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# ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 47-2/2

## “Advanced Radar Systems”
## («Современные РЛ системы»)

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## "The Design of the Microwave T/R Module Automation Test System Based on the Embedded System"

This paper describes the design principles of the automated test system for microwave T/R module, with the embedded system achieving the function control of the whole system. The system could implement automatic measurement of all the time domain and frequency domain parameters in the sixteen 32-channel modules using the single-connection multiple-measurement (SCMM) technique, and conduct automatic S-parameter test and error correction under both continuous wave and pulse according to presetted test programs. With the application of the embedded system, the system ranks a high flexibility, high reliability, open infrastructure and good scalability, and the performance specification has made it among the advanced products worldwide. [C819]

## "Advanced airborne SAR imaging"

The airborne experimental multichannel SAR/GMTI system PAMIR (phased array multifunctional imaging radar) serves as a platform for the demonstration of new capabilities in surveillance and reconnaissance. The sensor is working in the X-band and features a bandwidth of 1.8 GHz, five parallel receive channels, and an active phased array antenna comprising up to 256 Vivaldi columns and T/R modules and a broadband true time delay beamforming network. The antenna is reconfigurable, e.g. to a multi-baseline aperture for interferometric modes or to an elongated aperture for GMTI purposes. This contribution presents methods and results of two advanced radar tasks, namely high resolution SAR imaging with sub-decimetre resolution and non-canonical SAR imaging in case of rapid azimuth scanning [C820]

## "Advances in Phased Array Technology"

This paper presents an overview of developments at IMST in the area of steerable antennas, also often referred to as phased arrays. Such type of antennas have become a key area since the last few years. Various activities in this area have been conducted in the past, and are currently ongoing. Phased array antennas are, in general, rather complex systems that have to incorporate special features in order to perform beam steering, and have achieved ever more popularity during the last years, mainly driven by mobile multimedia applications. The complexity of the antenna systems, developed at IMST, ranges from small arrays with switchable elements, and partially mechanically and electronically steerable arrays (hybrid systems) to fully electronically steerable arrays. Such systems can be equipped with phase and amplitude shifters for each element, or the design can be based on digital beam forming (DBF). At IMST a large number of R&D projects reflects the broad spectrum of activities with respect to design and development of phased arrays. For the last 6 years, various projects have been carried out which all differ in topic, application and frequency range (L-band to Ka-band). It is intended to give here an overview of the work performed, and a global technical description [C821]

## "Nonlinear oscillator array antenna development at GTRI"

This paper reviews the Georgia Tech Research Institute's (GTRI) contributions to the field of nonlinear oscillator antennas. Over the last five years, GTRI, in collaboration with SPA WAR Systems Center in San Diego, has advanced the state of the art in the analysis, capability and design of coupled oscillator arrays. A theoretical framework describing the dynamics of coupled oscillators and its relevance to beam steering, beam shaping, monopulse and null steering is presented. Descriptions of 1- and 2-dimensional array designs are provided, including critical design issues encountered during their development. Performance assessments via range chamber testing and on-board diagnostic measurements are included. This paper concludes with a brief discussion of outstanding problems, directions of further study and possible insertion points for this technology [C822]

## "Enhanced ADS-B research"

Automatic dependent surveillance-broadcast (ADS-B) is emerging as an advanced aviation technology that

provides situational awareness within the aircraft that was previously available only on the ground. Pilots and ground personnel have begun to benefit from this technology but further benefits from technological improvements can still be realized. These improvements include security, increased data capacity, and advanced applications (4D trajectory and data exchange). To this end research is currently being performed by Sensis Corporation in cooperation with NASA Glenn Research Center to provide enhancements to the ADS-B UAT (universal access transceiver) data link. The research goal is to encourage user acceptance by improving upon existing capability and usability along with providing a roadmap and demonstrations of future data link capability [C823]

## "State of the art 200 GHz passive components and circuits integrated in advanced thin SOI CMOS technology on High Resistivity substrate"

As the high-frequency capabilities of CMOS improve through scaling (Dambrine et al., 2005), increasing efforts have been carried out during the past years to evaluate the potential of CMOS technologies to address millimeter wave (MMW) applications. The 7 GHz unlicensed bandwidth around 60 GHz and 77 GHz vehicular radar one have focused many attention. In addition this paper demonstrates for the first time that CMOS technologies are able to address higher frequencies applications up to G band (140-220 GHz) [C824]

## "Low-Latency Live Video Streaming over Low-Capacity Networks"

This paper presents an effective system for streaming over low-capacity networks (such as GPRS and EGPRS) of live videos with low latency. Existing solutions are either too complex or not suitable to our scope. For this reason, we developed a complete, ready-to-use streaming system based on H.264/AVC codec and UDP/IP stack. The system employs adaptive controls to achieve the best tradeoff between low latency and good video fluency, by keeping the UDP buffer occupancy at the decoder side between two given levels. Our experiments demonstrate that this system is able to transmit live videos at CIF format and 10 fps over GPRS/EGPRS with very low latency (1.73 sec on average, basically due to the network delay), good fluency and average quality, measured with PSNR, of 31 dB on GPRS at 23 kbps at 10 fps [C825]

## "New Approaches to Multilateration processing: analysis and field evaluation"

The "multilateration" (MLAT) system is a surveillance and identification element of the A-SMGCS using the SSR transponder (Mode S or even A/C) reply/squitter as signals received by fixed stations where the time-of-arrival (TOA) is measured. In a central processing unit, the target position is estimated by the TDOA technique (time difference of arrival), for which a station is assumed to be the reference one. The cooperation between Tor Vergata University and the Company SELEX-S.I. has originated a new generation MLAT system (whose original features are patented) tested in a small Italian airport (Tassignano, Tuscany) in 2004/05 and presently (early 2006) installed at Milano Malpensa (MXP) airport. The new features includes (a) time-of-arrival estimation, (b) MLAT algorithms, (c) recovery of clocks deviations; they have permitted advanced surveillance performance in terms of accuracy, timeliness and integrity [C826]

## "A Fast Scanning W-Band System for Advanced Millimetre-Wave Short Range Imaging Applications"

The paper presents the development of a fast scanning W-Band (75-100 GHz) system and a suitable antenna concept for advanced imaging applications. The goal is to obtain a broadband frequency response from a large target area within a short time period. Two typical approaches for the design of a free space millimetre-wave imaging setup will be discussed. The first approach consists of a focused bistatic measurement setup that includes a combination of a conical horn and a dielectric lens in order to focus the beam. The basic idea of the second approach is to use an unfocused measurement setup employing synthetic aperture radar (SAR) algorithms in order to focus the image numerically. Both measurement setups will be discussed with respect to the capability for fast scanning mm-wave imaging systems. Experimental results on planar test objects demonstrate the performance of the developed W-Band system compared to a commercial vector network analyzer (VNA) [C827]

## "Environment-Adaptive Antipersonnel Mine Detection System-Advanced Mine Sweeper"

In this paper, we propose an environment-adaptive antipersonnel mine detection system called Advanced Mine Sweeper. Advanced Mine Sweeper is developed based on sensing technologies, access-control technologies and system integration technologies for safe and effective demining procedure after the Level II survey. Advanced Mine Sweeper consists of a sensing vehicle/unit, an access vehicle, and an assist vehicle. The sensing vehicle/unit is composed of an integrated sensor and a small-reaction sensor head manipulator. The

access vehicle is parked facing a mine field in order to control the sensing unit position in a global area using its boom. The assist vehicle is parked keeping some distance from a mine field. It controls the sensing vehicle/unit and access vehicle and then displays the processed sensing information for landmine detection, receiving sensing information and sensing position. By using this system, experiments in the field buried dummy landmines were carried out for the utility and performance evaluation [C828]

## "Intelligent Identification Software Module (IISM) for the US Navy's Combat Centers"

We have developed and continue to enhance our automated intelligent software, which performs the tasks and decision making currently handled by the personnel manning the watch stations in the Combat Direction Center (CDC), the Task Force Combat Center (TFCC), on-board aircraft carriers, and other Navy ships. Integration of information from a variety of sources in a combat station is a complex task; surveillance guards can receive divergent information from on-board radars, sonar, and other sensors, and must assimilate and interpret even conflicting information in a timely manner to relay it up the chain of command. The intelligent identification software module (IISM) alleviates some of the burden placed on battle commanders by automating certain tasks, such as the management of historical data, disambiguating multiple track targets, assessing the threat level of targets, and even rejecting improbable data. IISM is interfaced to the Advanced Battle Station (ABS). Given tracking data and time stamps from ABS, IISM updates the history list of tracking and identification data, rejects nonsense tracks, compares recent history to past patterns of activity, alerts the commander via ABS when necessary, and provides customizable identifications of targets, as well as the threat level of each of these targets. IISM is also capable of correcting errors and recovering snap-shot and history data after unforeseen catastrophes. On a highly conceptual level, IISM is able to perform these tasks by viewing the target tracking as a classification problem of the threat levels that it assigns to the individual entities present in the situation. It maintains a consistent and reasonably approximate model of several entities' attributes that are only partially perceivable. This, fundamentally, is the task of track handling and analysis currently being handled by human decision-makers. Put simply, IISM 1) determines, to a degree of certainty, the identity of an entity, 2) performs a path-- analysis of the entities, and 3) infers abstract conclusions regarding the behavior of entities based on their movement over time. Stated another way, both positive and negative evidence is tracked to form multiple, possibly competing hypothesis, and conclusions of these tracks are made through a process of elimination reasoning. IISM is able to perform this complex task by utilizing certain AI-based solutions. IISM uses SimBionic, a visual authoring tool that outputs C++ code for fast execution. IISM also mimics the intelligent memory provided by current human track-watchers, including all track attributes (position, velocity, ID information, etc.), along with a time stamp for each. IISM also has system independence and will continue to remember the current tactical picture even if a tactical decision system go down, is very robust, has an automated system backup and restore function, and can even be saved to a file server to diminish physical vulnerabilities. IISM is an AI module that alleviates many of the burdens placed on battle commanders. It is a seamless enhancement to the current Advanced Battle Station, providing enhanced reasoning without the need for users to learn a new system [C829]

## "Satellite-aided Search and Rescue (SAR) System"

To carry out search and rescue of the peoples in distress on the distressed aircrafts/vessels, or on land, at sea or in a remote mountainous region, there are a number of different search and rescue systems and methods that are being used by the different national search and rescue organizations worldwide. In this paper the main terrestrial search and rescue (SAR) system that are in use are discussed in brief and a satellite-aided search and rescue (SAR) system COSPAS-SARSAT is discussed in detail highlighting its benefits over other SAR Systems [C830]

## "A Remote Imaging System Based on Reflected GPS Signals"

This paper describes a method for utilizing reflected Global Positioning System (GPS) signals to form an image of targets within a region of interest. The principle is based upon a type of bi-static synthetic aperture radar (SAR) in which a matched filter technique is employed to perform the image reconstruction. This method relies upon the fact that each component of the received signal resulting from a reflection from an individual target is subjected to a unique chirp. A major challenge to be tackled is the appalling signal to noise ratio associated with the received reflected GPS signals. Another difficulty is the masking of the reflected signals by power in the tails of the autocorrelation function of the direct signals which cannot be totally suppressed. Moreover, the reconstruction method results in an undesirable point spread function (PSF) which seriously smears the reconstructed image. We simulate the entire GPS signal generation and image reconstruction process as faithfully as possible within the limitations of the available computational effort. We are able to demonstrate that a spatial resolution of the order of the LI wavelength (19 cm) is theoretically possible from realistic observation distances provided that sufficient coherent correlator integration time is allowed and that the direct signals can be sufficiently suppressed. For the rather simplified organization of targets within the simulation we are able to show

that the image smeared by the PSF is able to be cleaned by means of a Wiener filter based deconvolution method. [C831]

## ""A System is More Than the Sum of Its Parts"-Conclusion of DLR'S Enhanced Vision Project "ADVISE-PRO""

Within its research project ADVISE-PRO (advanced visual system for situation awareness enhancement-prototype, 2003-2006) that will be presented in this contribution, DLR has combined elements of enhanced vision and synthetic vision to one integrated system to allow all low visibility operations independently from the infrastructure on ground. The core element of this system is the adequate fusion of all information that is available onboard. This fusion process is organized in a hierarchical manner. The most important subsystems are; a) the sensor based navigation which determines the aircraft's position relative to the runway by automatically analyzing sensor data (MMW, IR, radar altimeter) without using neither (D)GPS nor precise knowledge about the airport geometry, b) an integrity monitoring of navigation data and terrain data which verifies onboard navigation data ((D)GPS + INS) with sensor data (MMW-radar, IR-sensor, radar altimeter) and airport/terrain databases, c) an obstacle detection system and finally d) a consistent description of situation and respective HMI for the pilot [C832]

## "An Evaluation of Two Multi-Sector Planner Concepts: Multi-D and Area Flow"

Several developments in the technology supporting air traffic management (ATM), such as digital data communication and improved positioning accuracy, have enabled consideration of new organizational and functional operations. One such consideration is a modification of the standard air traffic control team configuration to include a "multi-sector planner" (MSP) position. This MSP position has been investigated in several research and field studies, both in the U.S. and in Europe. The feasibility and effectiveness of two of these concepts were investigated in the current study. One concept, termed "Multi-D", took the traditional role of a data-controller but provided these types of services to several radar controllers instead of one. In the second configuration, termed "area flow", the MSP coordinated with neighboring MSP areas and attempted to manage the overall traffic flows and actively balanced sector traffic levels within their area of responsibility. The experiment consisted of a pair of one-week human-in-the-loop studies, in which each MSP concept (i.e. multi-D and area flow) was tested separately with a different 5-person team. A baseline condition, which assumed traditional radar and data-controller teams with access to advanced decision support tools (DSTs) and automation, was also run each week to provide comparison data. Overall, data suggest feasibility of both concepts, with many similarities and some differences. Both configurations emphasize strategic traffic management and neither safety nor efficiency appeared to be adversely affected. Workload data supported an assumption that a single MSP can cover multiple sector positions with a better overall workload distribution. The coordination data revealed that both multi-D and area flow delegated a significant portion of their rerouting tasks to the upstream sectors since strategic traffic planning needed to occur well before the test sectors. The viability of requesting these reroutes to the upstream s--ectors needs to be verified in future studies. The MSP study was sponsored by FAA ATO Operations Planning and led by Kevin Corker at San Jose State University [C833]

## "Advances in Through Wall Radar for Search, Rescue and Security Applications"

A PowerPoint presentation on the design and performance, applications and future developments of through wall radar systems is provided. The portable radar interior space monitor (PRISM) system, an adaptation of Cambridge Consultants' short range radar technology to display the 3D position of objects sensed through the walls, is featured. Advances in RF design and processing has accelerated the development of short range UWB radar systems, making the system applicable to search and rescue, hostage rescue, area surveillance and tracking, and building security [C834]

## "A-SMGCS Surveillance Technology-Challenges and Opportunities"

Summary form only given. Advanced surface movement guidance and control systems (A-SMGCS) are being deployed worldwide. These systems provide controllers with improved situational awareness that enhances surface airport movement and enables advanced tower cab functionality. Without accurate, timely, and robust surface surveillance systems, a modern A-SMGCS would not be feasible. This representation will explore the fundamental capabilities of A-SMGCS and the underlying dependence on surveillance system technology [C835]

## "2006 IEEE CSIC Symposium"

The following topics are dealt with: W-band and beyond; oxide-semiconductor device and circuit technologies; millimeter wave frequency conversion; reconfigurable and tunable works; GaN MMICs; reliability and simulation; advanced III-V HEMTs; compound semiconductor MOSFETs; RF GaAs based amplifiers; III-V HBTs; automotive

radar; high-speed digital circuits; WiMAX; and wide bandgap technology [C836]

## "Highly Reliable and Accurate Level Radar for Automated Legal Custody Transfer and Inventory Management"

Accuracy and reliability on liquid level measurements in bulk storage tanks are getting increasingly important for oil and gas industry in which revenue losses from incorrect measurement are becoming more costly, specifically in legal custody transfer and custom monitoring. In this paper, a robust and self-adaptive radar gauging system for high-precision continuous level measurements is presented. The radar system has a compact size and is explosion proof. It consists of a stepped frequency continuous wave (SFCW) transmitter and receiver with monostatic gas-tight antenna. The frequency range is from 9.5 to 10.5 GHz. With most advanced processing software algorithm implemented in the microprocessor, the accuracy of plusmn 0.3 mm over whole measuring range is obtained. Even if under severe conditions, an accuracy of plusmn 1 mm can still be attained. By means of the advanced level radar system the fine accuracy can become attainable under worst-case scenarios. Whereby the authentic custody transfer and inventory management are guaranteed [C837]

## "Enhanced ADS-B Research"

Automatic dependent surveillance-broadcast (ADS-B) is gaining acceptance around the world as the next-generation surveillance technology. It can provide surveillance to air traffic controllers to support today's procedures as well as surveillance in the cockpit to support air-to-air applications. Pilots and ground personnel have begun to benefit from this technology but further benefits from technological improvements can still be realized. These improvements include security, increased data capacity, and advanced applications (4D trajectory and data exchange). To this end research is currently being performed by Sensis Corporation in cooperation with NASA Glenn Research Center to provide enhancements to the ADS-B UAT (universal access transceiver) data link. The research goal is to encourage user acceptance by improving upon existing capability and usability along with providing a roadmap and demonstrations of future data link capability [C838]

## "Throwing Down The Gauntlet: A Discussion Of Techniques For Bounding Advanced Tracking Algorithm Performance"

For many applications of radar and sensor based filtering, simulations can not represent the sole estimate of performance, provide points where threats become engagable, or determine when to use weapons' platform based sensors effectively in an engagement, etc... No significant advances have been proposed to analytically characterize performance or at least bound performance of the Kalman filter other than the use of simple two or three state constant gain filters. This paper suggests methods for characterizing filter algorithms that can be used to bound the advanced tracking algorithms that are used in a single sensor or multi-sensor environment [C839]

## "Tracking Through Jamming Using Negative Information"

Advances in characterizing the angle measurement covariance for phased array monopulse radar systems that use adaptive beamforming to null out a jammer source allow for the use of improved sensor models in tracking algorithms. Using a detection probability likelihood function consisting of a Gaussian sum that incorporates negative contact measurement information, four tracking systems are compared when used to track a maneuvering target passing into and through standoff jammer interference. Each tracker differs in how closely it replicates sensor performance in terms of accuracy of measurement covariance and the use of negative information. Only the tracker that uses both the negative contact information and corrected angle measurement covariance is able to consistently reacquire the target when it exits the jammer interference [C840]

## "Tracking Extended Targets-A Switching Algorithm Versus The SJPDAF"

Tracking extended targets is of central interest in mobile robotics as it is a prerequisite for interaction with the environment. There are significant differences between tracking punctiform targets and tracking extended targets. Most of the existing algorithms assume the targets to be punctiform, which is not always suitable. In recent years, two advanced algorithms for tracking extended targets have been developed by the authors-a switching algorithm and the SJPDAF. The switching algorithm uses the Kalman filter and an adapted version of the Viterbi algorithm, which includes certain geometrical characteristics of the problem. The SJPDAF combines the idea of particle filtering with the JPDAF. In this paper we present these two algorithms and compare them with respect to accuracy, speed and robustness in case of crossing targets. We show, that the more recently developed switching algorithm outperforms the SJPDAF regarding these criterions [C841]

## "Interpretation of high-resolution optical imagery with evidential fusion of spectral information and

## object attributes"

Since the past five years Lockheed Martin Canada is developing an advanced image interpretation system integrating classification tools and target detection operators for multispectral, hyperspectral and polarimetric SAR imagery. Improved classification maps and superior object detection and identification performances have been obtained with a pixel-driven evidential fusion of textural measurements and end-member respectively extracted from polSAR and HIS imagery. As in many applications objects to be extracted occupy several pixels in the image, the objective of current developments is to supplement the pixel-based fusion already performed with radiometric, textural, spectral features by adding specific object topological attributes (shape, size) and contextual description (spatial relationships). This paper presents a description of the new primitives and the results obtained on Ikonos imagery [C842]

## "Selected Systems for the Detection of Human Stowaways in Air Cargo Containers"

In the spring of 2005, the United States Department of Homeland Security, Transportation Security Administration (TSA) commissioned a study to identify effective methods for the detection of human stowaways in air cargo containers. A market survey was initially conducted that identified existing COTS products. That survey identified four products that were deemed worthy of further test and evaluation: the CD-2 human occupancy detector (HOD), handheld carbon dioxide (CO2) detector; the RadarVision2, a through-wall motion sensor using ultra-wide band (UWB) radar technology; the advanced vehicle interrogation and notification (AVIAN) heartbeat detector (HBD), a vibration-sensing system; and the MicroSearch human presence detection system (HPDS), a vibration-sensing system (similar to the AVIAN HBD, above) [C843]

## "Modeling Efficiency Gains from Diverging Departures at Atlanta Hartsfield-Jackson"

Atlanta Hartsfield-Jackson International Airport (ATL) implemented Area Navigation (RNAV) standard terminal arrival routes (STARs) and standard instrument departures (SIDs) in early 2005. Revisions to the RNAV SIDs implemented in April 2006 include diverging departure courses when ATL is in east flow operational configuration. The diverging departure courses can be expected to allow air traffic control (ATC) to separate departing aircraft more efficiently, reduce delays, and provide significant benefits to operators. The MITRE Corporation's Center for Advanced Aviation System Development (CAASD) has been tasked by the Federal Aviation Administration (FAA) to measure the benefits associated with RNAV implementation at several high complexity/high traffic sites across the NAS, and has developed Monte-Carlo simulation modeling tools to assist in RNAV benefits analysis. This paper presents model estimates of the benefits for both the current implementation of ATL RNAV procedures as well as a planned future implementation at ATL [C844]

## "SeaWinds Scatterometer Wind Vector Retrievals for Hurricane Claudette Using AMSR and NEXRAD To Perform Corrections for Precipitation Effects: Comparison of AMSR and NEXRAD retrievals of rain"

The estimation of sea surface winds near and within hurricanes, with the spatial coverage of a satellite radar (scatterometer), is an important objective for public safety. It is also a significant technical challenge when intense rain is present in the scatterometer Field-Of-View (FOV). The presence of rain affects the measured Ku-band normalized radar cross section (NRCS or SIGMA_0) in three ways: rain, cloud and vapor in the atmosphere attenuate the scatterometer signal; rain backscatter augments the signal that comes from the ocean surface; finally, rain hitting the ocean surface induces surface roughening ("splash") that also augments the wind-related signal from the ocean surface. Scatterometer wind retrievals assume that variations in the the measured SIGMA_0 are solely caused by variations in the wind-induced ocean surface roughening. Hence, any rain-related effects have to be accounted for before the scatterometer measurements in rain can be used to estimate the near-surface wind velocity. The MIDORI-II mission, during 2003, carried five earth-observing sensors including the SeaWinds scatterometer and the Advanced Microwave Scanning Radiometer (AMSR). The latter's six frequency brightness temperatures are collected to derive atmospheric water-related parameters and to measure the sea surface temperature. Since its coverage was closely coincident and collocated with the scatterometer, it provided the opportunity to obtain the precipitation measurements necessary to estimate the attenuation, volume backscatter and surface roughening by the raindrops within the scatterometer beam. Corrections to the scatterometer measurements of ocean surface winds can be pursued with either empirical or physical modeling. While both methods rely on the AMSR-based geophysical retrievals, they differ in how the information is used. The empirical method compares the observed sigmaO to the NCEP-model-wind-inferred SIGMA_0 to estimate the rain corrections (attenuation and backsca--tter that combines the rain backscatter and the "splash") as function of the AMSR-derived geophysical parameters. The physical method estimates the three rain effects separately using parametrized relationships between total liquid water, rain rate, surface roughening, volume attenuation and rain backscatter. As such, the physical method does not take into account the NCEP model winds and the produced corrections are more directly related to the AMSR-derived geophysical parameters. The

AMSR was designed to measure atmospheric water-related parameters on a spatial scale comparable to the SeaWinds scatterometer (~25km). Optimal estimates of the volume backscatter and attenuation require a knowledge of the three dimensional distribution of reflectivity on a smaller scale comparable to that of the precipitation. Studies selected near the US coastline enable the much higher resolution NEXRAD reflectivity measurements to help evaluate, understand, and improve the AMSR estimates and to conduct research into the effects of different beam geometries and nonuniform beamfilling of precipitation within the field-of-view of the AMSR and the scatterometer [C845]

## "UWB Radars for Chalenging Applications"

A number of challenging radar applications (such as antipersonnel mine detection and human being detection) has been discussed. In these applications UWB technology has a number of advantages of over the traditional narrow-band approach, in particular very high positioning accuracy, rigidity to multi-path propagation and target classification abilities. On a number of examples recent advances of UWB technology in radar have been demonstrated and remaining challenges have been discussed [C846]

## "Extraction of the signature of a buried object using GPR"

This paper deals with the possibility of remotely detecting buried objects using impulse radiating GPR. Most GPR systems involve the B-scan or the C-scan of the ground requiring the usage of advanced imaging techniques. Identification of a buried target is done using only a single snapshot of the ground. An electromagnetic pulse is sent into the ground from a transmitting antenna. The target reflects the pulse and the reflection is received by a receiving antenna. A single temporal scan of the ground is utilized for identification of the target characteristics. The antenna responses are deconvolved out from the receiver response. The deconvolution is carried out by using the conjugate gradient method. Finally, the target response is identified by extracting the natural resonance frequencies by applying the matrix pencil method on the transient waveform. Successful identification of buried targets is achieved through this methodology. [C847]

## "Swathbuckler: wide swath SAR system architecture"

Between 2001 and 2005, the Swathbuckler wide-swath SAR real-time image formation multinational project evolved a system architecture to continually process 40 KM strips into high resolution ( [C848]

## "Recent advances in spaceborne precipitation radar measurement techniques and technology"

NASA is currently developing advanced instrument concepts and technologies for future spaceborne atmospheric radars, with an over-arching objective of making such instruments more capable in supporting future science needs and more cost effective. Two such examples are the second-generation precipitation radar (PR-2) and the nexrad-in-space (NIS). PR-2 is a 14/35-GHz dual-frequency rain radar with a deployable 5-meter, wide-swath scanned membrane antenna, a dual-polarized/dual-frequency receiver, and a real-time digital signal processor. It is intended for low earth orbit (LEO) operations to provide greatly enhanced rainfall profile retrieval accuracy while consuming only a fraction of the mass of the current TRMM precipitation radar (PR). NIS is designed to be a 35-GHz geostationary earth orbiting (GEO) radar for providing hourly monitoring of the life cycle of hurricanes and tropical storms. It uses a 35-m, spherical, lightweight membrane antenna and Doppler processing to acquire 3-dimensional information on the intensity and vertical motion of hurricane rainfall. [C849]

## "Wideband planar phased array antenna at Ku frequency-band for synthetic aperture radars and radar-guided missiles tracking and detection"

This paper introduces the complete design, simulation and implementation of 1Ч2, 1Ч4, 1Ч8 sub-arrays antennas and 8Ч8 planar phased array antenna including power combiners and matching networks. U-slotted rectangular microstrip patch antenna element with aperture coupled feeding technique and impedance bandwidth of more than 20% at center frequency of 17.75 GHz is used as an array element. Method of moment (MoM) is used in the analysis process using the agilent-momentum tool in advanced design system (ADS) package. Gain of about 9 dBi is achieved for the 1Ч2 sub-array, about 12 dBi for the 1Ч4 sub-array, and about 14 dBi for the 1Ч8 sub-array with about 80% efficiency. Better than -10 dB return loss parameters are achieved for all sub-arrays in the frequency band 16-18 GHz that ensures good impedance matching. Comparison between the measured and the simulated gain radiation patterns of the 1Ч8 sub-array shows good agreement. The developed sub-arrays antennas and the planar phased array antenna are suitable for different radar applications. This includes synthetic aperture radars (SAR) and the detection and tracking of the radar guided missiles. [C850]

## "Optimal solution of finite dimensional filtering problems via solution of linear ODEs"

The work of Yau and collaborators on finite dimensional filters is a major advance in the solution of the general nonlinear filtering problem. In this paper, the solution of Yau and Lai for a large class of finite dimensional Yau filters (that includes the linear filter) is further simplified. The complete solution of the finite dimensional filtering problem is given in terms of a system of linear ordinary differential equations, which are easy to implement. A natural and numerically stable numerical techniques, suggested by group theoretical techniques, is also presented. [C851]

## "ISAR image segmentation by non linear diffusion equation"

This paper describes a non linear spatial filtering for the target radar segmentation of ISAR/SAR images. Since such images are usually corrupted by speckle noise and clutters, image processing technique are required in order to obtain a more clear image. We have implemented a spatial technique based on the non linear diffusion equation, also known as the Perona-Malik equation. Our model is based on an calculation of the spatial gradient on a 5Ч5 stencil in order to increase the merging of target corresponding regions. By suitably estimating a diffusion coefficient related parameter, the gradient threshold, target segmentation is done into few integration steps of the equivalent explicit scheme. The resulting images maintain most of the original details also visible in converting the filtered image in a binary format. The proposed method can be the first step of target classification by matching correlation of more advanced techniques. [C852]

## "Transmit/receive isolation and ERP measurements of the AMRFC testbed"

High transmit/receive (Tx/Rx) isolation of phased-array systems on board future US Navy ships is critical to preserving the performance of these systems. The advanced multifunction radio frequency (AMRFC) Testbed is a one-of-a-kind phased-array system that was evaluated to determine the level of Tx/Rx isolation for certain scan angles. The effective-radiated power (ERP) of the AMRFC Tx array was also evaluated to verify the emission characteristics under certain conditions. The preliminary results of evaluating the Tx/Rx isolation and ERP are discussed in this paper. [C853]

## "High fidelity circular array simulation"

This paper describes a unique approach to performing high fidelity UHF circular array simulations on a high performance computer (HPC). Traditional airborne surveillance simulations have been limited in either spatial or temporal fidelity due to the expensive software and hardware requirements. Recently, advances have been made which provide the rapid deployment of high fidelity scenarios through a modular visual programming environment on an HPC. Based on the visual programming environment Khoros, the radar analysis simulation tool (RAST-K) is a flexible simulation for quickly prototyping airborne surveillance configurations containing radar system features, point targets, and USGS maps. Additionally, RAST-K has been ported to a Linux cluster to simulate realistic flight scenarios. As these scenarios involve changing characteristics between coherent processing intervals (CPIs), additional interfaces were developed to control platform, target, and environmental attributes, as well as partition the simulations across the resource of processors. This paper will discuss these topics by providing an overview of the RAST-K simulation and its use in the simulation of a circular UHF antenna configuration. After which, the simulation of realistic flight scenarios through the use of the HPC is discussed, alone with relevant results. [C854]

## "The fundamentals of selected radar advances"

{no data available} [C855]

## "EMI issues in UWB systems"

Recent advances in microcircuits and other technologies have resulted in the development of pulsed radar and communications systems with very narrow pulse widths and ultra wide bandwidths. These UWB devices can perform a number of useful radar and communication functions that make them very appealing for both commercial and military applications. UWB Systems are characterized by having either a large fractional bandwidth (Signal Bandwidth Г· Center frequency must be > ~0.2) or a signal bandwidth exceeding 500 MHz. These systems have very wide information bandwidths, and are capable of performing a number of useful military functions. UWB systems provide potentially superior performance when compared to legacy systems in certain military radio communication and sensing systems functions. The major advantages and disadvantages of UWB systems are related to the bandwidths associated with the ultra-short pulse waveforms that are used in most implementations of UWB technology. Although these ultra-short pulses result in potentially high data rates for communications and high-resolution imaging for radar applications, their associated wide bandwidths, result in the possibility of EMI across a wide range of frequencies. In this paper the author would like to bring out various advantages and disadvantages of UWB Systems and different EMI issues that are encountered with the

usage UWB Systems, from the available literature. [C856]

## "CCSMOMS:A Composite Communication Scheme for Mobile Object Management System"

In this paper, we discuss the design and implementation of a mobile object management system that makes use of the existing GSM (Global System for Mobile Communication) networks and it's extension-GPRS (general packet radio service) for data communication. We use a novel composite communication scheme (CCS), which uses SMS (short message service) and GPRS to achieve reliable and economical communication between mobile objects and the control center. We also use unified data management (UDM) for control center management, which significantly reduces the cost of maintaining separate data centers. We have deployed our services in two medium-sized cities with real users. The cost evaluation shows the high performance, usability and cost-effectiveness of this service in real production environment [C857]

## "An advanced architecture design for a high performance oblique backscattering ionosonde-WIOBSS"

WIOBSS is a new kind of the full phase-parameter, digital Ionospheric Oblique Backscattering Sounding System that has been developed by Ionosphere Lab in Wuhan University for Ionospheric monitoring and research. It bases on the principle of pseudo-random noise (PN) phase modulated pulse compression and employs long coded pulses, a high PRF, and coherent integration to achieve adequate sensitivity while operating at lower power (less than 800 watts). By means of WIOBSS system, we can get a lot of useful information, such as the dynamic change character of the Ionosphere, Doppler frequency shift and spread about the channel. According to the character of WIOBSS, this paper provides a discussion on its architecture design in detail. The experimental results demonstrate that this architecture is computer controlled by software, designed as VXI bus-based modelled radar digital signal processing system, and its flexibility, versatility, upgrading can fully satisfy the demands of WIOBSS. [C858]

## "Performance of a tetrahedral antenna array in the HF band"

Analysis of and measurements on an 8-element uniform linear array for HF surface-wave radar are described. The array covers 8 to 16 MHz with beam-steering over a 90° arc. A total of 16 tetrahedral antenna elements are used, arranged in eight doublet pairs. Theoretical analysis of the array is described, and measured radiation patterns taken on board a small boat in the North Sea are presented. [C859]

## "Real-valued self-orthogonal finite-length sequences with maximum absolute value less than 2"

A finite-length sequence with impulsive auto-correlation function is effective for detecting signal with high resolution in CDMA communications, radar, sonar and so on. A finite-length sequence with zero sidelobe autocorrelation function except at both shift-ends is an ideal pseudonoise sequence and is called the self-orthogonal finite-length sequence or Huffman sequence. This paper presents a set of real-valued self-orthogonal finite-length sequences with maximum absolute value <2. The set includes the reversed sequences and bit-reversed sequences and the member size of a set is nearly 1.3M for length M. The real-valued sequences can be converted to the integer sequences with less quantization error for a practical application [C860]

## "Comparative studies on the effect of analog and digital phase shifters on the scanned sum patterns"

Sum patterns are very popular for point to point communications and higher angular resolution radars. The advanced communication and Radar systems require scanning at faster rate. This requires the implementation of scanning by Digital phase shifters. In the present paper the effect of Digitization on this scanned sum patterns is consolidated. [C861]

## "Distributed mobility prediction in a hierarchical infostation systems"

The infostations system, small and separated islands of coverage, provides intermittent but very high speed rate. The short time the mobile terminal spends in the coverage area has direct impacts on the network performance. Thus, it is essential to avoid the bandwidth wasting due to the overall delay by performing mobility prediction. A new mobility prediction protocol called distributed neighbor discovery protocol (DNDP) is proposed. DNDP handles a neighbor graph table that dynamically configures itself according to the terminals' mobility. The simulation shows that the terminals service continuity is significantly improved thanks to DNDP. [C862]

## "A service creation environment for interactive, menu-driven mobile services"

In this article, we describe a service creation environment (SCE) that allows for protocol- and technology-independent development, deployment, and maintenance of interactive, menu-driven mobile services for cellular networks. The presented SCE eases the maintenance of mobile services, in particular by means of versioning and access right management. The SCE even allows third-party content providers to deploy services on their own by remotely accessing the SCE residing at a mobile network operator (MNO). The presented SCE is based on an open source content management system and currently supports maintenance of HTML-based service descriptions. [C863]

## "Invited Paper: Advances in Millimeter Wave Imaging and Radar Systems for Civil Applications"

Recent developments in the field of millimeter wavelength imagers intended for security and other applications are described. Passive mm-wave systems are now available that exploit high performance MMIC based sensors combined with mechanically scanned optics to provide highly cost effective industrial security cameras. The paper will describe the general principles inherent in the approach, describe the supporting technology and provide performance examples. Additionally the potential for the development of longer range sensor systems intended for surveillance and other applications is discussed [C864]

## "Simple Multiuser Detectors for DS-UWB Systems"

UWB is an emerging technology inviting major advances in wireless communication, networking, radar and positioning systems. In this paper, we present novel algorithms for the multiuser detection based on minimum mean square error (MMSE) for a DS-UWB multiuser communication system. The algorithms exploit the inherent multipath diversity and also mitigate the effects of both inter symbol interference(ISI) and multiuser interference (MUI). Simulation results show that the given algorithms perform better than the other known detectors in literature. We also provide closed form expression for the BER results of the above scheme [C865]

## "Construction of an experimental second-harmonic CUSP GUN GRYO-TWT amplifier"

Summary form only given. There is considerable interest in millimeter-wave amplifiers to be used in high-resolution advanced radar and communications applications. The gyro-TWT is an excellent candidate for these applications because of its potential to produce high power at millimeter-wave frequencies with broad bandwidth. There has been significant achievement in fundamental cyclotron frequency mode gyro-TWTs; however, they require superconducting magnets which increases the size, weight and complexity of operating the gyro-TWT. The required magnetic field for a gyro-TWT for a given frequency of operation is reduced by the number of the cyclotron harmonic; thus, with harmonic operation the gyro-TWT can potentially operate at high frequencies with conventional magnets or even permanent magnets. Unfortunately, gyro-TWTs operating at harmonics with a magnetron injection gun (MIG) suffer a significant loss in efficiency especially at higher harmonics. An axis-encircling beam is more suited to interact in a harmonic device. In the case of the MIG, electrons are constrained to a fixed azimuth so some electrons experience a weak RF field, while others over saturate in a strong field. In the axis-encircling beam, electrons rotate through both the peaks and nulls of the mode yielding a more efficient harmonic interaction. A second harmonic TE21gyro-TWT is being constructed at UCD that is predicted to produce 50 kW in Ka-band with 20% efficiency, 30 dB saturated gain and 3% bandwidth. The device is driven by a 70 kV, 3.5 A axis-encircling electron beam from a Northrop Grumman cusp gun. The magnetic circuit consists of water cooled copper magnet coils and iron pole pieces. The magnetic circuit is designed to provide both the magnetic field reversal required in the cusp gun region to produce the axis-encircling beam and at the same time a constant axial magnetic field of 5.48 kG in the interaction circuit region over the 42 cm length of the circuit. Recently the m- agnetic circuit was reoptimized to provide a better field profile match to the field profile required by the cusp gun in the field reversal region. In addition, the axial magnetic field is designed to ensure that each section of the device is free from oscillation [C866]

## "Phase pushing measurements of a four-cavity multiple-beam klystron"

Summary form only given. The phase sensitivity of a high power amplifier to fluctuations in operational parameters such as power supply voltage is an important characteristic for applications in advanced radar. We present the results of experimental measurements of the phase sensitivity (pushing factor) of a four-cavity multiple-beam klystron (MBK) operating in S-band. This MBK has recently been shown to generate ~600 kW peak RF power with an electronic efficiency of 40% and a 3-dB instantaneous bandwidth of ~2% at a center frequency of ~3.3 GHz. The nominal operating parameters of the eight-beam electron gun are 45 kV, 32 A (8times4 A). The measured pushing factor is in the range of 0.0134deg/volt to 0.015deg/volt and is in excellent agreement with analytic theory and large-signal simulation. We will discuss the experimental results, describe the measurement technique, and discuss the analytic model and simulations [C867]

## "Design and Realization of Embedded Image Transmission System Based on GPRS"

The embedded image transmission system introduced in this paper is realized in advanced RISC machines (ARM9) platform and embedded Linux system which has excellent network function, and it is connected to net through the general packet radio service (GPRS) module. Image is transmitted by multimedia messaging service (MMS). MMSprotocol stack, the design principle, the hardware structure and main software process to transmission image are introduced in detail, and put the system into wireless intellectual home safeguard control system, also it can be used in other watch field. [C868]

## "Advanced Laser Architectures for Lidar and Microwave Photonics Applications."

We report on different laser architectures dedicated to both lidar and microwave photonics systems. We first demonstrate two architectures of single-mode semiconductor lasers providing a relative intensity noise limited by the shot noise floor, over a large frequency range from 100 MHz to 18 GHz. Secondly, we show, through two experimental demonstrations, that dual-frequency lasers are well adapted to provide widely tunable and highly stable optically-carried microwave signals. [C869]

## "Ionospheric Interference Suppression in HFSWR"

Over the past two decades, significant advances have been made in the use of high frequency surface wave radar (HFSWR) for remote sensing in an ocean environment. As one of the main outside interference, ionospheric interference may badly affect radar's performance. An effective method for ionospheric interference suppression in HFSWR based on time-sharing coherent side-lobe cancellation (CSLC) is presented. Experimental results acquired with the HF system OSMAR confirm that the method can achieve effective ionospheric interference suppression, but not decreasing the strength of the first-order sea echo [C870]

## "Advanced Sensor Models: Benefits for Target Tracking and Sensor Data Fusion"

Modern sensor systems are typically characterized by advanced signal processing techniques which have direct impact on the quantitative and qualitative properties of the sensor data produced. This makes a more advanced modeling of the statistical characteristics of the sensor output inevitable. Via constructing appropriate likelihood functions based on these models the performance of Bayesian tracking and sensor data fusion techniques can be much improved. The proposed paper discusses the benefits by selected examples from various applications [C871]

## "Vehicle Route Guidance Systems: Classification and Comparison"

Route guidance in vehicular roadways has become an important and emerging method of congestion alleviation. The proliferation of low cost electronics such as sensors, wireless communication, and computing equipment has now made large scale vehicle navigation practical. The advanced computational equipment available has made performing complex algorithms in real time possible, the key to the operation of vehicle route guidance systems. While route guidance systems fundamentally strive for similar optimum operation, several important differences exist in the design of these systems. This paper presents an investigation of some of the main distinctions between these systems. Much work has been done in this field in the past, which is presented here as a classification and comparison of such systems [C872]

## "Development of advanced entry, descent, and landing technologies for future Mars missions"

Future Mars missions may need the capability to land much closer to a desired target and/or advanced methods of detecting, avoiding, or tolerating landing hazards. Therefore, technologies that enable "pinpoint landing" (within tens of meters to 1 km of a target site) will be crucial to meet future mission requirements. As part of NASA Research Announcement, NRA 03-OSS-01, NASA solicited proposals for technology development needs of missions to be launched to Mars during or after the 2009 launch opportunity. Six technology areas were identified as of high priority including advanced entry, descent, and landing (EDL) technologies. In May 2004, 11 proposals with PIs from universities, industries, and NASA centers, were awarded in the area of advanced EDL by NASA for further study and development. This paper presents an overview of these developing technologies [C873]

## "Silicon full integrated LNA, filter and antenna system beyond 40 GHz for MMW wireless communication links in advanced CMOS technologies"

Today, SiGe HBT and MOSFET cut-off frequencies are higher than 230 GHz (Chevalier et al., 2004) and this increase allows new millimeter wave (MMW) applications on silicon such as 60 GHz WLAN and 77 GHz

automotive radar. This study focuses on a wireless communication block with the antenna integration. Functions such as amplifier and filter have been used to perform this block. This is a demonstration of individual component integration and co-integration with antenna/LNA matching. Antenna achieved on advanced sub 120nm HCMOS high resistivity silicon on insulator (HR SOI) (p >1 kOhms.cm) has been designed and integrated. A low noise amplifier (LNA) and a filter have been retained for this first chain. Antenna and block characterizations are led on a dedicated on-wafer test bench. Antenna performances in term of gain and radiation pattern are given. A communication link has been then established between a single antenna (-2 dB gain) and the full communication block with a -19 dB transmission gain at 40 GHz [C874]

## "Metal Layer Monitoring in DRAM Production by use of Spectroscopic Ellipsometry-based Scatterometry"

Current available metrology methods for metal layer line monitoring could include atomic force microscopic (AFM) scanning for trench depth measurement and top-down secondary electron microscope for CD measurement (CD-SEM). However, they both suffer from incomplete information outputs and repeatability issue. Transmission electron microscope (TEM) cross-sections and SEM cross-sections are the two major techniques for obtaining detailed profile information. However, both they are destructive and time-consuming. Scatterometry comes in as a potential process-monitoring candidate for the metal layer process. In this work, we use SE-based scatterometry to demonstrate a two-dimensional profile of the metal trench profile with post-etched structure, as well as CD and depth measurements of the trench. Theory and measurement results of dense structure are briefly discussed. These results are correlated to SEM cross-sections, AFM measurements and CD-SEM measurements. The data shows high correlation between them. Moreover, WAT data were seen a high correlation result in the paper as well [C875]

## "Simulative analysis of access selection algorithms for multi-access networks"

It is expected that future wireless systems will consist of several distinct radio access technologies (including WCDMA/HSDPA, GSM/EDGE/GPRS, WLAN and others) forming a multi-access system that offers advanced voice and multimedia services. Previous works have shown that the combined capacity region of such systems depend on the service allocation policy that assigns user sessions to the available subsystems. The currently available service allocation policies typically operate off-line implying that the actual service mix is assumed to be known prior to the service allocation taking place. In this paper we consider the on-line problem according to which sessions arrive one after the other and no assumptions on the service mix can be made. We adopt four on-line bin-packing algorithms to the multi-access environment and study their performance by means of simulation in terms of the class-wise blocking probability and throughput. We find that the algorithm termed Less Voice provides the best performance in terms of the blocking probabilities and imposes the least slow down for elastic sessions [C876]

## "An Interactive Software for Real-Time Simulation of Through-the-Wall Imaging Radar"

An interactive software written in Visual C# has been developed to provide real-time simulation capabilities for imaging behind the wall scenes. The software implements algorithms and techniques developed by the researchers at the Center for Advanced Communications in Villanova University, but is also amenable to house other imaging approaches. The software features a user friendly and flexible graphical interface that permits easy and interactive scene construction, from specification of the wall and array element locations to placement of objects at various locations behind the wall. All operations are performed using comprehensible dialog boxes and mouse drag-and-drop actions. For illustration, we present an example that demonstrates the usage of the real-time through-the-wall imaging radar simulator. The software serves as an educational tool for courses on radar imaging, introducing the students to the important emerging technology of through-the-wall imaging [C877]

## "Advanced Optical Processor for Arbitrary Waveform Radar Imaging"

Essex has developed a prototype hybrid optical/digital processor for range-Doppler image formation using wideband arbitrary waveforms. The processor is called the advanced optical processor (AOP) and is a hybrid acousto-optic/digital processor that generates high dynamic range, range-Doppler images from wideband radar returns in real time. The AOP was first tested at a U.S. Government facility in November 2005. The AOP is currently scheduled to be tested with a range radar in April 2006. The laboratory testing included three waveform types and verification of all the necessary trigger control signals. The range radar testing will include collection and processing of the same three waveform signals to demonstrate arbitrary waveform capability. The AOP supports high resolution processing necessary for target discrimination and kill assessment by enabling the use of true arbitrary wideband waveforms. The selected architecture combines the advantages of both optical signal processing for the front-end receiver and high-speed digital signal processing for the real-time processing. Its

size is a 6U form-factor and fits within the 6U electronic chassis [C878]

## "CopperCore Service Integration-Integrating IMS Learning Design and IMS Question and Test Interoperability"

This article describes a framework for the integration of e-learning services. There is a need for this type of integration in general, but the presented solution was a direct result of work done on the IMS learning design specification (LD). This specification relies heavily on other specifications and services. The presented architecture is described using the example of two of such services: CopperCore, a LD service, and APIS, an IMS question and test interoperability service. One of the design goals of the architecture was to minimize the intrusion for both the services as well as any legacy client that already uses these services [C879]

## "Mobile Learning: Is Anytime + Anywhere = Always Online?"

The new e-learning trend, called mobile learning opens variety of questions to solve. To allow access to learning content anytime and anyplace a technique called hoarding is sometimes indispensable for covering the periods of disconnection. In this paper we show the outcomes of the hoarding sub-system of Mobile ELDIT system, developed at the University of Trento. Our results demonstrate that in certain scenarios anytime, anywhere m-learning might be reached even without online access available [C880]

## "The GPOF-based Ground Return Deembedding in Stepped Frequency Ground Penetrating Radar"

The work is devoted to a problem of detecting shallow underground objects like anti-personnel mines using ultra-wideband ground penetrating radar (GPR). In case of step-frequency radar, an inverse discrete Fourier transform (IDFT) is a standard data processing technique to convert the raw radar data into the range profile. The latter can be used for detecting buried targets and estimating their depth. Here, an advanced data processing algorithm based on a general-pencil-of-functions (GPOF) method is proposed to improve the radar performance. [C881]

## "Need for large local FPGA-accessible memories in the integration of bio-inspired applications into embedded systems"

Advanced Principles Group (APG) has developed a reconfigurable computing board (RCB) based on the Xilinx Virtex-II Pro FPGA family, potentially capable of 1.5-2.0 TeraOps of compute power, 100 Gbps I/O on front panel, 4 Gbps I/O on backplane, as well as containing more than 4 GBytes of on-board memory. Computationally complex applications such as software-defined radio, synthetic aperture radar, hyper-spectral imaging and cellular neural networks drive similar wide bandwidths and therefore require super-computing I/O and signal processing densities far exceeding the capabilities of current and future microprocessor-based system technology. We illustrate how such applications benefit from the large amount of local FPGA-accessible memory (4+ GBytes) provided on the RCB [C882]

## "Pre-Crash Application for Multiple Target Situations"

In this paper a system model for an extended crash area is developed, which takes the maximum possible maneuvers and a reaction time of the driver into account simultaneously. The driver reaction time includes the current state of the steering wheel and the time needed to change from the throttle to the braking pedal. Advanced detection of crashes gives the opportunity to improve safety and to reduce serious consequences of the passengers. With decreasing driver reaction time the safety gain based on actuators can be improved. This concept finally offers a crash detection with an extended reaction time for the actuator. [C883]

## "Disk Topography Metrology for Addressing Head-Disk Interface Challenges"

A new technology for topography metrology of bare glass, metal substrate and finished media is presented. The capabilities of this technology relative to other methods and how it addresses requirements for advanced head-disk interface (HDI) challenges is discussed [C884]

## "Study on Rectangular Waveguide Grating Slow-Wave Structure with Cosine-Shaped Grooves"

Recently, a new need for high-frequency, high-power sources has been emerging for advanced radar and communication needs, with frequencies in the band between 100 and 300 GHz and peak powers as high as several hundreds of kilowatts, and with bandwidth of up to 10%. After investigation of the interaction mechanisms of different slow-wave structures, the rectangular waveguide grating SWS has attracted the scholar's interest due

to some of its peculiarities: the scalability to smaller dimensions and shorter wavelengths, high precession of manufacturing and assembling, super thermal conductivity and low loss, which make it worth consideration, especially at millimeter-wave frequency-band. From the investigation of the different structures, such as V-type, cosine-type, dovetail-type, etc., the cosine-shaped groove SWS has the weakest dispersion and the widest bandwidth. In this paper, this type of structure was analyzed. [C885]

## "Integrated ODP metrology as an APC enabler for complex high aspect ratio 3D deep trench device structures"

The current technology node and the complexity of device design and processing demand metrology systems that can provide profile and underlying layer information in one measurement; and perform this task with high accuracy and precision. Additionally, manufacturability and yield management requirements increase the need for fast, reliable, non-destructive and economical measurements that allow for extensive wafer sampling plans. The work in this paper shows promise that integrated optical digital profilometry (iODP) is a fast, non-destructive metrology solution to address these aforementioned challenges. In the following discussion, we present results of a characterization experiment where ODP is employed to measure 3-dimensional (3D) DRAM device structures on the leading edge technology node at four different process steps, including high aspect ratio multi-layer deep trench layers. [C886]

