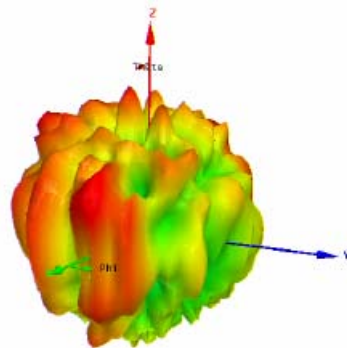
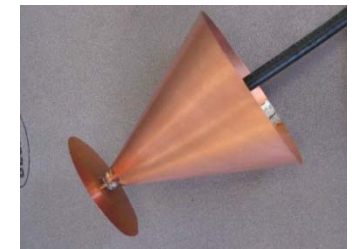


CMT LHA075-SPI S# 940485-002

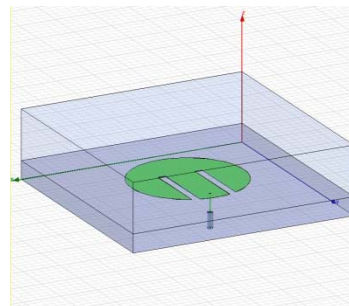
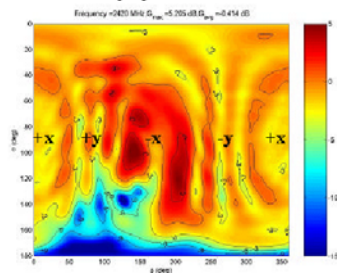


RF/Antenna Projects

Electrical Engineering Department
College of Engineering
Cal Poly San Luis Obispo

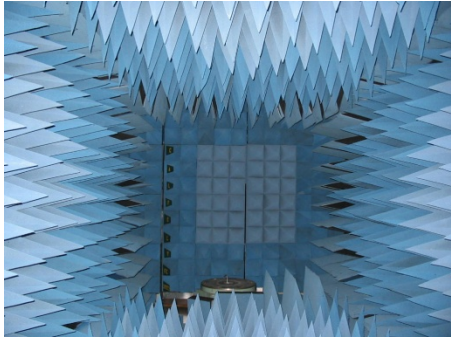


A1.3 – Total gain contour plot (dBi) at 5.2 GHz on a laptop.

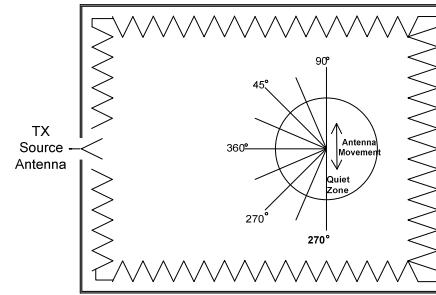


Dean Arakaki
Sept 2013

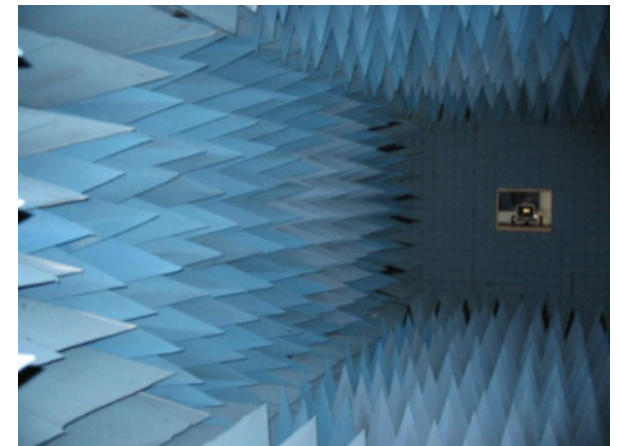
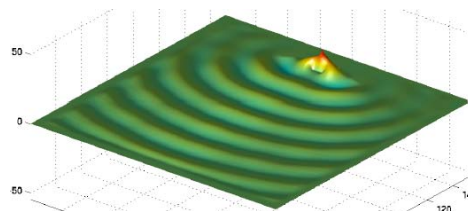
<http://www.ee.calpoly.edu/facilities/anechoic/>



Topics



- Anechoic & EMC Chamber Projects
 - Chamber development
 - Current chamber room facilities and equipment
 - Completed student & company projects
- Current and Future Projects



