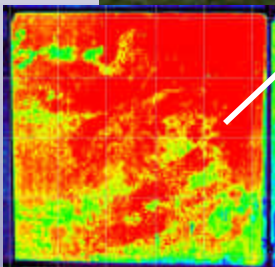
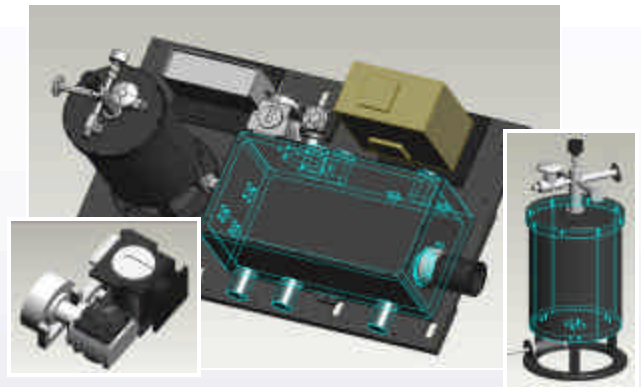
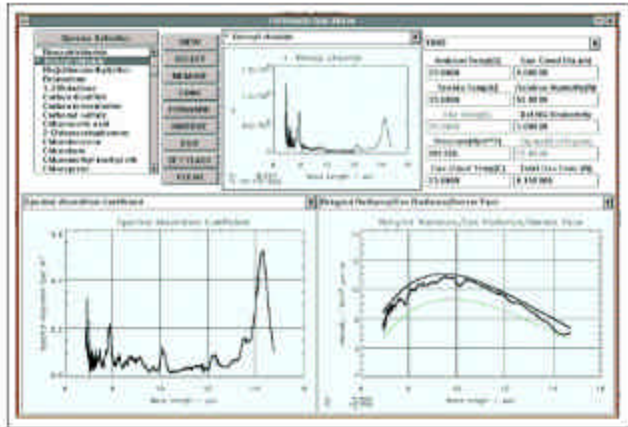
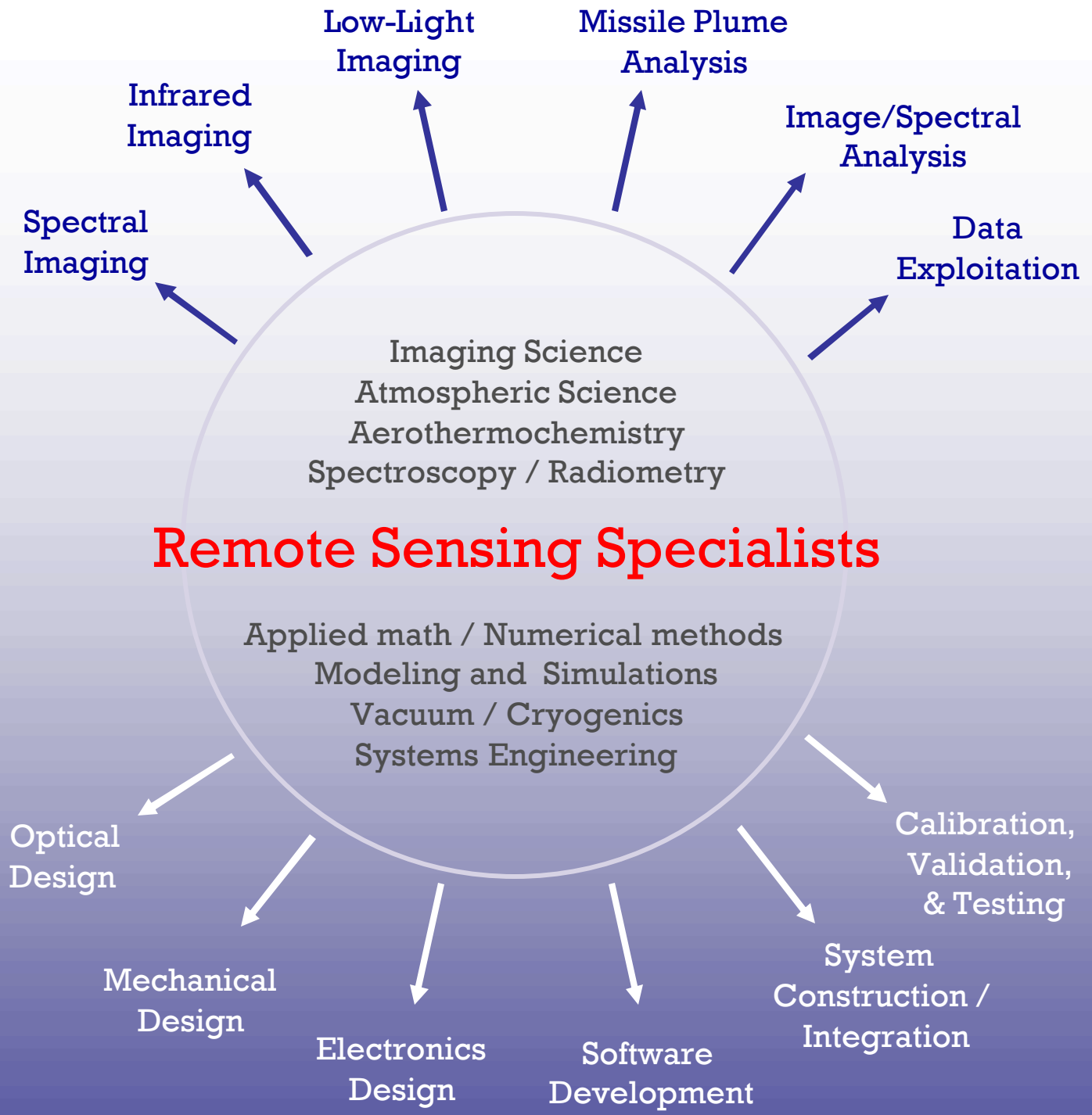