## "Methods of Turbulence Detection by Analyzing Precipitation Behaviour"

Recent advances in the radar system design allow to perform Doppler and polarimetric measurements simultaneously. This paper considers behaviour of different Doppler-Polarimetric parameters, such as slope of differential reflectivity, differential Doppler velocity, Doppler spectrum width, and mean Doppler velocity. Possibility of combining both polarimetric and pure Doppler measurements opens new horizons in turbulence and precipitation study. More and more new techniques appear every year. This paper describes some of these methods. [C887]

## "Recent Developments of Radar Remote Sensing; Air- and Space-borne Multimodal SAR Remote Sensing in Forestry & Agriculture, Geology, Geophysics (Volcanology and Tectonology): Advances in P0L-SAR, IN-SAR, POLinSAR and POL-DIFF-IN-SAR Sensing and Imaging with Applications to Environmental and Geodynamic Stress-change Monitoring"

In this overview, reasons are provided on why we do need to place multimodal, multi-band single and multiple pass POLinSAR monitoring platforms into air and space. The questions" on what POLinSAR monitoring can provide that POL-SAR and INSAR by themselves cannot accomplish " is assessed; whereupon facts and justifications on placing POL-IN-BISAR satellite clusters into space are presented. Reasons for this technology becoming a basic requirement for current, near-future and much more so for future all-day & night year around monitoring of the terrestrial covers are analyzed in view of the un-abating and uncontrollable terrestrial population explosion, which has, does and for ever will result in unavoidable conflicts deteriorating unfortunately at times into terrorism. The pertinent questions on how to reduce the exorbitant cost for initiating this "home-globe security protection"technology are therefore also broached, and the expected benefits are laid out. The pertinent National and International airborne and space borne multi-modal, multi-band SAR remote sensing and security conflict surveillance support agencies are herewith invited for co-sponsoring our proposal, which is timely and fleets of orbiting multi-band space-borne POLinSAR platforms are urgently required. [C888]

## "Multi-mode Microwave Remote Sensing Antenna Subsystem on Satellites"

This paper presents briefly design, assembly and testing of the multi-mode microwave remote sensing antenna subsystem of China. It concentrates active and passive microwave remote sensors. A prime focus paraboloid reflector, with the diameter of 600 mm, is applied as the altimeter antenna. The scatterometer antennas consist of two prime-focus reflectors, which take conical scanning and form two pencil beams orthogonal in space and polarization. The radiometer antenna is an offset paraboloid reflector with multi-frequency, dual polarization and common aperture feed. Computer aided integrated design for multi discipline, advanced assembly and holographic measuring techniques, which are used to achieve high accuracy, are also introduced. [C889]

## "Advanced signal processing improves search radar"

Modern fast signal processing can improve search radar performance significantly. Fast sampling will allow wide bandwidths, higher range resolution, an enhanced digital pulse compression ratio and dynamic range, less clutter and better ECCM. This paper reminds and analyzes what has become possible [1]. [C890]

## "Model-Based Aircraft Recognition"

This paper gives a brief account of a way of recognising aircraft using radar range profiles which does not need large numbers of radar measurements of the aircraft of interest beforehand The method is based on constructing backscatter models of the aircraft by identifying regions of high backscatter using drawings, photographs and commercially available scale models of the aircraft. Methods and results are briefly discussed. [C891]

## "High-Frequency Radar Signature Simulation of Complex Targets"

This paper describes an approach to the simulation of radar signatures from large complex targets. Due to the difficult problems of actual measuring and scaling measuring for the signature of large-scale radar targets under the condition to wideband, an effective approach of computing high-frequency radar cross section (RCS) to complex targets is presented in advance, and then the target's ID range profile can be obtained. The result suggests that it is possible to obtain satisfying simulated radar signature using this approach. [C892]

## "Space Time Adaptive Processing Estimates for IBM/Sony/Toshiba Cell Broadband Engine Processor"

In order to enhance the processing capabilities while keeping the power consumption at a reasonable level, processors have become more integrated with additional logic units. An exciting example of this technology trend is the Sony/Toshiba/IBM new Cell multi-core processor. This paper explores the application of a computationally intensive algorithm implemented on the Cell processor. The algorithm analyzed in this paper is the Space-Time Adaptive Processing (STAP). STAP is an advanced method to detect targets with small cross sections in noisy environments. [C893]

## "Security Enhanced Indoor Location Tracking System for Ubiquitous Home Healthcare"

Advances in sensor networking and location tracking technology enable many location-based applications but they create significant privacy risks. This paper describes our study on design of security enhanced indoor location-tracking system for in-building, ambient discovery application, location-dependent healthcare applications. Ceiling-mounted beacons are spread throughout the building which publish location information on RF and ultrasonic signals and allows applications running on mobile and static nodes to learn their physical location. The object to be tracked carries listener node, this node listens the beacons information as they arrived and forwards these beacons signals to the base station. A listener computes its position within the coordinate system, using the distances from multiple beacons with known beacon coordinates. This paper concentrates on privacy problem location aware sensor networks, since location information is especially privacy sensitive and potentially specific enough to reveal the identity of individuals. Also describe two ubiquitous home healthcare applications that use the location-tracking problem which we have implemented. [C894]

## "Conference Record of The Fortieth Asilomar Conference on Signals, Systems & Computers"

The following concepts are discussed: capacity of ad hoc networks; MIMO radar; temporal analysis and mining in multimedia; advances in medical imaging; DSP architectures;- MIMO ad hoc networks; adaptive systems for communications; advanced optical techniques for biology; adaptive filters; sensor networks; computer arithmetic; image and video processing; performance analysis for communications; statistical signal processing and applications; biometrics and security in image processing; wireless networks; VLSI digital signal processing; video coding and analysis; speech and audio processing; resource allocation in networks; sparse adaptive systems; blind source separation; geospatial image processing; biomedical signal and image processing. [C895]

## "Single Camera 3D Lane Detection and Tracking Based on EKF for Urban Intelligent Vehicle"

Road boundary detection and tracking is an important and integral function in advanced driver-assistance system. This paper proposes an algorithm, which can follow multi-kinds of lane, straight and curved, quickly and robustly. The algorithm uses several masks to extract blobs of road markings, combining with KNN function to remove the disturbance. Further more, road is modeled as a 3D surface, and some important parameters of current lane are provided on real-time by tracking based on Extended Kalman Filter (EKF). The results of experiments, which have been done in urban road, show that the algorithm is adapted to many road conditions. Even in a complex driving environment, it also has a good performance. [C896]

## "Analysis and Design of GPS based Target tracking system and MIL-STD-1553B Radar Target data"

The proposed system entitled "Analysis and Design of GPS based Target tracking system and Radar Target

data" will help the pilot, test engineers and radar evaluation team in real time and during offline by means of analyzing the path of the target aircraft and HACK aircraft in desired map and will provide navigation specific parameters such as latitude, longitude, altitude, speed, range etc. The system will save the target information during flight. The system will work in both online and offline mode. In this system the data is received from two independent systems (i) GTTS: Target information is received from the data modem and (ii) RADAR: Target information tracked by the RADAR available on MIL-STD-1553Bus. Using GTTS and RADAR data, the flight position of the targets is calculated and the path of the flight is shown on the map. This system also provides different zoom in and zoom out features for different map selection. [C897]

## "Compatible Advanced Definition Television System with Redundancy Reduction by Means of Wavelet Transform"

First Page of the Article [C898]

## "The Application of AMSR-E Soil Moisture for Improved Global Agricultural Assessment and Forecasting"

Soil moisture is estimated by the U. S. Department of Agriculture (USDA) Production Estimates and Crop Assessment Division (PECAD) by utilizing a modified two-layer Palmer water balance model derived from temperature and precipitation observations. It is envisaged that these soil moisture estimates can be improved by integrating passive microwave data which has greater temporal frequency and covers larger spatial domains than available in the past. By integrating direct observations from the EOS Advanced Microwave Scanning Radiometer (AMSR-E) into the current PECAD soil moisture model, more accurate soil moisture and correspondingly crop yield estimates may be possible. This paper presents a methodology for soil moisture data assimilation using a simple bias correction and 1D Ensemble Kalman Filter data assimilation algorithm. An outline of the technical approach is presented. [C899]

## "Electronic steerable MEMS antennas"

Recent advances in the technology of radiofrequency (RF) circuits, such as RF-microelectromechanical systems (MEMS) make it possible to practically implement electronically reconfigurable antenna arrays paving the way to innovative communication systems including applications such as next generation mobile communications, radar applications, remote sensing and imaging. This paper reviews the basic implementations of such antenna systems, namely phased arrays and reflectarrays, as well as the algorithms allowing for beam shaping, beam steering, null placing etc., as well as the typical RF-MEMS circuitry for both amplitude and phase control. [C900]

## "Predictive-Transform Source Coding With Subbands"

Minimum mean squared error (MMSE) predictive-transform (PT) source coding is integrated with subband compression to further improve the performance of low bit rate MMSE PT source coders. A desirable byproduct of the advanced scheme is that the incorporation of joint optimum prediction and transformation from subband to subband is ideally suited to its integration with JPEG2000 to yield even higher compression levels while producing an outstanding objective as well as subjective visual performance. [C901]

## "Compression-Designs in Artifilcial and Living Systems"

A novel practical and theoretical foundation for signal processing, named processor coding, is advanced as the computational time compression dual of source coding. Source coding is concerned with signal source memory space compression while processor coding is with signal processing computational time compression. Since source coding and processor coding solutions are characterized by compression designs, their combined use is given the name compression-designs (referred as Conde in short). A compelling and pedagogically appealing descriptive diagram of Conde is also given which highlights its remarkable successful application to knowledge-aided (KA) airborne moving target indicator (AMTI) radar subjected to severely taxing environmental disturbances. [C902]

## "Direct Perception Interface for Ship-Ship Collision Avoidance"

Ship-ship collisions have the potential to cause catastrophic marine accidents with human and economic losses as well as environmental pollution. Safe navigation is a major operative task for the officer(s) on the watch (OOW) as the ultimate responsibility for safe navigation resides with the human navigator. Though the universal use of automatic radar plotting aid (ARPA) system on board ships has greatly reduced the maritime collision risks, it brings the OOW great burden for collision risk assessment and in the planning of suitable evasive actions in complex situations (e.g., many targets approaching own ship simultaneously). This paper concerns the

development of a direct perception interface that displays collision danger lines (CDL) and collision danger sectors (CDS) to acquired targets for the OOW to enable a quick collision risk assessment and plan evasive maneuvers well in advance of a developing situation. A preliminary experimental study of this display has been conducted. The results showed that CDS display had the potential to improve navigators' performance compared with ARPA display. Further study is required to investigate the merits and demerits of this display. [C903]

## "Estimation of the Deformation Temporal Evolution Using Airborne Differential SAR Interferometry"

This paper presents airborne DInSAR results using a stack of 14 images, which were acquired by the Experimental SAR (E-SAR) system of the German Aerospace Center (DLR) during a time span of only three hours and fifteen minutes. An advanced differential technique is used to retrieve the error in the digital elevation model (DEM) and the temporal evolution of the deformation for every coherent pixel in the image. Furthermore, some modifications in the differential processing chain are included to deal with the existence of the so-called residual motion errors, which play a similar role as atmospheric artifacts in the spaceborne case. The detected deformation of a corner reflector and of some agricultural fields allows to validate the proposed techniques to measure deformation phenomena with an airborne platform. [C904]

## "Assimilating Passive Microwave Brightness Temperature Data into a Land Surface Model to Improve the Snow Depth Predictability"

This paper introduces the application of the ensemble Kalman filter (EnKF) technique for the assimilation of passive microwave remote sensing observations into a landsurface model, to improve the snow depth (SD) predictability. A new landsurface model, currently developed at the Japan Meteorological Agency (JMA), which is based on the simple biosphere model (SiB), is used as a forward model to predict the change of the snow pack. The microwave emission model of layered snowpacks (MEMLS) is used as observation operator, to transfer the model prediction into the corresponding satellite brightness. The assimilation system was applied using data from the coordinated enhanced observation period (CEOP) Asia-Australia monsoon project (CAMP) Eastern Siberia Taiga region for the period from November 2002 to March 2003. The data sets includes JMA-GSM model output, which is used as forcing data, satellite brightness temperature observation from the advanced microwave scanning radiometer (AMSR-E) and in-situ snow depth (SD) observation and the current AMSR-E snow depth product for comparison. The assimilation results are in good agreement with the data from the snow depth observation sites in this region and improve the forecast of the land-surface model. Furthermore, comparison with the AMSR-E SD product showed, that the assimilation results are also in better agreement with the in-situ snow depth observation. [C905]

## "Simultaneous Perturbation Stochastic Approximation Algorithm for Automated Image Registration Optimization"

Automated intensity-based image registration approaches become popular and urgent when facing today's increasing data mining and frequent fusion demands. As a core part of an automated image registration system, many kinds of gradient-based optimizers were proposed in the past decade. In this paper, a local gradient-free optimizer, namely the simultaneous perturbation stochastic approximation (SPSA) algorithm, was firstly applied for the automated multi-source image registration using the mutual information as a similarity measure. Results of rigid experiments on the image pairs of ASTER-ASTER, ASTER-Map and SAR-SAR showed the SPSA optimizer has much more flexibility and efficiency than the traditional gradient ascent optimizer. It is more suitable as a local optimizer to the automated image registration system. The main shortcoming of this algorithm is too many control parameters needed during the execution process. [C906]

## "Recent Advances in Polarimetry and Polarimetric Interferometry"

Radar polarimetry radar Interferometry and polarimetric SAR interferometry represent the current culmination in 'microwave remote sensing' technology, but we still need to progress very considerably in order to reach the limits of physical realizability. Whereas with radar polarimetry the textural fine-structure, target orientation, symmetries and material constituents can be recovered with considerable improvement above that of standard 'amplitude-only' radar; by implementing 'radar interferometry' the spatial (in depth) structure can be explored. With polarimetric interferometric synthetic aperture radar (POL-IN-SAR) imaging, it is possible to recover such co-registered textural and spatial information from POL-IN-SAR digital image data sets simultaneously, including the extraction of digital elevation maps (DEM) from either polarimetric (scattering matrix) or interferometric (dual antenna) SAR systems. Simultaneous polarimetric-plus-interferometric SAR imaging offers the additional benefit of obtaining co-registered textural-plus-spatial three-dimensional POL-IN-DEM information, which when applied to repeat-pass image-overlay interferometry provides differential background validation and environmental stress-change information with highly improved accuracy. Then, by either designing multiple dual polarization antenna

POL-IN-SAR systems or by applying advanced POL-IN-SAR image compression techniques, will result in 'POL-arimetric TOMO-graphic' (multi-interferometric) SAR or POL-TOMO-SAR imaging. By advancing these EWB-D-POL-IN/TOMO-SAR imaging modes, we are slowly but steadily approaching the ultimate goal of eventually realizing airborne and spaceborne 'geo-environmental background validation, stress assessment, and stress-change monitoring and wide-area military surveillance of the terrestrial and planetary covers'. [C907]

## "Improving Satellite Moderate Resolution Instrument Geolocation Accuracy in Rough Terrain"

When Earth-locating (geolocating) modern moderate resolution instrument data, such as from NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) on the Earth Observing System (EOS) Terra and Aqua satellites, corrections for Earth terrain effects are applied to enable accurate retrieval of global geophysical parameters. The current approach to terrain correction calculates the pierce point of the center of each observation with a digital terrain model. With the recent Shuttle Radar Terrain Mapping Mission (SRTM) terrain model data, which has a higher spatial resolution and better accuracy than previous global terrain models, there is an opportunity to improve geolocation accuracy in rough terrain by using more advanced techniques to compute geolocations that are more representative of the centroid of each observation. The authors evaluate whether calculating geolocation using an observation weighting approach is significantly better than calculating the pierce point geolocation and if so under what conditions. The relative additional computational cost of an approximate technique is weighed against the possible increase in geolocation accuracy. [C908]

## "Design and implementation of PALSAR Ground Data System at ERSDAC"

The Phased Array type L-band Synthetic Aperture Radar (PALSAR) is one of the imaging sensors onboard the Advanced Land Observing Satellite (ALOS) launched on January 24, 2006. The antenna of PALSAR is beam steerable to realize a variety of off-nadir angles. There are multi-polarimetric (dual and quad) observation modes and single polarimetric modes. It has also ScanSAR modes to observe a wide swath (250 km-350 km). PALSAR Ground Data System (GDS) has been developed at ERSDAC since 1999. In the system, raw data provided from JAXA are processed to SAR images as final products which are archived and distributed to the worldwide users. The SAR data processor of PALSAR GDS is designed to achieve optimal data quality as well as maximum performance to meet the requirements from various users. [C909]

## "Segura River Aquifer (SE Spain) Obtained by Means of Advanced DInSAR"

The hydrological quality of an aquifer system is evaluated by means of two parameters: its capabilities to transmit water (transmissivity, T) and to store water (storage coefficient, S). In this work, a method based on temporal data of the surface subsidence is employed to calculate storage coefficients (S) and transmissivities (T) of the Vega Media of the Segura river aquifer-system. Subsidence data are obtained by means of differential SAR interferometry. The retrieved values of S for all available wells vary from 3.2 times 10-5to 1.9 times 10-3m/m. For the only well where water flow is available, a T value of 0.302 m2/day is estimated. First results show a reasonable agreement between data calculated with this technique and other acquired by means of in situ measurements. [C910]

## "FPGA-based Implementation of a Polarimetric Radiometer with Digital Beamforming"

In [1] a general overview of the PAU system is provided. This work describes in more detail the implementation of the polarimetric and pseudo-correlation radiometer (PAU-RAD) that measures the four Stokes parameters. [C911]

## "FPGA Implementation of Embedded Cruise Control and Anti-Collision Radar"

The ModEasy project seeks to develop techniques and software tools to aid in the development of reliable microprocessor based electronic (embedded) systems using advanced development and verification systems. The tools are to be evaluated in practical domains such as the automotive sector for reactive cruise control and anti-collision radar. We choose to define specific IPs using FPGA techniques to cover this application domain. This paper presents the implementation of such a complex and safety application on a single FPGA. The target system is composed of a reactive cruise control, a detection radar and the associated treatments [C912]

## "Advanced High Precision Radar Gauge for Industrial Applications"

This paper presents a highly accurate and reliable radar gauging system for continuous level measurement in industrial bulk storage tanks. The radar system has a compact size and is explosion proof. It consists of a stepped frequency continuous wave (SFCW) transmitter and receiver with monostatic gastight antenna. The frequency range is from 9.5 to 10.5 GHz. With advanced signal processing software algorithms implemented in

the microprocessor, the accuracy of plusmn0.3 mm over whole measuring range has been obtained. Even if under severe multi-path effect from tank wall and mismatched high-mode interference in standpipes, an accuracy of plusmn1 mm can still be attained [C913]

## "An application of advanced spectrum estimation to multi-channel radar detection and location"

We explore the application of an advanced spectral estimation technique to target detection and localization in multi-channel space radar systems. Previous work had applied motion compensation and array calibration to produce SAR-like range-Doppler images for each channel, followed by a maximum likelihood angle of arrival (AOA) and alternating projections (AP) technique designed to optimally detect and locate targets in this representation. Moving targets in a given range-Doppler cell exhibit a channel-to-channel phase difference after the motion compensation and array calibration. This phase progression may also be detected and estimated using spectral estimation approaches. However, since the target and clutter phase ramps are very close, a super-resolution approach is needed. The reduced-rank linear predictor ROCKET is investigated in this role. It is shown that the original technique has a two-threshold capability that provides two opportunities to discard false alarms, whereas the pure ROCKET-based approach only has one. As a result, the two-threshold AOA+AP technique generally outperformed the ROCKET-based algorithm in Monte Carlo simulations. Furthermore, the two-threshold construct holds the promise for further performance improvements pending ongoing investigations [C914]

## "Effective Testing Principles for the Mobile Data Services Applications"

Wireless communication technologies like GPRS, UMTS and WLAN, combined with the availability of high-end, affordable mobile devices enable the development of advanced and innovative mobile services. Devices such as mobile phones and personal digital assistants let the users access a wide range of new offerings whenever and wherever they happen to be. A strategic approach for the quality assurance of these mobile data services should take into account a number of characteristics unique to the mobile paradigm such as the increased complexity of emerging handheld devices, the greater sensitivity to security and load related problems in wireless infrastructure and increased complexities of scale. This paper identifies the major factors influencing the development and testing strategies for these applications and works out effective quality assurance principles to ensure productive and scalable mobile data services [C915]

## "Lateral velocity estimation based on automotive radar sensors"

Automotive radar sensors are applied to measure the target range, azimuth angle and radial velocity simultaneously even in multiple target situations. The single target measured data are necessary for target tracking in advanced driver assistance systems (ADAS) e.g. in highway scenarios. In typical city traffic situations the radar measurement is also important but additionally even the lateral velocity component of each detected target such as a vehicle is of large interest in this case. It is shown in this paper that the lateral velocity of an extended target can be measured even in a mono observation situation. For an automotive radar sensor a high spectral resolution is required in this case which means the time on target should be sufficiently large [C916]

## "Indoor Localization Scheme in Wireless Sensor Networks Using Spatial Information"

Position information of individual nodes is crucial for many advanced functions including routing, querying and computer security forensics in wireless sensor networks. Most of the existing localization algorithms in wireless sensor networks are designed for outdoor environment and few of them can get a reasonable localization precision in indoor environment. This paper presents a novel indoor localization scheme which uses the spatial connective information to filter distorted messages, so as to improve the positioning precision. We establish an indoor positioning dome system, make performance comparison with other schemes and fully prove the advantages of our proposed indoor scheme [C917]

## "Design of Multi-carrier Digital Frequency Synthesizer for Coast-ship Multi-static GroundWave OTH Radar"

To design a digital frequency synthesizer of multi-carrier frequencies for the coast-ship multi-static ground wave over-the-horizon (OTH) radar, an analysis of the approach has been made by using multiple DDS chips AD9854. The constitution of the radar is introduced briefly. The synthesizer generates multiple signals of linear frequency modulated interrupted continuous wave (LFMICW) which should have different carrier frequencies as well as controllable initial phases and will be transmitted simultaneously. An effective method for generating LFMICW by advanced DDS technology is proposed in the paper. The designs of the FPGA control logic and the peripheral circuits are presented as well. The synthesizer has been implemented in the experimental radar system. The experimental results indicate that the phase noise of the frequency synthesizer is -92.6dBc@1Hz, which has met

the stability demands for long term coherent integration in high frequency ground wave radar [C918]

## "Low Cost Millimeter Wave Radars in the automotive field"

The first practical radar applications date from before World War 2, but radar techniques are widely used nowadays in a large number of mostly military or 'professional' civilian applications. They make use of extremely high frequencies generated by traditionally expensive technologies. Recent advances in electronics components, in terms of speed of development and cost, allow us to predict radar being used for civilian mass-market products, such as motor cars. In particular, these advances concern RF components in the millimeter wave bands with high-speed, wide-range digitization systems and digital signal processors [C919]

## "High Performance MM-Wave Radar Techniques"

The Millimetre Wave and High-Field ESR Group at St Andrews has recently been developing a range of mm-wave radar technologies that have yielded the successful development of various advanced prototype systems exhibiting state-of-the-art performance, which are reviewed here. These include a long-range, high resolution FMCW imaging radar for volcano mapping, and a nanosecond pulsed, coherent, radar-like system developed for spectroscopy [C920]

## "Target Classification by Radar"

Target classification by radar has enormous potential with many important applications. So far, with a couple of notable exceptions, this has proved to be an extremely challenging problem with no obvious solution. The chief method for improving the quality of information gathered has been to improve resolution in both range and cross-range dimensions. Recent advances, chiefly in digital technology means that radar systems are now able to operate varying parameters such as frequency, waveform, PRF, bandwidth on a pulse by pulse basis. Additionally, there is emerging evidence that geometric diversity when gathering measurements to be used for classification is an equally important factor. This paper will examine the relationship between radar design parameters and data collection strategies as a basis for solving the problem of radar target classification [C921]

## "Advances in Short Range Radar"

Short range UWB radar systems have significantly improved in capability over the last few years. Availability of high performance, low cost RF and processing components has delivered a number of improvements: multiple functions can be offered from a single system; size and power consumption has been reduced which in turn has led to lighter weight systems; and simplification of the RF front end. Ability to offer 3D location of scattering responses provides a significant advantage in fusion with video devices. Additional processing power has led to increased interest in synthetic aperture radar (SAR) techniques for ground based radar systems [C922]

## "Frequency-Dependent Modeling of Ultra-WideBand Pulses in Human Tissue for Biomedical Applications"

Due to the recent advances in ultra wide-band (UWB) radar technologies, there has been widespread interest in the possible medical applications of UWB microwave radar. To facilitate the development of signal processing algorithms, numerical methods may be used to generate representative backscattered signals. Two techniques for modelling the propagation of electromagnetic waves (UWB pulses) in human tissue, are presented: the planar technique and finite difference time domain (FDTD) technique. A four layer biological model is considered with three layers of normal tissue, and one layer of cancerous soft tissue (sarcoma). The two modelling techniques are used to predict the response of the model to the UWB input signal, with particular emphasis on the response of the sarcoma layer. It will be shown that both the Planar technique and the FDTD technique identify the presence of the soft tissue sarcoma quite easily. However the FDTD technique predicts more subtle phenomena such as multiple reflections, albeit at a higher computational cost [C923]

## "The Advanced Simulation System for MMW Imaging Radar Seeker onboard Air-to-air Missile"

Millimeter wave (MMW) radar is booming in application to target seeker onboard the air-to-air missile (AAM), which has the capability to obtain all-weather radar images for auto target recognition (ATR) and intelligent active homing guidance. An advanced simulation system for MMW imaging radar seekers of AAM was introduced in this paper. The system is composed of parameter initialization module, signal simulation module and image formation module. It is capable of investigating and demonstrating the system performance of MMW radar seeker. The modeling of radar signal and the geometric model for missile-to-target were presented in particular. The echo signal for major radar operation modes could be generated by the system, including high-resolution range profile (HRRP) mode, Doppler beam sharpening (DBS) mode as well as the high-resolution

burst-SAR mode. The image formation algorithms for each radar operation mode were integrated in the system to generate highly accurate radar imagery. Computer simulation results for an actual aircraft were presented, which validate the correctness of the simulation system. It is an advanced tool for the investigation of imaging algorithms and the optimization of the system parameter selection, as well as the demonstration of the radar scenario [C924]

## "Advanced Techniques for Watershed Visualization"

Analytical shaded relief is commonly used for visualization of digital elevation models (DEMs). Sometimes, the quality of unaltered analytical shaded relief can be lacking for identification of streams and water divides. Hydroshading is a technique that provides enhanced capabilities of visualization of hydrologically-meaningful topographical features. In this research, hydroshading algorithms are applied to NASA's Shuttle Radar Topography Mission (SRTM) DEM datasets. The visualization technique is applied to coastal and inland watersheds in Mississippi (Saint Louis Bay and Luxapallila, respectively). The testing of hydroshading in these two areas shows that the technique is more effective in areas with moderate topographical relief than in low relief terrain. Combining hydroshading with standard three- dimensional visualization identification of water Hydroshaded DEMs were used to manually delineate Luxapallila and Saint Louis Bay's Wolf River catchments. Delineation results are comparable to output of standard automated delineation produced by GIS software (BASINS). [C925]

## "Waveform Diversity in Intelligent Sensor Systems"

Waveform diversity in distributed radio frequency (RF) sensor systems offers the potential for breakthrough performance enhancements in the detection and identification of natural and manmade objects. This paper discusses advances in relevant technology and emerging applications to radar [C926]

## "Interference-Mitigating Waveform Design for Next-Generation Wireless Systems"

A brief historical perspective of the evolution of waveform designs employed in consecutive generations of wireless communications systems is provided, highlighting the range of often conflicting demands on the various waveform characteristics. As the culmination of recent advances in the field the underlying benefits of various multiple input multiple output (MIMO) schemes are highlighted and exemplified. As an integral part of the appropriate waveform design, cognizance is given to the particular choice of the duplexing scheme used for supporting full-duplex communications and it is demonstrated that time division duplexing (TDD) is substantially outperformed by frequency division duplexing (FDD), unless the TDD scheme is combined with further sophisticated scheduling, MIMOs and/or adaptive modulation/coding. It is also argued that the specific choice of the direct-sequence (DS) spreading codes invoked in DS-CDMA predetermines the properties of the system. It is demonstrated that a specifically designed family of spreading codes exhibits a so-called interference-free window (IFW) and hence the resultant system is capable of outperforming its standardised counterpart employing classic orthogonal variable spreading factor (OVSF) codes under realistic dispersive channel conditions, provided that the interfering multi-user and multipath components arrive within this IFW. This condition may be ensured with the aid of quasi-synchronous adaptive timing advance control. However, a limitation of the system is that the number of spreading codes exhibiting a certain IFW is limited, although this problem may be mitigated with the aid of novel code design principles, employing a combination of several spreading sequences in the time-frequency-and spatial-domain. The paper is concluded by quantifying the achievable user load of a UTRA-like TDD code division multiple access (CDMA) system employing loosely synchronized (LS) spreading codes exhibiting an IFW in comparison to that-of its counterpart using OVSF codes. Both systems' performance is enhanced using beamforming MIMOs [C927]

## "Tunable Filters Based on Dielectric Resonators"

Summary form only given. The 'TUF' tuneable filters Framework 5 project was focused on the development and characterization of tuneable ceramic dielectric resonators, of tuneable filters based upon them and on cryogenic bolometry based on a coupled tuned resonator. Its objectives were conceived in the light of strategic developmental needs of the European Community. Contractors of the project were as follows: National Physical Laboratory (NPL), Ericsson Radio Access, Filtronics Comtek (FC), Josef Stefan Institute (JSI), Forshungszentrum Julich (FZJ), London South Bank University (LSBU), and Warsaw University of Technology (WUT). Several prototype resonators and tuned filters have been constructed by TUF partners based, respectively, on ferromagnetic, simulated-MEMs and piezoelectric tuning. The resonators and filters include the following: ldr Single-pole ferromagnetic axially tuned filter (WUT ) ldr Single-pole ferromagnetic circumferentially tuned filter (WUT) ldr Two-pole ferromagnetic axially tuned filter (WUT) ldr Two-pole ferromagnetic circumferentially tuned filter (WUT) ldr Single pole MEMs-tuned filter with 4 tuning slots (FZJ) ldr Single-pole dielectric resonator filter

with piezoelectric bimorph tuning (LSBU) ldr Two-pole hybrid-mode dielectric resonator filter with piezoelectric bimorph tuning (LSBU) ldr Four-pole hybrid-mode filter based on two dielectric resonators with piezoelectric bimorph tuning (LSBU) .All of these devices present significant steps forward in filter design and have provided important new practical information about the implementation of electronic tuning in high Q-factor filters. The three filters, in bold type in the above list, each employing a different tuning mechanism, and each developed in a different TUF partner's laboratory, are the most advanced filters of each type that were comprehensively tested during the TUF project. [C928]

## "High-Resolution Radars for Environmental Studies"

Recent advances in the design and realization of high-resolution radars for environmental studies are discussed. Two types of such instruments are considered: Doppler, millimeter-wave meteorological radars and an airborne SAR system, which have been developed at the Institute of Radio Astronomy of the National Academy of Sciences of Ukraine. The meteorological radars have been designed for long-term, unattainable operation at remote locates. The SAR system benefits essentially from a novel algorithm, which enables the estimation of the antenna beam orientation angles directly from the radar returns. The SAR with this technique introduced can be operated from small aircrafts without using of a complicated navigation system. The set-up of these instruments, the technical solutions, and the signal processing techniques introduced are discussed. The results obtained during measurement campaigns are presented as well. [C929]

## "Ultra-broadband Nonlinear Microwave Monolithic Integrated Circuits in SiGe, GaAs and InP"

Analog MMIC circuits with ultra-wideband operation are discussed in view of their frequency limitation and different circuit topologies. Results for designed and fabricated frequency converters in SiGe, GaAs, and InP technologies are presented in the paper. RF type circuit topologies exhibit a flat conversion gain with a 3 dB bandwidth of 10 GHz for SiGe and in excess of 20 GHz for GaAs processes. The concurrent LO-IF isolation is better than -25 dB, without including the improvement due to the combiner circuit. The converter circuits exhibit similar instantaneous bandwidth at IF and RF ports of >7.5 GHz and >10 GHz for SiGe BiCMOS and GaAs MMIC, respectively. Analysis of the frequency behaviour of frequency converting devices is presented for improved mixer design. Millimeter-wave front-end components for advanced microwave imaging and communications purposes have also been demonstrated. Analysis techniques and novel feedback schemes show improvement to the traditional circuit design. Subharmonic mixer measurements at 50 GHz RF signal agree very well with simulations, which manifests the broadband operating properties of these circuits. [C930]

## "Project Resolution; Reconfigurable Systems for Mobile Local Communication and Positioning"

The aim of RESOLUTION project is developing of a wireless three-dimensional (3D) local positioning system with resolution in the centimetre regime and real-time ability. The system is intended to work in environment with strong multipath effects and fading. The solution will be implemented in advanced CMOS technology. Main project goals are: development of a wireless 3D high accuracy local positioning system, a novel frequency modulated continuous wave (FMCW) radar principle with pulsed active reflector will be employed, positioning system will be implemented on basis of common WLAN systems, to allow multifunctional tasks, highly integrated system on chip (SoC) frontends will be designed on advanced CMOS technology, smart power and adaptive performance control will be applied to minimize the power consumption according to application needs, in order to enhance the performance and coverage range, the transceiver features adaptive antenna combining in the radio frequency (RF) receiver. [C931]

## "A Multiband Passive Radar Demonstrator"

Passive radar systems that exploit signals from the plethora of RF emissions that exist in the external environment offer a number of advantages over conventional active radar system, including procurement and operational cost saving. Each emitter has its own characteristics, including waveforms, which dictate system performance. BAE Systems Advanced Technology Centre has designed and built a demonstrator system to act as a test bed for passive sensor research. The system operates over a multi-octave bandwidth and can exploit both analogue and digital transmissions from both broadcast and communication systems. This offers advantages over single band systems; for example, multiple observations in different bands using different geometries allow fusion of tracks to achieve more robust and accurate tracks. This paper outlines the system and design issues that were addressed during the development of the demonstrator, including the simulation model, and prediction of bistatic target signature. Results of experimental work illustrating the operation of the demonstrator system with targets of opportunity are shown. [C932]

## "Triangulation and Deghosting"

Triangulation and deghosting is the most complex part in multitarget tracking. It considers the relationship between the directions measured by the sensors and the original, real targets. This paper gives an overview and comparison, how advanced multisensor multitarget tracking methods can be applied and combined. [C933]

## "Implementation of differential repeat-pass SAR interferometry for (i) the search for earthquake precursory land-cover deformation in Taiwan in co-ordination with the integrated Search for Taiwanese Earthquake Precursors iSTEP' Taiwanese program for promoting research excellence; and (ii) the assessment of land-cover subsidence by ground-water withdrawal and/or sea-water infusion by coastal erosion"

Worldwide, medium-to short-term earthquake prediction is becoming ever more essential for safeguarding man due to an un-abating population increase, but hitherto, there have been no verifiable methods of reliable earthquake prediction developed -except for a few isolated examples of such in China and in Greece. This dilemma is a result of previous and still current approaches to earthquake prediction which are squarely based on the seismic measurement of crustal movements, observable only after a tectonic stress-change discharge (earthquake) has occurred. The prediction models derived from past histories of measurements were mainly carried out during the past 40-50 years, although initiated soon after the San Francisco earthquake of 1906. During the past decade it was proved and shown that it is not possible to derive reliable models for earthquake predictions from crustal movement measurements alone-as valuable and as indispensable those indeed are-and that an entirely new approach must be taken and rigorously pursued over many years and decades to come, and most likely throughout this twenty-first century. Of considerable importance will be the full integration of multi-band (P-K Band) repeat-pass differential interferometric Polarimetric Synthetic Aperture Radar (POL-SAR) space borne and high-altitude platform monitoring operations which will be considered here in conjunction with "seismo-electromagnetic " ground measurements. It will be shown that Taiwan is ideally suited for studying earthquake related electromagnetic precursor studies in that the island is separated from other continental regions, and there exist the resources, the dedication and will power for advancing our knowledge most rapidly. Both land-based and sub-oceanic measurement networks already exist, which need to be upgraded and perfected. With the aid of experienced and knowledgeable experts, this will be done soon. [C934]

## "Power Amplifier Linearization and Efficiency Improvement Techniques for Commercial and Military Applications"

This paper presents some recent developments in the area of power amplifier (PA) linearization and efficiency improvement techniques. Advanced digital pre-distortion (DPD) architectures implemented with digital signal processing (DSP) are discussed. Various results of improvements in intermodulation distortion (IMD) when applied to high power RF amplifiers are presented. Crest factor reduction (CFR) has been shown to substantially increase the power output, and hence the efficiency of PAs operating with high peak-to-average waveforms. The combination of DPD and CFR is shown to improve both efficiency and linearity to levels previously unachievable with analog technologies alone for commercial wireless applications. Independent of these signal processing techniques, polar transmitter circuit architectures have been proposed to improve PA efficiency. A combination of a polar transmitter architecture operating in combination with DPD and CFR is proposed in this paper to address more demanding military wireless communications applications. [C935]

## "Digital and Super-Resolution Ultra Wide Band Inter-Vehicle Localisation System"

We develop a digital multiple-antenna ultra wide band frequency modulation radar system devoted to inter-vehicle localisation applications. In this system, the radio frequency signal received in each receiver is digitized by an analog-to-digital converter (ADC) at the intermediate frequency. The phase method is used for direction of arrival (DOA) and time of arrival (TOA) estimations that are used for localisation purpose based on the hybrid technique named DOA/TOA. The DOA is estimated by measuring the phase difference of the signals picked up by the elements in the antenna array and by using the MUSIC (multiple signal classification) algorithm; meanwhile the TOA estimation is based on the IFFT (inverse fast Fourier transform) or the MUSIC algorithm. The system presents a lot of advantages of ultra wide band technology; the digital solution in terms of signal processing by software radio without hardware changing; and the high resolution method for DOA/TOA estimation. The system is simulated using ADS (Advanced Design System) and Matlab is used for signal processing. The simulation results show a promising solution for an inter-vehicle localisation system in particularly and for localisation applications in general. [C936]

## "Optimizing Eigenvector-Based Frequency Estimation in the Presence of Identical Frequencies in Multiple Dimensions"

Recently an eigenvector-based algorithm has been developed for multidimensional frequency estimation. Unlike

most existing algebraic approaches that estimate frequencies from eigenvalues, the eigenvector-based algorithm can achieve automatic frequency pairing without joint diagonalization of multiple matrices, but it is not applicable if there exist identical frequencies in certain dimensions. In this paper, we propose to use weighting factors to extend the eigenvector-based algorithm to handle identical frequencies in one or more dimensions. The weighting factors are optimized by minimizing the error variance. Simulation results demonstrate the effectiveness of the proposed approach [C937]

## "Robust Parallel Filtering for Mobile Agent Tracking"

In this paper we develop a robust method of target/mobile agent tracking involving two independent estimators with separate measurement systems. The outputs of the two estimators are combined using simple trigonometry (post-estimation data fusion) and provide a robust and reliable tracking path. We demonstrate that through the use of recent advances in robust set-value state estimation, our robust parallel filter approach performs well even when the individual filters do not. Brief comparisons with common data fusion methods are conducted in order to demonstrate the advantages of our parallel (post-estimation fusion) approach [C938]

## "FMCW Radar Transmitter Based on DDS Synthesis"

This paper presents some design problems and aspects of building FMCW radar transmitter based on DDS. Significant parameters of this radar are small targets detection possibility, small resolution cell and high range resolution. It requires resolving a problem of generation microwave signals with excellent linear frequency modulation and very good phase noise performance. One of possible solution is DDS (direct digital synthesis) technology, which is rapidly advancing. [C939]

## "Comparison of A Planar and Finite Difference Time Domain Technique to Simulate the Propagation of Electromagnetic Waves in Biological Tissue"

Due to the recent advances in ultra wide-band (UWB) radar technologies, there has been widespread interest in the possible medical applications of UWB microwave radar. Therefore, the development of accurate numerical techniques to predict the propagation of UWB signals in biological tissue is of great interest to researchers as an aid in developing signal processing algorithms. Two techniques for modeling the propagation of electromagnetic (EM) waves in human tissue are presented and compared in this paper: the planar and finite difference time domain (FDTD) technique. A four layer biological model is considered, three layers of normal tissue, and one layer of cancerous soft tissue (sarcoma). The two modeling techniques are used to predict the response of the model to the UWB input signal, with particular focus on the response of the sarcoma layer. Both the Planar technique and the FDTD technique identify the presence of the soft tissue sarcoma quite easily. However the FDTD technique predicts more subtle phenomena such as multiple reflections, albeit at a high computational cost. [C940]

## "Advanced Technique for Optimization of Active Frequency Multiplier Utilizing Harmonic Terminating Impedances with DGS"

A novel method for the optimization of the active frequency multiplier utilizing the harmonic terminating impedances with the defected ground structures (DGS) has been developed. Furthermore, a new type of the low-pass filter with DGS for the higher harmonic suppression will be reported. Experimental conversion gains (14.52 dB for the doubler, 5.56 dB for the tripler and 0.43 dB for the quadrupler) and real power-added efficiency (32.76% for the doubler, 10.15% for the tripler and 1.42% for the quadrupler) have been attained. To our knowledge, in the considered frequency range, these results represent the best performance reported up to date for the active frequency multipliers utilizing the low-cost BJT. [C941]

## "RCS Aspects of Multi-Band Radar Systems Composed of "VHF," L" and "X" Band Radars"

An essential characteristic of any radar target is the measure of its ability to reflect energy to the receiving antenna. The parameter used to describe this ability is the radar cross section (RCS) of the target. Stealth techniques and technologies, which affect the efficiency of early warning radar systems currently in operation, are described in ref [1]. The problem is to find countermeasures that fully integrate new requirement capabilities into the current long-range radar net and infrastructure, keeping research & development, and maintenance costs, low. The netcentric approach recently proposed in ref [2] using VHF-based multi-band radar systems is a new concept for Recognized Air Picture production based on long-range radars, which offers a powerful solution for the surveillance of large areas at a reasonable cost. Target RCS behaviour, fluctuations due to aspect angle and frequency are of particular interest in these systems, because the antenna beam positioning of the "VHF", "L" (or "S") and "X" band radars should be synchronised in azimuth and elevation. Targets could change

orientation, course and kinematical characteristics during the time required for beam positioning. Advance knowledge and accurate prediction of target RCS is therefore desirable in order to design and develop efficient (robust) discrimination algorithms for the optimisation of target detection, tracking and non-cooperative target recognition. This paper reviews the target RCS aspects in current radar systems of interest, and examines RCS behaviour for use in future multi-band radar system applications. [C942]

## "Autonomous driving in a time-varying environment"

Robot motion is a field of continuing and active research that has recorded a number of achievements in the last decade, but research appears to be becoming stagnant in key areas. Current researchers limit the success of their work by using sensors with limited features capable of operating in static environments with known static obstacles and not considering implementation on non-holonomic vehicles. These simplifications of the task of dynamic obstacle avoidance greatly reduce the possible applications of current robot motion algorithms in areas such as autonomous driving. This paper deals with algorithms for on-the-fly avoidance of dynamic obstacle by presenting a new approach, the time-varying dynamic window algorithm capable of operating at high speeds on a non-holonomic vehicle in an environment that changes over time. [C943]

## "2005 IEEE MTT-S International Microwave Symposium (IEEE Cat. No.05CH37620C)"

{no data available} [C944]

## "Advanced ground-based ESCAN radars"

Electronically scanned radars (ESCAN radars) are key system elements of ground based military systems being developed for air and missile defense against future threats including tactical ballistic missiles, high agile and low RCS targets like drones, ARMs, UAVs. The radar design is governed on the one hand by challenging requirements on ESCAN radar performance and on the other hand by strict limitations on weight and volume dictated by the need of high system mobility and transportability. First the paper discusses the important role of ESCAN radars within the architecture of mobile air defense systems. Secondly, key characteristics of ESCAN radars operating as primary sensor of an air defense system with a netted distributed architecture are addressed. Advanced ESCAN radars can meet the requirements of both multifunctional performance and high mobility, if advanced technology and innovative algorithms are applied. [C945]

## "Current status of airborne active phased array (AESA) radar systems and future trends"

AESA technology reached a mature technology level and is being adopted by advanced radar programmes. T/R modules are the key enabling technology and cost reduction efforts in this field are in progress. For future applications, GaN, MEMS RF switches and tile type T/R modules are anticipated and will pave the way for conformal and multi-function AESA radar systems. [C946]

## "Circuit and system design for future microwave systems"

Microwave systems continue to benefit from technological and system advances that provide for new levels of performance, form factor and lowered cost. In the past, these advances were primarily associated with new materials systems or device types (e.g. GaAs, GaN, InP, MEMS, HBTs, PHEMTs, etc.). Although improvements continue in these and other new areas, system designers are increasingly looking for areas where advances in CMOS digital IC technology can improve the performance of microwave systems. The ability to realize millions of logic gates in an area the size of a bond pad provides the signal processing capability required for highly adaptive microwave systems, which monitor their environment and adapt their matching, tuning, bias, or configuration, to realize the best possible performance. These adaptive microwave systems find wide application in areas as diverse as active phased-array radars, wireless local area networks and even the ubiquitous cellular telephone. This paper summarized the device and signal processing requirements of these new adaptive systems of the future, and highlight some of the research areas required for further development of the field. [C947]

## "Circular synthetic aperture sonar design"

Medical imaging enjoys a reputation of applying multi-aspect sensing to construct internal maps of patients. The CAT scan evokes a concept of an X-ray probe moving around the patient; the multi-aspect data is processed to construct images of the areas of interest. In contrast, advanced acoustic imaging of objects on the ocean floor has to date relied only on high resolution sensing from limited aspect angles using data gathered on straight-line trajectories. With the increased application of UUVs, it is fitting to consider the factors that govern the design of sonar that can reconstruct images taking advantage of data with aspect diversity. One future paradigm will be circular synthetic aperture sonar (CSAS) using tomographic methods to reconstruct scenes of interest from data

obtained over a full circular aperture. This presentation will address the parameters and procedures that play a role in CSAS and the relations between them that govern the performance of such a system. The design of a CSAS for high resolution surveillance of objects on the ocean bottom depends on parameters such as the diameter of the circular trajectory, the speed of the platform, the size of the imaged circle, and the ping repetition rate. The spatial and range resolutions are functions of the sonar signal wavelength and its bandwidth. These parameters define in turn the maximum allowable uncorrectable platform position errors, which lead to defining the requirements of the hypernavigation system that is needed to correct for the errors between the actual ping and receiver positions and the ideal sonar trajectory used in the main imaging computation. A possible realization of such a navigation system is described in the presentation. The ping repetition rate requirements are determined by the largest dimension and shape of the reflecting areas to be imaged. Analytical expressions relating all of the above mentioned design parameters are derived. These relationships define various performance metrics as functions of the deployment parameters, allowing optimization of search strategies to maximize area coverage rate for a choice of multiple circle patterns. Images of several objects using data from a turntable testbed at Lake Travis Test Station of the Applied Research Laborato- ries of the University of Texas at Austin will be shown and discussed in relation to the design and test parameters. [C948]

## "Building damage detection from post-earthquake aerial imagery using building grey-value and gradient orientation analyses"

The collapsed buildings due to 1999 Kocaeli earthquake were detected from post-event panchromatic aerial imagery based on grey-value and the gradient orientation of the buildings. The building boundaries were available and stored in a GIS as vector polygons. The building polygons were utilized to perform the assessments in a building specific manner. The approach was implemented in a selected area of Golcuk, which is one of the urban areas most strongly hit by the earthquake. First, the buildings were selected one-by-one from the integrated vector (building boundaries) and raster (aerial photo) data set. The building damage detection process was then divided into two branches. In the first branch, the detection was performed using the building grey-value information. To do that, a greyvalue threshold (T1) was determined for discriminating the collapsed buildings from the un-collapsed ones. In the second branch, a group of operations including the gradient calculation and the determination of gradient orientation were performed. By utilizing the orientation information, an optimum threshold level (T2) was determined for the standard deviation of the angle distribution of the building pixels. When assessing the condition of a building, the results of the two branches were combined and a final decision was made in an integrated manner. Of the 284 buildings analyzed, 254 were labeled correctly as collapsed or un-collapsed providing an overall accuracy of 89.44%. The results reveal that the collapsed buildings due to the earthquake can be successfully detected from post-event aerial images. [C949]

## "Space in the service of society: a Canadian case study"

Canada places great emphasis on using space science and technology for the benefit of its citizens. Canada's first satellite, Alouette-1, was launched to study the ionosphere in order to advance our understanding of a range of phenomena associated with solar storms-from disturbances in radio communications in Canada's North to the majestic Northern Lights. The Canadian space program has recognized that adapting space-based technologies and processes for applications on Earth is the best way to surmount uniquely Canadian challenges, such as the vast distances and variety of landscapes and climatic conditions that define Canada. In the sixties, while looking for a way to connect communities scattered over our vast expanse, Canada came up with a proposal for its own national communications satellite system. Another project, Canada's Radarsat-1 satellite, provides surveillance of the country's huge expanse of land and sea. In addition, it has captured 15% of the global commercial market for Earth observation data. Canadian researchers have collaborated with NASA to build the robotic arm onboard the Space Shuttle. This led to an invitation for Canadian astronauts to participate in NASA's Human Spaceflight program. To date, there have been 11 flights by Canadians. [C950]

## "Oil slick detection by SAR imagery using Support Vector Machines"

Spaceborne Synthetic Aperture Radar (SAR) is well adapted to detect ocean pollution independently from daily or weather condition. In fact, oil slicks have specific impact on ocean wave spectra. Initial wave spectra may be characterized by three kinds of waves, big, medium and small, which correspond physically to gravity and gravity-capillary waves. The increase of viscosity is due to the presence of oil damps gravity-capillary waves. This induces a damping of the backscattering to the sensor, but also a damping of the energy of the wave spectra. Thus, local segmentation of wave spectra may help oil slick detection. It can be achieved by the segmentation of a multiscale decomposition of the original SAR image. In this work, a supervised oil slick detection is proposed by using Support Vector Machines into the wavelet decomposition of a SAR image. It performs accurate detection with no consideration to signal stationarity nor to the presence of strong backscatters (such as ship). Moreover, when using normalized SAR images, the kernel expansion may be generalized from

one image to an other to make a near unsupervised detection scheme. The algorithm has been applied on Envisat ASAR images. First experiments yield accurate segmentation results with a very limited number of false alarms. [C951]

## "Spatial correlation SAR system with complementary signals"

In this work a new analytical geometrical approach in the description of the synthetic aperture radar (SAR) scenario, and high range resolution complementary phase code technique in SAR signal modulation and a spatial correlation image reconstruction procedure are suggested. The objects on the Earth surface are depicted in a 3-D Cartesians system and presented as assemblies of isotropic point scatterers of different intensities in relation to their reflectivity properties. No constraints are applied in the determination of point scatterers' distances from the observation point localized on the aircraft, moving with a constant velocity on a rectilinear trajectory arbitrary oriented in a 3-D Cartesians system. Objects on the Earth surface are illuminated by complementary phase code pulses providing for a high range resolution in SAR imaging. By applying geometrical summing of signals reflected from separate point scatterers of an object with complicated shape a 3-D model of a SAR signal is created. A spatial correlation image reconstruction procedure is developed. The reference function necessary to accomplish the spatial correlation is constructed on the assumption that the observation area is presented as a 3-D regular grid in the nodes of which isotropic point scatterers with identical intensities are placed. To verify this approach to the SAR problem numerical experiment is carried out. [C952]

