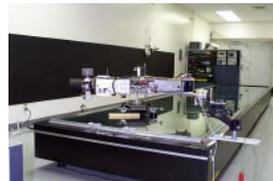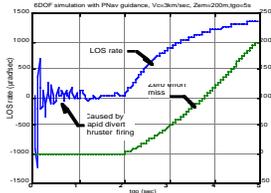We are also investigating precision ground testing of kinetic kill vehicles in support of Ballistic Missile Defense.
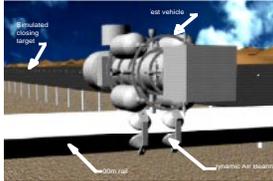
In collaboration with other university researchers, we are conducting advanced speech processing research using micropower impulse radars (MIR). The figure below shows the simultaneous measurements of audio, lips, tongue, and glottal area motion of the word "she" as spoken by a male.
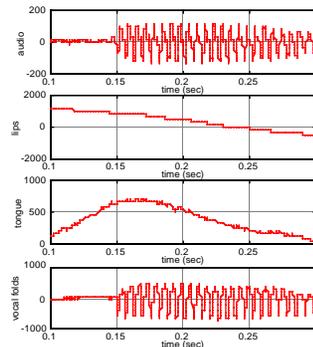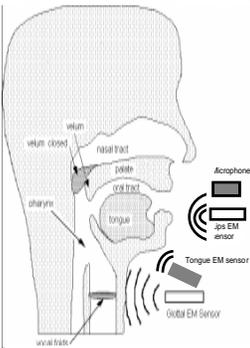

Future Goals

We will continue to maintain and advance the state-of-the-art capabilities in our core competencies, support new initiatives from Engineering Technology Centers, and seek challenging programmatic assignments.

Current Members

The group currently has 16 members working on various aspects of core technology areas in support of Laboratory programs. The following pie chart shows the current makeup of the group by disciplines.

Pie chart: PhD.Student 2, PhD.EE 5, MS.CS 2, MS.EE 5, BS.EE 2

3-27-98
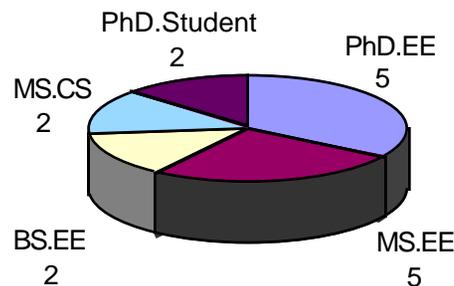
Front(L->R): Greg Clark, Brian Guidry, Randy Roberts, Melissa Myrick, Laura Mascio, Mark Wagner, Jose E. Hernandez, Larry Ng. Back(L->R): Bob Sherwood, Eric Breitfeller, Todd Gable, Skip Perkins, Tony De Groot, Greg Burnett, Melinda Bass, Robert Johnson.

New Members

We are seeking outstanding individuals who share our vision and goals to join the group.

Group Leadership

Larry Ng	('91-present)
Jim Berryman	('88-'91)
Dennis Goodman	('88-'88)
Mike Portnoff	('83-'88)
Rick Twogood	('79-'83)
Jim Sherman	('77-'79)
Mike Ekstrom	('73-'77)

Distinguished Alumni

Rick Twogood, EE Deputy Associate Director
Pat Fitch, Bioinstrumentation Division Leader
Jim Candy, CASIS Director
Dave Harris, CTBT Seismics Project Leader
Steve Azevedo, MIR Project Leader

Signal / Image Processing & Control Group

Clementine Spacecraft

Defense Sciences Engineering Division
Electronics Engineering
Lawrence Livermore National Laboratory
University of California

POC: Dr. Lawrence C. Ng
(925) 422-8741, ng6@llnl.gov
//www.llnl.gov/eng/ee/erd/siprg/

Last Rev: June 15, 1998

UCRL-TB-130913

Mission Statement

To provide world-class programmatic support to our customers in the areas of *signal & image processing, precision control, and advanced computations*, and to be recognized as the principal core technology group in these areas within Engineering and throughout the Laboratory.