OKSI OPTO-KNOWLEDGE SYSTEMS INC.

Converting Light into Knowledge



Core Technologies



Core Capabilities

Spectral Imaging

OKSI's primary expertise is in the development and utilization of spectral imaging systems. The output of these systems are "image cubes," which consist of a two-dimensional spatial image with spectral data at each pixel. OKSI develops the hardware, as well as algorithms and techniques specifically designed for the exploitation of this type of remote sensing data.

Systems built include both *multispectral* (discrete and narrow bands) and *hyperspectral* (contiguous spectral bands) sensors for the full EO/IR range:

- **Ultra Violet** (300 – 400 nm)
- **Visible - Near Infrared** (400 – 1000 nm)
- **Short Wave Infrared** (1 – 3 μm)
- **Mid Wave Infrared** (3 – 6 μm)
- **Long Wave Infrared** (6 – 15 μm)

For construction of these sensors we utilize

- **Grating-based spectrographs**
- **Liquid crystal tunable filters (LCTF)**
- **Dichroic Beamsplitters**
- **Linear Variable Filters (LVF)**
- **Gas Correlation spectroscopy**
- **Image Reformatters**
- **Dual-band FPA Detectors**

Specialty sensors include:

- **Airborne systems**
- **Four-dimensional imaging spectrometers (4D-IS), high temporal resolution**
- **Polarimetric / spectral sensors**
- **High spatial or spectral resolution sensors**
- **Image intensified systems**





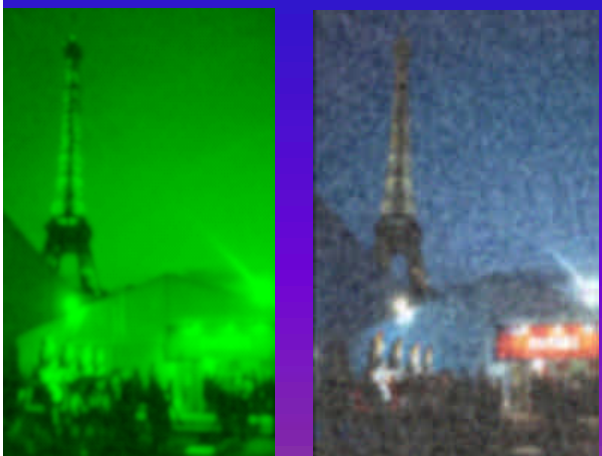
Infrared Imaging

OKSI is a leading developer of spectral imaging systems in the thermal infrared wavelength range ($3\mu\text{m}$ to $15\mu\text{m}$). OKSI also implements novel technologies and techniques for general infrared imaging, including creating the **first thermal IR camera equipped with a variable aperture cold stop** (patent pending). This feature is now a key capability on Army GEN-III FLIR (Forward Looking Infrared) systems, and OKSI is working with prime contractors to integrate this technology into next generation cameras. Furthermore, as part of a spectral imaging sensor designed for rapidly evolving events (4D-IS), OKSI has developed unique techniques in the area of image reformatting with infrared fiber optics.