## "Three-dimensional ISAR image reconstruction technique with multiple receivers"

In this work a new three-dimensional (3-D) model of deterministic components of ISAR trajectory signals with linear frequency modulation is suggested. 3-D ISAR geometry is described based on the analytical geometrical approach. The geometry and kinematics of the object and ISAR observation system are described in separate 3-D Cartesian coordinate system. The object space, moving rectilinearly, is presented as a 3-D regular grid of isotropic point scatterers. The analytical expressions for computing the range distance to point scatterers of the object space are derived. The complex ISAR signal, reflected from the 3-D target is obtained by four receivers, placed on the axes and origin of the coordinate system of observation. Four 2-D ISAR signals, registered by receivers appear to be four 2-D projections of the 3-D ISAR signal. The 3-D image is considered as a set of 2-D images retrieved from the 2-D ISAR signal projections. The image reconstruction procedure includes both range and azimuth compression. Fast Fourier transforms are applied to each 2-D ISAR signal projection to realize range compression and azimuth compression. A synchronized range alignment and an autofocusing technique are applied to each received ISAR signal projection. To illustrate the capability of the 3-D ISAR signal model numerical experiment is accomplished. [C953]

## "Seismotectonic investigation on the Bam earthquake prone area (Iran) based on ASAR interferometry"

In this study the Satellite Radar Interferometry (InSAR) was applied to investigate the crustal deformation caused by the Bam Earthquake (Mw=6.5) that occurred in Iran on December 26, 2003. It was a multiple seismic event that destroyed the historical City of Bam and provoked great damages in the urban centers of the region. The Bam area in the south-eastern part of Iran is an active seismic zone and the Bam Fault System is comprised by three specific segments (north, east and SE of Bam). The three-pass interferometric technique was applied using ENVISAT ASAR scenes. According to the interferometric processing results subsidence has occurred in the area NE of Bam City, while dextral strike-slip displacement has taken place in the southern area of Bam. The last deformation could be attribute to a parallel hidden segment of the Bam Fault that is reaching the surface according to the shear displacement during the earthquake. [C954]

## "Advanced radar systems"

{no data available} [C955]

## "FCM algorithm and index CS for the signal sorting of radiant points"

FCM algorithm is a well-known unsupervised clustering algorithm, which needs to know the number of clusters in advance. This paper proposes a method that uses GA according to the optimal value of an evaluation index CS to determine the best cluster result and its corresponding clustering number of FCM. This method prevents from the subjective and large computation by traditional method. The simulation results show that when the number of clusters is reasonable, FCM gets a better performance in signal sorting of radiant points. [C956]

## "Landmine imaging by a hand-held GPR and metal detector sensor (ALIS)"

We are developing a new landmine detection system, namely advanced landmine imaging system (ALIS), which is equipped with metal detector (MD) and ground penetrating radar (GPR). Despite it is a hand-held system, we can record the MD and GPR signals together with the sensor position information acquired by CCD camera. Therefore, MD image and GPR image can be obtained after signal processing. Since ALIS is a hand-held system, the sensor position is random when it is operated in the field. So interpolation processing is needed to provide a gridded data set for both MD and GPR. A good MD image can be achieved after interpolation. Also, interpolation can prepare the gridded data set for migration. 3D Kirchhoff migration is used to enhance the signal-clutter ratio for effective image reconstruction. The ALIS was tested in Afghanistan in December 2004 and showed a good performance. In particular, the GPR could obtain a good image of anti-personnel (AP) mine buried at more than 20 cm depth. Also images from both sensors could be combined to distinguish a mine from a metal fragment. [C957]

## "Drill head mounted obstacle avoidance radar"

Horizontal drilling in soft soil provides an efficient and cost effective solution for the installation of utilities. However, with the increased congestion of underground utilities, the probability of damaging mislocated or unknown utilities increases, reducing the financial benefits of this technology and increasing the possibility catastrophic damage such as striking gas lines. It is hence important to develop instrumentation that is capable of locating obstacles lying along the bore paths. This paper discusses the development of a obstacle avoidance system based on ground penetrating radar technology. The system is a stepped frequency continuous wave (SFCW) radar that has been designed to fit within a standard 2.75 inch diameter drill head. The only above-ground components are the human machine interface (HMI) and power supply. Communication and power are transmitted underground via a wireline technique. An advanced demonstration model has been built and tested. The paper provides an overview of the requirements of an obstacle avoidance radar system. This is followed by a brief discussion of radar and antenna development required to implement the system. Finally results of indoor and outdoor field trials will be provided. [C958]

## "Advanced mid-IR solid-state laser developments"

This paper reviews the state-of-the-art 2-micron solid-state laser developments. A world record one-Joule-per-pulse energy laser system and an advanced thermal management with fully conductive cooled laser technique are discussed. [C959]

## "Aircraft detection and tracking using intelligent cameras"

Systems that provide ground movement management at airports, maintaining ground safety and increasing air traffic capacity, are called A-SMGCS (advanced surface movement guidance and control systems). However, common A-SMGCS systems, based on surface movement radars (SMR), are affected by limitations in their coverage due to reflections or shadows from objects on the airport surface. Hence, the use of a complementary system is necessary to act as a "gap-filler", i.e. to provide accurate ground movement information for these problematic areas. This paper aims to present a novel cost-effective video-based system to act as a "gap-filler" for existing A-SMGCS systems. The proposed system consists of a network of intelligent digital cameras, which are able to detect the presence of an aircraft or vehicle in specific locations within their fields of view, and then provide this information to a multiple hypothesis tracking (MHT) algorithm to extract target tracks. [C960]

## "Improving tracking accuracy using information of dissimilar sensors"

Making use of information acquired from a sensor network to improve the accuracy of target tracking is one of the most important issues in sensor network research. This paper demonstrates this philosophy using a distributed dissimilar sensor fusion scenario, where a tracker was established and maintained by a surface radar sensor and the distributed sensor fusion is performed whenever target measurement from an angle-only sensor is available to the radar sensor. The target state information is extracted from the angle-only sensor measurement so that the distributed track fusion at radar sensor can be performed. The extended Kalman filters (EKF) have been used to implement all tracking functions due to the nonlinearity between target state and the associated sensor observations. The scenario is conveniently implemented using advanced radar tracking system (ARTS) toolbox in Matlab Simulink environment. Our simulation results have shown the improvement of the (racking accuracy bv applying distributed track fusion. The convenience of using ARTS toolbox for complex algorithm implementation and testing are also clear from the context. [C961]

## "A lane departure warning system using lateral offset with uncalibrated camera"

In this paper, we propose an automatic method for determining the lateral offset of the vehicle with respect to the center of the lane. Initially, a linear-parabolic model is used to detect lane boundaries. The linear part of the

model is then used to obtain an estimation of the lateral offset, without the knowledge of any intrinsic or extrinsic camera parameter. Finally, the analysis the offset across time is then used to determine a lane departure measure, allowing lane crossings to be detected in advance. [C962]

## "Managing PI-resources in 4G wireless systems: the opportunistic way"

Integration of different radio access networks will become a reality in the near future. Our interworking architecture assumes a ubiquitous primary network (the cellular one) and secondary networks used on an availability basis. Secondary networks form islands of coverage providing partial and intermittent (PI) resources with greater quality of service as the user moves along. This paper describes an application architecture that manages these resources in an opportunistic way. It makes use of the open service access (OSA) to control the core network and the OSA application servers to host the new applications that can take advantage of the PI-resources. These applications create a context for secondary networks and the context can survive losses of coverage. [C963]

## "Wireless link dimensioning: priority versus sharing"

The introduction of the multiple access service GPRS (general packet radio service) on GSM networks (global system for mobile communications) increases the use efficiency of radio resource through the sharing of data and voice users on the available channels in GSM networks. A comparison of two techniques for wireless link dimensioning of telecommunications networks is presented in this paper. The synthesis models are developed considering that the resources are shared between voice and data users. Schemes considering Markovian model and priority model are presented. Traffic overload simulations were made in order to analyze the behavior of the resulting quality of service parameters. [C964]

## "Statistical agreement between observed microwave satellite radiances and NWP hydrometeors including hexagonal plates and rosettes"

Accurate global observation of precipitation for all latitudes and seasons, and for all land, sea, and ice surfaces remains an elusive goal. One major obstacle to progress is lack of reliable global ground truth on horizontal and vertical scales consistent with those observed by satellite. For example, radar and scatter-dependent radiometric techniques respond to precipitation aloft, not on the ground, and can be unduly sensitive to large hydrometeors. On the other hand, rain gauges are excessively sensitive to local rainfall inhomogeneities and wind, and well-instrumented sites are rare. This paper quantitatively compares satellite observations with mesoscale numerical weather predictions of microwave brightness temperatures at those millimeter wavelengths most sensitive to hydrometeor structures and to the physics of precipitation. Only such models with high horizontal and vertical resolution allow comparisons of different sensors in detail. A Mesoscale Model, MM5, and a forward radiance program, TBSCAT, have been used to simulate radiances that would be observed from the Advanced Microwave Sounding Unit (AMSU-A and AMSU-B) aboard the NOAA-16 satellite for twenty-four globally representative storm systems, including 28,200 AMSU-A and 255,640 AMSU-B footprints, spanning a year. Good agreement has been obtained between histograms of coincident MM5-simulated and observed AMSU-A and AMSU-B radiances by adjusting ice parameter values in TBSCAT. Ice parameter values are consistent with the scattering for ice habits observed aloft, as computed using a Discrete Dipole Approximation program, DDSCAT6.1. These results suggest the potential use of MM5 as a rich new statistical form of ground-truth that will permit development of better precipitation estimators and improved understanding of precipitation itself, particularly in the more problematic areas of the globe. [C965]

## "Polarimetric SAR image classification employing subaperture polarimetric analysis"

Polarimetric SAR image classification remains an important research area. Various methods continue to be developed for specific applications. High-resolution polarimetric SAR systems and advances in computational and data storage capabilities have revived interest in novel polarimetric analysis techniques. Accordingly, subaperture analysis of polarimetric SAR data has received renewed attention. A central assumption of SAR image formation is that individual radar scatterers are stationary; they have no structure and provide a constant reflectivity during the imaging process. However, with increased resolution, and hence fewer scatterers per pixel, the nonstationary response from any given scatterer is more likely to influence total radar backscatter of a pixel. We present a method to assess the polarimetric variability across the full aperture. [C966]

## "Extended path prediction using camera and map data for lane keeping support"

Lane departure or lane keeping systems should detect in advance not only if a road/lane departure would occur, but also when it would happen. The goal of the paper is twofold; on one hand achieves accurate detection of such incidents decreasing system misses; on the other hand it extends the electronic horizon of the supervised

area to 500 m minimizing false alarms caused by intentional lane changes. To achieve the goals, the paper proposes an extended lane tracking scheme based on an information fusion system, map and camera data, and a path prediction algorithm that incorporates curvilinear vehicle models for the short term prediction and on-line learning for a wider time perspective. The presented algorithm is tested using simulated and real map, camera and vehicle data. [C967]

## "Ultra wideband multiple-input multiple-output radar"

The utilization of ultra wideband (UWB) signals enables the radar designer to solve the most important problems of radar target observation. The extremely wide bandwidth enables greater information to be obtained due to high time resolution and the frequency dependence of the scattering centers over this large bandwidth. Increase in the radar's signal bandwidth can improve radar performance by providing better range measurement accuracy, improving the target identification and tracking capability, improving radar immunity to passive interference, and enhancing radar countermeasure against narrowband electromagnetic signal interference. Recently there have been many advances in multiple-input multiple-output (MIMO) antenna systems in communications. These diversity systems have been shown to have the potential to dramatically improve the performance of the communications systems. Unlike the traditional beamforming approach, which uses highly correlated signals of an array of transmitting or receiving antenna elements to collimate a beam towards a certain direction in space, MIMO capitalizes on the independence between signals from different transmitters and on the diversity of target scattering to improve the information received from the response, Motivated by the advances and benefits of MIMO in communications and advantages of using UWB signals, this paper presents the experimental investigation of UWB-MIMO radars. The analysis of such radars has been carried out to demonstrate its promising features in terms of better target identification and improved signal to noise ratio (SNR). [C968]

## "P-SAR: an advanced miniature synthetic aperture radar for forestry applications. Preliminary design"

A preliminary study of the design of a small, low cost, P-band airborne, polarimetric synthetic aperture radar (SAR) is presented. The design was requested by the Wageningen University and the Borneo Orangutan Survival Foundation (BOS) to carry out forest biomass monitoring in Indonesia. The requirements of the application are established and the main radar parameters are derived from them. A preliminary design of the system, based on commercial off-the-shelf components is also presented. Some novelties of the system are the use of direct digital synthesis (DDS) to perform the modulation, the use of dual-polarized microstrip square patch antennas and the reduced size and power consumption of the system. [C969]

## "Advances in non-linear apodization for irregularly shaped and sparse two dimensional apertures"

Presented in this paper are selected new methods and applications of non-linear apodization for irregularly-shaped and sparse coherent apertures and arrays. The benefits include improved impulse response performance, i.e. reduced peak sidelobes and integrated sidelobe power, along with improved mainlobe resolution, compared to classic windowing techniques. Non-linear apodization (NLA) techniques can also serve as powerful engines for effective superresolution and bandwidth extrapolation of coherent data for filling sparse apertures. The sparse aperture filling property of superresolution algorithms for radar data forms the basis for a new concept which is introduced here: synthetic multiple aperture radar technology (SMART). Increased swath and/or reduced antenna size are some of the benefits postulated for SMART applied to synthetic aperture radar (SAR) systems. The benefits of these new methods and applications for nonlinear apodization are then demonstrated for two specific applications: 1) side lobe control for Y-type synthetic aperture radiometers, such as the European soil moisture and ocean salinity (SMOS) system [12] and JPL's proposed GeoSTAR [13] concept; and, 2) filling of sparse synthetic aperture radar data by exploiting the bandwidth extrapolation properties of non-linear apodization based superresolution techniques. The methods that have been developed and demonstrated here have potential application to a wide range of passive and e microwave remote sensing and radar systems. [C970]

## "Mine action: status of sensor technolo.gy for close-in and remote detection of antipersonnel mines"

{no data available} [C971]

## "Technology for emerging commercial applications at millimeter-wave frequencies"

The 60 GHz band has emerged as an international spectrum opportunity for short-range wireless communication networks. In this paper, technology trends that can impact the commercial deployment of systems utilizing

millimeterwave frequency bands is discussed. Millimeter-wave frequency bands have historically been costly to utilize and traditionally used almost exclusively for government and non-consumer products. Recent and ongoing advances in semiconductor and low cost high frequency packaging can be leveraged for low cost solutions that enable widespread deployment. In order to demonstrate the potential throughput of a broadband wireless system utilizing millimeter-wave spectrum, Motorola Labs has demonstrated multi-gigabit data transmission and reception over significant distances. [C972]

## "On-board fault-tolerant SAR processor for spaceborne imaging radar systems"

A real-time high-performance and fault-tolerant FPGA-based hardware architecture for the processing of synthetic aperture radar (SAR) images has been developed for advanced spaceborne radar imaging systems. In this paper, we present the integrated design approach, from top-level algorithm specifications, system architectures, design methodology, functional verification, performance validation, down to hardware design and implementation. [C973]

## "A gridding algorithm for efficient density compensation of arbitrarily sampled Fourier-domain data"

Uniformly sampled data is sometimes not directly available in engineering applications ranging from synthetic aperture radars to magnetic resonance imaging. However, certain signal processing techniques, such as the fast Fourier transform, cannot be applied to non-equispaced data. It is therefore desirable to resample the data on a regular grid. Various interpolation schemes have been proposed for this purpose, such as gridding reconstruction. A computationally expensive step in the gridding algorithm is the estimation of the data sampling density. The paper presents a method for improving both the efficiency and the quality of gridding density estimation based on partial Voronoi diagrams. It is shown that significantly higher computational efficiency is achieved by this method over existing schemes. Lower spreading and greater sidelobe suppression of the point spread function demonstrate the superiority of the proposed reconstruction method [C974]

## "SeaWinds radiometer (SRad) brightness temperature calibration and validation"

NASA's SeaWinds scatterometer, on Japan's ADEOS-II satellite, is a special purpose radar remote sensor used to measure ocean surface wind vector (speed and direction). The paper presents a novel use of this instrument as a SeaWinds radiometer (SRad) to measure the ocean microwave emissions (brightness temperature). The derivation of the SRad radiometric transfer function is presented, which is used to calculate the apparent brightness temperature collected simultaneously with the radar scattering measurement. Results are presented for the on-orbit calibration and validation of the SRad brightness temperature algorithm performed using simultaneous measurements from the advanced microwave scanning radiometer (AMSR) also on the ADEOS-II. [C975]

## "Design and demonstration of an advanced on-board processor for the second-generation precipitation radar"

First Page of the Article [C976]

## "Fast estimation of false alarm probabilities of STAP detectors-the AMF"

This paper describes an attempt to harness the power of adaptive importance sampling techniques for estimating false alarm probabilities of detectors that use space-time adaptive processing. Fast simulation using these techniques have been notably successful in the study of conventional constant false alarm rate radar detectors, and in several other applications. The principal task here is to examine the viability of using importance sampling methods for STAP detection. Though a modest beginning, the adaptive matched filter detection algorithm is analysed successfully using fast simulation. Of the two biasing methods considered, one is implemented and shown to yield excellent results. The important problem of detector threshold determination is also addressed, with matching outcome. The work reported here serves to pave the way to development of more advanced estimation techniques that can facilitate design of powerful and robust detection algorithms designed to counter hostile and heterogeneous clutter environments. [C977]

## "Site-specific modeling tools for predicting the impact of corrupting mainbeam targets on STAP"

This paper provides details about modeling tools being developed under the Defense Advanced Research Projects Agency's (DARPA) knowledge-based sensor signal processing and expert reasoning (KASSPER) program to efficiently predict the performance of GMTS sensors operating in real-world environments. Specifically this paper addresses model to compute losses due to targets corrupting the training data (W.L. Melvin and J.R. Guerci, May 2001) (J.S. Bergin et al., April 2002) for airborne radars that employ space-time

adaptive processing (STAP) (J. Ward, December 1994). The modeling tools can be used to predict losses in a computationally efficient manner and therefore allow analysis of GMTI performance for realistic simulation scenarios that span very long time periods. [C978]

## "The TerraSAR-X antenna system"

TerraSAR-X is a space borne high resolution imaging synthetic aperture system, based on advanced active phased array technology. The paper presents an overview of the TerraSAR-X frontend and discusses the strategy for antenna testing, verification and in-orbit pattern prediction. As an integral part of this approach, an antenna model has been developed which allows, on the basis of embedded subarray measurements, the calculation of the overall antenna pattern for a given gain/phase setting of the T/R-modules. [C979]

## "Background subtraction in the frequency domain for focusing ground-penetrating radar data"

{no data available} [C980]

## "Navigation system of Japanese folding paper based on the 3DCG animation"

Japanese folding paper is one of Japanese historical culture. Recently, it's used for rehabilitation or applied for structure analysis of industrial packing. However, Japanese folding paper may be recognized as a plaything for children in Japan. Otherwise it is recognized as a good educational material for low aged children in the world. But teaching tool of Japanese folding paper for children in English world has not been developed. To spread the Japanese folding paper to the world by improving the teaching method, we developed the navigation system of Japanese folding paper named PCML (Paper Craft making Language) and PCML browser. PCML shows the Japanese folding paper as the 3DCG animation with collision detection algorithm we developed. In this paper, we describe the detail of PCML and PCML browser. [C981]

## "A novel obstacle avoidance and navigation method of outdoor mobile robot"

This paper presents a novel method for obstacle avoidance and navigation of outdoor mobile robot, in which, the 2-dimension obstacle information in the polar coordinate space of current view scene is transformed to the 1-dimension angle field. Repulsive forces produced by obstacles and attractive forces produced by the object location are estimated integratively to determine the pass function and the purpose angle. As thus, both the safety of the robot and the approach to the object location are considered. The method has been tested on our outdoor mobile robot THMR-V [C982]

## "Advance warning of loop current from single-site SeaSonde on Genesis oil platform in the Gulf of Mexico"

A single SeaSonde HF radar operates on Chevron's Genesis deep-water floating platform in the Gulf of Mexico. The radar's purpose is to provide advance warning of strong loops or eddies that approach the rig. A single radar like this, however, only produces a map of the surface current component toward or away from the radar, called a radial map. A pair of radars with overlapping coverage is required for a 2D total vector map. Despite this limitation, and overcoming the strong antenna pattern distortions caused by the all-steel rig, useful information was obtained to a distance of 90 km. To verify the accuracy and utility, comparisons were done with an ADCP 72 km away. Low-pass filtering was used to remove short-term inertial oscillations, revealing close agreement with the 40-m deep ADCP measurement of the persistent geostrophic loops. Both saw the strong loop features. [C983]

## "Modeling on a gimbal with an antenna"

A model of an azimuth driving servo system with a flexible antenna in a tracking system was derived in this work. The validity of the model was verified by comparing the results of the model with experimental results. When modeling the dynamics of a gimbal with an antenna, the antenna should be considered as a flexible body. The effect of reducing the magnitude of the backlash that results in extending the bandwidth in a system with a flexible antenna is smaller than the effect of reducing the magnitude of the backlash in a system with a stiff antenna. When there is a need to reduce the weight and extend the bandwidth, the derived model enables the design of a tracking system to be optimized [C984]

## "Shape estimation of inflatable space structures using neural network"

Inflatable space structures need to maintain in a desired shape in space in order to achieve satisfactory performance. The active shape control technique has shown its advantages in solving this problem. One difficulty

to realize an active control system in space is how to establish a model that reflects the structure shapes under different environment and boundary tensions. This paper proposes a neural network scheme to estimate the shape of inflatable structures. A neural network is trained to map environment information and control tensions into the structure shape. After the neural network training completes, an estimation of the structure shape can be obtained by inputting the measured environment data and control variables to the neural network. Some validation studies have been conducted in laboratory on the estimation of the flatness of a rectangular Kapton membrane. The results showed the proposed scheme gave very good estimations of the membrane flatness [C985]

## "WebMODE: a framework for development of Web-based tools for management of educational activities"

Although there are many Internet-based educational applications available today, they usually do not allow functionality extensions, change or reuse. In this context, this paper presents a framework, based on the J2EE component architecture, for helping the development of more customizable educational applications. In order to reach its goal, it merges significant features from popular CMS (such as pluggable modules) to the MVC architecture, found in most popular frameworks for Web development. [C986]

## "Fiber lasers for lidar"

Advances in fiber laser technology can be used to further the capabilities of lidar remote sensing systems. The paper provides an overview of lidar requirements, where current fiber technology can play a role, and advances needed for future systems. [C987]

## "Ground penetrating radar as a quality assurance method for paved and gravel roads in finland"

{no data available} [C988]

## "Joint IRCTR/TNO-DS&S measurement campaign for AP-mine detection with VIR GPR"

{no data available} [C989]

## "Remote sensing techniques"

Remote sensing of ocean currents is becoming an operational tool in many countries. Wyatt reviews phased-array HF radar systems, with examples of wave, wind and current measurements from operational systems, and she provides an assessment of their accuracy. Observations from HF radar on board an oil platform in the Gulf of Mexico, as described by Barrick et al., show tremendous strides forward when working in this difficult environment, where only one system may be feasible and the structure of the rig distorts the antenna pattern. In contrast, Kohut et al. describe results from a "triple nested HF radar array" that combines lower frequency long-range systems with high-resolution radars and several other techniques to map the plume of the Hudson River in New York Bight. Advances in theory continue to be made, which may lead to future improvements in practical current and wave radars. Wang and colleagues describe new ideas on nonlinear polarisation vector translation. Dugan and Piotrowski argue that aircraft remote sensing is advantageous for rivers and estuaries where currents may change rapidly in time and space. Using images of light scattered by near surface sediment, mean flow vectors have been derived and compared with ADCP data. Terray and colleagues report on their assessment of the feasibility of studying horizontal dispersion and vertical mixing on metre to kilometre space scales using measurements of dye dispersion from an airborne lidar. [C990]

## "Environmental perception and situation assessment for an advanced highway assistant"

Environmental perception through sensor fusion for automotive applications is an intensive research area. Since the advent of the first driver assistance systems researchers have worked on multi sensor systems that perceived the whole surrounding traffic scene. At Volkswagen research diverse sensor and fusion configurations have been under examination over the last few years. Currently a Highway Assistant is being under development that focuses on well structured environments and ultimately aims to automate certain driving tasks. This paper describes the perception part from sensors and sensor fusion up to situation and risk assessment. [C991]

## "Pyramidal image analysis for vehicle detection"

Computer vision can provide a great deal of assistance to intelligent vehicles. In this paper an advanced driver assistance systems for vehicle detection is presented. A geometric model of the vehicle is defined where its

energy function includes information of the shape and symmetry of the vehicle and the shadow it produces. A genetic algorithm finds the optimum parameter values. As the algorithm receives information from a road detection module some geometric restrictions can be applied. A multi-resolution approach is used to speed up the algorithm and work in real-time. Examples of real images are shown to validate the algorithm. [C992]

## "Design of an A-SMGCS prototype at Barajas airport: data fusion algorithms"

The work presented here addresses practical aspects of data fusion to implement a prototype of advanced surface movement guidance and control systems (A-SMGCS). It reflects recent experiences in an on-going project to fuse data from available and future sensors at Madrid-Barajas airport: automatic surface detection equipment (ASDE), millimeter wave sensor (MWS), airport surveillance radar (ASR) and mode-S multilateration. Simulation results show system accuracy and robustness in representative situations, taking into account the airport configuration. [C993]

## "Clustered multidimensional data association for limited sensor resolutions"

The multidimensional data association methods were developed to establish the relation between measurements and tracks especially in dense target situations. However, even these advanced multidimensional data association methods lack in situations of unresolved measurement. Specifically, in real dense target situations being of most interest the phenomena of unresolved measurements happens quite often due to the limited sensor resolution. The new algorithm presented in this paper incorporates the unresolved measurement hypothesis into the multidimensional data association approach. An additional feature of this approach is, that also group tracking aspects are considered, which is an essential difference to proposals of other authors. Therefore, this new approach significantly increases the data association result as well as track accuracy, continuity and ensures early track initialization capabilities. [C994]

## "Multiple target tracking with possibly merged measurements modeled by point processes"

Generally, sensor resolutions are finite, and hence any measurement may originate from two or more objects. Recent advances in sensor signal processing technology have made it possible to estimate the number of objects that may originate from a given detection for a certain type of sensor. With these new methods, it may be possible to associate each, possibly merged, measurement with state components of an unknown number of objects from which the measurement originates. One suitable mathematical model for an unknown number of object states is a finite point process that can be defined by a family of permutable (symmetric) probability distributions together with the probability of the number of the objects. In this paper we will show how general multiple hypothesis tracking systems, usually designed with the assumption that measurements are all resolved, may be extended to process possibly merged measurements modeled by point processes. [C995]

## "Sensor resource management with level 2 fusion using Markov chain models"

Advanced optimization-based algorithms for sensor resource management have been a recent research focus area in multisensor tracking and fusion. These algorithms offer the potential for automating the sensor management process in response to level 1 (object or track-level) sensor fusion estimates. We have previously presented a hierarchical target valuation model that extends the target valuation model to include not only level 1 fusion information but also level 2 (group level) fusion information. We will use previously developed recursive composition inference techniques (specified using Bayesian inference techniques) that can efficiently and optimally reason about the identity of military units given partial observations of constituents in order to modify the sensor resource management target valuation algorithm. In this paper, we will develop new modifications to Markov state transition models that allow parameterization and approximate characterization of ground truth scenarios. [C996]

## "Active safety: the impact of SARA for future advances in the field"

This paper gives an overview on recent development trends and future European initiatives in the area of automotive e-safety. Short range radar (SRR) for novel safety and comfort systems being fostered by the SARA initiative has paved the way for more advanced ITS systems like stability control for heavy duty vehicles (HDV) or e-call. The obstacles to make it happen, possible solutions, and the resulting benefits are discussed [C997]

## "Radar cross section from a stack of two one-dimensional rough interfaces in the high-frequency limit"

The problem of electromagnetic wave scattering from a rough interface is a non-trivial but rather well-known subject, through the advances made over the last years. The study focuses here on a stack of two rough

interfaces (a layer): the objective is to dispose of a fast analytical method which can predict the bistatic radar cross section from a rough layer. The approach used here, which has not been treated before, is the case of very rough surfaces comparatively to the incident wavelength. In this model, the Kirchhoff approximation is used to calculate the field scattered by a rough layer. The first reflection inside the layer is taken into account, in order to determine its contribution comparatively to the field scattered by the upper interface. The shadowing effect, which occurs for grazing angles, is also considered. This model is reduced to the high-frequency limit so as to get numerical results, which are compared with a reference method based on the method of moments [C998]

## "Spectral Signature Calculations for Remote Sensing"

Remote sensing radar has shown to be an important tool to observe severe and hazardous weather and to provide operational forecasters prompt information of such rapidly evolving phenomena. Although the history of tornado measurements is long, there have been only a few successes in obtaining spectral signatures. This is largely because neither the technology to process spectra nor the technology to record voluminous amounts of time series data were available, except for a few customized systems. However, present day radar technology and computer resources are now advanced enough to study tornado spectral signature in a systematic manner. The research WSR-88D (weather surveillance radar) locally operated by the National Severe Storm Laboratory (NSSL) in Norman has the unique capability of collecting massive volumes of Level I time series data over many hours which provides a rich environment for evaluating our new post-processing algorithms. In this work, an approach of identifying tornado vortices in Doppler spectra is proposed and investigated through the use of neural networks [C999]

## "Unified Bayesian-experiment design regularization technique for high-resolution reconstruction of the remote sensing imagery"

In this paper, the problem of estimating from a finite set of measurements of the radar remotely sensed complex data signals, the power spatial spectrum pattern (SSP) of the wavefield sources distributed in the environment is cast in the framework of Bayesian minimum risk (MR) paradigm unified with the experiment design (ED) regularization technique. The fused MR-ED regularization of the ill-posed nonlinear inverse problem of the SSP reconstruction is performed via incorporating into the MR estimation strategy the projection-regularization ED constraints. The simulation examples are incorporated to illustrate the efficiency of the proposed unified MR-ED technique [C1000]

## "Beampattern synthesis for wideband MIMO radar systems"

A MIMO radar system is a radar system with multiple transmitters, each driven with its own signal, coherently with all the other transmitters. In this paper we consider the problem of using this flexibility to transmit wideband signals and control the spatial distribution of transmitted power. We show how the power distribution is a function of the signal cross-spectral density matrix (CSDM), and formulate the problem of determining the CSDM that generates a desired spatial beampattern subject to power constraints on the transmitters. Convex optimization techniques are used to find the numerical solution of the resulting optimization problem. [C1001]

## "Positioning a time-varying number of targets by a wireless sensor network"

In this paper we address the problem of positioning of multiple targets based on measurements obtained by sensors comprising a sensor network. The measurements represent a superposition of signals that carry information about the positions of the various targets. The sensors send the sensed information to a fusion center that combines the received data from all the sensors and carries out necessary computations. The number of targets may vary with time in an unknown way. We propose a particle filtering-based method for detecting the number of active targets and for estimating their positions. The particle filtering was carried out on data that represent measurements of acoustic signals, but it can also be applied to other types of signals. We provide simulations that show the performance of the particle filtering method in scenarios with one and two targets. [C1002]

## "Recognition of the predetermined random signals involving the unknown signals"

Some practical peculiarities of random signals recognition methods are considered for non-traditional cases when the signals with unknown probabilistic characteristics are presented for recognition along with the signals predetermined in a probabilistic sense. The distinctive peculiarities of the present work is that it considers the solution signals recognition problem on the basis of different probabilistic models-in the form of autoregression processes, mixtures of standard distributions, expansions in orthogonal functions of random signals. The data on decision of recognition problems are considered. In particular, that is decision the different problems of recognition signals for radio control, recognition of any types of targets by signals features using narrow-bend

signals and recognition signals for medical diagnostic [C1003]

## "m-Mag: The Mobile Magazine Services Platform"

The m-Mag platform advances the state of the art in mobile services by bridging the gap between mobile Operators and content Publishers, enabling the creation of a new category of mobile service called a mobile magazine. An m-Mag mobile magazine is a next generation mobile publishing service that is made available from a mobile operator's portal, that is integrated with value added mobile data services and that uses the operator's billing capabilities to charge consumers for access to the magazine. Using Parlay/OSA as an open approach, the m-Mag platform can integrate into an operator's network using standardised APIs and is portable across different operator networks. A discussion of the commercial potential analyses the route to the market [C1004]

## "Stereo vision based human body detection from a localized mobile robot"

Autonomous surveillance and monitoring of structures is one of the most studied tasks in the past years. In this paper we present an approach in mobile robotic surveillance to detect the presence of people or other moving objects in scenario and classify them as human body and not human body by stereo vision. [C1005]

## "Robust CFAR detection in clutter with unknown covariance matrix"

We conduct a simulation analysis for assessing the constant false alarm rate (CFAR) behavior of three coherent radar detectors in the presence of correlated Gaussian clutter with unknown covariance. We establish the conditions a detector must fulfil in order to ensure the CFAR property. We discuss several detectors with quasi CFAR property. The analysis of CFAR property and the performance analysis, which has been carried out in the presence of correlated Gaussian clutter with unknown covariance, show that the proposed detectors exhibit a quite acceptable loss with respect to optimum Neyman-Pearson detector [C1006]

## "An Algorithm for Lossless Signal Processing"

The information distortions during the signal processing at the receivers of a communication system are very undesirable, because they can be compensated only by means of increasing of transmitted energy. This leads to decreasing of system secrecy and its effectiveness. Due to this reason in our paper we suggest a mathematical algorithm for processing of communication signals, which can be executed by mass cheap microcontrollers with maximal possible accuracy and study the practical application of the algorithm in the present radar and communication systems. [C1007]

## "Calibration/validation of the SeaWinds radiometer rain rate algorithm"

The SeaWinds scatterometer, which has been flown on both the QuikSCAT and ADEOS-II satellites was designed to remotely sense ocean surface wind vectors. Because ocean wind retrievals are occasionally contaminated by rain in the tropics and because there is no independent rain measurement on QuikSCAT, a SeaWinds rain-estimation method was developed and implemented. This technique utilizes the SeaWinds receiver noise to measure ocean radiometric brightness temperature (Tb) and then applies a statistical regression algorithm to estimate the integrated rain rate. This rain algorithm was originally "trained" with QuikSCAT SeaWinds Tband near-simultaneous rain rate measurements from the Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI). In this study, the SeaWinds instrument on ADEOS-II and the Advanced Microwave Scanning Radiometer (AMSR), also onboard ADEOS-II, were used to refine the algorithm. This provided truly simultaneous and collocated measurements from the same platform and over the same swath, which was ideal for improving the SeaWinds rain algorithm. The improved algorithm can now be applied on QuikSCAT using the SeaWinds radiometric measurement. [C1008]

## "Evaluation of marine surface winds observed by active and passive microwave sensors on ADEOS-II"

Marine surface winds observed by two microwave sensors, SeaWinds and Advanced Microwave Scanning Radiometer (AMSR), on the Advanced Earth Observing Satellite-II (ADEOS-II) are evaluated by comparison with off-shore moored buoy observations. The wind speed and direction observed by SeaWinds are in good agreement with buoy data with root-mean-squared (rms) differences of approximately 1 m s-1and 20°, respectively. No systematic biases depending on wind speed or cross-track wind vector cell location are discernible. The effects of oceanographic and atmospheric environments on the scatterometry are negligible. Though the wind speed observed by AMSR also exhibited reasonable agreement with the buoy data in general with rms difference of 1.3 m s-1it is systematically lower than the buoy data for wind speeds lower than 5 m s-1.

Similar results are obtained in an intercomparison of wind speeds globally observed by SeaWinds and AMSR on the same orbits. Global wind speed histograms of the SeaWinds data and European Centre for Medium-range Weather Forecasts (ECMWF) analyses agree precisely with each other, while that of the AMSR wind shows slight deviation from them. [C1009]

## "Extraction of the Convective Day Category Index Using Data Mining Techniques"

One of the tasks of the Hellenic Hail Suppression Program is the determination of the observed convective day category (CDC) index. This process is accomplished by having the meteorologists analyze the operational data manually. To automate and speed up this procedure we have developed an application in the CLIPS Expert System environment that calculates the observed CDC index. In this paper we examine the appropriate data mining techniques that could be used to extract this index from operational data automatically. [C1010]

## "Doppler frequency parameters estimation for SAR imaging using a modified discrete chirp-Fourier transform"

The key technology of high resolution radar image is to precisely estimate the Doppler parameters. The discrete chirp-Fourier transform (DCFT) proposed recently is an effective technique for chirp signal detection. But it requires some rigorous restriction on the signal length and parameters, which restricts the application of DCFT to the engineering fields. The paper advanced a novel modified discrete chirp-Fourier transform (MDCFT) to overcome the restriction, this new transform can make the signal energy concentrate in the transform domain to precisely estimate the parameters. The simulation SAR imaging based on the MDCFT proves that the new algorithm is more practical and effective. [C1011]

## "System simulations for navigation and radar applications based on sophisticated numerical hybrid scattering analysis"

Classical and modern navigation, landing and radar systems rely on the radio transmission and reception. Relevant objects in the radiation field can harm the intended characteristics of these systems. Modern state-of-the-art simulations can predict in an increasing number of complicated cases the electrical performance in the presence of these objects. Countermeasures can be designed from this knowledge. This paper deals mainly with the "threat" (potentially in-acceptable distortions) by the forthcoming new large aircraft A380 on the widely spread ILS (Instrument Landing System; operating at 110/330 MHz) installed on every major airport. The related system simulations and the mathematical and numerical analyses are outlined and some results for different numerical cases are presented. It is in particular emphasized to apply three-dimensional and sophisticated state-of-the-art methods, which are adapted to the three-dimensional characteristics of the objects in contrast to inadequately simple methods. For the case of the new Airbus A380, some principle results are presented using simple physical optics based methods, trials to improve the simple PO by creating "fudge factors" by measurements and in contrast results for rigorous and quasi-rigorous numerical methods. Large errors for a simple physical optics PO treatment in contrast to the rigorous method-of-moments MoM and improved physical optics IPO solution are presented and explained. The practical consequences for airports illustrate the necessity of reliable state-of-the-art system simulations and the application of advanced electromagnetic scattering analysis [C1012]

## "Advanced Capacitor Development for Marxed Modulators"

Sci-Eng Solutions is developing advanced, high-energy density capacitors requisite to the demanding requirements of Klystron drive modulators in conjunction with the Stanford Linear Accelerator Center. Unique, nano-sized barium titanate and strontium titanate dielectric powders are used to fabricate high energy density ceramic capacitors. These crystalline ceramic powders have uniform spherical morphology and high dielectric constant, with sintering temperatures as low as 1000degC. The improved microstructure of the finegrained, sintered ceramic improves uniformity and reduces dielectric breakdown relative to equivalent, large grained ceramics. Moreover, various dopants or modifiers can also be used in binary compositions to tailor electrical performance for a wide range of applications. The size, purity and tailored compositions of the nano-powders result in a performance capability superior to convention ceramic technology; and the ultra-fine particle size makes these ceramic capacitors ideal for numerous modulator applications, such as directed energy weapons (high power microwaves and lasers), particle beam accelerators, high speed rail systems, lasers, and advanced radars. [C1013]

## "The Signal Processing System Design of General Weather Radar Based on ASIC"

A new signal processing system of General weather radar is described in this paper. The system is based on advanced Altera FPGA stratix 1S25 and Analog DSP TS101. The new system has more than four times

processing abilities compare with the original radar hardwired signal processor. The simulation results and test results are also described in the paper. [C1014]

## "Sophisticated numerical hybrid scattering analysis integrated into system simulations for navigation and radar applications"

Classical and modern navigation, landing and radar systems rely on the radio transmission and reception. Relevant objects in the radiation field can harm the intended characteristics of these systems. Modern state-of-the-art simulations can predict in an increasing number of complicated cases the electrical performance in the presence of these objects. Countermeasures can be designed from this knowledge. This paper deals mainly with the "threat" (potentially in-acceptable distortions) by the forthcoming new large aircraft A380 on the widely spread ILS (instrument landing system; operating at 110/330MHz) installed on every major airport. The related system simulations and the mathematical and numerical analyses are outlined and some results for different numerical cases are presented. It is in particular emphasized to apply 3D and sophisticated state-of-the-art methods which are adapted to the 3D characteristics of the objects in contrast to inadequately simple methods. For the case of the new Airbus A380 some principle results are presented using simple physical optics based methods, trials to improve the simple PO by creating "fudge factors" by measurements and in contrast results for rigorous and quasi-rigorous numerical methods. Large errors for a simple physical optics PO treatment in contrast to the rigorous method-of-moments MoM and improved physical optics IPO solution are presented and explained. The practical consequences for airports illustrate the necessity of reliable state-of-the-art system simulations and the application of advanced electromagnetic scattering analysis. [C1015]

## "Integrable ultra-compact, high-resolution, real-time MEMS LADAR for the individual soldier"

Laser radar (LADAR) has many advantages over other methods of target detection and analysis, both in combat and commercial applications. Because it uses a shorter wavelength than microwave radar and has significantly greater angular resolution, it is capable of a greater degree of accuracy and more precise target resolution to a level that allows for high-resolution image acquisition. The development of a next generation LADAR unit that is lightweight, ultra-compact, portable, and power-efficient real-time 3D LADAR unit would be a significant advance with many potential military and civilian applications. This paper describes a novel LADAR device that would be small, compact, field practical, eye safe, and integrable into a soldier's helmet. This would be achieved by using a 2-axis MEMS (micro-electro-mechanical system) scanner with an optical system that will extend the field of view (FOV). This next generation time-of-flight (TOF) LADAR design utilizes a novel angle amplification mechanism that uses a pre-compensating positive lens and a subsequent negative lens to overcome the small scanning range of MEMS mirrors where scan angles as small as 6deg can be increased to over 40deg. Also, with conventional digital zoom, a portion of an image is used to create a larger but much lower resolution image, while the LADAR zoom technology discussed in this paper will have a tighter field of view for a high-resolution zoom image. Other innovation is a relatively inexpensive and compact laser driver that can generate subnanosecond pulses of varying repetition frequency. Our analyses demonstrate that this portable LADAR device would work in close proximities as well as distances over 100 meters, could have a range resolution of less than a centimeter and a FOV greater than 40deg, and be able to display 320times240 pixel real-time images at a frame rate of 15. Such a LADAR unit could be enhanced to also record and transmit range, intensity, and GPS/vector data to a remote comp--uter. By using the same soldier for capturing LADAR images and data from multiple locations or multiple soldiers, a computer program could analyze and integrate the data so as to build a 3D survey of the combat field with in-depth target information. In this potential scenario even occluded (camouflaged) targets could be revealed and identified with appropriate signal processing. Also, as the intensity (amplitude) and range (time interval) data are being quickly processed, graphically enhanced 3D images could he transmitted hack to the soldiers in the field [C1016]

## "An overview of through the wall surveillance for homeland security"

The Air Force Research Laboratory Information Directorate (AFRL/IF), under sponsorship of the Department of Justice's (DOJ), National Institute of Justice (NIJ) Office of Science and Technology (OS&T), is currently developing and evaluating advanced through the wall surveillance (TWS) technologies. These technologies are partitioned into two categories: inexpensive, handheld systems for locating an individual(s) behind a wall or door; and portable, personal computer (PC) based standoff systems to enable the determination of events during critical incident situations. The technologies utilized are primarily focused on active radars operating in the UHF, L, S (ultra wideband (UWB)), X, and Ku bands. The data displayed by these systems is indicative of range (1 dimension), or range and azimuth (2 dimensions) to the moving individuals). This paper highlights the technologies employed in five (5) prototype TWS systems delivered to NIJ and AFRL/IF for test and evaluation [C1017]

## "Advances in Plasma Antenna Design"

Summary form only given. We have made significant progress in developing plasma antennas. Our antennas have been operating in the region 1 to 10 GHz. The basic advantages of plasma antennas over metal antennas are threefold. First, the plasma antennas are reconfigurable. When one plasma antenna is de-energized, the antenna reverts to a dielectric tube, and a second antenna can transmit through it. This allows us to use several large antennas stacked over each other instead of several small antennas placed next to each other. This results in better sensitivity and directivity. Second, the plasma antenna is stealthy. When de-energized, the plasma antenna does not reflect incident, probing RADAR signals. Third, the plasma antenna is resistant to electronic warfare. An operating plasma antenna can be at the same time transparent and immune to incident high frequency, high power electronic warfare pulses. The question is, how well do plasma antennas operate? Our tests at the Malibu Research Corporation in California have shown that an energized plasma reflector is essentially as effective as a metal reflector. However, when de-energized, the reflected signal drops by over 20 dB. Three remaining questions are, first, how to increase the operating plasma density without overloading the plasma discharge tubes? Second, how can we reduce the power required? And third, how can we reduce plasma noise caused by the ionizing power supply. [C1018]

## "A UWB impulse subsurface imaging radar"

An advanced UWB impulse subsurface imaging radar (SIR) system-RadarEye is introduced in this paper. A time-delay and amplitude modified back projection (TAM-BP) imaging algorithm is presented. Indoor experiments show the high performance of this system in the applications of surface penetrating imaging. [C1019]

## "The signal processing system design of polarimetric weather radar using DSP and FPGA"

A new signal processing system of polarimetric Doppler weather radar is described in this paper. The new system is based on advanced Altera FPGA stratix 1S25 and Analog DSP TS101. The new system follows in the footsteps of the Chinese new generation radar (CINRAD) hardwired signal processor (HSP). The simulation results and test results are also described in the paper. [C1020]

## "An algorithm or the neural fusion of IRST & radar for airborne target detection"

This paper investigates in to the possibility of using a BAM correlating encoding based neural fusion of IRST and radar at the point of the IRST's maximum range. During training phase (in peace time or at a safe place or range), intermittent appearance of a target on IRST display can be recorded in a temporal array. Corresponding intermittent appearance on radar will also be recorded on another array. Treating IRST array as horizontal array and radar array as vertical one, these two binary arrays will be made bipolar by replacing 0s with 1s and multiplied and square or rectangular arrays obtained. A large number of sets can be obtained like this representing the entire representative situations and corresponding square matrices added to form a general weight matrix. Data corresponding to the intermittent appearances of targets and other objects on radar display will be kept in the forms of binary arrays as database. In application phase, if a target is detected through the radar at the maximum range where target appears on the IRST display, radar can be switched off. IRST display will show intermittent appearances of the target, which may be difficult to track or even to discriminate from nearby bird or far off planet/star. The data collected for a number of frames for a single target's estimated intermittent appearance will be stored in an array as binary data. This binary array will be multiplied with the general weight matrix and resulting vertical matrix after thresholding represents an estimated radar data. This approximated radar binary array can be compared with stored radar representations and nearest class can be declared the class of the object present in the scene. As a further improvement, this whole experiment can be performed in a peaceful condition and the estimated radar representation obtained can be compared with exact radar representation and error calculated. Another neural model (like multilayer perceptron) can be used to provide a feedback to correct the errors in the radar estimation. The process basically works as an adaptive filter and predicts a radar array corresponding to the IRST array. The success of the algorithm depends on the training (selecting representative situations) and the implementation methods. Optical implementatio- n with optical associative memories can also be experimented for faster processing. [C1021]

## "Measuring the effects of RNAV departure procedures on airport efficiency"

To analyze the impact of area navigation-standard instrument departure (RNAV SID) on operations at Atlanta terminal radar approach control (ATL TRACON). The MITRE Corporation's Center for Advanced Aviation System Development (CAASD) collected radar track data prior to implementation of the RNAV procedures, as well as post-implementation data. Through analysis of this radar track data, we measure the effects of RNAV SID procedures on departure throughput, and the resulting effects on taxi-out time and departure delay. In addition,

distance flown inside the terminal area is a key metric. Vertical performance inside the terminal area was analyzed for reductions in level-offs. Results are coordinated and validated with anecdotal data from the airlines regarding these benefits and others, and statistical analyses combined with operational feedback provides insight towards the benefits of these procedures. [C1022]

## "An evaluation of airborne spacing in the terminal area"

This paper describes a simulation conducted at NASA Ames Research Center to evaluate the feasibility and benefits of time-based airborne spacing and merging operations in terminal radar approach control (TRACON) airspace. Certified professional air traffic controllers managed simulated traffic in a rich future operational environment with flight management system (FMS) and automatic dependent surveillance-broadcast (ADS-B) equipped aircraft flying charted FMS routes to final approach. A 2Ч2 repeated-measures design evaluated controller and pilot decision support tools (DSTs) for spacing and merging operations. In conditions with airborne spacing tools, 75 percent of the aircraft were equipped for airborne spacing, including single-piloted simulators flown by commercial pilots using cockpit display of traffic information (CDTI)-based DSTs. In conditions with ground-side spacing tools, controllers used standard terminal automation replacement system (STARS) displays augmented by a runway scheduler and timeline display, spacing advisories, and spacing feedback information. In all conditions, controllers maintained responsibility for separation. This research was conducted as part of the Advanced Air Transportation Technologies (AATT) project's distributed air ground traffic management (DAG-TM) element, with funding from the NASA Airspace Systems Program. DAG-TM research has been conducted at NASA Langley, Glenn, and Ames Research Centers. [C1023]

## "Space based radar on-board processing architecture"

This paper describes system-level issues and solutions for space-based radar on-board processing. A modular, upgradeable architecture has been defined and SEAKR Engineering has built three module types as a risk-reduction effort. The memory modules are scalable to 128 Gbits/board with 16 Gbps of I/O capacity. The processing element boards are FPGA-based and use five Xilinx Virtex-II Pro-70 parts. Four FPGAs each have four banks of 18Mbit fast SRAM and the fifth FPGA has 512 MBytes of SDRAM. There are 10 Gbps interconnects between the FPGAs and two 8Gbps external I/O ports. The network switch module is based on RapidIO with the first version handling 4 bidirectional ports with 8Gbps full duplex per port. System partitioning and thermal issues have led to the use of heat pipes for hot parts and advanced materials for the chassis. The system power supply has also been considered to provide 1000 Watts from the system bus to the high-current, low voltages used by the advanced deep sub-micron parts [C1024]

## "A study of Chicago O'Hare's March 2005 restrictions using an MIT analysis tool"

In order to efficiently maximize airspace usage, one element that deserves observation is miles-in-trail (MIT) restrictions. MITs are issued by any facility that needs to constrain traffic flow into a region of airspace-such as a fix, sector or specific route-that is expected to have future demand exceeding its capacity. Typically, a facility will either issue an MIT restriction for flights internal to it, or will pass the restriction to other adjacent facilities that feed traffic to that restricted region. The MITRE Corporation's Center for Advanced Aviation System Development (CAASD) has developed an MIT analysis tool that will aid in the process of understanding how MITs are applied. This paper provides a description of the MIT analysis tool and provides a limited analysis of MIT restrictions affecting Chicago O'Hare International Airport (ORD) over a one-month period. The application of the tool's results is supplemented with information about the background, purpose, usage, and limitations of the tool. [C1025]

## "Development of an Autonomous Mobile Surveillance System Using a Network-based RTK-GPS"

This paper describes an autonomous mobile surveillance system usually used in a factory premises with some high-rise buildings. This system consists of a wireless LAN network, a base station and an autonomous vehicle. The vehicle is equipped with a GPS/INS navigation system using the network-based Real-Time Kinematic GPS (RTK-GPS) with Positioning Augmentation Services (PASTM, Mitsubishi Electric Corporation 2003), an Area Laser Radar (ALR), a CCD camera called slaved camera, and an Omni-Directional Vision (ODV) sensor for surveillance and reconnaissance. The vehicle switches navigation modes according to the vehicle status. It has three guidance modes, which are "Normal", "Road tracking", and "Crossing recognition". A field test result shows that the vehicle can track the planned path within 0.10[m] accuracy at straight paths and within 0.25[m] for curved paths even if RTK fixed solutions are not available. Field experiments and analyses have proved that the proposed navigation method can provide good enough guidance accuracy even under poor satellite visibility and that the panorama image database with absolute position is useful for surveillance. [C1026]

