

## Foliage Penetration Radar Detection And Characterisation Of Objects Under Trees Electromagnetics And Radar

Penetration radars have been successful in detecting and locating many types of metallic targets under foliage, including flat plates, vehicles, reflectors, and pipes. The purpose of this study is two-fold: (1) define the radar operating parameters, especially frequency, that would maximise the chances of success for a penetration radar mounted on the CC-130 for detection of downed aircraft in search and rescue operations; and (2) investigate the feasibility of mounting a foliage penetration radar on the CC-130 RMAAS. The study concludes that the penetration radar can be operated from the CC-130 RMAAS pallet and associated pod using a frequency range which will be effective in detecting concealed sections of downed aircraft. The minimum size of detected metal parts will depend mostly on the background clutter in the radar image. In many scenes this will most likely be due not to snow or forest properties, but to surface rockfall in the area which itself has also been covered by foliage or snow. Pieces of metal two or more meters across will be readily detectable from a wide range of illumination angles. Snow cover is not an impediment to radar detection in this frequency range, or indeed for any frequencies, even beyond L-Band.

In 1995, James D. Taylor's Introduction to Ultra-Wideband Radar Systems introduced engineers to the theory behind a promising new concept for remote sensing. Since then, the field has undergone enormous growth with new applications realized and more applications conceptualized at a remarkable pace. However, understanding ultra-wideband (UWB) radar requires a new philosophical approach. Concepts such as radar cross section will have new meanings as range resolution becomes smaller than the target. Ultra-Wideband Radar Technology is a guide to the future of radar by an international team of experts. They present the problems, solutions, and examples of UWB radar remote sensing. Chapters discuss the theory and ideas for future systems development, and show the potential capabilities. The writers present concepts such as the differences between UWB and conventional radars, improving over-resolved target detection, receivers and waveforms, micropower systems, high power switching, and bistatic radar polarimetry. Finding comparable information elsewhere might require consulting hundreds of other books, technical journals, and symposium proceedings. Ultra-Wideband Radar Technology offers a unique opportunity to explore the theory, applications, and technology of UWB radar within a single source.

This book describes the key elements of the subject of surface penetrating radar, and in general terms the inter-relationship between those topics in electromagnetism, soil science, geophysics and signal processing which form part of its design.

This book covers all aspects of foliage penetration (FOPEN) radar, concentrating on both airborne military radar systems as well as earth resource mapping radars. It is the first concise and thorough treatment of FOPEN, covering the results of a decade-long investment by DARPA in characterizing foliage and earth surface with ultrawideband UHF and VHF synthetic aperture radar (SAR). Comparisons of the technologies for radar design and signal processing are presented, as are specific design approaches for transmitter design for operation in a dense radio frequency spectrum. Adaptive processing to remove the effects of radio and television signals from the system are also covered. In 10 years, FOPEN systems will find use in crop monitoring, land mine remediation, and creating digital maps under trees. This book will be the foundation for continued research for years to come both for radar and systems engineers in defense and earth resources companies. Government researchers, program managers and planners who have an interest in the unique capabilities of this radar technology, as well as university staff and faculty teaching radar and signal processing will find this book a critical part of their learning for years to come.

For centuries, criminologists have looked for scientific ways to study, understand, and ultimately prevent crime. In this volume, a unique offense, poaching, is explored in various contexts to determine what opportunity structures favor this crime and how situational crime prevention may reduce its prevalence. The data sources used range from publically available secondary data about animal populations, to interviews with hunters, to actual law enforcement data collected inside protected areas. Various methods are utilized to look for patterns in poaching behaviour regarding where poachers strike, which species they target and their modus operandi. Collectively, the volume shows that principles of criminal opportunity theory and situational crime prevention are useful for studying and preventing poaching in a variety of contexts. The methods employed by each chapter are easily replicated and meant to stimulate empirical poaching research where data is available. While the theoretical grounding of this volume is drawn from criminology, it is written for a broad audience of academics, practitioners and those interested in wildlife conservation.