Low-light Imaging

OKSI has developed spectral imaging systems for low-light applications by combining tunable filter systems with image intensified cameras. In related work, OKSI has developed video cameras that use novel technology to capture **True-Color images in low-light situations**. These color night vision cameras utilize light in the visible to NIR spectrum of a scene to produce images that look as if they were captured during the day. True-color images lead to better object recognition, faster reaction, and improved scene understanding as compared to monochrome grey or green night-vision images produced by present technology.



Missile Plumes

OKSI has developed **techniques and tools for the Automatic Differentiation (AD) of computer codes**. In particular these AD tools and techniques are being applied to codes used to model various aspects of missile plume physics and radiative transfer in the atmosphere (e.g., SPURC and MODTRAN). These codes are critical for missile defense applications, and the AD work is improving the use of the codes by enabling efficient computations of sensitivities and uncertainties of the code outputs. In related work, OKSI has developed **Monocular Passive Ranging (MPR)** techniques, which utilizes modeling codes to track thrusting missiles in flight. OKSI's MPR algorithm is being implemented on MDA's HALO-II aircraft.

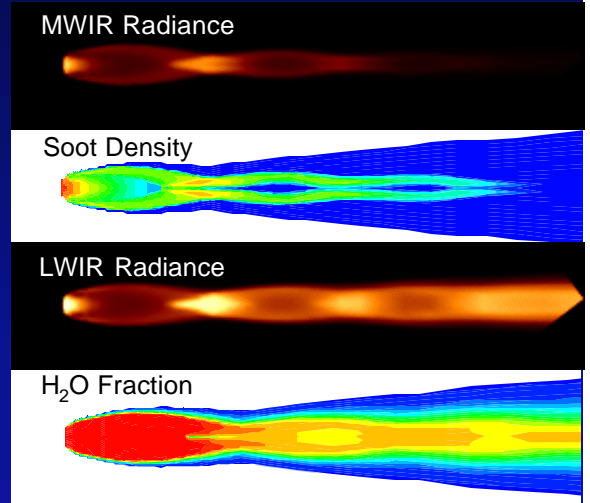
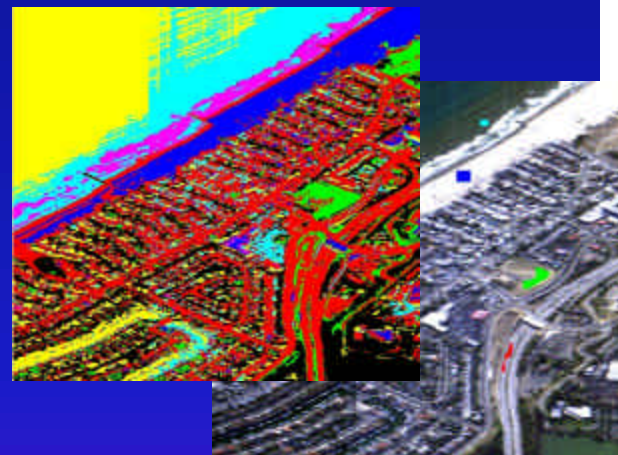


Image Analysis / Data Exploitation

OKSI develops computer algorithms for the exploitation of spectral and/or spatial data:

- **Target & anomaly detection**
- **Spectral classification**
- **Vegetation analysis for precision farming**
- **Chemometrics**
- **Video based navigation**
- **Retrieval of atmospheric parameters.**

For example, atmospheric parameters and target characteristics are determined from sensor data input by solving inverse problems using optimization techniques, standard likelihood algorithms, and Bayesian estimations.