Strategic Plans

- To maintain core competencies by seeking challenging programmatic assignments
- To develop new skills via entrepreneurial activities, exploratory research and/or in partnership with Lab programs
- To actively engage in technical exchanges with peers at UC campuses, other universities and laboratories, technical conferences, and through publications in professional journals.

History

The Signal and Image Processing Research Group or SIPRG was formed within the Engineering Research Division in the early 1970's to develop advanced signal and image processing tools to support users within Engineering and other programmatic Directorates. Tools such as SIG, VIEW, and VISION were developed via funding from the Remote Imaging and Sensing Engineering (RISE) thrust area.

The group joined the Defense Sciences Engineering Division as a result of EE reorganization in late 1997. The charter of the group was formally expanded to include applied research into complex distributed control systems and advanced computations. Key supporting programmatic directorates include:

- Defense and Nuclear Technologies
- Nonproliferation, Arms Control and International Security
- Physics and Space Technology
- Biology and Biotechnology Research
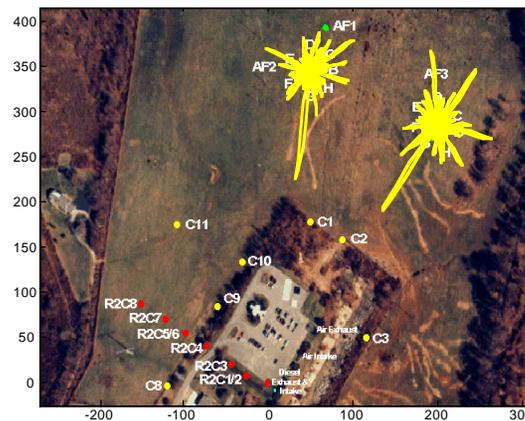- Lasers
- Engineering

Core Research Areas

Principal research topics in the three focused areas are:

- *Signal and Image Processing*
  - Digital mammography analysis
  - Structural failures detection and classification
  - MIR/Speech processing
  - MIR/Infrastructure inspection
  - Classification of heart valve failures
  - Tactical unattended ground sensors
  - Computed tomography and non-destructive evaluation

- *Complex Distributed Control Systems*
  - MicroSatellite guidance & control
  - Robotics and automation
  - Precision optical pointing, tracking, alignment and stabilization
  - High velocity impact experiments
  - Ballistic missile defense

- *Advanced Computations*
  - Genome Bioinformatics
  - ParaDyn implementation
  - Computer vision and neural networks

## Sample Accomplishments and Ongoing Research

We developed a method to localize underground structure and machinery from air-drop deployable sensor arrays. The figure below shows the underground source direction from two beamformed circular arrays.

We are classifying the condition of prosthetic heart valves using modern parametric signal processing techniques to extract and enhance critical features.
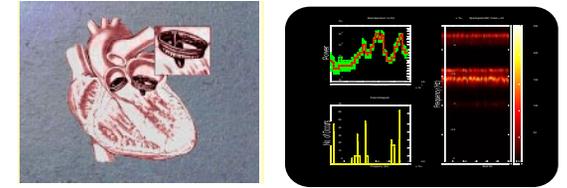
We use array signal processing techniques coupled with laser interferometric measurements for nondestructive evaluation to detect and resolve flaws in materials.
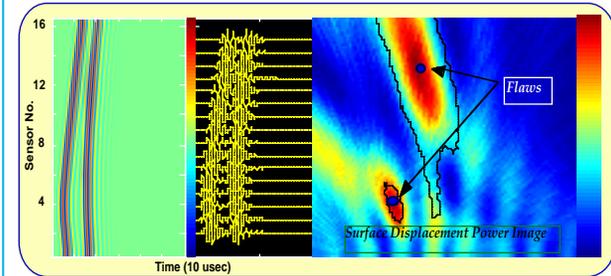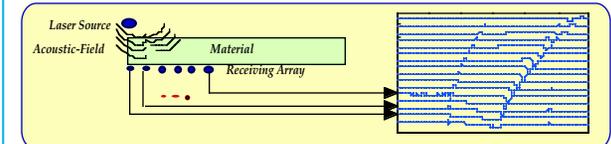
We participated in the successful Clementine Moon mapping mission in 1993, resulting in a complete mapping of the lunar surface and the detection of ice near the north and south poles. We are currently pursuing advanced technology development of agile Micro-satellites.