OUTLINE

Introduction
Radar fundamentals—Physics governing active microwave remote sensing
Synthetic aperture radar principles—Utilization of platform motion to increase effective antenna aperture for purposes of increased image resolution
Requirements Analysis
Trade of system parameters to achieve desired resolution and image quality (wavelength, polarization, look angle, antenna size, pulse width, pulse shape, pulse bandwidth, pulse repetition frequency, look averaging)
Equipment Specification
Configuration and selection of system components at a functional level (i.e., transmitter, antenna, receiver, timing system, data demodulation, image processing and display)
Processing Algorithm Formulation
Derivation of image processing algorithms for constructing high-resolution images—signal modeling, pulse compression, aperture shading, doppler ambiguity, azimuth processing, range migration, geometric corrections, radiometric corrections
Performance Prediction
Assessment of expected image quality in the presence of instrumentation errors, noise, algorithm approximations, and system-induced artifacts
Product Management
Establishment of documentation procedures to maintain traceability of the image product
Remote Sensing Applications
Overview of the utility of high-resolution radar images in the field of remote sensing, with emphasis on information extraction developed for final-use objectives

INSTRUCTORS

Samuel W. McCandless, Jr., is a private consultant to government and industry, providing remote sensor and satellite system design and application services. He is a specialist on related data reduction and information extraction and analyses, with emphasis on user needs. Formerly, Mr. McCandless was manager for NASA's SEASAT program, which placed the first SAR with other active and passive microwave sensors in orbit.

Stephen A. Mango, Ph.D., is a Research Physicist with the Naval Research Laboratory in Washington, D.C. He has been engaged in postdoctoral studies in the field of radio astronomy and has conducted projects devoted to analyses of solar physics and related electromagnetic phenomena. He has been associated with the application of remote sensing technologies for the last several years, with special emphasis on synthetic aperture radar and signal processing of radar data.

FEE

The fee for this course is $855.

Course No. 701DC

ELECTROMAGNETIC PULSE AND ITS EFFECTS ON SYSTEMS

November 22-24, 1982

OBJECTIVE

The objective of this course is to provide understanding of the unique form of electromagnetic transient signal called EMP and to introduce techniques most commonly used to increase system survivability. Presentations include examples of system vulnerability assessments and solutions to vulnerability problems.

WHO SHOULD ATTEND

Engineers, technical managers, and others who need working knowledge of electromagnetic pulse phenomenology, coupling, system vulnerability, and protection techniques.

DESCRIPTION

The proliferation of lower power semiconductor technology has created the need for enhanced survivability of electronic equipment with respect to transient electromagnetic signals. Since survivability is essential to mission-critical equipment in both the military and civil environments, it is crucial that system vulnerability and survivability technology be understood and applied at each level of the design and product process. Of particular concern is the electromagnetic pulse (EMP) and its effects on systems.

PREREQUISITE

There is no prerequisite for this course; however, a degree in engineering or science, or equivalent experience would be helpful. An extensive background in mathematics is not required to understand the principles and practices covered, as the instructor will emphasize basic concepts by demonstration.

OUTLINE

Introduction
The generation of EMP
Coupling to systems
Damage to component parts
The Origin and Nature of EMP
High-altitude EMP (HEMP)
Low-altitude EMP (LEMP)
System-generated EMP (SGEMP)
A Review of Electromagnetic Theory
Wave theory
Method of images
Transmission Line Theory
EM Coupling Theory as Applied to Systems Topologies
Examples of coupling to both fixed and mobile systems
Deliberate and nondeliberate antenna characterization
Approaches to System Vulnerability Assessment
System and critical circuit identification
Component damage testing
Circuit analysis test
EMP Simulation Tests
System-level test—bounded and radiated wave simulators: CW
Circuit/component test—cable drivers
Typical facilities
Approaches to System Survivability Enhancement
Techniques for existing equipment
Techniques for equipment being designed
Application to a Fixed System
Application to a Mobile System

INSTRUCTOR

Robert A. Pfeffer is Chief, Electromagnetic Effects Lab, Harry Diamond Laboratories. He has over 15 years of experience in assessing and protecting complex systems from effects of nuclear weapons. Over the years, he has directed and participated in numerous EMP analyses and test programs for both the United States and foreign governments. He has had a number of papers and reports published, presented papers at technical meetings, and served on committees on the subject of system survivability to nuclear weapons effects.

FEE

The fee for this course is $685.

