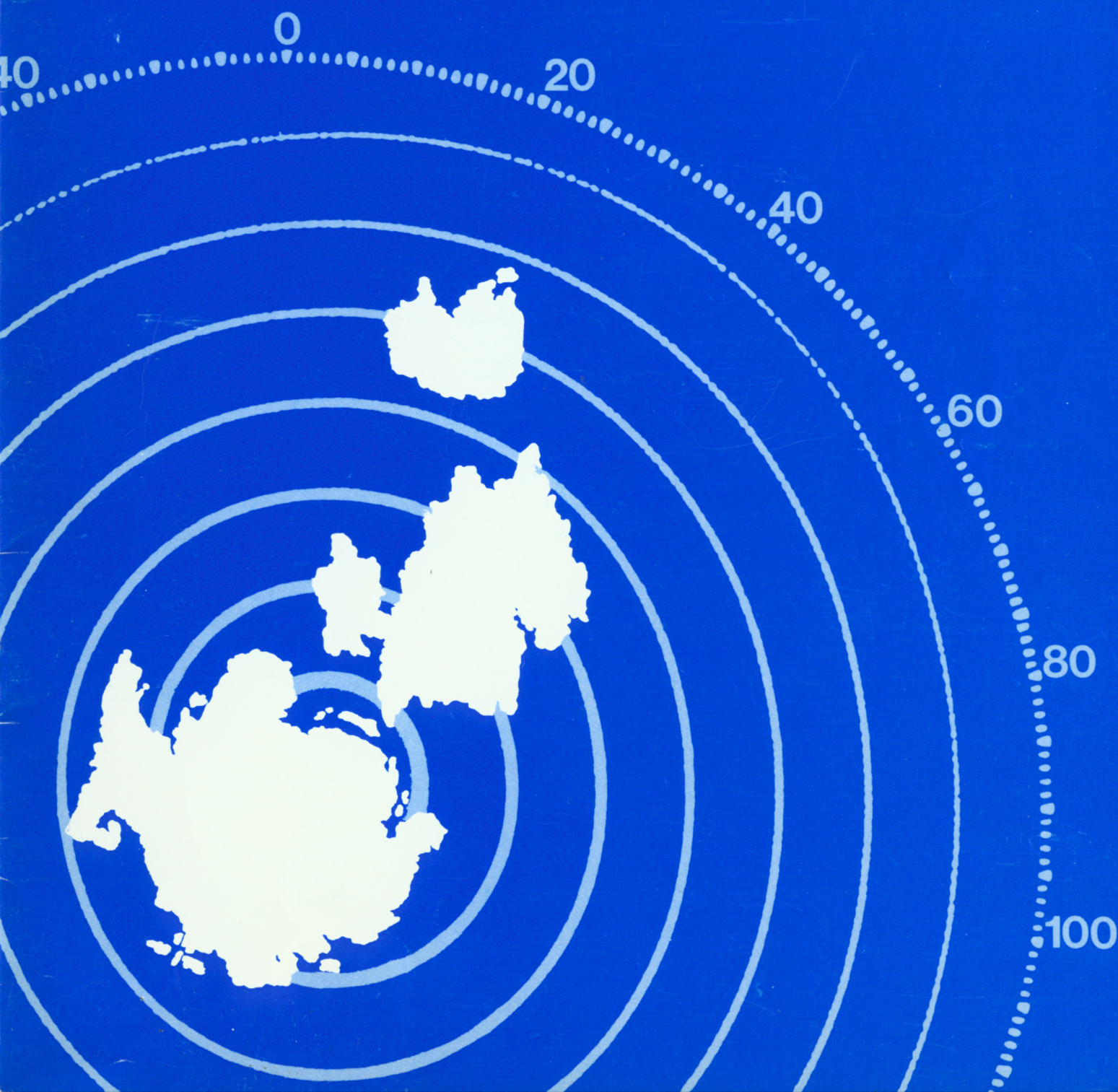


# **Radar and Instrumentation Laboratory Research Capabilities**





# Location



For further information contact:  
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Engineering Experiment Station  
Georgia Institute of Technology  
Atlanta, Georgia, 30332  
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# EES Overview

Over the years, Georgia Tech has become nationally recognized as a resource for radar technology. Most of this expert radar capability was perfected through research and development conducted by Georgia Tech's Engineering Experiment Station (EES).

EES, a non-profit, applied research organization was commissioned by the Georgia General Assembly in 1919. Its purpose is to serve the community, state, and nation through scientific, engineering, and industrial research. As an integral part of Georgia Tech, EES researchers are also aiding in the development of Georgia's natural resources, improving industrial and economic development, and participating in national programs of science, technology, and preparedness.

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## ELECTRONICS LABORATORIES

- Radar and Instrumentation Laboratory
  - Radar technology, millimeter wave technology, signal processing, instrumentation systems
- Computer Science and Technology Laboratory
  - Software research, software applications, and computer technology and applications
- Electromagnetics Laboratory
  - Electro-optics, radiation systems, solid state sciences
- Electronics Technology Laboratory
  - Communications, biomedical electronics, electromagnetic compatibility and environmental effects
- Systems Engineering Laboratory
  - Electronic defense, electronic support systems, electronic countermeasures, electronic warfare
- Systems and Techniques Laboratory
  - Selected radar systems, electromechanical research and development, antenna systems

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## RESOURCES LABORATORIES

- Chemical and Material Sciences Laboratory
  - Organic materials, environmental chemistry, biomedical processes
- Economic Development Laboratory
  - Economic analysis, business services, productivity, industrial development, transportation
- Energy Research Laboratory
  - Alternate energy forms and their environmental effects
- Engineering Extension Office
  - Domestic and foreign outreach activities
- Technology Applications Laboratory
  - Energy conservation, industrial process improvement, rehabilitation engineering



# RAIL—The Diverse Radar Laboratory

The Radar and Instrumentation Laboratory (RAIL) which grew out of the extensive radar experience of EES was formed in March of 1977. Since then, the laboratory has grown rapidly to meet the technological challenges of the 80's.

Laboratory capabilities span these broad areas:

*research*—to provide a broad base of fundamental information and to discover new phenomena that may be exploited to expand the existing radar technology base;

*development*—to expand the radar technology base necessary for advanced systems by identifying problems, by determining alternative solutions, and by testing innovative combinations of technological building blocks;

*system engineering*—to transform operational needs into system performance parameters and preferred system configurations;

*studies and analyses*—to organize and evaluate data and to make substantive contributions to planning, programming, and decision making.

