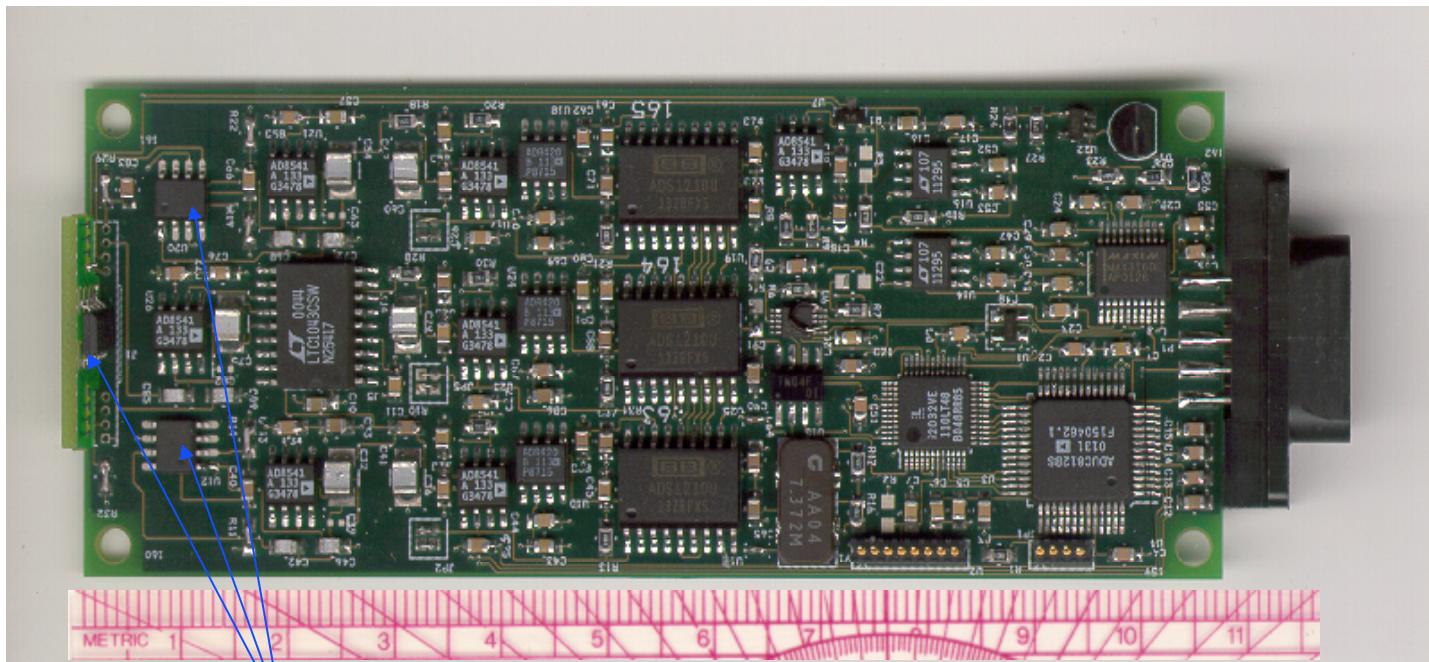
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Applications for Anomaly Detection