Robots are used in industry, rescue missions, military operations, and subwater missions. Their use in hazardous environments is crucial in terms of occupational safety of workers and the health of rescue and military operations. This book presents several hazardous environment operations and safe operations of robots interacting with people in the context of occupational health and safety.

This series will appeal to radar practitioners within military or government. The first volume was written as a textbook for courses in radar systems and technology and the second volume is aimed at practicing radar engineers and graduate level students. The third volume is designed to serve as a self-contained reference for those aiming to become experts in an advanced technology or application area. POMR: Radar Applications Volume 3 includes concise descriptions of the purposes, principal issues and radar methods found in a wide variety of current radar types. POMR: Advanced Techniques Volume 2 is a professional reference for practicing engineers that provides a stepping stone to advanced practice. POMR: Basic Principles Volume 1 focuses on 4 key areas; basic concepts, radar signal phenomenology, major subsystems of modern radars and signal and data processing basics.

Simulation is integral to the successful design of modern radar systems, and there is arguably no better software for this purpose than MATLAB. But software and the ability to use it does not guarantee success. One must also: Understand radar operations and design philosophy Know how to select the radar parameters to meet the design req

This unique resource presents the principles of meter wave ground imaging radar focusing on foliage penetration. Scattering of VHF/UHF radar signals are presented including the basic laws of electromagnetism, homogeneous media, media discontinuities/non-flat media discontinuities, and ground reflectivity. The book introduces meter wavelength synthetic aperture radar, bandwidth, and SAR imaging principles, including moving objects and also compares collected SAR data. Meter wavelength SAR system design and processing is explored, highlighting low frequency SAR design

aspects, characterization of additive noise, antenna system basics, waveforms and emission adaptation which is critical material to the advancement in sensors and signal processing for below ground imaging by the energy industry and governments worldwide. The FFBP method of processing, explicit treatment of base 2 FFBP is explained along with motion errors sensitivity and motion estimation methods. The book also explains the Bayesian change detection, covariance moving target extraction and polarimetric subsurface imaging.

In two volumes, this book presents a detailed, systematic treatment of electromagnetics with application to the propagation of transient electromagnetic fields (including ultrawideband signals and ultrashort pulses) in dispersive attenuative media. The development in this expanded, updated, and reorganized new edition is mathematically rigorous, progressing from classical theory to the asymptotic description of pulsed wave fields in Debye and Lorentz model dielectrics, Drude model conductors, and composite model semiconductors. It will be of use to researchers as a resource on electromagnetic radiation and wave propagation theory with applications to ground and foliage penetrating radar, medical imaging, communications, and safety issues associated with ultrawideband pulsed fields. With meaningful exercises, and an authoritative selection of topics, it can also be used as a textbook to prepare graduate students for research. Volume 2 presents a detailed asymptotic description of plane wave pulse propagation in dielectric, conducting, and semiconducting materials as described by the classical Lorentz model of dielectric resonance, the Rocard-Powles-Debye model of orientational polarization, and the Drude model of metals. The rigorous description of the signal velocity of a pulse in a dispersive material is presented in connection with the question of superluminal pulse propagation. The second edition contains new material on the effects of spatial dispersion on precursor formation, and pulse transmission into a dispersive half space and into multilayered media. Volume 1 covers spectral representations in temporally dispersive media.

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The report describes the implementation, procedure, and results of the Multipurpose Foliage Penetration Radar (M-FOPEN) conducted by the 25th Infantry Division. Maximum ranges of detection were determined for the M-FOPEN operating in various types of terrain and foliage, and probability of detection calculated for each range, target, and foliage combination. These tests demonstrated the capability of the M-FOPEN to penetrate up to 700 meters of foliage and detect moving targets, with a negligible false alarm rate. A tactical exercise was conducted during which the M-FOPEN and the standard AN/ PPS-5 Ground Surveillance Radars were deployed and the detection performance and false alarm rates of each compared. Detection experiments were performed with the M-FOPEN using a helicopter (AH-1G) as the target to determine the doppler signature of the aircraft. These demonstrated that a unique doppler signature does exist for helicopters and the helicopters are detectable using the M-FOPEN even though the path between the radar and the aircraft is blocked by foliage.