Optical Design

OKSI's highly skilled optical design team can produce full optical system designs for every aspect of general imaging systems, spectrographs, and spectral imaging sensors including:

- **Compound Lenses**
- **Relay Optics**
- **Reflective Optics**
- **Image Reformatters and**
- **Dispersive Gratings.**

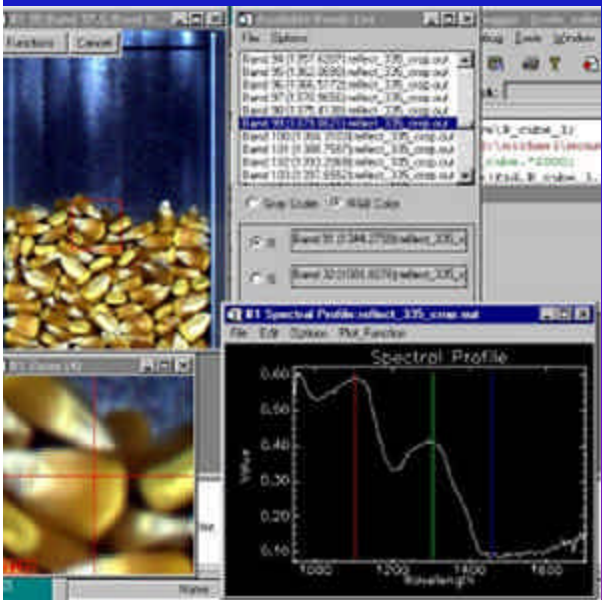
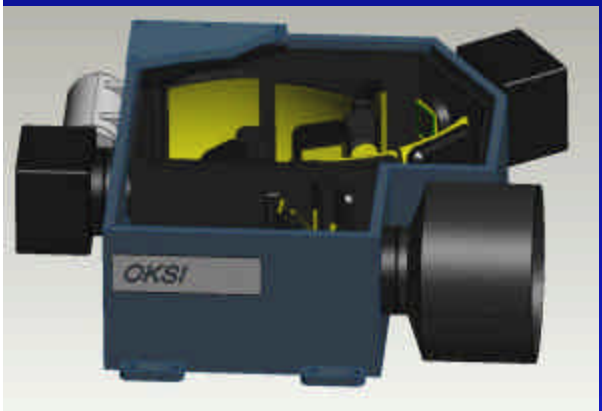
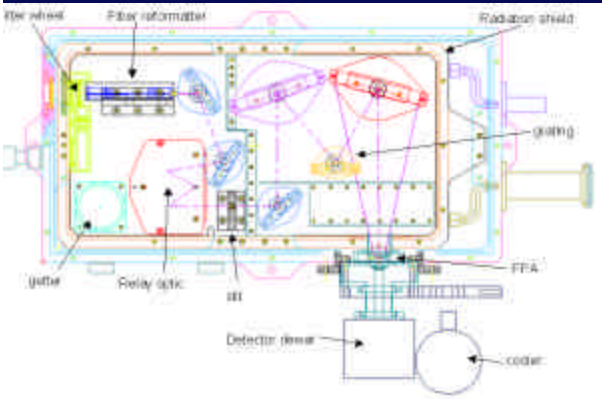
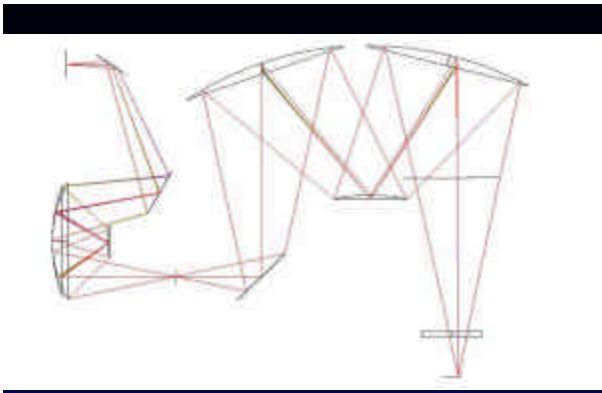
OKSI uses design tools such as Zemax and Code-V to optimize optical designs for the desired performance and cost specifications.

Mechanical Design

OKSI's engineering staff are skilled at creating full mechanical designs including custom optical housings and mechanical structures. OKSI also excels at generating designs for specialized systems where cryogenic cooling and precision optical alignment are needed. Design tools include both two-dimensional and three-dimensional CAD software.

Software Development

Along with hardware, OKSI delivers control and data analysis software to operate and utilize the sensors it develops. In addition, OKSI also creates general remote sensing algorithms and analysis software for data from a variety of other sources. In house resources include IDL/ENVI, a variety of comprehensive spectral libraries, satellite imagery, and atmospheric and radiation modeling codes.