3-Axis Magnetometer for Trip Wire or Target Classification

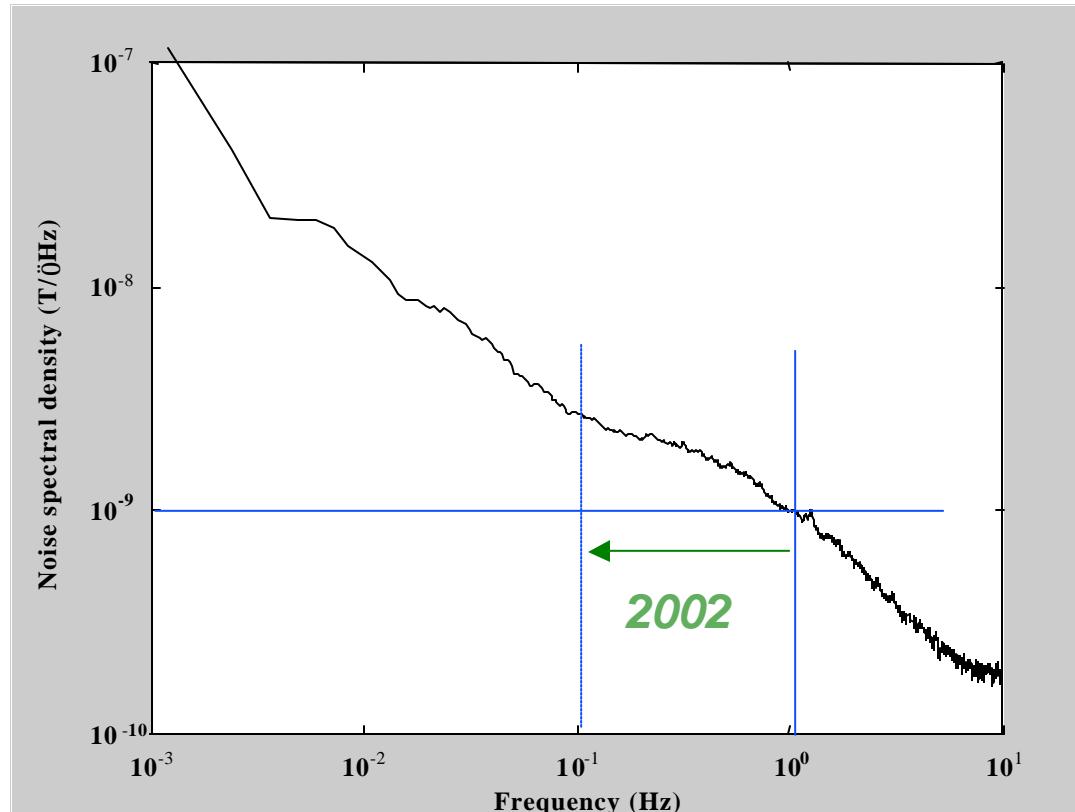


SDT Sensors



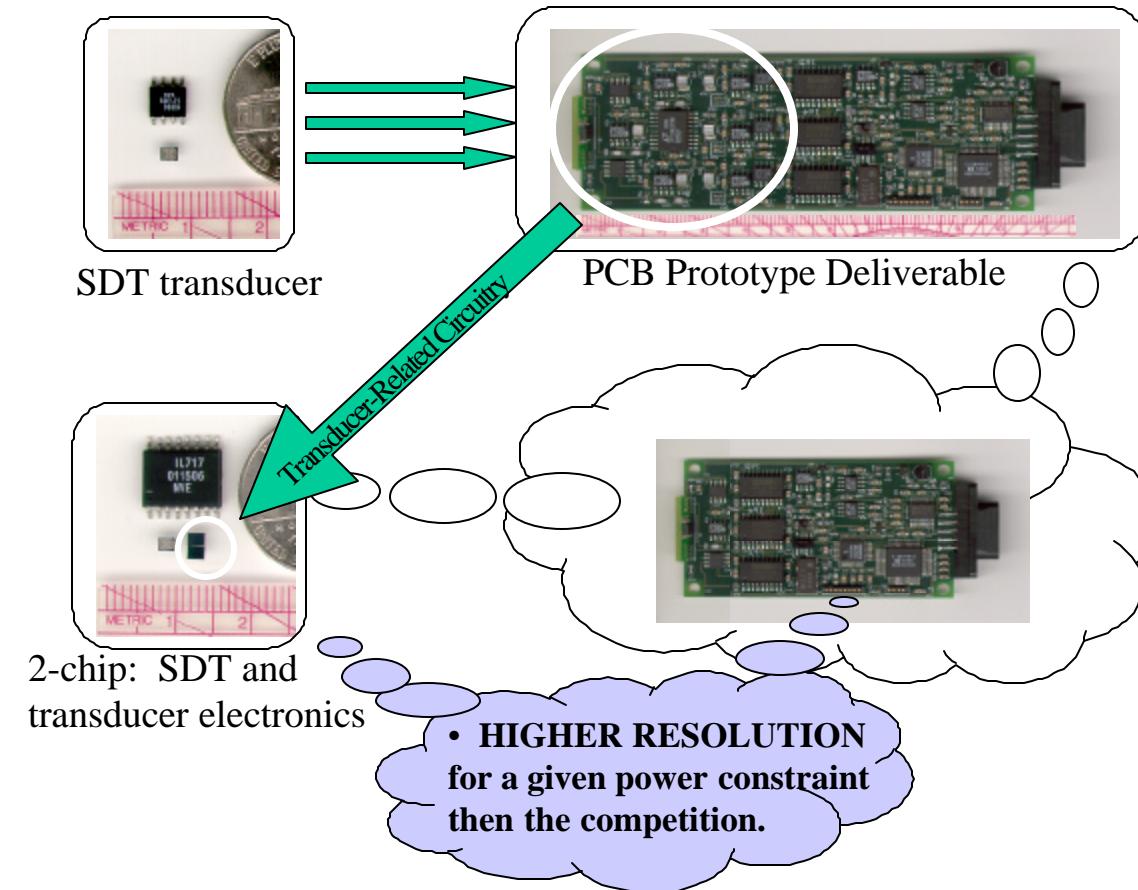
Applications for Anomaly Detection

3-Axis Magnetometer Performance



Applications for Anomaly Detection

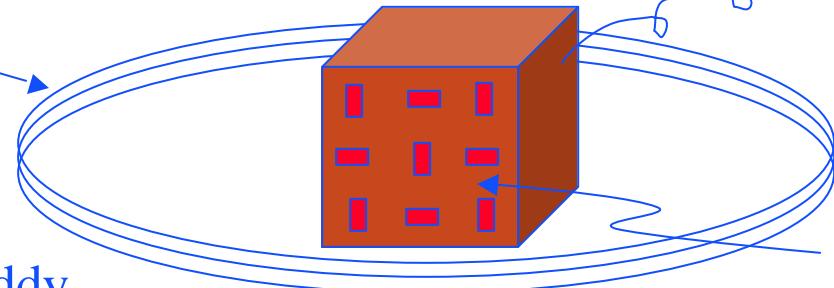
3-Axis Magnetometer “Growth”



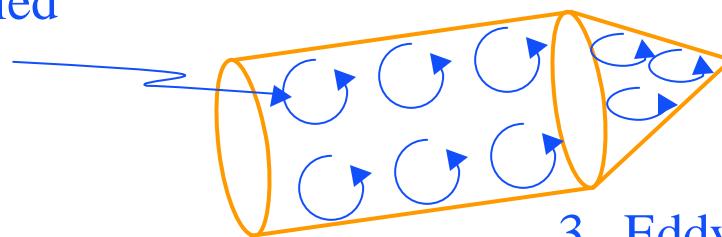