Communications, Signal Processing, and Systems is a collection of contributions coming out of the International Conference on Communications, Signal Processing, and Systems (CSPS) held August 2012. This book provides the state-of-art developments of Communications, Signal Processing, and Systems, and their interactions in multidisciplinary fields, such as audio and acoustic signal processing. The book also examines Radar Systems, Chaos Systems, Visual Signal Processing and Communications and VLSI Systems and Applications. Written by experts and students in the fields of Communications, Signal Processing, and Systems.

Radar is a technology used in several facets of modern life, with many different civilian and military applications. Although radars have been around since 1904, much work is still spent today designing, building, testing, and implementing new radars and developing new and more powerful radar signal processing techniques. Radar signal processing is still a very active area of research. Nowadays, there has been substantial interest in noise radar over a wide range of applications, such as through wall surveillance, detection, tracking, Doppler estimation, polarimetry, interferometry, ground-penetrating or subsurface profiling, synthetic aperture radar (SAR) imaging, inverse synthetic aperture radar (ISAR) imaging, foliage penetration imaging, etc. One of the major advantages of the noise radar is its essential immunity from congestion, detection, and external interference. Signal Processing in Noise Waveform Radar brings together comprehensive studies dealing with the emerging technology of noise waveform radar and its signal processing aspects. It discusses the properties, difficulties and potential of noise radar systems, primarily for low-power and short-range civil applications. The contributions of modern signal processing techniques to making noise radar practical are emphasized, and application examples are given. This book covers a diversity of categories in radar signal processing, including radar optimization and system design valuable for both practicing engineers and engineering students. Foliage Penetration Radar Detection and Characterization of Objects Under Trees IET

Through courses internally taught at IDA, Dr. Roger Sullivan has devised a book that brings readers fully up to speed on the most essential quantitative aspects of general radar in order to introduce study of the most exciting and relevant applications to radar imaging and advanced concepts: Synthetic Aperture Radar (4 chapters), Space-time Adaptive Processing, moving target indication (MTI), bistatic radar, low probability of intercept (LPI) radar, weather radar, and ground-penetrating radar. Whether you're a radar novice or experienced professional, this is an essential reference that features the theory and practical application of formulas you use in radar design every day. With this book, you're taken step-by-step through the development of modern airborne microwave radar, up to the cutting edge of emergent technologies, including new results on theoretical 2D and 3D ISAR point-spread functions (PSF) and current discussions concerning dechirp/deskew SAR processing, layover in SAR images, vibrating

targets, foliage penetration, image quality parameters, and more. Plus, for students of electrical engineering, physics, and radar, this book provides the best source for basic airborne radar understanding, as well as a broad introduction to the field of radar imaging.

The report describes detection experiments performed with the Foliage Penetration (FOPEN) Radar operating at 140 MHz in which the target was a helicopter flying nap-of-the-earth (NOE). Preliminary experiments performed in Hawaii during the user evaluation of the FOPEN system demonstrated the ability of this radar to detect helicopters flying NOE using foliage and terrain for cover. A series of experiments at Aberdeen Proving Ground were made to establish the detection ranges through foliage for a single UH-1 helicopter. Additional measurements of the radar cross section of the UH-1 on the ground were taken using the LWL Airborne Foliage Penetration Radar, and are also reported. The report concludes with a theoretical analysis of the propagation losses affecting the detection of aircraft flying NOE by radars operating at frequencies of from 100 to 10,000 MHz.

