IEEE GEOSCIENCE and REMOTE SENSING Newsletter

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This issue features two main articles. The first one is an Industrial Profile article describing the history and activities of Ball Aerospace. Written by *Brian R. Johnson* and *William B. Gail*, it is the first time a large company in the Remote Sensing field describes its activities in our Newsletter. As we grow toward 3000 GRS-S members, it is expected that we will see more articles of this kind in future issues. The second major article describes the history, structure, and activities of the GRS-S Technical Committees. Written by *Albin J. Gasiewski* (GRS-S Executive Vice President), *Paul C. Smits* (GRS-S Vice-President of Technical Activities), and *Roger L. King* (Chair of the GRS-S Data Archiving and Distribution Committee), it provides a general perspective of the Technical Committees and helps to clarify the organization of the technical activities of our Society. Among the other articles, I would like to point out the "Statement of the IEEE-USA Board of Directors on Remote Sensing." This is a strong support to our field. Hopefully, their recommendations will be followed, not only by the US, but also by other Space Agencies in other regions.

Beginning with this issue, there are two new members in the Editorial Board: *David Kunkee*, new Associate Editor for Organizational and Industrial Profiles, and *Sonia Gallegos*, new Associate Editor for Latin American Affairs. We thank *Edward J. Kim* for his dedication and hard work during the past three years as *Associate Editor for Organizational and Industrial Profiles*. His close communication with industry resulted in numerous articles from companies. Thank you, *Ed*! We wish you success in your other duties in our Society.

David B. Kunkee will occupy *Ed Kim*'s position. He is well known for his research in the field of polarimetric radiometry, as advisor of NPOESS, and for his involvement in the development of the Conical Microwave Imager/Sounder radiometer (CMIS). Since he is Associate Director of the Radar and Signal Systems Department at Aerospace Corporation, we expect even closer contact with companies in the field.

Sonia C. Gallegos is with the Naval Research Laboratory at the Stennis Space Center in Mississippi, and has excellent rela-

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Message from the President

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Dear GRS-S Members,

As I write this message Coalition bombs are falling on the city of Baghdad in a war very unlike any other, in terms of the degree of divisiveness it is creating throughout the world. The major economies of the world are in trouble, and major industries are on the verge of bankruptcy, mostly due to the sudden blows of terrorists on the infamous 9/11, and the prospects for future such actions worldwide. At the same time fear is gripping the global population as a result of the Severe Acute Respiratory Syndrome (SARS), for which there are no known causes or cures. These are indeed troubling times.

If there is anything positive that can be taken from these occurrences, it would be that the products of our Society and the Remote Sensing Community are playing a very positive, and at times dominant, role in minimizing the impact of many of these events. The present war is perhaps the first to be conducted with precision warfare, where instant imagery and pinpoint targeting are permitting destruction of specifically identified targets, while at the same time protecting cultural, religious and economic resources of significance, and minimizing, as much as possible, civilian casualties. In addition, there are countless other examples of the use of remote sensing to measure or monitor Earth resources, catastrophic events, etc. I hope, in the midst of all these concerns, there can be some sense of pride on

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Cover Figure Information

Ball Commercial Platform 2000 (BCP 2000) for NASA QuikSCAT mission. Originally designed to accommodate high-resolution cameras that acquire one-meter or better imagery, it can accept any type of Earth sensing instrumentation. This spacecraft bus has also been used on NASA ICESat and DigitalGlobe's QuickBird missions.

(See article on p. 17 for more details)

Editor's Comments

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tionships with Remote Sensing groups in Latin America. Through the GRS-S Newsletter, we will try to enhance the collaboration with these groups, whose work is often not disseminated due to budgetary restrictions and, sometimes, linguistic barriers.

Yoshio Yamaguchi and *Sonia Gallegos*, as Associate Editors for Asian and Latin American Affairs, respectively, should help to further enhance our Society's membership and activities in these two regions, in addition to North America and Europe. Please do not hesitate to contact me or any of the Associate Editors directly to make better use of the Newsletter as a communication means among the professionals of this field: undergraduate and graduate students, faculty members, engineers, and scientists in industry, research centers, government research or space agencies. Please contact us to submit your articles that can be printed without cost in black and white.

New Editorial Board Members:

Dr. Gallegos, Associate Editor for Latin American Affairs

Sonia C. Gallegos holds a Ph.D. degree in Oceanography from Texas A & M University and is currently a Principal Investigator with the Naval Research Laboratory at Stennis Space Center in Mississippi. She has over 20 years of experience on Remote Sensing of the land and oceans. She started her remote sensing career as a physical scientist with NOAA/NESDIS at Johnson Space Center in Houston, Texas. At NOAA, her work included the development of visible and near-infrared algorithms for land and water applications. In 1986 she moved to the University of Texas at Austin — Center for Space Research where she worked on developing algorithms for red tide and oil detection from visible and infrared sensors. In 1990 she joined the Naval Research Laboratory Remote Sensing Applications Branch. At NRL she has developed algorithms for cloud detection as well as a number of applications for naval tactical operations. She currently works in the Optics Branch of NRL where she develops models that integrate remote sensing measurements, in-situ data and products from dynamic models that allow the estimation of inherent optical properties from the surface to the bottom of the ocean.

Dr. Kunkee, Associate Editor for Organizational and Industrial Profiles

David B. Kunkee received the Ph. D. degree from the Georgia Institute of Technology, Atlanta, Georgia in 1995. He joined the Aerospace Corporation in 1995 and is currently the Associate Director of the Radar and Signal Systems Department. He serves as a technical advisor to the National Polar-orbiting Operational Environmental Satellite System (NPOESS), and is involved with development of the Conical Microwave Imager/Sounder radiometer. He is also involved with the Defense Meteorological Satellite Program and NASA's Global Precipitation Mission. His areas of expertise include passive microwave remote sensing, radiative transfer and ocean surface modeling, radio communications, electromagnetics, and solid-state electronics. Dr. Kunkee has performed research in the area of passive polarimetric remote sensing of the ocean and has participated in experimental missions to the South Pacific and to the Labrador Sea. He is member of URSI (Commission F), and serves on the National Research Council's Committee on Radio Frequencies (CORF).

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President's Message

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the part of GRS-S members, for our contributions to advances in remote sensing.

Fortunately, in spite of all the above, planning for IGARSS '03 continues apace, with a record 2366 abstracts submitted, a 20% increase over last year's record submissions. Twenty-two percent (22%) of the abstract submissions were from the U.S., while 78% were from other countries, reaffirming the international nature of our constituency. This is indeed shaping up to be another outstanding, and record breaking Symposium.

You may or may not receive this Newsletter before IGARSS '03. If you receive it before the conference, I highly encourage you to attend this event. For our U.S. members, just in case you may have some reservations at this time about your stay in France, I have had several discussions with the French organizers of this event, with U.S. attendees at very recent conferences in France, and with the U.S. Embassy in Paris. As a result I can recommend without reservation that you plan to attend. In spite of the political positioning and the media hype, I am convinced we will find that the French people are still very much our friends.

If you receive this Newsletter only after you have attended the Conference, I trust you found it to meet all of your expectations and more. I would be grateful to receive any comments, suggestions, complaints, or otherwise, which might help to improve future IGARSS symposia.

The status of our budget woes remains the same, stuck in the red, and waiting for market conditions to turn positive. Aggressive cost-cutting measures are continuing where possible. Again, our quest to implement new Society initiatives is at peril.

In the meantime our efforts to enhance membership value, to increase member involvement in the organizational activities of the Society, and to increase our membership numbers continue. A membership of at least 3000 remains our goal. Several items are of note since the last Newsletter:

a) The Washington D.C. GRS-S Chapter has been re-activated under the chairmanship of Dr. Guoqing Sun. This brings our Chapters total to 16, with two additional chapters, Naples, Italy, and Germany, now in the late stages of formation.

b) A new Society Awards Committee and elections process has been put in place for the express purpose of providing more recognition to our deserving members. This can happen best with your vigorous participation in the nominations process. Please respond to the call for nominations appearing in this issue of the Newsletter.

c) Dr. Sonia Gallegos, the GRS-S South American Liaison, was appointed an Associate Editor of the GRS-S Newsletter. This will result in certain short articles being translated into Spanish in some future issues of the Newsletter. Complimentary issues of the Newsletter are being sent to various South American entities in an effort to significantly increase the number of GRS-S members from South America.

I will take the opportunity here to highlight the newly formed User Applications of Remote Sensing Technical Committee, which I believe holds great promise for the Society. The purposes of this committee will be to serve two distinct scientific communities, namely:

(1) Earth and Atmospheric Sciences - To understand the various applications of remote sensing data, specifically in terms of sensing the land, atmosphere and oceans.

(2) Planetary Sciences - To explore the remote sensing of extra-terrestrial targets, i.e. other planets and objects in the Solar system.

This will be an international, multidisciplinary Technical Committee, with University, Government, Space Agencies and Industry representation, which will have the likely outcome of fostering scientific discussion in a larger forum than presently exists. In all likelihood the early stages of this Technical Committee will develop through Workshops for the purpose of articulating specific themes, with associated scientific objectives. Committee concepts will be introduced at the upcoming IGARSS, and a Technical Working Group meeting is being planned for the fall of 2003 to further articulate the committee's purpose and concept. The Working Group will also identify major themes by focusing on new challenges facing the remote sensing community, and will highlight how the committee can contribute to the Science and Application communities at large.

