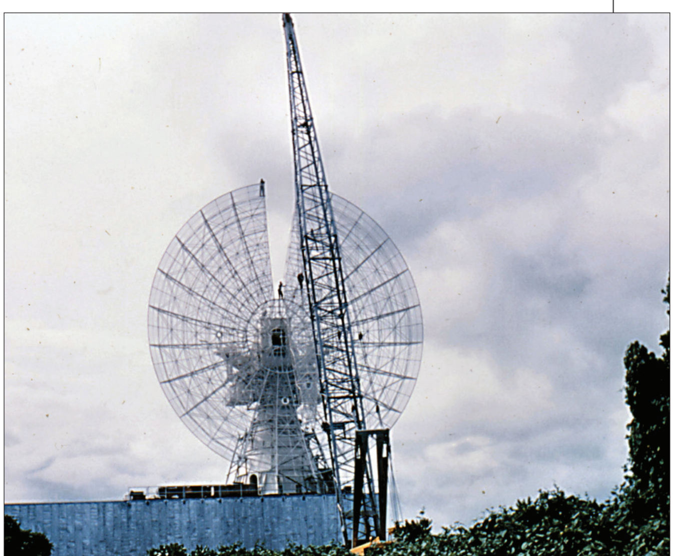
Historical Timeline

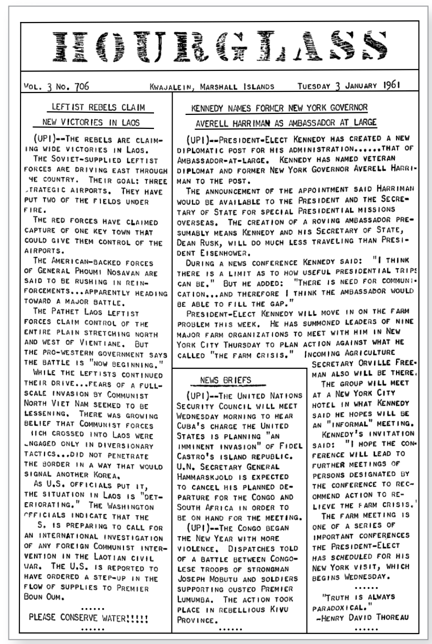
Kenneth R. Roth

Events at the Reagan Test Site

1960s

1961
RCA Corporation begins onsite construction of the TRADEX system. TRADEX was the first of the radars to be built at the Kwajalein range as part of Project PRESS.





HOURGLASS

Vol. 3 No. 706 | Kwajalein, Marshall Islands | Tuesday 3 January 1961

LEFTIST REBELS CLAIM NEW VICTORIES IN LAOS

(UPI)--The rebels are claiming wide victories in Laos.

The Soviet-supplied leftist forces are driving east through the country. Their goal: three strategic airports. They have put two of the fields under fire.

The red forces have claimed capture of one key town that could give them control of the airports.

The American-backed forces of General Phoumi Nosavan are said to be rushing in reinforcements...apparently heading toward a major battle.

The Pathet Laos leftist forces claim control of the entire plain stretching north and west of Vientiane. But the pro-western government says the battle is "now beginning."

While the leftists continued their drive...fears of a full-scale invasion by Communist North Viet Nam seemed to be lessening. There was growing belief that Communist forces which crossed into Laos were engaged only in diversionary tactics...did not penetrate the border in a way that would signal another Korea.

As U.S. officials put it, the situation in Laos is "deteriorating." The Washington officials indicate that the U.S. is preparing to call for an international investigation of any foreign Communist intervention in the Laotian civil war. The U.S. is reported to have ordered a step-up in the flow of supplies to Premier Boun Oum.

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PLEASE CONSERVE WATER!!!!!

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KENNEDY NAMES FORMER NEW YORK GOVERNOR AVERELL HARRIMAN AS AMBASSADOR AT LARGE

(UPI)--President-Elect Kennedy has created a new diplomatic post for his administration......that of Ambassador-at-Large. Kennedy has named veteran diplomat and former New York Governor Averell Harriman to the post.

The announcement of the appointment said Harriman would be available to the President and the Secretary of State for special Presidential missions overseas. The creation of a roving ambassador presumably means Kennedy and his Secretary of State, Dean Rusk, will do much less traveling than President Eisenhower.