The chapters in this volume were presented at the July 2005 NATO Advanced Study Institute on Advances in Sensing with Security Applications. The conference was held at the beautiful Il Ciocco resort near Lucca, in the glorious Tuscany region of northern Italy. Once again we gathered at this idyllic spot to explore and extend the reciprocity between mathematics and engineering. The dynamic interaction between world-renowned scientists from the usually disparate communities of pure mathematicians and applied scientists which occurred at our six previous ASI's continued at this meeting. The fusion of basic ideas in mathematics, biology, and chemistry with ongoing improvements in hardware and computation offers the promise of much more sophisticated and accurate sensing capabilities than currently exist. Coupled with the dramatic rise in the need for surveillance in innumerable aspects of our daily lives, brought about by hostile acts deemed unimaginable only a few short years ago, the time was right for scientists in the diverse areas of sensing and security to join together in a concerted effort to combat the new brands of terrorism. This ASI was one important initial step. To encompass the diverse nature of the subject and the varied backgrounds of the anticipated participants, the ASI was divided into three broadly defined but interrelated areas: the increasing need for fast and accurate sensing, the scientific underpinnings of the ongoing revolution in sensing, and specific sensing algorithms and techniques. The ASI brought together world leaders from academia, government, and industry, with extensive multidisciplinary background evidenced by their research and participation in numerous workshops and conferences.

Ultra-Wideband Surveillance Radar is an emerging technology for detecting and characterizing targets and cultural features for military and geosciences applications. To characterize objects near and under severe clutter, it is necessary to have fine range and cross range resolution. The resultant wide bandwidth classifies the systems as ultra-wideband, requiring special treatment in system technology and frequency allocation.

The chapters in this volume were presented at the July–August 2008 NATO Advanced Study Institute on Unexploded Ordnance Detection and Mitigation. The conference was held at the beautiful Il Ciocco resort near Lucca, in the glorious Tuscany region of northern Italy. For the ninth time we gathered at this idyllic spot to explore and extend the reciprocity between mathematics and engineering. The dynamic interaction between world-renowned scientists from the usually disparate communities of pure mathematicians and applied scientists which occurred at our eight previous ASI's continued at this meeting. The detection and neutralization of unexploded ordnance (UXO) has been of major concern for very many decades; at least since the First World War. UXO continues to be the subject of intensive research in many fields of science, including mathematics, signal processing (mainly radar and sonar) and chemistry. While today's headlines emphasize the mayhem resulting from the placement of improvised explosive devices (IEDs), humanitarian landmine clearing continues to draw significant global attention as well. In many countries of the world, landmines threaten the population and hinder reconstruction and fast, efficient utilization of large areas of the mined land in the aftermath of military conflicts.

In today's world, the range of technologies with the potential to threaten the security of U.S. military forces is extremely broad. These include developments in explosive materials, sensors, control systems, robotics, satellite systems, and computing power, to name just a few. Such technologies have not only enhanced the capabilities of U.S. military forces, but also offer enhanced offensive capabilities to potential adversaries - either directly through the development of more sophisticated weapons, or more indirectly through opportunities for interrupting the function of defensive U.S. military systems. Passive and active electro-optical (EO) sensing technologies are prime examples. Laser Radar considers the potential of active EO technologies to create surprise; i.e., systems that use a source of visible or infrared light to interrogate a target in combination with sensitive detectors and processors to analyze the returned light. The addition of an interrogating light source to the system adds rich new phenomenologies that enable new capabilities to be explored. This report evaluates the fundamental, physical limits to active EO sensor technologies with potential military utility; identifies key technologies that may help overcome the impediments within a 5-10 year timeframe; considers the pros and cons of implementing each existing or emerging technology; and evaluates the potential uses of active EO sensing technologies, including 3D mapping and multi-discriminate laser radar technologies.

Lists citations with abstracts for aerospace related reports obtained from world wide sources and announces documents that have recently been entered into the NASA Scientific and Technical Information Database.

This book discusses advances in smart and sustainable development of smart environments. The authors discuss the challenges faced in developing sustainable smart applications and provide potential solutions. The solutions are aimed at improving reliability and security with the goal of affordability, safety, and durability. Topics include health care applications, sustainable smart transportation systems, intelligent sustainable wearable electronics, and sustainable smart building and alert systems. Authors are from both industry and academia and present research from around the world. Addresses problems and solutions for sustainable development of smart cities; Includes applications such as healthcare, transportation, wearables, security, and more; Relevant for scientist and researchers working on real time smart city development.

