IEEE GEOSCIENCE and REMOTE SENSING Newsletter

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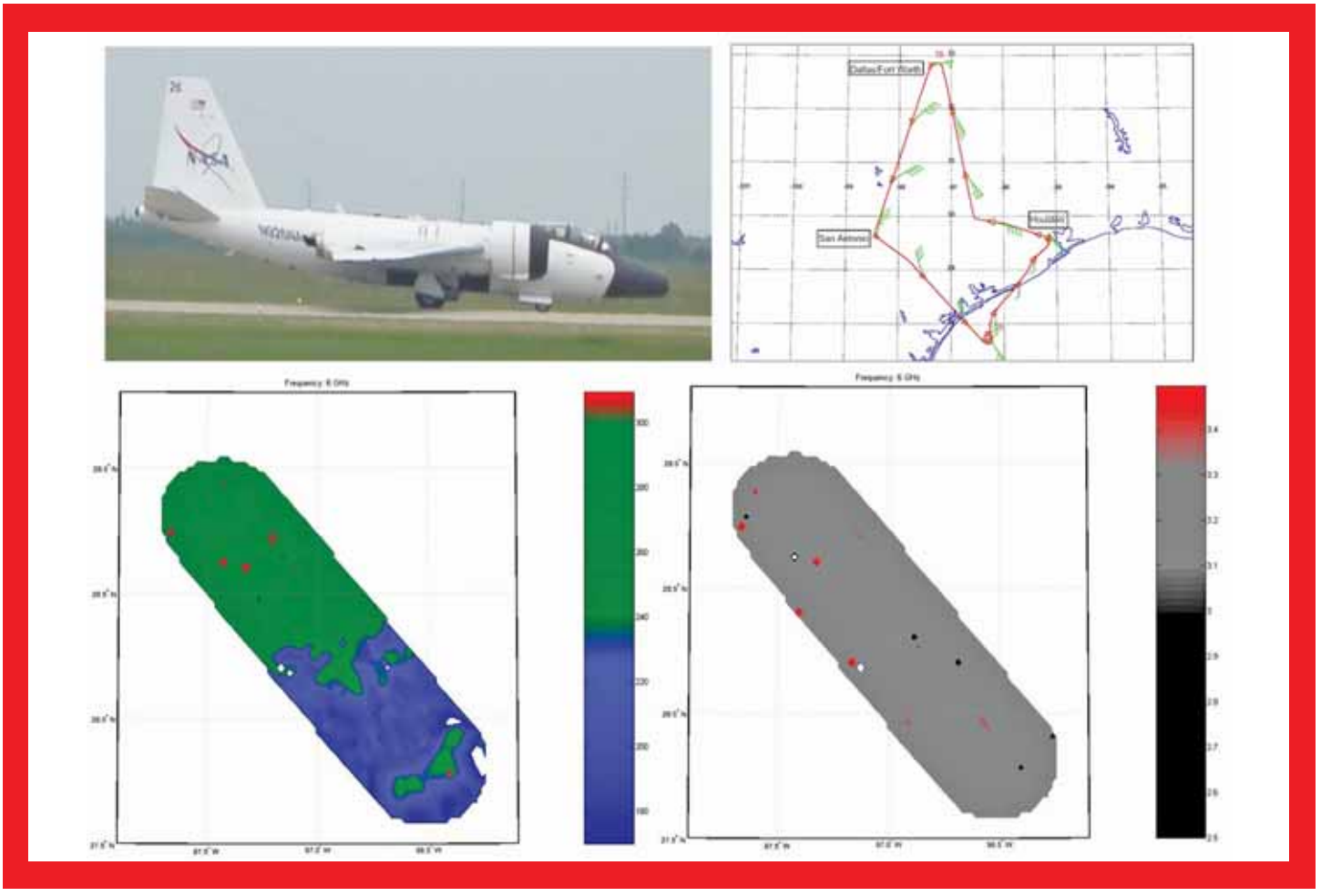

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The following is the schedule for the GRS-S Newsletter. If you would like to contribute an article, please submit your input according to this schedule. Input is preferred in Microsoft Word, WordPerfect or ASCII for IBM format (please send disk and hard copy) as IEEE now uses electronic publishing. Other word processing formats, including those for Macintosh, are also acceptable, however, please be sure to identify the format on the disk and include the hard copy.

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Month	June	Sept	Dec	March
Input	April 15	July 15	Oct 15	Jan 15

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Welcome to the December 2007 edition of the GRSS Newsletter. This letter features a short article on the fundamentals of multispectral thematic imaging of land areas written by David Landgrebe, Prof. Emeritus of Purdue University. This essay focusses on remote sensing of the earth's surface from a multispectral, visible - infrared sensor and data perspective. I think you will find the commentary very insightful.

On this month's cover is the first image of microwave kurtosis (4th moment). These data were collected over Texas in a 2005 airborne campaign. These and related measurement techniques show promise for Radio Frequency Interference (RFI) detection and mitigation applications in passive microwave systems.

One of my favorite experiences as the Newsletter editor has been the many conversations I've had with members about their activities related to the Society. This time I am pleased to have a contribution from Prof. John Kerekes summarizing the founding of the Western New York GRSS Chapter.