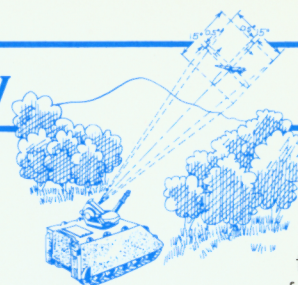
People are the primary resource of RAIL. The Laboratory staff of full-time professionals is well-balanced in terms of education and experience. RAIL's immediate staff is complemented by professionals from other laboratories within the Station and the teaching faculty of Georgia Tech to provide expertise in most fields of science and engineering.

An extensive array of equipment and laboratory facilities is available to RAIL researchers for conducting experiments, automated analysis and design, and developing and demonstrating advanced system feasibility.

RAIL is organized into five units. The Radar Experimental Division is primarily responsible for field experiments to measure microwave and millimeter wave characteristics of tactical targets and their environments. The Radar Applications Division is engaged in evaluating experimental data and synthesizing signal processing techniques that exploit identifiable signal characteristics to enhance target discrimination and classification.

Radar system engineering and prototype development are primarily the responsibility of the Radar Development Division. The Modeling and Analysis Division investigates electromagnetic wave propagation phenomena and formulates techniques to exploit these phenomena. Finally, the Operations Research Branch complements system research and development capabilities by providing expertise in the areas of training evaluation techniques and instrumentation, decision theory, and human factors.

Georgia Tech's capabilities in radar research and development have grown substantially over the past 25 years, and RAIL has been an integral part of that



development. RAIL projects sponsored by the Department of Defense, other

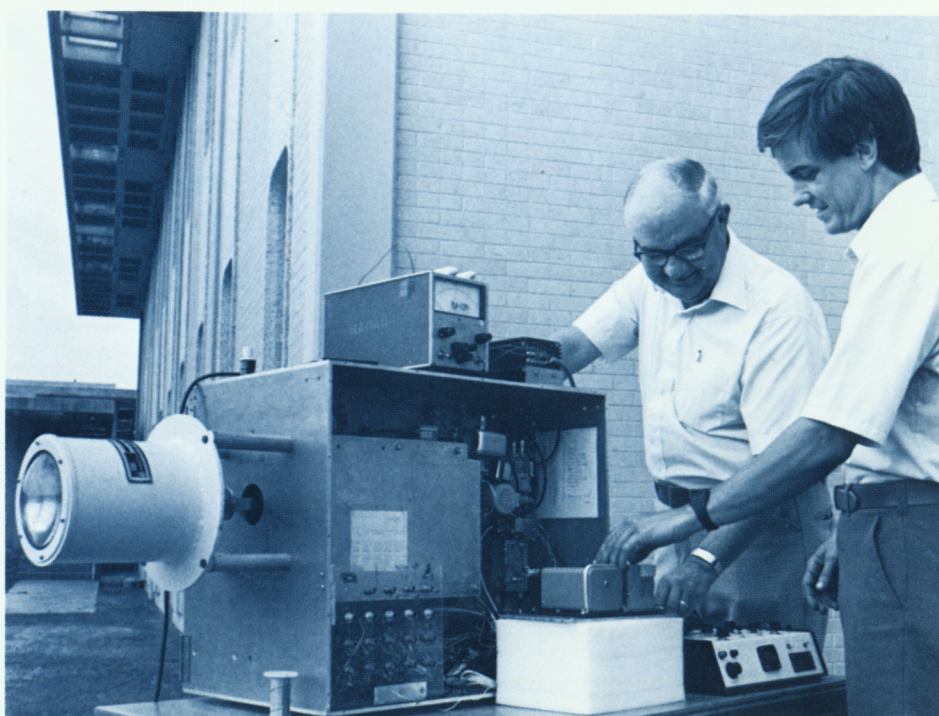
Federal agencies, and private industry have resulted in significant contributions in radar systems and technology and a host of radar-related fields.

This booklet highlights a number of areas of achievement.

## RAIL RADAR SYSTEMS AND TECHNOLOGY—THE BROAD PICTURE

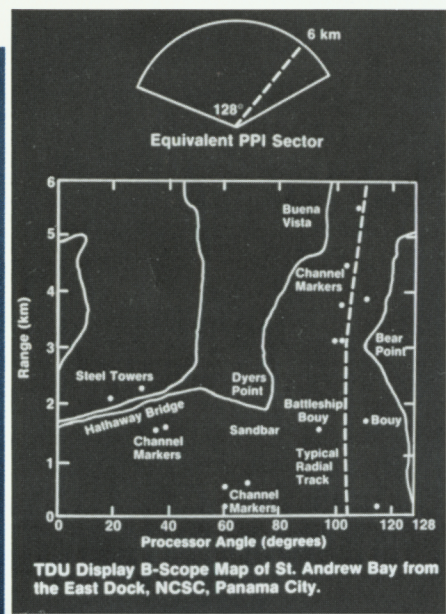
Ground-based, portable, airborne, and shipborne radar systems for government and industry are the focal points of research performed by the Radar and Instrumentation Laboratory. A staff of professionals located on the Georgia Tech campus and the nearby Cobb County Research Facility is actively involved in the study, analysis, design and development, and evaluation of multi-purpose radar systems.

For many years Georgia Tech operated a permanent radar field site at Boca Raton, Florida, for the U.S. Navy. In recent years, mobile and semipermanent sites have been used more extensively. Field operations have been conducted at St. Croix, Virgin Islands; Molokai, Hawaii; and Graffenwohr, Germany.





# Surveillance and Tracking Radar



RAIL is conducting a variety of research programs to develop tracking radar systems for surveillance purposes.

Minicomputers and microprocessors are used extensively to control the functions of the radar systems and to process the radar data in a track-while-scan mode, continuously detecting, tracking, and displaying moving targets.

## WATERBORNE INTRUSION DETECTION

Development of a low-cost microwave sensor system for automatic detection of surfaced water-borne intruders is underway in RAIL with U.S. Navy and Air Force sponsorship. The Waterborne Intruder Detection Segment (WIDS) system is designed to protect a naval facility from intruders under a wide range of weather conditions. Targets are detected on the basis of size, speed, and direction of travel.

The system must be able to keep an eye on slow and fast moving targets and cover a broad horizon. The WIDS system combines selected radar techniques with modern digital processing to handle these and other criteria with relative ease and little expense.

Cost was an overriding design factor. From the basic system concept, a cost-effective signal processor evolved—the Target Detection Unit (TDU). The TDU radar automatically detects, tracks, and analyzes targets of interest such as small boats and rubber rafts.