During a news conference Kennedy said: "I think there is a limit as to how useful presidential trips can be." But he added: "There is need for communication...and therefore I think the ambassador would be able to fill the gap."

President-Elect Kennedy will move in on the farm problem this week. He has summoned leaders of nine major farm organizations to meet with him in New York City Thursday to plan action against what he called "the farm crisis." Incoming Agriculture Secretary Orville Freeman also will be there.

The group will meet at a New York City hotel in what Kennedy said he hopes will be an "informal" meeting.

Kennedy's invitation said: "I hope the conference will lead to further meetings of persons designated by the conference to recommend action to relieve the farm crisis."

The farm meeting is one of a series of important conferences the President-Elect has scheduled for his New York visit, which begins Wednesday.

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"Truth is always paradoxical."
-Henry David Thoreau

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NEWS BRIEFS

(UPI)--The United Nations Security Council will meet Wednesday morning to hear Cuba's charge the United States is planning "an imminent invasion" of Fidel Castro's island republic. U.N. Secretary General Hammarskjold is expected to cancel his planned departure for the Congo and South Africa in order to be on hand for the meeting.

(UPI)--The Congo began the New Year with more violence. Dispatches told of a battle between Congolese troops of strongman Joseph Mobutu and soldiers supporting ousted Premier Lumumba. The action took place in rebellious Kivu Province.

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1961
Hourglass is published on Kwajalein with local and international news. Some of the headlines of this version from 3 January 1961 include “Sinatra will dress in style for inauguration of Kennedy,” “Kwajalein water facts [daily water usage 192,400 gallons],” and “Final Rose Bowl game score: Washington 17, Minnesota 7.”

1950s

1957
Soviet Union announces that it successfully tested an intercontinental ballistic missile, then launches Sputnik

1958
Secretary of Defense creates the Advanced Research Projects Agency (ARPA); Project PRESS (Pacific Range Electromagnetic Signature Studies) is initiated by ARPA

1960
ARPA designates MIT Lincoln Laboratory as scientific director of Project PRESS; first Lincoln Laboratory inspection of Roi-Namur Island is conducted

1962
The Target Resolution and Discrimination Experiment (TRADEX) acquires and tracks its first ICBM, an Atlas missile launched from Vandenberg Air Force Base

1962
The first Lincoln Laboratory family arrived to live on Kwajalein on 20 May. Bill Romaine was accompanied by his wife Susan and their two children, Janet, age 12, and Barbara, age 2. Bill Camp and his family, shown in the photo, arrived shortly thereafter.

1964
On 1 July, management of Kwajalein, originally known as the Pacific Missile Range Facility—Kwajalein, was transferred from the Navy to the Army. The Army assigned management responsibility to the Nike-X Project Office in Huntsville, Alabama, and the site was renamed the Kwajalein Test Site. The Project PRESS site at Roi-Namur, shown here, remained under the direction of ARPA.

1963
Project PRESS Airborne Optical Aircraft and Roi-Namur ground-based optical system is operational

1966
48-inch tracking telescope becomes operational on Roi-Namur

1967
ARPA Long-Range Tracking and Instrumentation Radar (ALTAIR) installation by GTE Sylvania begins

1968
ARPA-Lincoln C-band Observables Radar (ALCOR) installation by Lincoln Laboratory and subcontractor RCA begins

1969
Project PRESS site at Roi-Namur is renamed Kiernan Reentry Measurements Site (KREMS) after LTC Joseph M. Kiernan

1970

The ARPA-Lincoln C-band Observables Radar (ALCOR) became operational. ALCOR was the first high-power microwave radar to utilize wideband waveform transmissions. ALCOR's goals were to develop the technology necessary to generate and process wide-bandwidth signals and to investigate the applications of broadband data for reentry vehicle discrimination and space situational awareness.

1970

The ARPA Long-Range Tracking and Instrumentation Radar (ALTAIR) is operational at VHF and UHF. The white "teacup" (notice its size relative to that of the man standing below it) is the cover of the conventional five-horn focal-point feed of the VHF system. The "saucer" is the dichroic secondary reflector of the UHF Cassegrainian system with a multimode horn at the vertex. The reflector is composed of two layers of crossed dipoles that are resonant at UHF, making it an excellent reflector at UHF and almost transparent at VHF. The system angle-tracks at both frequencies, and either frequency can drive the antenna-servo system.