You may be interested to know that when you visit the GRSS website you can now purchase items with the GRSS logo on them at Cafépress! See the 'Web Corner' in this Newsletter for the latest about our website (in hardcopy that is). The GRSS website continues to add features, capability and activity. I understand the coffee mugs are going fast…

This Newsletter also offers three excellent contributions related to IGARSS'07. First we have a report from Prof. Corbella providing his perspective of IGARSS'07 in Barcelona as the conference chair. Secondly, there is a report on the 2007 IEEE GRSS publications awards presented at the banquet. And to round out the activities from IGARSS, I believe this issue includes the first full Newsletter report on the IGARSS soccer tournament.

And finally, we note with sadness the passing of Dr. Steven Clifford, formerly of the NOAA Environmental Technology Laboratory. Steve led NOAA ETL from 1986 until his retirement in 2001.

President's Message

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The 2007 Nobel Peace Prize was awarded to the Intergovernmental Panel on Climate Change (IPCC) and to former US Vice President Mr. Al Gore "for their efforts to build up and disseminate greater knowledge about man-made climate change and to lay the foundations for the measures that are needed to counteract such change". In announcing the award, the Nobel Committee said, "Indications of changes in the earth's future climate must be treated with the utmost seriousness and with the precautionary principle uppermost in our minds". Mr. Al Gore is best known for his documentary film "An Inconvenient Truth" about climate change. The IPCC was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP). The IPCC has three Working Groups and a Task Force. The IPCC is well known for the Assessment Reports (AR) it publishes. The first three Assessment Reports were completed in 1990, 1995 and 2001 respectively. The fourth assessment report (AR4) will be released shortly in 2007. Working Group 1 deals with the scientific basis of climate change and its focus area is closely related to our Society's research strength. The AR4 report of Working Group 1 discusses atmospheric changes, pattern of climate variability, extreme weather events, changes in the cryosphere, ice sheet dynamics and stability, and changes in the ocean and sea levels. All of these topics are of interest to our Society and we develop and apply instrumentation and algorithms to monitor and analyze these changes. In the U.S., the Decadal Survey was recently completed by the Committee on Earth Science and Applications of the U.S. National Research Council. After the release of the Decadal Report, we have seen renewed activities in satellite remote sensing and many NASA working groups convened to plan new satellite missions. Universities in the U.S. are leading major initiatives in the studies of the earth environment as students, professors and administrators recognize that these are critical needs of humankind. New academic units

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Cover Information: Images of 6.0 GHz horizontally polarized brightness temperature (lower left) and kurtosis (lower right) during an overpass of the Gulf coast near Galveston, TX on 25 August 2005 by the NASA WB-57 research aircraft (upper left). A complete flight plan for this campaign is shown in the upper right panel. *(continued on page 26)*

(President's Message continued from page 3)

emerge that focus on the studies of the earth and on environmental changes and their impact on global issues. At my home institution, the University of Washington in Seattle, the Provost has assembled a working group to plan for a new College of Environment. In addition, many private non-profit foundations and philanthropists are making financial contributions to research on environmental and global climate change problems. At IEEE, there is continued enthusiastic participation in the Group on Earth Observations (GEO). Both the IEEE President, Leah Jamieson and IEEE President-Elect Lew Terman will be attending the GEO IV and Ministerial Summit at Capetown in November 2007. The IEEE Committee on Earth Observations (ICEO) has initiated a focus area to address the impact of earth observation and remote sensing on water resources. Technical experts from IEEE will convene to interface with the GEO Community of Practice on Water. IEEE has started the television series "Circuit Earth" with the goal of heightening public awareness of technology and increasing appreciation of engineering and their use in addressing societal needs.

All these recent events epitomize the importance of GRSS Society, our activities, and the conference and journal papers that we present and publish. It is the goal of the Society and the GRSS AdCom that, by bringing the community together, we serve humankind in the important task of geoscience and remote sensing.

IGARSS 2007 in Barcelona concluded with tremendous success. There were approximately 1760 attendees and 2000 papers were included in the final program. The number of no-shows has been greatly reduced. At the Symposium, 94% of the oral papers and 78% of interactive papers were presented. Many congratulatory emails were received. I want to thank Professors Ignasi Corbella and Adriano Camps for a job well done. IGARSS 2008 will be held in Boston with the theme "Geoscience and Remote Sensing: The Next Generation". The theme is particularly well selected in view of the accelerating rate of new missions and new instrumentation that are on the horizon. It also emphasizes opportunities for the next generation of remote sensing researchers and innovators to step up to the next-generation of challenges and global responsibilities to monitor the earth's environment. The deadline for abstract submission is January 8, 2008. We have also recently recruited a new conference management team, CMS, to help GRS in managing IGARSS. CMS (http://cmsworldwide.com/) has extensive experience in organizing and managing large IEEE conferences.