Applications for Anomaly Detection

UXO and Landmine Detection

1. Source Coil
generates magnetic
field pulses



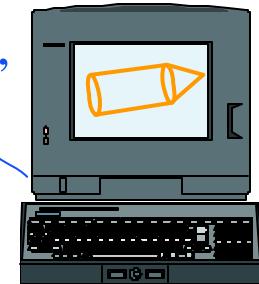
2. Pulses induce eddy
currents in a buried
object



3. Eddy currents create
characteristic magnetic fields



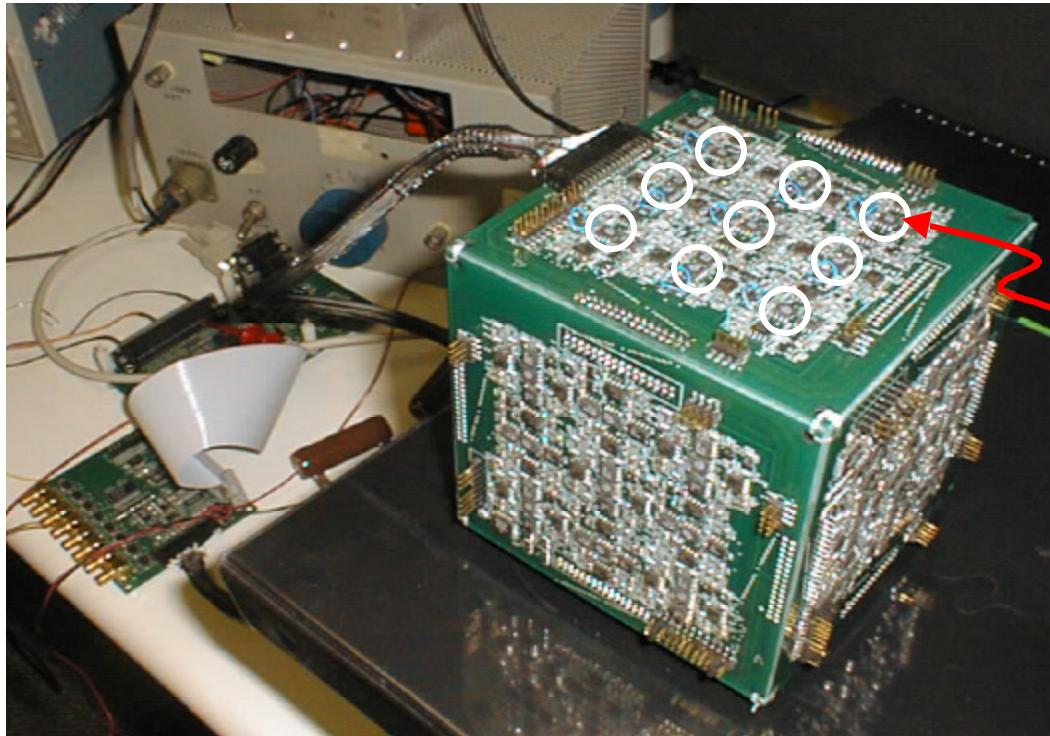
5. Computer “decodes” the data,
identifies object