## ANTI-ARMOR SURVEILLANCE

In the spring of 1978, ASTAR (Anti-armor Surveillance and Target Acquisition Radar), a RAIL battlefield surveillance system, was used in the seventh Human Engineering Laboratory Battlefield Artillery Tests (HELBAT-7) conducted at Fort Sill, Oklahoma. The ASTAR system, mounted on a truck or on the ground, surveys the area and provides an instant map of the battlefield scenario. The U.S. Army ERADCOM, Fort Monmouth, New Jersey, sponsored the project.

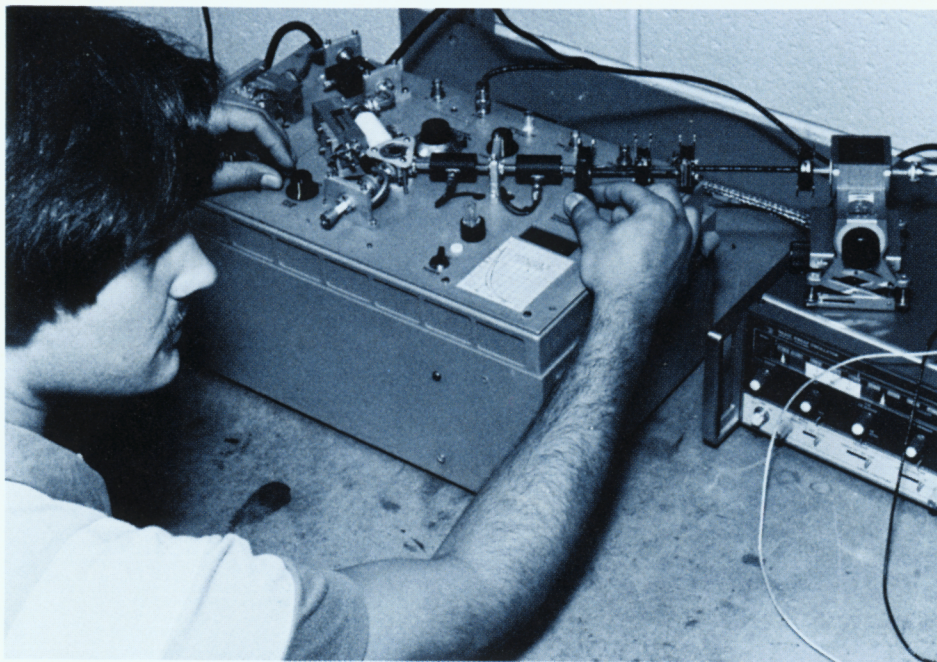
## RADAR NETTING

Individual radar systems can be linked together to form a computerized radar net capable of protecting strategic missiles deployed at sites dispersed over hundreds of miles. The LARIAT (Long Range Area Radar for Intrusion Detection and Tracking) system was developed to demonstrate the capability of a semi-automatic surveillance system that detects and tracks ground targets and alerts the operator when threat conditions are present.

Ground targets, such as a walking man, a man riding a horse or a motorcycle, vehicles, and low flying aircraft are automatically interrogated and tracked. The system includes IFF (Identity Friend or Foe) capabilities to distinguish between intruders and security personnel. All radar information and recent track histories are presented to the operator in a situation map format on the computer graphics display system.



# Millimeter Wave Technology and Applications



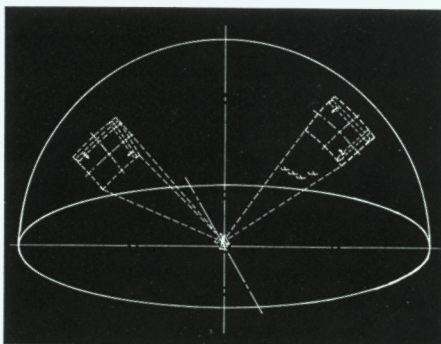
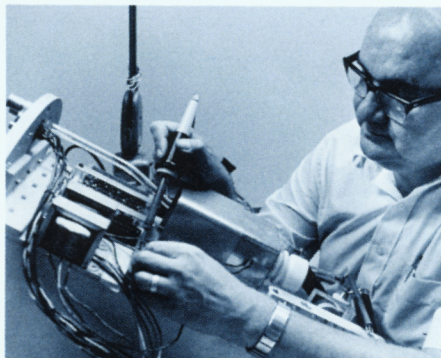
Advances in millimeter wave technology in recent years have been rapid. The maturing technology has spawned innovative concepts for advanced radar systems. RAIL has acquired an international reputation for the design and development of radar systems operating at millimeter wavelengths.

RAIL personnel are particularly well-known for their contributions to research in the millimeter spectrum. Millimeter wave instrumentation radar systems, as well as high power millimeter transmitters, and multifrequency millimeter wave antennas have been developed to enhance the quality of research. These systems are essential for investigating the reflectivity characteristics of targets and clutter at millimeter wave frequencies and for improving the technology base needed to develop operational systems. (Studies of signal processing and target enhancement/identification are in progress as well as hybrid radar/laser system evaluation.)

## MILLIMETER WAVE RESEARCH

Much of RAIL's millimeter wave research exploits the 35 and 95 Gigahertz frequency ranges. Currently a 35 GHz solid-state instrumentation radar is being readied for a flight test program in support of the Wide Area Antiarmor Munitions (WAAM) program. RAIL developed a tower-mounted model used at Griffis Air Force Base in Verona, New York, to study snow backscatter characteristics. The system has been modified for use in an airborne configuration. Signature data of ground clutter and military targets will be taken on flights in the U.S. and in Germany.

In the 95 GHz range, a monopulse instrumentation radar is being constructed for an inflight tracking experiment. Tracking performance is being studied closely. Backup information on tracking error will be provided by an optical tracker incorporated in the system.