At the November 2007 AdCom meeting in Seattle, a Strategic Planning session was conducted. The AdCom has adopted several important action items. The formation of a Senior Council was approved. The members of the Senior Council shall consist of past presidents and former AdCom members that have served many

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	Zhiwu Li	Xian Section
	Manuel Martin-Neira	Benelux Section
	Scott Palo	Denver Section
	Michael Schaepman	Benelux Section
	Kenneth Slatton	Gainesville Section
	Paul Speer	Oregon Section
	Florence Tupin	France Section
	Christopher Williams	Denver Section
October:	David Lamb	New South Wales Section
	William Blackwell	Boston Section
	Linda Hayden	Eastern North Carolina Section
	Shannon Blunt	Kansas City Section
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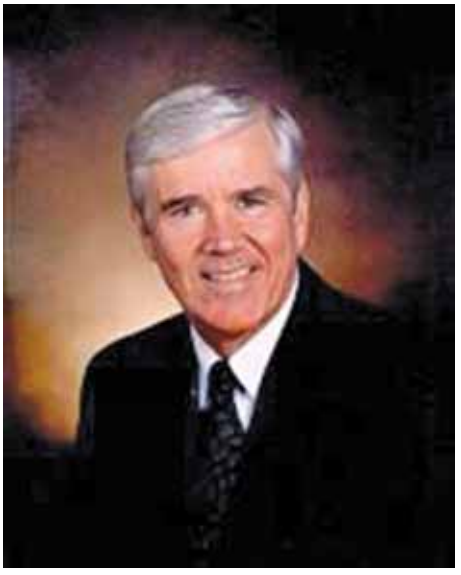
GRS-S CHAPTER ACTIVITIES

At the Fall AdCom we discussed ideas for making our Chapters more attractive to new members. For example, one idea we discussed is to make Distinguished Speakers available for Chapter meetings via videocons. If you have ideas along these lines please let me know. I will put together a plan based on your input and present it at the March AdCom meeting.

Diane Evans
GRSS Chapters

IN MEMORIAM

Steven Clifford



Steve Clifford, former Director of the U.S. National Oceanic and Atmospheric Administration (NOAA) Environmental Technology Laboratory (ETL) passed away on September 18, 2007. He was born on January 4, 1943 in Boston, MA, and attended Northeastern University in Boston, MA and Dartmouth College in Hanover, New Hampshire, where he received his Ph.D. in studies related to laser and microwave propagation through turbulent media. Steve began his career in 1969 as a National Science Foundation postdoctoral research associate with the Wave Propagation Laboratory (WPL) of the U.S. Environmental Science Services Administration, a precursor to NOAA). For more than three decades he published widely on topics related to the physics of wave propagation and scattering in random geophysical media, and the remote sensing of the atmosphere and oceans. He led the reorganized Environmental Technology Laboratory from 1986 until his retirement from NOAA in 2001. Steve became a Research Scientist Emeritus of the University of Colorado's Cooperative Institute for Research in the Environmental Sciences in 2001, where he continued his work as a senior advisor to the U.S. Department of Defense. Steve was a Fellow of the Optical Society of America and the Acoustical Society of America, and a member of the U.S. National Academy of Engineering and numerous national and international advisory panels. He played a significant role in the development and application of novel environmental remote sensing methods worldwide. His friendship, outstanding leadership, and technical skills will be sorely missed.

GRS-S CHAPTER'S CORNER

WESTERN NEW YORK GRSS CHAPTER

John Kerekes, Chapter Chair
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Chapter Formation

We are pleased to announce the formation of a new chapter of our society in Western New York. The chapter was formed spanning the five Sections of IEEE Region 1 Area D including Binghamton, Buffalo, Ithaca, Rochester and Syracuse, with Rochester serving as the parent Section. Formed in response to the growing remote sensing activity in industry and academia in the area, the goals of the chapter are to serve as a vehicle for networking opportunities and information sharing through technical presentations at chapter meetings, as well as to raise the visibility of GRSS within the local community.

Inaugural Meeting

The inaugural meeting of the Western New York Chapter was held September 20, 2007, at the Chester F. Carlson Center for Imaging Science on the campus of the Rochester Institute of Technology, in Rochester, New York. Attendees were treated to a pre-meeting reception with pizza, fruit and drinks where many friendships were renewed and new connections made.

The highlight of the meeting was a technical presentation by Prof. John Schott entitled "Landsat Remote Sensing Research at RIT." Prof. Schott leads the Digital Imaging and Remote Sensing (DIRS) Laboratory at RIT and has been active in the remote sensing community for over thirty years. In his presentation to the chapter Prof. Schott described three ongoing projects at DIRS in support of the Landsat Program. These included their support of thermal calibration of the Landsat satellites, the use of invariant land surface sites for long term radiometric calibration of Landsat sensors, and the potential use of the upcoming Landsat Data Continuity Mission for water resource assessment.

The meeting was held jointly with the Central New York (CNY) Region of the American Society for Photogrammetry and Remote Sensing (ASPRS). This cooperative scheduling of a joint meeting between these two local remote sensing organizations helped enable an excellent turnout of thirty-five attendees. One story overheard was that two professors who work with remote sensing at the same university, but in separate departments, met for the first time at the meeting. These types of connections demonstrate the value of chapter meetings.

Additional Fall Meetings

Following this successful inaugural meeting, three additional meetings were scheduled for the rest of 2007.

- In October, Dr. Michael Gazarik of the NASA Langley Research Center gave a presentation entitled "R&D Activities at NASA Langley in Support of the Space Shuttle, the Mars Science Laboratory and Atmospheric Science." This presentation was hosted by RIT's Center for Imaging Science and was in conjunction with their CIS Weekly Seminar Series.

