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WHAT'S NEW AT SANDIA NATIONAL LABORATORIES:
DEPLOYING THERMAL IMAGING SYSTEMS ON THE GROUND AND IN SPACE

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Uncooled Thermal Imaging in Use at Whiteman AFB, Missouri, Since 1994

The Security Systems and Technology Center at Sandia has been advocating the use of low-maintenance, uncooled thermal imaging devices in security systems for many years. In applications for both the Department of Energy and the Department of Defense, 24-hour, 365-day operation is needed. In USAF applications, aircraft parking areas are simply too large to use conventional lighting and visible imaging closed-circuit television (CCTV) cameras for immediate visual assessment of the cause of alarms. The large, open parking ramp at Whiteman Air Force Base is approximately the size of 48 football fields.

The Wide-Area Ramp Surveillance System (WARSS) was developed to provide day/night assessment capability in support of the B-2 aircraft physical security system at Whiteman AFB, Missouri. WARSS utilizes the thermal imaging sensor component of the Texas Instruments Security Sensor, Infrared (SSIR). It was originally developed under the Low Cost Uncooled Sensor Prototype (LOCUSP) program sponsored by the US Army Night Vision and Electronic Sensors Directorate (NVESD), Fort Belvoir, Virginia. In use since 1994, this was the first operational deployment of an uncooled thermal imaging system.

Other WARSS components include high-speed, computer-controlled pan/tilt mounts and an integrated frame digitization, digital video storage system that is tied into the overall alarm display system. This provides immediate assessment of alarms from buried coaxial cable sensors on the massive aircraft parking ramp at Whiteman. Operators can also manually control the imagers using a joystick or move them to specific locations using preset points. These functions, along with camera control switches, are provided to the operator via a WARSS control panel mounted near the monitors.

Cryo-cooled thermal imagers were considered in early testing activities because of the higher infrared performance. However, maintenance issues drove the tradeoff analysis. At many installations, the units need to be mounted high-up on towers or on structures where access for maintenance activities may be difficult. Such is the case at Whiteman where the imagers had to be mounted very high in order to see the entire sensor detection area and so that the field of view would not be blocked by aircraft and flightline maintenance vehicles (Figure 1).

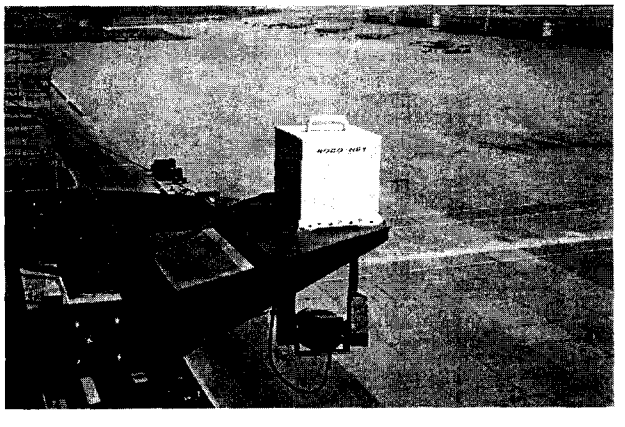

Figure 1. Wide-Area Ramp Surveillance System on 110-foot air traffic control tower.

WARSS provides operators with the ability to quickly assess alarms generated by other sensors in the area. When an alarm is triggered, WARSS automatically positions pan/tilt units and thermal imagers to view the appropriate alarm sector. Video from the thermal imagers is transmitted to monitors located in the Central Security Control (CSC) building, approximately one kilometer away. Operators can then assess the nature of the intrusion and determine the appropriate security force response.

Operational Assessment Systems ImprovementS (OASIS) Project

This USAF project encompassed upgrades to Multi-Role Thermal Imagers (MRTI) which were in the inventory of the US Air Force Europe (USAFE) Security Forces. The upgrades included changing the detector cooler, incorporating remote control capability, and integrating a pan/tilt mount. These upgrades produced the OASIS-Improved MRTI (Figure 2).

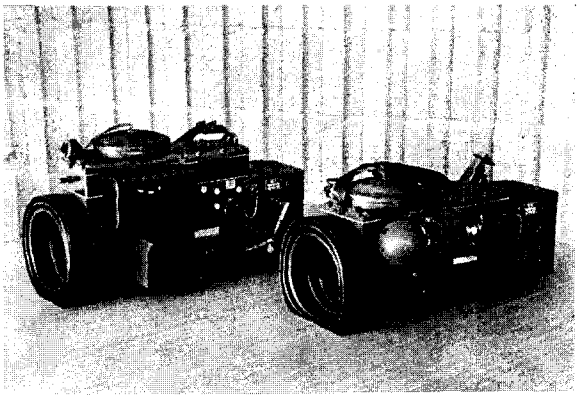

Figure 2. OASIS-improved MTRI (left) and MRTI prior to OASIS upgrades.