I highlight this new Committee here, because it has the potential to expand significantly the society's goals and objectives, and to greatly enhance our membership base. More specific information about this Committee appears in the article beginning on page 12. I invite you to participate in this exciting new venture. It is also a part of our continuing push to Make the Best – Better.

I sincerely look forward to seeing all at IGARSS '03. Help keep the record of record-breaking symposia alive!!

Charles A. Luther

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CHAPTERS' CORNER

AESS & GRS-S Vancouver Chapter

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The Vancouver Chapter of the IEEE Aerospace and Electronic Systems Society (AES-S) and the IEEE Geoscience and Remote Sensing Society (GRS-S) was formed in 2001 for the benefit of our local AES-S and GRS-S members.

The objectives of the chapter meetings are to promote exchange of technical information, to encourage social interaction among the IEEE AES-S and GRS-S members, to attract new IEEE members, and to generate awareness of the local industrial and academic communities. Our local community encompasses the province of British Columbia (BC), except for Vancouver Island, which is part of the Victoria Section, and parts of Northeastern BC, which are part of the Northern Canada Section.

Since the formation of this chapter, our monthly meetings have attracted a sizable audience of 19 to 60 people. We hold eight meetings per year and welcome all IEEE, non-IEEE, and student members. The meetings are all held during mid-week, in the middle of the month, and the same location. The consistency of this schedule enables members to plan their busy work schedules around the meetings. When the attendees arrive at 5:30 pm, light snacks and drinks are available, providing an opportunity for them to socialize and network before the program starts.

Our technical talks start promptly at 6:00 pm and last approximately two hours, depending on the speaker and interactions during the questions-and-answers period at the end of each talk. Each meeting is held at MacDonald Dettwiler, in a high-tech park within walking distance of other companies such as Raytheon, Sierra Wireless, Broadcom, and Brooks. Our location is equidistant from our three local universities, the University of British Columbia (UBC), Simon Fraser University, and the British Columbia Institute of Technology.

MacDonald Dettwiler (MDA) has been the major corporate sponsor for meetings, administrative support, and refreshments. MDA has been in the aerospace and remote sensing business for over 34 years and employs 2,300 worldwide, 900 of which work in our Richmond facility. This provides a ready source of speakers and attendees.

The current Chapter Chair is Mr. Jerry Lim. An MDA administrative assistant helps to order the refreshments, book the meeting rooms, welcome the attendees, and prints the meeting announcements for our local high tech companies. We are also well supported by the IEEE Vancouver Section through publication of meeting announcements in their monthly Contact newsletter and their web site. In addition, the IEEE Vancouver Section supports dinner for the speakers and provides them with a plaque. In addition, two IEEE student volunteers from UBC update the AES-S / GRS-S web site and compile an e-mail list of attendees of previous meetings used for reminders of upcoming events.

There was some work involved in formation of the Chapter, i.e. finding local speakers and volunteers, advertising, and writing monthly status reports. However, over time this became easier because we are now more organized. During the summers, we enlist our eight speakers for the following year. By September, we advertise the speakers for the September to April meetings. We developed advertising and report templates that reduce administrative overhead. We used the IEEE member database for the Vancouver Section to begin our first e-mail list. After each meeting, we add new members to our database and remove e-mail addresses that bounce. After one year of chapter operations, speakers and volunteers began to come forward unsolicited.

For our first meeting in September 2001, Dr. John MacDonald, cofounder of MDA, gave a presentation entitled, "Past, Present and Future of Remote Sensing Technology." Dr. MacDonald is an excellent speaker and attracted a full house. His talk focused on his perspective the evolution of space borne remote sensing from the late 1960's into the twenty-first century. Dr. MacDonald discussed the interpretation of data from various sensors and some of the advanced techniques for extracting desired information. He identified some of the technical challenges in the field and expectations for future development. His presentation emphasized Canada's role in the development of this technology, and what its impact on our future is likely to be.

Another example of our technical talks is a presentation by Dr. Martie Goulding in December 2002. Dr. Goulding discussed the basic problem of detecting, locating, and tracking moving vehicles from an airborne or space borne radar platform. He described systems such as the Ground Moving Target Indication (GMTI) radar and others using Space Time Adaptive Processing (STAP), Displaced Phase Centre Antenna (DPCA), and Along Track Inteferometry (ATI) techniques.

If you enjoy geoscience, remote sensing, and aerospace technologies, I encourage you to volunteer as an officer in your local Chapter. If you live where no Chapter exists, consider helping to start one! You will meet others with common interests and the willingness to help your Chapter succeed. Also, if you happen to be in Vancouver, please stop by and attend one of our meetings. If you are surfing the Net, please have a look at http://www.ieee.ca/vancouver/grs.

Liebe Receives 2002 IEEE Harry Diamond Memorial Award

Dr. Hans J. Liebe (F'87) of Boulder, Colorado, was selected as the 2002 recipient of the Harry Diamond Memorial Award, one of the highest recognitions of technical achievement conferred by the IEEE-USA, the 230,000-member United States unit of the IEEE. The award was presented to Dr. Liebe on Saturday, March 29, 2003, in a ceremony at the Hilton Seattle Airport Hotel in Seattle, Washington.

Dr. Liebe was honored for his outstanding technical contributions during his 30-year career at the Institute for Telecommunication Sciences (ITS) in Boulder, the research laboratory of the National Telecommunications and Information Administration (NTIA), U. S. Department of Commerce.

Dr. Liebe is internationally recognized for his pioneering research in the interaction of millimeter radio waves with the Earth's atmosphere. His Millimeter-wave Propagation Model (MPM) has been widely distributed and used by researchers all over the world for over 15 years. The applications of MPM include passive and active microwave remote sensing of the Earth's atmosphere and surface, propagation through the Earth's atmosphere for a wide range of wireless communication applications, and new radio wave applications such as collision avoidance radars for automobiles.

The Harry Diamond Memorial Award recognizes outstanding technical contributions in the field of electrotechnology while in U. S. Government service. The citation to Dr. Liebe states "for pioneering contributions to the microwave spectroscopy of oxygen and water vapor and for the development of models of complex refractivity of the atmosphere."

Dr. Liebe is a Fellow of the IEEE and a member of the International Union of Radio Scientists (URSI), Commissions A and F. Previously he has received two silver medals (in 1984 and 1991) from the U.S. Department of Commerce for meritorious service.

- E.R. Westwater and A.J. Gasiewski

GRS-S Members Elevated to the Grade of Senior Member from June 2002 to May 2003

Congratulations to the following 48 IEEE GRS-S members who were elevated to the Senior membership grade during the period June 2002 to May 2003. Their names and dates of elevation are listed below.

June 2002: David W Paglieroni.

August 2002: Thomas L. Ainsworth, Rodney G. Roberts, and Eugenio Sansosti.

September 2002: Henry Berger, Jing Li, Christoph Gierull, and Didier Henri Massonnet.

November 2002: Guifu Zhang, Saibun Tjuatja, Magda O. El-Shenawee, René Marklein.

January 2003: Kung-Hau Ding, Joel T. Johnson, Raymond P. Wasky, Josefino Comiso, Charles L. Walthall, Valery U. Zavorotny, Ronald Kwok, Son V. Nghiem, Helmut Rott, Fabrizio Lombardini, Jan Flusser, Jouni T. Pulliainen, Konstantinos Papathanassiou, Adriano Camps, and Yisok Oh.

February 2003: Stephen J. Frasier, Steven W. Ellingson, Edward J. Walsh, Ian R. Joughin, Jean-Pierre Wigneron, Tazio Strozzi, and Hong Tat Ewe.

April 2003: Long S. Chiu, Patrick K. Simpson, Thomas W. Cooley, Ellsworth F. LeDrew, Peter Coppo, Joong-Sun Won, Paul C. Smits, Umberto Spagnolini, Ebbe G. Nyfors, Borisas Levitas, and Urs Wegmuller.

May 2003: Dorothy K. Hall, Peggy E. O'Neill, and Christian Matzler.

Senior membership has the following distinct benefits:

- The professional recognition of your peers for technical and professional excellence.
- An attractive fine wood and bronze engraved Senior Member plaque to display proudly.
- Up to $25.00 gift certificate toward one new Society membership.
- A letter of commendation to your employer on the achievement of Senior member grade (upon request of the newly elected Senior Member).
- Announcement of elevation in Section/Society and/or local newsletters, newspapers and notices.
- Eligibility to hold executive IEEE volunteer positions.
- Can serve as Reference for Senior Member applicants.
- Invited to be on the panel to review Senior Member applications.
- Eligible for election to be an IEEE Fellow.

Applications for Senior membership can be obtained form IEEE GRS-S website:
http://ewh.ieee.org/soc/grss/ (click Join Us)
or the IEEE Senior membership program:
http://www.ieee.org/organizations/rab/md/smprogram.html

Call for Nominations

All GRS-S members are requested and encouraged to become active in nominating candidates for GRS-S awards:

GRS-S Distinguished Achievement Award

Eligibility: IEEE membership is not required, but is recommended.

The Distinguished Achievement Award was established to recognize an individual who has made significant technical contributions, usually over a sustained period, within the scope of the Geoscience and Remote Sensing Society. In selecting the individual, the factors considered are quality, significance and impact of the contributions; quantity of the contributions; duration of significant activity; papers published in archival journals; papers presented at conferences and symposia; patents granted; advancement of the profession. The award is considered annually and presented only if a suitable candidate is identified. The awardee receives a plaque and a certificate.