- In November, Prof. Bea Csatho of the State University of New York (SUNY) at Buffalo will make a presentation entitled "Monitoring Earth-Surface Dynamics with ICESat Satellite Laser Altimetry." The meeting and presentation will be preceded by an open house at the new Remote Sensing Laboratory of the Department of Geology at SUNY Buffalo.
- In December, Prof. Matthew Pritchard will provide a presentation entitled "Imaging Sub-centimeter Ground Deformation from Space: Earthquakes, Volcanoes, Groundwater, Glaciers, and Some Mysteries of New York State." This presentation will be hosted by Cornell University in Ithaca.

This full schedule of meetings in our initial six months illustrates two characteristics of the chapter. One is the diverse nature of the presentation topics and research being conducted in the area. The second is the geographic spread of the locations of the meetings. Rotation of the locations of the meetings among the various IEEE Sections spanned by the chapter allows members and interested professionals to attend meetings held in their local area.

Chapter Website

The chapter has taken advantage of the IEEE's Entity Web Hosting (EWH) service and tools and established a WNY Chapter website at http://ewh.ieee.org/r1/new_york/grss/. The site is primarily used to announce upcoming meetings by providing information on the technical seminar as well as location information and directions. In addition to this use the site also provides convenient links to area remote sensing organizations and other events, as well as links to the local IEEE Sections and the IEEE and GRSS home pages.

Summary

We are excited to have this new chapter established and to see the wonderful initial response of the local community in volunteering to give technical presentations, host meetings and to participate in its activities.

President's Message *continued from page 4*

terms. Their past experience and insights can provide guidance for the AdCom. We also approved recruitment for a staff position, "the GRSS Society Executive Officer" to facilitate Society initiatives and AdCom functions. The officer will support Administrative Committee meetings and teleconferences, log and track action items and assist the society vice presidents with implementation of new initiatives. For IGARSS, we approved an increase of travel grants threefold to $100,000 USD. This will allow GRSS to provide more stipends to student authors and authors from developing countries. A Conference Committee will be established to oversee the program, and the needs and quality of IGARSS. In society relations, we will use the technical co-sponsorship of Specialty Symposia to strengthen our collaborations with other societies. Presently, we have Memorandums of Understanding with the International Society of Photogrammetry and Remote Sensing (ISPRS), Canadian Remote Sensing Society (CRSS), Open Geospatial Symposium (OGC), and the IEEE Committee on Earth Observations (ICEO). We will also organize workshops in Latin America, Africa and Asia through our regional liaisons. In information infrastructure improvement, our website traffic has doubled since 2006, with the largest increase in on-line lecture viewing. We are looking into the possibility of offering free tutorials in combination with speakers program. The web will support electronic deployment of journals, tutorials, newsletters and member interactions. To make it easier to use our website, a help desk will soon be developed.

I would like to welcome two newly elected AdCom members, Dr. Jon Benediktsson and Dr. Bill Emery who will begin their 3-year term in January 2008. Drs. Benediktsson and Emery have been the Editors in Chief of the IEEE Transactions on Geoscience and Remote Sensing (TGARS) and IEEE Geoscience and Remote Sensing Letters (GRSL) respectively. They will be taking up new roles in the GRSS AdCom. Under Jon's leadership, TGARS has grown tremendously. In 2007, the average number of papers submitted is close to 70 papers per month. Bill is the founding editor of GRSL. The first issue was published in 2004. The GRSL has now matured to a self-sustaining journal and will publish 700 pages this year. We thank Jon and Bill for their years of service. A search committee has been formed and we are launching searches for two new Editors in Chief respectively for TGARS and GRSL. The first issue of our new journal IEEE Journal of Selected Topics in Earth Observations and Remote Sensing (J-STARS) will be published in the first quarter of 2008. I encourage you to subscribe to the journal and also submit your papers to the journal.

I would like to congratulate Joel Johnson, Waymond Scott, Curt Davis, David Long, Didir Massonnet and Jay Pearlman for being elected to IEEE Fellows in 2008. Dr Joel Johnson is elected for "contributions to ocean surface remote sensing using microwave systems". Dr. Waymond Scott is elected for "for contributions to the detection of buried objects using ground penetrating radar". Dr. Curt Davis is elected for "for contributions to satellite remote sensing". Dr. David Long is elected for "for contributions to systems and applications of radar scatterometry and synthetic aperture radar in land and ice studies". Dr. Didir Massonnet is elected for contributions to space-based synthetic aperture radar. Dr. Jay Pearlman is elected for "for leadership in space-based earth observing systems". I acknowledge their scholarly contributions and their services to GRSS.

This will be the last President's Message I write, as I will be Past President starting January 1, 2008. I appreciate the opportunity of serving you in this capacity for the last two years. Dr. Anthony Milne is the newly elected President in 2008. Tony was the General Chairman of IGARSS 2001 in Sydney. He has been very active in remote sensing research programs in countries around the Pacific Rim. With Tony at the helm, GRSS is in good hands.