## RADAR TRANSMITTERS

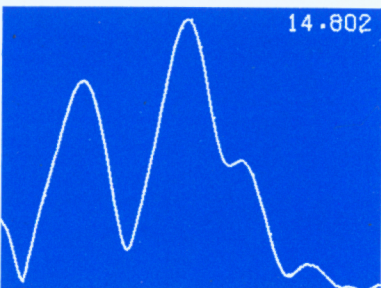
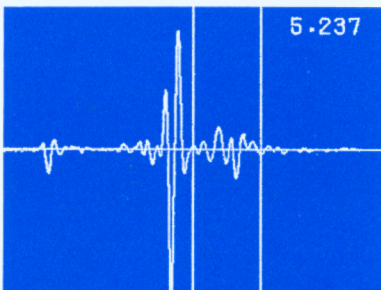
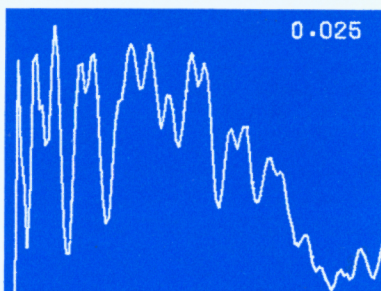
High power transmitter development for the primary radar frequencies includes extensive efforts at the 95 GHz and at even higher 140 and 220 GHz frequencies. RAIL-developed modulator techniques for extended interaction oscillator (EIO), magnetron, and solid-state millimeter wave transmitters are currently being included in several operational radar systems. These high powered transmitters will be used in traditional radar configurations as well as in bistatic and coherent designs.

The RAIL staff recently presented a short course and published a book on high power modulator and transmitter technology.

## REMOTE BATTLEFIELD SURVEILLANCE

Other system studies are underway in support of several millimeter development programs such as Assault Breaker, the Army strategy to halt an armored attack by adversary forces. Remote vehicles will carry 95 GHz radar systems overland to gather battlefield data. RAIL is involved in the study of the radar sensor properties for such platforms.

Standard Elektrik Lorenz (SEL), A.G., the German ITT subsidiary, approached Georgia Tech for assistance with product-related millimeter wave research. SEL is building the technology necessary for production of a drone incorporating a millimeter wave radar system. The company enlisted RAIL's help in determining millimeter wave characteristics of typical targets and clutter utilizing a RAIL-designed instrumentation radar. SEL is drawing on the laboratory's expertise for a complete study of the optimum system. Progress continues as the program moves from the experimental to the developmental stage.





# Target Discrimination and Classification

Utilizing advanced system design and analysis, RAIL researchers have developed radar techniques capable of detecting and classifying stationary and moving targets.

Stationary, tactical target signatures are being studied to identify characteristics that can be exploited for target identification. Classification efforts focus on statistical pattern recognition methods, drawing from various techniques based on radar returns.

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## TRACKING RADAR SCAN INTERROGATOR

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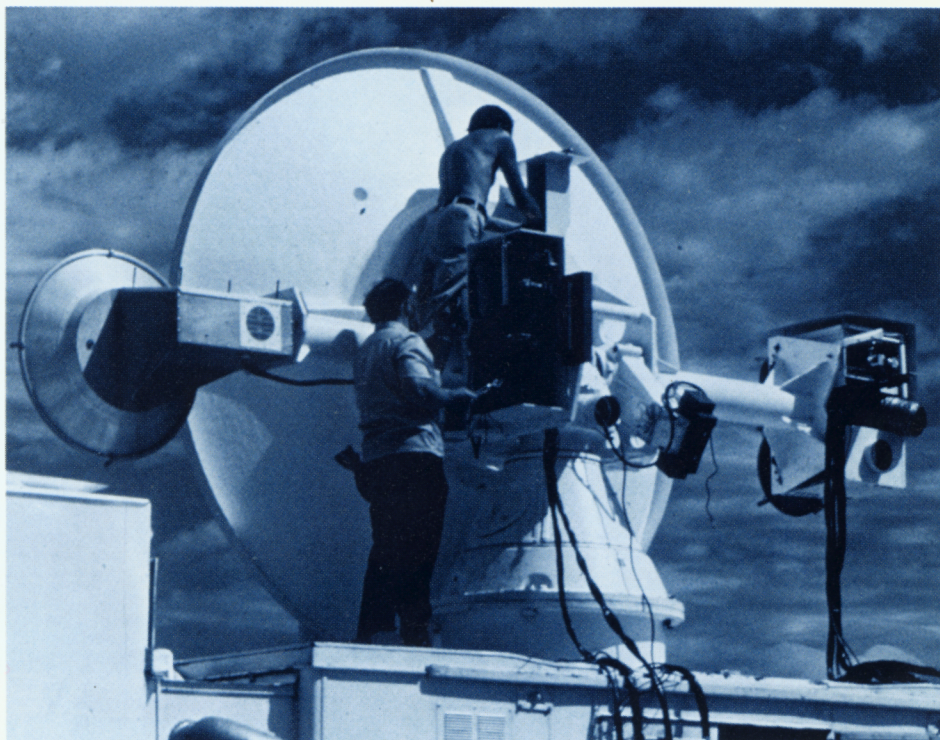
The feasibility of using a radar target identification technique for electronic countermeasure applications was demonstrated for the U.S. Air Force. The Tracking Radar Scan Interrogator Technique (TRASIT) was developed to detect and identify Surface-to-Air Missile (SAM) system radars by identifying the radar scanning patterns. TRASIT is effective even when the target radar is operated in the scan-on-receive-only mode and also provides information to a deceptive jamming system.

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## TWO-CHANNEL SYSTEMS

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Polarization discrimination techniques using two receiver channels are under development for both U.S. Army and Air Force radar systems. The detection system developed gathers a larger amount of target information than traditional one-channel systems and can remain operative in one channel when the alternate is jammed. EES programs include analysis of the polarization characteristics of moving and stationary targets, and radar echoes from a number of typical tactical targets—buildings, guns, trucks, tanks, and jeeps—and typical ground clutter areas—deciduous and coniferous forests, grassy hillsides, rocky terrain, and the ocean surface. Data were also analyzed to determine the dependability of the polarization diversity radar in distinguishing typical man-made targets or classes of targets from terrain, with changes in target aspects, seasons, and other parameters and for target classification.



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## MINE/VOID DETECTION

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Buried, non-metallic mine detection techniques are being investigated for the U.S. Army. Spectral and temporal data for mines and false targets are collected which incorporate soil characteristics and target depths. Data are then analyzed to identify unique features of target signatures. Finally, computer algorithms for the detection, discrimination, and classification of targets are evaluated and refined for future use.

As a result of the work RAIL has done in the area of identifying land mines using radar, the laboratory has become involved in programs to find new ways to detect highway voids. Sponsors of this research effort are the Georgia Department of Transportation and the Transportation Research Board under the National Cooperative Highway Research Program. Signal processing techniques are used to locate and quantify air voids under concrete highway slabs using a high-resolution, L-band radar.

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## TARGET BACKSCATTER

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Backscatter characteristics of radar targets have been extensively studied. Radar measurement and analysis programs are continuously pursued by RAIL

staff to provide input data for design of all types of radar sensor systems. Statistical and frequency spectra analyses of the data are made to determine the target backscatter properties and reradiation characteristics. Helicopter backscatter characteristics have also been investigated including modulation imposed by helicopter rotor blades.