EE Dept Anechoic Chamber



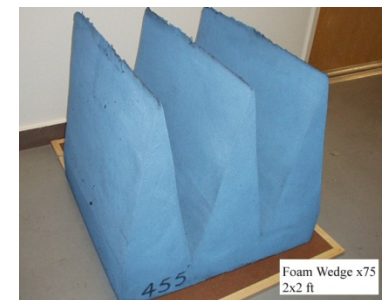
- Anechoic chamber, past support
 - Deskin Research Corp: Jan 2003
 - 150 pieces, 48"-height wedge absorbers
 - 7 pairs, standard gain horns, Narda
 - Raytheon: July 2003



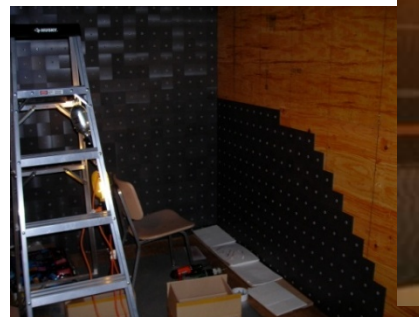
- Absorber foam: 130 pieces 48"-height pyramid absorbers and 100 corner block pieces
- Azimuthal positioner and associated recording equipment
- EE Dept, Cal Poly: Sept 2003
 - 30 pieces (24"-height) and 20 pieces (12"-height) pyramid absorber
- Cal Poly Summer Services and Fall Grant Programs, 2003
 - Student labor
- JPL: consulting services: 2003



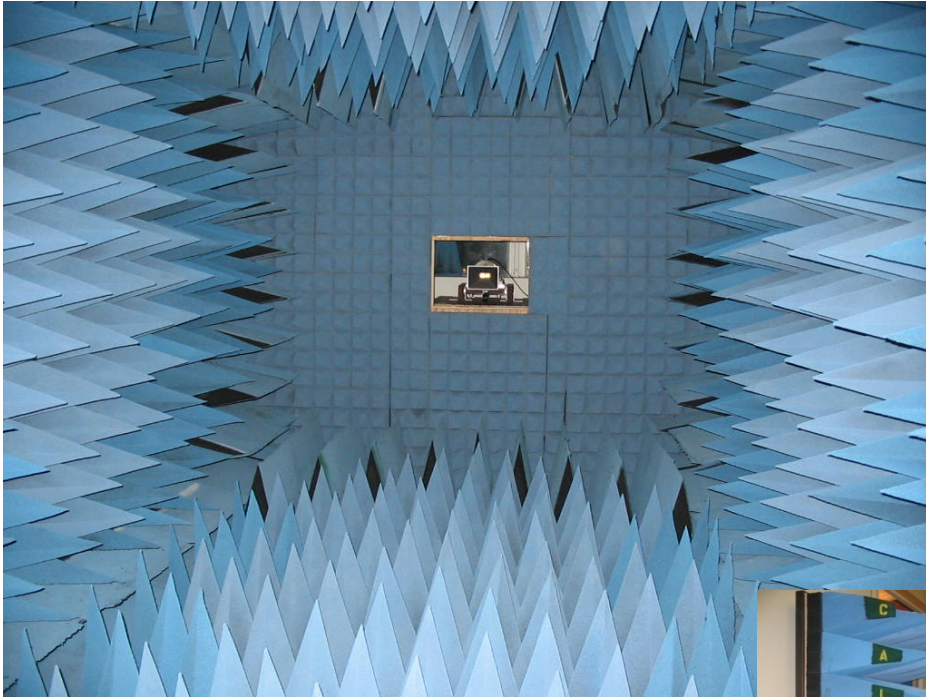
<http://www.ee.calpoly.edu/facilities/anechoic/>