OUTLINE

Overview of Mapping from Space
- Development and application of Landsat to mapping Earth

The Surveying and Control Problem
- Ellipsoid, grid, and map projections
- Ground control establishment using space systems
- Mapping without ground control
  - Positional determination of satellite
  - Attitude determination and control
  - Spacecraft stability
- Use of ground control in mapping

Shallow-Sea Mapping
- Space imagery applied to hydrographic surveys and nautical charting
- Positional and depth determination
- Use of imagery as a shallow-sea chart base

Digital Merging of Image and Cartographic Data
- Problems associated with the combination of conventional line map data with digital image data

Analog Mosaicking of Landsat Images
- Description of the film mosaic technique
- Hands on construction of a mosaic
- Multiband problems and solutions

Digital Landsat Mapping
- Derivation and use of ground control
- Digital correlation of control points to image
- Digital mosaicking
- Color treatment

Future Mapping Systems
- New sensor developments
- Evaluation of the stereo mode
- Automation of the mapping process

Review and Discussion

INSTRUCTORS

Alden Colvocoresses (course coordinator), research cartographer for the U.S. Geological Survey. Principal investigator for the cartographic applications of Landsat and Skylab space flights.

William Chapman, Chief of the Field Instrumentation Section, National Mapping Division, U.S. Geological Survey. Specialist in new surveying techniques involving aircraft and spacecraft.

James Hammack, physical scientist for the U.S. Defense Mapping Agency, Hydrographic and Topographic Center. Specialist in the investigation and application of space imagery to shallow-sea mapping, hydrographic surveys, and nautical charting.

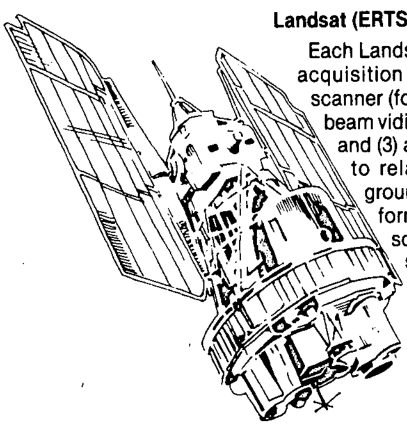
Robert McEwen, Chief of the Office of Cartographic Research, National Mapping Division, U.S. Geological Survey. Specialist in the digitization of cartographic data.

Alden Warren, research photographer for the U.S. Geological Survey. Specialist in the preparation of image maps and mosaics based on aircraft and space systems.

Albert Zobrist, member of the technical staff, Earth Resources Image Processing Laboratory, Jet Propulsion Laboratory. Specialist in the digital processing of Landsat-type data.

FEE

The fee for this course is $780.



Landsat (ERTS).
Each Landsat presently carries three data acquisition systems: (1) a multispectral scanner (four spectral bands), (2) a return beam vidicon (RBV) or television system, and (3) a data collection system (DCS) to relay environmental data from ground-based data collection platforms (DCPs). The multispectral scanner, or MSS, is the primary sensor system and acquires images of 115 miles (185 km) per side in four spectral bands in the visible and near-infrared portions of the electromagnetic spectrum.

Course No. 664DC

SYNTHETIC APERTURE RADAR WITH REMOTE SENSING APPLICATIONS

November 15-19, 1982

OBJECTIVES

The course is designed to enable participants to:

- Identify the fundamental concepts and physical aspects of synthetic aperture radar (SAR)
- Apply knowledge of SAR to the design of high-resolution sensor systems used in remote sensing applications
- Create information products to match user needs

WHO SHOULD ATTEND

This course is designed for radar system designers and users, engineers, physical scientists, systems analysts, image interpreters, and others who need an update on the latest SAR technology.

BACKGROUND

Obtaining high-resolution remotely sensed images normally requires antennas so large that it would be impractical to use them on aircraft or satellite systems. SAR provides an opportunity to substitute certain data processing functions for the physical size of the radar aperture or antenna. (One such function is the synthesis of the high-resolution image from the received radio signal.) Recent advances in technology have increased the mission flexibility of synthetic aperture radar. These advances are significant because the essential characteristics of both system hardware and data processing techniques are application-dependent.

DESCRIPTION

The course presents the principles of synthetic aperture radar, beginning with a brief review of radar fundamentals. It describes:

- how mission requirements are analyzed
- how equipment specifications are developed
- how high-resolution images are obtained
- how processing variability is used to discriminate and classify objects

Special emphasis is placed on processing algorithm formulation and performance prediction. Creation of procedures used in information product management is covered. Finally, a survey of remote sensing applications is presented, utilizing design examples that illustrate the mission versatility of SAR.

PREREQUISITE

Understanding of scientific mathematics (i.e., trigonometric functions, Fourier transforms, etc.) is desirable.

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