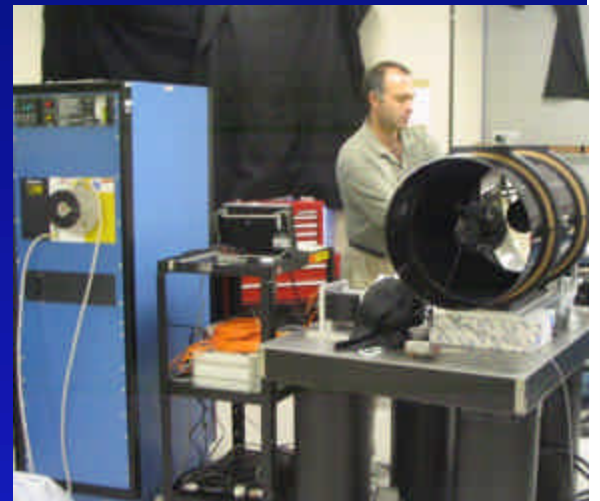
System Construction / Integration

OKSI operates from a commercial facility with 14,000 sq. ft. of laboratory/office space and has close access to a full machine shop with state of the art CNC machines. **OKSI constructs complete hardware systems for both prototype and small-scale production.** For large scale production, OKSI collaborates with market leading companies to integrate OKSI technologies through licensing agreements and partnerships.

Calibration, Validation, & Testing

OKSI takes pride in delivering turn-key systems that perform exceptionally in realistic conditions. Our sensors and electronics laboratories are equipped with a full suite of radiometric and spectral calibration and testing equipment, along with vacuum systems, leak detection, and cryogenic cooling equipment. OKSI routinely conducts field tests and ground truth verification studies, including:

- **Conducting aerial and ground truth measurements with multispectral, hyperspectral, and thermal sensors for precision agriculture.**
- **Participating in data collection events using a spectral and polarimetric imager (SPI) at government missile tests.**
- **Collecting hyperspectral image cubes of human brain tissue during neurosurgery at the National Institutes of Health.**



Partners

OKSI partners with companies and universities in three different ways:

Systems Integrator

OKSI develops complete systems utilizing the advanced technologies developed by a partner. For example, OKSI develops turn-key spectral imaging sensors using filters from leading companies and research groups, such as CRI and the Display and Photonics Lab at Brown University. OKSI writes custom software and integrates the filters with appropriate cameras, e.g. Q-Imaging cameras.

Technology Expert

OKSI applies its diverse remote sensing and engineering experience to help partners develop technology in their specific areas of expertise. For example, in a partnership with the Wisconsin Center for Space Automation and Robotics (WCSAR), OKSI and WCSAR are jointly building a dual mode fluorescence imaging system for agricultural engineering experiments on board the International Space Station.

Technology Innovator

OKSI also develops advanced technologies that require integration by a prime government contractor or other industry partner. For example, OKSI is working with Raytheon Vision Systems, DRS Infrared Technologies, and Cincinnati Electronics to integrate our patent pending variable aperture cold stop into next generation IR imaging systems.



Customers

OKSI provides custom solutions to problems where off-the-shelf products are unavailable. OKSI has a long track record of successfully delivering sensors and algorithms to government agencies, universities, and commercial companies. A partial list of our customers includes:

- Air Force Research Labs (AFRL)
 - Geophysics Directorate (Hanscom)
 - Munitions Directorate (Eglin)
 - Propulsion Directorate (Edwards)
 - Sensors Directorate (Wright-Patterson)
 - Space Vehicles Directorate (Kirtland)
- Air Force Material Command (AEDC)
- Army Night Vision & Electronics Sensors Directorate (NVESD)
- Army Research Laboratory (ARL)
- Army SMDC
- CI Systems
- DARPA
- DIA, Central MASINT Organization (CMO)
- DIA, Missile & Space Intelligence Center
- Ford Motor Company
- Missile Defense Agency (MDA)
- Monsanto
- NASA
 - Glenn Research Center
 - Goddard Space Flight Center
 - Jet Propulsion Labs
 - Kennedy Space Center
 - Marshall Space Flight Center
 - Stennis Space Center
- Naval Surface Weapons Center Dahlgren
- Office of Naval Research (ONR)
- Purdue University
- Virginia Tech University
- US Department of Agriculture (USDA)



Company Profile

Brief history

OKSI was founded in 1991 by Dr. Nahum Gat specifically to capitalize on the emergence of novel applications for imaging spectroscopy systems. He brought with him years of experience working as a project manager for a large prime contractor in the aerospace and defense industry. His leadership experience also includes combat missions as an armored battalion commander during his service in the Israeli Army from 1969-1974.