EE Dept RF Chambers

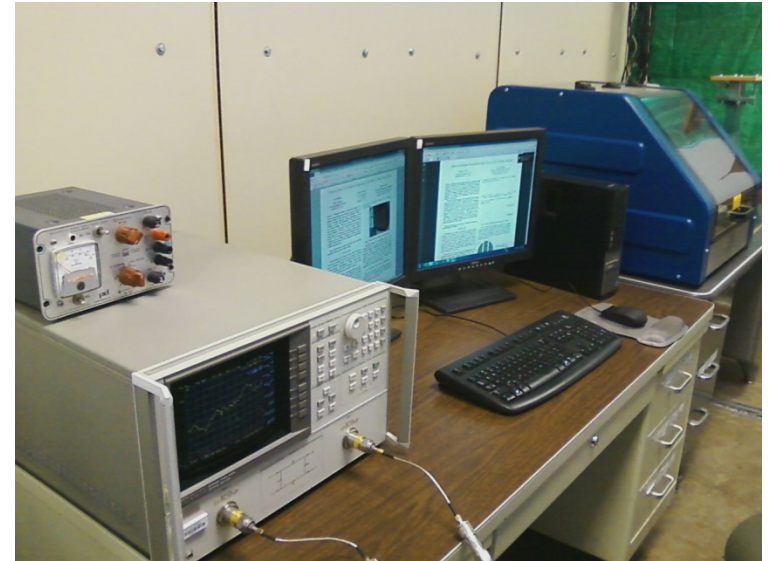
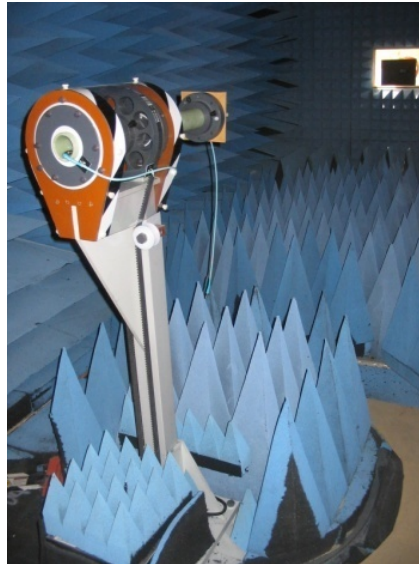


EE Dept RF Chambers

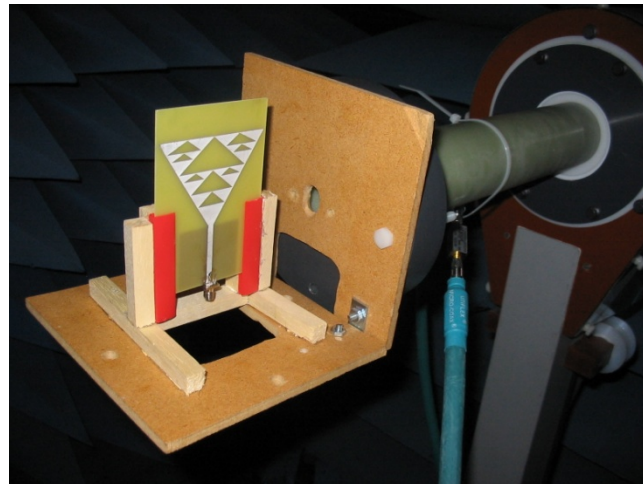


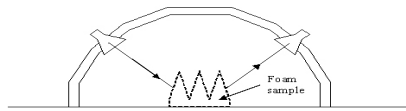
Anechoic Chamber Facilities/Equipment

Chamber rooms &
offices: Sept 2013



Aero Hangar, Building 04
Rooms 112, 113, 206

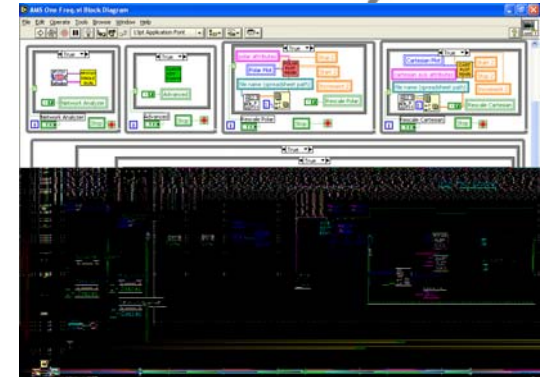




RF Chamber Projects

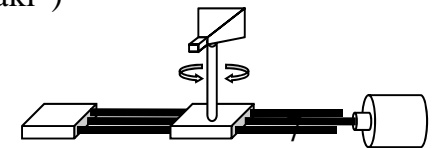
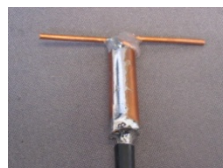
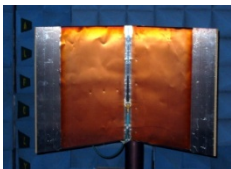
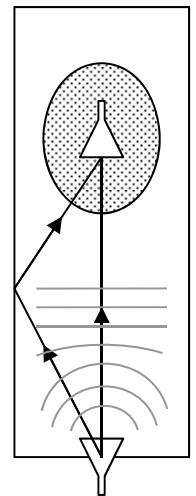


