



PETROGLYPH ELEMENTARY 2nd grader Josh Brown and teacher Janet Sanchez read aloud a letter sent by a pen pal at School 121 in Snezhinsk, Russia, where Chelyabinsk-70 is located. The letter was part of a goodwill package put together by students in a Russian classroom and transported to Albuquerque by John Taylor (5336). Twelve New Mexico teachers and several Sandians are participating in the International School-to-School Program, coordinated by Patricia Newman (5337). See story below. (Photo by Randy Montoya)

## A giant leap for Sandia: Labs takes lead on total satellite system

**Multispectral Thermal Imager satellite project a first for Sandia**

By Bill Murphy

Begin with a scenario: Imagine a nuclear power plant in a closed country whose intentions toward the US and its interests may not be benign. The country's leaders insist that it is a peaceful nuclear power plant, but it could be used to produce weapons-grade nuclear materials. In today's world, scenarios like this are a reality.

The proliferation of weapons of mass destruction is a critical national and international concern that has steadily grown since the end of the Cold War. The nation's leaders charged with protecting US security and monitoring treaty compliance are in constant need of information on facilities in countries where it is not possible to have inspection teams on the ground.

This requires new high-tech methods like those being developed by the Sandia-led Multispectral Thermal Imager (MTI)

*"This is a research and development satellite. . . It's a first-of-a-kind, one-of-a-kind R&D system."*

project, which will launch Sandia's first satellite into orbit from Vandenberg Air Force Base, California, in October 1999.

MTI is the \$130 million flagship project of a major DOE Office of Nonproliferation and National Security (DOE/NN) R&D program aimed at developing a broad range of new technologies for detecting facilities that could be manufacturing weapons of mass destruction. The project is under the direction of Bob Waldron, DOE/NN Director of Research and Development.

Sandia recently unveiled a full-scale model of the MTI satellite, which promises to give nonproliferation experts and policy makers a powerful new means of obtaining badly needed information. The project, championed early on by Waldron, is designed to demonstrate and evaluate advanced imaging, image processing, and associated technologies that could be used in future systems to detect and characterize facilities producing weapons of mass destruction. The technology also has a broad range of other potential national security and civilian applications that will be investigated.

James Kelsey, Director of Monitoring Systems and Technology Center 5700, emphasizes the R&D nature of the MTI

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## Students shed Cold War mentality in cyber-age Russia pen-pal program

By John German

Their parents spent their school-age years learning to mistrust Russians. But for the 19 second graders in Janet Sanchez's Petroglyph Elementary School classroom, Russians aren't reason to "duck and cover." They're pen pals, friends, summer camp companions, perhaps. They're a good reason to check your classroom's e-mail.

This school year 12 New Mexico teachers and their students are exchanging e-mails, goodwill packages, and the occasional video conference greeting with school children in Snezhinsk, Russia. Located in the southern Urals 800 miles southeast of Moscow, Snezhinsk is one of the Soviet Union's formerly secret "closed" cities, home of the nuclear weapons design lab known as Chelyabinsk-70.

Sandia is coordinating the program, largely through the volunteer efforts of employees who travel regularly to and from Snezhinsk to work with Chelyabinsk scientists. They provide technical support and often carry packages of small gifts ranging from scrapbooks and video tapes to coins and candy.

The New Mexico participants include kindergarten-aged students at The Learning Circle; elementary school students at Zuni, Georgia O'Keeffe, Petroglyph, and Valencia; middle school students at Desert Ridge; and high school students at Sandia High and the Career Enrichment Center.

"How can we go back to wanting to shoot at each other when our kids are getting to know each other like this?" says Patricia Newman (5337), who coordinates the School-to-School Program.

### Technologies making world smaller

The Russians are particularly eager to get to know their American counterparts because former Soviet policies prohibited foreign interactions by residents of its secret cities. "It's an elite, closed culture," she says. "These kids wouldn't have had these opportunities during the Cold War."