Leung Tsang

FEATURE

MULTISPECTRAL THEMATIC MAPPING OF LAND AREAS, SOME FUNDAMENTALS

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Introduction This essay is an attempt to put down in concise form some fundamentals related to the technology of remote sensing. Obtaining information about land areas via remote sensing involves fundamentals from a number of cross-disciplinary fields. For some workers in the area, having adequate access to expertise in all of these fields may be difficult, thus perhaps this listing may be helpful to some. The statement of fundamentals is followed by a commentary on some concepts that occur frequently in manuscripts that do not seem to effectively apply some of these fundamentals.

Remote Sensing Fundamentals. Remote sensing is the science and technology of identifying and mapping materials without coming into direct contact with them. The fundamental idea of remote sensing is that the energy field emanating from a material contains information about what the material is. Most commonly electromagnetic fields are used, however other types of energy fields (e.g., gravitational fields) might sometimes be used as well. Reflected fields, emitted fields based on the material's thermal state, and fluorescent fields are useful for this purpose.

From a technology standpoint, a remote sensing system is in some ways similar to a wireless communication system. In a wireless communication system,

- There is a transmitter that formats the information into a signal that can be transmitted,
- There is a medium through which the signal must be successfully transmitted, and,
- There is a receiver that reformats the received signal to a form specified by the user.

With a communication system, the designer can design the transmitter and the receiver, but has no control over the medium. In a remote sensing system, the material itself serves as the transmitter, and thus the designer cannot directly design it but must learn about it as thoroughly as possible in order to best perceive how the desired information will be contained in the signal. Like the communication system, the designer has no control over the medium. In the remote sensing case, the sensor system and the data analysis process play the role of the receiver, measuring the energy field emanating from the subject matter coming through the medium and extracting the desired information. Indeed, much of the remote sensing data analysis methodology is based upon previously developed communication receiver technology.

To implement a remote sensing system then, one must (a) measure the energy field emanating from the subject material, and then (b) apply the resulting measurements to some type of analysis process. Often (but not necessarily) the measurement process is implemented by scanning the subject matter in raster fashion and dividing its area into discrete spatial sub-areas, often referred to as pixels. These pixels may or may not have underlap or overlap.

There are two separate and distinct common forms of data analysis, i.e. information extraction.

- **Image Oriented.** One, and the most intuitive one, is to **present the data as an image** assuming the scene has been scanned in raster fashion. The image is then viewed and interpreted by a human analyst.
- **Thematic mapping.** The second consists of s**orting the measurements into themes** by devising some means by which to associate the multispectral data of each measurement or pixel to one of a candidate list of material classes. If the data were obtained by a raster scan, a thematic map of the subject matter area can then be produced.

The former method relies heavily on the perception powers of the human eye-brain combination. Various types of image enhancement techniques may be used to aid in this process. The second, thematic map type, rather than using an image, uses the data directly to achieve the final product.

Thinking about the distinction of these two types in this way, human cognitive "hardware" is quite different from computing machinery. Both have very powerful attributes, but they are very different attributes. For example, the human cognitive system is especially "designed" to process imagery. An image is defined as an array of data specifically intended to be viewed by a human. Computing machinery does not deal at all well with an image, but handles arrays of numbers quantitatively much more powerfully and flexibly than a human can. Thus, the term "multispectral imagery" is actually an oxymoron, in that there is no way that a human can, for example, view and process all of a 10 band, 10 bit array of data as an image, only subsets of it, but a computer can process such

data very effectively. In planning for the analysis of a data set, it is very important to not become confused between these two types of systems, lest an unnecessarily suboptimal procedure result.

A first step in devising a remote sensing system requires understanding and thinking critically about the subject matter, how information might be conveyed in the energy field arriving at the sensor, and how the desired information is to be extracted from it. The fundamental parameters of the measurement process are its

- Spatial resolution or geographic area covered by a single measurement,
- Spectral resolution or level of spectral detail for each measurement, and
- Radiometric resolution.

It is important to recognize that these three are inherently interrelated. This is because the power density of the electromagnetic field emanating from the subject area is finite. Thus there is a tradeoff in setting the pixel size, the bandwidth of each band, and the precision of the radiometric measurement of each pixel and band. If, for example, one chooses a very small pixel size and very narrow bandwidths, there may be little power left to overcome the level of the sensor internal noise, and thus one may not be able to make a very precise spectral response measure for a given pixel. This tradeoff speaks to the importance of choosing these parameter values properly, depending on whether the means for analysis is to be image-oriented or directed toward thematic mapping. As a result of this, it is really not possible to simultaneously optimize a sensor design for use as both image-oriented tasks and spectral thematic mapping tasks, since image-oriented tasks ordinarily require high spatial resolution and thematic mapping requires high spectral resolution with good radiometric precision.

Spatial Resolution. For image-oriented systems, spatial resolution, in terms of pixel size, is usually desired to be quite high with little pixel overlap or underlap, as the human eye-brain combination handles such spatial resolution very effectively. On the other hand, for thematic mapping, spatial resolution is ordinarily set based not upon human image perception, but on the size of objects (a group of contiguous pixels of the same user class) that are of primary interest.

