

Working with U.S National Laboratories: An Example From Lawrence Livermore National Laboratory



**PTAC Workshop
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Science & Technology Principal Directorate

Lawrence Livermore National Laboratory

What is Lawrence Livermore National Laboratory (LLNL)?



- An applied science laboratory for Department of Energy (DOE) National Nuclear Security Administration (NNSA)
- Managed 1952 through 2007 by the University of California.
- Currently managed by Lawrence Livermore National Security, LLC.
- Annual budget: roughly \$1.6 B
- Over 6,000 employees.
- 3,000 scientists, engineers, and technicians.



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Option:UCRL#

Option:Directorate/Department Additional Information



Why are we in Hilo?

- **Hawaii is our Neighbor**
 - Can benefit from our Federal requirements (e.g. engage small and disadvantaged businesses)
- **Location is Important to LLNL's National Security Mission:**
 - Ensure that the nation's weapons remain safe, secure, and reliable
 - Meet other national security needs, including countering the proliferation of weapons of mass destruction and strengthening homeland security against the terrorist use of such weapons.



Can We Assist?

We Want to Compliment--not to Duplicate Or Compete



- **Network** with science and technology businesses, universities, and government
- **Learn** about needs - workforce and infrastructure
- **Explore** areas of mutual interest
- **Collaborate** where common interests exist
 - Co-author proposals
 - Subcontracts, procurements
 - Licensing
 - Technology development partnerships
 - Hardware loans, access to facilities
 - Expertise and mentoring
 - “Mentor” for SBA Mentor/Protégé Program
- **Our relationships are long term**
- **Our partnerships evolve**



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A Perspective From “Innovation and Technology in Hawaii: an Economic and Workforce Profile” (October, 2008)



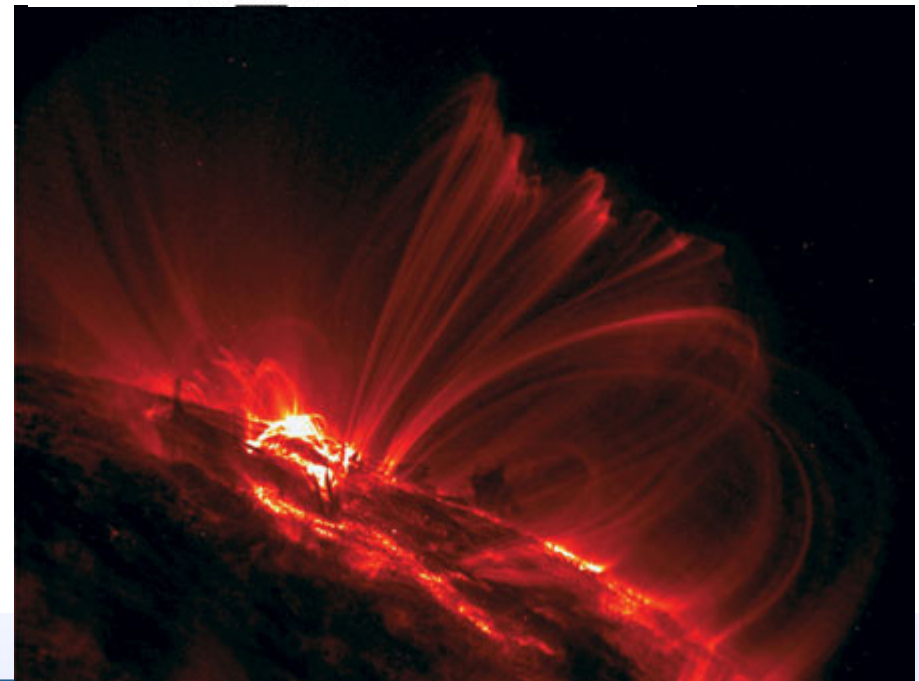
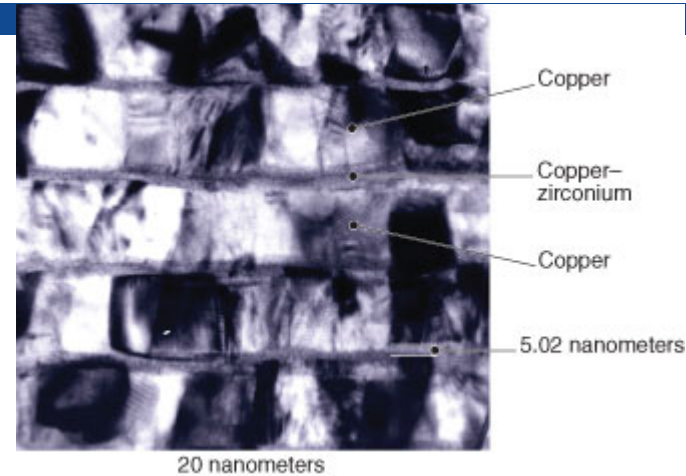
- **Private tech sector annual growth rate 3.3%, 2002 - 2007.**
 - Compare 2.5% HI overall, 1.8% Mainland tech sector.
 - 4,158 net new public and private technology sector jobs.
- **S&T enterprises contributed \$3 B in 2007, 5% of HI’s GDP.**
 - 46% faster growth than overall HI economy over next decade.
- Maui : private sector tech-related jobs.
- Kauai : smallest, but fastest growing tech sector.
- The Big Island : globally competitive astronomy sector and an array of opportunities in potential renewable energy resources.
- **Fastest growing tech market segment-- Renewable Energy.**
 - 8.4% annual job rate increase in the private sector.
 - Compare: 5.8% increase nationally.
- **More than 50% of tech employment: defense, info/ communications.**
- Defense contracts in excess of \$2 billion in 2007.
- **Astronomy:** the smallest employment sector, but possibly the most unique competitive advantage.