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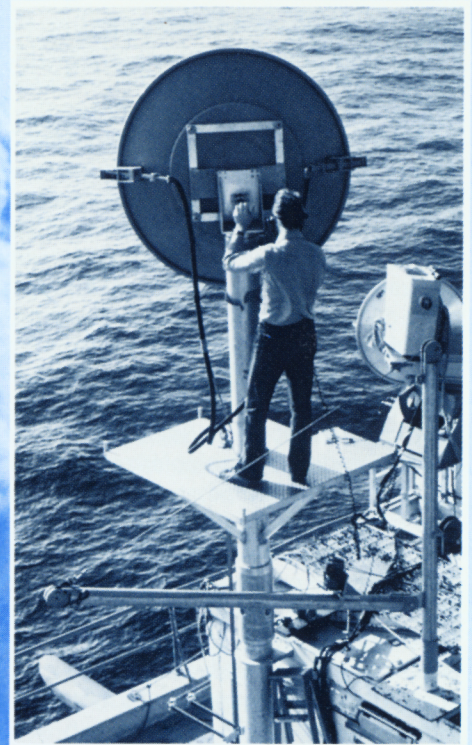
## MATCALS

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Radar systems play a vital role in securing remote areas. RAIL researchers are helping define the capabilities of several types of radar units involved in the Marine Air Traffic Control and Automatic Landing Systems (MATCALS) which are used to control air traffic at expeditionary air bases. The system incorporates two types of radar: the Air Traffic Control radar (ATC) featuring the ATC Beacon, a transmitter requesting aircraft identification and altitude, and the Precision Approach Radar (PAR), handling automatic, hands-off aircraft landings. RAIL personnel are analyzing radar and beacon requirements of the system which is being tested at the Patuxent River Naval Air Station in Maryland. A variety of data is being taken including tracking error, auto gain control levels, and radar video amplitude signals.



# Reflectivity Measurements and Analysis



The land, sea, snow, rain, dust and debris, military ground vehicles, and aircraft are all subjects under study for radar reflectivity characteristics by RAIL personnel.

Natural and military targets are characterized at microwave and millimeter wavelengths according to coherent properties, interpulse frequency agility, interpulse polarization agility, intrapulse frequency agility (chirp), intrapulse polarization agility (IPAR), dual polarization, and polarimetric phase processing.

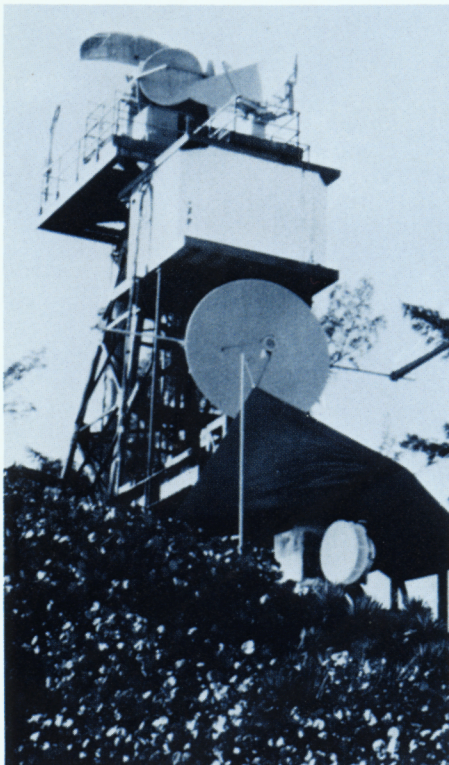
Amplitude characteristics, frequency spectra, and correlation functions generated from actual target and clutter data calibrated by receiver operating curves are included in data analyses.

Recent measurement programs have included millimeter sea backscatter measurements at 10, 16, 35, and 95 GHz, measurement of military vehicle polarimetric signatures at 35 and 95 GHz, snow backscatter measurements at 35 GHz, measurement of the radar cross section of power lines at 10 and 16 GHz, and characterization of jet engine modulation at 1.6 GHz. Facilities exist at EES for target and clutter reflectivity measurements at all of the standard radar frequencies.



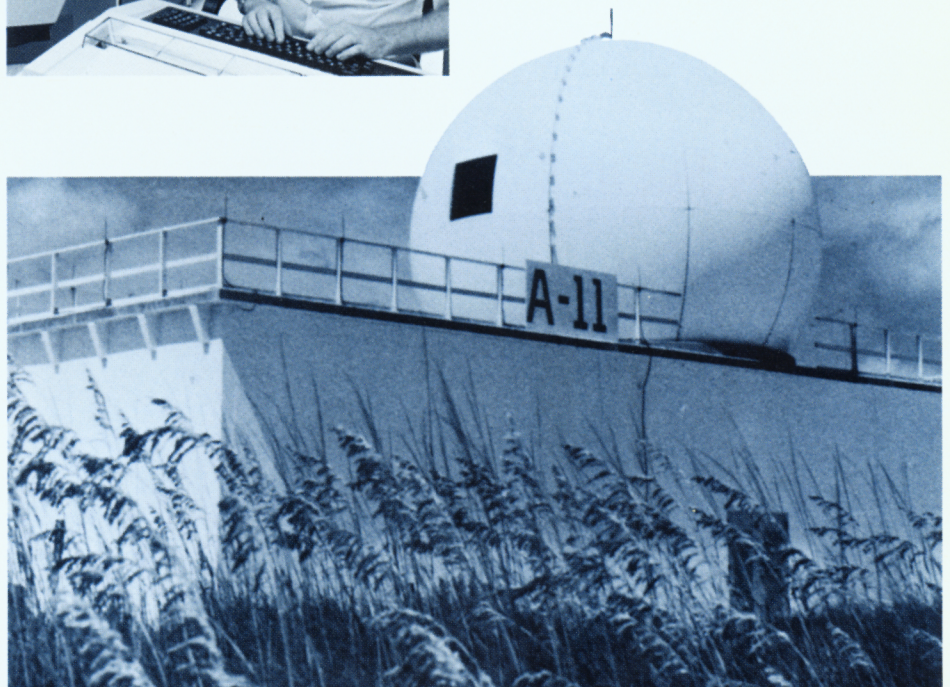
# Signal Processing Capabilities of RAIL

Radar signal processing activities at RAIL range from theoretical studies to hardware implementation. Some of these studies include the development of target discrimination and classification algorithms, tracking radar optimization studies, application of the chirp z-transform to MTI processors, and use of the Maximum Entropy Method (MEM) of analysis to form a discriminant for a mine detection radar. Signal processing techniques which have been implemented into hardware systems include Fourier analysis via the FFT, correlation analysis, polarimetric processing (including pulse-to-pulse and intrapulse polarization agility), and pulse compression. RAIL has also been active in the development of intrusion detection radar systems for the base defense or battlefield surveillance mission. In this role, MTI techniques and CFAR methods must be employed for clutter rejection, and track-while-scan algorithms are employed to monitor the targets' positions.