Personnel

OKSI is able to efficiently solve advanced technology problems due to our highly skilled, versatile, and diverse staff. Over 75% of the employees at OKSI hold an advanced degree in fields including Optical Science, Imaging Science, Physics, Mechanical Engineering, Computer Science, and Aerospace Engineering.

Facility

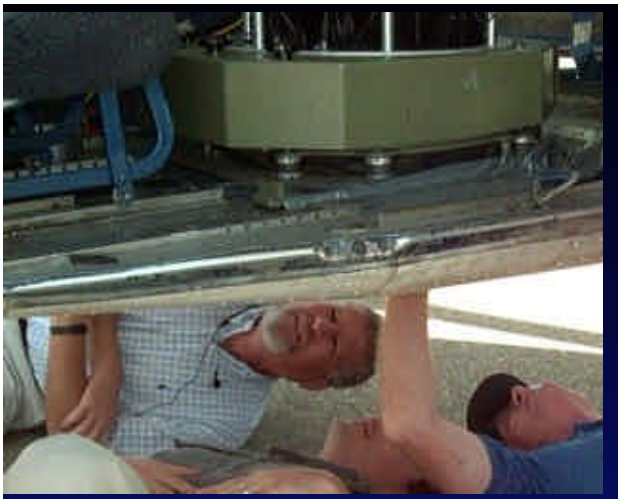
OKSI's facility consists of over 16,000 sq. ft. of office/lab space located about 15 minutes driving time from Los Angeles airport (LAX).

Patents

OKSI holds patents for hyperspectral sensors based on variable linear arrays and remote sensing applications and patents pending for variable aperture cold stops.