Technology is LLNL's business



- **We apply scientific and technical knowledge and skills.**
 - Defense, sustainable energy and environment, medical and other technologies
- **We create technology as a result of our government mission**
 - Some innovations are protected by patents and copyrights
- **We partner to most effectively achieve the government mission**
 - Tailored to mutual benefit
- **We integrate regional and cultural values** as an important element of our collaborations



Science & Technology Principal Directorate

- LLNL Supply Chain Management Department spends approximately **\$650,000,000 annually** for a broad range of products and services.
- All businesses must be registered with the Central Contractor Registration (CCR) (<http://www.ccr.gov/>), the primary vendor database for the Federal Government.
 - Socioeconomic: small and disadvantaged business opportunities
 - DOE regulations identified in LLNS' contract with NNSA.

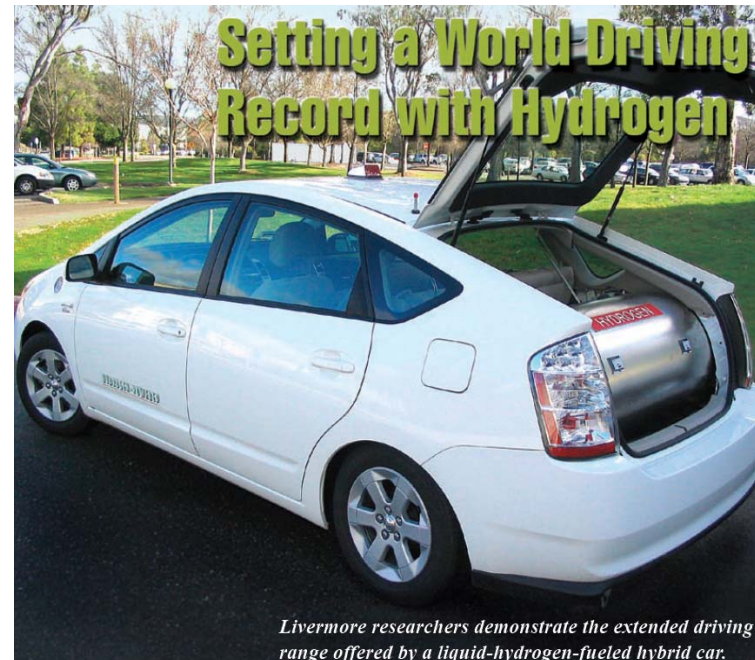


Working with LLNL: Industrial Partnering and Technology Transfer



- Promote economic development and national competitiveness
- Provide direct public benefit in the areas such as environmental remediation and health care.