Several years ago, the MRTIs in the USAFE inventory were experiencing limited use deployment because of the requirement to change high-pressure air bottles approximately every two hours. Recharging the gas bottles requires special high-pressure equipment and safety training, and this was burdensome to the operational mission of USAF Security Forces. Deployment was also restricted because the MRTI lacked remote control capabilities that allowed the unit to be mounted and operated at some distance from the operator.

In an effort to make these systems more user-friendly and useful to the Security Forces, Sandia developed a retrofit kit which replaced the open-loop Joule-Thompson cryostat detector cooler with a linear-drive, split-Stirling cooler. The technical risk of replacing the Joule-Thompson cooler was considered low because the linear cooler was a proven design and available as a commercial off-the-shelf (COTS) item. Cryo-cooler maintenance was considered acceptable in this case because of the man-portable nature of the equipment and the fact that many of the thermal imagers were being warehoused and therefore under-utilized.

The upgraded MRTI has since been installed at a USAFE base in England, along with a color CCTV camera, for wide area surveillance. The imager is mounted at the top of a 100-foot communications tower (see Figure 3). The USAF is now benefiting from this equipment, and the MRTIs are being considered for additional flightline security enhancements at other USAFE locations.

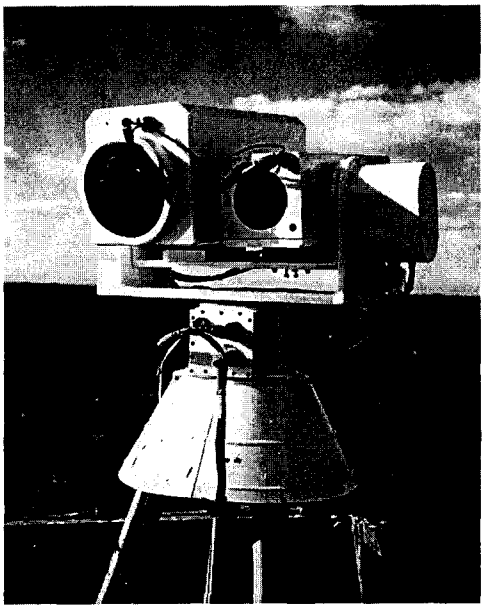

Figure 3. OASIS-improved MRTI thermal imager, camera, and pan/tilt unit.

Cobra Brass Payload Completes Vehicle Level Integration and Test

The Cobra Brass Payload is a space-based research and development system designed to demonstrate the utility of multispectral, fast-framing, staring sensor technology for applications to Theater Missile Defense (TMD) and Support to Military Operations (SMO) missions.

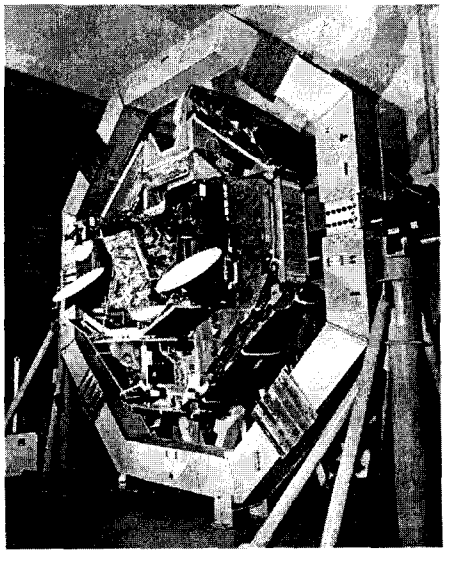

Figure 4. Cobra Brass system and adjoining payloads.

The Cobra Brass team at Sandia has completed the integration of the Cobra Brass payload with the host spacecraft. The extraordinary effort to develop, integrate and test this unique, complex and capable payload was completed within the 24-month schedule. Figure 4 shows the Cobra Brass system along with four other new payloads which will accompany it into orbit. (The telescope is visible in the center of the photograph.) Although the 467-pound Cobra Brass payload shares many complex interfaces with the host spacecraft, the Sandia team powered up the system and operated it successfully on the first attempt.

The Cobra Brass system is designed to collect and characterize multispectral, fast transient events from space. The system is capable of collecting and storing transient data at rates up to 192 million bits per second. Continuous operation at rates of 100 million bits per second and above are possible under many conditions. Frame rates up to 284 frames per second are also selectable by ground command. The design team has designed and successfully integrated several advanced technology subsystems into the Cobra Brass payload to produce a sophisticated high-performance research and development data collection system.

References

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