Sanchez's students correspond every few weeks with students in Nina Morozova's and Anastasia Maslova's classes at Snezhinsk School 121, exchanging e-mail greetings and sending by special courier drawings and stories depicting

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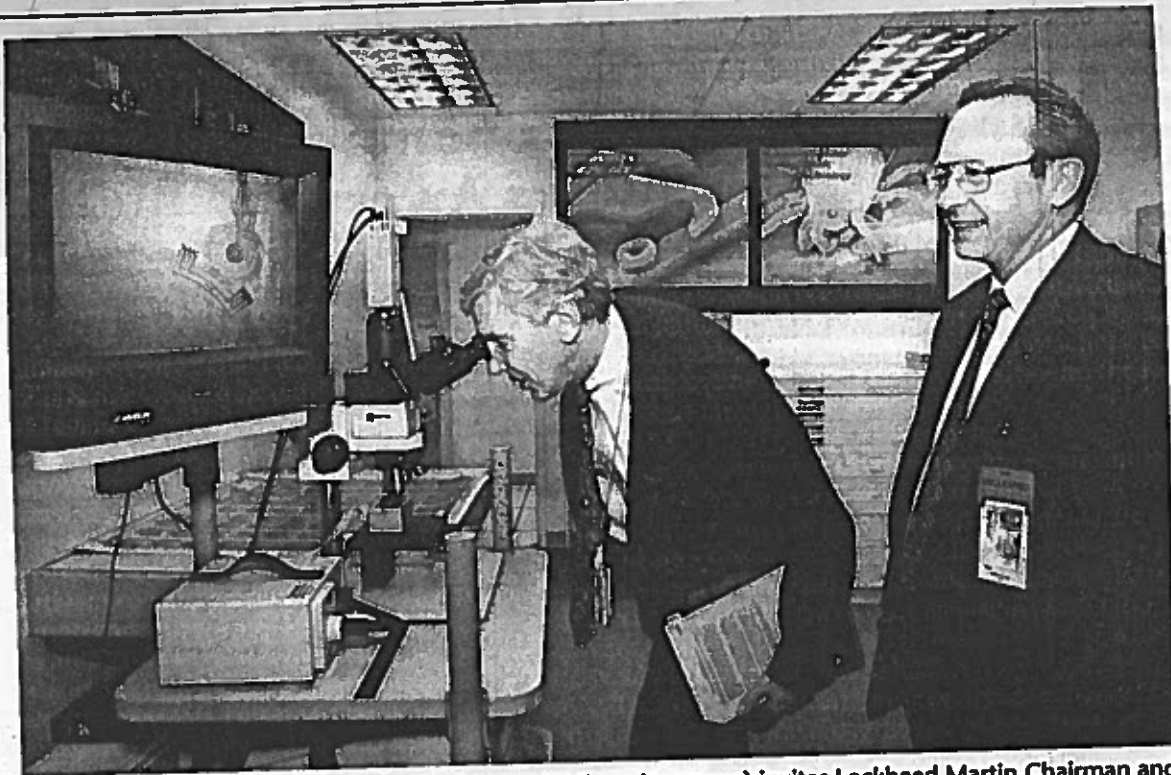
# Sandia LabNews

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GEARING UP— Labs President C. Paul Robinson (at the microscope) invites Lockheed Martin Chairman and CEO Vance Coffman to take a look at one of Sandia's latest micromachines. During a daylong visit to the Labs last week, Coffman toured the Microelectronics Development Laboratory and received high level briefings from Paul and Division 5000 VP Roger Hagengruber. During his visit, Coffman delivered an address to Sandia employees on the subject of Lockheed Martin's plans for competing in the global marketplace of the 21st century. See story on page 5. (Photo by Randy Montoya)

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Tony Castillo retires after 40 years of operating snack bar

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# MTI satellite

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project.

"This is a research and development satellite," he says. "No operational capability is planned. It's a first-of-a-kind, one-of-a-kind R&D system intended to prove technical feasibility and applicability."

## A technology developer and provider.

It is important to note, James says, that Sandia's role in the project is to support DOE's mission as a technology developer and provider in treaty verification and treaty compliance monitoring.

"We do not provide operational systems, and we are not the customers for data," James says. "We assist other organizations with technology to help them do their jobs."