GRS-S Education Award

Eligibility: Member or Affiliate Member of the IEEE GRS-S; Attend IGARSS'03 Banquet to receive the Award.

The purpose of this award is to reward significant educational contributions in the field of remote sensing. The award shall be considered annually, but will only be awarded when an outstanding recipient is identified.

GRS-S Outstanding Service Award

Eligibility: Must be an IEEE GRS-S member.

The Outstanding Service Award was established to recognize an individual who has given outstanding service for the benefit and advancement of the Geoscience and Remote Sensing Society. The award shall be considered annually but not be presented if a suitable candidate is not identified. The following factors are suggested for consideration: leadership, innovation, activity, service, duration, breadth of participation and cooperation. The awardee receives a certificate.

Please send a letter of nomination describing the specific contributions of the nominee directly to:

Prof. Werner Wiesbeck
Chair, GRS-S Awards Committee
University of Karlsruhe, Institute for High Frequency and Electronics
Kaiserstrasse 12, 76128 Karlsruhe
GERMANY
E-Mail: werner.wiesbeck@ihe.uka.de

The previous recipients are listed below:

Year	DAA	OSA	EA
1981	—	H. Kritikos	
1982	R. Moore	F. Ulaby	
1983	F. Ulaby	J. Eckerman	
1984	D. Hogg	K. Carver	
1985	J. Wait	R. McIntosh	
1986	V. Salomonson	K. Tomiyasu	
1987	C. Elachi	A. Sieber	
1988	Guyot	D. Landgrebe	
1989	A. Fung	J. Reagan	
1990	—	K. Raney	
1991	E. Schanda	K. Itten	
1992	D. Landgrebe	C. Swift	
1993	K. Raney	R. Doviak	
1994	C. Swift	M. Hallikainen	
1995	J. Reagan	D. Goodenough	
1996	D. Staelin	A. Blanchard	
1997	R. McIntosh	V. Salomonson	
1998	A. Ishimaru	W. Keydel	
1999	M. Hallikainen	J. Smith	
2000	J. Kong	L. Tsang	
2001	W. Keydel	J. Gatlin	—
2002	W. Wiesbeck	T. Jackson	N. Khazenie
2003	E. Westwater	R. Narayanan	D. Landgrebe

Call for Nominations for the IEEE GRS-S Administrative Committee. Deadline: May 31, 2003

The Nominations Committee calls upon our membership to nominate members to serve on the GRS-S Administrative Committee (AdCom). A **nominating petition** carrying a minimum of five names of Society members, excluding students, shall automatically place that nominee on the slate, although the Nominations Committee may choose to include a name on the slate, regardless of the number of names on the nominating petition. Your nominees should **confirm in writing** their willingness to stand for election.

A brief biography of the nominee, similar to that used for TGARS authors, will be required and should be **submitted** with the nominating petition **by June 15, 2003,** to the GRS-S Nominations Committee, c/o Martti Hallikainen, Nominations Chair, Helsinki University of Technology, Laboratory of Space Technology, P.O. Box 3000, 02015 HUT, Finland; Fax: +358.9.451.2898; E-mail: martti.hallikainen@hut.fi.

The slate derived by the Nominations Committee shall be presented to the Society membership at large via mail ballot, and the three candidates receiving the greatest number of votes shall be elected. The Administrative Committee shall hold an Annual Meeting in October 2003 after the results of this vote are known, at which time elections will be held to fill the remaining regular vacancies in the Administrative Committee to occur on January 1, 2004.

Our AdCom consists of 18 elected persons, each of whom serves for three years. Their terms are overlapping to assure continuity. Additional information on the Society and the AdCom is available at http://ewh.ieee.org/soc/grss. There is no remuneration for serving on the AdCom, other than the knowledge and recognition of having made additional contributions to the well-being of our colleagues and our profession.

We need your involvement and support!

Statement of the IEEE-USA Board of Directors on Remote Sensing

(Approved by the IEEE-USA Board of Directors, 12 February 2003)
(Reprinted from http://www.ieeeusa.org/forum/positions/remotesensing.html)

Since its formation in 1950, the National Aeronautics and Space Administration's mission has expanded from a focus on space exploration to encompass many related areas, including development of innovative aerospace remote sensing technologies. The ability to provide remote sensing of the Earth's surface and atmosphere is one of the truly unique capabilities of the nation's aerospace program. These remote sensing technologies detect and record electromagnetic radiation that is reflected or emitted from the surface of the earth. The collected data is used by various Federal agencies to increase our understanding of the earth and for defense purposes. For instance, civil airborne remote sensing systems can detect air, ground and water pollution due to spills caused by pipeline breaks, ship disasters and train wrecks.

In order to continue its vital measurement programs and compete with growing and aggressive foreign remote sensing business activities in an environment of increasing fiscal austerity, the United States government must adopt policies that will lead to the development of an efficient, internationally competitive remote sensing industry that balances private sector growth with public sector capability. Toward this end, the IEEE-USA recommends U.S. remote sensing policies that:

- Ensure maximum availability of the government's aerospace remote sensing data for use by the U.S. private sector and educational institutions.
- Support the worldwide preservation of appropriate segments of the radio-frequency spectrum for use by Earth and atmosphere observation systems.
- Support the use of civil airborne remote sensing systems and adequately maintain these programs within NASA and NOAA.
- Support development of remote sensing applications within agencies that have a strong national mandate to provide new operational products and services.
- Encourage transfer of near-operational remote sensing services to non-NASA agencies.
- Support remote sensing calibration and validation activities within non-NASA agencies.
- Encourage the use of advanced remote sensing technologies such as hyper-spectral imaging radar and laser imaging.
- Decrease duplicative remote sensing operations among Federal agencies.
- Encourage Federal agencies to develop improved methods for sharing remote sensing equipment and services between each other.

The government should also support remote sensing policies that encourage private investment in U.S. commercial space ventures. New policies should also encourage, advocate, fund, and support the use of remote sensing data products as an educational tool for all age levels.

PACE Time

John Reagan has stepped down as GRS-S PACE chair. John served as society PACE chair for more than 5 years, during which time he made regular contributions to the Newsletter on PACE related activities. At the March 2003 meeting, the IEEE GRS-S AdCom appointed Paul Racette to the GRS-S PACE chair. Paul is senior member of the Microwave Instrument Technology Branch's technical staff at the NASA Goddard Space Flight Center. In future issues, he will start a series of interviews with senior members of GRS-S, addressing relevant topics for our Society. Please do not hesitate to contact him for PACE-related issues.

Mr. Paul Racette, GRS-S PACE Chair
Code 975
NASA Goddard Space Flight Center
Greenbelt, MD 20771
E-mail: Paul.E.Racette@nasa.gov

The GRS-S Technical Committees: Voices of the Geoscience and Remote Sensing Society

Albin J. Gasiewski
GRS-S Executive Vice President
E-mail: al.gasiewski@noaa.gov

Paul C. Smits
GRS-S Vice-President of Technical Activities
E-mail: paul.smits@ieee.org

Roger L. King
Chair, GRS-S Data Archiving and Distribution Committee
E-mail: rking@ece.msstate.edu

Commensurate with the growth of the Geoscience and Remote Sensing Society, it has been an increasing need for the Society to actively promote its technical areas of interest by identifying new means of remote sensing and addressing timely and critical issues affecting the remote sensing community. The areas and issues are many and varied, and include frequency allocations, coordination, and support of new technology development, amalgamation of remotely sensed data, establishment of standards, and new applications of remote sensing. While the Society promotes individual dissemination of information through its publications, conferences, and educational activities, the development of coherent opinions and organizational actions on new areas and issues has required a means of proactively drawing from the best of its membership. Pursuant to this goal, in 1994, the GRS-S AdCom chartered the formation of three standing technical committees of its membership charged with providing direction and voice for the Society on new areas and issues in remote sensing. In this article, we discuss the charges, history, evolution, and accomplishments of the GRS-S technical committees, and how they serve the GRS-S membership.

History

In 1994, Charles Luther was appointed by the GRS-S AdCom as Chair of Technical Activities and charged with devising a means of developing Society-wide consensus on new technical areas and issues. Before this action, the Society had no formal bodies for developing consensus, and a sense of the importance of technical direction and voice for the GRS-S was widespread. In response to this need, Chuck organized the three original standing technical committees (TCs) of the GRS-S: the Data Fusion (DF), Data Standardization and Distribution (DSD), and Instrumentation and Future Technologies (IFT) TCs. The general charter for each of the TCs as proposed by Chuck and approved at the Pasadena AdCom meeting in August of 1994 reads:

"The ——- Technical Committee is an established committee […] with the primary purpose to provide a special focus on certain research and technology areas, to assist in bringing them to maturity in some cases, or in fostering applications in others; all with a view toward encouraging and promoting the technical activities of the Society. […]

The first meeting of the TCs was held under Chuck's direction on August 10, 1994 at the Caltech Athenaeum. An unexpected fifty plus individuals pushed the meeting into a larger space with the end result being the establishment of the three original committees, and the election of their founding chairpersons: Curt Davis (IFT), Wooil Moon (DF), and Tony Freeman (DSD).

In 2000, Al Gasiewski succeeded Chuck as GRS-S Vice President of Technical Activities, and continued TC development by chartering a fourth committee: the Frequency Allocations in Remote Sensing (FARS) TC. In 2002, Jon A. Benediktsson suc-

Table 1. History of GRS-S Technical Committee chairs and (listed below) their co-chairs.