## "A microjet array cooling for the thermal management of active radar systems"

Next-generation active radar systems are employing high power density, high temperature electronic devices such as those based on wide bandgap GaN semiconductors, requiring more advanced thermal management technology that is capable of providing higher heat dissipation and a more accurate temperature control. An innovative microjet cooling concept, bottom-side microjet array cooling (BSMAC), is proposed to cope with the demanding thermal management imposed by active radar systems. Compared with current or other emerging cooling techniques, the BSMAC has the advantages including high thermal performance, low cost and easiness to be incorporated into the currently used package structure and processing. A numerical simulation is conducted to investigate the thermal performance of the BSMAC. For the numerical study, a commercial code, FLUNET, is used to model a 3D chip array package structure with a BSMAC heatsink. The convection heat transfer is analyzed and some influential parameters are evaluated. The numerical results demonstrate the superior thermal performance of the BSMAC heatsink that is able to dissipate high heat power with a uniform temperature distribution among chips. [C1027]

## "Parametric cost estimating: a practical independent method of estimating the manufacturing cost of chips to modules in the Peoples Republic of China"

The cost estimating discipline is making rapid progress in the Peoples Republic of China. Parametric cost estimating tools, including a microcircuit parametric estimating model, have been introduced to the major large system developers in China. The parametric cost estimating process not only estimates product cost but also provides an effective program cost management tool used for design to cost trade studies. This paper introduces the parametric cost estimating method and explores the parametric process when applied to an advanced microcircuit packaging (LTCC) in a high volume, relatively low cost application used in a rugged environment. The PRICE Systems Microcircuit (PRICE M) parametric cost estimating model is presented along with its fundamental cost drivers and factors. An independent parametric estimate for a low temperature cofired ceramic (LTCC) microcircuit module is presented. The required estimating parameters and the resulting estimate is described along with a technical walk-thru using the independent parametric estimate of the 24 GHz short range radar sensor for automotive applications. The independent cost analysis estimate is based upon a microcircuit developed in a joint project of IMST GmbH (Germany) with DuPont Microcircuit Materials (a detailed presentation of the microcircuit project is described in the IMAPS Advancing Microelectronics March/April 2005 publication). The packaged chips and all components along with the LTCC substrate cost and assembly and test costs of the assembled module is estimated and presented. The entire estimate uses P.R. China financial factors. [C1028]

## "Space based radar technology challenges"

Space based radars are gaining significant acceptance for world-wide, all-weather, on-demand surveillance and earth resources monitoring. The main impediment has been affordability, followed closely by the limitations by satellite communications for providing near real time target detection data to the users. Recent advances in active electronic scanned arrays and on-board signal processing are enabling SBR development for both surface and fixed target imaging and moving target detection. The real challenge is for future surveillance of airborne targets. This paper outlines some critical SBR design architectures, and a roadmap for developing the enabling technologies to meet future surveillance needs [C1029]

## "Advanced multi chip module solutions for RF and digital space applications: status and perspective"

The evolution of space modules and equipment hardware is strictly related to the progress of enabling technologies in terms of available high reliable processes and devices, advanced interconnection and packaging techniques and high repeatability production systems. The evolution towards highly integrated microwave and digital hybrids implies an integrate study of electrical, thermal and mechanical properties and proper power dissipation and thermal management techniques. The paper goes through the last solutions conceived and applied by Alenia Spazio in its broad product portfolio for telecommunication, radar and scientific space electronics application. [C1030]

## "An Analytical Model and A Fast Mechanism for Fault Restoration in IP over WDM Networks Based on n:m Scheme"

The fault restoration technique based on n:m scheme can improve system availability with small cost increases for WDM networks, where it is possible that n faults occur synchronously in a protection domain or a protection entity, but it has rarely been implemented or standardized. In this paper, an analytical model for mean restoration time of restoration mechanism based on n:m scheme is developed. As a general model, it aims at the WDM networks with the restoration paths created in advance of fault occurrence without wavelength reserved. In

particular, the proposed protocol for processing faults has been improved to make the restoration based on n:m scheme as fast as that based on 1:1 or n:1 scheme [C1031]

## "Advanced design of phased array beam-forming networks"

Recent fundamental results in the theory of linear, multi-port networks enable cost-effective, higher-reliability designs for electronically-steered phased arrays. The new results are based on a generalization of the classical concepts of scalar image impedance, and of a scalar image-transfer function for two-port networks, to the new concepts of multidimensional image-impedance matrix, and of multidimensional image-transfer function for linear multi-port networks. [C1032]

## "Handheld GPR and MD sensor for landmine detection"

A novel landmine detection sensor system, called ALIS (advanced landmine imaging system), which combines a metal detector and GPR, has been developed. This is a handheld equipment, which has a sensor position tracking system, and the sensor output can be visualized in real time on a head-mounted PC display. A field evaluation test of ALIS was conducted in Afghanistan, and we demonstrated that it can detect buried antipersonnel landmines, and can also discriminate metal fragments from landmines. [C1033]

## "Optically steerable antenna systems overview"

Simple methods to obtain phase shifts and an amplitude regulation using electro-optical technique, with purpose to drive antenna array systems, are presented. This solution comprises true-time delay properties of the optical fiber, driven by tunable lasers, in the following overview, several techniques proposed by different authors are presented. All methods are based on the same idea, which consists on setting the radiofrequency signal phase and amplitude in the optical domain instead of using radiofrequency techniques. Trough the electro-optical conversion the radiofrequency signal is transferred onto an optical carrier, where it can be influenced to achieve the desired result. [C1034]

## "Powerful radiation on electronic IR transitions of rare gases in a simple TEA laser"

The goal of this work is to show the prospects for a simple TEA laser excited by self-sustained discharge the same as a typical TEA CO2laser for generation of powerful pulses in rare gases (Xe, Kr, Ar, Ne) on IR electronic transitions. For this purpose the optimization of power and spectral parameters of such laser (working chamber-65Ч2.5Ч1.8 cm) for four rare gases has been carried out. In result, powerful lasing on 15 lines in the range of 1-4 microns with the output energy on stronger of them has been achieved >10 mJ (peak power >0.2 MW). Estimations have shown that more detailed optimization of the pumping and the cavity will essentially raise energy performances of such laser. Preliminary experiments have confirmed prospects of the use of the simple TEA laser on electronic IR transitions of rare gases in a typical lidar system. [C1035]

## "Very long microstrip array feeds of a membrane reflector for the advanced precipitation radar"

Very long microstrip arrays have been developed at the Ku-band and Ka-band frequencies. Each array, having an electrical length of about 110 free-space wavelengths, is used to feed a deployable thin-membrane cylindrical reflector for a spaceborne precipitation radar application. These arrays, designed for 0° and 30° fixed beam directions, achieved peak sidelobes of -20 dB and average sidelobes below -30 dB with peak cross-pol levels below -20 dB. Several unique challenges were encountered during the technology prototype development of these very long arrays, such as the strong coupling between very long power divider lines, the strong leakage radiation from the lengthy transmission lines, and the lack of computer analysis capability of these electrically large arrays. [C1036]

## "Ultra narrow band adaptive tomographic radar"

This paper addresses the issue of spatial diversity in radar applications. Typically, information concerning ground and air targets is obtained via monostatic radar. Increased information is often equated with increased bandwidth in these radar systems. However, geometric diversity obtained through multistatic radar operations also affords the user the opportunity to obtain additional information concerning threat targets. With the appropriate signal processing, this translates directly into increased probability of detection and reduced probability of false alarm. In the extreme case, only discrete ultra narrow band (UNB) frequencies of operation may be available for both commercial and military applications. With limited spectrum, UNB in the limiting case, the need for geometric diversity becomes imperative. This occurs because the electromagnetic spectrum available for commercial and military radar applications is continuously being eroded while the need for increased information via radio frequency (RF) detection of threat targets is increasing. In addition, geometric diversity improves target position

accuracy and image resolution, which would otherwise remain unavailable with monostatic radar. [C1037]

## "Evolution of the radar target tracking algorithms: a move towards knowledge based multi-sensor adaptive processing"

Though there are a no. of methods for target tracking described in literature like Kalman filtering, extended Kalman filtering, Bayesian approach, IMM-PDA, ML-PDA, particle filters, random set theory, covariance intersection, neuro-fuzzy methods, tracking through genetic algorithms and so on, the goal has always been to bring adaptivity to tackle the changing situations. Since, no one sensor can perform well in all the conditions, Multi-sensor adaptive processing has been the inherent focus. This paper presents a brief account of the target tracking algorithms developed till date and to be developed in future and brings out the main development trends. As a novel way of presentation, a Boston Consulting Group (BCG) matrix analysis has been performed and the algorithms have been classified in four classes i.e. Question marks, stars, cash cows and dogs. It has been applied to the radar target tracking algorithms. The evolution and further discussion about future trends clearly show a shift towards knowledge based adaptivity and sensor fusion. Though a number of papers have come out bringing complete account of target tracking algorithms but their presentation format does not provide a way of their practical utilization in the system development. The mathematical formulations are complex and mixing is too much for a non-expert or even a system manager to take decisions. Thus a need was felt to provide a suitable format to the decision makers and provide the non-expert a balanced simple account of the algorithms. Further, a knowledge based perspective has been brought out well in this paper. Knowledge based theme though shown in target tracking here is not limited but applies to other areas of radar, ATR, air traffic control & collision avoidance, network centric warfare etc. also. Latest knowledge based research has been incorporated in a broader sense to cover ANNs, CI, fuzzy etc. also. [C1038]

## "Structured covariance estimation and radar imaging with sparse linear models"

The problem of the computational complexity of the structure covariance EM algorithm is considered. Ordinarily this algorithm requires O(N3) floating point operations, per iteration, for the estimation of an N-point power spectrum. However, if the linear model relating the observations to the underlying variables is sparse, the computational burden can be reduced to O(N) operations. This sparsity can be achieved approximately by a data preprocessing step that causes the effect of each underlying variable to be seen in only one component of the preprocessed observation vectors. An illustrative example involving a rotating linear array as the sensor and a Chebyshev filter bank as the preprocessor is given. [C1039]

## "Autonomous intelligent radar system (AIRS) for multi-sensor radars"

An autonomous intelligent radar system (AIRS) deployed on a surveillance aircraft is briefly described. A net-centric compliant approach for integrating AIRS is presented. An overview of unmanned autonomous air vehicle research is provided along with a discussion of some of the issues with integrating AIRS aboard these vehicles. [C1040]

## "A method for combining focused monostatic and bistatic GPR to reduce multipath effects"

Imaging of buried objects using subsurface microwave technology can result in images with numerous undesirable artifacts due in part to noise and multipath scattering. In order to alleviate the problem of multipath scattering, the authors propose the combined use of monostatic and bistatic systems. Focusing both images and compensating the bistatic system enables us to place the direct path scatterers at the same position as in the monostatic case. A multiplication of the final images will attenuate the scatterers that are formed by multiple reflections and will therefore reduce artifacts. Results are shown using simulations in which the signatures of several point scatterers overlap for the direct reflections and where the multipath signatures do not; thus allowing the multiplication to enhance the final image. [C1041]

## "A beamforming approach to stepped-frequency synthetic aperture through-the-wall radar imaging"

A data-adaptive stepped-frequency synthetic aperture radar system based on quadratically constrained Capon beamforming is presented for through-the-wall wideband microwave imaging applications. Various effects of the presence of the wall, such as refraction, change in speed, and attenuation, are incorporated into the beamformer design. Proof of concept is provided using real data collected in a laboratory environment. The results show that the proposed Capon beamformer outperforms the non-adaptive through-wall delay-and-sum beamformer. [C1042]

## "Target height estimation in an emulated bistatic radar via interferometric processing"

This paper investigates the application of emulated bistatic radar geometries to interferometric processing techniques. This is carried out in order to allow an estimation of a target's height without the complexity associated with standard interferometric processing systems. In this paper the interferometric technique is reformulated to incorporate an emulated bistatic radar configuration. Simulation results with error analysis are also provided. [C1043]

## "Multi-dimensional aperture design and analysis for SAR using the Cramer-Rao theorem"

We are applying the Cramer-Rao theorem to synthetic aperture radar (SAR) processing in order to establish flight paths that permit height estimation and minimize errors in reflectivity measurements. The Cramer-Rao bound (CRB) establishes a lower bound on the error variance of unbiased estimates. Error bounds are developed for multi-dimensional synthetic apertures that improve the overall performance and efficiency of monostatic, single-pass SAR missions. A computationally efficient means for the design and analysis of SAR waveforms is proposed using simulated scattering models that are limited in size. A comparison made with the error bounds for standard SAR show that estimates of scatterer range and cross-range positions are sufficiently accurate for multi-dimensional aperture SAR, even with the additional estimator for height. [C1044]

## "Real-time wideband optical processing of S-and X-band signals for advanced radar systems"

Real-time, wideband (>1 GHz) analog signal processing is experimentally demonstrated utilizing electro-optical devices and spectrally selective optical materials. Broadband signals are processed directly at S-band and X-band carrier frequencies without any down conversion. [C1045]

## "UC Davis 94 GHz gyrotron traveling-wave amplifier developments"

Summary form only given. During the past year, record performance has been obtained at W-band from the UCD TE01 proof-of-principle gyro-TWT: 75 kW output, 45 dB gain, 22.5% efficiency, and 3.7% saturated bandwidth (BW) at 93.5 GHz. In this talk, we report the design and fabrication of a new follow-on ultra high gain (71 dB) gyro-TWT producing 110 kW output at 5% BW with the focus on advanced millimeter wave radars. [C1046]

## "Doppler radar sensing of multiple subjects in single and multiple antenna systems"

Doppler radar life sensing has shown promise in medical and security applications, however the problems of motion artifacts and presence of multiple subjects limit the usefulness of this technique. By leveraging recent advances in signal processing and wireless communications technologies, the Doppler radar technique has the potential to overcome these limitations. We explore the single and multiple antenna systems and SIMO/MIMO signal processing to isolate desired radar return signals from multiple subjects. It has been experimentally demonstrated that up to two subjects can be separated in a single antenna systems. Simulations have also shown that in case two subjects have identical cardiovascular behavior, it is possible to distinguish them using MIMO techniques. [C1047]

## "1st IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (IEEE Cat. No.05EX1140C)"

{no data available} [C1048]

## "Cognitive radar networks"

In my previous publication, I described, for the first time, the novel idea of cognitive radar, its attributes and potential applications. This article expands on one of the applications described therein-namely, cognitive radar networks. After briefly describing the constitution of this new radar system, we focus on the specific application of homeland security, for which a cognitive radar network is rather well suited. [C1049]

## "Model based vehicle detection for intelligent vehicles"

One of the Advanced Driver Assistance Systems are being researched nowadays for Intelligent Vehicles has to deal -with the detection and tracking of other vehicles. It will have many applications: Platooning, Stop&go, Blind angle perception, Manoeuvres supervisor. In this paper, a system based on computer vision is presented. A geometric model of the vehicle is defined where its energy function includes information of the shape and symmetry of the vehicle and the shadow it produces. A genetic algorithm finds the optimum parameter values. Examples of real images are shown to validate the algorithm. [C1050]

## "Session 4B: Wideband wireless communication"

{no data available} [C1051]

## "Radar sensors and sensor platform used for pedestrian protection in the EC-funded project SAVE-U"

The automotive industry and sensor suppliers have responded to the European Commission's request to reduce the road fatalities by 50% until 2010 and they are developing advanced systems for road safety. Short range radar (SRR) sensors in the 24 GHz domain allow coverage of the surroundings of the vehicle, complementing the existing 77 GHz radars used for adaptive cruise control (ACC) systems since 1999. This paper deals with a special variant of pre-crash systems, namely: "pre-crash for vulnerable road users protection". The target is the protection and collision mitigation of pedestrians and bicyclists versus a vehicle. To achieve trigger information for automatic protection systems (like automatic braking or other reversible systems) as well as warning information for drivers, a high performance sensor platform is necessary. This paper presents approaches from the EC-funded project SAVE-U (sensors and system architecture for vulnerable road users protection) of the fifth framework program of the European Commission. The sensor platform consists of short range radar sensors, cameras in the visible and infrared domain. The focus is located on a high- and low-level- data fusion architecture to fulfill the strong requirements. The intension of this paper is mainly to describe the 24 GHz short range radar sensor development for the detection capability of pedestrians in ranges up to 30 m and the sensor fusion technique. [C1052]

## "Standard platform for sensor fusion on advanced driver assistance system using Bayesian Network"

In this paper, a new architecture for sensor fusion for advanced driver assistant system (ADAS) is proposed. This architecture is based on Bayesian Network and plays the role of a platform for integrating various sensors such as Lidar, Radar and Vision sensors into sensor fusion systems. This architecture has the following 3 major advantages: (1) It makes structure and signal flow of the complicated fusion systems easy to understand (2) It increases the reusability of the sensor algorithm modules (3) It achieves easy integration of various sensors with different specifications. These advantages are confirmed by vehicle test. [C1053]

## "Through-wall and wall microwave tomography imaging"

In the present work new results of experimental investigation on TWWI with using the microwave tomography technique are submitted. A tomographic algorithm is employed for the cross-section imaging of dielectric and metal objects on the other side of a concrete wall and within a concrete block. The cross-section restoration of studied objects is based on the tomography integral equation. The scattered field of the object is measured on a direct line parallel to the wall investigated. The solution of this integral equation gives the possibility to find the function representing the normalized polarization current distribution in the probing cross-section which is normal to the wall surface and in which the scan line lies (vertical cross-section). The normalized polarization current distribution depends on frequency and can be calculated for a set of frequencies. The image function is defined as modulus of the sum of the normalized polarization current distributions. If the wall material in vertical cross-section is not homogeneous because of the presence of defects or quests within the wall or on the other side of the wall, one can see these inhomogeneities. A set of images in different vertical cross-sections allows us to reconstruct a 3D image of the object. It is shown that advanced through-wall and wall images can be obtained by application of an indemnification procedure to the field caused by final sizes of the scanning line and also by using an algorithm allowing us to allocate from the complete field the scattering component. [C1054]

## "CHAUFFEUR Assistant: a driver assistance system for commercial vehicles based on fusion of advanced ACC and lane keeping"

This paper presents the integrated approach for environment perception and vehicle control developed for the CHAUFFEUR Assistant application. Using a combination of radar and video sensor, the sensor fusion approach provides the vehicle controllers with valuable data about preceding vehicles and about the lane. These controllers guide the truck to stay in the lane and keep a short but still safe distance to the preceding vehicle. [C1055]

## "Ultra scanning geostationary orbiting radar: an array compensated spherical reflector antenna"

Current advances in monitoring hurricanes and convective storms throughout their life cycles necessitate the development of technologies for high resolution spacecraft antennas with an ultra-scanning capability. Therefore for the first generation of geostationary orbiting radars, an antenna system is to be designed at 35 GHz. The feasibility of correcting phase aberration of spherical reflector antennas with planar array feeds is investigated. A

synthesis procedure for the array excitation is developed which invokes the reciprocity theorem and phase conjugate matching. Using the synthesized compensating array-feed, the radiation characteristics of a compensated spherical reflector is simulated for both focus and 4° scan cases and results are compared with the uncompensated case to show performance improvement. [C1056]

## "Evaluation of the detection characteristics of road sensors under poor-visibility conditions"

Implementation of the Advanced Cruise-assist Highway System requires rigorous testing of the road sensors, which play a central role in the system, on actual roads to ascertain their vehicle detection characteristics. We evaluated these detection characteristics on actual roads under conditions of poor visibility caused by fog. This report presents an overview of the test results and issues raised for operational deployment of the system. [C1057]

## "The advanced protection of vulnerable road users (APVRU)-project information sheet"

Summary form only given. The aim of the APVRU project is to develop a sensor system capable of detecting a pedestrian (or other vulnerable road user) and to distinguish vulnerable road users from the road environment. This sensor system may eventually provide the technological link between detection and a driver warning system or activation of a suitable safety system on the exterior of the vehicle. The sensor system that is currently under development comprises radar units to determine the range and bearing of an object. Infra-red sensors then determine whether or not the object is a vulnerable road user by analysing the size, shape, position and distribution of the infra-red image. The information regarding the relative position of the vulnerable road user, as well as information on the car's speed, will be processed using algorithms that will decide when an active safety system should or should not deploy. [C1058]

## "Advances in computational electromagnetics"

The paper presents a selection of techniques that are currently being investigated at the Technical University of Gdansk and can be used to accelerate CAD of microwave circuits and the computation of high and low frequency electromagnetic fields. Techniques for creating surrogate CAD models and their application to automated design of band pass filters are discussed. Different strategies of electromagnetic field representation for mesh based and meshless methods are introduced and their efficiency illustrated on examples involving structures with complex geometries. [C1059]

## "Analysis of 2-D correlation properties of sea surface backscattered signal"

New radar technology applications need more and more advanced signal processing algorithms. In order to design processing algorithms it is necessary to dispose sufficiently accurate signal model. In this paper the 2-D correlation properties of sea surface radar return are analysed. The data for the analysis are real registered radar signals. The results show the dependence of correlation coefficients and correlation distances on range. Some parameters of power spectral density are introduced and analysed too. The conclusions formulated can be useful for modelling, simulation and segmentation of 2-D radar signals (images). [C1060]

## "State of the art high-speed photodetectors for microwave photonics application"

The paper reviews the recent advances in high-speed photodetectors based on A3B5compounds for microwave photonics application. The two main trends in the evolution of the high speed photodetectors like improving of the bandwidth-efficiency product and increasing of the saturation current are discussed. The main types of the high-speed photodetectors such as p-i-n photodiodes, avalanche photodiodes, Schottky photodiodes, metal-semiconductor-metal photodetectors, resonant-cavity-enhanced photodiodes, waveguide photodiodes, traveling-wave photodetectors, and velocity matched distributed photodetectors are considered. [C1061]

## "Recent advances in the development of polarimetric interferometric SAR imaging in microwave remote sensing of the terrestrial covers: need for developing multi-band single and multiple pass POLinSAR monitoring platforms in air and space"

In this overview, reasons are provided on why we do need to place multi-modal, multi-band single and multiple pass POLinSAR monitoring platforms into air and space. The questions "on what POLinSAR monitoring can provide that POL-SAR and IN-SAR by themselves cannot accomplish" is assessed; whereupon facts and justifications on placing POL-IN-BISAR satellite clusters into space are presented. Reasons for this technology becoming a basic requirement for current, near-future and much more so for future all-day & night year around monitoring of the terrestrial covers are analyzed in view of the un-abating and uncontrollable terrestrial population explosion, which has, does and for ever will result in unavoidable conflicts deteriorating unfortunately

at times into terrorism. The pertinent questions on how to reduce the exorbitant cost for initiating this "home-globe security protection" technology are therefore also broached, and the expected benefits are laid out. The pertinent National and International airborne and space borne multi-modal, multi-band SAR remote sensing and security conflict surveillance support agencies are herewith invited for co-sponsoring our proposal, which is timely and fleets of orbiting multi-band space-borne POLinSAR platforms are urgently required. [C1062]

## "From airborne via drones to space-borne polarimetric-interferometric SAR environmental stress-change monitoring-comparative assessment of applications"

Very decisive progress was made in advancing fundamental POL-IN-SAR theory and algorithm development during the past decade. This was accomplished with the aid of airborne and shuttle platforms supporting single-to-multi-band multi-modal POL-SAR and also some POL-IN-SAR sensor systems, which are compared and assessed with the aim of establishing the hitherto not completed but required missions such as tomographic and holographic imaging. Because the operation of airborne test-beds is extremely expensive, aircraft platforms are not suited for routine monitoring missions which is better accomplished with the use of drones or UAVs. Such unmanned aerial vehicles were developed for defense applications, however lacking the sophistication of implementing advanced forefront POL-IN-SAR technology. This shortcoming is thoroughly-scrutinized resulting in the finding that we do now need to develop the most rapid POL-IN-SAR drone-platform technology especially for environmental stress-change monitoring with a great variance of applications beginning with flood, bush/forest-fire to tectonic-stress (earth-quake to volcanic eruptions) for real-short-time hazard mitigation. However, for routine global monitoring purposes of the terrestrial covers neither airborne sensor implementation-aircraft and/or drones-are sufficient; and therefore multi-modal and multi-band space-borne POL-IN-SAR space-shuttle and satellite sensor technology needs to be further advanced at a much more rapid phase. The existing ENVISAT with the forthcoming ALOS-PALSAR, RADARSAT-2, and the TERRASAT are compared, demonstrating that at this phase of development the fully polarimetric and polarimetric-interferometric modes of operation must be viewed and treated as preliminary algorithm verification support modes and at this phase of development, they are still not to be viewed as routine modes. [C1063]

## "Advances in RF-microwave and light sources for applications in therapeutic medicine"

The expansion in the use of RF/Microwaves and optical sources in therapeutic medicine is dramatic. In this paper, some of the ongoing therapeutic modalities will be mentioned with the emphasis on our future research, for example: our attempts to combine microwaves and laser sources in therapeutic medicine, such as their applications in photodynamic therapy, and the utilization of blue LED's (light emitting diodes) for neonatal phototherapy. [C1064]

## "Circuitry and technological aspects of frequency synthesizers design for modern radars"

Different aspects and results of the development of multifunctional frequency synthesizers for coherent airborne radar systems of high detection characteristics are presented. The practical recommendations as to a circuitry choice, component base, design and production technology of synthesizers under consideration are given. The key element of advanced coherent radar is multifunctional frequency synthesizer (FS) forming the nomenclature of intercoherent signals, the main parameter of synthesizers are used to determine the characteristics of radar detection and its noise immunity. Thus the development of FS design is made by certain guided principles and considerations. [C1065]

## "Adaptive time-critical resource management using time/utility functions: past, present, and future"

Time/utility function time constraints (or TUFs) and utility accrual (UA) scheduling optimality criteria, constitute, arguably, the most effective and broadest approach for adaptive, dynamic time-critical resource management. A TUF, which is a generalization of the classical deadline constraint, specifies the utility of completing an application activity as an application-or situation-specific function of that activity's completion time. With TUF time constraints, timeliness optimality criteria can be specified in terms of accrued (e.g., summed) activity utilities. This work overviews past and recent advances on adaptive resource management for dynamic time-critical systems using UA algorithms. Emerging challenges and new research directions are also identified. [C1066]

## "A DSP engine for an extensible media embedded processor"

An extension interface for a configurable processor enabling implementation of an application specific programmable DSP is described. A DSP engine for mobile applications with 32-bit dual MAC architecture based on the extension was designed. The engine can also run separately as stand-alone processor decoupled with the configurable CPU core. A test chip was successfully fabricated using 0.13μm CMOS technology and has measured 0.23 mW/MHz for random logic of the engine and the core. [C1067]

## "Wide bandgap transistor amplifiers for improved performance microwave power and radar applications"

The generation of high RF output power, on the order of 100s to 1000s of watts necessary for transmitters for radars and wireless communications systems, remains a difficult challenge for semiconductor devices. RF power devices fabricated from standard semiconductors such as Si and GaAs are limited in the RF output capability by the inherent breakdown voltage of the semiconductor material. Recently, the development of wide bandgap semiconductors, such as SiC and GaN and related heterostructures, offers the potential to fabricate transistors with an order of magnitude improved RF output power compared to traditional devices. The wide bandgap semiconductor transistors offer the potential to fabricate high power transmitters for radars and communications systems, thereby permitting full semiconductor realization of advanced systems. However, the wide bandgap semiconductor devices currently suffer from several physical effects that are limiting the RF performance, and thereby, their application. These limitations are discussed and solutions presented. [C1068]

## "A wireless Internet-based measurement architecture for air quality monitoring"

This paper prevents a wireless monitor and control system using mobile communication. This system includes the remote measurement units (RMUs), GPRS network, Internet and a server computer. The GPS, GPRS modem and advanced RISC machine (ARM) are employed to achieve the functions of RMU. The measurement data are transmitted from RMUs into the server computer via Internet protocol (IP) address. In this way, the server computer can be very far away from RMUs and it can be also flexibly assigned. The server computer can support several RMUs with flexibly assigned functions. Therefore, the measurement results can be widely spread via Internet access in real time. The proposed measurement system is applied to an example to monitor the ambient air quality. The experimental results demonstrate the performance of overall system. [C1069]

## "Advanced time-domain processing of aperture antenna field"

Antenna design for new ultra-wide band (UWB) applications requires us to exploit true time domain (TD) electromagnetic models, not only to quickly achieve a broadband antenna response but also to investigate wavefront propagation and distortion directly in the time domain. In this paper an improved representation of impulsive aperture field is proposed which not only permits us to better represent the effective-height early transient, but also requires a reduced set of data compared with that involved in the previous model. The accuracy and efficiency of the corresponding far field representations is demonstrated by an example. [C1070]

## "Advanced SAR GMTI techniques"

Synthetic aperture radar (SAR) systems are designed to produce high quality imagery of a stationary target on the ground. These systems are not designed to handle moving targets and perform poorly in the areas of detecting and imaging moving targets. The paper presents advanced techniques developed to handle the detection and refocusing of moving targets for SAR systems. [C1071]

## "Imaging moving objects in 3D from single aperture synthetic aperture radar"

General Dynamics Advanced Information Systems (GDAIS), supported by the USA Air Force, has been investigating exploiting moving targets whose returns are captured by conventional SAR systems. The result is a processing system that can extract the detailed 3D motions of a moving object. This system is called Three-Dimensional Motion and Geometric Information (3DMAGI). This paper reports on work done with a full volume of data from the National Ground Intelligence Center (NGIC) and vehicle trajectories measured by an inertial system on a moving vehicle. Its goal is to determine how to best use the rich data available from advanced processing to produce images and image products that will simplify the task of exploiting the radar image. The data and sample trajectory are described as well as how they are used to emulate the result of 3DMAGI processing. The work consists of investigations into the methods of creating a 3D data volume that matches the NGIC chamber collection, starting from a small subset defined by the data surface which lies in the full volume. How much extrapolation is needed to get acceptable results is the first question posed. From there, the question of just what methods yield the best results is examined. Limitations of various methods are explained with examples. Comparisons of each method of extrapolation to the original data volume are presented to give an indication of progress toward the goal. [C1072]

## "Analysis of advanced data association techniques for ASDE radar"

The paper analyses and evaluates the application of different techniques to the data association problem for ASDE (airport surface detection equipment) radar. Data association for this sensor requires the removal of the

classical one-to-one constraints and should allow tracks to be updated by sets of blobs. Different innovative alternatives, based on recent advanced techniques, have been formulated and tried to solve this problem in complex scenarios. Simulation results show the capabilities achieved in terms of tracking robustness, accuracy and required computation. [C1073]

## "Advanced geostationary radar for hurricane monitoring and studies"

The current geostationary operational environmental satellites (GOES) are equipped to make cloud top measurements only. In contrast, a millimeter-wave radar allows 3D measurements of precipitation associated with hurricanes and other convective systems. It also provide important inputs for numerical weather prediction models for improving the accuracy of weather nowcasting and forecasting. Recently, a novel instrument concept and the associated critical technologies are being developed for a 35 GHz Doppler radar for detailed monitoring of hurricanes and severe storms from a geostationary orbit. This instrument is designed to be capable of producing rainfall rate at 13-km horizontal resolution and 300-m vertical resolution, and the line-of-sight Doppler velocity at 0.3 m/s precision, of the 3D hurricane structure once per hour throughout its life cycle. [C1074]

## "An open architecture for an embedded signal processing subsystem"

The paper describes the process employed to implement an advanced embedded signal processing subsystem for a legacy search digital signal processor (DSP), with emphasis on cost and open architecture (OA). This effort produced a low-cost, reconfigurable search DSP in a 15 month design cycle. A team of international partners was assembled, including Lockheed Martin Maritime Systems and Sensors (LM) (Moorestown, NJ), Indra Sistemas (Indra) (Madrid, Spain) and CSP Inc. (CSPI) (Billerica, MA). LM acted as the system design agent and was responsible for definition of the commercial off the shelf (COTS) architecture, technical requirements and fire control system (FCS) integration. Indra's responsibility was for software development that included the design, implementation and test of radar signal processing functions on general purpose processors. CSPI's responsibilities included providing development hardware, software, and training, as well as the development of a real-time interface to the legacy radar's processing cabinet. [C1075]

## "A new technique for testing GPRS mobiles"

First Page of the Article [C1076]

## "An inter-band handover technique for testing tri-band GSM mobiles efficiently"

First Page of the Article [C1077]

## "UMTS core network planning model and comparison of vendor product performance"

First Page of the Article [C1078]

## "Pulse-modulated radar display processor on a chip"

Summary form only given. As technology advances, equipment is becoming more compact, so the idea of having radar on a chip becomes more important. A radar system is broken down into its circuit elements. This system shows how we can have control of the minimum range detected by a software tool (LABVIEW) by simply moving a button instead of having complicated circuitry. A display system implemented fully with the same software that can be transformed into FPGA is also shown as a step towards having a radar system fully implemented on a chip. The use of software gives flexibility as it can be applied to any radar without the need to change any parameter in the display system. [C1079]

## "A robust algorithm for automatic target recognition using passive radar"

The goal of this research is to add automatic target recognition (ATR) capabilities to existing passive radar systems. We do so by comparing the radar cross section (RCS) of detected targets to the precomputed RCS of known targets in the target class. The precomputed RCS of the targets comprising the target class is modeled using a multi-step process involving programs such as the fast Illinois solver code (FISC). Advanced refractive effects prediction system (AREPS) and numerical electromagnetic code (NEC2). A Rician likelihood model compares the power profile of the detected target to the precomputed power profiles of the targets in the target class; this comparison results in target identification. Thus far, the results of simulations are encouraging, indicating that the algorithm correctly identifies aircraft with high probability at the anticipated noise level. Performance can be expected to decline as the noise power surpasses the maximum signal power. [C1080]

## "A CMOS WLAN/GPRS dual-mode RF front-end receiver"

A dual-mode, triband RF front-end receiver for GSM-900, DCS-1800 and IEEE 802.11b/g is introduced. With advanced architecture selection and frequency plan, only a single VCO and frequency synthesizer are required for both GSM/GPRS cellular and IEEE 802.11b/g WLAN. The receiver front-end has been realized in a 0.25 μm CMOS process. It dissipates about 30 mA from a 2.7 V supply for all modes and exhibits noise figures of 3 dB for the GSM-900 band, 5.9 dB for the DCS-1800 band, and 5.7 dB for 2.4 GHz WLAN. [C1081]

## "Cellular handset evolution-convergence of high-speed data services"

Summary form only given. Modem cellular handset designs are incorporating a wide variety of wireless interfaces. Wide area network (WAN) technologies are rapidly migrating from second generation voice interfaces to GPRS, EDGE, CDMA2000, WCDMA, and HSDPA that offer voice along with high speed data. WLAN technology, IEEE802.11a/b/g, is finding its way into handset designs and offers an attractive interface for high speed wireless data and voice over IP (VOIP) services. Wireless personal area networks (PAN) such as Bluetooth are also finding wide adoption. On top of this, GPS now ships in millions of handsets each year, digital broadcast television holds promise for widespread adoption within a few years, UWB products are coming to market, and advanced interfaces such as 4G WANs and cognitive radios are under discussion for the future. This offers a view of how all these standards will impact wireless services and what it will mean for handset design. [C1082]

## "Perfect punctured binary sequence pairs and application in frame synchronization"

Perfect discrete signal and it's design play key roles among many modern communication fields. A new perfect discrete signal is advanced in this paper, which is named perfect punctured binary sequence pairs(PPBSP).The properties and the combinatorial admissibility conditions of PPBSP are presented. We apply them to frame synchronization of digital communication by their good cross-correlation properties. The results produced from the computer simulation are found that PPBSP are good for frame synchronization. [C1083]

## "Multi-band antenna technology"

Enhancing the operational capability of current sensors and radar systems to detect targets at long ranges and map the terrain in all kinds of weather is a well-accepted measure. Multi-target tracking would require multi-beam, multi-band scanning phased array antennas. Therefore, in order to meet the current challenges, current sensor systems and radar systems must be expanded and strengthened to support the ever-increasing military requirements. Phased array antennas have emerged as the most viable solution for these important applications that include surveillance, tracking targets on the ground and for high-resolution ground mapping when operating at a sufficient altitude. Active phased array radar uses an advanced antenna system that not only employs electronic phase shifters to provide beam steering, but also contains solid-state RF amplifiers and low noise amplifiers for signal reception. Such phased array radar systems provide an excellent alternative to conventional radar systems on unmanned airborne vehicles (UAVs) or other air-platforms for surveillance and reconnaissance. In addition, the active array radar system offers advantages in the areas of power management and efficiency, reliability, signal reception, beam steering target detection and system performance. [C1084]

## "Electromagnetic scattering by thin dielectric sheets using integral equation techniques"

We present a volume integral equation formulation to analyze a thin dielectric sheet without a conductor backing. The integral equation uses both tangential and normal polarization currents to model the material, where the normal component is assumed to be constant across the thickness of the material. The currents are reexpressed in terms of the electric flux density because it has a continuous normal component across material discontinuities. The presented integral equation approach hinges on the accurate evaluation of the potential integrals involved. An integration scheme has been presented that accurately and efficiently handles both singular and near-singular terms for 2D and 3D subdomain geometries (Wilton, D.R. and Khayat, M. A., IEEE AP-S Int. Symp. and URSI Radio Science Meeting, 2003; Khayat and Wilton, Int. Conf. on Electromagnetics in Advanced Applications, 2003; URSI National Radio Science Meeting, 2004). The radar cross section is calculated for a thin dielectric sheet and found to be in good agreement with the literature for incident field polarization which is transverse electric (TE) or transverse magnetic (TM) to the sheet. [C1085]

## "Design of an ultra high-speed all-optical analog-to-digital converter"

An all-optical analog-to-digital converter capable of sampling at 50 GS/s is described. The ADC works in the spectral domain, unlike the other all-optical or hybrid methods. The RF signal is sampled by electro-optically steerable gratings and quantized by a set of detectors with scalable apertures. Low timing jitter is provided by a

mode-locked laser. [C1086]

## "The knowledge aided sensor signal processing and expert reasoning (KASSPER) real-time signal processing architecture [Cradar signal processing]"

The KASSPER project is a Defense Advanced Research Projects Agency (DARPA) program which has the goal of improving the performance of ground moving target indicator (GMTI) radar systems by incorporating external sources of knowledge into the signal processing chain. The KASSPER real-time signal processing architecture is a radar system scheduling and signal processing framework that is being developed at Massachusetts Institute of Technology Lincoln Laboratory (MIT LL). This paper discusses the design of the architecture, knowledge handling issues. resource scheduling issues, the current state of the prototype implementation of the framework, and the current state of the project's real-time processor testbed. [C1087]

## "GLRT-detection performance in subsurface sounding"

The performance of subsurface deep sounding is investigated with reference to the radar sounder, MARSIS (Mars advanced radar for subsurface and ionosphere sounding), aboard the Mars Express mission, designed to investigate the presence of water-related interfaces in the subsurface of Mars. The analysis aims at providing the necessary tools for (i) performance prediction and (ii) data processor design. Using well known models for the backscattered signal, we compare the expected signal-to-clutter ratio values under most of the instrument's operating conditions. The generalized likelihood ratio (GLR) approach is followed for subsurface interface detection, and along-track integration is introduced in order to achieve the desired performance. In particular, we address the design of the integration window, and the requirements of data homogeneity. A thorough performance analysis is presented to cope with the expected MARSIS scenarios. In particular, we investigate several sources of mismatch between the assumed model and collected data, and derive the performance degradation due to each source. [C1088]

## "Electrothermal models of transistors based on finite element analysis for radar applications"

Electrothermal models of power devices are necessary for an accurate analysis of their performances. For this reason, this paper deals with the methodology to obtain an electrothermal model based for its thermal part on a reduced model of a three dimensional Finite Element (FE) thermal simulation and on electrical measurements for its electrical part. The reduced thermal model is based on a Ritz vectors approach and its equivalent SPICE subcircuit implementation. The complete model has been successfully implemented in the Advanced Design Simulator (ADS) for two kind of X band power amplifiers of 8 W class. One is based on TRIQUINT PHEMT transistors and the other on UMS HBT transistors. Coupled to a distributed electrical model, this electrothermal model has been used in order to investigate the behavior of these two High Power Amplifiers (HPAs) during radar pulses. [C1089]

## "Wideband bow-tie slot antenna with tuning stubs"

Printed bow-tie and bow-tie slot antennas are planar-type variations of the biconical antenna that has wideband characteristics. We present the effects of adding a tapered metal stub to a bow-tie slot antenna design to enhance the antenna bandwidth for X-band operation. Our study yields a design with 88% bandwidth relative to 10 GHz. The simulation and analysis are performed using the commercial computer software package, Momentum of Agilent Technologies, Advanced Design System (ADS). Verification of the ADS results is performed by using our developed finite difference time domain (FDTD) code and with measurements of the return loss from 7 to 15 GHz. [C1090]

## "SDR approach to 3G cellular/PCS and position location services"

In the past few years. third generation (3G) mobile communication systems, where the spectrum of the services now extend up to 60 MHz to 75 MHz, have emerged. In this process, new communication waveforms, such as WCDMA (TDD and FDD) cdma2000 and TD-SCDMA. are now joining the legacy communication waveforms such as GSM/EDGE/GPRS and cdmaOne, to form a large set of services that are used throughout the world. CellularWS manufacturers are now facing various challenges in supporting multiple services as these services have different frequency, bandwidth and protocol structures. Furthermore, in 2001, USA FCC has mandated the E911 requirements for user location services. To meet these requirements radio manufacturers have investigated methods of position location for user equipment. The main objective is to develop the position location solution that is synergistic with the cellular/PCS technology while minimizing the change of current base station infrastructure. In this paper, the SDR architecture for 3G cellular/PCS services and location services is addressed along with the technologies that make this advanced architecture feasible. [C1091]

## "Direct perception of collision danger information for safe marine navigation"

Collision avoidance is a crucial operative task in marine navigation. The potential consequences of a ship-ship collision could be catastrophic with human losses and environmental pollution. Though the universal use of automatic radar plotting aid (ARPA) system on board ships has greatly reduced the risk of collisions, ARPA is insufficient to support operators' direct perception of potential collision danger and knowledge-based problem-solving behaviors. Therefore it is imperative to visualize collision-related information graphically in an interface. The authors introduce the limitations of current ARPA display and point out that visualization of a collision danger line (CDL) and a collision danger sector (CDS) to an acquired target in true-motion interface is a practical approach for the navigator to detect potential collision danger directly and take suitable evasive actions well in advance of a developing situation. A CDL/CDS display has been developed and evaluated subjectively. It is argued that this display is promising and has the potential for real application. A simulator test program is currently being planned to further investigate the potential. [C1092]

## "Performance of MIMO radar systems: advantages of angular diversity"

Inspired by recent advances in multiple-input multiple-output (MIMO) communications, this paper introduces the statistical MIMO radar concept. The fundamental difference between statistical MIMO and other radar array systems is that the latter seek to maximize the coherent processing gain, while statistical MIMO radar capitalizes on the diversity of target scattering to improve radar performance. Coherent processing is made possible by highly correlated signals at the receiver array, whereas in statistical MIMO radar, the signals received by the array elements are uncorrelated. It is well known that in conventional radar, slow fluctuations of the target radar cross-section (RCS) result in target fades that degrade radar performance. By spacing the antenna elements at the transmitter and at the receiver such that the target angular spread is manifested, the MIMO radar can exploit the spatial diversity of target scatterers opening the way to a variety of new techniques that can improve radar performance. In this paper, we focus on the application of the target spatial diversity to improve detection performance. The optimal detector in the Neyman-Pearson sense is developed and analyzed for the statistical MIMO radar. An optimal detector invariant to the signal and noise levels is also developed and analyzed. In this case as well, statistical MIMO radar provides great improvements over other types of array radars. [C1093]

## "Technical advances in the Naval Meteorology and Oceanography program"

The challenge of the Naval Meteorology and Oceanography Command is to assess and predict the world's most diverse operating environment and translate its impact on military defense areas-aviation, maritime operations, expeditionary/special operations and undersea/surface/mine operations. The command seeks continual improvement in its core competencies to provide meteorology and oceanography geospatial information -in order to provide safety of navigation and turn environmental information into combat power. In recent years, the Navy has reinvigorated its METOC program through advanced training programs, numeric modeling, state of the art survey ships, airborne lidar surveys, autonomous underwater vehicles and rapidly deployable fleet survey teams. This presentation describes the role of new technologies in Navy Oceanography. [C1094]

## "Seeing beyond the perimeter: the Advanced Exterior Sensor (AES)"

The system design of the Advanced Exterior Sensor (AES), test data and Sandia National Laboratories' current work on the AES is described. The AES integrates three sensor technologies (thermal infrared waveband, visible waveband, and microwave radar) in a Remote Sensor Module communicating with three motion detection target trackers and a sensor fusion software module in the Data Processor Module to achieve higher performance than single technology devices. Wide areas are covered by continuously scanning the three sensors 360 degrees in about one second. The images from the infrared and visible detector sets and the radar range data are updated as the sensors rotate each second. The radar provides range data with approximately one-meter resolution. Panoramic imagery is generated for immediate visual assessment of alarms using the Display Control Module. There is great potential for site security enhancement using the AES, which was designed for low-cost, easy use and rapid deployment to cover wide areas beyond typical perimeters, possibly in place of typical perimeter sensors, and for tactical applications around fixed or temporary high-value assets. Commercial-off-the-shelf (COTS) systems have neither the three sensor technologies nor the imaging sensor resolution. Cost and performance will be discussed for different scenarios. [C1095]

## "The next generation of GUIDAR technology"

The next generation of Guided Radar (GUIDAR) is based on Ultra Wide Band (UWB) radar signal processing. Just as spread spectrum technology has revolutionized the communications industry, UWB is dramatically changing radar signal processing. These advanced signal-processing techniques are adapted to leaky coaxial

cable technology in the next generation GUIDAR to provide new features and enhanced performance. At the core of the new technology is an ultra high-speed digital correlator implemented in a Field Programmable Gate Array (FPGA). Complementary orthogonal codes based on Golay codes are used to produce thumbtack correlation functions simultaneously in multiple range bins. The net result is "near continuous wave (CW)" performance in forty to eighty 11.6-meter long-range bins with targets located within one meter along the length of cable. This is a dramatic improvement over the 3% duty cycle of the original GUIDAR and the typical 100 to 200 meter long zones of current CW leaky cable sensors. Orthogonal complementary codes are transmitted on each of two leaky coaxial cables. The response from two parallel receive cables is fed to a full synchronous detection receiver. The orthogonal nature of the code allows the composite coded pulse response to be de-multiplexed into the independent response for each of the two cables. This ultra-high speed correlation process involves the addition and subtraction of the sampled in-phase and quadrature-phase responses to the multiple range bin accumulators at 10 million samples per second. [C1096]

## "ADAM: advanced airport multilateration system"

First Page of the Article [C1097]

## "Advanced ground based escan radars"

First Page of the Article [C1098]

## "Advanced onboard RF radar subsystems"

First Page of the Article [C1099]

## "Consolidated Advanced Technologies for Law Enforcement Program"

The Consolidated Advanced Technologies for Law Enforcement Program (CAT Program) is a collaborative effort between the University of New Hampshire and the New Hampshire Department of Safety. The program addresses related problems in the integration of electronic devices within police vehicles, and in the network communications integrating vehicles and law enforcement agencies, all of which impact the ability to seamlessly collect, interpret and exchange information in real time. Since the program was first funded in September, 1999, major technological changes have been put into place within the NHDS. All cruisers in the NH State Police have been provided with wireless access to standard state and national law enforcement databases. All new cruisers are being equipped with a unique voice actuated computer system which integrates the control of in-cruiser devices such as lights and siren, radar, and video, as well as performing voice driven data queries. In parallel to redesigning the in-cruiser environment, new server systems for NHDS headquarters operations have been specified and acquired with program funds. These server systems directly impact daily dispatch operations for the NH State Police and some local agencies, and they lead the way towards reducing paper records and automating the flow of law enforcement information within the state. [C1100]

## "Simulation of self-heating in advanced high-speed SiGe bipolar circuits using the temperature simulator TESI"

Advanced SiGe bipolar technologies now allow the realization of very-high-speed IC such as 40 Gbit/s multiplexers and 77 GHz automotive radar VCO, even if high output power levels are required. However, in such circuits self-heating often leads to high peak temperatures. This can decrease transistor performance and circuit lifetime and must, therefore, be considered during circuit design. In this paper we demonstrate how the temperature increase resulting from self-heating can be accurately determined already in the design phase. For this, we present the experimentally verified three-dimensional numerical temperature simulator TESI that was specifically developed for such problems. It is shown how this tool can be applied to investigate practical circuits using the core of a 40 Gbit/s power multiplexer and the buffer stage of a 77 GHz VCO with high output power as examples. [C1101]

## "Photonics for RF signal processing in radar systems"

We present an overview of optical summation principles and technologies, related to architectures for signal processing and optical beam forming networks (OBFN). This paper relates theoretical analysis as well as experimental demonstrations for advanced radar and electronic warfare concepts. [C1102]

## "Ion implanted SiC static induction transistor with 107 W output power and 59% power added efficiency under CW operation at 750 MHz"

There are many commercial applications which require high RF CW power in the kilowatt to megawatt range. To date, these high RF power requirements can only be accomplished by incorporating traveling wave tubes (TWT) or inductive output tubes (IOT). However, recent advances in the output power capability of SiC power devices for radar systems now suggest that high power SiC static induction transistors (SIT) can be used to develop a 10 kW solid state RF power amplifier. From analysis of existing high power RF amplifiers, development of a transistor cell that can produce 10 W CW output power would provide the necessary building block for assembly of a 10 kW power amplifier. As a first step in this development, existing ion implanted SiC SIT device cells fabricated at Northrop Grumman were packaged and tested for CW operation at 750 MHz. Identical transistor die from a single wafer of ion implanted SIT devices were selected, each having a layout of 10 device cells per die, with each cell having a gate periphery equal to 1.30 cm, and an active area of 2.92 Ч 10-4cm2. To minimize heating under CW operation, only 10 cells were bonded into a transistor package. This was accomplished by attaching only 2 die to a package, and wire bonding every other cell in each die. In this manner, only 5 cells from each die were connected together, and the remaining 5 cells were not used, thus allowing for improved heat spreading. [C1103]

## "Polarimetric EM scattering and information retrieval in SAR remote sensing"

The advance of polarimetric SAR imagery technology. such as SIR-C and RADARSAT-2 has promoted extensive study and applications for information retrieval from polarimetric scattering measurements. This paper briefly reports our research on three issues: (1) solutions of the Mueller matrix, the eigenvalues of the coherency matrix and information entropy to directly relate with measurements of the co-polarized and cross-polarized scattering in SAR imagery; (2) an inversion approach for digital elevation mapping (DEM) by using a single pass instead of two-pass or interferometric SAR (INSAR), of polarimetric SAR data; (3) an algorithm of two-threshold EM (expectation maximisation) and MRF (Markov random field) for automatic analysis of the context change detection in the urban area from multi-year SAR observations. [C1104]

## "Advanced ground based escan radars"

First Page of the Article [C1105]

## "M3 filter with adaptive mode probabilities control for low sampling rate tracking"

This paper proposes the Multiple Maneuver Model (M3) filter with recalculation of residual covariance in mode probabilities calculation. The conventional M3filter had a problem that mode probabilities oscillate in the long range radar with long sampling period. The oscillation is caused by extremely low likelihood functions of target models at the measurement in mode probabilities calculation. For controlling the oscillation under clutter and frequent miss detection environment, the M3filter that calculates the residual covariance in mode probabilities calculation is proposed. The residual covariance is calculated in advance using the overlap coefficient that indicates how error ellipses are overlapped. It is shown that the proposed M3filter has capability of controlling the oscillation without residual information and improving the tracking quality for maneuvering target. [C1106]