According to Brian Brock (5711), Sandia's MTI project manager, some 50 government, academic, and industry organizations are involved in MTI, not including numerous parts vendors and data users. These organizations include DOE's Los Alamos National Laboratory and Savannah River Technology Center, the Air Force Space Test Program (providing the launch), and the Air Force Research Laboratory (formerly the Phillips Laboratory). Major industrial partners are Raytheon Optical Systems, Ball Aerospace, Santa Barbara Research Center, and TRW.

The MTI satellite weighs 1,377 pounds and stands just over eight feet high. Its payload includes a state-of-the-art, 12-inch telescope with a cryogenically cooled focal plane and complex built-in calibration hardware designed to collect radiometrically calibrated images with accuracies currently achievable only in the laboratory. Instrument calibration will be completed at LANL in a new state-of-the-art facility developed especially for MTI with assistance from the National Institute of Standards and Technology. Los Alamos is also developing advanced computerized site models, atmospheric transport models, and system models, which have been employed in the system design and will be used in the analysis of project data.

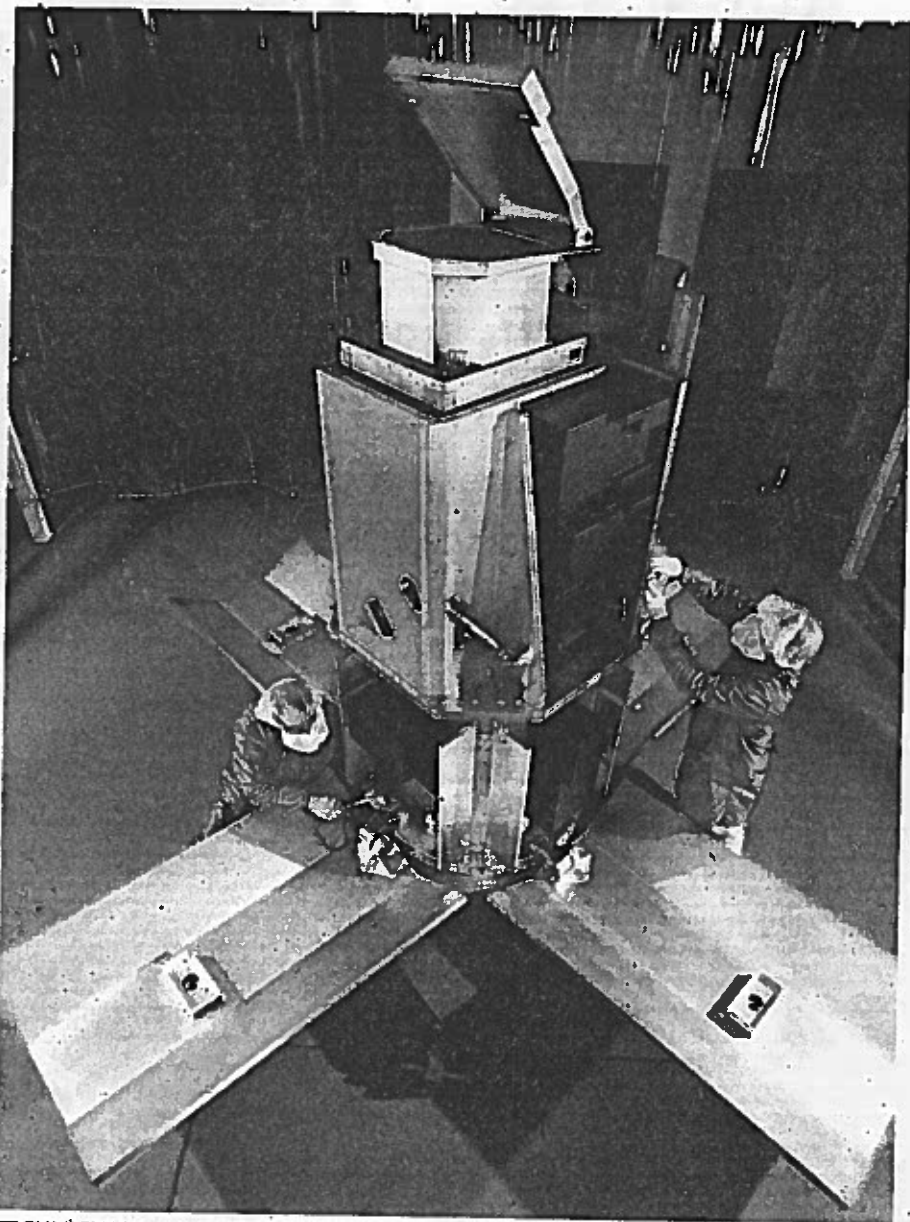
During its three-year mission MTI will periodically

record images of participating government, industrial, and natural sites, mostly within the continental US. These sites will be instrumented to record ground-truth data by a team of scientists and technicians from the Savannah River Technology Center, whose research in the late 1980s laid much of the ground work for the project.