For image-based analysis, generally the smaller the pixel the better (up to a point), i.e., better resolution means finer resolution, but this is not the case for thematic mapping. For example, for U.S. agriculture, 5-10 meter spatial resolution might be suitable for mapping crop types. One would like pixels small compared to agricultural field size but not too small, since for row crops such as corn, it would be best for pixels to integrate across several rows so that a pixel is composed of the composite of what is desired to be called corn rather than some being different elements which are to make it up, i.e., corn tassels, leaves and stems and spaces between the rows. Corn rows are about a half meter apart. For an image-oriented analysis of corn, the spatial resolution would probably best be of the order of centimeters, so that leaf shape could be discerned. Thus for thematic map based analysis, the much larger pixel size would have the advantage of greatly reducing the data volume in order to cover a given sized area.

The desirable spatial resolution also depends on the desired user classes. For example, for an urban setting where he desired classes of a thematic map might be high-density housing, low-density housing, commercial areas, and industrial areas, 50 meter pixels might be suitable, whereas if the data consisted of 1 meter pixels, logical classes might be grass, trees, rooftops, streets, parking lots, etc, the elements making up the 50 meter pixels. Indeed, there is generally a hierarchy of classes based upon spatial resolution, with logical sets of classes at any given resolution being made up of mixtures of the logical sets of classes at the next finer resolution. In this urban illustration a high-density housing pixel at 50 meters would be made up of a certain mixture of 1 meter pixels of grass, trees, rooftops, etc, a mixture of different proportions than that for low density housing and the other classes. Further, at still finer resolution, grass, for example, would be made up of stems, leaves, understory soil, etc, and so on down to the molecular level. Recognizing this kind of hierarchy is important in determining what kind of thematic map can be successfully created at a given spatial resolution; further, it suggests that there is no such thing as a "pure" pixel. All pixels provide a mixture of spectral responses, and any user class is best represented as a statistical ensemble, accounting for the variations in the mixture within the user class.

Spectral Resolution. Whereas spatial resolution and what one can "see" is usually the primary concern in image-oriented systems, spectral resolution becomes of greater significance in thematic mapping systems. Spectral resolution is usually less so for image-oriented systems, since the human visual system has a somewhat more modest capability to deal with complex spectral wavelength variations than do well-chosen computer algorithms for thematic mapping.

The ability to discriminate between materials based on their spectral response is directly related to the detail of the spectral responses emanating from the materials of the scene. Customarily, spectral detail is described in terms of the number of discrete spectral bands per pixel. These bands are used to make up a multidimensional vector space where the coordinates are in terms of the response in spectral band 1 vs. that of band 2 vs. that of band 3 vs. … Generally speaking, the greater the number of spectral bands available per pixel, the greater the potential for achieving accurate discrimination between highly detailed lists of classes. However there is a

down side to high dimensional spectral data that must be balanced against increasingly large number of spectral bands, as will be seen below. Further, this bound on spectral dimensionality is intertwined with radiometric resolution, as described in the following.

Radiometric Resolution. Radiometric resolution deals with the precision with which the power level in a given pixel and a given wavelength band can be resolved. More directly stated, it is usually measured in terms of the number of bits and therefore the number of possible discrete radiometric levels resolvable in each spectral band of data. These two, the number of bands and the number of possible discrete values in each band, determine the volume of the discrete vector space and this volume relates directly to the detail achievable in the separability of different classes in the vector space for thematic mapping. Since the radiation field from the subject matter is finite in magnitude, once the spatial pixel size is determined and the width of each wavelength band is chosen, there is only so much power left to overcome the internal noise present in the sensor system.

Early sensor systems, such as the Landsat MSS, used 6 bit data systems, allowing for $2^6 = 64$ levels to be resolved. The dynamic range of these 64 levels needed to be set so the brightest pixels expected would not exceed the 64th brightness level, while the darkest area expected was at or above the first level. In any given data set, a data range of well less than 64 levels would likely occur, since both the brightest and the darkest pixels ever expected would not likely occur in any single data set. Data systems of only 6 bits proved to be too limiting for most thematic mapping application problems. Second-generation senor systems, such as Landsat Thematic Mapper used 8 bit data systems, however, this, together with only 7 spectral bands, still proved to be only marginally adequate. Modern sensor data systems now typically use 10 or more bits, meaning that the power level in each pixel and spectral band is potentially resolvable to as many as 2^{10} =1024 different levels, though again in any given data set, substantially fewer levels would likely be found. But to achieve this level of power resolution while at the same time increasing both the spatial and the spectral resolution required increases in the sensor sensitivity or the dwell time on each pixel or both.

Extracting Information from Data. Optimal system design fundamentals specify that, to obtain an optimum design for information extraction,

- one must make an adequately precise quantitative model of the physical data to be dealt with and that
- a desired index of performance must be quantitatively specified as well.

Then one can determine the optimal design based on the model by maximizing the index of performance. For an image-oriented approach, these fundamentals are difficult to implement due to the subjective nature of images relative to the human visual system. However, for spectrally oriented thematic mapping problems, the application of these fundamentals is more straightforward.

For spectrally oriented thematic mapping systems the index of performance is nearly always classification accuracy. The modeling process is accomplished by specifying an appropriate list of classes and defining them quantitatively to adequate precision via the training process. The ensemble modeling each class must be complete enough to include the range of conditions (e.g. forest stand densities, crop varieties and development states, etc.) that the analyst wishes to have included in each of the thematic classes.