## "Bandwidth and bits: new AWG design achieves both"

This paper describes the architecture and application of a new modular, dual channel arbitrary waveform generator (AWG) capable of generating a 1 GHz IQ modulation bandwidth. Each channel supports a signal fidelity of over 65 dB of spurious-free dynamic range (SFDR). The key technology consists of two Agilent-developed digital-to-analog converters (DAC) operating at 1-25 gigasamples per second (GSa/s) clock frequency and 15 bits of vertical resolution. The new design supports advanced waveform sequencing and triggering for event-based pulse building. This new level of performance gives designers the ability to generate not only wide-bandwidth pulse compression radar signals, but also to add interfering radar and EW signals into the signal scenario. When combined wide-bandwidth IQ and pulse modulators, real-world signatures can be realized at microwave frequencies. [C1107]

## "Silicon-based RF ICs up to 100 GHz: research trends and applications"

This paper presents recent advances in circuit design which evaluate the high-speed and low-power potential of state-of-the-art CMOS and SiGe bipolar technologies. In 0.13 µm CMOS a 17 GHz ISM/WLAN RF front-end with only 130 mW power consumption is described. An injection locked frequency divider with a power consumption as low as 3 mW at 40 GHz is presented. A fully integrated 2:1 multiplexer IC which operates up to 50 Gb/s data rate has been realized in CMOS. A 100 Gbit/s amplifier in a 200 GHz/275 GHz fT/fmaxSiGe bipolar technology with 16 dB gain has been realized. Finally, a 65 GHz-95 GHz double-balanced mixer for 77 GHz automotive radar applications is discussed. [C1108]

## "The effect of single-antenna interference cancellation on GPRS performance"

Single antenna interference cancellation (SAIC) is a very interesting and promising technology currently being standardized in 3GPP as part of GERAN Release 6. It is based on the latest developments in advanced receiver design. In the most advantageous interference conditions, SAIC can improve the signal-to-noise ratio over 10 dB. In this paper, we report on a study of the effect of SAIC on the capacity of a typical GSM network in terms of GPRS data throughput. Our results verify that SAIC provides a significant increase in network capacity not only for speech traffic but also for GPRS data traffic. Since current SAIC receiver algorithms are generally optimized for GMSK modulated signals, we were also interested in the proportion of GMSK and 8-PSK signals in a typical GSM network with EDGE data traffic. We found that in the case of a typical distribution of speech, GPRS and EGPRS traffic, the proportion of 8-PSK signals is relatively small. We can therefore expect that EDGE will not significantly diminish the effectiveness of SAIC in GSM networks. [C1109]

## "An integrated approach of remote sensing and geophysics for investigating geological structure in the East Vietnam Sea"

The East Vietnam Sea (South China Sea) is a large area with the diversely complicated conditions of geological structure. In spite of over the past many years of investigation, many marine places have remained poorly understood because of a thick seawater layer as well as of the sensitive conflicts among the countries in the region. Fortunately, satellite altimeter technology is allowing the enhancement of marine investigation in any area. The spatial variation of the ocean surface topography can be measured by a very accurate radar altimeter mounted on a satellite. The ocean surface is an equipotential surface of the Earth's gravity field. Therefore it can be converted into marine satellite-derived gravity by using the mathematical model. The detailed satellite-derived gravity anomaly and its variants are essential for understanding geological structure and marine geophysics. They provide a reliable opportunity to geologists and geophysicists for studying the geological features beneath the oceanfloor. Also satellite altimeter data is perfect for planning the more detailed shipboard surveys. The satellite altimeter data is collected by the Geosat, ERS-frac12 altimeters. In this paper, the authors emphasize the application of satellite-derived data for investigating of geological structure in the East Vietnam Sea. The satellite data is compared and combined with the shipboard data and has resulted in a significant improvement on its accuracy and resolution. It is constrained by shipboard data using the finite difference, minimum curvature methods. The satellite-derived gravity along with the geophysical advanced methods such as finite difference, gravity gradient, gravity derivative, residual isostatic gravity etc, have brought out an unambiguous picture on the geological structure in the area. Many geological features, such as seafloor spreading ridges, fault systems, volcanic chains, seamounts and shear zones are revealed on the satellite-derived gravity maps as-well as on its variants. Especially, it is more meaningful in the remote or sparsely surveyed areas. The achieved results are checked and confirmed by the shipboard and seismic data [C1110]

## "Oceans '04 MTS/IEEE Techno-Ocean '04 (IEEE Cat. No.04CH37600)"

{no data available} [C1111]

## "Advanced onboard RF radar subsystems"

First Page of the Article [C1112]

## "Advanced design of an elliptic lens antenna for MM-wave and sub-mm wave receivers"

First Page of the Article [C1113]

## "An advanced multi-element microcellular ray tracing model"

In this paper an advanced site specific image-based ray-tracing model is developed that enables multi-element outdoor propagation analysis to be performed in a microcellular environment. Sophisticated optimization techniques such as pre-processing the environment database using object partitioning, visibility determination, diffraction image tree pre-calculation techniques, and parallel processing are used to improve run time efficiency. A comparison of path loss prediction with multi-element site specific measurements shows strong agreement, with a mean error of 3.6 dB and a standard deviation of 3.2 dB. The model is also shown to be capable of performing detailed MIMO analysis. [C1114]

## "Assimilation of the Aqua/AMSR-E data to numerical weather predictions"

An application of satellite information to numerical weather predictions (NWPs) is one of the most expected achievements in satellite remote sensing. In some meteorological agencies, the data of the space-borne

microwave radiometers (MWRs) have been used in their operational weather forecasts. The Japan Meteorological Agency (JMA) introduced the assimilation system of rain rate (RR) and total column precipitable water (TCPW) derived from Special Sensor Microwave/Imager (SSM/I) and TRMM microwave imager (TMI) for the operational mesoscale model in October 2003 and we are trying some observation system experiments about TCPW assimilation using the global model. These water-related data are very useful to detect tropical and extratropical cyclones over ocean. The advanced microwave scanning radiometer (AMSR) for EOS (AMSR-E) on board the Aqua satellite was launched in May 2002. The AMSR-E measures several parameters related to global water circulation at 1:30 a.m./p.m. in local time in which no MWR observation is implemented so far. The MWR constellation composed of AMSR-E, SSM/I, and TMI is satisfactory for global observation at six-hour refresh rate. The refresh rate is essential to give homogeneous initial field for the Global Model and to detect and assimilate the signal of severe weather phenomena with short lifetime such as heavy rain for the mesoscale model. We are investigating the impacts of the retrieved TCPW and RR by the MWR constellation with the JMA NWP systems. In the global model experiments, the homogeneous data distribution with the constellation improves the performance of the data assimilation and the forecast. In the mesoscale model experiments, the frequent observation with the constellation succeeds in detecting the signal of heavy rain and improving the short-range rainfall forecast for disaster prevention. [C1115]

## "Angular and frequency correlation for sea-ice thickness retrieval"

A combined spatial and frequency domain interferometer or angular and frequency correlation (ACF/FCF) between two radar beams in the VHF-band is applied for the direct measurement of sea-ice thickness. This measurement is critical because the thickness of sea ice within the polar region indicates the state of ocean circulation and the associated air-sea heat exchange, which profoundly affects the global heat balance and ocean thermohaline circulation. This new instrument technology-cryospheric advanced sensor (CAS)-can measure sea-ice thickness, tilling a critical gap in measuring the polar region. In this paper, we present the algorithm development and demonstration by simulations of estimating the height of the sea-ice that led to the robust design of CAS interferometric system. Sea-ice thickness is derived from the interferometric phase of the ACF/FCF function of two VHF-band-scattered returns of two radar waves that have different frequencies, incident angles, and observation angles. The inversion calculation to estimate the ice thickness is based on several methods, gradient-descent (GD). least-square (LSQ) method, and genetic algorithm (GA). Compared with a GD method, and LSQ method, GA does not require the knowledge of the derivative of the ACF/FCF function. Good agreement is shown with GD and LSQ results, when a single unknown variable-sea-ice thickness-is to be determined. To support the inversion calculations and analysis, we developed an analytical model. The analytical model used to formulate the ACF/FCF function depends on the age of the ice being measured. The analytical model for first-year ice is based on the small perturbation method (presented here) and, for multiyear ice, the Kirchhoff approximation (presented in accompanying paper by the authors). [C1116]

## "SAR based products for the implementation of humanitarian aid and development assistance projects within the UNOSAT project"

The UNOSAT service is an ESA Earth Observation Market Development initiative whose objective is to encourage, facilitate, accelerate and expand the use of accurate geo-information derived from EO satellite imagery by professionals involved in the implementation of humanitarian aid and development assistance projects. In this paper, we focus on the role of SAR within this context. Space-borne SAR has a particularly good potential to support disaster management and humanitarian relief projects thanks to its all-weather capability, its capabilities for change detection, the large existing data archives, and, of course, the geometric and thematic information content of the images. Basic processing techniques, including precision image co-registration, multi-temporal analysis, terrain corrected geocoding, interferometry, and radargrammetry are well developed and operational. Advanced techniques like differential interferometry and interferometric point target analysis (IPTA) became more and more operational during the last years and provide unique information about terrain stability and deformation [C1117]

## "Analysis on uncertainty in the MODIS retrieved land surface temperature using field measurements and high resolution images"

In this paper, a generalized split-window method to derive land surface temperature (LST) from MODIS (Moderate Resolution Imaging Spectroradiometer) data is applied. A major problem in land surface temperature inversion is that there are too many unknown variables, especially for MODIS data which is in low resolution, one pixel is a mixture of several cover types. To analysis the uncertainties of the LST retrieval algorithm based on MODIS images, the field measurements, together with fine resolution images, AMTIS (the airborne multi-angle TIR/VNIR imaging system) data and ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) data have been used [C1118]

## "Soil moisture analysis using RADARSAT satellite image in the Choke Canyon Reservoir Watershed, South Texas"

The surface soil moisture is very difficult to measure on a river basin scale due to versatile soil types and their associated textures. Consistency of measuring in-situ soil moisture on site is barely obtainable even on a local scale. Recent advances in remote sensing technology have demonstrated that soil moisture can be measured systematically by many optical techniques, such as microwave technology of Synthetic Aperture Radar (SAR). It has the ability to quantitatively measure soil moisture under a variety of topographic and vegetation cover conditions from a satellite system. RADASAT-1 is a space borne SAR imagery satellite. With its all-weather capability, the RADASAT-1 is a promising tool for measuring the surface soil moisture. This research focuses on relations made to soil moisture variability' within RADASAT-1 footprints and on the use of SAR images to develop models of surface soil moisture profile. The case study in the Choke Canyon Reservoir Watershed, South Texas reflects soil moisture spatial distribution patterns in the summer that can be viewed as an extreme situation of water resources management within a semi-arid coastal watershed in 2003. [C1119]

## "Experiments of interferometric layover solution with the three-antenna airborne AER-II SAR system"

Interest is recently growing in exploiting the advanced multibaseline operation of synthetic aperture radar interferometry (InSAR) to solve layover effects, that can degrade conventional SAR and InSAR imagery. In this work we report about: experiments of the functionality of "layover-free" or "higher-order" interferometry with the dual-baseline single-pass SAR interferometer AER-II. Non-parametric, parametric and hybrid spatial spectral estimators are applied to process the three-antenna non uniform array data. Calibration issues, first real data results and impact of order selection are discussed for a bridge over the valley scene [C1120]

## "Atmospheric dynamics mission: Aeolus"

The Atmospheric Dynamics Mission (ADM-Aeolus) represents the second Earth Explorer core mission within ESA's 'Living Planet Programme'. Following launch in 2007 the spacecraft would be injected into a sun-synchronous, polar orbit and provide global observations of atmospheric wind profiles throughout the troposphere and the lower part of the stratosphere. Due to its excellent sampling capabilities, combined with a systematic processing and dissemination of key data products in near-real-time (i.e., within 3 hours after sensing) Aeolus would enable major advances in operational short- and medium-range weather forecast systems. The ALADIN payload on board Aeolus is a direct detection Doppler Lidar system, equipped with a pulse laser operating in the ultraviolet) and a dual-channel receiver system. The spectrometer assembly would allow independent recording of the Mie (aerosol) and Rayleigh (molecular) components of the atmospheric backscatter signal, covering an overall height range from ground up to approximately 25 km. The Aeolus mission concept foresees systematic processing and dissemination of various data products over the envisaged mission lifetime of three years. This includes both the generation and delivery of Level 1B data (calibrated Doppler wind observations) to meteorological service centers in near-real-time and the off-line distribution of higher level products, serving a variety of scientific applications [C1121]

## "Advanced quality of service strategies for GERAN mobile radio networks"

Customer demand for wireless data services is rapidly increasing. The introduction of GPRS, EDGE and UMTS providing high bit rate radio bearer, however, is not the complete response for satisfying the demands of these new high quality services. An advanced quality of service QoS management is necessary to handle the characteristic requirements of both different service types and user expectations. A new QoS strategy is proposed and analyzed comprising 3GPP QoS parameters along with operator's specific weighting factors to define the appropriate QoS priority of each service type and user profile. Admission control as well as a deterministic up-and downgrading strategy are applied to ensure a minimum grade of service for low-priority applications. Furthermore, delay time sensitive services and premium users are granted a full bandwidth. Simulation results are provided to qualify the behavior of the proposed QoS strategy under different packet data load conditions. Especially in highly loaded and even overloaded GERAN networks the introduction of QoS provides significant benefits for the end user and offers powerful means to increase the service revenues according to the charging policy adopted by the network operator. The introduction of an appropriate QoS strategy is the prerequisite for an overlay deployment strategy of GSM/EDGE and UMTS. [C1122]

## "Microwave radar sensor as solid flow counter"

Microwave radar sensors (MRS) studies are usually based on the analysis of the frequency response of the reflected signal. A MRS system operating at 10.6 GHz, with computer integration, has been built to study the

signal characteristic of solid flows. Beans of λ/4 in size have been used in this study. The amplitude of the reflected signal has been found to be useful in describing the flow characteristics. The amplitude response can be converted into a digital counter with the application of advance signal processing to eliminate noise and unwanted signals. In fact, the system not only counts the number of solids flowing but was also able to identify the size of the solids. Experimental results are presented in this paper. [C1123]

## "High resolution DEM generation from ALOS PRISM data-simulation and evaluation"

The Advanced Land Observing Satellite (ALOS) has been developed to contribute to the fields of mapping, precise land coverage observation, disaster monitoring, and resource surveying. The Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM), carried on ALOS satellite is expected to generate worldwide Digital Maps in respects of its high resolution and stereoscopic observation. The development and evaluation of the software for generating Digital Elevation Model (DEM), based on this aim of ALOS operation, is now undertaking for the purpose of equipping the system which producing DEM semi-routinely in the Earth Observation Research and application Center (EORC). In this paper, the software's outline of functions, the algorithm and the current status of its development and evaluation are described. PRISM consists of three panchromatic radiometers for forward, nadir, and backward views and acquires each image in the same orbit at almost the same time. It enables to generate more precision DEM frequently than usual stereoscopic observations. For this specific stereo image configuration, the triplet images matching algorithm is applied for the DEM generation. To evaluate the algorithm, Three Line Scanner (TLS) data is used as the PRISM simulation data and the Lider DEM is used as the reference data. The absolute accuracy of generated DEM is estimated in this simulation [C1124]

## "CryoSat Ground Segment: PDS-IPF infrastructure design overview"

CryoSat is the first ESA Earth Explorer Opportunity mission. It is designed to remotely sense the Earth's ice-covered surfaces using a new concept of radar altimeter instrument. It will use synthetic aperture radar and radar interferometry techniques in addition to conventional nadir looking pulse limited technique to provide superior measurements of surface elevation over both the continental ice sheets and sea ice. In the frame of a European tender competition, Advanced Computer Systems SpA has been awarded by ESA in 2001 for the design and development of the Payload Data Segment (PDS) and of the Instrument Processing Facility (IPF) infrastructures for the CryoSat Ground Segment. With more than twenty years of experience in design, developing and delivery of Earth Observation Data processing systems, Advanced Computer Systems SpA (ACS), based in Rome, Italy, is a leading firm in this field. More than one hundred operational systems are today in operation in 25 countries, within and outside Europe, mostly running 24 hours a day, ingesting and processing many of the available EO satellites like Landsat, SPOT, ERS, JERS, SRTM, Radarsat, Envisat. The aim of this paper is to provide an overview of the developed infrastructure. [C1125]

## "Iceberg and ship discrimination with ENVISAT multipolarization ASAR"

Spaceborne synthetic aperture radar (SAR) can provide wide area and all-weather surveillance for iceberg and ship targets. However, the discrimination between icebergs and ships in SAR imagery, especially in the single polarization imagery that has been available over the past decade, is not always reliable. This is especially true when vessel and iceberg size are on the order of the pixel spacing. Present requirements for ocean surveillance with SAR data include a high detection and classification accuracy due to the necessity of comparable performance with other reconnaissance methods, such as aerial. ENVISAT advanced SAR (ASAR) data offers a potential solution to the iceberg-ship discrimination problem. ASAR data has comparable swath and resolution to other operational SAR systems and in addition offers an alternating polarization (AP) mode. AP targets offer more information than single polarization with respect to radar scattering mechanisms. The AP ship and iceberg targets in this study were observed to have considerably different polarization responses. In particular, ship targets in the HH and HV channels were comparable. In contrast, iceberg targets had at best, weak HV responses compared to the HH channel. Two methods for target discrimination were investigated: a multipolarized area ratio and HV signal-to-clutter ratio (SCR). [C1126]

## "Trends in design of massively parallel coprocessors implemented in digital ASICs"

This paper collects the most recent parallel coprocessors and highlights the recent trends. It is shown that the single chip massively parallel processor implementations seem to disappear from the scientific investigations (with the exception of low-level near-sensor image processing). Meanwhile, the formerly developed architectures have moved inside complex system-on-chips/microprocessors. The common aspect of the recent architectures is the advanced processing element and internal interconnection solutions, and the dominant mid-grain parallelism (i.e. up to a hundred processing element per chip). [C1127]

## "A community faulted-crust model using PYRAMID on cluster platforms"

Development has boosted the GeoFEST system for simulating the faulted crust from a local desktop research application to a community model deployed on advanced cluster platforms, including an Apple G5, Intel P4, SGI Altix 3000, and HP Itaniam 2 clusters. GeoFEST uses unstructured tetrahedral meshes to follow details of stress evolution, fault slip, and plastic/elastic processes in quake-prone inhomogeneous regions, like Los Angeles. This makes it ideal for interpreting GPS and radar measurements of deformation. To remake GeoFEST as a high-performance community code, essential new features are Web accessibility, scalable performance on popular clusters, and parallel adaptive mesh refinement (PAMR). While GeoFEST source is available for free download, a Web portal environment is also supported. Users cap work entirely within a Web browser from problem definition to results animation, using tools like a database of faults, meshing, GeoFEST, and visualization. For scalable deployment, GeoFEST now relies on the PYRAMID library. The direct solver was rewritten as an iterative method, using PYRAMID'S support for partitioning. Analysis determined that scaling is most sensitive to solver communication required at the domain boundaries. Direct pairwise exchange proved successful (linear), while a binary tree method involving all domains was not. On current Intel clusters with Myrinet the application has insignificant communication overhead for problems down to 1000s of elements per processor. Over one million elements run well on 64 processors. Initial tests using PYRAMID for the PAMR (essential for regional simulations) and a strain-energy metric produce quality meshes. [C1128]

## "Vital-an advanced time-based tool for the future 4D ATM environment"

The number of aircrafts will increase in the future. It is commonly agreed that in several high density traffic areas like central Europe the capacity limits are nearly reached. A solution can be seen in 4-dimensional (4D-x, y, z-coordinates, time) air traffic management (ATM). As no revolution in ATC will take place, the close future 4D ATM system will be human centred. The human controller will still have to construct a mental picture of the air traffic for his own understanding. This mental picture is required for anticipating and predicting the movement of the aircrafts. The quality and speed of the construction of the mental picture depends largely how on the information is presented. Today, the presentation of the information is well adapted to the current working methods. A future 4D ATM system requires more complex information. Presenting this information with current methods, will increase the mental load for controllers to create their mental traffic picture. Further mental demand for the controller will either decrease his quality and/or his speed and therefore the working capacity. To overcome these constraints for a future 4D ATM the EUROCONTROL Experimental Centre (EEC) searched a new method to present this information to the en-route controller. Therefore information from radar and flight plans are correlated on the common time base and presented in a time-line. The concept, called 'Vital' represents the information in form of a table, the en-route MONitor (EMON). Each row of the EMON represents the artefact of an aircraft path related to the sector. The controller may place this artefact freely at any line of the EMON to support his mental representation of the sector. The innovation of this representation is the combination of digital and analogue information in the same artefact. The analogue information is presented on a time-line which is progressing in real-time. The size of the time-line window is common to all artefacts. The time-line information represents the past, actual and extrapolated future positions of an aircraft in the route network of the sector. The digital part of the artefact contains fix information from the flight plan and updated flight parameters. Future 4D concepts will include new features like route offsets, 4D-rendezvous points, station keeping of two or more aircrafts, delayed or locally fixed climb/descend orders, including uncertainty. Furthermore displaying an envelope for possible speed variations are included in the analogue timeline representation without overloading the display and increasing the complexity significantly. [C1129]

## "Advanced design of an elliptic lens antenna for mm-wave and sub-MM wave receivers"

First Page of the Article [C1130]

## "Advances in SiGe HBT technology in Europe"

Advances in SiGe HBT process technology in Europe and emerging new product application areas are discussed. High-speed bipolar and BiCMOS technologies with fTand fmaxvalues in excess of 200 GHz have been used to realize fundamental building blocks for applications like 60 GHz wireless communications and 77 GHz automotive radar. Highly integrated SiGe MMICs for these frequency bands are within reach now. [C1131]

## "Onboard pilot decision aid for high volume operations in self-controlled airspace"

Distributed pilot decision-making plays a critical part in high volume operation in non-controlled/non-radar airports, a concept proposed by the NASA Small Aircraft Transportation System program. Realization of the concept relies on advanced cockpit systems that assist pilots in both information-processing and decision-

making. In this paper, we presented the design of an onboard pilot decision aid system, called the Small Aircraft Pilot Assistant, which is dedicated to help pilots perform the high volume operation flight tasks. It increases the cockpit decision-making capacity and pilot situation awareness by automating part of the pilot decision-making process, especially in its early stages of information acquisition and analysis. The pilot tests of the system are conducted using a real-time, multi-aircraft, pilot-in-the-loop simulation system that is presently capable of middle-fidelity HVO simulation. [C1132]

## "Scheduling acyclic branching programs on parallel machines"

In this paper we address the following problem: given an acyclic program scheme with if-then-else control structures, together with the duration of each procedure, and given an architecture consisting of n identical processors, compute offline a scheduling policy that guarantees minimal execution time (in the worst-case) for the entire program on this architecture. Since this is a problem of scheduling under uncertainty (the results of the branching decisions are not known in advance) it cannot be solved in a satisfactory manner using static or fixed priority schedulers but rather requires a state-dependent scheduling strategy. We use timed automata technology to derive such strategies using algorithms for finding shortest paths on game graphs. [C1133]

## "A few examples of interferometry applications in space-related active and passive remote sensing"

The paper describes only a few examples of interferometry applications for space related active and passive remote sensing scenarios. Pulses with defined bandwidths as needed in a total system picture are applied (active remote sensing). Several accurate radar remote-sensing satellites have been produced under ESA's technical management. Work continues (www.esa.inQ) and new missions are developed. Also, such activities are ongoing at the level of National Space Agencies (Italy, Germany, etc.). Stability in instrumentation and related signal settings permits to make further advances and interferometry applications are advancing strongly. Some examples are shown, from which one observes, that accuracy is a very important factor. Ultra stabile reference clock signals are needed in interferometry applications with as an extreme example an experiment to perform Very Long Baseline Interferometry (VLBI) tracking of a weak transmission signal at Saturn's distance. Clock stability, using masers with 10"14 to 10"15 sec accuracy is needed here. [C1134]

## "A UWB impulse surface penetrating radar system for pavement evaluation"

An advanced UWB impulse surface penetrating radar (SPR) system-RadarEye is introduced in This work. It provides high resolution pavement thickness estimation and subsurface objects imaging for civil structures inspection. Super resolution time delay estimation algorithm based on wavelet transform and TAM-BP imaging algorithm are presented with high accuracy on layer thickness estimation and high spatial resolution on subsurface imaging. Both indoor and outdoor experiments show the feasibility of this system. [C1135]

## "Evaluating operational benefits of terminal RNAV: Las Vegas case study"

The Federal Aviation Administration (FAA) asked The MITRE Corporation to evaluate the effectiveness of implementing terminal area navigation (RNAV) procedures at Las Vegas McCarran International Airport (LAS). New RNAV procedures were implemented in November 2003 and have been in use for arrivals to runways at LAS since that time. MITRE's Center for Advanced Aviation System Development (CAASD) collected and examined flight track data from the FAAs terminal approach control facility at LAS for the purpose of this analysis. This paper presents the results of analysis of the flight track data for operations before RNAV was in use at LAS (in the year 2000) and several months after RNAV was being used at LAS (in the year 2004). The paper describes operational effects of RNAV and provides insight into these effects. [C1136]

## "Technology-enabled airborne spacing and merging"

Over the last several decades, advances in airborne and groundside technologies have allowed the air traffic service provider (ATSP) to give safer and more efficient service, reduce workload and frequency congestion, and help accommodate a critically escalating traffic volume. These new technologies have included advanced radar displays, and data and communication automation to name a few. In step with such advances, NASA Langley is developing a precision spacing concept designed to increase runway throughput by enabling the flight crews to manage their inter-arrival spacing from TRACON entry to the runway threshold. This concept is being developed as part of NASA's distributed air/ground traffic management (DAG-TM) project under the Advanced Air Transportation Technologies Program. Precision spacing is enabled by automatic dependent surveillance-broadcast (ADS-B), which provides air-to-air data exchange including position and velocity reports; real-time wind information and other necessary data. On the flight deck, a research prototype system called airborne merging and spacing for terminal arrivals (AMSTAR) processes this information and provides speed guidance to

the flight crew to achieve the desired inter-arrival spacing. AMSTAR is designed to support current ATC operations, provide operationally acceptable system-wide increases in approach spacing performance and increase runway throughput through system stability, predictability and precision spacing. This paper describes problems and costs associated with an imprecise arrival flow. It also discusses methods by which air traffic controllers achieve and maintain an optimum inter-arrival interval, and explores means by which AMSTAR can assist in this pursuit. AMSTAR is an extension of NASA's previous work on in-trail spacing that was successfully demonstrated in a flight evaluation at Chicago O'Hare International Airport in September 2002. In addition to providing for precision inter-arrival spacing, AMSTAR provides speed guidance for aircraft on converging routes to safely and smoothly merge onto a common approach. Much consideration has been given to working with operational conditions such as imperfect ADS-B data, wind prediction errors, changing winds, differing aircraft types and wake vor- tex separation requirements. A series of Monte Carlo simulations are planned for the spring and summer of 2004 at NASA Langley to further study the system behavior and performance under more operationally extreme and varying conditions. This coincides with a human-in-the-loop study to investigate the flight crew interface, workload and acceptability. [C1137]

## "2003 IEEE MTT-S International Microwave Symposium Digest (Cat. No.03CH37411)"

First Page of the Article [C1138]

## "Open wireless architecture-the core to 4G mobile communications"

Fourth generation (4G) mobile communications should not focus only on the data-rate increase and new air interface. 4G mobile should instead converge the advanced wireless mobile communications and high-speed wireless access system into an open wireless architecture (OWA) platform which becomes the core of this emerging next generation mobile technology. Based on this OWA model, 4G mobile will deliver the best business cases to the wireless and mobile industries, i.e. TD-SCDMA/ WLAN/ GPRS 3-in-1 product, WCMDA/OFDM/WLAN 3-in-1 product, etc. Asia is the most dynamic market of new generation mobile communications with over $50 billion investment in the next five years. The 4G mobile technology-convergence of wireless mobile and wireless access, will definitely drive this growth. [C1139]

## "IEEE Antennas and Propagation Society International Symposium. Digest. Held in conjunction with: USNC/CNC/URSI North American Radio Sci. Meeting (Cat. No.03CH37450)"

First Page of the Article [C1140]

## "Target recognition using wavelets decomposition"

Radar target recognition continues to be a challenging problem which has yielded considerable algorithmic and hardware advances, particularly in military applications. It has been known for many years that the echo received from a remote object in response to illumination by a radar system is dependant on the nature and shape of the object, leading to the idea that a system could be devised for an eventual recognition of objects of differing shapes from radar echoes. In the development of automatic target detection and recognition systems, the issue of image data interpretation commonly yields to very difficult deciding situations. This paper addresses the problem of radar target recognition using models and images along with a matching approach involving the radar cross section signature. [C1141]

## "Electronically scanned millimeter-wave radar for pre-crash safety and adaptive cruise control system"

An objective of developing intelligent transport systems (ITS) is to enhance driving convenience. As an ITS technology that meets this objective, an adaptive cruise control (ACC) system has already been commercialized. Another objective is to enhance the vehicle safety performance. With the aim of attaining this objective, we have developed a Pre-crash Safety system by evolving the ITS technology used in ACC. The Pre-crash Safety system is designed to predict an unavoidable collision and activate Pre-crash Seatbelt and Pre-crash Brake Assist well in advance of the collision to mitigate occupant injury caused by the collision. A millimeter-wave radar sensor is indispensable to the Pre-crash Safety system. This present paper describes the electronically scanned millimeter-wave radar sensor developed for use in the system. This radar is physically compact while providing high object recognition performance. This is due to the phased array technology employed for the first time in the world for automotive radar. Other features of the radar include a "high-efficiency planar antenna, "high-power and low-loss monolithic microwave ICs (MMICs) and millimeter-wave circuit" and a "high-speed digital-beam-forming (DBF) algorithm". [C1142]

## "VALSE- validation of safety-related driver assistance systems"

Advanced driver assistance systems (ADAS) support the driver in his driving task. Such systems include the warning of the driver in critical situations as well as the support of the driver in the longitudinal and lateral control of the vehicle. Established assistance systems like anti-lock braking or electronic stability management depend only on the driving dynamics of the vehicle itself In contrast to that, an ADAS in addition has to detect the driving behavior of other vehicles by sensing the environment, e.g. via radar, lidar, and video technology. Typical ADAS examples are emergency braking systems, adaptive cruise control or lane keeping systems. The additional complexity of ADAS makes the validation process a far more difficult and hazardous task. Test drives with experimental cars can be considered state-of-the-art ADAS validation technique. The aim of the VALSE project is to set-up a validation platform enabling ADAS testing in a safe and cost-efficient laboratory environment. The presented validation platform VALSE uses a standard hardware-in-the-loop system which is extended by a proprietary software for microscopic real time simulation of a truck platoon. [C1143]

## "The effect of the elevation of GPR antennas on data quality"

In many GPR-measurement situations it is possible to measure with the antennas of the GPR-system in contact with medium containing the unknown objects. In this paper, we have tested the performance of a commercial Pulse Ekko 1000 system at various heights above a sand-surface. We show measurements over the same area with the antennas of this near-surface GPR system at four different heights above the surface. We show that the decrease in signal to noise ratio is small for two-way distances between antenna and surface is smaller than one third of the dominant wavelength. For larger distances, the signal quality decreases rapidly for data processing purposes and object detectability. [C1144]

## "Subsurface imaging using measured antenna footprints"

For the detection of landmines, images of the subsurface are made using a bistatic stepped frequency continuous wave radar system. During the measurements, the system moves along the surface and due to the presence of objects in the subsurface changes in measured voltages are observed. These changes are formulated as a convolution of a complex contrast function with a sensitivity function. In fact, this sensitivity function is the vectorial inner product of the incident and the total electric wavefield. Using the Born approximation, the sensitivity function is obtained as the inner product of the field emitted by the transmitter and the field from the receiver operating in transmitting mode. For imaging purposes, knowledge of the wavefields in the subsurface is needed. Since it is difficult to model the radiation characteristics very accurately, we measure the footprints of the antennas at one level and propagate the emitted wavefields using Huygen's principle. After we verify the usability of this principle, we create synthetic data using measured patterns and apply back-propagation on the data to localize objects. [C1145]

## "Stepped frequency continuous wave radar-data preprocessing"

Radar systems have been paid a lot of attention since the end of WWII. Along with performances improvement one has witnessed a diversification of their applications, which range from target detection and parameter measuring to navigation systems, anti-collision systems and subsurface sensing. The last application has had a great importance for humanitarian demining purposes taken into account the number of landmines spread across the world and the danger they pose to humans. Both, continuous wave and pulse radar have been employed for landmine detection. This paper deals with stepped frequency continuous wave (SFCW) radar that operates from 400 MHz to 4845 MHz, in steps of 35 MHz. The novelty of the system, built at International Research Center for Telecommunication-transmission and Radar (IRCTR), consists in the fact that 8 frequencies are transmitted simultaneously, which drastically decreases the data acquisition time. Because of the strong reflection from the air-ground interface one may face some difficulties to "see" the landmines, which are lying on, or just below of the surface. If the antenna system footprint is much more larger than the size of the mine, this is even more difficult as the signal from the mine will be buried in the clutter signal. In order to remove the clutter signal and to improve signal to clutter ratio, average clutter subtraction and synthetic aperture radar have been investigated. [C1146]

## "Iodine molecules concentration fluorescence lidar measurements"

The lidar equation computer simulations have been fulfilled earlier and it has been concluded that fluorescence lidar (FL) is the most preferable for the detection of iodine molecules at very low concentration levels. The goal of this report is the molecular iodine FL lidar backscattered fluorescence intensity vs. iodine partial pressure or concentration in special cuvette dependences experimental studies [C1147]

## "GPRS radio network performance simulation and optimization with dynamic simulator"

This paper discusses GPRS network performance optimization with a dynamic simulator. Simulator models the GSM/GPRS system and a realistic cellular environment with accurate models of e.g. propagation environment, user mobility and traffic distribution. All the relevant details of GPRS protocol stack (LLC, RLC/MAC and physical layer) are taken into account, but less focus is put on GPRS core network, signaling and IP transport layer effects. After defining a set of key performance indicators (KPI) as the basis for the analysis, a real network configuration scenario was applied with the simulator. This setup was then used when GPRS network performance was investigated in order to find the maximum capacity for both GPRS and voice services. At the same time the effect of different radio resource management (RRM) algorithms and parameter alternatives were studied, together with the dynamic interaction between circuit and packet switched services. As a result of this study, a set of optimized and tuned parameters are suggested, which could help operators to go towards more aggressive network deployments with more advanced RRM schemes and at the same time provide higher quality of service (QoS) to the end users with maximized capacity. [C1148]

## "Fusion of polarimetric infrared features and GPR features for landmine detection"

Currently no single sensor reaches the performance requirements for humanitarian landmine detection. Using sensor-fusion methods multiple sensors can be combined for improved detection performance. This paper focuses on the feature-level; fusion procedure for a sensor combination consisting of a polarimetric infrared imaging sensor developed by TNO and a video impulse GPR developed by Delft University of Technology. Feature-level sensor-fusion is the process where specific information (i.e. features) from objects detected by different sensors are combined and classified. The single sensor detection methods and the feature-level sensor-fusion methods are evaluated using a leave-one-out evaluation method. This evaluation method provides an independent evaluation set while retaining the largest possible training set. The detection results of both single sensors and the sensor-fusion methods are both presented in receiver operator characteristics (ROC) curves. They show that on the training set feature-level sensor-fusion always outperforms the best single sensor. Furthermore, on the independent evaluation set, there are ROC points of the feature-level sensor-fusion methods that are better than the best sensor. [C1149]

## "Integrated support system for the self protection system"

This paper describes the Logtronics process to develop and deploy a highly integrated maintenance support system for the Avitronics complex Radar Warning Receiver. The fully integrated state-of-the-art multi sensor warning system (MSWS) provides advanced and comprehensive multi spectral situational awareness that includes radar, laser and missile approach warning functions. The MSWS is being used on various helicopters and transport aircraft. The Logtronics approach to develop and deploy an integrated support capability for this complex system involves a highly structured process, resulting in one of the only true "Class V" interactive electronic technical manuals (IETMs). This paper describes the development process and the use of automated tools within that process, and the focus on integration of the tools within the process. An O-level and I-level test station hosting IETMs and an advanced diagnostic reasoning system running under LabWindows/CVI is the core of the maintenance capability. The development process includes the integration and use of LSAR data base, FMECA tools, IETM authoring tools, model-based diagnostic reasoning development tools and test development tools. [C1150]

## "Using Bayesian Programming for multi-sensor multi-target tracking in automotive applications"

A prerequisite to the design of future Advanced Driver Assistance Systems for cars is a sensing system providing all the information required for high-level driving assistance tasks. Carsense is a European project whose purpose is to develop such a new sensing system. It will combine different sensors (laser, radar and video) and will rely on the fusion of the information coming from these sensors in order to achieve better accuracy, robustness and an increase of the information content. This paper demonstrates the interest of using probabilistic reasoning techniques to address this challenging multi-sensor data fusion problem. The approach used is called Bayesian Programming. It is a general approach based on an implementation of the Bayesian theory. It was introduced first to design robot control programs but its scope of application is much broader and it can be used whenever one has to deal with problems involving uncertain or incomplete knowledge. [C1151]

## "Driver assistance: an integration of vehicle monitoring and control"

About 1.17 million people die in road crashes around the world each year. It is estimated that up to 30% of these fatalities are caused by fatigue and inattention. There are systems able to detect what is happening outside of the car, e.g., lane tracking, obstacle detection, pedestrian detection etc. Further on, there are also means for monitoring the actions of the driver. A natural step is to fuse the available data from within and outside of the car, and suggest a suitable response. This paper discusses driver assistance systems, lists a set of necessary

core competencies of such a system and in particular presents a system for force-feedback in the steering wheel when crossing lanes. The presented system utilises a robust lane tracker which is experimentally evaluated for the purpose of driver assistance. In addition, preliminary results from simultaneous driver monitoring and lane tracking are presented that indicates a good correlation between the two, i.e. the driver's gaze direction and the structure of the road. These data can in turn be used for more advanced driver assistance systems in the future. [C1152]

## "Longitudinal road gradient estimation using vehicle CAN bus data"

Knowledge of the longitudinal road gradient can be used by Advanced Cruise Control (ACC) and automatic transmission control systems to provide more accurate longitudinal velocity control. This paper presents a method of estimating the longitudinal road gradient just using the available vehicle CAN bus data. This method ensures that no extra sensors need to be added to the vehicle, and therefore there is no added cost to the vehicle. The gradient estimation algorithm is developed combining vehicle modelling techniques and parameter estimation methods. A simple longitudinal acceleration vehicle model is derived using standard vehicle model equations. The unknown longitudinal gradient parameter is then estimated using the data available on the CAN bus. [C1153]

## "Modern data acquisition system in the road weather stations monitoring"

A modern road weather monitoring stations system in Poland was shown. A new communication and data visualization standard for that stations system was designed. It enables user to collect data from the stations by Internet or mobile technology. Software for the system is based on J2ME, WAP and GPRS standards. The proposed tools enable weather data viewing and managing from every place at every time [C1154]

## "Adaptive real-time publish-subscribe messaging for distributed monitoring systems"

Many complex distributed real-time applications, monitoring and controlling the external environment, require sophisticated processing and sharing of an extensive amount of data under critical timing constraints. We present adaptive real-time publish-subscribe (RTPS) messaging service for distributed real-time applications, and four primitives are defined for expressing the adaptive RTPS. Furthermore, adaptive RTPS is incorporated into an active real-time database (ARTDB) named Agilor by translating RTPS primitives into subscription objects and ECA rules. We also apply real-time scheduling algorithm to protocol processing for improving predictability and minimizing priority inversions during message transmission. The experimental results indicate the idea is feasible, and the current implementation shows better performance [C1155]

## "Removal of impulse bursts in satellite images"

Characteristics of impulse bursts in satellite images are analyzed and methods for burst removal are considered. Artificial compact burst model is proposed and test images are created. An advanced multipass algorithm for the detection and removal of compact bursts in the presence of both additive and multiplicative noise is proposed. The efficiency of the algorithm is evaluated quantitatively using the artificial test images and visually using the artificial test images and real radar and optical satellite images. It is shown through experiments that the proposed method removes impulse bursts efficiently while preserving information [C1156]

## "Autonomous lateral following consideration for vehicle platoons"

In this paper the problem of lateral control of vehicles operating in a platoon without the use of road infrastructure is analyzed. It is shown that the use of sensors that monitor the preceding vehicle's relative lateral position is enough to achieve lateral control for a pair of vehicles, provided that certain limitations are taken into account. For a platoon of multiple vehicles, the lateral error propagation is a serious issue that can be solved if performance is compromised. The use of inter-vehicle communication is proposed in order to recover platoon stability and satisfactory performance. Experimental data and simulations for both passenger and tractor-semi-trailer vehicles illustrate the analytical results. [C1157]

## "Practical evaluation of GPRS use in a telemedicine system in Cyprus"

The unceasing emergence of new technologies in wireless and mobile telecommunication networks, combined with the simultaneous rapid advances in information technology, are leading to many new solutions in the field of telemedicine, thus offering more opportunities for improving further existing and supporting new advanced services for healthcare. The objective of this paper is to carry out a practical evaluation of the performance of the GSM and GPRS systems in the transmission/reception of X-ray images and video in emergency orthopedics cases. As expected, the performance of GPRS is superior to that of GSM. The data transfer rate achieved with

GPRS were in the range of 32 Kbps with the download time for typical X-ray images of a file size of 200 Kbytes to the mobile device to be in the region of 60 seconds. Similar performance was also recorded in the case of a moving station (simulating the ambulance) for the biggest part of the journey. In conclusion, although the medical imaging downloading timing was in the range of a few minutes, the physicians were very pleased by the benefits offered by the system through the freedom of access, anywhere and anytime even in motion. [C1158]

## "Ground penetrating radar (GPR) studies at the ElectroScience Laboratory (ESL)"

There are a number of factors to be considered in making many GPR measurements. These include (a) electronic hardware (b) antenna systems (c) electromagnetic properties of the ground (d) target identification arid remote sensing concepts and (e) use of numerical simulations. The purpose of this paper is to review the contributions made at the ESL for these factors and to discuss future potential advances in the state of the art. [C1159]

## "Warden: W-band advanced radar for debris early notification form ISS"

The feasibility of a radar instrument working at 95 GHz placed on ISS (International Space Station) to detect very small debris has been investigated and analyzed in this paper. First of all a study about the debris population around the ISS orbit has been taken under consideration by analyzing the debris flux and by determining the preliminary design and mission parameters for Warden instrument, as for instance the pointing angle of the antenna reflector. A technology survey has been also performed to individuate the state of the art in the millimeter wave frequencies band, with particular reference to the transmitter, the front-end, the master oscillator and for A/D converters and DSPs (Digital Signal Processors) suitable for space. The proposed solution for the ISS on board experiment was basically composed of two segments: the on-orbit segment, that is the payload and the ground segment. The on-orbit segment deals with a radar sensor working at 95 GHz which represents a good trade-off between satisfying the limited power consumption available on ISS ExPA (Express Pallet) adapter and having significant range and detection performance necessary for the success of the overall mission, with particular reference to the scientific results. In the overall radar system design major emphasis has been given mainly to the weights, the overall dimensions, and to the EMC problems due to the simultaneous presence of other experiments on the same ExPA. Once fixed the transmitted power, the pulse length and the probability of detection different performances in range are predicting depending on the dimension of the debris and on the approaching speed. For example a detection range (90% PD) of about 180 Km is predicted for a debris of 50 cm running at a relative speed of 10 Km/sec (F=95 GHz, 1 m Cassegrain monopulse antenna, 1000W peak power, 40 μsec pulse length, 2.5-100 KHz staggered p.r.f.) Concerning the ground segment, a preliminary architecture has been proposed based upon the extensive use of existing infrastructures and facilities and including a WARDEN control system mainly for all concerns on board payload support, a mission control facility for the general planning of the ground and space resources, and a debris data processing devoted to perform all the- activities relevant to the supply of products and services based on payload according to user request. In conclusion the proposed Warden experiment offers several opportunities both in technological field by giving the possibility to verify the sue of millimeter waves components in space environment helpful for future ESA components qualification plan, and in scientific field to validate the concept of a future stand-alone flying on-orbit space-based radar devoted to the detection of very small debris population (0.5 ч 1 cm as diameter). [C1160]

## "Robust adaptive beamforming: an overview of recent trends and advances in the field"

In recent decades, adaptive arrays have been widely used in sonar, radar, wireless communications, microphone array speech processing, medical imaging and other fields. In practical array systems, traditional adaptive beamforming algorithms are known to degrade if some of exploited assumptions on the environment, sources, or antenna array become wrong or imprecise. Therefore, the robustness of adaptive beamforming techniques against environmental and array imperfections and uncertainties is one of the key issues. In this paper, we present an overview of recent trends and advances in the field of robust adaptive beamforming. [C1161]

## "Semiconductor lasers on type II heterostructures: calculation features and threshold characteristics"

The aim of this work is to illustrate features of calculation for semiconductor lasers based on type-II heterostructures. The theoretical results founded on the given distinctions allowed to investigate the threshold current temperature dependence and research the behaviour of all its components by the example of InGaAsSb/GaSb heterostructure. the obtained data assure further threshold current optimization which will result in its lowering. [C1162]

## "Engineering of the global precipitation measurement system"

Global Precipitation Measurement (GPM) is an international effort to improve climate, weather, and hydrological prediction through more accurate and more frequent precipitation measurements. GPM will be conducted through an international partnership led by the National Aeronautics and Space Administration (NASA) of the United States and the National Space Development Agency (NASDA) of Japan, with other organization and countries providing additional data streams and scientific analysis. Measurements are made with a constellation of Earth observing satellites and a global ground validation program. NASA provided two spacecraft to the constellation, the Core and the Constellation spacecraft. For instrumentation, NASA provides a conical-scanning, polarization-sensitive, multi-frequency microwave radiometer termed the GPM Microwave Imager (GMI) for both the Core and Constellation satellite. NASA also provide the mission operations for the two spacecraft, two ground validation "Supersites", and the Precipitation Processing System (PPS) needed to assimilate all of the various data streams and produce the products. NASDA provide the Dual-frequency Precipitation Radar (DPR) for the Core spacecraft, the launch of the Core spacecraft, and a data stream from the GCOM-B1 spacecraft. This paper presents the engineering of the NASA portion of GPM from scientific objectives to viable system design. GPM's six elements, (1) the flight instruments, (2) the Core spacecraft, (3) the Constellation spacecraft, (4) the mission operations system, (5) the ground validation system, and (6) the PPS, must operate together and within the political environment of partnership in order to achieve the science objectives. Decisions on topics such as autonomy, Internet Protocol, Virtual Direct Broadcast, and orbits affect multiple elements across the mission. Advances in system engineering tools and techniques enable a more cost-effective development effort. As GPM approaches its Preliminary Design Review (PDR) and the start of implementation, we take a look at the current system design, how we arrived here, and where we plan to go. [C1163]

## "Application of microwave radiometry for buried landmine detection"

In this paper we illustrate the phenomenological background, the design, and some experimental results of a multi-spectral low frequency microwave radiometer as a part of a multi-sensor mine detection system. The overall system is intended to work in a hand-held operation allowing the use in areas of difficult access without excluding missions in more friendly environments. Thus the radiometer antenna is operated in an extreme near-field mode to achieve a corresponding ground resolution in the order of the active antenna aperture size. In particular, the radiometer receiver is swept in low-bandwidth steps through a broad microwave (MW) frequency range to vary the penetration depth and the reflectivity properties of the actually observed ground part. This can provide significantly increased information about the location and shape of buried objects for discrimination purposes. The relevant theoretical aspects of this interference based effects are illustrated and attempts to interpret the spectrum for specific layered arrangements as in the case of buried objects are presented. [C1164]

## "Proceedings of the 2nd International Workshop on Advanced Ground Penetrating Radar (IEEE Cat. No.03EX680)"

First Page of the Article [C1165]

## "High fidelity modeling of space-based radar"

Space based radar design are becoming more affordable given new technologies of solid state active apertures and advanced digital signal processing. However, it is important to be able to synthesize the design of the system with sufficient detail to anticipate the radar system's operation and interference effects expected in a space environment. This includes simulation of site specific clutter with realistic Earth rotation and statistical variation, wideband propagation of the signal from multiple phase center aperture, and impact of channel match and errors on adaptive processing for detecting targets. The research laboratory space time adaptive processing (RLSTAP) has been developed as a variable fidelity radar simulation tool to captures these effects. The paper will describe results of modeling an L-band multimode space based radar, including effective of ambiguities from antenna subarrays, and range and Doppler waveforms on adaptive processing. [C1166]

## "Design of large space based radar for multimode surveillance"

Space based radars have been under consideration for several years [Skolnik, MI, 1997], and have only been made commercially available for synthetic aperture radar modes. This is due to the limited availability of space based microwave technologies and the high cost of manufacturing large space systems. Several technology programs have promised significant advances in affordable phased array radar designs. However, the design of true multimode radars require aperture sizes and average power significantly larger than previously considered. This paper outlines a design approach that anticipates future developments of ultra lightweight antenna manufacturing techniques. Based on a notional design, the performance predictions and challenges to radar signal processing is presented. [C1167]

## "Studies of ground penetrating radar antennas"

Virtually all systems that have been developed in recent years to detect landmines and buried unexploded ordinance (UXO), have included the ground-penetrating radar (GPR) as one of the principal subsystems. Much of the effort reported to date in evaluating these GPRs has focused on obtaining overall end-to-end detection performance metrics (Pd, Pfa). These studies have been useful but they provide little insight into the functioning of individual GPR components and the limitations they may impose on system performance. By contrast, this project concentrates on investigating performance characteristics of the GPR antenna, which is perhaps the most critical component in determining GPR system performance. Some of the antenna issues that remain unresolved are: determination of the most useful bandwidths, defining the role of polarization and polarization diversity, minimizing the effects of self-clutter (also known as "ringdown" or "reverberation"). Over the course of this ongoing program, we plan to investigate a variety of GPR antenna subsystems, including the spiral, the sinuous log-periodic, various dipoles, the TEM horn, the TEM rhombus, tapered slots and forms of the impulse radiating antenna (IRA). In this paper, we report some initial experiments carried out on a transmit-receive pair of Archimedean spiral antennas. To characterize these antennas, we carried out measurements in a conventional radio frequency (RF) laboratory using a vector network analyzer to synthesize waveforms covering the frequency range from 500 MHz to 5.5 GHz. Transformation of these data to the time domain allows us to gate out extraneous laboratory clutter beyond a 1.5-m (10 nsec) range. The principal measurements reported here are: the gain and phase properties, noise and clutter levels, and the antenna system spatial response footprint. The spatial patterns were measured by raster-scanning a stainless steel sphere through a two dimensional grid located 17 cm (a range typical of GPR applications) from the aperture of the transmit/receive antenna pair. [C1168]

## "System description of a stepped frequency CW radar for humanitarian demining"

A multiple frequency stepped frequency continuous wave radar for detecting flush buried and surface laid antipersonnel landmines was designed and built. The system covers a frequency band from 400 MHz up to 4845 MHz. The range resolution is 3.4 cm and the maximum unambiguous range is 4.3 m. The antenna configuration is a bistatic one with two Archimedean spirals with opposite sense of rotation. The instrumented dynamic range is 40-50 dB per frequency channel. After synthesis of the range profile the dynamic range is significantly higher. The system parameters are aimed at imaging algorithms exploiting the phase evolution over the antenna footprint in particular. One example of the results achieved with and without synthetic aperture radar processing is presented. [C1169]