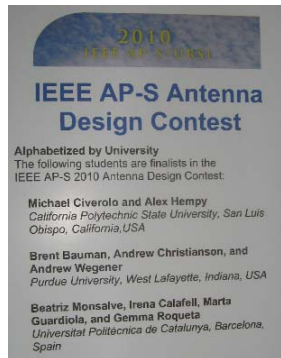
- Completed Projects
 - Absorber foam characterization
 - Chamber performance analysis
 - Primary reflection paths into quiet zone
 - LabView program development:
 - Synchronize positioner with network analyzer
 - Original (SA) and Sunol Sciences Positioner
 - Antenna measurements course
 - EMC screen room: conducted and radiated emissions measurement capability, May 2008
 - Aperture-coupled antenna design techniques



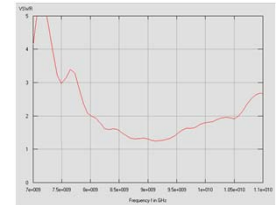
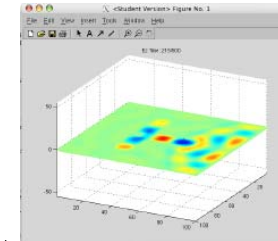
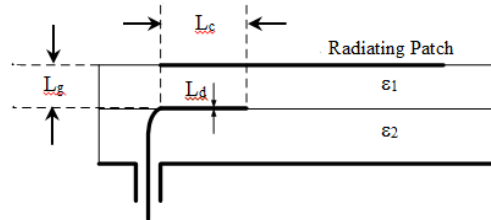
Papers presented at Antenna Measurements & Techniques Association (AMTA) and Institute of Electrical & Electronics Engineers (IEEE)

Conferences: <http://digitalcommons.calpoly.edu/> (search "Dean Arakaki")

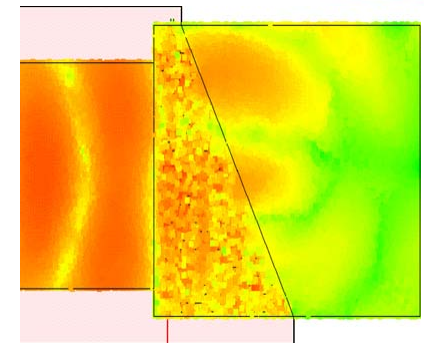
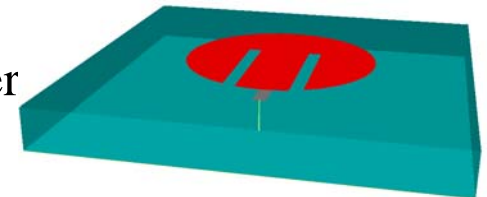




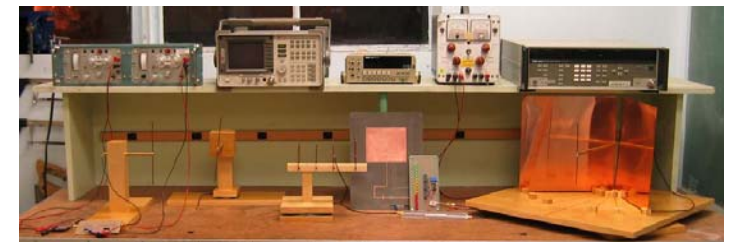
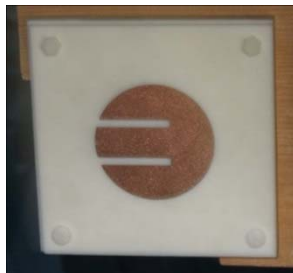
RF Chamber Projects