This second volume, edited and authored by world leading experts, gives a review of the principles, methods and techniques of important and emerging research topics and technologies in communications and radar engineering. With this reference source you will: Quickly grasp a new area of research Understand the underlying principles of a topic and its application Ascertain how a topic relates to other areas and learn of the research issues yet to be resolved Quick tutorial reviews of important and emerging topics of research in array and statistical signal processing Presents core principles and shows their application Reference content on core principles, technologies, algorithms and applications Comprehensive references to journal articles and other literature on which to build further, more specific and detailed knowledge Edited by leading people in the field who, through their reputation, have been able to commission experts to write on a particular topic Providing a practical review of the latest technology in the field, Ultrawideband Radar Applications and Design presents cutting-edge advances in theory, design, and practical applications of ultrawideband (UWB) radar. This book features contributions from an international team of experts to help readers learn about a wide range of UWB topics, including: History of the technology American and European governmental regulations and key definitions Nonsinusoidal wave propagation theory Random signal radar Object detection by ground permittivity measurements Large-target backscattering effects Medical applications Large current radiator antenna design Materials-

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penetrating theory Radar signal processing Weak-signal detection methods Holographic and real time radar imaging This book's contributors use practical information to illustrate the latest theoretical developments and demonstrate UWB radar principles through case studies. Radar system engineers will find ideas for precision electronic sensing systems for use in medical, security, industrial, construction, and geophysical applications, as well as those used in archeological, forensic and transportation operations.

This volume brings together many of the world's leading experts in the development of new imaging methodologies to detect, identify, and counter security threats to society. It covers three broadly defined but interrelated areas: the mathematics and computer science of automatic detection and identification; image processing techniques for radar and sonar; and detection of anomalies in biomedical and chemical images.

This book is about spaceborne missions and instruments. In addition, surveys of airborne missions and of campaigns can be found on the accompanying CD-ROM in pdf-format. Compared with the 3rd edition the spaceborne part grew from about 300 to 1000 pages. The complete text - including the electronic-only chapters - contains more than 1900 pages. New chapters treat the history of Earth observation and university missions. The number of commercial Earth imaging missions has grown significantly. A chapter contains reference data and definitions. Extensive appendices provide a comprehensive glossary, acronyms and abbreviations and an index of sensors. An effort has been made to present the information in context, to point out relationships and interconnections. The book may serve as a reference and guide to all involved in the various national and international space programs: researchers and managers, service providers and data users, teachers and students.

The report documents the USA Land Warfare Laboratory's Foliage Penetration Radar program including the historical aspects, the technology developed and four resulting systems that saw combat in Southeast Asia. Application of the FOPEN technology to intrusion detection systems, airborne FOPEN radars, swimmer detection systems, and a radar capable of detecting low flying aircraft concealed by foliage are presented. A review of signal processing techniques and tradeoffs for ground surveillance radars and a summary of propagation research concludes the report.

In light of the spectacular performance of American high-technology weapons in the 1991 Persian Gulf War, as well as the phenomenal pace of innovation in the modern computer industry, many defense analysts have posited that we are on the threshold of a revolution in military affairs (RMA). The issue has more than semantic importance. Many RMA proponents have begun to argue for major changes in Pentagon budgetary priorities and even in American foreign policy more generally to free up resources to pursue a transformed U.S. military—and to make sure that other countries do not take advantage of the purported RMA before we do. This book takes a more measured perspective. Beginning with a survey of various types of defense technologies, it argues that while important developments are indeed under way, most impressively in electronics and computer systems, the overall thrust of contemporary military innovation is probably not of a revolutionary magnitude. Some reorientation of U.S. defense dollars is appropriate, largely to improve homeland defense and to take advantage of the promise of modern electronics systems and precision-guided munitions. But radical shifts in U.S. security policy and Pentagon budget priorities appear unwarranted—especially if those shifts would come at the expense of American military engagement in overseas defense missions from Korea to Iraq to Bosnia.

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