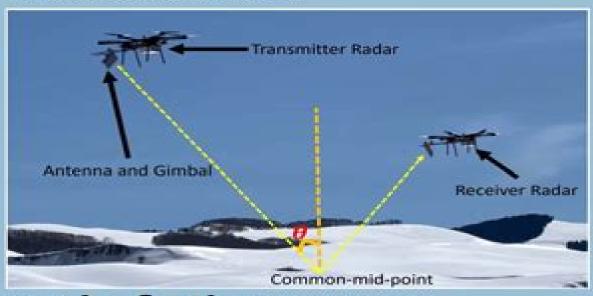


# ARTICLE SPOTLIGHT

# Ultra-Wideband Bistatic Radar Measurements of Snow

Authors: O. Reyhanigalangashi, S. Gogineni, D. Taylor, S. Kolpuke, F. Abushakra, J. Larson

Field deployment of UWB bistatic radar in the Gothic, CO. Two sUAS are positioned over the common-mid-point.





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# <u>Ultrawideband Radar Measurements Ultrawideband</u> <u>Radar Measurements</u>

James D. Taylor

#### **Ultrawideband Radar Measurements Ultrawideband Radar Measurements:**

*Ultrawideband Radar Measurements* Lev I∏U∏r'evich Astanin,A. A. Kostylev,1997 Fast response transistors for ultrawideband UWB radar systems and faster computers have prompted novel approaches to theoretical descriptions of such signal systems and solutions to conventional radar problems According to Astanin Baltic Technical U St Petersburg and Kostyley Mozhaisky Military Academy of Space Engineering UWB has entered a third wave of research interest this decade the first being tracking of a radar target and the next steady oscillation transmission After introducing definitional modeling and measurement issues they probe target scattering target responses UWB signal processing and design principles and mathematical modeling of UWB radar meters Annotation copyrighted by Book News Inc Portland OR Radar James D. Taylor, 2012-05-18 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 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

**Ultrawideband Radar Measurements** L. Astanin, A. Kostylev, 1999 This book presents some novel approaches to radar system analysis now being investigated It is shown how systematic application of numerical procedures can provide new results in the evaluation of UWB radar target responses The authors do not try to cover all of the possible solutions to the problem of multidimensional representation of target responses rather they aim to give a general understanding of the techniques of confluent analysis computer holography and adaptive synthesis of antenna apertures The methods have great potential for solving conventional radar problems in target detection and recognition **Long-Range Ultra-Wideband Radar Sensor for Industrial Applications** Ahmed Abbas Hussein Ameri, 2013 **Advanced Ultrawideband Radar James D.** Taylor, 2016-12-19 This book presents the latest theory developments and applications related to high resolution materials penetrating sensor systems An international team of expert researchers explains the problems and solutions for developing new techniques and applications Subject areas include ultrawideband UWB signals propagation and scattering materials penetrating radar techniques for small object detection and imaging biolocation using holographic techniques tomography medical applications nondestructive testing methods electronic warfare principles through the wall radar propagation effects

and target identification through measuring the target return signal spectrum changes Ultrawideband Radar James D. Taylor, 2017-12-19 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 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

Ultra-wideband Radar Measurements Over Bare, Snow-covered and Pancake Ice P. Kanagaratnam, S. Gogineni, Kenneth Charles Jezek, L. Peters, J. Young, Cold Regions Research and Engineering Laboratory (U.S.), University of Kansas. Radar Systems and Remote Sensing Laboratory, 1997 An ultra wideband radar and a plane wave antenna have been used to measure the high resolution scattering response of bare saline ice snow covered ice and pancake ice during the winter seasons of 1994 and 1995 at the US Army Cold Regions Research and Engineering Laboratory CRREL The objectives of these experiments were to study various mechanisms for simulating roughness and to understand scattering mechanisms better These backscatter measurements were made at 2 18 GHz and 0 5 16 5 GHz during the 1994 and 1995 experiments respectively and were made for incidence angles ranging from 0 to 55 deg These broadband measurements provide a vigorous test for models at many frequencies using a single system instead of many single frequency systems

Ultra-wideband Radar Technology James D. Taylor,2000-09-21 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 Time-Domain Ultra-Wideband Radar, Sensor and Components Cam Nguyen, Jeongwoo Han, 2014-04-09 This book presents the theory analysis and design of ultra wideband UWB radar and sensor systems in short UWB systems and their components UWB systems find numerous applications in the military security civilian commercial and medicine fields This book addresses five main topics of UWB systems System Analysis Transmitter Design Receiver Design Antenna Design and System Integration and Test The developments of a practical UWB system and its components using microwave integrated circuits as well as various measurements are included in detail to demonstrate the theory analysis and design technique Essentially this book will enable the reader to design their own UWB systems and components In the System Analysis chapter the UWB principle of operation as well as the power budget analysis and range resolution analysis are presented In the UWB Transmitter Design chapter the design fabrication and measurement of impulse and monocycle pulse generators are covered The UWB Receiver Design chapter addresses the design and measurement of the strobe pulse generator sampling mixer low noise amplifier and synchronous sampling receiver Next the UWB Antenna Design chapter details the design and measurement of to two UWB antennas the microstrip quasi horn antenna and the UWB uniplanar antenna The System Integration and Test chapter covers the transmission reception test signal processing system integration and evaluation of the UWB sensor The final chapter provides a summary and conclusion of the work