Mission operations will be conducted from a control center housed in Bldg. 890 in Tech Area 1. From there, mission planners will assign MTI a set of tasks for each pass over its targeted test sites. With its three-year mission and a polar orbit that brings the bird over several of its test sites each day, they'll have their hands full.

Raw data downlinked from MTI will be forwarded to a new, specially built facility at Los Alamos, where it will be converted into "data products" and distributed to more than 100 researchers across the US. These researchers, members of the MTI User's Group, will compare ground-truth and satellite data to develop and validate applications ranging from treaty monitoring and military operations to environmental and climate research.

In addition to the primary DOE sensor, MTI will carry a high energy X-ray spectrometer (HXRS) sponsored by the National Oceanic Atmospheric Administration (NOAA), with additional funding from the Astronomical Institute Academy of Sciences of the Czech Republic, and built by Space Devices, Ltd. of the Czech Republic. HXRS is designed to



TECHNICIANS prepare the MTI satellite for installation of key subsystems. When assembly is completed in a clean room in Bldg. 890, the satellite will be shipped to a new facility at Los Alamos National Laboratory for calibration. (Photo by Randy Montoya)

record a rare species of solar flare associated with high-energy proton storms known to damage satellites and potentially endanger astronauts. From HXRS, NOAA hopes to obtain data needed to design a system capable of forecasting such storms.

## MTI: How it works

Here's how the MTI satellite will work: Its 12-inch telescope with a cryogenically cooled focal plane will scan participating sites in 15 spectral bands, ranging from visible to long-range infrared. Think of the spectral bands as colors, with this proviso: Only three of the colors are visible to the human eye. The sensors on MTI, though, can "see" the other 12 colors, and each color has its own story to tell about a scanned location. Also, MTI, with its advanced thermal sensing capabilities, is designed to collect highly accurate temperature readings of the earth from space.

MTI's spectral bands are carefully selected to collect data needed to derive a broad range of information on facilities and activities, including surface temperatures, materials, water quality, and vegetation health. To enhance accuracy, additional bands provide simultaneous information on atmospheric water vapor, aerosol content, and subvisual cloud presence.

Twice a day, the MTI satellite will transmit collected images to facilities in New Mexico, where they will be processed and distributed to DOE analysts and other investigators throughout the United States. These investigators will analyze and compare MTI images to ground-truth data. This research will be used in the development of future systems designed to support treaty monitoring, military operations, environment and climate monitoring, and other national needs.

## A proud history of space-related work

While Sandia has a long and proud history of involvement in space applications, up to now its work has entailed building payloads for spacecraft developed elsewhere. Since the early 1960s, more than 100 Sandia instruments have been launched, performing a variety of national security and scientific missions. Sandia provided nuclear detonation detectors for Vela satellites first launched in 1963, and is still flying detonation detectors on Defense Support Program satellites. The nation's primary system for detecting nuclear detonations in the atmosphere currently resides in a suite of Sandia instruments carried by Global Positioning System satellites. Most recently, a Sandia instrument was launched aboard a FORTE satellite, which is a sister project to MTI, sponsored by DOE/NN and led by Los Alamos National Laboratory.

With the development of the MTI satellite, Sandia for the first time has prime responsibility for the entire satellite.

"This is the first free flyer that we are totally responsible for," James Kelsey (5700)



MTI ON ORBIT, 360 miles above earth, in this artist's conception.

says. "It's been a major system integration challenge. You have to draw upon a much broader base of technology [to do an entire satellite] than if you were just to do a payload."

Kelsey notes that although MTI won't fly until 1999, the project is at a critical juncture. "The flight subsystems are coming together as we speak," he says, "and integration of the components into a fully configured satellite has begun."