Commentary. Straying from reliance on the fundamentals of class modeling and a quantitatively defined index of performance can result in inappropriate or incorrect conclusions. It is of critical importance not to confuse elements of the spectrally based thematic mapping method with that of the image-oriented approach. For example, many authors analyzing Landsat Thematic Mapper data used only six of the seven available bands, "because of the poor resolution of the thermal band." This viewpoint, carried forward from paper to paper, has led to an apparently widely held belief that it is true, even though no concrete quantitative evidence has been given. The relevance and usefulness of the thermal (or any other) band needs to be evaluated quantitatively for a thematic mapping task and based directly upon the intended index of performance, i.e., classification accuracy, rather than how the data appears in image form to a human observer. The simple task of classifying the data with and without the thermal band can point to whether the spatial resolution of the band has specific relevance to the task at hand, but also use of an appropriate feature selection or feature extraction procedure can result in a much more sound and objective conclusion. Once again, reliance solely on intuition is an unwise practice. There are a number of examples of this problem in the literature. Others are whether to "correct for the atmosphere" or in assessing the viability of "pixel unmixing."

Evidence has shown that the precision with which the class modeling is done is of critical importance. The particular algorithm used in the analysis process is less significant in that any of a number of methods (maximum likelihood, neural network, fuzzy logic, genetic algorithms, etc) properly applied, can produce satisfactory results. See for example, Graeme G. Wilkinson, "Results and Implications of a Study of Fifteen Years of Satellite Image Classification Experiments," IEEE Transactions On Geoscience And Remote Sensing, Vol. 43, No. 3, March 2005.

Indeed, the precision of class modeling has a direct relationship to the complexity of the spectral feature space to be used. Classes do tend to occur in different portions of the feature space, but not necessarily completely so. As previously noted, radiometric resolution together with the spectral reso-

lution in terms of the number of spectral bands tends to determine how fine a detailed class can be discriminated, since they determine how many discrete locations exist in the defined feature space for each spatial pixel. The idea is to spread the data out in the feature space adequately so that discrimination between the desired classes to an adequate level of accuracy is possible. A high volume space tends to increase this possibility. For example, for 10 bit data in 100 spectral bands there are potentially $(1024)^{100} \cdot 10^{300}$ discrete locations. That number is so large that, even for a data set of 106 pixels, the probability of any two pixels lying in the same discrete location is vanishingly small. Thus, in theory, everything is separable from everything. The problem is, to achieve an accurate discrimination in such a feature space, the decision boundaries between the desired classes must be very precisely located and the higher the feature space volume, the more so. To achieve this precision, very large training sets for each class are ordinarily required in order that the distribution of each class can be determined with adequate precision.

This is the reason for the so-called Hughes phenomenon (see G. F. Hughes, "On The Mean Accuracy Of Statistical Pattern Recognizers," IEEE Trans. Information Theory, Vol. IT-14, No. 1, pp. 55-63, 1968), the fact that as one includes an increasing number of spectral bands so as to increase the potential discriminating power, classification accuracy tends to increase for a while then decreases as the demand for precision in decision boundary location begins to overcome the value of increasing the volume of the feature space as determined by the number of bands and the number of resolvable levels per band. It is for this reason that, early on in the development of multispectral analysis technology, first feature selection and later feature extraction algorithms became of use, these being ways to determine a case-specific subset or smaller number of spectral features to use in a specific discrimination task. The process is one of determining a subspace from within the full signal space where the best discrimination could be obtained for the given classes.

Feature selection is the process of selecting the best m bands out of the total of n bands available to use for a given analysis problem. It was effective early in the development of the technology when the number of bands in sensor systems was more limited. However, feature selection has several significant limitations. For one, the number of bands, m, to be used must usually be arbitrarily selected, since ways to do so quantitatively are often difficult to carry out. For another, choosing m bands out of n means that any diagnostic properties of the n-m bands not used are lost. Available feature extraction algorithms can mitigate both of these limitations. In this case, rather than outright discarding some of the bands, a transformation based on all available bands is used. The transformation is based on the class models of interest and results in definition of a subspace with an indication of the likely degree of class separability achievable. A disadvantage of such feature extraction algorithms is that they may be somewhat mathematically complex to understand and apply.

Other shortcomings can arise when reliance is on intuition rather than sound quantitative evaluation based on the intended quantitative index of performance. For example, a principal components transformation is frequently put forth as a useful preprocessing step to "remove interband correlation" implying that correlation indicates redundancy and thus is undesirable. Correlation between bands is not necessarily a bad thing. It merely gives an initial indication of how the data set is distributed around its mean location in feature space. Indeed, the diagnostic aspect of a spectral response relative to a given class may manifest itself as spread over a spectral range as wide as several spectral bands. In such a case, correlation over those bands is to be expected. An illustration illuminating the role of interband correlation is given in Chapter 1 of the textbook by David Landgrebe entitled, Signal Theory Methods In Multispectral Remote Sensing, Wiley, 2003.