« 1970s

1971

First radar image of orbiting satellite is generated by ALCOR on *Salyut 1* spacecraft

1971

Reentry Designation and Discrimination Experiment, the first real-time discrimination test bed, begins at Kwajalein

1972

First Sprint missile is launched from Illeginni as part of Safeguard system test

1972

PRESS ground-based optics program ends; TRADEX is modified to L and S bands

1973
Surface-acoustic-wave device developed for compressing ALCOR's 512 MHz wideband waveform. Note the faint white curves (bottom) that visibly indicate the finite-impulse-response filter coefficients. These coefficients implement a very narrow bandpass filter.

1974
The Army Ballistic Missile Defense Advanced Technology Center decided to establish the Army Optical Station at Kwajalein. The SOLITAIRE narrow- and wide-field-of-view infrared radiometer system was moved to Roi-Namur from the White Sands Missile Range in New Mexico. A long-wave infrared wideband radiometer, known as the Wide Angle Sensor, was also installed. In 1976, the Ground-Based Measurements short- and long-wave infrared tracking optical system was also established.

1973
ALCOR begins to routinely image satellites in support of space-object identification

1973
A program known as SIMPAR (SIMulation of Safeguard System Perimeter Acquisition Radar) becomes operational on the ALTAIR radar

1973
Safeguard Missile Site Radar prototype operations begin at Meck Island

1977
Laser Infrared Tracking Experiment laser radar becomes operational as part of the Army Optical Station

1977
Pacific Barrier (PACBAR) trial begins at ALTAIR

1983
The last-built KREMS radar, the Millimeter-Wave (MMW), became operational at 35 GHz center frequency. MMW was initially designed as an adjunct to ALCOR but has since grown to become a complete, self-sufficient system. The original charter for MMW was to provide a database of millimeter-wave signature data of reentry phenomenology and to support fine-scale miss-distance measurements for interceptor experiments. The radar was also used to generate fine-scale resolution images of near-Earth satellites.

1983
In January, the Multistatic Measurement System (MMS) became operational. MMS provided multistatic L-band metric data with TRADEX as the illuminator, and L-band and UHF multistatic signature data with TRADEX and ALTAIR as the illuminators. Receiving antennas were located on the islands of Gellinam and Illeginni. By using triangulation, MMS was able to provide very precise three-dimensional metric data.

« 1980s

1981
High-speed satellite data link is established between Kwajalein and Lexington for transmittal of mission data

1982
ALTAIR Space Detection and Tracking System becomes operational

1984

In November, ALTAIR's original UHF klystron transmitter was replaced with an array of 24 traveling-wave-tube (TWT) transmitters that were combined through a series of hybrids, each consisting of eight in-parallel TWTs. Later in time, another group of eight additional TWTs was added to ALTAIR. This modification greatly increased the radar's UHF sensitivity and provided the capability to do dual-frequency tracking of deep-space satellites.

1986

In May, the Army restructured the organization at Kwajalein. The lead command on the atoll became known as the United States Army Kwajalein Atoll (USAKA) and a subordinate command known as the Kwajalein Missile Range Command was established. The Kwajalein Missile Range Command was responsible for the technical facilities and instrumentation, while the USAKA Command was responsible for base operations and all nontechnical functions.

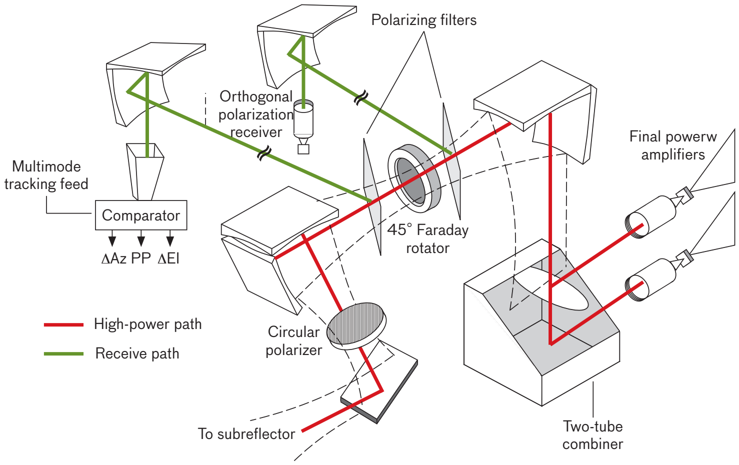
1985
Millimeter-Wave Radar (MMW) becomes operational at 95 GHz