Pressurized Hydrogen Fuel Tank



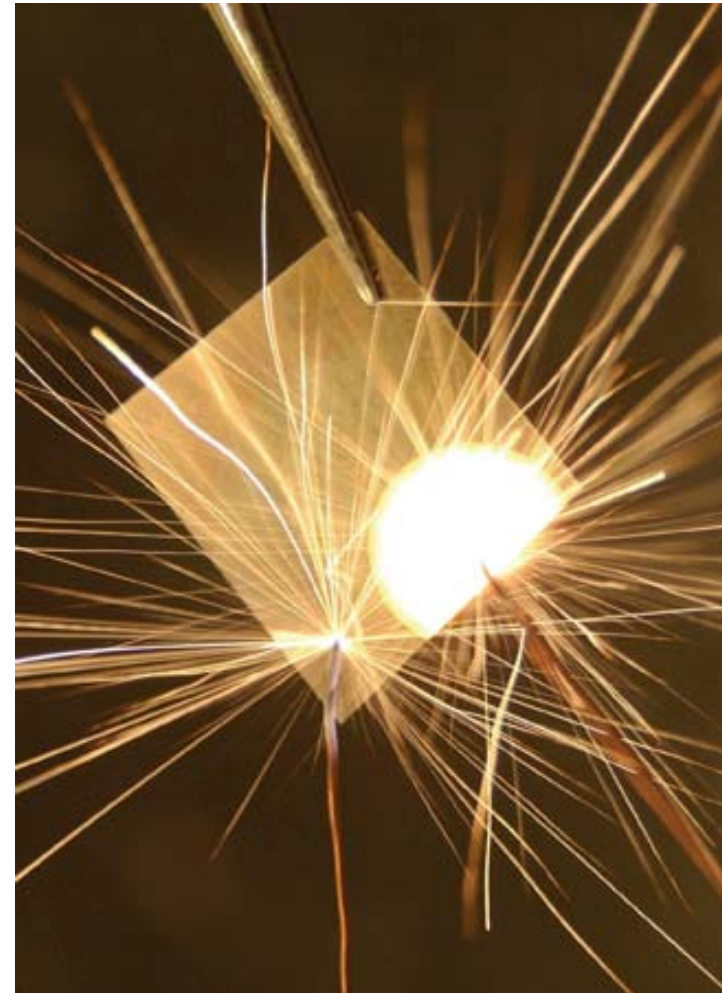
Working with LLNL: Industrial Partnering and Technology Transfer



- In specific, LLNL shall:
 - (i) **Provide Fairness of Opportunity** in accordance with the requirements of public notice and dissemination of technology transfer opportunities information;
 - (ii) **Give consideration to the Conflicts of Interest** requirements;
 - (iii) **Give special consideration to small business firms, and consortia involving small business firms;**
 - (iv) **Give preference to business units located in the United States** which agree that products or processes embodying Laboratory Intellectual Property will be **substantially manufactured and practiced in the United States**; ...and,
 - (v) Adhere to export control rules of the United States regarding the transfer to non-U.S. entities or individuals of:
 - Commodities (equipment, hardware, or materiel),
 - Technologies (technical data, information, or assistance), and
 - Software/codes (commercial or custom).



- Grants permission to reproduce, manufacture, sell, or use LLNL-intellectual property.
- [Exclusive](#) or [Non-exclusive](#),
- field-of-use.
- Issue fee and royalty fees
- Due diligence,
- performance milestones
- business plans
- A license may be completed in as little as six weeks.
- Protection of Information
[Nondisclosure Agreement](#)..
- Technical assistance under separate agreement.
- **Begin License Discussions** by speaking to a Business Development Executive or completing our [Company Contact Form](#).