Year	Instrumentation and Future Technologies	Data Fusion	Data Standardization and Distribution*	User Applications of Remote Sensing	Frequency Allocations in Remote Sensing
1994	Curt Davis [H]	Wooil Moon [H]	Tony Freeman [H]		
1994-95	Curt Davis	Wooil Moon	Tony Freeman		
1995-96	Paul Racette	Wooil Moon	William J. Emery		
1996-97	Paul Racette	Jon A. Benediktsson Thomas Cooley	Daniel Ziskin		
1997-98	Jonathan A. Rall	Jon A. Benediktsson Thomas Cooley	Daniel Ziskin		
1998-99	Jonathan Rall	Jon A. Benediktsson Thomas Cooley	Daniel Ziskin		
1999-2000	Gary G. Gimmestad David DeBoer	Paul C. Smits Olaf Hellwich	Larry E. Fishtahler Richard E. Ullman		
2000-01	Gary G. Gimmestad David DeBoer	Paul C. Smits Olaf Hellwich	Larry E. Fishtahler Richard E. Ullman		Ram Narayanan [H]
2001-02	Gary G. Gimmestad Jeffrey R. Piepmeier	Paul C. Smits Olaf Hellwich	Roger L. King		Ram Narayanan Christopher S. Ruf
2002-03	Gary G. Gimmestad Jeffrey R. Piepmeier	Olaf Hellwich Palma Blonda	Roger L. King Liping Di	Ellsworth LeDrew [H] Venkat Lakshmi [H]	Christopher S. Ruf Ram Narayanan

* Renamed the "Data Archiving and Distribution" TC in 2002.
H Founding committee chair.

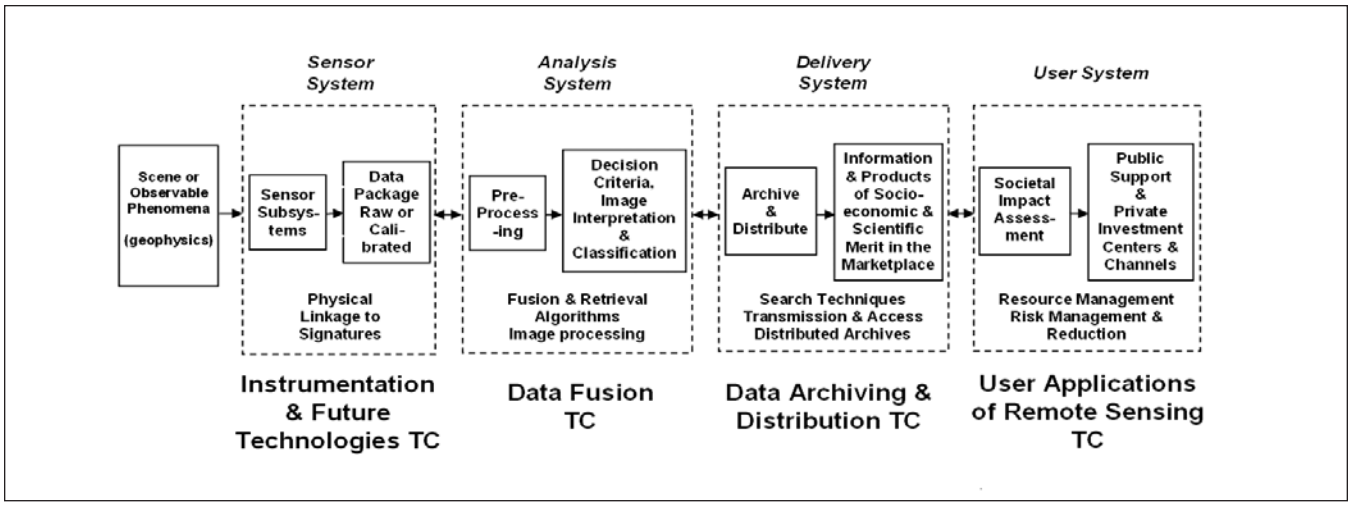

Fig.1. End-to-end model of the remote sensing process showing the relations between several of the various GRS-S Technical Commitees.

ceeded Al and added the User Applications of Remote Sensing (UARS) TC. There are now five standing TCs within the GRS-S that cover the breadth of GRS-S technical activities (IFT, DF, DAD, and UARS, see Figure 1) along with one (FARS) charged with providing a special focus on issues related to spectrum management. The TCs are currently managed by Paul Smits, the GRS-S VP of Technical Activities.

Participation on a GRS-S technical committee is encouraged, and is open to any member of the Society. Individual TC membership has ranged from a few to over sixty members. The activities of each committee are coordinated by a TC chair, and (more recently) assisted by a co-chair. The nominal terms of office for the chair and co-chair start on September 1 and run through August 31 each year. The TC chair is determined each August by election among the TC membership. Immediately after the election or re-election, the TC co-chair is selected by the chair. A history of the TC chairs and their co-chairs is provided in Table 1.

Operations and Activities

Consensus within the GRS-S TCs is achieved primarily through two means:

1) TC communications conducted by e-mail and web site, and
2) Annual organization of special sessions at each International Geoscience and Remote Sensing Symposium (IGARSS).

These activities typically occur during the fall/winter and spring/summer seasons, respectively. Each year at IGARSS, the Society has traditionally held at least one special session for each of the TCs - sessions that have historically been well attended. Each TC meets during its special IGARSS session along with additional sidebar organizational meetings during IGARSS. During the fall and winter, each TC chair updates the membership rosters, position statements, and web pages for their committee. During this period, the chairs also develop an agenda for their technical session at the upcoming IGARSS. During the spring, TC members develop their extended abstracts and presentations for IGARSS. The primary summertime activity for each TC is the IGARSS special session and related organizational meetings.

Each TC chair or their designee is invited to attend the spring IGARSS Technical Program Committee and AdCom meeting. At the AdCom meeting, each chair or designee provides a presentation of TC activities during the past year and ongoing and proposed activities for the current year. The GRS-S also holds a technical committee luncheon each year at IGARSS. This luncheon has provided an annual opportunity for all members of the various technical committees to meet under one roof, thus allowing the members to become familiar with each other's activities and interests. Each TC chair or their designee provides a brief discussion during the luncheon of their activities.

Technical Committee Scope

The specific charges of each committee have been tailored to serve the GRS-S membership by promoting the end-to-end process of remote sensing, that is, from sensor physics to applications (Figure 1), and including radio frequency coordination. A detailed description of each TC follows.

1. ***Data Fusion (DF) Technical Committee***
   Chair (2002-2003): Dr. Olaf Hellwich,
   Technical University Berlin, Germany
   hellwich@fpk.tu-berlin.de
   Co-chair: Dr. Palma Blonda,
   CNR-IESI, Italy
   palma.blonda@iesi.ba.cnr.it
   Web page: http://www.dfc-grss.org

The DF TC first met at IGARSS 1994 in Pasadena to discuss issues pertaining to geospatial data fusion in remote sensing. The goal of data fusion is to develop improved remotely sensed information by amalgamating data from distinct sources, for example, from sensors using different spectral bands, spatial responses, and/or detection principles. Data fusion comprises issues ranging from registration and pixel-level fusion of data for improving the

spatial resolution of imagery to decision level fusion by using previously computed information stored in Geographic Information Systems (GIS). The charge to the DF TC is:

"To serve as a global, multidisciplinary, network for geospatial data fusion, connecting people and resources. The DF TC aims at educating students and professionals, and at promoting best practice in data fusion applications."

The DF TC serves as an international multidisciplinary network for geospatial data fusion, connecting people and resources. It seeks to educate students and professionals in best practices in data fusion applications and enhance knowledge of developments important for the application of data fusion such as standardization, metadata, and interoperability. The DF TC has historically been the most active of the TCs, partly because of members' interests and partly because of the extensive organizational efforts of its chairs. It has a well-maintained and visited web site that provides benchmark data sets for data fusion studies. More information on data fusion techniques can be found in a special issue of the IEEE Transactions on Geoscience and Remote Sensing published by the DF TC and in a strategy paper on data fusion by the committee.

2. Data Archiving and Distribution (DAD) Technical Committee

Chair (2002-2003): Dr. Roger L. King,
Mississippi State University, USA
rking@ece.msstate.edu
Co-chair: Dr. Liping Di,
George Mason University, USA
ldi@gmu.edu
Web page: http://www.dad-grss.org

Remotely sensed data streams or data sets often push available transmission and storage technology to extreme limits, and thus require special techniques in their handling, distribution, application, rendering, fusing, mining, and compression. The DAD TC (originally entitled the Data Standardization and Distribution TC) promotes the study of the manipulation and rendering of large data sets for geoscientific purposes. The original charge to the DSD TC as approved in 1994 was:

"To study the standardization and application of remotely sensed data with particular emphasis on storage, distribution, visualization, and analysis."

Since data standards are intimately connected to the associated application software (within which data is ultimately used), as well as the telecommunication channels and media used for its transmission and storage, it was decided by the AdCom in 2001 that the charge of the DSD TC be modified to better reflect rapid evolution in data transmission, storage, and access. Accordingly, the name was changed to the Data Archiving and Distribution (DAD) TC, with the following charge:

"To provide recommendations and responses to issues related to the archival and distribution of remotely sensed geospatial and geotemporal data, and on how new media, transmission means, and networks will impact the archival, distribution, and format of remotely sensed data. Also, to study the impact of media, channel, and network scaling on the archival and distribution of data."