1986
ALCOR near-real-time imaging of satellites becomes operational

1986
Real-time coherent integration and phase-code modulated waveforms are added to TRADEX radar

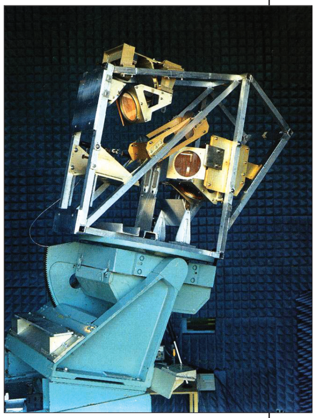
1987
Kwajalein Discrimination System (KDS) demonstrates real-time imaging of reentry vehicles using MMW data

1989
MMW demonstrates capability to generate satellite images in real time and transmits them to NORAD-Cheyenne Mountain via encrypted data link



1992

In the early 1990s, the MMW rigid-waveguide components were replaced with a quasi-optical-transmission system, known as the Beam Waveguide (BWG) system. The BWG system uses mirrors to transport RF energy from the high-power tube output through free space to the antenna feed. Using free-space transmission greatly reduces system losses. In addition, the BWG system can carry much higher transmitter power levels than the rigid waveguide system.



1993

In October, the Laboratory's responsibilities expanded as Lincoln Laboratory became the Army's scientific director for all measurement assets on Kwajalein Atoll, not just those at KREMS. In addition to the KREMS sensors, the range's sensor suite includes two MPS-36 tracking radars located on Kwajalein Island; a variety of visible, MWIR, and ballistic camera optical systems located around the atoll; 13 telemetry collection systems; a range safety ship equipped with command, destruct, and telemetry systems; and a hydroacoustic impact scoring array. As an initial project, the Laboratory successfully integrated the KREMS and Kwajalein independent control centers into a single control center located on Kwajalein Island. The new mission control center was called the Kwajalein Mission Control Center.

« 1990s

1990
All-digital universal signal processor is added to ALTAIR

1991
TRADEX multi-target tracker is operational

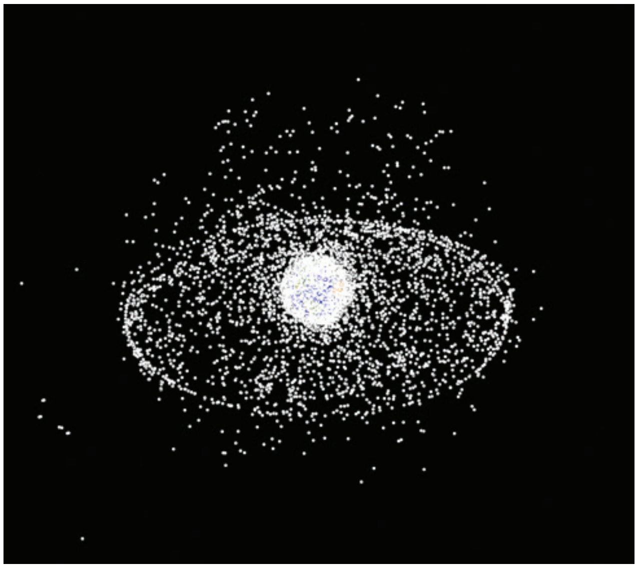
1993
Submarine fiber-optics ring is installed around atoll

1994
Honolulu Data Reduction Facility is shut down and work is transitioned to Lincoln Laboratory in Lexington

1994
MMW system is upgraded from 1 GHz to 2 GHz bandwidth

1994

A special operating mode referred to as stare and chase was added to TRADEX to enable it to assess the space-debris population at low latitudes. This mode was used to collect space-debris data for NASA.



1996

The Kwajalein Mobile Range Safety System (KMRSS) became fully operational in July. KMRSS is a ship-based mobile range safety system that was developed at Kwajalein under Laboratory supervision for safely conducting tests of theater-class ballistic missiles. Testing of theater-class missiles had begun at Kwajalein in 1993 with the initiation of the Laboratory's Theater Critical Measurements Program.