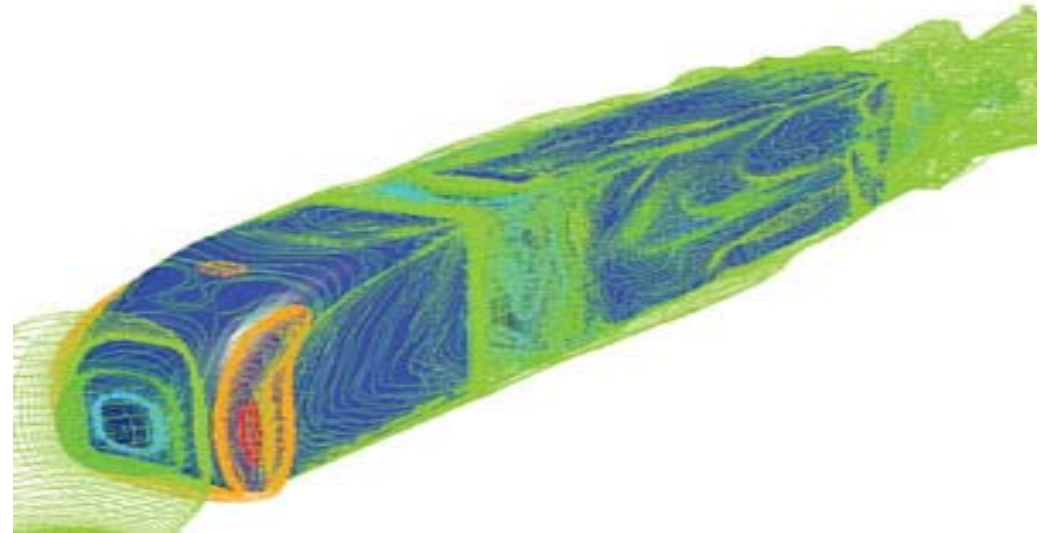
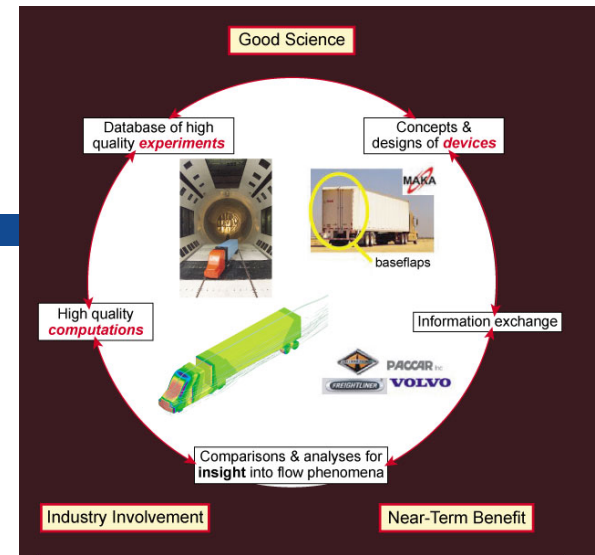


Software Licensing

- Standard end user licenses for some LLNL-developed software. Visit our [software web site](https://ipo.llnl.gov/technology/software/) for more detail.
 - <https://ipo.llnl.gov/technology/software/>
- Tailored licensing agreements for more complex licenses



•Swiss designer Luigi Colani: 2007 managed to reduce fuel consumption by 50 percent by aerodynamics alone



Cooperative Research and Development Agreement (CRADA)



- LLNL and an industrial partner collaborate on specific development projects.
- information developed under the project is protected
- Each party takes title to intellectual property created by its employees.
- The industrial partner has an option for a limited exclusive license, on reasonable commercial terms, for inventions developed during the project.
- Most CRADAs are 100% industry-funded
- LLNL cannot fund work by the partner.
- The DOE, IPO the LLNL legal department, and the responsible LLNL program review and approve the work plan.
- **Begin License Discussions** by speaking to a Business Development Executive or completing our [Company Contact Form](#).



Work for Others Agreements (WFO)



- Non-federal sponsor
- The work must draw on a unique capability of LLNL and not place LLNL in competition with the private sector.
- Not collaborative work between the private partner and LLNL. If technical collaboration is involved, a CRADA is required. A WFO can provide maximum protection of intellectual property.
- Full cost recovery is the norm; however, DOE overhead and depreciation costs may be waived if there is demonstrable benefit to DOE programs. DOE approval is required.
- Three weeks to a few months to establish, depending on complexity.



- Heat engine conversion kit (from internal combustion engine)
 - From any heat source including geothermal, waste heat, solar
- Ergonomic Cart
- Voltage “Leak” Detector
 - Directionality can be readily determined
 - Potentially highly portable
 - Diagnostic tool rather than trial and error method
 - Locate lower frequency (e.g., power-line frequency and associated harmonics) electrical interference noise sources in complex electrical/electronic environments.
 - Locate non-noise sources that have frequency components falling within the operational bandwidth of the receiver.