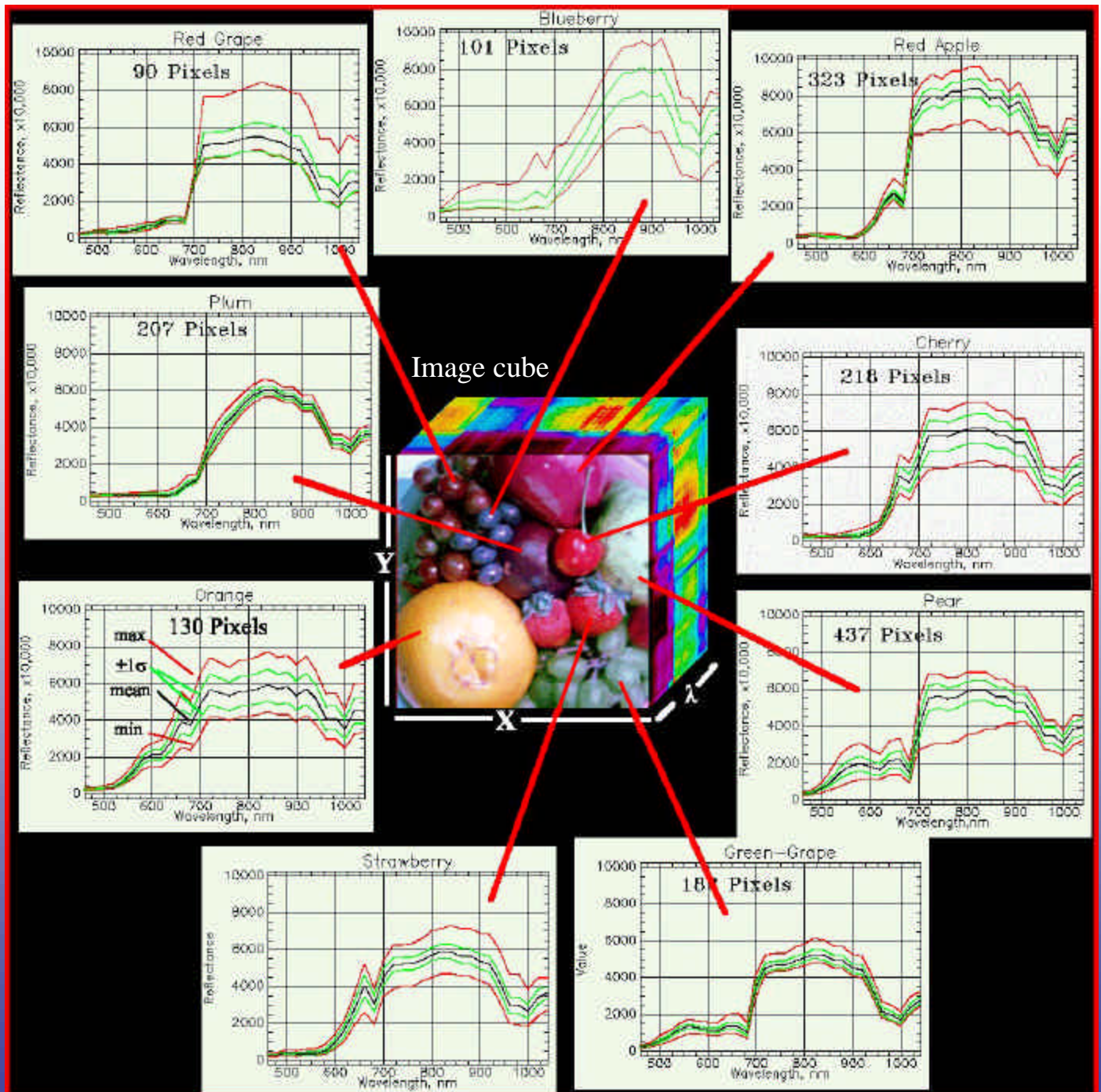
Administration

OKSI has a DCAA approved accounting system and full financial & contract management capabilities.

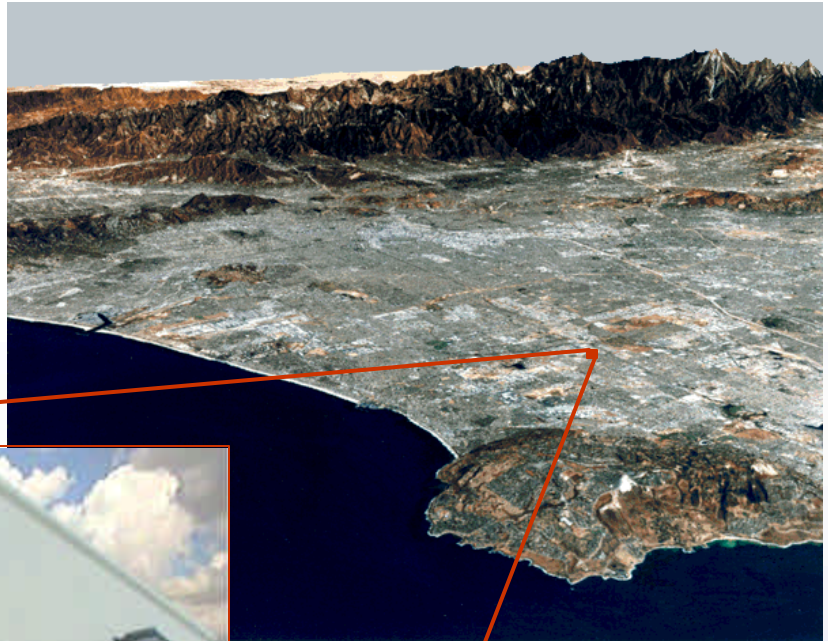


Leadership Statement

For over a decade, Opto-Knowledge Systems, Inc. (OKSI) has been a leader in the advanced research and development of custom spectral imaging systems and software for remote sensing. Our expertise in all aspects of sensor construction, operation, and data exploitation sets us apart from other small companies and enables us to efficiently provide complete custom solutions, including the design, construction, testing, and integration of sensor systems and analysis software. Our mission is to provide effective hardware and software tools that enable the collection and interpretation of optical information (*converting light into knowledge*) for law enforcement, security, defense, agriculture, and medical applications. We deliver “turn-key” solutions to problems where off-the-shelf products do not exist.



WHEN YOU NEED TO COMPARE... APPLES TO ORANGES



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