1996

Lincoln Laboratory's role is changed from scientific director to scientific advisor at request of the U.S. Army

1997

A new frequency-jump-burst waveform is added to TRADEX and later transitioned to the Aegis SPY-1 radar

1998

Perseid and Leonid meteor shower measurements are initiated using ALTAIR VHF radar

1998

TRADEX is officially recognized by Air Force Space Command as a contributing sensor to the Space Surveillance Network

1999

Kwajalein Missile Range is renamed RTS, the Ronald Reagan Ballistic Missile Defense Test Site

2000

Work focused on a major effort, the Kwajalein Modernization and Remoting (KMAR) program, which began in 1997, to bring commonality to the KREMS instrumentation. KMAR was a five-year program designed to reduce operation and maintenance costs, and to improve the capability and reliability of the KREMS radars by developing a common set of radar back-end hardware and software. Only the radar antennas, transmitters, and receivers were to remain unique. Lincoln Laboratory developed an architecture known as the Radar Open System Architecture (ROSA). The ROSA design decomposes the radar system into a number of loosely coupled subsystems using commercial off-the-shelf hardware and connected by standard, commercial interfaces. The ROSA upgrade was completed on schedule in 2002. It has since been transferred to many other U.S. radars and to all the optical systems at RTS.

2002

In October, the project to consolidate and modernize all of the telemetry collection systems was completed. The telemetry systems were removed from the remote islands as a cost-savings measure and consolidated on the islands of Kwajalein and Roi-Namur.

« 2000s

2002

KREMS radars are all operated remotely from Kwajalein Mission Control Center, located on Kwajalein Island

2002

First radar sidecar is installed at KREMS on ALCOR radar

2002

BMD fusion test bed is established using KREMS sensors

2003

New Gore-Tex® radome installed on MMW

2004

Advanced multistatic experiments are conducted at Kwajalein

2004

In January, the Continental United States Operations Support Center (COSC) located in Lexington, Massachusetts, was completed. This center was tied to the control center at Kwajalein via a satellite communications link and was used to monitor missions from Lexington in real time.

2007

A major multiyear project was begun to modernize the optical systems around the atoll. The scope of the project is to replace the existing domes, refurbish the mounts, replace all film cameras with digital systems, and replace the existing real-time control software with a new open system architecture that is a follow-on to ROSA. Two of the five Super RADOT (for Recording Automatic Digital Optical Tracker) systems have been completed and the remainder are nearing completion.

2007

Kwajalein Space Surveillance Center is moved from Roi-Namur to Kwajalein Island

2007

Extended Space Sensors Architecture advanced concepts technology demonstration is under way

2008

RTS Distributed Operations local-area network version is integrated into the Kwajalein Control Center

2008

Ballistic Missile Defense—Space Situational Awareness multimode real-time net-centric demonstration is successfully conducted

2009

Lincoln Laboratory's Kwajalein Atoll energy initiative study is completed

2011

The MMW bandwidth was upgraded once again by a factor of 2—from 2 to 4 GHz. The project involved the design and fabrication of a new transmitter tube, an enhanced receiver, and a Lincoln Laboratory custom-designed upgrade to the RF path. This effort has made MMW the broadest-band high-power radar in operation today.

2011

The multiyear RTS Distributed Operations (RDO) program, initiated by the Laboratory in 2006, was completed and accepted by the government in December. RDO allows the RTS sensor suite to be operated remotely from Huntsville, Alabama. All future space and test operations will be conducted from Huntsville, thereby increasing the accessibility of RTS for range users and helping to further reduce the on-island footprint. Major enablers for RDO were the development of a net-centric architecture within the mission control center, the laying of an undersea fiber-optic cable from Kwajalein to Guam, and the build out of a new facility in Huntsville for housing the operator consoles and other infrastructure.

« 2010s

2010

An advanced version of the ROSA architecture, known as ROSA II, begins to be integrated into the KREMS radars

2012 >>

To recognize the 50th anniversary, a special celebration was held at the atoll on 12 and 13 February. U.S. government officials attending included Martha Campbell, the U.S. Ambassador to the Marshall Islands; Zachary Lemnios, the Assistant Secretary of Defense for Research and Engineering; and Debra Wymer, the Director of U.S. Army Space and Missile Defense Command's Technical Center. Lincoln Laboratory Kwajalein alumni from the early 1960s and their family members, and current Laboratory leadership attended the celebration events and spent a few days on the island.

Answer to the question on the back cover: the photo was taken circa 1978, predating the construction of MMW, which was built in 1983.


EXIT


50 YEARS OF SERVICE