## "STW project "Advanced relocatable multisensor system for buried landmine detection""

Delft University of Technology has just finished its major efforts in a most challenging project, supported by the Dutch Technology Foundation STW. This four-year project entitled "Advanced relocatable multi-sensor system for buried landmine detection" was the largest project in STW history. Within the scope of this project we have built up a unique expertise and knowledge in the whole GPR chain starting from all aspects in GPR technology and finishing with target classification and soil characterization. The paper describes the goals and results within this project. [C1170]

## "An efficient SAR ATR approach"

Automatic target recognition (ATR) based on synthetic aperture radar (SAR) imagery (denoted as SAR ATR for simplicity) is very important for battlefield awareness. Since SAR images are very sensitive to pose variation of targets, SAR ATR is a well-known very challenging problem. An efficient SAR ATR algorithm is given, which uses KFD (kernel Fisher discriminant) as feature extractor and linear SVM (support vector machine) as classifier. Experimental results evaluated with the MSTAR (moving and stationary target automatic recognition) public data sets provided by the DARPA/AFRL (Defence Advanced Research Project Agency/Air Force Research Laboratory) show that the proposed scheme performs much better than the conventional template matching and SVM methods, especially when the target pose uncertainty is large, which is desirable for SAR ATR. [C1171]

## "Performance of VoIP over GPRS"

We study the performance of VoIP over GPRS by simulation of standard GPRS system with some improvement for real time attributes. It is showed that the VoIP over GPRS has more capacity than circuit switch voice while guaranteeing acceptable QoS. With one radio frequency, the circuit switch system can provide 7 voice connections, while VoIP over GPRS can support 12 voice connections if they use the same 13Kbps speech coder. If VoIP over GPRS uses 5.3Kbps speech coder, it can support 34 voice connections. The uplink voice packet loss comes from the contention for the random access channels and shortage of idle data traffic

channels. Because of its random contention characteristics, the access channel effective usage is low. We apply a modified PRMA to increase the access channel utilization, and the maximum voice connections can be increased by 17% compared to the reservation slotted ALOHA. [C1172]

## "Microwave Remote Sensing: Needs and Requirements Concerning Technology"

Spaceborne microwave remote sensing instruments, like the imaging radiometer and the synthetic aperture radar, are over time faced with two partly conflicting requirements: performance expectations (resolution, sensitivity, coverage, a.o.) steadily increase while resource allocations (weight, power, bulk, cost) decrease. This results in needs and requirements to the development of advanced technology thus enabling future advanced systems to be viable and realistic. [C1173]

## "Advanced MMICs for Remote Sensing and Radar Applications"

Modern remote sensing systems and radars are more and more based on electronically steered antennas. Instead of using one high power tube, each radiating element must contain a full T/R module allowing an individual modulation of amplitude and phase of both transmit and receive signal. The key elements in such systems are monolithic microwave integrated circuits. In this paper some general information about these components are given as well as the latest achievements in terms of power amplifiers are described. The CHA7010 is a 10W power amplifier (in pulsed mode) featuring high PAE and small size. [C1174]

## "Millimeter-wave microelectromechanical (MEMS) switches for automotive surround sensing systems"

In recent years, great advances have been made in the field of silicon millimeter-wave integrated circuits (SIMMWIC) as well as In microsystems technology. These developments jointly allow the preparation of micromechanical capacitive switches, which exhibit excellent RF properties far into the millimeter-wave frequency range. This paper presents coplanar bridge and longitudinal switches and discusses their applicability for automotive surround sensing systems. It comprises a detailed review of RF properties in addition to an short introduction to the systems background. Furthermore, aspects are treated which are important for the application, such as thermal and mechanical properties, reliability aspects and packaging and mounting technologies. [C1175]

## "Modeling avalanche multiplication for advanced high-speed SiGe bipolar transistors"

For correct modeling of avalanche breakdown effects in bipolar transistors with the six transistor model, the multiplication factor M must be accurately described. However, as a simplification it is sometimes suggested to neglect its current dependence. We will show that this is not possible for advanced high-speed SiGe bipolar technologies. In this work, we present a practical model for M which takes the current into account as well. It allows simple parameter extraction and, moreover, can easily be used with standard circuit simulators. The model is verified for a fast pre-production SiGe technology by comparison to measurements. [C1176]

## "High frequency radar measurements of friction velocity in the marine boundary layer"

This work uses the hydrodynamic theory of the turbulent boundary layer to interpret High Frequency (HF) radar data and to address the potential of HF radar for determination of the friction velocity in the water over a broad spatial region. Recent advances in HF radar instrumentation have resulted in the development of a radar capable of detecting small changes in surface wave phase velocities as a result of an underlying current. The development of a multi-frequency radar system extends this capability to the determination of the vertical distribution of the flow in the water column, or current shear. In this work, the Levenberg-Marquardt method of nonlinear least squares is used to determine the near surface current profile based on a theoretical model of the effect of the current on the phase velocity of a surface gravity wave. The results of this analysis are compared to in situ measurements of wind velocity and measurement-based calculations of friction velocity. The results show that estimates of the friction velocity compare well with in situ measurements under moderate wind conditions. [C1177]

## "Realistic modeling of surface ground-penetrating radar antenna systems: where do we stand?"

The generation and recording of electromagnetic waves by ground-penetrating radar (GPR) systems are complex phenomena. To investigate the characteristics of typical surface GPR antennas operating in realistic environments, we have developed an antenna simulation tool based on a finite-difference time-domain (FDTD) approximation of Maxwell's equations in 3-D Cartesian coordinates. The accuracy of the algorithm is validated with respect to laboratory measurements for comparable antenna systems. Numerically efficient and accurate

modeling of small antenna structures and high permittivity materials is achieved via subgridding. We simulate the radiation characteristics of a wide range of common surface GPR antenna types ranging from thin-wire antennas to bow tie antennas with arbitrary flare angles. Due to the modular structure of the algorithm, additional planar antenna designs can readily be added. Shielding is achieved by placing a metal box immediately above the antenna. Damping is accounted for by filling the shield with absorbing material, by connecting the antenna to the shield with resistors or by continuous resistive loading of the antenna panels. The effects that these features have on the radiative properties of the tested GPR systems and thus on the illumination of the subsurface are investigated for various half-space models. [C1178]

## "Electromagnetic field and material properties in ground penetrating radar"

Electric, magnetic and electromagnetic fields are consequences of the existence, motion and acceleration of electric charge. Complex coupled vector field distributions in space and time result. Most material properties are consequences of EM field interactions between adjacent matter particles at atomic scales. Velocity, attenuation, wavelength, polarization, scattering, relaxation, and resonance are some of the properties and processes important to electromagnetic wave propagation in ground penetrating radar. Such properties and processes determine the performance limitations of ground penetrating radar systems, and they are also what are measured by ground penetrating radar to describe ground and things buried within the subsurface. Space and time distributions of material properties are described in terms of complex dielectric permittivity and complex magnetic permeability. "Complex" means there are parts describing both energy dissipation and storage, with consequential frequency dependent properties. Dielectric properties are dominantly controlled by the distribution and properties of water in the ground. Magnetic properties are dominantly controlled by the distribution and properties of iron in the ground. Field polarization and scattering processes are dominantly controlled by the geometric orientation and spatial distribution of contrasts in material properties at wavelength scales. Measurement of field properties and processes allows GPR to determine material properties. [C1179]

## "Landmine detection technology research programme at TNO"

This presentation gives an overview of most of the activities on research and development in the technology area for landmine detection at TNO in the Netherlands. The projects cover the range from military applications to humanitarian demining. In the "conventional" detection systems area the activities on an instrumented prodder, metal detection, ground penetrating radar thermal infrared are covered. Signal processing and sensor fusion are key activities in this area. The focus for these techniques is on vehicle mounted and airborne multi-sensor systems. The activities are supported by more fundamental modelling of the interaction of sensors with the landmines. Especially the effects of the environment of the mines (background clutter, scenario) on this interaction are taken into account. [C1180]

## "Results of, measurements, processing and modelling of GPR data showing the effect of soil moisture content on land-mine detection"

Summary form only given. To be able to predict the performance of a ground penetrating radar system (GPR) under certain environmental conditions, one needs to relate the parameters that predominantly determine the environment, to parameters that directly govern GPR performance. Soil type and soil water content are such environmental parameters. The latter is determined by prevailing (and historic) weather conditions and has a large effect on the electrical permittivity and conductivity of the soil medium. Thus, by relating soil water content to electrical permittivity and conductivity one can gain a better understanding of GPR performance and in principle could even predict GPR performance. For the purpose of land-mine detection it is advantageous to be able to have some idea of GPR performance under given circumstances. Knowledge about the environment will influence the choice of sensor and the moment in time, the de-miner wishes to deploy the GPR as mine detection sensor. In the summer of 2002 detailed GPR measurements were taken at the TNO Physics and Electronics Laboratory (TNO-FEL), mine-detection test-facilities. These measurements were executed under relatively dry as well as moderately wet conditions, in both sand and grassy soils. Data acquisition was done on a high-density grid with several GPR systems. The test facility contains a number of moisture conditions to GPR measurements. In this paper we will illustrate the effect of soil moisture content of different soil types, on the detection of buried land-mines, and compare this with the outcome of a numerical GPR model which takes moisture level and soil type into account. [C1181]

## "Antenna development and a stepped-frequency GPR system for landmine detection"

A project for developing a compact size GPR system for landmine detection was started. It will be based on stepped-frequency radar system for wider application in various kinds of soil conditions. We have developed a prototype stepped-frequency for fundamental evaluation of the system. This system uses a broadband Vivaldi

antenna and operates at 2-6 GHz. The system was tested in laboratory and could be used for imaging buried mine-like targets by high resolution. Series of tests were carried out by using sand with rough surface and inhomogeneous soil. We discuss the ability of GPR for landmine detection. [C1182]

## "A new bistatic GPR system using a passive optical sensor for landmine detection"

A novel GPR system for stand off landmine detection is discussed. This is a bistatic GPR system, which use a TEM horn antenna for a transmitter and a passive optical electrical field sensor as a receiver. A small size passive optical sensor scans on the ground surface and the acquired signal is used for synthetic aperture processing. Since the receiver is very small, it is suitable for scanning near the ground surface, where landmines can be buried. Fundamental laboratory test shows its capability of imaging of buried objects. [C1183]

## "Full-polametric video impulse radar for landmine detection: experimental verification of main design ideas"

A full-polarimetric ultra wideband GPR front-end has been developed in IRCTR especially for landmine detection application. A number of new ideas have been implemented in the design. A principally new antenna system design and an ability to perform quasi-simultaneous measurements with two transmit polarizations and in two different frequency bands are main novelty aspects of the radar. Additionally in comparison with commercial available video impulse GPR systems the front-end has considerably larger bandwidth, ability to measure polarimetric structure of the scattered field and very high precision of scattered field measurements. Experimental verification of these new design ideas is discussed in this paper. [C1184]

## "GPR design and modeling for identifying the shallow subsurface dielectric properties"

A ground penetrating radar (GPR) system for identifying the shallow subsurface dielectric properties is proposed. It consists in a stepped frequency continuous wave (SFCW) radar operating in the 0.8-4 GHz ultrawide band combined with a dielectric filled TEM horn antenna to be used off ground in monostatic mode. This radar configuration is of practical interest since it responds to subsurface mapping requirements and allows for an efficient and realistic modeling of the radar-antenna-subsurface system. Forward modeling of the system is based on linear system response functions and on the exact solution of the three-dimensional Maxwell equations for damped wave propagation in a horizontally multilayered medium representing the shallow subsurface. The model is validated under controlled laboratory conditions. This model is destined to be inverted to reconstruct the depth dependent shallow subsurface dielectric properties from field observations. [C1185]

## "Analysis of target responses and clutter based on measurements at test facility for landmine detection systems located at TNO-FEL"

Target responses and natural clutter have been analyzed based on GPR measurements performed in July 2002 at the test facilities for landmine detection systems located at TNO-FEL. The object responses of four different types of antipersonnel mines (surface laid and buried at depths of one, five and six centimeters) in three different types of ground have been analyzed for different polarizations of incident and scattered wave, for different pulse durations and for different antenna configurations. Clutter levels have been defined for two different presentations of raw data and have been determined for three different types of ground. It is shown that detectability of targets by GPR is limited not by the sensitivity or the dynamic range of the radar, but by the clutter. It is demonstrated that it is possible to detect targets below clutter level using the statistical data analysis. [C1186]

## "Experimental and theoretical analysis of different buried object systems using time domain reflected signal analysis"

In this paper, some of the GPR applications at higher microwave frequencies (X and Ku bands) are highlighted. Employing the GPR methodology, different dielectric objects are detected; underground roots are detected and differentiated from other naturally occurring dielectric objects. The theoretical simulation studies of the scattered field from various objects are also carried out to substantiate the experimental results. [C1187]

## "Efficient computation of the wavefield in a two media configuration emitted by a GPR system from incident field measurements in the air"

For proper imaging and inversion, accurate information on the wavefield that is emitted into the ground is of paramount importance. In case of ground-coupled antennas and without the possibility of time windowing, the wave field in the ground can be best modeled by taking this coupling into account in the model. For air launched antennas, with less ground coupling, or when time windowing is possible, we can obtain the wave field in the

ground from wave field extrapolation of the emitted wave field, which is recorded in a certain plane in free space. It is shown that in two media configuration, with homogenous layers, only the down going wave field in the upper half space below the antennas, contributed to the down going wave field in the lower half space. This is generally true for laterally homogenous media. The present state of the art in three-dimensional multi-component GPR imaging is to use analytic expression for Green's functions in canonical configurations that do not sufficiently match the real background. The reason is that full computation of the Sommerfeld-type integrals, which have to be solved for each image plane, are too time consuming for imaging GPR data within reasonable time. We show that approximations to the correct two-media Green's functions leads to a more accurate resolution function than exact formulations of the approximate Green's functions of a single homogenous medium. To achieve this, we use a wave field extrapolation method honoring the spectral bandwidth of the data to be imaged. [C1188]

## "Integrated vertical radar profiles (VRP) and multi-fold GPR for site characterization"

Non-invasive characterization of contaminated sites and brownfields is being used to support planning and correlation of sampling and in decision-making and monitoring of rehabilitation procedures. We exploit a combination of surface (linear/azimuthal multi-fold) and borehole [vertical radar profiling (VRP)] techniques for an integrated and constrained assessment of the radar velocity field. The test of the method is performed with a Mala Geoscience system equipped with 100 MHz borehole and 100-250 MHz surface antennas. We test the technique at a disposal site where mixed industrial and solid urban waste is piled on alluvial sequences. The stratigraphic column includes sandy loams with variable fractions of silt and clay, a gravel and coarse sand aquifer, a bottom clay layer of variable thickness. Two shallow layers, an allochthonous soil, 0 to 80 cm thick from topographic surface, lying on coke ashes mixed with industrial debris (100 to 170 cm thick), attenuate the radar wave due to strong scattering and low resistivity. Maximum penetration from surface is restricted to approximately 250 cm. Borehole measurements are used to integrate surface methods and reconstruct the velocity field. Results of the radar experiment are validated by laboratory measurements, performed with a network analyzer, and by FDTD numerical simulation. [C1189]

## "Applications of GPR for surface mining"

Over the past 25 years, a myriad of applications for GPR technology have evolved ranging from archaeology to subsurface mapping on Mars. However, it is only recently that GPR has been applied on a production basis for surface mining. Due to the generally resistive nature of the media, GPR is an obvious candidate for alluvial gold and diamond resource exploration in aggregate-filled paleochannels. By correlating the radar reflectors to known geological features detected by boreholes or trenches, GPR has been used on a large scale for preliminary exploration, as well as on a local scale for the three-dimensional reconstruction of complex braided paleochannel systems. Although GPR has been attempted historically at a variety of placer sites, newly developed visualization techniques have enabled greater exploitation of the richness GPR data affords. Data are presented which illustrate the utility of GPR in the three-dimensional mapping of various fluvial paleofeatures, to depths frequently exceeding 40 m. A demanding application for GPR is that presented by tropical weathering environments. With the dramatic growth of interest in lateritic and bauxitic resource exploration, fueled by increasing demand and new processing technologies, the need for accurate resource delineation and careful mine planning becomes paramount. The traditional use of borehole grids to calculate ore reserves has proven to be neither sufficiently accurate nor cost-effective at many sites due to the complexity of tropical weathering profiles. Although conventional wisdom dictates that radar surveys are usually unsuccessful in regions with a high clay fraction, GPR has emerged as the most suitable geophysical tool to complement borehole grids in addressing project geology, resource delineation, and mine planning issues in the high clay fraction soil found in most tropical weathering environments. [C1190]

## "MINETECT"

This paper describes the MINETECT, combined MD and GPR mine detector, sponsored by the UK Department for International Development and developed by ERA Technology. Using a radically different patented approach from conventional GPR designs, in terms of the man machine interface, MINETECT offers simplicity of use and affordability, both key factors in humanitarian demining operations. The ground penetrating radar employs novel operator audio interface techniques embodied in European patent number 99306164.7. This paper describes the design concept, summarises the trials carried out and provides the conclusions as to requirements for GPR performance. [C1191]

## "Observations and modelling of the response of along-track SAR interferometry to mesoscale ocean features"

First Page of the Article [C1192]

## "Precision geolocation determination and pointing managemen for the advanced land observing satellite (ALOS)"

First Page of the Article [C1193]

## "Cloud liquid water retrievals from aqua AMSU/HSB"

The aqua satellite of NASA's Earth observing system carries, among other instruments, the atmospheric infrared sounder, the advanced microwave sounding unit-A, and the humidity sounder for Brazil, which are used cooperatively to retrieve numerous geophysical parameters, including profiles of atmospheric temperature, ozone, water vapour, and cloud liquid water. This paper discusses the method of obtaining nonprecipitating cloud liquid water and some results form the first year of operation; for example, images of retrieved cloud liquid water show the positions of weather fronts. The retrieval process consists of several stages; cloud liquid water is estimated in the first stage, using the microwave channels. This algorithm seeks to minimize, by iteration, a cost function composed of quadratic functions of the differences between observed and computed brightness temperatures and the differences between the retrieved and a priori atmosphere/surface parameters. The algorithm uses internally a condensation model that relates water vapour and cloud liquid water to a single profile of a humidity variable, through which the a priori statistics of water vapour are introduced. The transition between vapour and liquid (saturation point) is a parameter found by the algorithm, thus allowing for possible error in the retrieved temperature profile. In simulations, the integrated cloud liquid water has rms errors of 50g/m2over water surfaces, and 150g/m2over land surfaces. [C1194]

## "Evaluation of ENVISAT ASAR data for measurement of surface wind field over the Korean east coast"

The detailed knowledge of ocean surface wind field is useful for understanding of ocean circulation and variability in a specific spatial and temporal window. An efficient way to obtain such information in sufficient density is through satellite remote sensing. The most recent environmental observation satellite, ENVISAT, has an Advanced Synthetic Aperture Radar (ASAR), which operates at C-band frequency. The ASAR has the potential of retrieving sea surface wind field more accurately than the ERS-1/2 AMI because the ASAR can collect high resolution images with a various viewing geometry and simultaneously in two polarization mode. Several ASAR images including alternating polarization mode and wide swath mode were obtained off the eastern coast of Korean peninsula during the winter season. Simultaneously, we installed two corner reflectors on the near beach to calibrate ENVISAR ASAR data. In this paper we combined polarization ratio models and modified C-band VV-polarization wind speed retrieval models (CMOD_4 and CMOD_IFR2) to apply them to ASAR alternating polarization mode data. We compared the resulting wind fields estimated from ENVISAT ASAR data with wind speed and direction measured by the several coastal automatic weather systems and two ocean buoys which are deployed at 10 km and 100 km off the east coast of Korean peninsula respectively. [C1195]

## "Combining MISR, ETM+ and SAR data to improve land cover and land use classification for carbon cycle research"

Accurate and reliable information about land cover and land use is essential to carbon cycle and climate change modeling. While historical regional-to-global scale land cover and land use data products had been produced by AVHRR and MSS/TM, this task has been advanced by sensors such as MODIS and ETM since the latter 1990s. While the accuracies and reliabilities of these data products have been improved, there have been reports from the modeling community that additional work is needed to reduce errors so that the uncertainties associated with the global carbon cycle and climate change modeling can be addressed. Remotely sensed data collected in different wavelength regions, at different viewing geometries, usually provide complementary information. Their combination has the potential to enhance remote sensing capabilities in discriminating important land cover components. In this paper, we studied multi-angle data fusion, and optical-SAR data fusion for land cover classification at regional spatial scale in the temperate forests of the eastern United States. Data from EOS-MISR, Landsat-ETM+ and RadarSat-SAR were used. The results showed significantly improved land cover classification accuracy when using the data fusion approach. These results may benefit future land cover products for global change research. [C1196]

## "Information and understanding: analysis of remotely sensed data"

A review is given of the development of the field of image understanding in remote sensing, with an emphasis on the contributions of David Landgrebe and his group at the Laboratory for Applications of Remote Sensing,

Purdue University. The differences in approach required for multispectral, hyperspectral and radar image data are emphasised, in which the seminal contributions to the field by Landgrebe as well as others are summarised. The treatment concludes by examining the current problem of thematic mapping from mixed spatial data types, such as would be found in a geographical information system. Rather than seeking techniques that "fuse" available data types as a means for deriving joint inferences, it is proposed instead that the most practical means is to have each individual data source analysed separately by the most appropriate techniques and the fuse at the label level using the facilities of an expert consultant. [C1197]

## "Operational applications of RADARSAT-1 for the monitoring of natural oil seeps in the South Gulf of Mexico"

The origin of the oil activity in Campeche Sound is closely related to the activity of the natural oil seeps. At the moment, the operational areas with greater production in the Cantarell field from PEMEX Exploration and Production (PEP), coincide with the activity of the most important seep in the south of the Gulf of Mexico. With the intention of establishing the origin and magnitude of the hydrocarbon contributions of the natural seeps in this area, the Northeast Marine Region (RMNE) of PEP, with the support of the Subdivision of Technology and Development (STDP) of PEP and the Corporative Unit of Geographic Information Systems (SICORI) developed during the 2000-2001 with RADARSAT International and RADARSAT Resource Center in Brazil a progressive application of the RADARSAT-1 satellite to evaluate oil seep potentiality in detection and measurement, being allowed to establish a proven method for the monitoring of oil seep behavior. The methodology is applied in a continuous way from 2002 and includes a regional criterion for the selection of images, basic and advanced digital analysis utilizing the Unsupervised Semivariogram Textural Classifier (USTC), and meteo-oceanographic calibration. The methodology also correlates geologic and environmental information. The results shown activity of the Cantarell seep in 79.5% of the 83 images analyzed during 2000-2002. Area coverage of Cantarell seep from 66 images ranks between 0.04 to 207.4 km2, with an average area of 32 km2.RADARSAT-1 analysis identified that the main hydrocarbon contribution, in area as well as frequency for South Gulf of Mexico, comes from the natural oil seeps, particularly from the Cantarell field. This project also demonstrates the viability of the integration of disciplinary groups within PEMEX for the development of new technologies with multiple applications that allow the optimization of resources and enhance the availability of environmental tools. [C1198]

## "Innovative radar altimeter concepts"

In the frame of the study "Innovative radar altimeter concepts", founded by the European Space Agency (ESA), the authors analyzed potential advanced measurement concepts for radar altimeters of future generation, studied the feasibility of the identified techniques and proposed a design for an instrument based on the most promising system concept. This paper summarizes the major results of the study. [C1199]

## "Jet engine condition monitoring using radar"

First Page of the Article [C1200]

## "Advances in the design of single-layer slotted waveguide arrays and their system applications"

High efficiency and low cost waveguide arrays have been proposed and developed by using four kinds of single-layer waveguides. These are potential for varieties of millimeter-wave wireless systems using high gain antennas. The latest advances in the analysis and design methods of single-layer waveguide arrays are reviewed. Then the system applications such as fixed wireless access (FWA), local area network (LAN), TV-video home-link systems and mobile communication base stations are introduced. [C1201]

## "Triple-frequency radar for cloud and precipitation microphysics research"

The University of Massachusetts (UMass), Colorado State University (CSU) and the National Center for Atmospheric Research (NCAR) are collaborating to develop an advanced multifrequency radar (MFR) system for studying clouds and precipitation, which should become operational in 2004. This highly portable radar consists of three polarimetric Doppler subsystems operating at Ku-band (13.4 GHz), Ka-band (35.6 GHz) and W-band (95 GHz), a programmable scanning pedestal, and a unique single aperture antenna that generates colocated matched beams at each frequency. This combination of frequencies allows measurement of a wide range of atmospheric targets including weakly reflecting clouds and precipitation. [C1202]

## "NASA Advanced Component Technology Program, investments in remote sensing technologies"

Investments in remote sensing technologies have become increasingly important as Earth scientists strive to better understand changes of the Earth System on a global scale. This paper discusses investments in active

and passive remote sensing technologies that will provide new measurement capabilities for advanced observing satellites systems. Such measurements will enable more reliable predictions of weather, climate and other globally important elements of the Earth's system. The Earth Science Technology Office, Advances Component Technology program manages this portfolio of technology developments for the Earth Science Enterprise. [C1203]

## "Multiyear MODIS observation of global aerosols from EOS Terra/Aqua satellites: validation, variability, and application"

The multiyear MODIS (Moderate Resolution Imaging Spectroradiometer) measurements are full of exciting aerosol events, such as the well-known Asian/Saharan dust outbreaks, biomass burning in South Africa, Southeast Asia, Central America, and Southern Africa, and air pollution all over the world. The MODIS aerosol optical depths (τa) are validated against AERONET (aerosol robotic network) and other radiometer/sunphotometer (e.g., airborne sunphotometer, shadowband radiometer, microtops, etc.) measurements within the expected retrieval errors of Δτa= ±0.05±0.2 τa(e.g., 25% fir τa= 1) over land and Δτa= ±0.03±0.05τa(e.g., 8% for τa= 1) over ocean. The comparisons of monthly MODIS V4 (version 4) and GACP (global aerosol climatology project) AVHRRR (advanced very high resolution radiometer) aerosol optical depths with AVHRR show that the difference of aerosol loading are generally larger in the northern hemisphere than in the southern hemisphere form March to August 2000 and February 2001 in both hemispheres. Similar conclusions can also be drawn from regional analysis, except in pristine oceans in the northern hemisphere where MODIS and AVHRR aerosol retrievals are in agreement throughout the year. The preliminary results of correlating MODIS aerosol optical depths with PM2.5(particular matter with diameter [C1204]

## "Global SWE monitoring using AMSR-E data"

We demonstrate the "baseline" global snow water equivalent retrieval (SWE) algorithm using Advanced Microwave Scanning Radiometer EOS (AMSR-E). Daily, pentad and monthly records for March 2003 of AMSR-E SWE estimates are generated and gridded to the 25 km EASE-grid projection. The estimates are tested using ground measurements from the World Meteorological Organization Global Telecommunications Network. Preliminary bias characteristics are evaluated. A fraction of the error is related to uncertainties about the grain size changes throughout the winter season that directly affect the parameterization of the snow depth estimation in algorithm. The algorithm includes the need for a correction of forest cover and this effect is clearly observed in the retrieval. AMSR-E has twice the spatial resolution of the Special Sensor Microwave Imager and is able to characterize snow variability at the local scale. Development of the algorithm is focused on a dynamic parameterization of the snow grain size and density via a dense media radiative transfer model plus the inclusion of a high quality forest correction data set. [C1205]

## "On the concept of an all digital sensor design"

The digital communications revolution that began in the last decade has produced technology advances that have yet to be included in the design of remote sensing sensors especially high resolution optical and RF sensors. Current wireless telephony operates with software radios as an integral design construct with improved performance over analog equivalents. The commercial technology sector driven by aggressive business plans and deployment strategies allowed the development of RF components, processors and embedded software implementation, to enable all digital system architectures. Traditional design approaches used in the telecommunications industry have not typically been transferred to the sensor design community. This paper addresses a new sensor design approach that incorporates the technology and philosophy of the telecommunications industry. [C1206]

## "Compatible improvement of the GSM/GPRS system by means of space-time block codes"

We investigate the application of the Alamouti space-time block code (STBC) on the basis of the GSM/GPRS system, especially with regard to aspects of compatibility with current specifications. The performance improvements obtainable by means of this technique are demonstrated on the basis of simulation results. A novel trellis-based soft-output equalization and detection algorithm for the Alamouti scheme is presented which is of the same complexity as in the single transmit antenna case. Moreover, appropriate training sequence pairs are derived. In this context, optimized partner sequences with respect to the eight GSM sequences are introduced that significantly outperform any pair of GSM sequences. Analytical results are presented demonstrating the sensitivity of the Alamouti scheme to fast and/or frequency-selective fading as well as to imperfect knowledge of the channel coefficients at the receiver. [C1207]

## "Tracking direction-of-arrival for wireless communication with multiple antennas"

The goal of this contribution is to bind together results available for radar systems for direction-of-arrival (DOA) tracking and wireless communications with multiple antennas. We show that for accurate tracking of DOA the MUSIC-like methods based on inversion of the channel snapshot covariance matrix are suboptimal. In our approach we apply an alternative algorithm developed by H. Gu (2002) that uses the instant channel snapshot to update the DOA estimates directly. We improve on this algorithm by introducing online data association capabilities based on linear extrapolation that leads to better tracking performance and lower computational complexity. The performance is evaluated using simulated channels as well as real wideband multiple-input-multiple-output (MIMO) measurements at 2 GHz. The obtained estimates confirm previous results obtained with alternative techniques but provide more accurate results at lower computational complexity. [C1208]

## "TerraSAR-X, German X-band remote sensing system"

TerraSAR-X is the latest development at EADS Astrium GmbH of Synthetic Aperture Radar using an active phased array for spaceborne remote sensing. Its technical implementation is based on core technologies which have been developed and qualified in a demonstrator programme (DESA). New capabilities have been added like full polarimetry and along track interferometry via a Dual Receive Antenna. The programmatic implementation follows a Public Private Partnership (PPP) between the German Aerospace Center, DLR and EADS Astrium GmbH. EADS Astrium is investing into TerraSAR-X to build-up a data service for world wide customers through the founded Infoterra GmbH. [C1209]

## "Development of GPS aided INS via Federated Kalman filter"

In the paper an algorithm on aiding the Inertial Navigation System with GPS is presented. Federated Kalman filter, which includes two different Kalman filters and processes INS and GPS data in real time, is designed for this reason. Simulation is made and presented on the flight dynamics, and it is determined that the algorithm for aiding the INS with GPS, evaluates the motion parameters with high accuracy. [C1210]

## "A new iterative technique for image restoration of ERS-2 raw data"

In this study, a method for restoration of synthetic aperture radar ( SAR ) images is presented. We implement an iterative restoration algorithm on ERS-2 images of Istanbul, Turkey. We consider restoration to be a process that attempts to reconstruct or recover an image that is degraded by using some a priori knowledge of the degradation phenomenon. A degraded image often has a noise term. Speckle noise exists in all types of coherent imaging systems and its presence reduces the resolution of the image and detectibility of the target. The method handled in the study is based on a total sum preserving regularization (TSPR) concept. The basic property of the TSPR method is that it preserves the mean values of local homogeneous regions and reduces speckle noise effectively. We obtain the original image from a degraded observed image. At each step of the technique the current pixel value depends on its neighbour ones, according to some regularizing parameters. [C1211]

## "Potentials for high-resolution imaging with small satellites"

In the field of space-borne topographic mapping instruments the trend to smaller ground sample distances (GSD) can be observed, making use of the best technology available at the given time. From the 80 m GSD of ERTS (later renamed Landsat-1), the first satellite dedicated to civil space-borne Earth surface imaging launched in 1972, the GSD now approaches 1 m. Mass and power consumption of spacecraft and instruments follow similar trends. Alternatives to passive optical systems such as SAR and laser altimeters also benefit from the immense improvement in very diverse fields of technology. Nevertheless, the most promising prospects for topographic mapping with small satellites are connected with passive optical systems, especially push-broom systems. The paper tries to contribute to the answer of the question, how far can we go with decreasing instrument size, mass and power consumption, and decreasing the GSD at the same time. After explaining the basic topographic mapping concepts, the paper deals with important parameters for mapping with small satellites: spatial resolution, radiometry, mass, volume, power consumption, microelectronics, pointing accuracy and stability, data volume and transmission. From the technology point of view, small satellite missions for topographic mapping are feasible. One system is already in Earth orbit, others are in the planning stage. There is a good chance to install mapping systems with a low cost space segment. It is a question of market requirement and behavior whether or not these small satellite based mapping systems can successfully compete with existing space-borne or airborne based mapping systems. [C1212]

## "Hierarchical classification of SAR data with feature extraction method based on texture features"

In this study hierarchical classification structure and the feature extraction method based on texture features are applied to SAR data. The most important feature of hierarchical classification is to break down a complex

decision-making process into a collection of simpler decisions. In order to achieve more complex analysis it is advantageous to use binary decision trees, in which the decision between only two classes must be assigned at each node. Pixel based feature extraction methods reduce classification performance because of the speckle and also conventional texture analysis is not applicable to every part of an image. Therefore, a decision-making process, which can be applied to every pixel of an image, is required. The results show that computation time and accuracy of classification process are improved. [C1213]

## "Applying space technologies for human benefit; the Canadian experience and global trends"

In the era since Canada followed the Soviet Union and the United States into space, space technology has evolved enormously. No longer the exclusive purview of fully developed countries, space is being harnessed for the benefit of humanity by even small countries and individual establishments. The exploitation of space applications is limited only by the imagination and resolve of the interested parties. Canada's initiation into space took the form of Alouette 1, launched in 1962 to learn more about the physics of electromagnetic phenomena interfering with its radio communications with its northern areas. International collaboration has played an important role and continues to be emphasized as its exploitation of space progressed from science and communications to remote sensing to space robotics. Even today, Canada has declined to develop an independent launch capability, preferring to collaborate with the nations endowed with such a capability. Recent developments in Canada have seen collaboration extend inward, with federal/provincial and private/public sector cooperation on selected space missions. Such collaboration has proven very beneficial to Canada and is recommended globally. Canadian harnessing of space technology began in the domain of communications, moving from R&D into phenomena affecting communications to the world's first domestic geostationary satellite communications system. Today, Canadians have access to not only our own domestic comsats but also international service providers which include Canadian elements. Canadian involvement in space robotics received a big boost with the contribution of the CANADARM to NASA for use on their space shuttles. It grew further with the CANADARM-2 for the International Space Station (ISS), a sophisticated robot which is still evolving, the third main element not yet launched. This arm is available for use by the international partners on the ISS, a major international scientific collaboration. [C1214]

## "Hydrometeor classification system using dual-polarization radar measurements"

Hydrometeor classification system using fuzzy logic technique based on dual-polarization radar measurements is presented. In this study, five radar measurements (horizontal reflectivity, differential reflectivity, specific differential phase, correlation coefficient, and linear depolarization ratio), and height relating to environmental melting level are used as input variables of the system. The hydrometeor classification system chooses one of nine different hydrometeor categories as output. The system presented in this paper is a further development of an existing hydrometeor classification system model developed at Colorado State University. The hydrometeor classification system is evaluated by comparison against the in situ sample data collected by instrumentation on T-28 aircraft during Severe Thunderstorm Electrification and Precipitation Study (STEPS). [C1215]

## "Automatic registration of electro-optical and SAR images"

Presents a new and robust method to perform multisensor image registration from dissimilar sources. It is a proof of concept demonstration. It is based on multiple transformations of two quite dissimilar images into new domains, where local or global similarities are extracted. [C1216]

## "Multisensor image fusion and mining: from neural systems to COTS software with application to remote sensing AFE"

We summarize our methods for the fusion of multisensor/spectral imagery based on concepts derived from neural models of visual processing (adaptive contrast enhancement, opponent-color contrast, multi-scale contour completion, and multi-scale texture enhancement) and semi-supervised pattern learning and recognition. These methods have been applied to the problem of aided feature extraction (AFE) from remote sensing airborne multispectral and hyperspectral imaging systems, and space-based multi-platform multi-modality imaging sensors. The methods enable color fused 3D visualization, as well as interactive exploitation and data mining in the form of human-guided machine learning and search for objects, landcover, and cultural features. This technology has been evaluated on space-based imagery for the National Imagery and Mapping Agency, and real-time implementation has also been demonstrated for terrestrial fused-color night imaging. We have recently incorporated these methods into a commercial software platform (ERDAS Imagine) for imagery exploitation. We describe the approach and user interfaces, and show results for a variety of sensor systems with application to remote sensing feature extraction including EO/IR/MSI/SAR imagery from Landsat and Radarsat, multispectral Ikonos imagery, and Hyperion and HyMap hyperspectral imagery. [C1217]

## "Monitoring freeze-thaw events in Siberia using the seawinds Ku-band scatterometer: first results"

In this paper we will report the first results of our work carried out within the framework of the SIBERIA II project. This project has the aim to demonstrate the viability of full greenhouse gas (GHG) accounting using a set of multi-sensor Earth Observation instruments, detailed existing databases of field information and some of the worlds most advanced climate models. Freeze-thaw information is intended to be used for validation and input into the GHG models. Utilising the high temporal sampling of the SeaWinds sensor on QuikSCAT, along with a unique gridding and extraction method, from observational to analysis space, we present a new approach for freeze-thaw detection by time series analysis and evaluation of the temporal characteristics of the backscattered signal. [C1218]

## "A discussion on the threat of supersonic air-to-surface missiles"

An advanced RF surface-to-air missile (SAM) system accompanies with ground radars, missiles, launchers, etc. which are very vulnerable against air-to-surface missiles (ASMs). This paper studies about the threat of supersonic ASMs with random maneuver and an IR homing anti-missile missile (AMM) system, which defends the SAM site. The interception problem between the ASM and the AMM is considered as a game, and some features of the game are discussed and an approach is explained. [C1219]

## "Proceedings of International Conference on Recent Advances in Space Technologies (IEEE Cat. No.03EX743)"

First Page of the Article [C1220]

## "Millimeter wave control switch for secure giga-scale system"

A driver-enhanced single pole double-throw (SPDT) switch was designed and implemented for secured giga-scale system. The design were simulated on advanced design system (ADS) package and implemented on RT-duriod 5880 with 10 mils thick dielectric substrate in a 3-port WR28 waveguide, to validate the design for broadband application in Ka-band of digital millimeter waves. [C1221]

## "Bayesian computer-intensive methods for statistical signal processing"

Summary form only given. The talk discusses various computational techniques for solving complex inference problems in signal processing. The focus of the talk would be Monte Carlo methods, and in particular the sequential Monte Carlo methods which are currently proving extremely powerful for non-linear/non-Gaussian sequential environments. The author review the basic formulation of the sequential Monte Carlo framework, or particle filter, from the perspective of sequential updating of a general probability distribution, such as the posterior distribution of a hidden state or signal parameter. These methods, in their most basic forms, have proved very powerful for solving of non-linear problems in radar tracking, financial time series, communications, robotics and computer vision. In recent years increases in available computer power and memory have facilitated substantial algorithmic advances in these methods, allowing for more accurate inference and solution of more complex problems. In the second part of the talk the author describe some of these recent advances in sequential Monte Carlo, including Monte Carlo smoothers and trans-dimensional filters, which allow for on-line model selection. The methods described would be illustrated with examples from radar tracking, audio signal extraction and inference of musical beat from an audio waveform. [C1222]

## "LTCC-technology for miniaturized Ka-band frontends"

A modern state-of-the-art radar frontend for use in Ka-band radar applications like small seekers for missiles or drones has stringent requirements to electrical, mechanical and thermal aspects. It has surely also be taken care on economical and environmental demands. This vast array of seemingly contradictory conditions can be fulfilled by using a LTCC-multilayer (low temperature cofired ceramic). LTCC-technology is one of the most advanced approaches to the miniaturization of RF circuits. [C1223]

## "AN/SPY-3: the navy's next-generation force protection radar system"

This article provides a description of the functionality and design of the navy's first ship-board active array multifunction radar, the AN/SPY-3. The AN/SPY-3 radar principally provides detection, tracking, and illumination of low-flying antiship cruise missiles (ASCMs) as an integral part of advanced antiair warfare (AAW) systems including DD 21 and CVN 77. In order to provide the appropriate system context for the radar description, this article begins with an overview of the challenges of cruise missile defense and some of the issues that affect both weapon system and radar requirements. It then briefly discusses the concept of an advanced radar sensor

suite that is designed to perform all shipboard radar functions, as well as some of the factors that influence the choice of radar frequency. A brief summary of the radar suite functionality is provided, along with a somewhat more detailed discussion of the functionality of the AN/SPY-3 radar. Next, rationale is provided for the selection of X-band as the frequency for the AN/SPY-3 radar. It finally concludes with a description of the AN/SPY-3 system architecture and key subsystems. [C1224]

## "Calibration overview of the AMRFC test bed"

The AMRFC (advanced multi-function radio frequency concept) phased array test bed is a joint effort to demonstrate the latest technologies to concurrently perform several Navy's shipboard RF functions (e.g., communications, electronic warfare, and radar) including a calibration function through a common, shared software and RF architecture. The calibration function involves monitoring the drifts and misalignments of each subsystem as they vary over time and temperature. The main goal of calibration is to ensure that all interconnected components and subsystems perform as expected in terms of amplitude, and phase alignment. Key features of the calibration procedure are the method by which test and reference signals are generated, and how test data are collected and analyzed. The transfer functions of various subsystems in the test bed are measured via software control of these subsystems. A total of 22 calibration modes have been developed. In this paper, a single mode is described. [C1225]

## "Miniature Ka-band I/Q vector modulator using 3D-MMIC technology"

A 3D-MMIC I/Q vector modulator for direct multilevel modulation at 38GHz is reported. The experimental 3D-MMIC process developed at Bookham Technology (Caswell) offers 5 metal layers with BCB dielectric, making it possible to miniaturise the passive components using the lumped-distributed technique, overlaid couplers and TFMS lines. This approach offers compactness and easy implementation as compared to the planar forms. The modulator measures only 1.9 Ч 0.9 mm2and achieves exceptionally precise tuning response leading to a near-ideal square constellation plot, making the modulator suitable for advanced signal processing and modulation techniques. [C1226]

## "Advance MMICs for remote sensing and radar applications"

Modern remote sensing systems and radars are more and more based on electronically steered antennas. Instead of using one high power tube, each radiating element must contain a full T/R module allowing an individual modulation of amplitude and phase of both transmit and receive signal. The key elements in such systems are monolithic microwave integrated circuits. In this paper some general information about these components are given as well as the latest achievements in terms of power amplifiers are described. The CHA7010 is a 10W power amplifier (in pulse mode) featuring high PAE and small size. [C1227]

## "A pulse Doppler radar using reconfigurable computing"

In a variety of signal processing applications, nowadays, the use of radar for advanced control has become a necessity, e.g., navigational systems, aircraft, automobiles and other sensing devices. A normal microprocessor based radar signal processor eats a lot of processing power and time so we have proposed the implementation of a dynamically reconfigurable pulsed Doppler radar in a mixed system comprising a digital signal processor (DSP) and FPGA to perform linear frequency modulation, Gaussian noise filtering, downconversion, pulse compression (matched filtering) and pulsed Doppler processing. Allowing the users to modify range and delay, the reconfigurable processor on-chip helps DSP(s) exploit more of the parallelism found in digital signal processing applications, thus improving the processor's overall performance. [C1228]

## "Microwave remote sensing: needs and requirements concerning technology"

Spaceborne microwave remote sensing instruments, like the imaging radiometer and the synthetic aperture radar, are over timed faced with two partly conflicting requirements: performance expectations (resolutions, sensitivity, coverage) steadily increase with resource allocations (weight, power, bulk, cost) decrease. This results in needs and requirements to the development of advanced technology thus enabling the future advanced systems to be viable and realistic. [C1229]

## "Intelligent radar management by advanced beamscheduling algorithms based on short-time planning & constraints relaxation strategies"

The intelligent radar management study project is composed of industrial partners, THALES Air Defence and AMS (a joint BAe Finmeccanica Company) involved in research and development in modern radar control techniques. The capabilities of modern ground based military multifunction radars cannot really be fully satisfied

by using older sensor control strategies, due to the advance in radar technology and the complexity of the tactical environment. The most obvious radar management objective is the real-time optimisation of radar functionality according to an assessment of the current environment conditions, taking into account tactical requests from an external centre, in order to manage as well as possible, radar operational missions. The objective of the study is to evaluate the algorithms and techniques developed during the study. Results are based on a software demonstrator, specially developed for this purpose. The intelligent radar manager (IRM) in the present study is considered to integrate all the intelligent processes supporting the operation of MFR radar. As indicated in the figure it includes the MFR scheduler with a new component, the "supervisor" which embodies the intelligent classification, prioritisation and adaptive control of radar functions, which are required. The IRM demonstrator contains several other software components in addition to the supervisor and scheduler, as shown in the figure. While necessary for the operation of the simulation, the framework and environment simulator are not part of the IRM proper, there are here, only to emulate environment. Thus, they are not described further. In the following, we will focus on the supervisor and more specifically on the scheduler in detail. [C1230]

## "Phased arrays around the world-progress and future trends"

This is a survey paper summarizing the developments and future trends in passive, active bipolar and monolithic microwave integrated circuitry (MMIC) phased arrays for ground, ship, air, and space applications. Covered is the DD(X) ship radar suite; THAAD (formerly GBR); European COBRA; Israel BMD radar antennas; Dutch shipboard APAR; airborne US F- 22, JSF and F-18 radars, European AMSAR, Swedish AESA, Japan FSX and Israel Phalcon; Iridium (66 satellites in orbit for total of 198 antennas) and Globalstar MMIC spaceborne active array systems (these last two are communications but the technology is the same as used by radar systems, in fact the IRIDIUM T/R module technology derives from technology developed for a space based radar); Thales (formerly Thomson-CSF) 4 inch MMIC wafer 94 GHz seeker antenna; digital beamforming; ferroelectric row-column scanning; optical electronic scanning for communications and radar; the MMIC C-band to Ku-band Advanced Shared Aperture Program (ASAP) and AMRFS antenna systems for shared use for communications, radar, electronics countermeasures (ECM) and ESM; and continuous transverse stub (CTS) voltage-variable dielectric (VVD) antenna. [C1231]

## "Advanced sensor data fusion in MSDFLib"

First Page of the Article [C1232]

## "Measurement of the dielectric properties of dispersive materials over a wide frequency range"

The propagation of electromagnetic waves through dispersive media forms the basis for a wide variety of applications. Rapid advances in materials have produced new products with tailored responses across frequency bands. Many of these new materials, such as radar absorbing material and photonic crystals, are dispersive in nature. This, in turn, has opened up the possibility for the exploitation of these dispersive dielectric properties for a variety of applications. Thus, it is desirable to know the electromagnetic properties of both man-made and natural materials across a wide frequency range. With the advent of transient pulsers with sub-nanosecond risetimes and rates of voltage rise approaching 10**16 V/s, the frequencies of interest in the transient response extend to approximately the 2 GHz range.. Although a network analyzer can provide either frequency- or time-domain data (by inverse transform), common TEM cells are only rated to 0.5 to 1.5 GHz-significantly below the maximum frequency of interest. To extend the frequency range to include 2 GHz, a TEM cell was characterized and a deembedding algorithm was applied to account, in part, for the limitations of the cell. The de-embedding technique is described along with such measurement issues such as clear time and sneak around. Measurements of complex permittivity of common drinking water are shown. This frequency extension will lead to more expansive testing of dielectric materials of interest. [C1233]

## "Phased-array development at DARPA"

This paper reviews ongoing phased-array antenna and system development in the Special Projects Office of the Defense Advanced Research Projects Agency (DARPA/SPO). These programs fall into two categories: development and application of phased-array antenna component technologies and development of transportable phased-array radar antennas. These phased-array technology development programs are presented in a chronological order. [C1234]

## "32-Channel X-band digital beamforming plug-and-play receive array"

Phased array architectures have evolved to a point where digital beamforming (DBF) is rapidly becoming the preferred approach for many new advanced communication and radar phased arrays that will be in production by the end of this decade. DBF is often touted as the ultimate in phased array performance, yet one of its biggest

potential long-term advantages may be lower cost. Traditionally, two of the biggest cost drivers in analog phased arrays have been non-recurring engineering costs attributed to non-scalable one-of-a-kind array designs and low-volume production of high performance RF components. Very few phased arrays share common components to any great degree and nearly all utilize uniquely designed RF manifolds. The advent of DBF will likely foster scalable modular phased array designs that reduce design costs and promote higher-volume production of key RF components. Below L-band, DBF receiver components are now small enough to integrate directly behind the array within the element unit cell. Above L-band, DBF architectures often use subarrays, or row/column implementations because the receiver hardware is still too large. This paper introduces a prototype X-band receive-only DBF array with a modular, scalable architecture and a very compact profile. This DBF array architecture uses column-level digital beamforming in the azimuth plane without subarrays, and has a rectangular aperture of 512 elements, arranged in 32 columns of 1x16 elements. Each column is connected to one of 32 compact digital receiver modules, which in turn, plug directly into a 4-beam real-time parallel processor board. The DBF receiver modules are composed of two separable sections, an "RF front-end" and a "digital back-end". The RF front-end is designed for specific phased array frequency, bandwidth and dynamic range requirements, whereas the "digital back-end" design is generalized to interface with several different RF front-ends that operate at different frequencies. Interchangeability of RF front-ends is made possible using a standardized intermediate frequency (IF) interface between the RF front-end and the digital back-end, with fixed IF bandwidth and dynamic range. The overall architecture is scalable since more modules can be added to build a larger array aperture. The ke- y limiter of DBF architecture scalability is processor load. To address this problem, we are building a multi-beam parallel processor which itself is scalable. To that end, this paper reports our progress to date in the development of this prototype modular DBF array. [C1235]

## "The TERRASAR-X active phased array antenna"

TerraSAR-X is an X-band synthetic aperture radar satellite which is financed, designed, built and operated in frame of a public-private partnership between the German Aerospace Center DLR and Astrium GmbH. The TerraSAR Frontend is based on the DLR funded technology program DESA [R. Zahn et al., June 2002]. End of 2005, TerraSAR X will be launched into a circular, sun-synchronous 514 km dusk-dawn orbit. The use of an active phased array antenna allows for a wide variety of advanced SAR modes like ScanSAR or SpotlightSAR. This supports the commercial use of the radar for earth observation services and also offers through its flexibility a good experimental platform for radar scientists. The design drivers for the array are not only antenna performance but mainly the thermal stability, mass and power efficiency and cost effectiveness. [C1236]

## "ISAT-innovative space-based-radar antenna technology"

ISAT is the innovative space-based-radar antenna technology program of the Defense Advanced Research Projects Agency (DARPA). The goal of the ISAT program is to develop antenna technology to enable tactical grade space-based GMTI (ground moving target indicator) radar-particularly from higher (-10,000 km) orbits which facilitate constellations with fewer satellites. [C1237]

## "A modified velocity projection method for estimating the subsurface velocity structure of the Chesapeake Bay outflow plume"

We describe a methodology for estimating subsurface velocity structure in a buoyant outflow plume from a set of available observations. The observational data include HF Doppler radar, SST and sea surface color. In addition, plume-specific temperature and salinity information from in situ observations are used minimally, if available. Detailed application of the methodology is shown via a case study for the Chesapeake Bay during November 1997. The proposed methodology depends on developing a zero-order dynamical feature model for a typical plume. Theoretical models and past synoptic observational data sets are used to design the 'plume feature model'. The feature model's primary parameters include the location and extent of the frontal boundary, a simplified gravity current structure in the vertical with prescribed (or inferred) density stratification, and spatial gradient of salinity across the plume. These parameters are inferred from remote sensing or minimal strategic in situ observations. For the Chesapeake Bay case study, a previously developed velocity projection method by Shen and Evans (2002), which obtains subsurface current structure within the Ekman layer depth from surface currents (HF Doppler radar) and wind observations, is employed in a modified configuration. The 'feature model' density stratification in shallow water is incorporated now in the dynamical projection equations. The resulting subsurface projected currents are compared with available ADCP profiles. The difference between the density-stratified estimate and ADCP is further used to calibrate and improve the zero-order dynamical feature model parameters. This synergistic approach can now be applied to other shallow water features such as salt lenses and other anomalous entities. [C1238]