4. 3-D Tensor sensor
array detects time
dependent fields

Applications for Anomaly Detection

3-D Array for UXO Classification

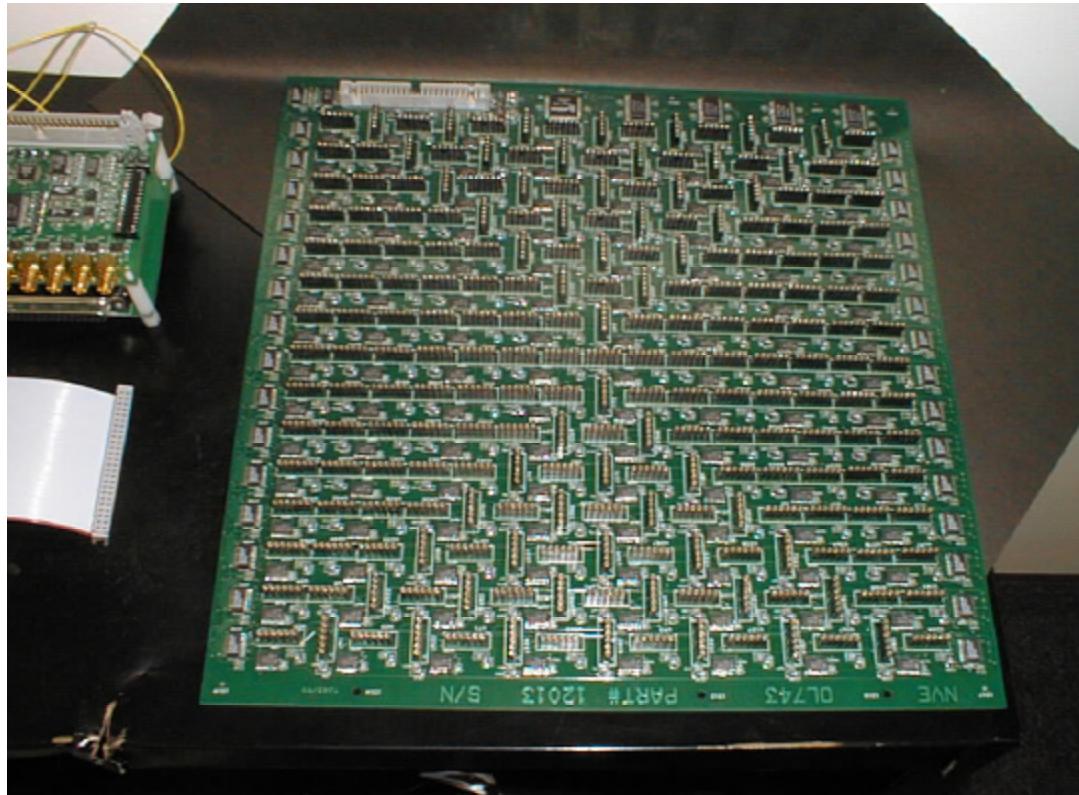


9 SDT
sensors on
each of six
faces



Applications for Anomaly Detection

2-D Array for Landmine Detection



Conclusions

- *SDT sensors will facilitate the development of sensitive, low-power, and cost effective magnetic anomaly sensing systems*
- *Military Applications*
 - *Trip Wire and Target Classification in Unattended Networks*
 - *UXO Classification*
 - *Landmine Detection*
- *Commercial Applications*
 - *Compassing*
 - *Vehicle Detection/Classification for Traffic Monitoring*
 - *Security Scanners and System Tripwires*



Acknowledgments

- AFRL/MNMF SBIR contract F08630-00-C-0030
- ATK
- ARL SBIR contracts DAAD17-01-C-0037 and DAAD17-01-C-0050
- DARPA SBIR contract DAAH01-02-C-R042