## MAJOR SOFTWARE SUPPORT RESOURCES

Electronic Equipment Cost Prediction  
Radar Performance Prediction  
Target Characterization  
(UHF-Near Millimeter)  
Clutter Models (UHF-Near Millimeter)  
Propagation (HF-Millimeter)  
Radar Cross Section Prediction  
Radar Cross Section Reduction  
Target Classification  
ECM/ECCM  
Missile and Radar Simulation  
Data Analysis



## COMPUTER FACILITIES

Laboratory programs in target classification, system simulation, design and analysis, data reduction, and modeling are supported by several major computer systems dedicated to Laboratory research in addition to the Institute's CYBER 70/74.

Digital Equipment Corporation (DEC) VAX-11/780;  
PDP-11/40; PDP-8  
Systems Engineering Laboratory (SEL) 32/55  
Interdata 8/32  
Data General (DG) Eclipse S130; Nova/2



# Modeling and Simulation Technology

RAIL contributes substantially on a continuing basis to the investigation of electromagnetic propagation phenomena. Expert pooled resources incorporating a thorough knowledge of propagation theory and a broad experimental background have facilitated the development of computer models of interest to all stages of radar system design and evaluation.

Detailed models are available within the laboratory for predicting target and clutter reflectivity characteristics. Models for simulating ground propagation at HF and VHF frequencies have been developed. Curved earth effects, specular and diffuse multipath, and anomalous propagation effects are included in the models.

Radar performance models developed by RAIL are used extensively in radar system analyses. Models that predict the radar return from both the target and clutter were developed for estimating the probability of detecting a target by a search radar. Other models were developed to simulate the radar signal processor and display units.

Similar models for tracking radars were developed to simulate tracking errors from sources such as signal-to-noise ratio effects, surface and volume clutter, multipath, scintillation, glint, and servo system lag.

## CLOSED LOOP MISSILE SIMULATOR

A very complex closed loop missile simulation system was designed, fabricated, delivered, and recently checked out at Eglin Air Force Base. The four-year project required engineers with expertise in missile flight dynamics, simulation hardware/software design, electromagnetic propagation phenomena, microwave component design, real-time simulation design, seeker system characterization and several other areas, including advanced computer technology.

## ADVANCED AIRBORNE RADAR

Performance and cost-benefit analyses are being conducted on several new radar system configurations designed to improve the AN/APS-94F of the OV-1B (Mohawk) surveillance system. RAIL has joined forces with the U.S. Army Special Electronic Mission Aircraft (SEMA) Program, U.S. Army Electronics Research and Development Command, and the Radar Division of the Fort Monmouth Combat Surveillance and Target Acquisition Laboratory to improve and modify the existing system. The Mohawk currently operates a fixed, side looking airborne radar (SLAR) which will be modified to scan electronically, cutting down considerably on flying time and speeding up information returns.

## ENVIRONMENT AND RADAR OPERATION SIMULATOR (EROS)

Under contract to the Army Electronics Command, EES applied computer, radar, and simulation technologies for development of an Environment and Radar Operation Simulator (EROS) to be used for environmental and operational radar tests. EROS is a hybrid system that combines a general purpose computer, special purpose digital hardware and analog hardware to produce synthetic backscatter. The simulator is electrically connected to a subject radar, and the synthetic backscatter constitutes a simulation of the radar's external world. EROS reduces the cost of environment testing for battlefield surveillance radars by improving the repeatability and control of tests and by replacing much of the field testing with laboratory testing. Battlefield clutter is synthesized by an array of digital filters that allow user selection of amplitude distributions, spatial distributions, and spectra. The targets are simulated by combining recorded backscatter with user-defined maneuvers. EROS interacts with the subject radar by sensing its antenna scan angle and by responding in real-time with the correct composite backscatter at video frequency.





# Radar Cross Section Reduction

Problem areas are located and detectability is reduced by a variety of techniques such as replacement of flat surfaces by curved surfaces, deployment of screens, or application of radar absorbent materials.