The DAD TC develops a prioritized agenda for research in data archiving and distribution via inputs from its TC membership. A special responsibility of the DAD TC is to function as a liaison between the IEEE GRS-S and the International Standards Organization (ISO) on standards for geographic information (ISO TC211). This liaison was organized with the assistance of George Percival of the NASA Goddard Space Flight Center in 2000. The DAD TC now serves as a clearinghouse for coordinating any GRS-S members' comments on ISO TC211 proposed standards.

The DAD TC will be sponsoring a special technical session at IGARSS '03 on "Best Practices for Geospatial Data Management," immediately after which will be a TC meeting. A DAD TC special session on "Special Requirements for Climate Change Records" is being planned for IGARSS '04. The DAD TC supports a web site listing the past papers sponsored by the DAD TC and linking to related sites of interest.

3. Instrumentation and Future Technologies (IFT) Technical Committee

Chair (2002-2003): Dr. Gary G. Gimmestad,
Georgia Tech Research Institute, USA
gary.gimmestad@gtri.gatech.edu
Co-Chair: Dr. Jeffrey R. Piepmeier,
NASA Goddard Space Flight Center, USA
Jeffrey.piepmeier@nasa.gov
Web page: http://www.ift-grss.org

The IFT, as one of the original three TCs, began its work in 1994 with the following charge:

"The IFT promotes the dissemination of technical information related to new remote sensing instrumentation and related technologies."

Over the years, the IFT has expanded its mission to include identifying and advocating promising new remote sensing technologies. In this role, the committee furnishes a contributing member to the IEEE New Technology Directions Committee (NTDC) and annually provides the NTDC with a succinct list of technology development needs known as "one-liners." The IFT TC also continues its original charge to disseminate technical information, but its larger vision is to

influence R&D investments to optimize the global remote sensing capabilities of the future.

The committee has identified three key technology areas that pose significant challenges to the remote sensing community, specifically in instrumentation, in the coming years. The first area is reducing the size, power requirements, and cost of remote sensing instrumentation, to promote more widespread application and more feasible access to space. This area includes the following technologies: large aperture antennas, MMIC technologies for millimeter- and sub millimeter-wave components, low noise receivers (superconducting technologies, cryogenic coolers), digital signal processors, high-speed correlators, and fast analog to digital converters. The second area is developing infrastructure in the rapidly changing world of computing and networking to process and disseminate the terabytes of data per day anticipated from remote sensing platforms. Applicable technologies include efficient search and retrieval of archived data, data compression, improved utilization of the Internet for data distribution, and standardization of remotely sensed data formats. The third area is implementing data fusion, including standardization of instrument and algorithm calibration, supercomputing to incorporate remotely sensed data into global weather and climate models, cross calibration of remotely sensed data from instruments with different spatial and temporal resolution, and distributed network computing for the operational assimilation of remotely sensed data.

4. Frequency Allocations in Remote Sensing (FARS) Technical Committee

Chair (2002-2003): Prof. Christopher S. Ruf,
University of Michigan, USA
cruf@umich.edu
Co-chair: Prof. Ram Narayanan,
University of Nebraska, USA
rnarayanan@unl.edu
Web page: http://www.fars-grss.org

Frequency allocation and related interference problems remain areas of growing importance to the GRS-S, particularly to individuals engaged in passive microwave remote sensing. Accordingly, the charge of the FARS TC is:

"To provide recommendations and responses to issues on interference and frequency allocations in passive and active microwave remote sensing. The specific questions and issues of concern include those currently being addressed by the ITU Working Party 7C, U.S. CORF, and European CRAF, as well as issues to be discussed at upcoming World Radio Conferences (WRCs) and those forwarded by AdCom through the VP of Technical Activities."

The formation of this fourth technical committee was approved by the AdCom in February 2000. The FARS TC provides technical assessments, guidance, and recommendations regarding matters of frequency sharing and interference between remote sensing and other uses of the radio wave spectrum. Its specific objectives include:

1) Maintaining up-to-date data on present and projected user requirements and sensor specifications for radiometric frequencies, bandwidths, and sensitivities, including scientific rationale for such requirements,
2) Providing a standardized methodology for computing the appropriate link budgets to assess radio frequency interference between the most common types of remote sensing instruments and anthropogenic radio sources,
3) Responding to requests for instrument and user requirements information and technical interference assessments from outside organizations and individuals,
4) Proactively investigating potential interference problems, and
5) Promoting the development, analysis, and dissemination to interested parties of interference mitigation techniques.

Well-attended FARS sessions on "Frequency Allocations in Remote Sensing" were held at IGARSS 2000 and 2002. Several issues pertinent to the allocation and protection of passive microwave sensing bands were discussed, including potential new methods for interference mitigation. A third special session will be held at IGARSS 2003 in Toulouse, France.

5. User Applications of Remote Sensing (UARS) Technical Committee

Co-Chairs (2002-2004): Prof. Ellsworth LeDrew,
University of Waterloo, Canada
ells@watleo.uwaterloo.ca
Prof. Venkat Lakshmi,
University of South Carolina, USA
venkat-lakshmi@sc.edu
Web page: http://www.uars-grss.org
(link to be activated summer 2003)

Satellite and other remotely sensed data have had major impact on the face of science, industry, and policy. Recognizing that it is at the user level that the value of remotely sensed data is manifested, the GRS-S in November 2002 approved on a two-year trial basis the formation of a technical committee to focus on user applications of remote sensing. The charge of the UARS TC is:

To support the development of remote sensing applications within the broad communities of users in earth and atmospheric sciences and planetary science.

The UARS TC will work in close collaboration with the Canadian Remote Sensing Society (CRS-S) under an agreement between the IEEE GRS-S and CRS-S. The constituent communities will include scientific, societal, government, and administrative users, with synergetic linkages to related user societies including the, American Geophysical Union (AGU), European Geophysical Society (EGS), European Optical Society, American Meteorological Society (AMS), International Union of Geodesy and Geophysics (IUGG).

Proposed themes areas for the committee reflect new challenges in how the GRS-S can contribute to these constituent communities. These areas include:

1) Fusion of remotely sensed data for improving the accuracy of derived geophysical parameters,
2) Data mining of multidimensional data archives of various types and structures,
3) Regional and global environmental model development, including models incorporating feedback from multiple

ecosystems processes at several spatial and temporal scales, and 4) wideband distributed analysis techniques for remote sensing applications.

The UARS TC will hold its introductory meeting at IGARSS'03 at which there will be a discussion of the above themes and associated activities. A second meeting is being organized in conjunction with the CRS-S meeting in the fall of 2003.

Further Information

Information on the GRS-S Technical Committees can be obtained by visiting the GRS-S web pages at http://ewh.ieee.org/soc/grss/ or by directly contacting one of the TC chairs or co-chairs. Suggestions for papers to be presented in TC special sessions or special topics to be sponsored at upcoming IGARSS or related specialty symposia can be made to the committee chairs or co-chairs at any time.

TECHNICAL COMMITTEE REPORT

Technical Committee on Instrumentation and Future Technologies (IFT)

The Technical Committee on Instrumentation and Future Technologies (IFT) was formed at the IGARSS '94 Symposium held in Pasadena, CA, by the Technical Activities Committee of the IEEE Geoscience and Remote Sensing Society (GRS-S). The original aim of IFT was to promote and encourage dissemination of instrumentation and new remote sensing technology information within GRS-S and the broader remote sensing community. IFT accomplishes this goal through two main activities: the IFT web page and the IFT special session of invited papers at each IGARSS.

Our web pages provide ITF members access to technology-specific information and resources, and inform the public about instrumentation and future technologies in remote sensing. The website has three main functions. First, it provides a membership list with contact information so that members may network among institutions, which facilitates the accomplishment of technical work. Second, a library of technical briefs on various instrument categories is maintained. These technical briefs cover the spectrum from radio, millimeter-wave and far-infrared, to visible and ultraviolet wavelengths. Finally, the IFT has established three grand challenges in instrument technology development and views them as direction signs for the broader technology development community. The IFT strives to encourage research and development in those areas that will advance the state-of-the-art in remote sensing instrumentation.

The chairpersons of IFT also organize an annual IGARSS special session of invited talks on IFT throughout all areas of remote sensing. We solicit papers covering a broad range of topics in passive and active, microwave and optical remote sensing. Oral presentations might cover new components technologies several years away from operational usage or new instruments in development or shortly after their "first-light" measurements. While the IFT already has internationally-based membership, we strive to broaden the non-US participation in the invited session and IFT membership.

All GRS-S members are encouraged to contact one of the committee co-chairs if you are interested in contributing to IFT activities. There will be a special session on IFT in the technical program at the IGARSS'03 meeting this July in Toulouse, and the committee will hold a business meeting. The session will be an opportunity to hear the IFT oral papers, meet with some of the community of GRS-S members involved with IFT issues, and consider joining the IFT. The committee meeting will be open to all interested persons. We look forward to seeing you there.

