VISSTA

Vehicle Integrated Sensor Suite for Targeting Applications

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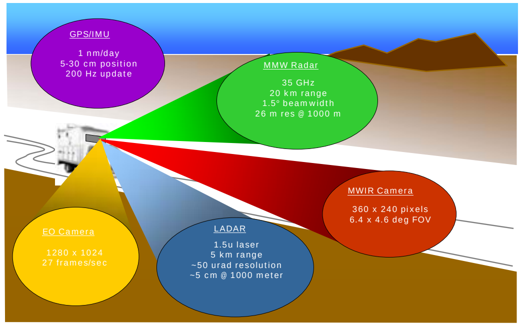
OVERVIEW

The goal of the VISSTA program is to provide the U.S. Navy with the ability to simultaneously collect data from a variety of co-boresighted sensors mounted on a moving platform. Sensors include a millimeter wave radar, an in-house developed ladar with an integrated EO (color) camera, and a mid-wave infrared camera.

The VISSTA facility will explore multi-sensor performance in various scene conditions (vegetation, obscurants, rugged terrain, etc.), atmospheric conditions (fog, haze, etc.), and fields-of-view. It will also allow each sensor's strengths and weaknesses in the detection, recognition and identification roles to be explored.

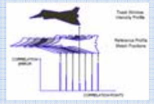
This project is a joint effort of Utah State University's Center for Advanced Imaging Ladar and Space Dynamics Laboratory and the Naval Air Warfare Center, China Lake, California.



ELECTRO-OPTICAL TRACKING and CALIBRATION

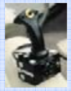
Tracker Operation
real-time object tracking

The Tracker uses selectable image processing enhancement and discrimination algorithms to automatically acquire moving objects of interest and calculate their precise position, velocity, approximate size, and intensity. This information is forwarded in real-time to the pointing control electronics, which use the positional data to keep the object of interest in the center of the field-of-view for accurate LADAR scanning and point cloud construction.



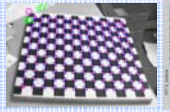
Tracker User Control
operator interface

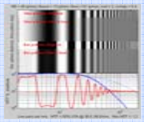
Tracking is user controlled via a full-featured graphical interface and joystick. These tools allow the operator to improve object tracking by selecting appropriate algorithm parameters and window sizes. The tracker GUI is a subset of the top level Eyesafe LADAR Testbed software.



Optical Calibration
camera correction

To accurately match digital imagery and LADAR data, the number of pixels per LADAR footprint must be known. To ensure the quality of the digital images, the camera is calibrated to remove any radial distortion. To determine the number of resolvable pixels per footprint, the zoom lens is tested to establish its MTF and zoom position repeatability. Zoom control software is made to account for hysteresis.





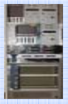
VEHICLE INTEGRATED SENSOR SUITE

Optical Sensor Suite
for sensor fusion studies

Sensors include the eye-safe ladar test-bed (ELT) instrument, a millimeter wave radar, and an infrared camera. The ELT also includes an imager for visible wavelengths called a Texel Camera™. These can all be pointed and operated on the van platform.

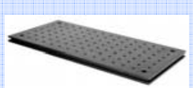
Custom Van Body
electronics rack, control station and creature comforts

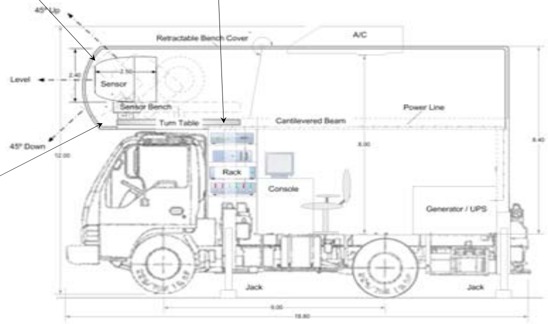
The rack contains the electronic equipment used for control of the sensor bench and suite of sensors. The electronics are shock resistant and are cooled by AC equipment. A UPS allows a graceful shut down in the event of a power failure. Creature comforts, including a microwave and fridge, make long stints of data collection more bearable.



Sensor Bench
controls and measures gross sensor orientation and position

A manually positioned motorized platform controls the orientation of the suite of sensors relative to the van. A precision GPS/IMU position and orientation system senses the motion of the bench and allows geopositioning of acquired data.

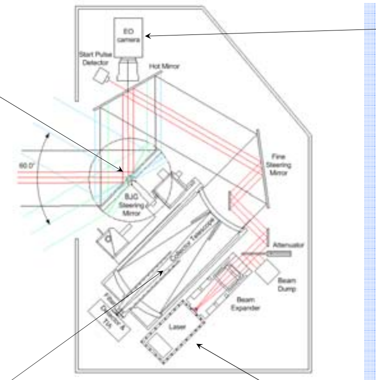




EYESAFE LADAR TESTBED

Ball Joint Gimbal Mirror
coarse sensor pointing

The Ball Joint Gimbal Mirror steers the laser beam toward the area of interest. Compared to the fine steering mirror, it has a greater range of motion, moves slower, and increments at a larger resolution.



Texel Camera™
high resolution color imagery

A co-boresighted color camera takes high-resolution CMOS digital images of the scene. The pixels of the image are precisely aligned with the ladar shots. This results in on-the-fly generation of three-dimensional color images composed of texels.

Telescope Receiver
collects reflecting photons

The laser pulse is reflected off of the target, collected in a telescope, and focused on a photodiode detector. The detector converts the pulse to an electronic signal that is digitized and stored. The full waveform of the signal is collected enabling experimentation with a variety of techniques for accurately measuring the range to target.

Fine Steering Mirror
fine raster scanning

The Fine Steering Mirror (FSM) scans the laser energy in a raster pattern, which is then steered by the Ball Joint Gimbal Mirror. The FSM has a small range of motion but can move fast and accurately.

Laser Transmitter
sends photons to the target

Laser pulses are emitted 10,000 to 100,000 times per second by a laser head. The photons in each pulse are bounced off of the target and returned to the telescope receiver for detection and measurement.