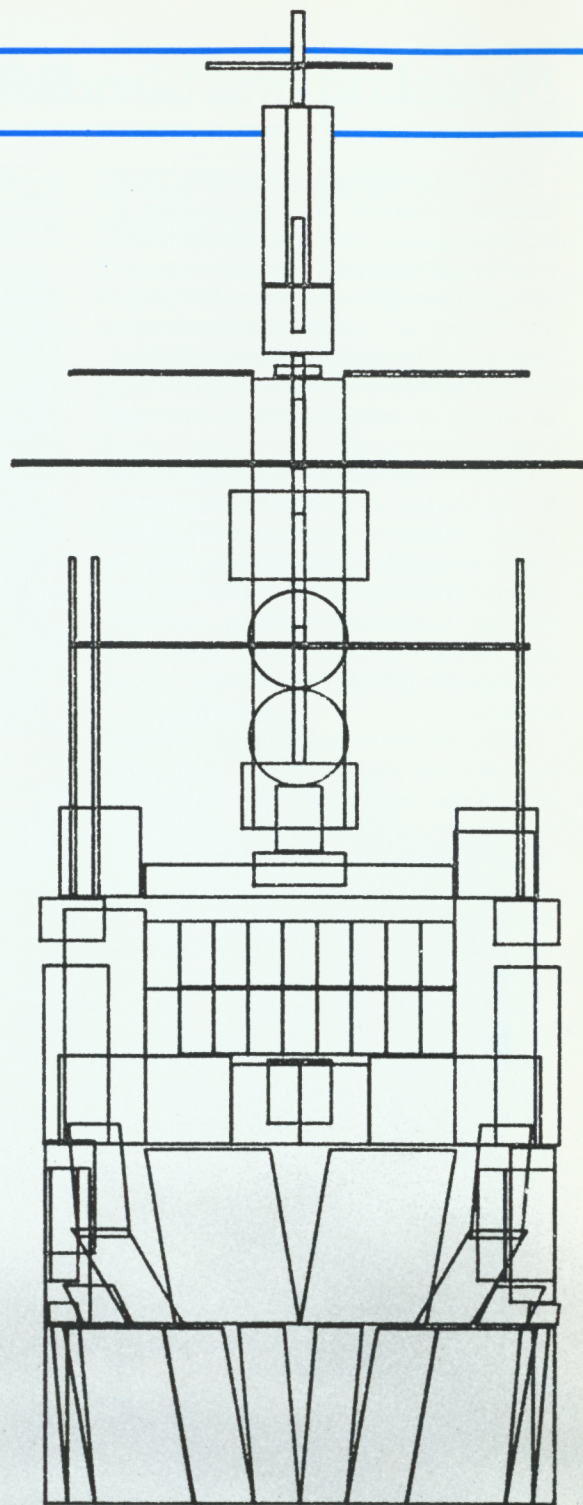
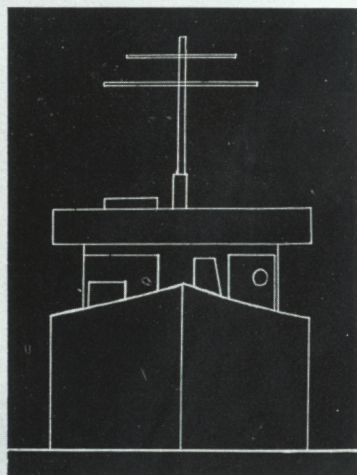
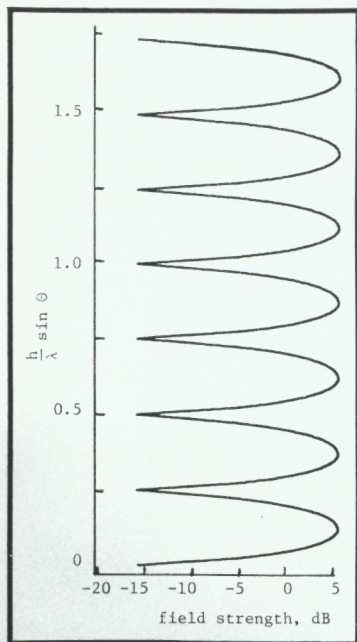
In conjunction with the RCS models, other models are used to research RCS reduction techniques. Computer programs have been developed to model the reflectivity of multi-layered flat plates and cylinders, allowing numerous combinations to be investigated at a low cost.

Expensive prototype, low RCS radome construction is reserved for the most promising configurations. A multi-layer radome recently developed and tested for Sperry Systems Management provides a very low RCS at design frequencies, while passing the operating frequency with little loss.

In the last few years, increasingly sophisticated hostile detection systems have developed, threatening to reduce the effectiveness of U.S. military systems. Attention is now being given to methods of increasing the survival of U.S. military equipment by reducing its detectability.

Major improvements in camouflaging U.S. surface ships at sea are possible when design techniques are coupled with current radar cross section modeling and analysis techniques.

Target computer models are used to calculate radar cross sections (RCS) of extended objects by approximating the actual shapes of the targets with a collection of simple, geometrically shaped scatterers. Physical optics techniques are then used to calculate a complex RCS for each scatterer; the results are then added together to provide total target RCS. (A computer drawing of the model for a cruiser is featured.)





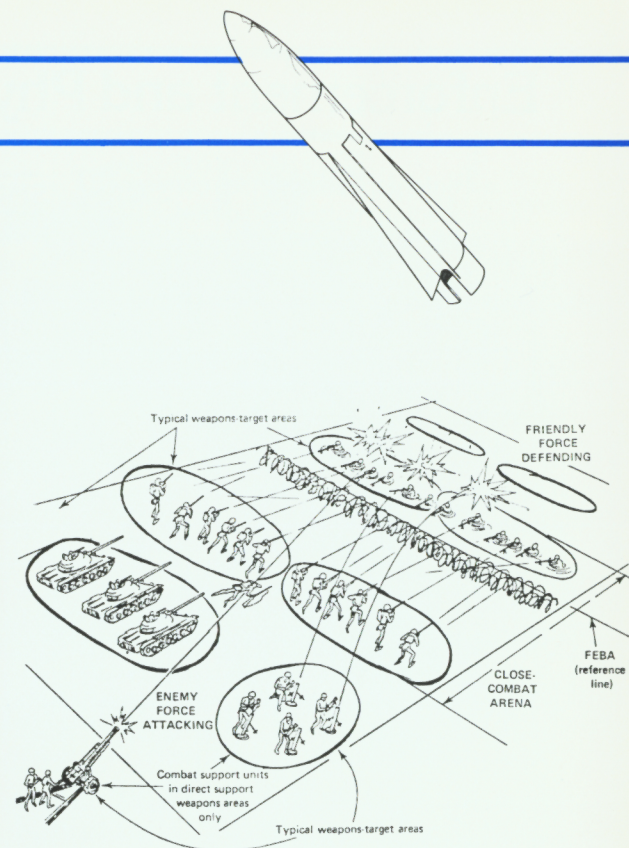
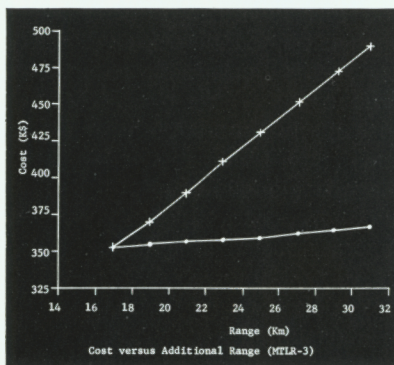
# Operations Research

In recent decades, national defense mechanisms have created the most sophisticated technological arena in the world. Improving the effectiveness of troops as new procedures or new equipment are integrated into the battlefield scenario is a central thrust of RAIL operations research. Focusing on two major aspects, performance and cost, RAIL personnel have formulated methods of assessing people-oriented activities with the mathematics of modeling, simulation and optimization. Techniques of human factors, man-machine interface, and training devices have been developed as well.

The bases of knowledge acquired by the RAIL staff for human performance measurement and analysis includes traditional operations research and industrial psychology, human factors engineering, and physiological systems. Recent programs involved training assessment systems and the development of instrumentation and devices for training. Special emphasis was placed on the development of battlefield simulation devices, posture and position sensors for soldiers in the field, and systems that automatically track players and equipment in instrumented battlefield games.