New Heat Engine is more efficient than Stirling

Standard Technology

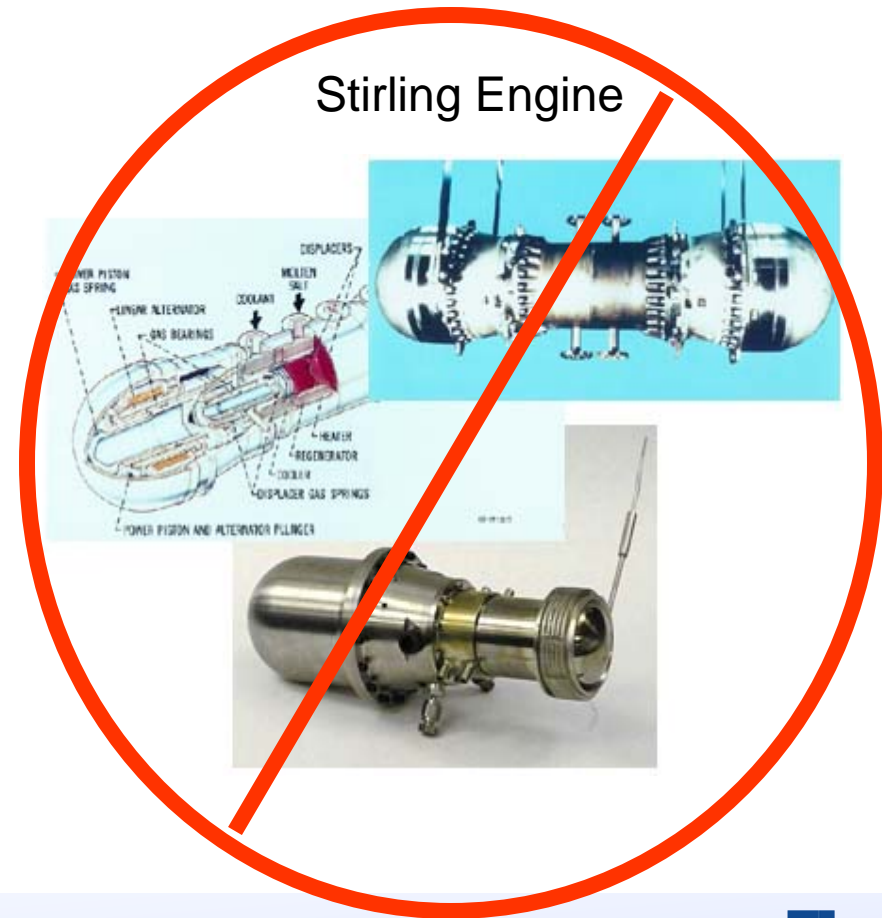
- Stirling Engine

Advantages

- More efficient
- Order of magnitude lower cost
- Can convert combustion engine

Application

- Solar thermal power
- Obtain power from waste heat



GyroSole™ Distributed Solar Thermal Power can compete coal power generation prices NOW



Standard technology

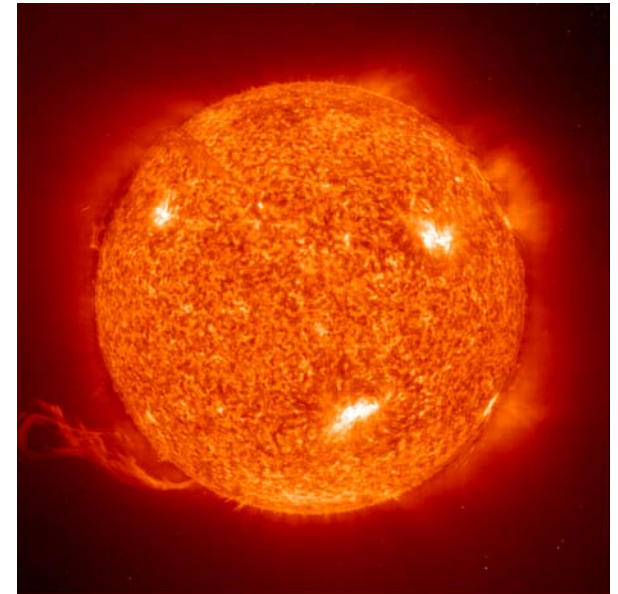
- **Photovoltaic**
 - Distributed power option
- **Solar thermal**
 - Provides electric power and thermal energy for heating
 - Increase robustness, reliability of solar thermal power
 - Increase efficiency of tracking and heat transfer

LLNL approach

- Collector: size of satellite dish
- Stored surplus energy allows a recalculation of solar power economics, a competitive return on investment is possible
- Uses new heat engine

Applications

- Distributed power grid
- Residential
- Light industry



TRACE: Highest spectral temporal and spatial resolution image of solar corona enabled by LLNL nanolaminate technology.