## "Mars Advanced Radar for Subsurface and Ionosphere Sounding (MARSIS): subsurface

## performances evaluation"

According to the Mars Express mission, the MARSIS primary scientific objectives are to map the distribution of water, both liquid and solid, in the upper pot-lions of the crust of Mars. Three secondary objectives are also defined subsurface geologic probing, surface characterization, and ionosphere sounding. In order to obtain the primary objectives the Radar Sounder design was based on the Ice/water interface and Dry/ice interface scenario: defining the material composition of the first layers and porosity and the pore filling materials. Concerning the surface, we have characterized the geometric structure in terms of a large-scale morphology, on which a small-scale geometric structure, due to rocks, is superimposed, taking into account also that recently the structure of the planets surface was described by means of fractals and in particular the new MARS surface models obtained by processing of the MOLA data. According to these models, this paper provides a description of the operational planning approach and expected performances of MARSIS. [C1239]

## "Subsurface sounding of Mars: multi-pulse detection of water-related interfaces"

We introduce optimized multi-pulse algorithms for the analysis of Mars surface and subsurface radar data, referring in particular to the data which should be acquired by the MARSIS instrument in the near future. The proposed processing schemes aim at detecting the presence and estimating the depth of water-related subsurface interfaces. A statistical model is introduced to cope with the expected scenario, and maximum likelihood based detection and estimation techniques are derived. The performance of the new techniques is deeply investigated, proving the effectiveness of the proposed approaches. [C1240]

## "Surface transport and mixing in Monterey Bay II. Synoptic summaries of particle motions"

"Summary form only given". For pt.I, see ibid., vol.4, no.0, p.2043 (2003). In the past five years there have been significant advances in dynamical systems theory to the point where the framework can now be utilized in the context of "real" problems. In this talk we will briefly describe the dynamical systems framework for Lagrangian transport and the new analysis tools it gives us for obtaining synoptic summaries of particle motion. Our focus will be on transport in a coastal system (i.e., Monterey Bay) using a velocity field obtained from high frequency (HF) radar measurements. In this talk we describe two new analytical techniques for studying transport: synoptic Lagrangian maps (SLMs) and incoming/exiting regions. SLM's is a method for compressing the information contained in millions of trajectories and, at the same time, reveals detailed, time-dependent, Lagrangian structures. The incoming/exiting regions reveal the time varying, geometrical structures in the flow responsible for controlling access to the bay. Both methods also provide novel ways to compute certain statistical quantities related to transport. [C1241]

## "A middleware architecture for inter ad-hoc networks communication"

Complex and decentralized information systems need advanced communication services at the middleware level in order to leverage context-aware distributed applications working, for example, despite node mobility and in a setting where such services can be billed. In this paper, we present a middleware architecture offering a communication service which, in its more general case, is able to provide connectivity between two nodes belonging to distinct mobile ad-hoc networks by taking user profiling into account. The proposed architecture is based on a resource awareness service enabling dynamic resource discovery and composition despite the assumed heterogeneity of the ad-hoc networks building the system. [C1242]

## "A CW 500 watt Ka-band coupled-cavity TWT for digital satellite communication"

The paper deals with a CW500 watt Ka-band coupled-cavity TWT for digital satellite communication. The communication and power industries developed a PPM focussed coupled-cavity TWT for conduction cooled amplifier systems. The TWT can be operated at the 500 watt output level or backed off from saturation in the linear mode. The technology advances have been applied to the newly designed CW TWT radar systems. [C1243]

## "Proceedings. 2003 IEEE International Conference on Robotics, Intelligent Systems and Signal Processing (IEEE Cat. No.03EX707)"

First Page of the Article [C1244]

## "Considerations in the development of the advanced propagation model (APM) for U.S. Navy applications"

This paper focuses primarily on the advanced propagation model (APM), developed by the Atmospheric

Propagation branch at SSC San Diego, and looks at initial developments of the model along with approximations made in its design for consideration of the operational user. [C1245]

## "Radar target imaging and identification using the advanced inverse scattering technique"

A new target recognition procedure is developed. In order to efficiently obtain feature vectors for target discrimination, the closed-form expression of geometrical wave fronts is also derived to provide efficient and accurate computation. Then, the resulting low dimensional feature vectors, obtained by the developed extractor, are identified using the well-known artificial neural networks (ANNs) classifier. In the illustrative experiments. three thin-wire targets are discriminated. The results show that the presented scheme gives successful automatic target recognition (ATR) in the low SNR with low computational costs. Therefore, the proposed technique has a significant potential for use in ATR. [C1246]

## "A programmable ultra wideband signal generator for electromagnetic susceptibility testing"

Under Phase I of the Defense Advanced Research Projects Agency (DARPA) Networking in Extreme Environments (NETEX) initiative, Multispectral Solutions, Inc. (MSSI) was tasked with the development of a general purpose, ultra wideband hardware simulator capable of reproducing a wide variety of ultra wideband (UWB) waveforms. The simulator, with UWB outputs from baseband through millimeter wave, was to be used for the purpose of electromagnetic susceptibility testing of legacy military radio, radar and positioning systems. The ultimate goal of this portion of the Phase I program was the quantitative determination of those UWB parameters (e.g., frequency, power, pulse rate, pulse shape, dithering, etc.), which had the least impact on the operational performance of legacy designs. This paper describes the development of the MSSI NETEX UWB simulator (BFPI000). [C1247]

## "Teaching ethics in the engineering design process: a legal scholar's perspective"

Engineering ethics are a critical "gap filler" in the regulation of technology. Engineers, as "professionals", are given professional autonomy in promoting risky activities, based on a promise that they will act in the public interest. Both regulation and liability put constraints on the design process, but often leave gaps that must be filled by ethical precepts. The conflict between the public's interest and the private interest of the engineer is often most acute in the acceptance or rejection of relatively rare risks with the greatest uncertainty of injury. Rare risk of catastrophic injury can fall "under the radar" of regulatory systems, or technological advances may make regulatory systems obsolete. A key ethical problem can be described as "design process" failures where engineers wrongfully assume that another party will cope with a risk. Engineers must be taught to recognize and deal with ethical problems in product design. In particular reliance on regulatory approval may be insufficient. Design processes that actually Hold paramount the public safety must be the benchmark for engineering ethics. [C1248]

## "Three dimensional packaging and interconnecting techniques for microwave modules"

Three dimensional (3D) packaging and interconnecting techniques can greatly reduce the weight and volume of conventional planar microwave modules. The objective of this study was to employ a novel 3D structure with simple manufacturing process to develop 3D microwave modules. Many advanced 3D packaging and interconnecting methods, such as LTCC microwave multichip modules, vertical interconnects, and 3D electromagnetic field analyzing and optimizing, were applied to increase the package density and improve the electric performance. Test method and test results of 3D microwave modules were introduced. These techniques are very useful to many types of modern active phased array radar systems and communication systems. [C1249]

## "Advanced synthetic aperture radar imaging and feature analysis"

We review and discuss advanced algorithms for synthetic aperture radar image formation, the effect of motion perturbation on radar imaging, synthetic aperture radar imaging of ground moving targets, and micro-Doppler feature analysis. [C1250]

## "Radar the next generation-sensors as robots"

One can easily envisage future military operations and emerging civilian requirements (e.g. intelligent unmanned vehicles for urban warfare, intelligent manufacturing plants) that will be both complex and stressing and will demand innovative sensors and sensor configurations. The goal of our research into sensors as robots is to develop a cost effective and extendable approach for providing surveillance for a variety of applications in dynamically changing military and civilian environments. We discuss the development of a futuristic intelligence,

surveillance and reconnaissance concept utilizing the innovative integration of cutting edge technologies such as: knowledge-based signal processing; robotics; wireless networking; waveform diversity; the semantic Web; advanced computer architectures and supporting software languages. This concept is projected as an autonomous constellation of air, space, and ground vehicles that would offer a robust paradigm to build toward future deployments. [C1251]

## "CINRAD C-band design based on Altera CPLD and LVDS technology"

Building on its NEXRAD (Next Radar) heritage, CINRAD (Chinese Next Generation Radar) incorporates many technological advances to further enhance performance, reliability and can be easily upgraded. These include an open system workstation platforms, VLSI DSP signal processor, network communications, real-time display, fibre-optical transfer, and new scan modes. The CINRAD signal processor hardware contains two major subassemblies: hardwired signal processor (HSP) and programmable signal processor (PSP). CINRAD HSP, based on Altera CPLD and LVDS technology, is the central of CNRAD system timing and control. It also receives data from receiver and transfers it to PSP in high speed. Because of the long distance between HSP and PSP, the LVDS technology has to been used. [C1252]

## "The data fusion approach to the priority assignment in the multifunction radar"

The paper deals with the problem of the multifunction radar resources management (MFR RM). MFR RM consists of target ranking and tasks scheduling. The paper is focused on the data fusion approach to the target ranking. The data from the radar (object's velocity, range, altitude, direction etc.), IFF system (identification friend or foe) and ESM system (electronic support measures-information concerning a threat's electro magnetic activities) are used to decide of the importance assignment for each defected target. The problem is also known as a threat assessment. The main problem consists of the multiplicity of various types of the input information. The information from the radar is of the probabilistic or ambiguous imperfection type and the IFF information is of evidential type. To take advantage of these information sources an advanced data fusion system is necessary. The paper describes a comparison between the fuzzy and the neural network systems which were used in order to perform the threat assessment. [C1253]

## "Satellites and microwaves"

Advances and improvements in microwave technology enabled the rapid deployment of numerous communications satellite systems. Various satellite systems such as: fixed satellite systems (FSS), direct broadcasting satellite (DBS), digital audio radio service (DARS), mobile satellite systems (MSS), broadband, and weather monitoring systems are described with a special emphasis on microwave subsystems and components. The requirements and performance of these important satellite elements are discussed. Essential developments in microwave technologies for future satellite systems are outlined. [C1254]

## "Technological developments for microwave and opto-electronics"

We are living now in an exciting period in which advances of technology enable the construction of a new generation of devices and circuits, making the dream of an "intelligent world" feasible. The realisation of this aim is possible by developing all the communication systems, from satellite, through long range optical fibre, to short range mobile phones and the last meter links, which provide communication between human beings and intelligent objects. To make this happen, a further dynamic development of technology is needed. Emerging technologies like submicrometre electronics, nanotechnology, microsystems, blue and UV opto-electronics and THz electronics have to be further developed and strongly linked with medical sciences and biotechnology. An interdisciplinary approach is a must. The paper reviews the latest technology developments which can make this vision reality. [C1255]

## "A novel simultaneous tracking and direction of arrival estimation algorithm for beam-switched base station antennas in millimeter-wave wireless broadband access networks"

In this paper, a novel simultaneous tracking and direction of arrival estimation algorithm for TDD/TDMA broadband wireless access networks employing beam-switched base station antennas is presented. Direction of arrival estimation could be useful, for example, to generate occasional user dedicated beams to overcome temporary channel impairments or to develop advanced network management strategies such as system handover based on direction of arrival knowledge. The algorithm has been studied theoretically and by means of simulations achieving high efficiency and very good performance results. [C1256]

## "NATO programmes in science and technology for Eastern and Central Europe"

One of the instruments (opportunities) to enhance the collaboration between East and West European Institutes is the Science for Peace Sub-Programme, part of the NATO Science Programme. Since its foundation in 1958 the NATO Science Programme has developed support mechanisms like advanced study institutes, collaborative research grants and science fellowships in order to support training of young scientists and engineers, mechanisms that are still in use. Since the early 1990s the NATO Science Programme has been extended to support also scientists from NATO Partner countries. In 1999 the Science Programme was transformed so that support is now devoted to collaboration between scientists of Partner countries and NATO countries. NATO activities in research and technology are stimulated via the Research and Technology Organisation, RTO. In this paper attention is paid to the Science for Peace Sub-Programmes and to other science sub-programmes. We overview the NATO and Partner countries, elucidate some examples of projects under NATO funding, and describe RTO areas. [C1257]

## "Verification of CAD models for microstrip components using FD-TD method"

We compare S-parameters calculated for selected microstrip components using an electromagnetic simulator and the Advanced Design System (ADS). On this basis, we verify validity of simplified CAD models in the K-band. Significant discrepancies found in the data show that millimeter-wave designs should be carefully examined to avoid costly errors. [C1258]

## "RA-2/MWR in-flight performance-preliminary results"

The EnviSat-1 satellite embarks an innovative radar altimeter, the RA-2, which represents a new generation of radar altimeters compared the earlier ERS altimeters and TOPEX/Poseidon. This is due to its use of many advanced features such as autonomous resolution selection a robust "model free" tracker and its ability to telemeter individual echo samples. EnviSat also embarks a radiometer, the MWR which provides the altimeter with the tropospheric correction. Before the measurements from the RA-2 are exploited the instrument and the data processing system will be commissioned and a verification activity will be performed. During this activity the operation of the instrument in-flight operation will be verified and its functionality optimised. The measurement performance of the instrument and the overall system will also be evaluated, including verification of the instrument auxiliary data retrieval and correct use of these data in the ground processing algorithms. Finally, calibration and validation of the data products are performed such that, at the end of the commissioning phase, the data may be fully released for scientific exploitation. In this paper we will outline the strategy and procedures adopted to tune the parameters used on-board and in the on-ground processing. We show results before and after the optimisation activities as well as comparison with pre-flight simulations. Also, we will show the RA-2 measurement performance of range and sigma-0 as well as the performance of its tracker. In particular the tuning of the autonomous range resolution selection logic is a challenging task and we will show the results of this activity. Finally we will show the status of the in-flight calibration of the Range and Sigma-0. [C1259]

## "Possible military requirements and applications of active and passive imaging sensors at micro- and millimeterwave frequencies"

In order to reveal the differences between military and civil applications of remote sensing common military user requirements for the detection, recognition, identification, and revisit time of military targets are discussed. Typical application examples of imaging SAR and radiometer systems are given as well as design examples for advanced sensor systems demonstrating the technological realisation and limits. [C1260]

## "The Global Hawk UAV Australian deployment: imaging radar sensor modifications and employment for maritime surveillance"

The Global Hawk system is a high altitude endurance unmanned aerial vehicle developed under the United States Air Force Advanced Concept Demonstrator program primarily as a reconnaissance system for use against fixed and mobile targets. The Global Hawk system deployed to Australia in April 2001 for six weeks and in this period conducted 11 missions with the focus on maritime surveillance. The Australian deployment was the culmination of two years collaboration between the United States and Australia that included modifications to the radar sensor, system control and exploitation to support a surveillance focus. This paper presents aspects of the Australian contribution to the Global Hawk deployment including the rationale behind the sensor modifications and employment that achieved a surveillance capability with a system primarily designed for land reconnaissance. [C1261]

## "Feasibility study on polarimetric use and calibration of ALOS/PALSAR"

Calibration and application of polarimetric synthetic aperture radar (SAR) onboard the Advanced Land Observing

Satellite (ALOS) is discussed using airborne L-band SAR data. We find that even a simple calibration is useful for polarimetric classification, if the system has a small cross-talk and good channel valance. [C1262]

## "Advances in extra wide-band multi-modal air/space-borne radar polarimetry, POL-IN-SAR imaging and its applications"

Radar Polarimetry, Radar Interferometry and Polarimetric SAR Interferometry represent the current culmination in 'Microwave Remote Sensing' technology, but we still need to progress very considerably in order to reach the limits of physical realizability. Whereas with radar polarimetry the textural fine-structure, target orientation, symmetries and material constituents can be recovered with considerable improvement above that of standard 'amplitude-only' radar; by implementing 'radar interferometry' the spatial (in depth) structure can be explored. With Polarimetric Interferometric Synthetic Aperture Radar (POL-IN-SAR) imaging, it is possible to recover such co-registered textural and spatial information from POL-IN-SAR digital image data sets simultaneously, including the extraction of Digital Elevation Maps (DEM) from either Polarimetric (scattering matrix) or Interferometric (dual antenna) SAR systems. Simultaneous Polarimetric-plus-Interferometric SAR Imaging offers the additional benefit of obtaining co-registered textural-plus-spatial three-dimensional POL-IN-DEM information, which when applied to Repeat-Pass Image-Overlay Interferometry provides differential background validation and environmental stress-change information with highly improved accuracy. Then, by either designing multiple dual polarization antenna POL-IN-SAR systems or by applying advanced POL-IN-SAR image compression techniques, will result in 'POL-arimetric TOMO-graphic' (Multi-Interferometric) SAR or POL-TOMO-SAR imaging. [C1263]

## "L-band polarimetric AIR/Pi-SAR images around Niigata City"

Pacific Rim Campaign has been successfully carried out in 2000. The well known AIRSAR system by JPL flew over Niigata Area, Japan, on Oct. 2, 2000, which brought us the L-band fully polarimetric data set. On the other hand, Pi-SAR, developed by CRL and NASDA, Japan, simultaneously (2 hours in advance) flew the same path taking the same area data in the L-band. It became possible for us to carry out comparative analyses using the same area data. Since the resolution and incidence angle of each SAR are different, we examined the difference in the two POL-SAR images using correlation coefficient in the Right-Left Circular (RL) polarization basis, polarimetric entropy, and three component scattering power ratio. [C1264]

## "A coplanar waveguide bow-tie aperture antenna"

In this paper, a new design for a coplanar waveguide (CPW) fed, aperture antenna is introduced. This CPW aperture antenna is designed at a central frequency around 10 GHz with an input impedance of approximately 50 Ω. Numerical simulation is performed for antenna analysis using Momentum from the Advanced Design System (ADS) software package of Agilent Technologies. The bandwidth of this basic bow-tie aperture antenna is about 1 GHz and the return loss approximately -18 dB. Another advanced design for this basic bow-tie aperture antenna shows a bandwidth of 1.3 GHz with a return loss of -40 dB around 10 GHz. Simulation results for return loss, input impedance and radiation pattern are presented. These characteristics make these two antennas suitable for antenna arrays for radar applications. [C1265]

## "Recent progress in the development of compact solid-state, high voltage radar modulators"

As the operating life of existing transmitters is extended, solid-state high voltage modulators are replacing conventional tube-type radar modulators in a range of transmitter upgrades and new designs. The new technology is a viable and cost-effective replacement for obsolete components. Further, it improves the reliability of the transmitter and delivers better protection to the RF amplifier. This paper summarizes DTI's recent ongoing work in developing solid-state components for three different radar transmitter upgrades and one new design. The systems discussed include the AN/SPG-60 Fire Control Radar, the AN/FPQ-17 Multiple-Target Instrumentation Radar, the AN/SPS-49 Long Range Air Surveillance Radar, and an Advanced High-Power Solid-State Modulator for the NRL's 94Ghz gyroklystron. [C1266]

## "Development of an advanced electron gun for high power radar applications"

Existing klystron high power amplifiers used for wide-band, S-band radar incorporate a gridded electron gun developed prior to the 1960s, which uses an oxide cathode. Since then, the electron gun technology has evolved including many new materials and advanced manufacturing techniques. Thus, the cost to manufacture these older guns can be improved to reduce the financial burden to the end user. This development program addresses the high costs and low reliability with the existing design by replacing the oxide cathode with a dispenser. A dispenser cathode can survive high power arcs without significant damage or degradation of performance. Recovery time is reduced since it is directly related to arc damage. More importantly, a dispenser cathode can be reused when exposed to air during repair, thereby reducing the overall repair costs. The

principal goal of the program is to develop a replacement electron gun utilizing the latest advances in materials, manufacturing and assembly techniques. Since the new gun is designed to be a replacement of the existing gun, it is important that the new design provides the same beam optics performance. [C1267]

## "Development update of a 10 MW, 91 GHz gyroklystron"

Calabazas Creek Research, Inc. (CCR) is funded by the U.S. Department of Energy to develop a high efficiency gyroklystron amplifier for W-Band linear collider applications. This research supports an international effort to design the next generation of linear electron-positron colliders with anticipated center of mass energies of 0.5 TeV and beyond. In particular, this program supports development of a W-Band accelerator now underway at the Stanford Linear Accelerator Center. CCR is developing a 91.392 GHz gyroklystron to produce 10 MW of RF power with efficiency greater than 40% and a gain of 55 dB. Achievement of 10 MW of peak power would advance the state of the art for W-Band amplifiers by two orders of magnitude and potentially lead to other applications, including land- and ship-based radar, medical accelerators, and materials processing. [C1268]

## "Application of polarimetric synthetic aperture radar interferometry for land cover classification"

The development of radar polarimetry and radar interferometry is advancing rapidly. The textural fine structure, target orientation, system metrics and material constituents can be recovered with radar polarimetry; while with radar interferometry, the elevation structure of a target can be explored. Polarimetric synthetic aperture radar interferometric (Pol-InSAR) is interferometry between all possible polarization channels at each end of the baseline. Using polarimetric interferometry, the combination of the final structure properties and the spatial information of targets can be implemented. In this paper, we investigate the application of these three approaches to Earth terrain classification with results from the evaluation of fully polarimetric interferometric SIR-C/X-SAR data. The potential of Pol-InSAR for land cover classification has been demonstrated. [C1269]

## "Analytical and computer model of a Doppler weather radar system"

With advances in Doppler weather radar, severe storm and tornado detection has improved greatly. However, the resolution limitations of deployed radar systems can still limit severe storm detection. In the case of larger tornadoes, characteristic abrupt changes in wind direction can usually be detected between adjacent range-angle bins. However for smaller tornadoes, the rotating cell may be contained within one bin. In this case, a wind directional change cannot be detected, and the tornado may go undetected. The purpose of this research is to develop analytical and computer simulation models of typical Doppler weather radar measurements. These models can be used to determine how various factors affect the reflectivity, velocity, and spectrum width measurements that are commonly used in storm detection algorithms. The models account for convolution in azimuth due to the radar antenna pattern, convolution in range due to the radar pulse shape, randomness of the weather events and measurements, variations in the measurements between radar pulses, and the addition of noise to the measurements. Using both analytical and simulation models allows for simulated data to be generated, as well as equations that predict the behavior of the data. Therefore, the analytical and simulation models can be used to test the other's accuracy. Additionally, the analytical model can be used to create future algorithms (e.g. resolution enhancement), and the simulated data can be used as a test for these algorithms. [C1270]

## "Northrop Grumman radar simulation (AVSIM)"

The Northrop Grumman avionics simulation (AVSIM) is one of a set of simulations focused on fighter class radars. It is designed to support a variety of analysis and development activities, spanning requirements analysis, radar software development, performance evaluation and pilot interfaces. This paper describes AVSIM and the simulation architecture that surrounds it. The model provides high fidelity representations of both air-to-air and air-to-ground radar modes, encompassing detection capability, measurement errors, tracking performance and time lines. Analytical models are used to represent high data rate signal processing functions, while operational software is used for less intensive data processing such as radar control and tracking activities. AVSIM can be driven by models such as the joint integrated mission model (JIMM) or by tightly controlled scenarios from its own scenario generator. It can be run in real time, as part of a cockpit simulator, or in Monte Carlo mode, for detailed performance analysis. Extensive post processing capabilities provide insight into radar detection, measurement errors, tracking and time line performance. Scan patterns are also visualized, via playback capabilities. AVSIM represents a substantial advance in the state of the art for high fidelity multi-use avionics simulations. [C1271]

## "Two-way approached information spreading system (TWAIS) for inter-vehicle communications"

This paper deals with an effective method to share various kinds of vehicular information among a great number

of vehicles for advanced inter-vehicle communications (IVC). We present a simple and effective communication scheme named two-way approached information spreading system (TWAIS) in order to provide high quality communications service in ITS. It makes smooth communications and high availability suitable for IVC. [C1272]

## "A 60 GHz MMIC chipset for 1-Gbit/s wireless links"

This paper describes the development of a MMIC chipset for 60 GHz; radio links and radars. The chipset includes a low noise amplifier, an image rejection mixer, a frequency quadrupler, and a power amplifier. All were optimized to work together as a 1-Gbit/s radio link in the unlicensed 59 GHz to 64 GHz wireless band, although most are suitable for any application from 55 GHz to 70 GHz. These MMICs are fabricated in Agilent's advanced e-beam PHEMT process and have been demonstrated in fully operational 1-Gbit/s radio-links in field testing [C1273]

## "A study of bit planes for the compression of raw synthetic aperture radar data"

The compression of raw SAR data has been a topic of interest to researchers for many years. The goal of such compression is to transmit the highest fidelity data from the radar satellite within the downlink bandwidth constraints. The necessity of new compression techniques is further emphasized as advances in the design of radar technologies are close to surpassing the capabilities of current compression techniques. Developing only a theoretical compression technique is not a complete solution to the problem as the technique must be realizable in the hardware available for placement on the radar satellite. The implementation must not only be low in computational complexity, but must also be able to handle the ever increasing throughput demands of the radar. Bit-planes have been used successfully with several other compression techniques, and are extremely amenable to hardware due to their inherent parallelism. This paper shows that bit-plane segmentation and simple coding transformation of raw SAR data can reduce the entropy of a single plane by 59%. [C1274]

## "Microwave III-V semiconductors for telecommunications and prospective of the III-V industry"

The microwave III-V semiconductor IC technology (primarily GaAs) has emerged as a powerful enabling technology for wireless and optical communications in the past 5 years. It has been dominating, or making substantial penetration into, the market for handset power amplifiers and switches, advanced wireless LAN RF front-ends and various other key RF components for broadband wireless, wireless infrastructure, satellite telecommunications, high data rate fiber optical communications and automotive radar applications. The microwave III-V semiconductor IC industry has grown dramatically in the past 2-3 years. It is worth noting that the majority of the recently formed GaAs fabs are located in Taiwan. Their intent is to provide pure-play foundry services following the silicon foundry business model developed by TSMC and UMC. In this presentation, we discuss the key components of III-V microwave transistors (HBT, pHEMT and MESFET etc.) and their RFICs/MMICs, their electrical performance, major applications, market status, trends and opportunities. We define the current status for the global III-V semiconductor industry, the rapidly growing GaAs MMIC fab industry in Taiwan and its advantages for providing a one-stop, total solution for wireless and optical communication components customers. [C1275]

## "LiNbO3 modulators: status and advanced concepts for microwave signal processing"

The status of the LiNbO3integrated optical circuit technology is reviewed and compared with the alternative solutions for wide bandwidth processing of microwave signals. The advantages of external modulation over direct laser diode modulation of optical radiation in fiber optic systems, mainly in terms of bandwidth and chirping, drove the development of LiNbO3based fabrication technologies of integrated optical modulators at a very high maturity level, which makes LiNbO3advantageous also over other external modulation solutions: semiconductors, electroabsorption, electro-optical polymers. Advanced concepts are presented to face some of the critical issues in the optical signal processing of microwave signals in defence systems (phased array radars, ECM, ESM) and consumer applications. [C1276]

## "Yield prediction using critical area analysis with inline defect data"

This paper presents methodologies for using critical area analysis with inline defect data to predict random defect limited yield and for partitioning yield losses by process step. The procedure involves (1) calculating critical areas, (2) modeling defect size distributions, and (3) combining critical area information and defect size distributions to estimate yield loss. We introduce a method to model defect size distribution from inline defect data. We develop two yield prediction methods that can overcome the difficulties caused by the inaccuracies in determining defect size when using laser scatterometry detection. We compare the predicted yield with the actual yield and show that the two are in good agreement. [C1277]

## "An advanced airborne real-time SAR processing system"

An advanced airborne real-time SAR processing system has been developed. Some sets of the system are now in operation at several organizations. By implementing all necessary processing functions by software, such as yaw-steering compensation and multi-resolution mode with pre-summing, we are able to eliminate several important hardware components such as mechanical yaw steering system and data reduction filters. This fully digitized and software oriented SAR architecture gives significant flexibility to the system, without compromising its performance. Besides above-mentioned advantages, the system has some new improvements, such as precise target positioning and compatibility of seamless imaging and software yaw steering, which is usually contradictory. [C1278]

## "Digital signal processing technology and applications in hearing aids"

Digital signal processing has found applications in almost every industry and the hearing aid industry is no exception. Building practical DSP platforms for hearing aids has been difficult due to the physical limitations of small size, low power consumption and low operating voltage, and although progress was initially very slow, real advances have been made during the last decade. Now DSP based hearing aids make use of many well-known digital signal processing technologies developed for communication, speech processing, radar and sonar systems. More sophisticated digital platforms are going to be created and more advanced digital signal processing technologies will be developed and implemented on this new digital hardware. This paper addresses DSP hardware, algorithm, and their application in hearing aids. [C1279]

## "The design of an special parallel language for soft-radar system"

This new parallel advanced high level language is specially designed based on the characteristics of modern radar signal processing. This language defines various types of parallelism in different granularity. Programming in it, users with little information about bottom structure can construct radar signal processing systems at will. A method for designing a radar signal processing system using this language is studied with a sample program. [C1280]

## "Modern synthetic aperture radar systems"

Synthetic Aperture Radar (SAR) is a side looking airborne radar sensor that provides high-resolution microwave images of selected ground areas. It is an all weather day and night sensor. Additional features include stand-off capabilities (long range) and fast coverage rate. Stationary ground targets are clearly visible upon a SAR image and can also automatically be detected. SAR sensors are used for reconnaissance and remote sensing applications. In this article a new generation of advanced SAR systems is presented. It features high performance reconnaissance and Zooming SAR modes as well as dedicated modes for display overlay of moving targets upon SAR images. It processes the radar raw data on-board and transmits SAR images via data-link. That on board processing capability greatly reduces the data link bandwidth. Those advanced systems operate upon fighter and transport aircrafts and upon unmanned vehicles ( RPV's). A derivative of SAR for airborne fire control radars and for airborne maritime patrol applications is also presented. [C1281]

## "Passive coherent detection via exploiting illuminator of opportunity"

An experimental passive coherent target detecting system via exploiting illuminator of opportunity (also can be considered as external illuminator, such as broadcast, television etc.) is constructed, based on this experimental system, the principle of coherent receiving is analyzed and its power coverage is estimated, also, an applicable signal processing scheme is described. With the help of real data collection and processing, researches on the influence of direct signal rejection, channel properties and multi-path clutter rejection on the performance in passive coherent detection are investigated, results show the effectiveness of such system can be implemented by employing elaborated system allocation and advanced signal processing. [C1282]

## "Indium gallium arsenide avalanche photodiodes... not just for telecom anymore"

Continual advances in III-V semiconductor growth and processing technologies are bringing devices that were once considered exotic into the mainstream. Here we discuss the design and fabrication of InGaAs avalanche photodiodes that are produced with yields approaching that of PIN photodiodes, enabling optical receivers that achieve 8-10 dB better sensitivity than their PIN diode counterparts. In addition to driving cost down, the high die yield enjoyed by current designs enable new applications using 1D and 2D arrays of devices such as imaging laser radar. The availability of inexpensive control circuits that are used for APD bias and temperature compensation makes the widespread use of these detectors extremely practical. [C1283]

## "STREAMOBILE: pay-per-view video streaming to mobile devices over the Internet"

As new mobile communication technologies are becoming broadly available, there is urgent pressure to populate them with services that provide returns for the huge investments made by telecommunications operators. Services around video transmission are expected to play a key role: news broadcasting, videoconferencing, movie channels, on-line gambling, etc. The goal of the STREAMOBILE project is to demonstrate an Internet pay-per-view distribution system toward GPRS and UMTS mobile devices. Copyright-protected contents are streamed to the customer and a micropayment scheme is used so that contents are not paid for in advance, but as they are being received by the customer. This paper presents an evolving prototype., whose client software has been designed in such a way that it can be easily migrated to 3G mobile devices. [C1284]

## "Multi-sensor data fusion using Bayesian programming: An automotive application"

A prerequisite to the design of future advanced driver assistance systems for cars is a sensing system providing all the information required for high-level driving assistance tasks. Carsense is a European project whose pur pose is to develop such a new sensing system. It will combine different sensors (laser, radar and video) and will rely on the fusion of the information coming from these sensors in order to achieve better accuracy, robustness and an increase of the information content. This paper demonstrates the interest of using probabilistic reasoning techniques to address this challenging multi-sensor data fusion problem. The approach used is called Bayesian Programming. It is a general approach based on an implementation of the Bayesian theory. It was introduced first to design robot control programs but its scope of application is much broader and it can be used whenever one has to deal with problems involving uncertain or incomplete knowledge. [C1285]

## "Oceans 2002 Conference and Exhibition. Conference Proceedings (Cat. No.02CH37362)"

First Page of the Article [C1286]

## "Development status of a 10 MW, 91 GHz gyroklystron"

Summary form only given. Calabazas Creek Research Inc. (CCR) is funded by the US Department of Energy to develop a high efficiency gyroklystron amplifier for W-Band linear collider applications. This research supports an international effort to design the next generation of linear electron-positron colliders with anticipated center of mass energies of 0.5 TeV and beyond. In particular, this program supports development of a W-band accelerator now underway at the Stanford Linear Accelerator Center. CCR is developing a 91.392 GHz gyroklystron to produce 10 MW of RF power with efficiency greater than 40% and a gain of 55 dB. Achievement of 10 MW of peak power would advance the state of the art for W-Band amplifiers by two orders of magnitude and potentially lead to other applications, including land- and ship-based radar, medical accelerators, and materials processing. This presentation briefly describes the design of the tube and then covers the results of the cold tests and the schedule for hot tests. [C1287]

## "Proposals for a novel Ka-band frequency-tripling gyroklystron amplifier"

The gyro-amplifier is currently of great interest for millimeter wave radar applications. A novel Ka-band frequency-tripling gyroklystron amplifier with clustered cavities is proposed. The output power and bandwidth are designed as 100 kW and 1%, respectively, and a permanent magnet will be used. This gyro-amplifier basically satisfies the demands of advanced radar transmitters. [C1288]

## "Advances in millimeter-wave imaging technology for enhanced vision systems"

Trex Enterprises is developing a 2ndgeneration passive millimeter wave imaging system which operates in real time with a 20Ч30 degree field of view and a 2 K temperature sensitivity. This system is based on a pupil-plane aperture architecture. A pupil-plane architecture allows for a lower system volume and reduced number of receivers compared to focal plane systems. The system has low noise W-band amplifiers, a flat panel dielectric antenna, high sensitivity diodes and will serve as the basis for a commercially available system. Millimeter wave imaging provides enhanced vision capabilities to pilots, allowing them to see through fog and smoke and aiding in navigation, landing, and taxiing in low-visibility situations. Unlike radar, passive millimeter wave imaging provides the pilot with a display based on angle-angle data rather than range-angle data which must be interpreted into an angle-angle display. The passive system avoids problems with multi-path reflections that can create problems for active systems in close proximity to the ground. The fact that the sensor does not emit also makes it useful for military applications where the pilot wishes to avoid detection. [C1289]

## "Microwave circuits modeling using neural networks: overview of the results achieved at the faculty

## of electronic engineering in Nis"

This paper is an overview of the results in neural networks application in the microwave circuits modeling achieved within the Laboratory for Microwave Technique and Satellite Television at the Faculty of Electronic Engineering in Nis, Yugoslavia. Neural networks are applied in modeling either of passive or active structures. Modeling is performed using not only simple multilayer perceptron network but also advanced knowledge based neural network structures. [C1290]

## "Implementing wireless networks with transition mechanisms"

The deployment of wireless networks based on IPv4 is spreading quickly all over the world. However, there is a strong shortage of public IPv4 addresses. Because of this, IPv6 has recently, received a new push of development. Most of the advances related to IPv6 are concerned to the development of transition mechanisms allowing IPv6 hosts to communicate through an existing IPv4 infrastructure or yet, permitting the communication between IPv4 and IPv6 hosts. This paper addresses the issue of using private IP addresses for implementing Mobile IP in wireless networks using IPv4/IPv6 transition mechanisms. An overview of the published IPv4/IPv6 transition mechanisms is presented, then, a new mechanism, called Transparent IPv6, which combines features of existing mechanisms, is proposed. The Transparent IPv6 mechanism consists in virtually assigning IPv6 addresses to IPv4 hosts without modifying user devices. This technique could be used to permit the deployment of wireless networks without requiring public IPv4 addresses, using legacy IPv4 equipments. [C1291]

## "Phased array radars-past, present and future"

This is a survey paper summarizing the developments and future trends in passive, active bipolar and monolithic microwave integrated circuitry (MMIC) phased array radars for ground, ship, air, and space applications. Covered is the DD(X) ship radar suite; THAAD (formerly GBR); European COBRA; Israel BMD radar antennas; Dutch shipboard APAR; airborne US F-22, JSF and F-18 radars, European AMSAR, Swedish AESA, Japan FSX and Israel Phalcon; Iridium. (66 satellites in orbit for total of 198 antennas) and Globalstar MMIC spaceborne active array systems (these last two are communications but the technology is the same as used by radar systems, in fact the Iridium T/R module technology derives from technology developed for a space based radar); Thales (formerly Thomson-CSF) 4 inch MMIC wafer 94 GHz seeker antenna; digital beamforming; ferroelectric row-column scanning; optical electronic scanning for communications and radar; the MMIC C-band to Ku-band Advanced Shared Aperture Program (ASAP) and AMRFS antenna systems for shared use for communications, radar, electronics countermeasures (ECM) and ESM; and continuous transverse stub (CTS) voltage-variable dielectric (VVD) antenna. [C1292]

## "Qualitative and quantitative characteristics of deghosting in advanced radar systems"

Deghosting, i.e. elimination of false targets during data processing in multi-sensor tracking of jamming targets, is a crucial process for effective use of air defence systems. It is particularly important for radar systems operating in passive mode because of their excellent properties against present-day electronic warfare techniques and tactics (especially jamming equipment and anti-radiation missiles). A deghosting algorithm based on bearing association/compounding strategy is outlined. A method of deghosting effectiveness evaluation using the ghost eliminator operating characteristic (reference to the receiver operating characteristic from statistical theory of signal detection) is presented. Such an approach enables to compare performances of various deghosting procedures in different operational conditions or scenarios. [C1293]

## "Mobile multi-modal data services for GPRS phones and beyond"

The paper discusses means to build multi-modal data services in existing GPRS infrastructures, and puts the proposed simple solutions into the perspective of technological possibilities that will become available in public mobile communications networks over the next few years along the progression path from 2G/GSM systems, through GPRS, to 3G systems like UMTS, or equivalently to 802.11 networks. Three demonstrators are presented, which were developed by the authors in an application-oriented research project co-financed by telecommunications companies. The first two, push-to-talk address entry for a route-finder, and an open-microphone map-content navigator simulate a UMTS or WLAN scenario. The third demonstrator implements a multi-modal map finder in a live public GPRS network using WAP-Push. Indications of usability are given. The paper argues for the importance of open, standards-based architectures that will spur attractive multi-modal services in the short term, as current economic difficulties in the telecommunications industry put support for long term research into more advanced forms of multi-modality in question. [C1294]

## "An analysis on model mismatch problem of multiple maneuver model estimator"

We evaluate the multiple maneuver model (M3) estimator in the short and long range radar and show the problem of the oscillation on mode probabilities. The overlapping coefficient is also proposed as an indicator to analyze the oscillation problem. The results of a Monte-Carlo simulation show that the quality of mode probabilities degrades when the proposed overlapping coefficient falls below the certain value. These results also indicate the overlapping coefficient is available for detecting the model mismatch. In other words, the model mismatch problem could be avoided in advance by monitoring the overlapping coefficient and setting appropriate parameters. [C1295]

## "Millimeter wave SPDT switch for giga-scale system"

A driver-enhanced single pole double-throw (SPDT) switch was designed and implemented for giga-scale systems. The design was simulated on the Advanced Design System (ADS) package and implemented on RT-Duroid 5880 with 10 mils thick dielectric substrate in a 3-port WR28 waveguide, to validate the design for broadband application in Ka-band of digital millimeter waves. [C1296]

## "Update on the development of a 10 MW, 91 GHz gyroklystron"

Summary form only given. Calabazas Creek Research, Inc. (CCR) is funded by the U.S. Department of Energy to develop a high efficiency gyroklystron amplifier for W-Band linear collider applications. In particular, this program supports development of a W-Band accelerator now underway at the Stanford Linear Accelerator Center. CCR is developing a 91.392 GHz gyroklystron to produce 10 MW of RF power with efficiency greater than 40% and a gain of 55 dB. Achievement of 10 MW of peak power would advance the state of the art for W-Band amplifiers by two orders of magnitude and potentially lead to other applications, including land- and ship-based radar, medical accelerators, and materials processing. The design uses the second-harmonic mode to reduce the magnetic field requirements and use available TWT drivers. The current circuit design employs six cavities consisting of an input cavity, three buncher cavities and a final output cavity. The input cavity is a fundamental cavity operating with the TE011 mode and uses radial coupling to the input rectangular waveguide. The following buncher cavities operate with the TE021 mode and are stagger-tuned to improve efficiency and bandwidth. The output cavity operates in the TE021 mode and has smooth-wall transitions. A conventional, double anode, magnetron injection gun generates the electron beam. Following the circuit, a large radial gap is introduced in the output waveguide to allow voltage depression of the beam collector to increase the overall efficiency. A hybrid mode is used (TE01/02) to maximize transmission across the gap. An internal elbow is included to prevent beam bombardment of the output window. All major subassemblies of the gyroklystron have been fabricated and the cavity sections are currently being cold-tested. Completion of tube assembly is expected by the end of January with testing scheduled to begin in March 2002 at the Stanford Linear Accelerator Center. [C1297]

## "A portable eye-safe scanning aerosol lidar of the Hampton University Center for Lidar and Atmospheric Sciences Students"

Hampton University Center for Lidar and Atmospheric Sciences Students (CLASS) team and ITT's Advanced Engineering & Sciences Division have worked together to develop a portable, eyesafe and scanning aerosol lidar system, the system is based on a 1.5 micron, 125 mJ, 20 Hz eye-safe optical parametric oscillator (OPO). Its purpose is to remotely detect aerosols, clouds, and pollution in the lower atmosphere. [C1298]

## "A review of radar as a sensor for advanced surface movement guidance and control systems (A-SMGCS)"

Over the past decade or so there has been increasing interest and recognition of the ground movement environment as part of the overall air traffic control problem. There are a number of reasons for this, both on safety and airport efficiency grounds. One recognition of this was the adoption by Eurocontrol of a gate to gate air traffic control concept. There is also considerable activity by organisations such as FAA, ICAO, the EU, and EUROCAE. As an example of this, the FAA is currently procuring a large number of ground surveillance systems for use at USA airports. Equally many European airports and aviation authorities are purchasing or have recently purchased surface movement systems. Traditionally, radar has been the main sensor for surveillance of the airport surface. While this is still the case, the overall concept of ground movement control is considerably more complex than that of the radar alone, and will involve multiple types of sensor data fused to provide data output. This paper presents a short review of the overall A-SMGS system concept, before discussing in more detail the radar problem per se and a overview of current system trends. [C1299]

## "Advanced classification of buried UXO using a broadband, fully polarimetric ground penetrating radar"

A broadband, fully polarimetric ground penetrating radar (GPR) system has been applied for classification of buried unexploded ordnance (UXO) for the past few years. It utilizes both late-time and early-time signatures extracted from GPR data collected with multiple antenna positions and multiple scan orientations. Various field measurements were conducted from 1999 to 2001 at UXO sites that have quite different environmental conditions. Lessons learned from these tests have led to significant system improvements. [C1300]

## "Turning the scientifically possible into the operationally practical: RADARSAT-2 polarimetry applications"

RADARSAT-2, planned for a late 2003 launch, is an advanced SAR satellite. Key features of RADARSAT-2 are high resolution (3 m), polarimetry modes, enhanced ground system providing rapid satellite tasking and near-real time data processing, improved image location accuracy, and on-board solid state recorders. RADARSAT-2 offers three polarimetric modes: (1) selective polarization providing one co-pol channel (HH or VV) and the corresponding cross-pol channel (HV); (2) high resolution (3 m) single pol channel (HH or VV); and (3) a fully polarimetric mode providing both amplitude and phase. The fully polarimetric mode is significant since RADARSAT-2 is the first commercial satellite to offer this mode. The commercial focus of the RADARSAT-2 mission dictates the development of operational applications, and ultimately the extraction of information from the SAR data. [C1301]

## "Triple-wavelength radar for cloud and precipitation microphysics research"

The University of Massachusetts, Colorado State University and the National Center for Atmospheric Research are collaborating to develop an advanced Multi-Frequency Radar (MFR) system for studying clouds and precipitation, which should become operational in 2004. This highly portable radar consists of three polarimetric Doppler subsystems operating at Ku-band (13.8 GHz), Ka-band (33 GHz) and W-band (95 GHz), a programmable scanning pedestal, and a unique single aperture antenna that generates co-located matched beams at each wavelength. This combination of wavelengths allows measurement of a wide range of atmospheric targets including weakly reflecting clouds and precipitation. [C1302]

## "The SAR-580 facility-system update"

Discusses the Environment Canada SAR-580 system: its capabilities, acquisition hardware upgrades, processing system advances and recent acquisitions. [C1303]

## "Affordable moving surface target engagement"

This paper presents the results of the Defense Advanced Research Project Agency-funded Affordable Moving Surface Target Engagement program. The overall objective was to develop affordable technologies to engage moving surface targets such as tanks, tactical ballistic missile transporters and small boats. The Northrop Grumman team used moving target indicator sensors on multiple aircraft to individually track moving ground targets. Report data were shared between sensor platforms to form an accurate multi-laterated track. These highly accurate track data were transmitted to a Lockheed Martin Precision Direct Attack Munition, which was released from an F-16 aircraft and guided by an inertial navigation system with updates from a differentially-corrected carrier-phase Global Positioning System receiver. The sensor platforms provided continuous target location updates to the weapon during flight. The final demonstration flight was completely successful. The Northrop Grumman high update rate, multilaterated moving target indicator concept scored a direct hit on a remote controlled van moving at 25 miles per hour. [C1304]

## "Acquiring new technology for US airports"

Ensuring safety in America's airports is of primary concern to the Federal Aviation Administration (FAA). As airport traffic increases, the dual challenge of maintaining a high threshold of safety while enabling future growth in capacity has become the focus of new technology acquisitions. To that end, the FAA is focused on deploying advanced technology to enhance the situational awareness of air traffic controllers by acquiring the Airport Surface Detection Equipment-Model X (ASDE-X), a multi-sensor data fusion surveillance system. The ASDE-X base system, consisting of a primary radar subsystem multilateration subsystem, data fusion subsystem and a display processor subsystem, provides controllers with aircraft vehicle position and identification information overlaid on a color map depicting the airport runways/taxiways and approach corridor leading to the runways. This "system of systems" approach, largely consisting of commercial off-the-shelf components, supports deployment of a modular, scaleable system, which will meet the needs of the varied airport configurations in the US National Airspace System (NAS) as well as facilitate quick adaptation to airport expansion. [C1305]

## "Environmental representation for fused millimetre wave radar and nightvision data"

This paper presents a method for the fusion of millimetre wave radar and nightvision sensors to generate an information-rich representation of the environment. The data from each of the sensors is divided into unstructured spatial objects according to the data available to that sensor. A hyperdimensional representation then constructed from these objects, with the observable characteristics providing the axes. This representation can then be provided to target extraction, classification and tracking algorithms to achieve advanced machine sensing and perception tasks. This differs significantly from the traditional approaches to this problem in which target identification is completed for each individual sensor and these estimates are then combined. The results of initial field trials are used to demonstrate the feasibility of this approach. [C1306]

## "Multi-sensor data fusion using Bayesian programming: an automotive application"

A prerequisite to the design of future advanced driver assistance systems for cars is a sensing system that provides all the information required for high-level driving assistance tasks. Carsense is a European project whose purpose is to develop such a new sensing system. It combines different sensors (laser, radar and video) and relies on the fusion of the information coming from these sensors in order to achieve better accuracy, robustness and an increase of the information content. This paper demonstrates the interest of using probabilistic reasoning techniques to address this challenging multi-sensor data fusion problem. The approach used is called Bayesian programming. It is a general approach based on an implementation of the Bayesian theory. It was introduced initially to design robot control programs but its scope of application including uncertain or incomplete knowledge handling problems. [C1307]

## "Next generation technologies to enable sensor networks"

Examples are advances in ground moving target indicator (GMTI) processing, space-time adaptive processing (STAP), target discrimination, and electronic counter-countermeasures (ECCM). All these advances have improved the capabilities of radar sensors. Major improvements expected in the next several years will come from exploiting collaborative network-centric architectures to leverage synergies among individual sensors. Such an approach has become feasible as a result of major advances in network computing, as well as communication technologies in both wireless and fiber networks. The exponential growth of digital technology, together with highly capable networks, enable in-depth exploitation of sensor synergy, including multi-aspect sensing. New signal processing algorithms exploiting multi-sensor data have been demonstrated in non-real-time, achieving improved performance against surface mobile targets by leveraging high-speed sensor networks. The paper demonstrates a significant advancement in exploiting complex ground moving target indicator (GMTI) and synthetic aperture radar (SAR) data to accurately geo-locate and identify mobile targets. [C1308]

## "F/A-18D(RC) built-in-test false alarms"

Built-in-test (BIT) false alarm indications have been a challenge for the F/A-18D (RC) Advanced Tactical Air Reconnaissance (ATARS) program throughout development and production. Numerous software updates and hardware changes have reduced the frequency of BIT false alarm indications. These improvements have boosted the confidence of maintenance personnel to believe in BIT for use in troubleshooting and repair. However, improvement is still needed to reduce the frequency of false alarms. Experience has shown that BIT false alarm performance is best expressed as Mean Flight-Hour Between False BIT Indication (MFHBFBI) vice BIT false alarm rate. [C1309]

## "Developing a remote staring sensor for optimizing successful boost phase intercept"

Interception of large missile systems during their boost phase has been a goal of the United States Defense industry for quite some time. Due to a variety of technical obstacles, however, defense scientists have focused their energy upon developing systems that are capable of intercepting the missiles in mid-course; so the boost phase interception (BPI) objective has, until recently, remained on the sidelines. Shortly following the change in Administration in January, 2001, it was announced that the Ballistic Missile Defense Organization (BMDO) would begin actively developing BPI capabilities. Although, perhaps, this change in agenda is primarily attributable to the different priorities of the respective Administrations, it may also be due in part to recent advances in remote sensing technologies. In this paper, we describe a theoretical space-based sensor that will be capable of cueing retaliatory forces in time for successful BPI. The specifications for the sensor in this theoretical system are developed using modeled missile signatures and scene data from the LANDSAT 7 sensor. [C1310]

## "Technological spin-offs of the PMST program of the Italian. Space agency (ASI)"

ASI Small ("Piccole") Missions for Science and Technology (PMST) have been running full speed ahead for four

years already. The program is one of Italy's responses to the general call, by the Space Agencies, for challenging science missions that are also a good opportunity for new advancements in space technology and in the related technology transfer. Both research institutes and industries are asked to cooperate in the program. Another goal of the program is to demonstrate ASI's capability of launching a scientific/technological satellite every two years with the objective of doubling launching frequency by 2005. Currently ASI has two PMST already approved and in advanced development phases: AGILE and DAVID. The former is a γ-ray observatory, which uses innovative photon detectors developed in Italian centers; the latter a dedicated TLC program operating at very high frequencies: 80-100 GHz. A third PMST, for Earth observation science, will be selected by the end of the year, out of five preselected proposals which have been funded for Phase A study. [C1311]