RAIL has conducted several equipment cost studies which included the costs of research, development, and production of radars, airborne sensors, communication links, command operation centers, and other major components. Life-cycle costs which comprise the operations, maintenance, and personnel expenses have also been studied. Other efforts have included cost estimation and analysis of software development, displays and decision support systems, and special interface devices.

Operational effectiveness addresses the nature of organizational effectiveness as well as the technology used to support the organization. RAIL has pursued several effectiveness research areas including: information systems which monitor system performance; decision support systems to enhance system performance; and system simulations to acquaint potential decision-makers with system performance.





# Enforcement and Physical Security Surveillance Systems

Law enforcement agencies concerned with speeding motorists, border and remote coastal area patrols tracking smuggling operations, engineers responsible for maximum security at nuclear power sites—all have enlisted RAIL's expertise in current radar surveillance techniques. Surveillance techniques that integrate information from the Federal Aviation Administration, North American Air Defense Command, Airborne Warning and Control System, and other sources are being developed to solve enforcement and physical security problems.

## RADAR SPEED TIMING

A radar system is only as good as its operator. As a result of the recent studies in Georgia, RAIL is preparing a video tape for the Department of Transportation that will insure more effective use of highway safety speed timing radar in the U.S. Preliminary studies were conducted using equipment commonly used throughout the state to detect speeding motorists. Researchers observed a large margin for error due to vehicle monitoring practices. Such errors will be reduced via specialized video training courses that will be available to law enforcement officers on a nationwide basis.

## SMUGGLER DETECTION

Working under contract to the U.S. Customs Service, RAIL personnel developed the methodology to allow customs officials to test proposed radar systems against possible threats without actually deploying the systems in the field. The modeling approach, optimizing cost versus performance functions, allows radars to be placed in optimum locations after considering numerous planning variables such as possible smuggler flight paths, interceptor airfield locations, interceptor performance against a postulated threat, and radar operational considerations.

## NUCLEAR SITE PROTECTION

At the Savannah River Nuclear Plant near Augusta, Georgia, RAIL researchers conducted air surveys to determine where to locate sensor systems to detect and track air traffic approaching sensitive areas of the plant. Hostile forces might attempt a mission using any one of a number of methods. Various threat scenarios studied for the Department of Energy included attacks of terrorists using helicopters, parachutes, hang gliders, light aircraft, and other airborne assault modes.





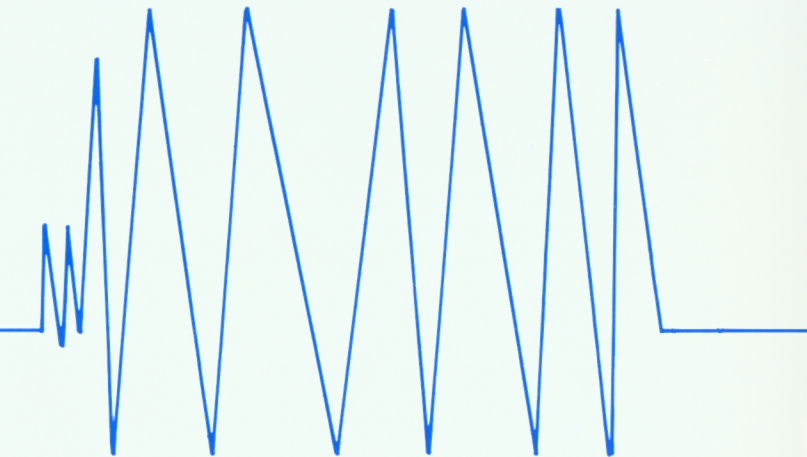
# Major RAIL Facilities

RAIL has developed a number of instrumentation radar systems for use in various experimental tasks, including collecting basic radar reflectivity data, simulating radar systems, and evaluating new radar techniques. The systems cover most radar bands from 1 GHz to 95 GHz, are designed to allow maximum flexibility of configurations, and are instrumented to permit accurate measurements to be made.

RAIL researchers have complete use of two elevated outdoor antenna ranges with multiple transmitting sites at various distances, a compact reflectivity range, and a millimeter test laboratory with facilities for measuring power, sensitivity, and spectrum at frequencies of 35 GHz to 220 GHz. Laboratory facilities for high power transmitter development include high voltage power supplies, high voltage/current probes, and test equipment. RAIL also maintains model shop facilities for sheet metal work and has access to the EES machine shop with full metal working capabilities.

## RADAR MEASUREMENT CAPABILITIES

| Frequency | Capability   |
|-----------|--|
| UHF       | RF sources (+10 dBm), Log Receiver   |
| L-Band    | 1 kW Power; Coherent; Vertical or Horizontal Polarization; Log or Linear Receiver  |
| S-Band    | High-Power (2MW); Scanned; Non-Scanned; 0.7-2 $\mu$ s Pulse Length; Horizontal Polarization                                  |
| C-Band    | High-Power (250kW); Scanned; Log or Linear Receiver  |
| X-Band    | Frequency Agile, Polarization Agile, Dual-Polarized, Coherent, Short Pulse (10 ns); Polarimetric Phase; Scanned; Non-Scanned |
| Ku-Band   | Frequency Agile; Dual Polarized; Polarimetric Phase; High-Power (40 kW)  |
| Ka-Band   | Frequency Agile; Polarization Agile; Chirp; Short (variable) Pulse (10 ns); Coherent; Polarimetric Phase; High-Power (20 kW) |
| 70-GHz    | Rapid Scanned (70 rps); Short Pulse (10 ns); Incoherent MTI; Log Receiver  |
| 95-GHz    | Short Pulse (10 ns); Dual Polarized; Polarization Agile; Polarimetric Phase; Chirp; EIO, Magnetron, Solid State              |



## CONTINUING EDUCATION

### RAIL short courses:

**Reflectivity of Land and Sea**

**High Power Microwave Radar Transmitters**

**Principles of Modern Radar**

**Techniques of Radar Reflectivity Measurement**

**Modeling and Simulation of Land Combat**

Registration information may be obtained from the Department of Continuing Education, Georgia Institute of Technology, Atlanta, Georgia 30332. (404) 894-2400.

## SUMMARY

The Radar and Instrumentation Laboratory is an applied research organization. Over 150 staff members specialize in solving problems associated with radar technology and applications, and general instrumentation technology. The Laboratory has a national and international reputation in these areas of specialty. Laboratory research contributions are disseminated through formal technical reports, an annual average of more than 35 reviewed papers and presentations, coordination and presentation of five continuing education short courses, attended by representatives of government and industry from all over the nation, and the publication of, or major contributions to, four books in the general area of radar technology.