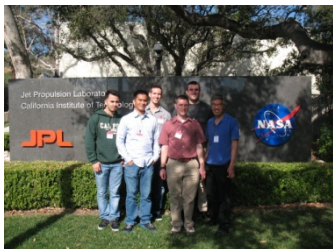


- Other past projects
 - Antenna/Electromagnetic simulator (FDTD)
 - Microstrip antenna design and test
 - Enhancement for wideband operation
 - Simulation, fabrication, and test in anechoic chamber
 - Metamaterials
 - Metamaterial simulation and design
 - EMC radiated emissions chamber design and construction
 - IEEE Antenna Design Contest, 1st Annual
Toronto, Ontario, Canada: July 2010



<http://ceng.calpoly.edu/news/cal-poly-one-three-finalists-international-antenna/>





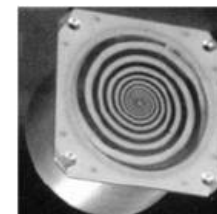
RF Chamber Projects



- Company Sponsored Projects

- Randtron Antenna Systems (Menlo Park, CA): 2005

- Long-range radar transmission line, jet exhaust cooled
 - Air coax dielectric center conductor support design



- WaveZero (Sunnyvale, CA): Summer 2007

- Read range patterns for WaveZero-developed RFID tags
 - TX/RX patch antenna development, software control of positioner and RFID tag reader



- St. Jude Medical (Sylmar, CA): Summer/Fall 2009

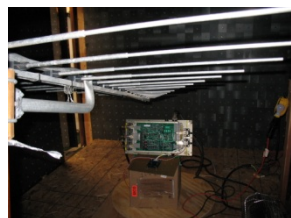
- Antenna design, wireless communications with IMD (implantable medical device)



- Enerpro (Goleta, CA): December 2009

- Installed three-phase power in EMC chamber
 - Tested locomotive supply for EM radiated susceptibility

<http://www.ee.calpoly.edu/projects/electromagnetic-compatibility-emc-testing-enerpro/>



- Aeromech (San Luis Obispo, CA): April 2010

- Radiation patterns for two antenna types (blade and swept dipole designs) for UAV (unmanned aerial vehicle) systems

<http://www.ee.calpoly.edu/news/aeromech-uav-antenna-testing-cal-poly-anechoic-cha/>

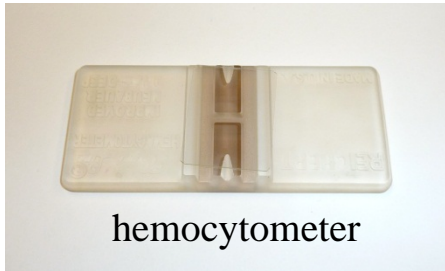


- Stellar Exploration (April 2011 & December 2011)

- Radiation patterns and S-parameter testing on Silver Sword Antenna Project
 - Sounding rocket for interceptor missile test

<http://www.ee.calpoly.edu/news/stellar-exploration-antenna-testing-cal-poly-anech/>





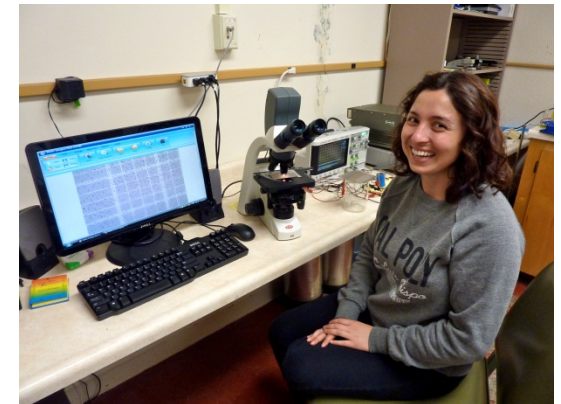
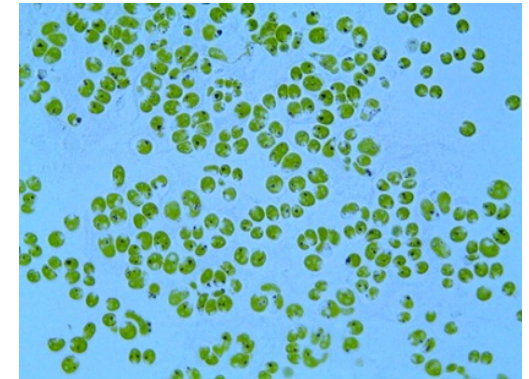
RF Chamber Projects