## "Low loss optical coat for 157 nm lithography"

The authors are aiming to develop an optical coating which has low optical loss at 157 nm; the loss should be <0.3% under our criteria. The optical loss of the optical coating consists of scattering, absorption, and reflection losses. We have provided newly developed instrumentation to measure the optical loss: a scatterometer, absorption measurement, and a VUV spectrometer. Using these measurement systems, we have investigated the transmittance (T), reflectance (R), absorptance loss, and scattering loss of five coating materials (AlF3, Na 3AlF6, MgF2, LaF3, GdF3 ) and three deposition processes (resistive heat evaporation, electron beam heat evaporation, ion beam sputter). In this paper, we introduce the scatterometer, absorption measurement, and VUV spectrometer. We also discuss the measurement results of the test samples [C1312]

## "2001 International Conferences on Info-Tech and Info-Net. Proceedings (Cat. No.01EX479)"

The following topics are dealt with: digital Earth; remote sensing for geology, water resources, agriculture and land; SAR technology; GIS technology; data and image processing; telecommunication traffic control and engineering; network operation and management; high speed switching and routing; 3G and beyond; advanced optical communications; broadband access networks; MAC and scheduling issues; resource management and QoS control; multicasting; smart antennas and propagation; modeling and performance of communication networks; mobile communication systems; signal processing in communication systems; modulation and coding; intelligent networks; information retrieval; data mining; network computing; agent technology; neural networks; computer vision; self-organization maps and intelligent systems; multi-agent systems and hybrid controls; intelligent transport systems; fuzzy systems; intelligent control systems; variable control systems and robust control; blind separation and object identification; intelligent automation in Internet environment; nonlinear control systems; evolutionary computation; robot control systems; fuzzy control; information security and network security; Web technology; information network management, architecture and protocols; Internet engineering and applications; computer supported cooperative working; wireless computing networks; e-commerce; network-based learning and education; intranets and enterprises automation [C1313]

## "Advanced technology on radar signal processing"

The task of radar signal processing is the extraction of the target information from the radar echo. The functions of radar extend from the target detection and the coordinate measurement (range, angle of azimuth and elevation) to the measurement of Doppler frequency, the judgement of target property, anti-jammer anti-deception and anti-ARM and so on. This means that modern radar should work in wide band or multi-band, look everywhere all the time, and possess multi-functions. Then it must use advanced signal processing technology to improve the capability of catching the target information. The advanced technologies of. radar signal processing involve the advanced processing algorithms and advanced digital processing hardware and software [C1314]

## "Application of new techniques in surveillance radar"

Military radar faces four threats including electronic jamming, ARM, stealth targets and ultra-low altitude penetration. The promotion of the importance of electronic information warfare has brought about a great advance in new techniques. This paper expounds the new research and development in recent years, which is making rapid progress in the capability of military radar and radar networks in electronic information warfare [C1315]

## "Phased arrays for the new millennium"

This is a survey paper summarizing the recent developments and future trends in passive, active bipolar and Monolithic Microwave Integrated Circuitry (MMIC) phased arrays for ground, ship, air and space applications. We cover the THAAD (formerly GBR), European COBRA and Israel BMD radar antennas; Dutch shipboard APAR; airborne US F-22 European AMSAR, Swedish AEDA, japan FSX and Israel Phalcon; Iridium (66 satellites in orbit for total of 198 antennas) and Globalstar MMIC spaceborne antenna systems; Thomson-CSF 4 inch MMIC

wafer 94 GHz seeker antenna; digital beamforming; ferroelectric row-column scanning; optical electronic scanning for communications and radar; the MMIC C-band to Ku-band Advanced Shared Aperture Program (ASAP) antenna system for communications, radar, electronic countermeasures (ECM) and ESM; and continuous transverse stub (CTS) voltge-variable dielectric (VVD) antenna [C1316]

## "Design considerations of a new type all solid-state phased array 3D radar"

This paper introduces an advanced phased array 3D radar, which has the features of long detection range, high accuracy, good ECCM performance and high reliability. Considerations are outlined to show briefly the design procedure of the radar. Some test data are also given to further describe the performances of the radar [C1317]

## "Recent advances in extra-wide-band multi-modal POL-IN-SAR imaging"

Radar polarimetry, radar interferometry and polarimetric SAR interferometry present the current culmination in 'microwave remote sensing' technology, but we still need to progress very considerably in order to reach the limits of physical realizability. Whereas with radar polarimetry the textural fine-structure, target orientation, symmetries and material constituents can be recovered with considerable improvement above that of standard 'amplitude-only' radar; with radar interferometry the spatial (in depth) structure can be explored. With polarimetric interferometric synthetic aperture radar (POL-IN-SAR) imaging, it is possible to recover such co-registered textural and spatial information from POL-IN-SAR digital image data sets simultaneously, including the extraction of digital elevation maps (DEM) from either repeated-pass polarimetric (scattering matrix) or interferometric (dual antenna) SAR systems. Simultaneous polarimetric-plus-interferometric SAR imaging offers the additional benefit of obtaining co-registered textural-plus-spatial three-dimensional POL-IN-DEM information, which when applied to repeat-pass image-overlay interferometry provides differential background validation and environmental stress-change information with highly improved accuracies. Then, by either designing multiple dual polarization antenna POL-IN-SAR systems or by applying advanced POL-IN-SAR image compression techniques, will result in 'POL-arimetric TOMO-graphic' (multi-interferometric) SAR or POL-TOMO-SAR imaging. By advancing these EWB-D-POLIN/TOMO-SAR imaging modes, we are slowly but steadily approaching the ultimate goal of eventually realizing air-bome and space-borne 'geo-environmental background validation, stress assessment, and stress-change monitoring of the terrestrial and planetary covers' [C1318]

## "Millimeter-wave observations of precipitation using AMSU on the NOAA-15 satellite"

Promising agreement over land and sea has been obtained between NEXRAD 3-GHz radar observations of precipitation rate and retrievals based on simultaneous passive observations at 50-191 GHz from the Advanced Microwave Sounding Unit (AMSU) on the NOAA-15 meteorological satellite. This paper extends prior work by increasing the number of inputs into the feed-forward neural network used for estimating precipitation. It also is based on a much larger and more representative training and evaluation data set that spans rain rates up to 80 mm/h and incorporates 22 rainy orbits distributed over a year [C1319]

## "IGARSS 2001. Scanning the Present and Resolving the Future. Proceedings. IEEE 2001 International Geoscience and Remote Sensing Symposium (Cat. No.01CH37217)"

The following topics were dealt with: soil moisture remote sensing; archaeology; global clouds and aerosols; remote sensing; data compression and coding; SAR; floods and disasters; Antarctica; Arctic; classification, labelling and inference; visualization; advanced sensors and measurement techniques; missions and programs; skin sea surface temperature; agriculture, coastal lakes and rivers; hyperspectral environment; geoscience; Global Change Observation Mission; environmental degradation and Earth systems; student prize paper competition; processing and analysis methods; interferometry; Africa; Radarsat 1; sensor calibration; oceans; Australian applications; aquatic and submerged ecosystems; hyperspectral and multispectral mineral exploration; advanced lidar systems; Tropical Rainfall Mapping Mission; clouds and precipitation data fusion; thermal remote sensing; biophysical modelling; Shuttle Radar Topography Mission; forestry; fires; passive remote sensing; state communities; active remote sensing; snow; local communities; geospatial data fusion; multisource vision; knowledge based systems and unmixing; tropospheric refractivity estimation; radar polarimetry; ocean color; sea ice, snow and glaciers; short wind waves; topography, DTM and cartography; arid zone; rangelands; lidar technology; ozone; clouds and precipitation; inverse problems; spaceborne scatterometers; differential SAR interferometry; antipersonnel landmine detection and classification; landcover change; air-sea interaction; knowledge based systems and unmixing; Bayesian techniques; data formats, archiving and retrieval; EOS-Terra mission; ocean waves; agriculture; salinity; urban studies; hydrology; soils; geoscience; atmosphere; climate; large scale thematric products; emission and scattering; image processing and enhancement; GPS reflection; electromagnetics; AIRSAR and PACRIM; synthetic aperture techniques; processing systems; policy, education and societal issues; GPR; ocean winds; disaster assessment; target detection; environmental degradation;

coastal landscapes and fisheries; biophysical modelling; neural networks, expert system systems; inverse problems [C1320]

## "Mars surface models and subsurface detection performance in MARSIS"

The MARSIS (Mars Advanced Radar for Subsurface and Ionosphere Sounding) instrument is a multi-spectral, low. frequency, nadir looking pulse limited radar sounder and altimeter with ground penetration capability. Moreover the detection of a subsurface interface will be possible only if the following conditions are met:-the level of the subsurface reflection is higher than the noise floor-the surface/subsurface dynamic is included in the system dynamic range-the subsurface reflection is higher than the corresponding surface clutter reflection For MARSIS the noise floor has been evaluated to be about 60 dB below the fully coherent surface echo, so that an overall 60 dB dynamic range will be allowed if sidelobes and nonlinearities are controlled and reduced down to the noise level with a proper design. In this case we can assess that the penetration depth can be defined as that depth where the subsurface power is equal to the surface clutter power. In this paper the subsurface to surface clutter ratio will be evaluated, taking also into account the results related to the new fractal models of the structure of the planet's surface and in particular the new MARS surface models obtained from the MGS/MOLA data [C1321]

## "An overview of the PACRIM 2000 Airborne Synthetic Aperture Radar (AIRSAR) mission in the Pacific, Australia and Asian region"

PACRIM 2 is a NASA-Australia sponsored science program whose primary purpose is to advance the development and use of polarimetric and interferometric radar in Pacific Rim countries including island nations of the South Pacific, New Zealand, Australia, Papua New Guinea, Indonesia, Malaysia, Cambodia, Philippines, Taiwan, South Korea, Japan and the United States. The deployment of AIRSAR on board NASA's DC-8 research aircraft has provided an opportunity to investigators with diverse backgrounds to collect, analyze and apply state-of-the-art data for Earth science studies in preparation for datasets likely to become available in the near future from satellite and commercial airborne systems [C1322]

## "Multi-polarization C-band SAR signatures of arctic sea ice"

The Advanced Synthetic Aperture Radar (ASAR) is scheduled to be launched on the ENVISAT satellite in summer 2001. For Arctic-sea ice mapping using future ASAR data, we carry out a study of multiple polarization C-band SAR signatures of various sea ice types. We present polarimetric SAR data acquired over sea ice acquired by the Jet Propulsion Laboratory polarimetric AIRSAR system on the NASA DC-8 aircraft over sea ice regions in the Beaufort Sea and the Bering Sea. We use a physical sea ice model to study polarimetric scattering signatures of sea ice. The results also provides useful information to the future RADARSAT-2 multi-polarization SAR for sea ice mapping [C1323]

## "CINRAD WSR-98D and its ground clutter filter design"

Based on the US NEXRAD WSR-88D Doppler weather radar, Beijing Metstar Radar Co., Ltd. ( A China-US joint venture) has designed a successor product-the CINRAD (China New Generation Radar) WSR-98D. The two systems have comparable overall performance. However, taking advantage of advances in the electronics industry in the last decade, it was able to re-implement the radar signal processor, along with all the central timing and control functions that are unique for the NEXRAD design, into just three PC style plug-in boards. Its processing capability is almost twice compared to the NEXRAD's signal processor. With extensive use of VLSI DSP and PLD devices, this is an open system based, highly scalable and re-programmable design that can easily be upgraded as the need demands. The objective of the ground clutter suppression capability is to improve the measurement of weather return parameters in the presence of clutter. The CINRAD WSR-98D ground clutter suppression function consists of the following: (a) clutter filter; and (b) clutter map. The filter is a fifth-order elliptic high-pass filter operating on each 250 m range bin independently. For each range bin, the input time series consists of samples occurring at the PRF rate [C1324]

## "High-speed real-time digital radar processors: design and implementation"

This paper is on the design and implementation of high-speed real-time digital radar processors. The applications background, key technical problems and solutions are discussed. Some state-of-art advanced processors, including two programmable digital signal processors, a high-speed data acquisition system, two digital pulse compression systems and a radar echo generator are introduced [C1325]

## "Design and implementation of a high speed vector processor for real-time SAR imaging"

The VP (vector processor), designed and accomplished by ourselves, is an advanced processor, with BDSP9124/9320 as its main component. It can process 1M samples of data, and processing precision approaches the floating point processor. It could be applied for SAR (synthetic aperture radar) and other fields. The CSA (chirp scaling algorithm) is suitable for the VP calculation. Using the two-dimensional FFT to perform the CSA, the VP can remove corner turning memory and reduce processing overhead. Using the a large radix to complete the FFT, it can also reduce the processing time. The VP can produce a satisfactory image with high resolution, in right and squint side looking strip mapping [C1326]

## "A Cell-Culture Exposure System for Millimetric Wavelength Radiation"

We describe the design and construction of waveguide cavity cell-culture exposure system that allows the study of potential biological effects arising from an interaction with low-intensity millimetre wave radiation. Previous reports of millimetre wave induced biological effects have seldom been independently replicated due to confounding experimental factors that have led to uncertainty and controversy with regard to the existence of related phenomena. In order to reduce experimental inaccuracies we have paid particular attention to the design, set-up and calibration of our cell and, in addition, the environment in which it is placed. Furthermore, we have made use of high-accuracy microwave/millimetre test equipment and advanced electromagnetic simulation software to fully characterise the millimetre wave propagation characteristics of the cell over its operational frequency range of 27.5-35GHz. Experimental results and theoretical simulations of the cell millimetre wave characteristics show good agreement and give confidence that our technique can be applied to the entire millimetre wave spectral region. [C1327]

## "Efficient implementation of comb filters using block processing"

First Page of the Article [C1328]

## "Detection of urban areas in multispectral data"

During various campaigns, multispectral data have been gathered with airborne sensors over typical urban environments. For each of these scenes passive IR-systems, as well as laser-scanners, mm-wave radars under different operating modes, forward-looking with beam scanning antennas, side-looking SAR and interferometric SAR for 3D-imaging, have been employed. For these sample scenarios advanced image based pattern recognition algorithms have been validated and the features of each sensor have been studied to allow to choose the optimum sensor combination for a specific application. The contribution describes the different sensors and gives an overview over the image material for the sample scenes. Methods of image discrimination for the urban environment are discussed [C1329]

## "Advanced interconnecting techniques of integrated T/R modules"

The basic requirements for transmit/receive(T/R) modules of active phased array radar systems are small volume and light weight with excellent microwave performance and uniformity. The objective of this study was to employ new interconnecting techniques to develop high density, integrated T/R modules. Many advanced interconnecting methods were applied to increase the package density and improve the electric performance. High density, integrated T/R modules with good microwave performance and uniformity were manufactured successfully. These techniques are very useful to many types of modern active phased array radar systems [C1330]

## "Anti-ARM technique: feature analysis of ARM warning radar"

The paper first proposes a kind of equipment that can be used for anti-ARM and can be produced in batches. This new anti-ARM method adopts the integrated countermeasures system of the advanced ARM (anti-radiation missile) warning radar and the distributed general-purpose decoy (DGPD) series to protect most of the ground air-defense radar. This paper also analyzes the system and the features of the advanced ARM warning radar according to future operational demands [C1331]

## "Real-time vessel tracking system used for the Yangtse three gorges materials transportation"

We use the global positioning system (GPS) receiver, short wave communication set, Yangtse river GIS map and computerized data base to realize vessels automatic management on the thousand kilometers long water channel of the Yangtse river. As we employ advanced technologies while conventional side band short wave set is refitted, the vessel tracking system is an advanced and economic one. We describe some technologies on vessel positioning, data and voice communication, electronic river map and electromagnetic compatibility [C1332]

## "Researches of a new kind of advanced meter wave radar"

Synthetic impulse and aperture radar (SIAR) is new kind of advanced meter wave radar. Stealth techniques and anti-radiation missiles (ARM) raise challenges to military radar. Many research results show that meter (or much longer) wavelength electromagnetic waves are the right way against the stealth technique and ARMs. However, traditional meter wave radar has many disadvantages, such as poor angle resolution, weakness against ECM, low measurement precision etc. The new concept of synthetic impulse and aperture radar was presented, by J. Dorey et al. (see Colloque International sur le Radar, p.556-62, 1989). SIAR has no scanning mechanism or phased devices. The beams or antenna patterns of both the transmitting array and the receiving array are formed by digital calculation. SIAR can keep the advantages of traditional meter wave radar and overcome most of its disadvantages. This new kind of radar has many other advantages, for example, low probabilities of interception (LPI), capacity of long coherent integration of targets and fine Doppler resolution, high feasibility of system processing, etc. The basic concepts of SIAR and some experimental results are introduced [C1333]

## "Full solid state transmitter system for S band active phased array radar"

In this paper, a full solid state transmitter system with. high efficiency, stability and reliability for S band active phased array radar is introduced. Advanced system design methods, development of key modules and solutions for critical technologies, as well as the testing results for this system are also given in the paper [C1334]

## "Parallel processor in space time adaptive signal processing"

The massive processing volume of multichannel space time adaptive signal processing (STAP) is a great challenge to implement. The difficulties lie in intensive computation, high data communication bandwidth and the complexity of processing methods. Now with advanced parallel DSP modules, based on the parallel processing technique and fast algorithms, the STAP processor can be realized. The overall hardware equipment has been greatly reduced to become affordable. A compact processor with better performance to cost ratio can be implemented [C1335]

## "Anti-ARM technique: distributed general-purpose decoy series (DGPD)"

This paper first gives 4 features of the anti-ARM technique, then analyzes three present anti-ARM methods and evaluates them. On this basis, a kind of equipment concerning a new anti-ARM method that is easy for mass production is therefore suggested. The use of advanced ARM warning radar and the distributed general-purpose decoy series to compose the integrated countering system so as to protect the majority of the ground-based air defense radar is discussed. Later, based on the future requirements of the actual combat, this paper presents particularly the basic requirements for the DGPD, analyzes the properties of DGPD and introduces some system examples [C1336]

## "SeaWinds: the QuikSCAT wind scatterometer"

The QuikSCAT wind scatterometer, named SeaWinds, is a scanning, pencil-beam, microwave radar that was designed to measure global ocean surface winds from space. Originally planned for flight aboard the National Space Development Agency of Japan (NASDA) Advanced Earth Observing Satellite II (ADEOS-II) spacecraft, SeaWinds was expected to continue the series of Ku-band scatterometer data initiated by the NASA Scatterometer (NSCAT). Unfortunately, the failure of NSCAT's host spacecraft, ADEOS-I, prematurely ended NSCAT's mission and created a data gap. The QuikSCAT mission was rapidly developed to fill in the data gap between NSCAT on ADEOS-I and SeaWinds on ADEOS-II. A scatterometer nearly identical to SeaWinds was quickly assembled and launched on June 19, 1999 aboard the QuikSCAT spacecraft. In this paper, we describe the QuikSCAT mission, outline the key design features of the SeaWinds scatterometer, and mention some of the current and emerging science applications [C1337]

## "Advanced design concepts for a SeaWinds scatterometer follow-on mission"

The SeaWinds wind scatterometer was first launched in June of 1999, and has contributed significantly to the study of global climate phenomena and to the fidelity of operational weather forecasting. A second SeaWinds instrument is planned to be launched aboard the Japanese ADEOS-II platform in late 2001, and operate until mid-decade. To extend the important Ku-Band scatterometer data base to the end of the decade and beyond, a follow-on system to the SeaWinds series of scatterometers is being developed. The goals for this system are to continue the core Ku-Band backscatter measurement, to further improve spacecraft accommodation constraints so as to be easily operated on a variety of platforms, and-where possible under existing cost constraints-improve wind retrieval performance. It is shown that a system, which meets these objectives, can be achieved by the addition of polarimetric measurement capability to the existing SeaWinds approach. Polarimetric scatterometry is

demonstrated to improve wind measurement performance without impacting instrument complexity or cost, and has the long term potential to further ease spacecraft accommodation requirements [C1338]

## "Phased array technologies for next-generation space based radar"

The challenges and requirements that make Earth-observing phased array antenna (PAA) designs for space based radar (SBR) applications different from those for ground and airborne radar systems are discussed. These challenges include both electrical design issues impacting RF performance and mechanical/environmental issues affecting system reliability. Design trades necessary to meet those requirements are illustrated with a case study of a typical SBR antenna design. This discussion explains methods for trading design parameters to minimize cost and mass while maximizing performance and efficiency. The current state-of-the-art in critical phased array components (including radiators, transmit/receive modules, and time delay units) is documented, and future trends in the performance and cost of those components are discussed. Advanced manufacturing technologies that are critical for reducing component and integration costs are discussed. A recent example is presented showing how these advanced components and manufacturing techniques yielded a lightweight and efficient PAA design suitable for use in an SBR system [C1339]

## "The passive sensor subsystem for DITP-current status and projected performance"

The passive sensor subsystem (PSS) is under development as part of the DITP, which is a BMDO and tri-service flight demonstration of advanced interceptor technologies. We describe the PSS in terms of its three basic constituents the LWIR focal plane array (FPA), the flight cryostat assembly, and the malleable signal processor. We first review each of these basic constituents. We then describe how these constituents relate in the overall system, including the FPA in the operating environment provided by the flight cryostat assembly; the operation of, and data acquisition from, the FPA by the malleable signal processor; and the optical configuration used to achieve the desired pixel and FPA fields of view in both flight and ground-test embodiments [C1340]

## "Dual frequency synthetic aperture radar (SAR) mission for monitoring Earth"

Advances in spaceborne Synthetic Aperture Radar (SAR) remote sensing technology make it possible to acquire global-scale data sets that provide unique information about the Earth's continually changing surface characteristics. Short duration missions such as the Spaceborne Imaging Radar-C (SIR-C) and the Shuttle Radar Topography Mission (SRTM) have established the vast potential of SAR for expanding our knowledge of Earth. A long-duration (⩾5 year) free-flying SAR mission is essential to routinely provide valuable information about the dynamic characteristics of our planet. The SAR mission concept, consists of a dual frequency, polarimetric, interferometric system that has broad scientific, environmental preservation, operational, and commercial utility. A feature that greatly reduces the potential for tasking conflicts is the instrument's ability to operate both frequencies independently and simultaneously. The implementation approach includes an innovative government-industry collaboration that has the potential to lead to the creation of new information industries, in a manner similar to the Internet, Global Positioning Satellite (GPS) and commercial space telecommunications [C1341]

## "Modeling of drivers' longitudinal behavior"

Adaptive cruise control (ACC) extends the conventional cruise control system by controlling the relative speed and distance to other vehicles. In order to design an ACC controller it is essential to have a model on drivers' behavior. Our approach to find the dynamical models of drivers' behavior is to use system identification. A basic data analysis was made by means of the system identification methodology, and several models of drivers' longitudinal behaviors are proposed, including both linear regression models and subspace based models. The detection of a driver changing his/her behavior in various situations to a deviant behavior is useful. For that purpose the GARCH model used to model the driver in arousal situations, where the driver changes his/her behavior, is proposed [C1342]

## "EUROCON'2001. International Conference on Trends in Communications. Technical Program, Proceedings (Cat. No.01EX439)"

The following topics were dealt with: new media in education; equalization; communication theory; routing; image processing; mobile cellular systems; electronic commerce; communication subsystems architecture and technology; advanced sequences for communications; Internet services; telecommunication management; social and economic impacts; multimedia and distant tutoring; protocols; radio propagation; radar signals; satellite systems and services; framing synchronization; video coding and retrieval; security and cryptography; models and simulation; local loop technologies; speech compression and DSP; quality of service; distributed systems and model checking [C1343]

## "Computation of time optimal movements for autonomous parking of non-holonomic mobile platforms"

We present a method for calculation of time optimal movements for parking of non-holonomic mobile platforms. The parking problem is considered as a specialization of the general problem of path planning for non-holonomic robots. This is formulated as a nonlinear optimal control problem and solved using advanced numerical methods. The concept of artificial potential field is used for accounting for the obstacles in the environment. This method allows us to compute the time optimal control for all possible parking configurations (parallel, diagonal, row parking). The experiments show that using this method the movements for different complex situations can be calculated in a timely fashion. [C1344]

## "Inductive and capacitive sensor arrays for in situ composition sensors"

Advances in electromagnetic sensor design provide the potential for high resolution imaging of subsurface objects and material properties at the microscopic (micrometer) and mesoscopic (meter) scales. With quasi-static, capacitive and inductive sensor arrays, objects are detected, identified, and imaged via their perturbations to the applied electric and magnetic fields, rather than through time delays of reflected electromagnetic waves as in ground penetrating radar. Building on the successful application as nondestructive quality assessment and monitoring tools as well as land mine detectors, several subsurface in situ sensors are enabled by this technology. Examples include: an electronic 3D microscope, enabling examination of cell level structures and composition; examination of near surface structures such as soil moisture, permafrost dynamics, soil properties with depth, root growth carbon sequestration, Martian surface aquifers, and buried deposits of carbon dioxide or methyl hydrides [C1345]

## "Interplanetary small mission studies"

Small missions can play a large role in future robotic space exploration. While these missions cannot accomplish the vast scope of science objectives achieved by large missions such as Mars Sample Return or Cassini, they offer opportunities to explore smaller, but pertinent, science goals for significantly reduced total mission cost. The Jet Propulsion Laboratory's Advanced Projects Design Team (Team X) has conducted several mission studies to explore the feasibility of scientifically significant small interplanetary missions. These mission studies encompassed various targets (Mars, Earth's Moon, Venus, the Sun) using several scientific payloads (radar, imagers, radiometers). These missions can also perform other functions such as probe/balloon delivery or communications relay for landed missions. The studies considered a range of secondary payload launch vehicle options. This paper will highlight the results from these studies and discuss how the concurrent engineering environment of Team X lends itself to pre-phase A concept investigations [C1346]

## "Future mobile phones-complex design challenges from an embedded systems perspective"

In the coming few years, three trends for mobile phones will be seen. First, new communication standards provide packet-switched high-bandwidth wireless communication globally. Second, user applications are going from simple phone administration and text messaging to advanced multimedia and entertainment applications. Finally, because of Internet access and security support, the phones have the potential to move into a financial instrument for economical transactions. The article mainly covers the two former trends, and describes key complexity issues and design challenges. The concept of future mobile phones is described; communication capabilities and some emerging user application capabilities are outlined. The article describes and discusses complexity issues and some design challenges, and also provides a summary. Overall, the focus is from the digital system architecture perspective, and does not cover challenges in the areas of radio, antenna, or analog/digital integration [C1347]

## "Application of array processing techniques to multibaseline InSAR for layover solution"

Synthetic aperture radar interferometry (InSAR) is a modern technique to derive digital height maps of the land surface from SAR images. In recent years there has been great interest in exploiting the advanced multibaseline operation for solving layover effects that can degrade SAR and InSAR imagery. We consider detailed modelling of this problem including speckle noise for extended targets, application of several nonparametric and parametric spectral estimation methods to multibaseline layover solution, and performance analysis. The problem of layover solution is formulated as the estimation of a multi-component signal composed by multiple cisoids corrupted by complex multiplicative Gaussian noise and additive white Gaussian thermal noise. Beamforming, Capon's, High-Order Yule-Walker, MUSIC, Min-Norm, and ESPRIT spatial spectral estimators are applied to this interferometric problem, and an extensive simulated performance comparison is carried out in terms of statistical accuracy and

resolution [C1348]

## "Sidelobe reduction through subarray overlapping for wideband arrays"

For wideband arrays, the contiguous subarray architecture using phase shifters at the element level and true time delays at the subarray level results in higher sidelobes due to subarray dispersion and grating-lobe generation. Sidelobe reduction using overlapping subarray architecture is discussed. The architecture is effectively applied to an experimental AMRF-C (Advanced Multifunction RF Concept program) receive system. It is shown that, in addition to aperture weight distribution at different stages, the overlap ratio between subarray aperture size and subarray step size primarily affects the array sidelobe performance. Excellent sidelobe performance is achieved over large bandwidth when the overlap ratio is close to 2 and typical Taylor weight distributions are used at both element and subarray levels [C1349]

## "An improved calibration framework for electromagnetic tracking devices"

Electromagnetic trackers have many favorable characteristics but are notorious for their sensitivity to magnetic field distortions resulting from metal and electronic equipment in the environment. We categorize existing tracker calibration methods and present an improved technique for reducing the static position and orientation errors that are inherent to these devices. A quaternion-based formulation provides a simple and fast computational framework for representing orientation errors. Our experimental apparatus consists of a 6-DOF mobile platform and an optical position measurement system, allowing the collection of full-pose data at nearly arbitrary orientations of the receiver. A polynomial correction technique is applied and evaluated using a Polhemus Fastrak resulting in a substantial improvement of tracking accuracy. Finally, we apply advanced visualization algorithms to give new insight into the nature of the magnetic distortion field. [C1350]

## "Smart sensing for mine detection studies with IR cameras"

Because of the high risks involved, it is necessary to conduct mine detection remotely. By making use of infrared (IR) cameras, scattered mines can be detected from remote locations. In the case of mines buried in the ground, detection is possible if the peripheral temperature difference is large enough between the ground and mine weapon. As one of the world's advanced nations in sensor technology, Japan should promote surveys and studies for detecting mines safely by using its advanced remote sensing technologies. [C1351]

## "Anti-monopulse jamming techniques"

So far, several anti-monopulse advanced jamming techniques have been proposed: some of them have just been studied, some have been tested and some are already in operation. The article presents an overview of the most commonly known anti-monopulse jamming techniques such as: cross polarisation; towed decoy; expendable decoy; and wavefront distortion (WFD), i.e. cross-eye jamming (CEJ); and underlines their benefits and drawbacks. [C1352]

## "A robust variable step-size LMS-like algorithm for a second-order adaptive IIR notch filter for frequency detection"

The best adaptive algorithm requires fast convergence speed, low variance, unbias and low steady-state mean square error (MSE) in both low and high signal-to-noise ratio (SNR) situations. We have proposed a robust variable step-size LMS-like algorithm (VS-LMS-L) for a second-order adaptive IIR notch filter for frequency detection in radar, sonar and communication systems. This algorithm is compared with the conventional LMS-like algorithm called the plain gradient algorithm (PG). The time-varying step-size μ(n) is adjusted by using the square of the time-averaged estimate of autocorrelation of the present output signal y(n) and the past one y(n-1). This technique can reject the effect of the uncorrelated noise sequence on the step-size update, resulting in a small MSE due to the small final μ(n). Moreover, this algorithm can also improve the convergence speed by comparison with the PG at the same MSE value [C1353]

## "Phased arrays for the new millennium"

This is a survey paper summarizing the developments and future trends in passive, active bipolar and monolithic microwave integrated circuitry (MMIC) phased arrays for ground, ship, air and space applications. The developments covered are the THAAD (formerly GBR), European COBRA and Israel BMD radar antennas; Dutch shipboard APAR; airborne US F-22; European AMSAR, Swedish AESA, Japan FSX and Israel Phalcon; Iridium (66 satellites in orbit for total of 198 antennas) and Globalstar MMIC spaceborne antenna systems; Thomson-CSF wafer integration 94 GHz seeker antenna; digital beamforming; ferroelectric row-column scanning; optical electronic scanning for communications and radar; the MMIC C-band to Ku-band Advanced Shared

Aperture Program (ASAP) antenna system for communications, radar, electronics countermeasures (ECM) and ESM; and continuous transverse stub (CTS) voltage-variable dielectric (VVD) antenna [C1354]

## "Determinations of aircraft position and orientation from images of a millimetric surface radar"

The present work mainly deals with the determination of geometrical and kinematics parameters by the processing of images gathered from a high-resolution radar sensor. The aim of this application is to determine the orientation and the position of aircraft in an Advanced Surface Movement Guidance and Control (A-SMGCS) environment. The radar sensor is a prototype operating in the millimetre band (95 GHz) and conceived for the surveillance function. By using suitable image processing the aircraft position is computed with different methods including moments and cross-correlation with a model variable as a function of the angle between the aircraft axis and radar ray direction. The more accurate calculations (e.g., cross-correlation) are made only around a rough estimated position, and therefore the calculation time is drastically reduced [C1355]

## "Maximum likelihood angle extractor for two closely spaced targets"

In a scenario of closely spaced targets special attention has to be paid to radar signal processing. We present an advanced processing technique, which uses the maximum likelihood (ML) criterion to extract from a monopulse radar separate angle measurements for unresolved targets. This processing results in a significant improvement, in terms of measurement error standard deviations, over angle estimators using the monopulse ratio. Algorithms are developed for Swerling III models of radar cross section (RCS) fluctuations. The accuracy of the results is compared to the Cramer Rao lower bound (CRLB) and also to the monopulse ratio technique. A novel technique to detect the presence of two unresolved targets is also discussed. The performance of the ML estimator was evaluated in a benchmark scenario of closely spaced targets-closer than half power beamwidth of a monopulse radar [C1356]

## "MSAG based MAE-UAV active array antenna"

This paper summarizes the key enabling technologies developed during a three-year effort to design and demonstrate the advanced performance of a multi-function self-aligned gate (MSAG) MMIC-based MAE-UAV active array antenna. The antenna system was developed as prototype for future SATCOM and SAR antennas to be used aboard unmanned autonomous vehicles (UAV). This effort culminated in 1998 with a highly successful field demonstration at the CIRPAS facility (Center for Interdisciplinary Remotely Piloted Aircraft studies) in Marina, California [C1357]

## "Technical Digest. CLEO/Pacific Rim 2001. 4th Pacific Rim Conference on Lasers and Electro-Optics (Cat. No.01TH8557)"

The following topics are dealt with: microstructured fibers and devices; photonic crystals; thin film and nanoparticle formation; functional structure fabrication; x-ray lasers; laser based high energy physics; high intensity laser technology; LiNbO3waveguide devices; QPM devices and applications; advanced photonic sensing; atmospheric Lidars; Lidar technologies; nanostructures and nanosystems; imaging spectroscopy of semiconductor nanostructures; ceramics lasers; new scheme lasers; techniques for biomedical optics; second-generation photomedicine; dynamics in semiconductor optical amplifiers and lasers; wavelength control for WDM applications; laser processing; micro and macro engineering; strong-field interaction and applications; optical coherence tomography; spectroscopy and imaging for brain and tissue characterization; integration and packaging; photonic network devices; DWDM components; optical MEMS; THz-radiation and nonlinear devices; nonlinear optics in fiber; nonlinear optical devices in optical communication; lasers and electro optics; photonic sensing; sensing devices; distributed photonic sensing and photonic sensing networks for reliability, safety and security; spectroscopy in nano-photonics; atom manipulation and nano-fabrication; semiconductor materials; Yb and Nd:YAG lasers; new sources; advanced industrial lasers in 21st century; eyesafe laser radar; physics of ultrafast phenomena; ultrafast pulse technologies and their applications; high density optical disk; devices for transmission systems; short wavelength and widegap material lasers; semiconductor lasers for lightwave communications; light sources for DWDM applications; materials for nonlinear optics; optical chaos; nonlinear optical devices in UV; quantum information; optical state control and detection; lasers and spectroscopy; UV nonlinear optical materials; photorefractive materials; bulk and thin film materials; new lasers; analog signal processing; short pulse generation and control; ultra high density optical disks; transmission technologies; optical networking; IP over DWDM networks; access networks for Internet era; VCSELs for datacom; long-wavelength VCSELs and related materials; VCSELs and microcavity lasers; nonlinear coherent systems; atom optics and laser cooling; ultrafast phenomena-molecules; ultrafast phenomena-coherence control; image processing; novel materials; organic optical materials; photonic information processing systems; holographic devices and systems; spatiotemporal information processing; ultrafast optical devices; ultrafast pulse characterization; THz generation

and photoconductive switches [C1358]

## "Detection of the number of signals in super-resolution ocean surface current algorithm for OSMAR2000"

Super-resolution ocean surface current algorithm based on MUltiple SIgnal Classification (MUSIC) is used for current mapping of Wuhan University's ocean state measuring and analyzing radar (OSMAR2000), in which MUSIC is applied to estimate the bearings of the first-order sea echo signals. The premise of MUSIC processing is that the number of signals is known in advance. In fact, the number of signals is unknown, and needs to be estimated from received data. In the case of discrete targets, the problem can be perfectly solved using information theoretic criteria such as the Akaike Information Criterion (AIC) or the Minimum Description Length (MDL) criterion. However, these criteria are proved unsuccessful for sea echo signals both in simulation and in actual application, since sea surface is essentially a continuum. Therefore, an ad hoc method of detection of number of signals, a bit different from the existent methods, is developed for the current algorithm of OSMAR2000. The underlying idea is to determine the number of signals based on the variance of MUSIC spectra structure under different candidate number of signals [C1359]

## "Shallow trench isolation scatterometry metrology in a high volume fab"

Focuses on the current roles of metrology systems associated with a shallow trench isolation (STI) run-to-run (RtR) controller and recent advances AMD has made applying new, ODP scatterometry-based metrology to this application. It will compare industry standard metrology techniques to ODP, with the objective of identifying the STI metrology system or systems that will produce timely and reliable data streams with the largest quantity of process information at the highest possible signal to noise (S/N) ratio [C1360]

## "An overview of advanced processing techniques for RCS measurements"

For the last ten years, VSD (formerly ERIM International) has had the opportunity to work with several government and industry RCS ranges to develop an intimate understanding of the errors that can occur in making RCS measurements of today's sophisticated targets. This has led to the successful development and demonstration of a variety of advanced processing techniques (APTs) to improve the quality and utility of both indoor and outdoor RCS/ISAR data. These include algorithms for removal of clutter, RFI, and target-support contamination (including interactions), prediction of far field RCS from near field measurements, suppression of multipath contamination, and extraction of scattering features. Several of these are summarized in a table. A discussion and examples of each are also provided [C1361]

## "Microelectronics/nanoelectronics and the 21st century"

The advent of nonphotolithographic lithography, new electronic materials, and the devices, circuits, and systems they enable will see the electronics revolution of the 20th century to continue well into the 21st century. New lithographic techniques using tools such as nano-imprint and AFM are expected to lead to electronic circuits with lateral spatial resolution under 10 nm. When coupled with innovative materials such as those exhibiting giant magnetoresistance, new ultradense, ultrafast, nonvolatile memory is expected to ensue. New records are expected to be set in solid state laser output power when new wide bandgap semiconductors are combined with concepts such as the quantum cascade laser. Differential etching techniques that have proven efficacious in the design of surface emitting lasers are expected to propel bipolar transistor switching speeds into the THz spectrum with resultant logic devices clocking at well over 100 GHz. This increase will lead to improved signal processing capability. New advances in control of the phase stability of local oscillators and amplifiers will lead to electromagnetic systems with much greater Doppler resolution for radar and much better spectral utilization for communications systems. Devices and ICs combining semiconductors and magnetic spin states are expected to lead to a new class of ICs whose functionality can be dynamically changed in order to adapt optimally to the computational or sensing requirements of the moment. Further advances are expected to accrue in the area of nanophotonics, where device sizes can be smaller than the wavelength of the light they emit or receive [C1362]

## "New modes and techniques of the RADARSAT-2 SAR"

The RADARSAT-2 system currently under development is required to generate a much wider range of data products than any other preceding civilian satellite SAR. In addition to the single polarization Standard, Fine Resolution, Wide Swath, ScanSAR and Extended Coverage Beams of RADARSAT-1, the new mission requirements include Quad-Polarization and UltraFine Resolution modes, and selectable single and dual-polarization options for the heritage beams. The radar is also required to operate in experimental modes to provide data for detection of moving objects. To support this mission, a significantly more technologically advanced instrument has been designed, with a number of extra degrees of freedom in its operation. This paper

describes some key features in the design of the instrument, and explains how they will be used in generating the new types of data [C1363]

## "Preparing for operational use of RADARSAT-2 data at the Canadian Ice Service"

As one of the world's largest operational users of RADARSAT-1 data, the Canadian Ice Service (CIS) is looking forward to the future launch of RADARSAT-2. The RADARSAT-2 mission, including both the Space and Ground segments, promises several technical enhancements beyond RADARSAT-1, which should be beneficial to the CIS. Towards that end and to prepare for operational use of the data, the CIS has been working closely with the Canadian Space Agency (CSA) and MacDonald Detwiller (MDA), particularly on the Ground Segment, to ensure that the RADARSAT-2 system will best meet our operational needs. Additionally, the CIS is investigating the operational utility to be gained from some of the advanced capabilities of the SAR sensor, specifically the selective single-, dual-, and quad-polarization modes. In this paper we briefly examine, from an operational perspective, various elements and enhancements of the RADARSAT-2 Space and Ground segments, and issues concerning data usage to be addressed in order to maximize the operational utility of RADARSAT-2 data at the CIS [C1364]

## "Interferometric calibration for DEM enhancing and system characterization in single pass SAR interferometry"

In this paper the comparison between different methods to calibrate a digital elevation map (DEM) generated from airborne differential SAR interferometry will be presented. The traditional methods applied phase ramp corrections along the swath derived from the errors in some ground control points (GCP) to improve the DEM. A more advanced technique is proposed based on the sensitivity equations, which are derived by differentiating the basic location equations with respect to the different parameters of the error model. The behavior of the different techniques have been tested with both synthetic and real interferometric SAR data [C1365]

## "The Northern Gulf of Mexico Littoral Initiative"

The Northern Gulf of Mexico Littoral Initiative (NGLI) is a multi-agency program established through a partnership between the Commander, Naval Meteorology and Oceanography Command (COMNAVMETOCCOM) and the Environmental Protection Agency's Gulf of Mexico Program Office. The goal of NGLI is to become a sustained comprehensive nowcasting/forecasting system for the coastal areas of Mississippi, Louisiana, and Alabama that will use model forecasts and observational data for military training and coastal resource management. The program integrates a reliable and timely meteorological and oceanographic modeling scheme, combining three-dimensional circulation, sediment transport, and atmosphere and wave models with in situ and remotely sensed observations via an extensive data distribution network that is available to a wide range of users in near-real time through an interactive website. The Naval Oceanographic Office, who manages the program for COMNAVMETOCCOM, has chosen the Mississippi Bight as an ideal test bed to economically examine new modeling and observational technologies before they are applied to littoral areas of military interest. NGLI directly addresses the Navy's requirement to project oceanographic information from deepwater environments shoreward into hostile littoral areas. Model nowcasts and forecasts are being applied to the ocean littoral environment by cascading information from large ocean basin models to shallow-water models. NGLI plans to support military training exercises performed by Special Boat Unit 22, stationed at Stennis Space Center, MS. Lessons learned within this "natural laboratory" also provide civil authorities with the means to consider the environmental stresses (sediment transport modifications, increased pollution, etc.) caused by growth in hotel and casino developments, population, and industry. The NGLI modeling system will aid in ensuring the quality of shellfish harvests, one of the area's largest industries. NGLI utilizes a variety of oceanographic technologies for in situ observations. Measurements consist of both moored upward-looking and buoy downward-looking acoustic Doppler current profiler observations telemetered in near-real time; buoy meteorological observations; surface drifters; and survey-collected profiles of temperature, salinity, oxygen, current velocity, optical parameters, and sediment data. Remotely sensed observations include surface currents from Coastal Ocean Dynamics Applications Radar, Sea-viewing Wide Field-of-view Sensor, Geostationary Operational Environmental Satellite, and Advanced Very High Resolution Radiometer imagery, satellite altimetry, gravimetric geoid studies, and Global Positioning System technology to determine sea surface height. Information generated from observational data and model output is deposited into a large data distribution system, consisting of data archives, data exchange and networking systems, and web site maintenance. This infrastructure provides NGLI data access not only to the U.S. Navy, but also to the area's resource managers, conservationists, educational institutions, and the entire Gulf Coast community [C1366]

## "System and estimation problems for multibaseline InSAR imaging of multiple layovered reflectors"

In the recent years there has been growing interest in exploiting the advanced multibaseline operation of synthetic aperture radar interferometry (InSAR) to solve layover effects that can degrade conventional InSAR imagery. In this work we consider detailed modelling of this problem including speckle noise for extended targets, application of several non-parametric and parametric spatial spectral estimation methods to multibaseline layover solution, and system trade-offs analysis. Corresponding statistical accuracy of estimated heights is investigated by simulation [C1367]

## "Advanced range sensor processing using DGPS and a geospatial database"

Manufacturers of automotive radar typically use narrow beam angles to minimize the number of detected objects (traffic signs, guard rails, etc.) which ought not to pose a threat to the host vehicle. Although narrow beam angles are sufficient for some applications, namely automatic cruise control (ACC), wider fields of view are necessary for driver assistive systems. In order to make wide field of view range sensors perform well for driver assistive systems, a novel radar processing technique has been developed which integrates vehicle location provided by a high accuracy Differential Global Positioning System receiver and a highly detailed Geospatial Database map into the radar processing algorithm. Road objects such as road shoulders and road islands are used to delineate the driveable road surface. Objects detected by the range sensor which are located off of the driveable road surface are identified as such. Relevant vehicle systems (i.e., Heads Up Display or Collision Avoidance) can use this information to minimize false positives. This radar processor was implemented on an International snowplow and results from a series of experiments using this vehicle on Minnesota Trunk Highway 101 between Rogers and Elk River are presented. The system proved very effective at minimizing radar false positives [C1368]

## "Vehicle health management research for legacy and future operational environments"

The Air Force will require the ability to diagnose and predict component failures in order to more effectively meet the requirements of the fast and agile Aerospace Expeditionary Force (AEF) and future space vehicles. This paper will cover topics relevant to Vehicle Health Management for current and anticipated support environments. It reflects current projects underway at the Air Force Research lab in the Air Vehicles and Human Effectiveness Directorates. Specifically, the Predictive Failures & Advanced Diagnostics (PFAD) for Legacy Aircraft, Passive Aircraft Status System (PASS), and the Space Operations Vehicle Integrated System (SOVIS) projects will be discussed [C1369]

## "An advanced STAP implementation for surveillance radar systems"

Space-time adaptive processing (STAP) has emerged as a key technology for improving the performance of radar systems required to operate in the presence of severe and dynamic interference which generally includes clutter as well as jamming. While the theory of optimum STAP is well known, practical issues, such as interference heterogeneity, finite sample support, mismatched signal models and computational load, need to be overcome when it comes to implementing STAP in operational radar systems. This paper proposes an advanced STAP formulation which addresses important issues facing practical implementation and then tailors this general formulation for the case of interference rejection in over-the-horizon (OTH) radar to evaluate experimentally its target detection and localisation performance [C1370]

## "Novel inverse methods in land mine imaging"

The imaging of buried land mines continues to present significant signal-processing challenges in the development of inverse methods for the detection of plastic mines buried in soil. To address this difficult problem, mathematical advances in the development of the elliptic systems method are used to generate images of the buried land mines. The-proposed approach adapts earlier methods, successfully applied in laser tomography of breast tumors using the diffusion equation, to the present problem of land mine imaging using the Helmholtz equation. The images generated by the new method represent electromagnetic properties of underground regions, providing effective differentiation of plastic land mines from surrounding soil. Experimental results are presented to demonstrate the new method [C1371]

## "Measurement of SCI patient's buttock pressure on wheelchair and bed"

The prevention of pressure sores is a serious problem for patients with spinal cord injuries (SCI). It is most important for SCI patients to relieve their buttock pressure for the prevention of pressure sores. Many kinds of pressure-relieving cushions and mattresses have been developed to distribute the weight evenly and widely. We previously measured the buttock pressure of SCI patients using the Tekscan pressure measurement system to evaluate the pressure distribution. In this study, we propose the evaluating system of the buttock pressure distribution. Using this system, the medical staff can easily adjust the air quantity of the air cushion for each SCI

patient for prevention of pressure sores. Moreover we measured the buttock pressure on four kinds of posture on the bed to clear the pressure relieving effect of the mattress. The air mattress has a large pressure relieving effect at sacrococcygeal regions in all postures on the bed [C1372]

## "Superactive pump-and-probe LIDAR technology: biophysical insight into aquatic remote sensing"

Summary form only given. An advanced pump-and-probe (P&P) airborne LIDAR technology for remote monitoring of aquatic photosynthesis and complimentary environmental variables has been recently developed at Wallops Flight Facility (NASA Goddard Space Flight Center). The P&P LIDAR provides remote measurement of important phytoplankton photosynthetic characteristics, such as the functional absorption cross-section of photosystern II (PSII), PSII photochemical quantum yield, and PSII turnover time. In addition, the rate parameters of singlet-singlet and singlet-triplet quenching and carotenoid triplet lifetime are measured. A set of 'conventional' LIDAR characteristics, such as chlorophyll (Chl), phycoerythrin and dissolved organic matter fluorescence, as well as water Raman scattering are simultaneously retrieved for detailed characterization of the surveyed area. The utilization of an airplane as a platform allows the remote acquisition of unique biophysical and environmental data over large aquatic areas at synoptic space/time scales. The P&P LIDAR can be efficiently used in studies of regulatory mechanisms of biological "carbon pump" in the ocean and ocean responses to environmental changes, as well as for improved validation of satellite data and monitoring coastal processes and special events (phytoplankton blooms, nutrient deficiency, tidal mixing, floods, etc.) [C1373]

## "Using time advance information to choose coding scheme in GPRS"

GPRS defines four coding schemes named from CS-1 to CS-4 with different degrees of data protection against transmission errors in the air interface. The former coding scheme is already used in GSM and the others sequentially offer higher throughput rates but less protection. The selection of the best suited coding scheme could be based on link quality estimators but also on more deterministic system parameters such as time advance (TA) information. This paper analyses this latter option and provides results in order to quantify the feasibility of such allocation based on the time advance information. Aspects such as TA resolution, cell coverage, power control policies and system load are taken into consideration [C1374]

## "Design of the GE aircraft engine compact range facility"

GE Aircraft Engines (GEAE) in Cincinnati, Ohio recently built a compact range facility to operate from 800 MHz to 18 GHz. The design process included visits to other recently completed facilities so that industry best practices could be incorporated into the design of the state-of-the-art facility. The facility includes a 30x30x65 ft. chamber, corner fed blended rolled edge reflector, Chebyshev multilevel absorbers, a 12 ft. diameter turntable and a rail mounted gantry crane for target mounting. Facility design, chamber, reflector, absorber, target handling and fire protection systems are discussed. The performance of the facility is discussed elsewhere (see Gupta, I.J. et al., AMTA 22nd Meeting and Symposium Proceedings, 2000). The facility was built to meet two primary objectives: (1) perform production acceptance testing of GEAE engine components; (2) to support advanced technology research and development programs [C1375]

## "Antenna developments of the 1950s to the 1980s"

The three decades after 1950 marked a period of intense and wide-ranging antenna accomplishment. Large reflector antennas were built for communications, radar, and radio astronomy. Founded on the developments of World War II and driven by cold war programs, the technology for phased arrays was refined and realized in several versions. The understanding of array effects was greatly advanced, and the fundamental ideas of adaptive arrays were put into practice. Several significant developments addressed the goals of the radio astronomy community, and the emerging space programs led to a deep space communications network that required steerable antennas with very high gain/effective temperature (G/T) ratios. This paper illustrates the developments of this period with examples of three antenna types: reflector antennas, phased arrays, and signal processing arrays. These examples are just a sampling of the many diverse antennas created during this prolific period in electromagnetics [C1376]

## "Advances in time domain antenna measurements"

This paper presents some previous and novel developments in time domain antenna measurements. In particular, their implementation in compact ranges for antenna pattern measurements, the development of time domain holography together with their application to non-destructive reverse engineering and antenna diagnostics, and a pattern error correction method using super-resolution techniques are addressed. Measurement results for the phased-array antenna of the Envisat Advanced Synthetic Aperture Radar (ASAR) and a standard gain horn illustrate the developments [C1377]

"Design, development and implementation of a voice email system using next generation networks technology-a case study"

More companies build the next generation networks for developing applications, it gives birth to more solutions and products for the needs of the market. The voice email system is definitely one of them and it becomes another trend for the technology savvy users. The voice email system becomes a starting point of the voice browsing technologies over the phone where there is a wide spreading of applications and services from different areas, such as stock trading and voice conferencing [C1378]

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