Ergonomic material-handling device



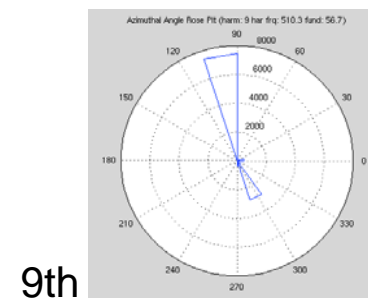
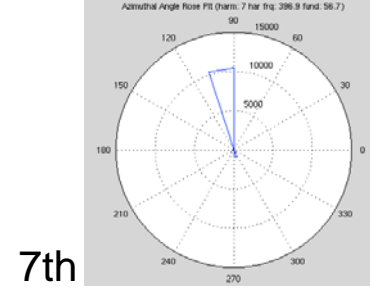
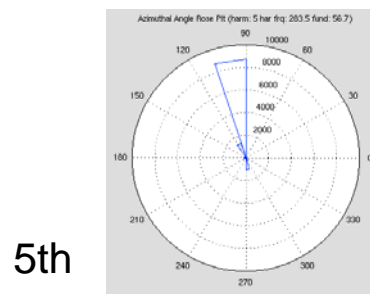
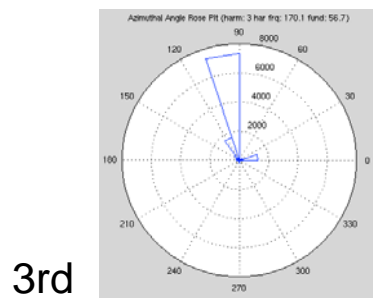
- Lance E. Barsnick, David M. Zalk, Catherine M. Perry, Terry Biggs, Robert E. Tageson US Patent 6,779,803 B1 August 24, 2004
- A hand-held **ergonomic** material-handling device capable of moving heavy objects, such as large waste containers and other large objects requiring mechanical assistance. The **ergonomic** material-handling device can be used with neutral postures of the back, shoulders, wrists and knees, thereby reducing potential injury to the user. The device involves two key features:
 - 1) gives the user the ability to adjust the height of the handles of the device to ergonomically fit the needs of the user's back, wrists and shoulders; and
 - 2) has a rounded handlebar shape, as well as the size and configuration of the handles which keep the user's wrists in a neutral posture during manipulation of the device.



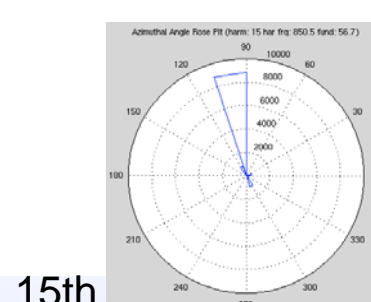
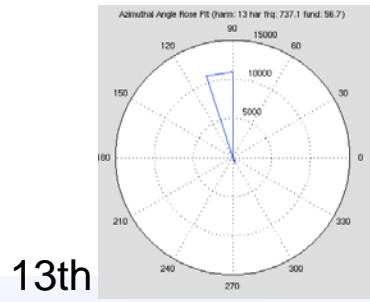
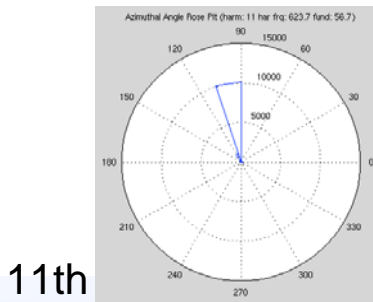
Voltage “Leak” Detection In Urban Power Environments

The LLNL Voltage Leak Detection Kit can be used to find the direction of an electromagnetic(EM) source using the Poynting Vector (PV). Both the electric and magnetic components of the wave are measured, which provides information about the **direction** of wave emanation as well as the **flux of energy**.

$$\vec{S} = \vec{E} \times \vec{H}$$



PVs are similar for all broadband harmonics of generator/load signal while PV for noise is different



LLNL Field Test

Quasar E-field sensor



- Field testing demonstrated that directional information about the noise source.
- Further development is needed to scale down the electric- and magnetic-field antennas, the receiver and the processing hardware to a convenient level of portability (e.g., handheld).
- The analysis technique has been developed through detailed computer simulations of noise and signal sources,
- Analysis can benefit from signal processing and optimization development.

Triaxial BF-6 Coils



← Generator



Mahalo!