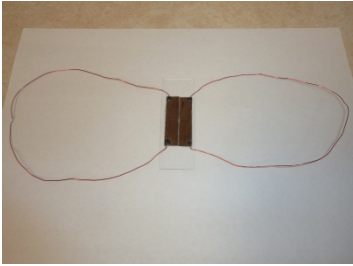


- Current Projects
 - Boeing, Biofuel Extraction from Algae
 - Multi-disciplinary: Biology, Food Science
 - Culturing high-lipid content algae species
 - Chlamydomonas, chlorella, dunaliella



- Boeing Biofuel Project Group
- Chlorella culture
- Dunaliella on microscope slide
- Microscope viewing station





RF Chamber Projects

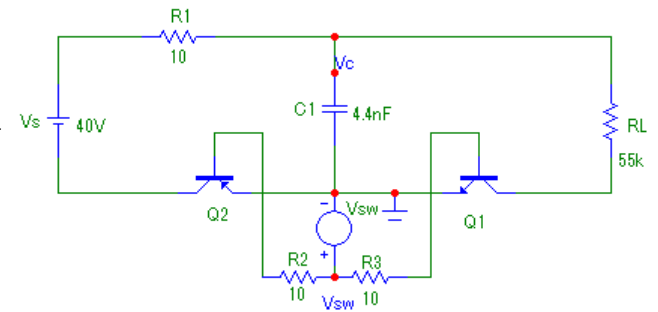


- Current Projects

- Boeing, Biofuel Extraction from Algae

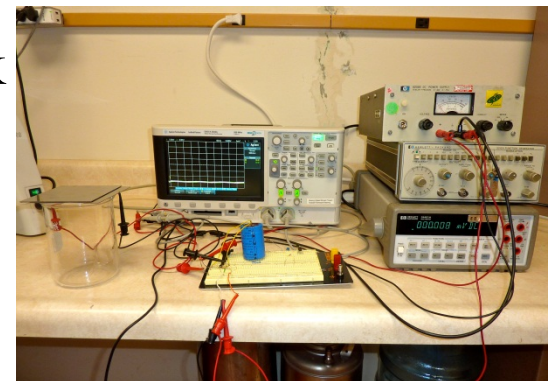
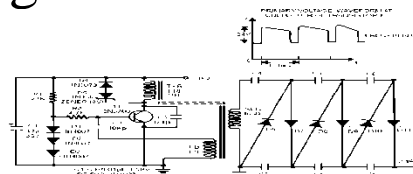


- Algae chamber development, electrodes on microscope slides
 - Algae lysis with sonicator, pulsed electric field
 - Pulsed high-voltage power supply development



Pulsed electric field (PEF) test station

- Pulse control circuit, capacitor bank
- Digital oscilloscope
- Built-in function generator
- Multimeter
- Power supply

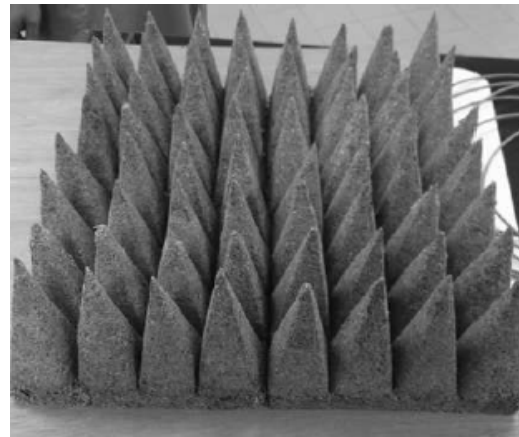




RF Chamber Projects



- Current Projects
 - RF Absorber from Corn Stover
 - Multi-disciplinary: Materials Science, Industrial Technology, Forestry, ABI
 - Corn stover grinding (Forestry)
 - Plastics Lab hot press, RF absorber formation (Industrial Technology)
 - NRL arch for RF testing





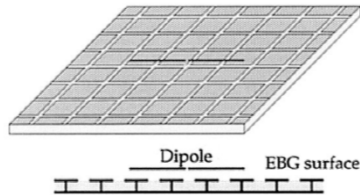
Future Projects



• One-Year Timeframe

– Anechoic & EMC Chamber Labs

- Oceanit: absorber testing, NRL arch
- Lab for EE 533, Antennas
- NSF-MRI proposal: certified antenna and EMC chambers: submitted Jan 2012
 - Eleven partner companies identified
 - Anticipated antenna and EMC testing contracts in proposed chambers
 - Collaboration with UCSB Prof. Robert York
 - AeroMech, Agile RF, Diodes Inc., Enerpro, GateWorks, Oceanit Laboratories, PolySat Program, Stellar Exploration, Toyon Research, Transphorm, Trust Automation