Sincerely,
Dr. Gary Gimmestad, GTRI,
Georgia Institute of Technology
Dr. Jeffrey Piepmeier,
NASA's Goddard Space Flight Center

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Microwave Instrument Technology Branch
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INDUSTRIAL PROFILE

Ball Aerospace & Technologies Corp.: Earth Science and Remote Sensing

Brian R. Johnson and William B. Gail
Ball Aerospace & Technologies Corp.
1600 Commerce Street, Boulder, CO 80306

Introduction

Earth observation from space is an increasingly valuable tool for managing natural resources, understanding and predicting weather and climate, monitoring natural hazards, and ensuring national security. Ball Aerospace & Technologies Corp. has been supplying scientific instruments, imaging systems, and spacecraft to meet these needs for over 40 years. From the first solar observatory of the 1960s, to corrective optics for the Hubble Space Telescope in the 1990s, to today's highest resolution commercial Earth imaging satellite Quickbird, Ball has consistently delivered high quality, state-of-the-art spaceborne systems that outperform expectations for aerospace, government and commercial customers. Ball spacecrafts are designed specifically for remote sensing applications, providing high precision pointing control and knowledge, and accommodating a wide range of instruments from very high resolution imaging cameras to large active microwave systems.

Building on this long history of success, Ball is pioneering the exploration missions of the new millennium and designing the next generation of weather satellites. During the next decade, Ball products will produce critical observational data needed by NASA and University researchers to make possible more precise weather forecasts on Earth, and to unravel the perplexing questions about how our planet is changing.

Capabilities

Ball Aerospace & Technologies Corp. is a wholly owned subsidiary of the Ball Corporation, a Fortune 500 company. Ball Aerospace's major development facilities are located in Boulder, Broomfield, and Westminster, Colorado (Fig. 1). Approximately 2,100 of the company's 2,500 employees work in the Ball Aerospace facilities in the Boulder area, with the rest distributed throughout the United States in facilities established to support specific customer needs. Ball's resources include extensive laboratory, manufacturing, and test facilities for commercial, military and space flight hardware. These facilities, located Northwest of Denver, within 10 miles of each other, include all of the resources required for the design, production, and test of state-of-the-art antennas, satellites, electro-optical and microwave instruments, spacecraft subsystems, cryogenic devices, and video systems. Ball capabilities support every aspect of spaceborne mission development, from conceptual design through on-orbit data processing and distribution.

Ball is an industry leader in space sensor technology. Ball has built or integrated more than 300 different sensors and instruments that detect the full range of the electromagnetic spectrum, charged particles, and neutral particles. In addition, Ball provides sophisticated electro-optical instruments for manned and unmanned space missions as well as strategic surveillance, space defense, and remote sensing. Since Ball's aerospace venture began in 1956, Ball has designed many "firsts," including pointing controls for rockets, the first spin-stabilized satellites, cryogenic systems for the Space Shuttle, microstrip antennas, and the optics that corrected the Hubble's flawed mirror. Understanding challenging mission requirements and the ability to provide unique solutions to difficult problems continues to be one of Ball's strengths.

Ball-built optical and spacecraft components provide enabling technologies for the full range of Earth-sensing systems. These systems include high precision star trackers to measure the angular locations of stars for use in accurate spacecraft attitude determination. Ball has been a leading supplier of general-purpose star trackers for three decades. Ball is a leading developer of state-of-the-art sensor passive and active cooling systems with a history that dates back to the early 1970's. Technologies include Dewar systems housing solid hydrogen, nitrogen, superfluid helium, and solid ammonia cryogens. Development of Stirling-cycle and Joule-Thompson mechanical refrigeration systems has led to fabrication and delivery of the 60 K Stirling cryocooler subsystem for the High resolution Dynamics Limb Sounder (HIRDLS) to be flown on NASA's Aura Mission in early 2004.

Fig. 1. Ball Aerospace's Boulder facility

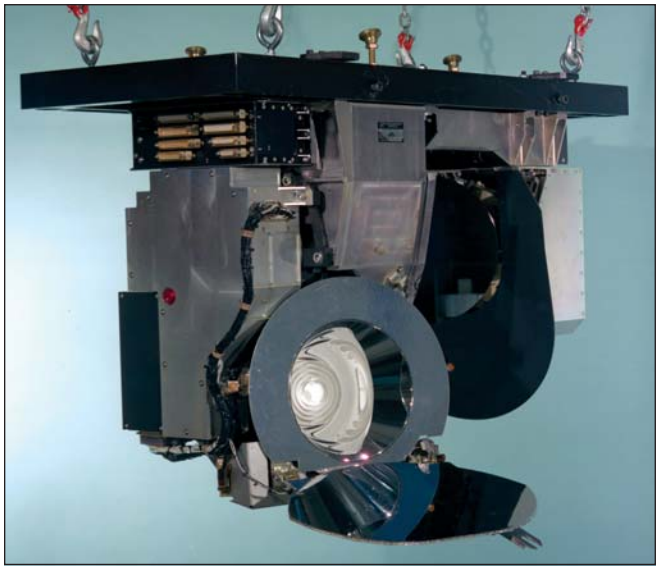

Fig. 2. Ball's Coastal Zone Color Scanner

Heritage

One of the earliest sensors developed by Ball for Earth observation was the Coastal Zone Color Scanner (CZCS, Fig. 2). It was an Earth-scanning 6-channel VIS/IR radiometer and flew on the NIMBUS 7 satellite. An 8-year operational life significantly exceeded its 1-year design life specification. Ball's involvement in Earth science missions continued with the development of the operational Solar Backscatter Ultraviolet Radiometer/2 (SBUV/2) for NOAA's Polar Orbiting Environmental Satellite. Seven flight models have been built, tested, and delivered. The first sensor was launched in 1984, and the most recent was launched in June 2002. SBUV has exhibited excellent on-orbit performance with long-term calibration stability providing accurate observations of atmospheric ozone concentration and its distribution in altitude and around the globe.

Fig. 3. Space Shuttle SRTM Mission

Recently, Ball built three Stratospheric Aerosol and Gas Experiment III (SAGE III) instruments for the Earth Observing System (EOS), a part of NASA's Mission to Planet Earth. SAGE III is the fifth in a family of remote sensors developed and flown in the past 20 years by NASA. Previous instruments include the Stratospheric Aerosol Measurement instruments (SAM and SAM II). SAM II was successfully flown aboard NIMBUS 7 (l978); SAGE II was launched aboard the Ball Aerospace-built Earth Radiation Budget Satellite (ERBS) in 1984, and is still operating in orbit. SAGE III was successfully launched on a Russian Meteor 3M spacecraft on December 10, 2001, from the Baikonur Cosmodrome in Kazakhstan.

With increasing scientific interest in the impact that clouds and aerosols have on the Earth's radiation balance, NASA is developing a mission under its Earth System Science Pathfinder program specifically to address this issue. Ball Aerospace is responsible for supplying the three scientific instruments and the communications equipment for the mission, called the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO). Ball will provide an active Lidar sensor that probes the atmosphere with green and infrared laser light, a wide-field visible light camera, and a three-color infrared imaging radiometer. This instrument suite will fly aboard the *Centre National d'Etudes Spatiales Plateforme Reconfigurable pour l'Observation, les Télécommunications Et les Usages Scientifiques Spacecraft*, built by Alcatel Space industries.

In addition to active and passive optical systems, Ball has been vigorously involved in development of spaceborne microwave hardware, with application to studies of land surface processes, topography, and measurement of winds over the ocean. For example, the Shuttle Imaging Radar (SIR-C) generated multi-frequency multi-polarization radar images from the Space Shuttle in April and October 1994, providing information on land surface processes such as crop type and health, freeze/thaw cycles, flooding, volcanology, and biomass. Ball participated in the NASA/JPL mission, providing the L-band and C-band antenna panels.

The NASA/JPL Space Radar Topography Mission (SRTM), flown onboard the Space Shuttle in January 2000 (Fig. 3), obtained the most complete high-resolution digital topographic database of the Earth to date. The Interferometric synthetic aperture dual-polarization, wide-swath C-band radar consisted of the previously flown SIR-C/X-SAR radar electronics and antennas operating from within the payload bay of the Space Shuttle. Outboard antennas are attached to the end of a 60-meter deployable mast. Ball provided the Outboard Antenna Subsystem (OAS), including the C-band antenna panels, the RF combiner network, the control and power distribution unit, the beam auto tracker, and the signal power harness.

In addition to developing spaceborne science payloads, Ball has a strong heritage building spacecraft designed specifically for remote-sensing applications, including high-resolution im-

aging and advanced synthetic aperture radar. These spacecraft are agile, and extremely stable with highly accurate pointing capability, making them ideal platforms for any type of Earth-remote sensing instrumentation.

Illustrating Ball's capable remote sensing buses is the recently launched spacecraft built for the NASA Ice, Clouds, and Land Elevation Satellite (ICESat) altimetry mission. It is based on the Ball Commercial Platform 2000 (BCP 2000). Originally designed to accommodate high-resolution cameras that acquire one-meter or better imagery, the BCP 2000 can accept any type of Earth sensing instrumentation. This spacecraft bus has also been used on previous NASA QuikSCAT (cover figure) and DigitalGlobe's QuickBird missions. ICESat employs the Geoscience Laser Altimeter System (GLAS) to measure changes in the Antarctic and Greenland ice sheets, where nearly 77 percent of the planet's fresh water is frozen. NASA's Goddard Space Flight Center designed and built GLAS, a next-generation space-based Lidar. Observations from ICESat will help answer fundamental questions about the shrinking of the polar ice sheets and future global sea level changes.

Ball will soon deliver a spacecraft based upon its BCP 2000 bus series for the NASA/JPL Cloud Satellite mission (CloudSat). Ball Aerospace is building the spacecraft and providing mission operations. The BCP 2000 bus height has been shortened for CloudSat to fit within the Delta Dual Payload Attach Fitting, and it has been modified to communicate through the Air Force Satellite Control Network's Space-Ground Link System. CloudSat will coordinate its measurements of the vertical structure of clouds using profiling radar with NASA's Earth Observing System Aqua mission. This formation of separate sensing platforms is dedicated to gathering data on the Earth's atmosphere. CloudSat is co-manifested with CALIPSO for an expected launch in 2004.