Ultrawideband Radar James Taylor, 2017 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 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

Introduction to Ultra-Wideband Radar Systems James D. Taylor,1994-12-16 This introductory reference covers the technology and concepts of ultra wideband UWB radar systems It provides up to date information for those who design evaluate analyze or use UWB technology for any application Since UWB technology is a developing field the authors have stressed theory and hardware and have presented basic principles and concepts to help guide the design of UWB systems Introduction to Ultra Wideband Radar Systems is a comprehensive guide to the general features of UWB technology as well

as a source for more detailed information Ultrawideband Radar Ivan J. LaHaie, 1992 Ultrawideband Radar Clutter Measurements of Forested Terrain, 1991--1992, 1993 The ultrawideband UWB radar clutter measurements project was conducted to provide radar clutter data for new ultrawideband radar systems which are currently under development A particular goal of this project is to determine if conventional narrow band clutter data may be extrapolated to the UWB case This report documents measurements conducted in 1991 and additional measurements conducted in 1992 The original project consisted of clutter measurements of forested terrain in the Olympic National Forest near Sequim WA The impulse radar system used a 30 kW peak impulse source with a 2 Gigasample second digitizer to form a UHF 300 1000 MHz ultrawideband impulse radar system Additional measurements were conducted in parallel using a Systems Planning Corporation SPC step chirp radar system This system utilized pulse widths of 1330 nanoseconds over a bandwidth of 300 1000 MHz to obtain similar resolution to the impulse system Due to the slow digitizer data throughput in the impulse radar system data collection rates were significantly higher using the step chirp system Additional forest clutter measurements were undertaken in 1992 to increase the amount of data available and especially to increase the amount of data from the impulse radar system Ultra Wideband Radar Antenna Design for Snow Measurement Applications John Samy Mosy, 2009 Creating a high precision compact and low cost snow structure and depth sensor has always been the dream of many industries and yet hard to achieve all together Snow depth sensors are used in avalanche search and rescue and widely in recreational snow industry as well as in environmental monitoring systems for snow water equivalence measurements The use of radar for snow depth measurement is not new and many techniques such as Frequency Modulated Continuous Wave FMCW have been used but they prove to be costly bulky and have relatively low precision Today with the availability of chip scale Ultra Wide Band UWB technology it is possible to create Snow Depth Sensor SDS and Snow Water Equivalent SWE measuring systems in low cost small size and possibly mobile devices with very high precision One problem that remains at the RF Radio Frequency end of the UWB technique in measuring snow parameters is the antenna used in transmitting and receiving UWB pulses UWB pulses are characterized by an instantaneous fractional energy bandwidth greater than about 0 20 0 25 The FCC has allocated spectrum for UWB use in the 3 1 10 6 GHz band and available chipsets generate pulses in the lower 3 6 GHz band For creating applications that use UWB in measuring snow parameters such as SWE and snow depth a UWB antenna is required A successful UWB radar antenna needs to have high gain linear phase low dispersion and low Voltage Standing Wave Ratio VSWR and high directivity throughout the entire band The antennas are to have physically compact design with high gain linear phase low VSWR and high directivity for UWB radar applications in the snow measurements industry This thesis presents several antenna designs for the 3 1 10 6 GHz UWB band and the 3 6 GHz UWB lower band that have the potential to meet these requirements and show through laboratory measurements modeling and simulations that the required attributes can be achieved *Ultra-Wideband Radar* Bruce Noel,1991-09-06 This unique book

features 37 full length peer reviewed versions of papers presented at the First Los Alamos Symposium on Ultra Wideband Radar The purpose of the symposium was to offer an open unbiased forum where researchers in areas connected to ultra wideband radar UWBR could present results of their work and exchange ideas The papers published from the proceedings illuminate the breadth and depth of the topic and cover seven general areas fundamental electromagnetic theory computational electromagnetics and code development signal propagation scattering and reception new technologies advanced arrays and imaging signal processing and radar systems and applications and testing The book will provide stimulating reading for scientists engineers managers and students working with UWBR Time-domain Imaging of Radar Targets Using Ultra-wideband Or Short Pulse Radars Yingcheng Dai,1997 Ultra-wideband, Short-pulse Electromagnetics Henry L. Bertoni, Lawrence Carin, Leopold B. Felsen, 1993 Proceedings of an international conference held October 1992 at the Microwave Research Institute Brooklyn New York The conference topic was chosen because of the steadily increasing importance of time domain techniques and applications and also because of the general trend toward wider signal b

**Performance of Ultra-wideband Communication Systems** John Duggue Choi,2003 **Algorithms for Synthetic Aperture Radar Imagery** ,1994 **Algorithms for Synthetic Aperture Radar Imagery** Dominick A. Giglio,1994

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