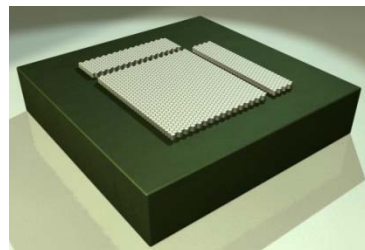
Yang & Rahmat-Samii, IEEE Trans Antennas Propag., Vol. 51, No. 10, Oct 2003, pp. 2691 - 2703



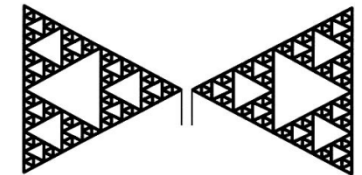
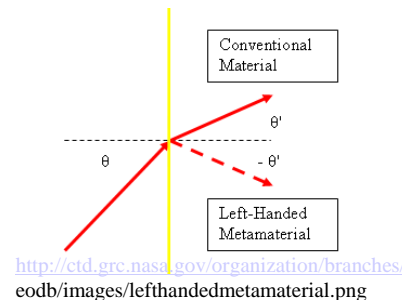
<http://www.physics4u.gr/news/images3/metamaterial.jpg>



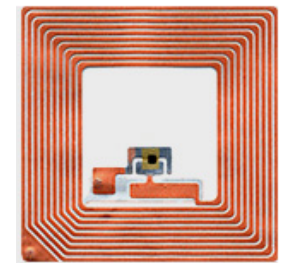
Cal Poly Anechoic Chamber



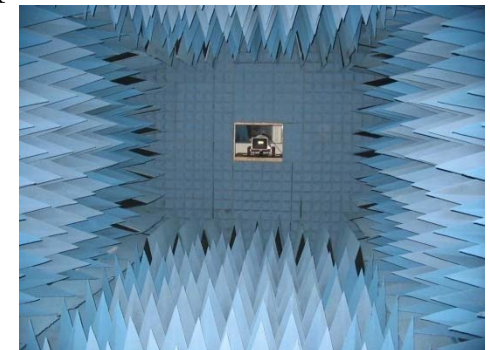
Flat 12.5x12.5in Antenna Array



<http://esl.eng.ohio-state.edu/~rjm/antennas/images/fractal1.jpg>



<http://www.barcode-solutions.com/images/RFID/RFID-Tag-1.jpg>



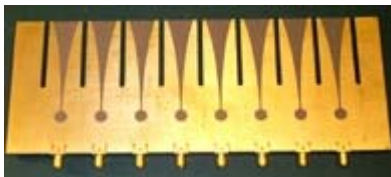


Future Projects

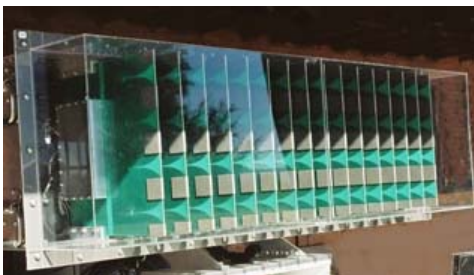
- Three-Year Timeframe
 - Future projects: SBIR/NASA Proposals
 - SBIR proposal submissions with Toyon Research Corporation (Goleta, CA)
 - SBIR/STTR proposals with Oceanit Laboratories (Honolulu, HI)
 - Anechoic & EMC Chamber Labs
 - Additional testing contracts



<http://www-antenna.ee.titech.ac.jp/research/photo/r1sa2.jpg>



http://www.ecs.umass.edu/ece/labs/antlab/APLab_images/faculty%20graphics/Schaubert_graphics/8x1_Vivaldi_array.png



http://www.rincon.com/images/phased_array1.jpg

Cal Poly Tech Park Companies

- Future wireless and antenna system development and EMC testing contracts



http://www.oersted.dtu.dk/upload/institutter/_oersted/emi/afg/vast2_200.jpg