Future Directions

Ball continues to be committed to the development of advanced remote sensing instruments and spacecraft to meet the needs of future Earth science missions including NOAA's next-generation Geostationary Operational Environmental Satellite (GOES) Project, the NOAA/Department of Defense National Polar-orbiting Operational Environmental Satellite System (NPOESS), and the NASA Earth Science Enterprise.

The GOES satellites are the primary element of U.S. weather monitoring, forecast operations, and are a key component of NOAA's National Weather Service operations and modernization program. Spacecraft and ground-based systems work together to accomplish the mission of providing weather imagery and quantitative sounding data that form a continuous and reliable stream of environmental information used for weather forecasting and related services. The next-generation GOES is currently under development, including two primary sensors: the Advanced Baseline Imager (ABI), and the The Hyperspectral Environmental Suite (HES). Ball is actively involved in several GOES development efforts.

Next-generation sensors on the NPOESS spacecraft will monitor the Earth's weather, atmosphere, oceans, land, and near-space environment over the entire planet and provide data for long-range weather and climate forecasts. One of the sensors to fly on NPOESS is the Ozone Mapping and Profiler Suite (OMPS) built by Ball. OMPS will collect total column and vertical profile ozone data and continue the daily global data produced by the current ozone monitoring systems, the Solar Backscatter Ultraviolet radiometer (SBUV)/2 and Total Ozone Mapping Spectrometer (TOMS), but with higher fidelity.

Ball continues to enhance its core technologies and capabilities to meet the needs of future missions requiring sensors with greater spectral, spatial, and temporal resolution, and more agile and stable spacecraft platforms than ever before.

IEEE GRS Letters approved as an independent publication

In a transition phase, all present IEEE GEOSCIENCE AND REMOTE SENSING LETTERS (GRS-L) papers are being published as Part II of the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING (TGARS) journal as "letters" articles. During this phase, which starts with this April 2003 issue, GRS-L papers will be bound separately as Part II of the Transactions journal. The instructions for "letters" papers can be found on the inside back cover of TGARS, and paper submission is handled through the TGARS Website http://www.ewh.ieee.org/soc/grss/tgars.html, where authors should select "letters" under "manuscript type." GRS-L "letters" papers are intended to be shorter communications for which the publication time can be shortened in an effort to communicate new ideas more quickly. In addition, we encourage the submission of "letters" papers with "enhanced objects" such as animations, digital elevation "fly throughs," etc.

We are pleased to announce that this new GRSL will officially launch in January 2004. It will separately handle all of the letters papers in remote sensing. One of its primary goals is to shorten the time to publication of these shorter (four printed pages) letters papers.

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University of Colorado
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University of Iceland
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NEW IEEE GRS-S Letters and TGARS Editors

Dr. Emery, Editor of the IEEE Geoscience and Remote Sensing Letters

W. J. Emery (M'90–SM'01–F'02) received the Ph.D. degree in physical oceanography from the University of Hawaii, Honolulu, in 1975. After working at Texas A&M University, College Station, on the International Southern Ocean Study, he moved to the Oceanography Department, University of British Columbia, Vancouver, BC, Canada, in 1978, where he created a satellite oceanography facility and program. He was appointed Full Professor in aerospace engineering sciences at the University of Colorado, Boulder, in 1987. He is active in the analysis of satellite data for oceanography, meteorology and terrestrial vegetation. His focus research areas are satellite sensing of sea surface temperature, mapping ocean surface currents, and terrestrial vegetation. In addition, his group writes analysis software and establishes/operates data systems for the distribution of satellite data received by their own antennas. He is a member of the University of Colorado's Laboratory for Atmospheric and Space Physics (LASP) and the Program in Oceanic and Atmospheric Sciences (PAOS). He is an author of two textbooks in physical oceanography, has translated three oceanographic books (German to English), and has authored over 120 refereed publications. Dr. Emery is the Letters and Communications Editor of the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING. He is a Fellow of the IEEE, a member of the Administrative Committee (AdCom) of the Geoscience and Remote Sensing Society, and incoming Editor of GEOSCIENCE AND REMOTE SENSING LETTERS.

Dr. Benediktsson, Editor of the IEEE Transactions on Geoscience and Remote Sensing

Jon Atli Benediktsson (S'86–M'90–SM'02) received the Ph.D. degree from the School of Electrical Engineering, Purdue University, West Lafayette, IN, in 1990. He is currently a Professor of electrical and computer engineering at the University of Iceland, Reykjavik. He is also a Visiting Professor at the School of Computing and Information Systems, Kingston University, Kingston upon Thames, U.K. He has held visiting positions at the Joint Research Centre of the European Commission, Ispra, Italy; Technical University of Denmark, Lyngby; and the School of Electrical and Computer Engineering, Purdue University. His research interests are in remote sensing, pattern recognition, neural networks, image processing, and signal processing, and he has published extensively in those fields. Dr. Benediktsson was a Fellow at the Australian Defence Force Academy, Canberra, Australia, in 1997. In 1991, he received Purdue University's Stevan J. Kristof Award as outstanding graduate student in remote sensing. In 1997, he was the recipient of the Icelandic Research Council's Outstanding Young Researcher Award. In 2000, he was granted the IEEE Third Millennium Medal. He was Associate Editor of the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING (TGARS) from 1999 to 2003 and is currently the TGARS Editor. From 1999 to 2003, he was a member of the Administrative Committee (AdCom) of the IEEE Geoscience and Remote Sensing Society (GRS-S) and Vice President of Technical Activities from 2002 to 2003. From 1996 to 1999, he was the Chairman of GRS-S's Technical Committee on Data Fusion. He co-edited (with Professor David A. Landgrebe) a Special Issue on Data Fusion of TGARS May 1999.

IEEE Workshop on Advances in Techniques for Analysis of Remotely Sensed Data

An Honorary Workshop for Prof. D. A. Landgrebe
NASA Goddard Visitor Center, Washington DC, USA
October 27-28, 2003

The aim of the workshop on ***Advances in Techniques for Analysis of Remotely Sensed Data*** is to celebrate the work of Prof. David A. Landgrebe, to create an open forum for critical evaluation of the evolution of methodological approaches over the past decades, and to discuss fruitful directions for future work through lively interaction. The workshop program will include invited lectures and papers accepted for oral presentation. Two distinguished speakers, Prof. David A. Landgrebe (Purdue University, USA) and Prof. John A. Richards (Australian National University, Australia) have been invited to address both the progress of remote sensing data analysis during recent years and provide perspective on the most critical needs for future methodological advances. Accepted papers will appear in the workshop proceedings.

Submission: Abstracts are solicited that are in line with the workshop aims. Contributions that summarize the author's work in this area are encouraged. A two-page extended abstract must be received via e-mail at ieee.landgrebe.conf@csr.utexas.edu before June 23, 2003, identifying a suitable topic from the list provided in the web page. Two members of the Technical Committee will review each abstract.

Schedule		
	Two page extended abstracts of papers due	June 23, 2003
	Notification of acceptance	July 10, 2003
	Final version of papers due	September 20, 2003

Workshop Chairs: J. A. Benediktsson (University of Iceland, Iceland), M. Crawford (University of Texas at Austin, USA), J. P. Kerekes (MIT Lincoln Laboratory, USA), S. Bruno Serpico (University of Genova, Italy).
Local Organizing Committee: Guoqing Sun and James Tilton (NASA Goddard, USA).
More information on the workshop will soon be available at http://ewh.ieee.org/soc/grss/

International Conference onRecent Advances in Space Technologies Emerging applications and opportunities for all RAST 2003

November 20-22, 2003, Istanbul, TURKEY

Objectives: The trends observed in space technologies over the 1990s have been attracting the attention of ever-larger communities not just in science, engineering, and education, but also of those engaged in the economic and the social fields. The planned conference has the objective of bringing together the theoreticians and the practitioners, as well as the policy makers from such different fields. The main emphasis will be on the emerging opportunities.

Paper submission: Prospective participants are invited to electronically submit a summary (500 words, text only) of their work, following the instructions available on the web page. Accepted papers will be published in a proceedings volume.

Special Sessions: The participants of the conference are encouraged to organize special sessions (5-6 papers) on a particular area. For details, please contact the special sessions chair Seyhan Onbaşıoğlu (onbasiogl1@itu.edu.tr).

Deadlines:		
	Submission of summaries	*20 July 2003*
	Special session proposals	*1 August 2003*
	Notification of acceptance	*20 August 2003*
	Camera-ready submission of full papers	*15 September 2003*

Please visit the web site for details of topics and paper submission http://www.hho.edu.tr/RAST2003

8th Specialist Meeting on Microwave Radiometry and Remote Sensing Applications

February 24-27, 2004, Rome, Italy

The Meeting is the last one of a series focusing on **Microwave Radiometry and Remote Sensing of the Environment**. The first one dates back to March 1983. Twenty years later, this announcement is an open invitation to convene again in Rome at the University "La Sapienza." Hosted by the Faculty of Engineering of the University "La Sapienza" of Rome, Italy, it is organized by **Prof. N. Pierdicca** and **Prof. G. d'Auria**, Department of Electronic Engineering, University "La Sapienza", and by **Prof. F.S. Marzano**, Center of Excellence CETEMPS, University of L'Aquila, Italy.

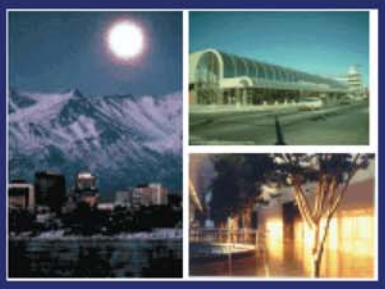
The **objective** is to set up a common forum to report and discuss **recent advances in the specific field of microwave radiometry**, gathering all parties belonging to the research and industrial community, active in projects and studies in microwave radiometry of land, ocean and atmosphere. Contributions on **topics of primary interest** are expected.

Fist Announcement: *April 15, 2003*
Abstract submission deadline: *September 30, 2003*
Pre-registration deadline: *January 15, 2004*

Detailed information on the Meeting can be found at the **Meeting web site**: ***http://www.microrad04.org***.
The 2004 Microwave Radiometry and Remote Sensing Applications Specialist Meeting will be **supported by**:

IEEE INTERNATIONAL GEOSCIENCE AND REMOTE SENSING SYMPOSIUM

— IGARSS —



FUTURE SYMPOSIA LOCATIONS

IGARSS'03

21-25 July 2003 • Toulouse France
Pierre Baudis Congress Centre
Didier Massonet, CNES
General Chairman (didier.massonnet@cst.cnes.fr)

ABSTRACT DEADLINES:
INVITED — 07 January 2003 (*extended*)
GENERAL — 17 January 2003

IGARSS'04

20-24 September 2004 • Anchorage Alaska
William A. Egan Convention Center
Verne Kaupp, University of Missouri-Columbia
General Chairman (KauppV@missouri.edu)

IGARSS'05

Date Pending • Seoul Korea
COEX Convention and Exhibition Center
Wooil Moon, Seoul National University, Seoul Korea
General Chairman (wmoon@eos1.snu.ac.kr)

IGARSS'06.

31 July - 4 August 2006 • Denver Colorado
Colorado Convention Center
A.J. Gasiewski, NOAA (al.gasiewski@noaa.gov)
and V. Chandrasekar, Colorado State University
(chandra@engr.colostate.edu)
General Co-Chairmen

For information on any of the upcoming symposia, please contact IEEE GRSS at grss@ieee.org or visit the society website at http://ewh.ieee.org/soc/grss/

IGARSS'03 • Toulouse France

21-25 July 2003
Centre de Congrès Pierre Baudis

Stroll through the old town, with its colourful markets, viewing the architecture and environment of a subtle mix of stone, red brick and russet roof tiles. Discover narrow winding streets with their treasure troves of hidden courtyards and ancient dwellings. Relax along the Garonne riverbank or the tree-shaded tow paths of the Canal due Midi slowly navigated by pleasure boats. Enjoy the bustling terrace life or an unforgettable traditional streetside cafe. All of these pleasures await the guest who ventures to Toulouse France, host city for the 2003 IEEE International Geoscience and Remote Sensing Symposium (IGARSS'03).

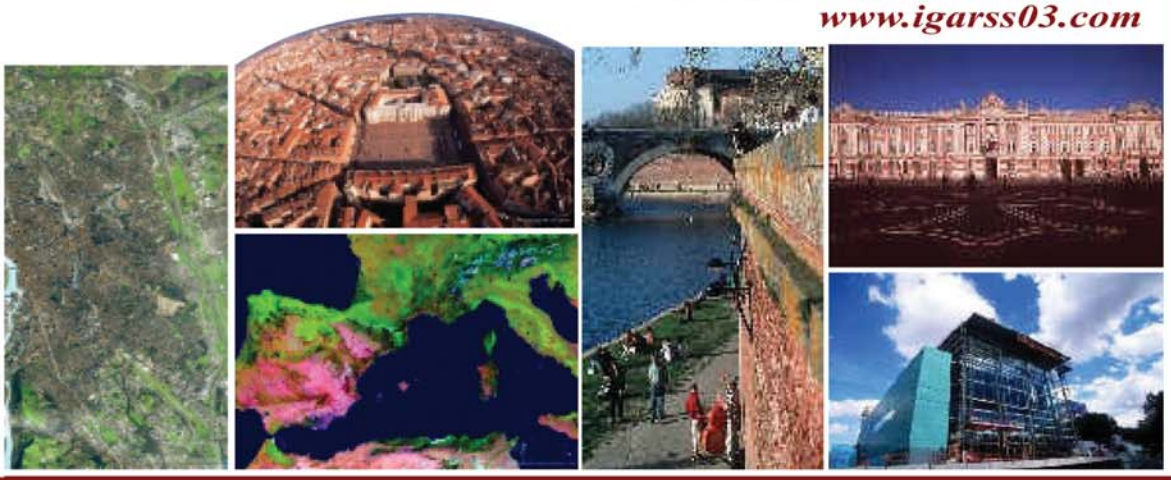
Located in France's largest region, Midi-Pyrenees, 150 miles from the Atlantic, 90 miles from the Mediterranean, nestled at the foothills of the Pyrenees Mountains, Toulouse is the country's fourth largest city. The vast number of red brick buildings give Toulouse an Italian appearance but visitors will find a prominent Spanish influence. Touted as a southern city, its citizens enjoy the outdoors and guests will appreciate the ease of traversing the city and visiting its 140 parks and 40 fountain squares on foot. Toulouse's openness to newcomers, extensive range of public transportation, educational and leisure facilities, and peaceful security annually place the city at the top of most desired places to be.

Home to the French National Space Agency (CNES) and to one of the largest aircraft assembly facilities in the world, Aerospatiale, Toulouse offers the IGARSS attendee insight into the vast technological advances driving the city, bringing foreign nationals to its region and giving it an international dimension. Toulouse boasts 11,000 researchers, 400 laboratories, and multiple links between research and industry from well-known high-tech companies to its three universities.

This year's theme, *Learning from Earth's Shapes and Colors*, brings to mind the two fundamentals of Earth observation — geometry and radiometry — while pointing out the continuing need to improve our methodology. Symposium topics have been selected to offer a broad selection of the most current specializations within the fields of geoscience and remote sensing. The 149 topics are organized under seven headings: Applications of Remote Sensing; Missions and Programs; Geoscience Modeling and Processes; Data Processing and Algorithms; Electromagnetic Problems; Instrumentation and Techniques; and Policy Societal Issues and Education Initiatives. The IGARSS symposia are known for the high technical standard of their presentations, wide-ranging coverage of all remote sensing areas, and quality publications.

Enjoy the good life — join us for excellent food, fine wine, a relaxed venue and an outstanding technical program.

For more information access www.igarss03.com



UPCOMING CONFERENCES

See also **http://www.techexpo.com/events** or **http://www.papersinvited.com** for more conference listings.

Name: **2003 Workshop on Oceanography with GNSS-R**
Dates: July 17 - 18, 2003
Location: Starlab
Barcelona, Spain
Contact: Giulio Ruffini
Fax: +34 932126445
E-mail: giulio@starlab-bcn.com
URL: http://starlab.es

Name: **2003 IEEE International Geoscience and Remote Sensing Symposium**
Dates: July 21 - 25, 2003
Location: Centre de congrès Pierre Baudis
Toulouse, France.
Contact: Lisa Ostendorf
Fax: 973-586-7961
E-mail: ieeegrss@adelphia.net
URL: http://www.igarss03.com/

Name: **IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems (MFI 2003)**
Dates: July 29 – August 1, 2003
Location: Tokyo, Japan
Contact: Prof. Katsushi Ikeuchi
Fax: +81 3 5452 6244
E-mail: ki@iis.u-tokyo.ac.jp

Name: **19th Biennial Workshop on Color Photography, Videography and Airborne Imaging for Resource Assessment, American Society for Photogrammetry & Remote Sensing (ASPRS)**
Dates: October 6 – 8, 2003
Location: Utah State University
Logan, UT, USA
Contact: Christopher Neale
Fax: +81 3 5452 6244
E-mail: cneale@cc.usu.edu

Name: **Progress in Electromagnetics Research Symposium (PIERS)**
Dates: October 13 – 16, 2003
Location: Sheraton Waikiki Hotel
Honolulu, Hawaii, USA
Contact: J. A. Kong
Fax: 617-258-8766
E-mail: piers@cetaweb.mit.edu
URL: http://www.piers.org/

Name: **IEEE Workshop on Advances in Techniques for Analysis of Remotely Sensed Data**
Dates: October 27 - 28, 2003
Location: NASA Goddard Visitor Center
Washington DC, USA
Contact: Jon Atli Benediktsson
Fax: +354 525-4632
E-mail: ieee.landgrebe.conf@csr.utexas.edu
URL:

Name: **30th International Symposium on Remote Sensing of Environment, NASA**
Dates: November 10 - 14, 2003
Location: Sheraton Waikiki Beach Resort
Honolulu, Hawaii, USA
Contact: Per Erik Skrøvseth
Fax: 808-944-7399
E-mail: isrse@email.arizona.edu.
URL: http://isrse.pdc.org/

Name: **AGU Fall Meeting, American Geophysical Union**
Dates: December 8 - 12, 2003
Location: Moscone Center
San Francisco, California, USA
Contact: E. Terry
Fax: 202-328-0566
E-mail: eterry@agu.org
URL: http://www.agu.org/meetings/fm03/

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