Frequently the principal components transformation is suggested as a feature extraction procedure. It may appear at first glance to be effective in this role, however it has a significant weakness in this use and indeed involves a hidden danger. The weakness arises from the fact that the principal components transformation is not based upon the classes of current interest, but only on the data set as a whole. Thus it cannot be optimal in producing a subspace that best separates the given set of classes at hand. But beyond that, the diagnostic aspect of some classes may be spread across several bands, while for others it may exist in narrow regions or even single spectral bands. An example of this would be that of certain minerals where their identity may be due to molecular absorptions at single wavelengths, as used in spectrographic analysis often done in the laboratory. Principal components analysis orders features according to the size of the components with those accounting for the largest variation first. Variation from narrow regions would be small and are likely to be relegated to the least principal components and thus lost.

In the literature one often finds statements to the effect that maximum likelihood classifiers make a strict assumption of multivariate Gaussian probability distributions for classes. Though unfortunately common in the literature, this statement is not true. Maximum likelihood methods make decisions based upon the value of class density functions at the point of a given sample and this may be done based upon whatever type of density function is most appropriate. Spectral class distributions are often more complex than a simple Gaussian distribution, thus attempting to model such a class with a single Gaussian density leads to an imprecise class model and therefore reduced classification accuracy. However the parametric nature of the Gaussian density is a convenience, and so as a practical matter, any given class is

frequently modeled to arbitrarily good precision via a combination of Gaussian density functions, individual members of which are referred to as subclasses of the class of interest. This approach allows for accurate modeling of even complex spectral classes while at the same time minimizing the number of density parameters that must be estimated.

Other uses of multispectral technology. Though much of the work on multispectral technology has been done with regard to data of the Earth acquired from spacecraft, the use of measured electromagnetic energy emanating from illuminated molecules as a function of wavelength is quite fundamental and should have wide applications. When asked how remote is remote in remote sensing, a colleague often gives the answer "ten wavelengths," a distance where the edge effects have faded, and drawing attention to the fact that the information-bearing aspects of a multispectral return really are based at the molecular level. Thus the technology is just as applicable through a microscope in a laboratory as from a telescope on a space satellite and all scales between. This realization opens up many possible applications, probably most of which have yet to be explored. As an example of this, for the past decade or so, a company in the Boston area had been working on using a multispectral approach to detect cervical cancer. The idea is to illuminate the surface of the cervix and to analyze the response, measuring it in many wavelengths, relating the responses to the types of cells present. The work proceeded to the point of having obtained US FDA approval in March 2006 for its wide clinically use. It is less invasive than the conventional Paps Smear and provides near immediate results.

Using the same technology, Purdue University researchers reported in May 2006 that they have developed a system that quickly determines the composition of cells and tissue for medical diagnostics and scientific applications as applied to the field of "flow cytometry," or analyzing cells that are contained in a liquid flowing past a laser beam. See http://news.uns.purdue.edu/html4ever/2006/060522.Robinson.spectral.html. The same technology has also recently been reported for use in mouse skin tumor detection. See Song G. Kong, Matthew E. Martin, and Tuan Vo-Dinh. "Hyperspectral Fluorescence Imaging for Mouse Skin Tumor Detection," ETRI Journal (Korea), Vol. 28, No. 6, December 2006.

As another example, the use of multispectral technology in examining artwork has become an active area. See http://www.nap.edu/catalog/11413.html. The need in the art museum and archive world is for effective means for authentication of valuable pieces of artwork, for example by determining the actual pigments used and thus the era in which it was painted, and for the study of painting techniques, among other things, so as to correctly associate a piece of work with the proper artist and era.

There are surely many more ways in which multispectral technology could be used to derive valuable, needed information. Returning to the wireless communication system analogy briefly, since it is characteristic of remote sensing applications that the "transmitter," i.e. the subject matter, cannot be designed but must be as thoroughly understood as possible in terms of its interaction with electromagnetic fields, it is clear that in any such new use of the technology and the development of the methodology must be approached as an interdisciplinary problem requiring the expertise of specialists in both the subject matter and the signal processing aspects of the problem.

GRSS ADMINISTRATIVE COMMITTEE MEMBERS AT THE NOVEMBER ADCOM MEETING

REPORTS

GRS-S PUBLICATION AWARDS PRESENTED AT IGARSS 2007 BANQUET

Werner Wiesbeck, Chairman, Fellow, IEEE; R. Keith Raney, Fellow, IEEE; Kamal Sarabandi, Fellow, IEEE; Kiyo Tomiyasu, Life Fellow, IEEE; Yoshio Yamaguchi, Fellow IEEE

The 2007 IEEE Geoscience and Remote Sensing Society's publications awards were presented at the Awards Banquet in the Reials Drassannes de Barcelona on Thursday, July 26th in Barcelona, Spain. The Awards Banquet was embedded in a visit to the Maritime Museum. The Reials Drassannes is the ancient shipyard, were the wooden ships were built and the first steamers and submarines were developed. The ships were from the Reials Drassannes directly set to water, the Mediterranean See. An impressive show, some ships took several hundred rowers to move them. After the visit to the Museum we were invited to the reception with aperitifs and Catalonian fingertips. Impressions from this impressive environment are conveyed by the following photos.

The big hall where we had the aperitif. Can you recognize some of the GRS members?

The banquet was on the other side of the hall. Most guests are already sitting, a few still looking for a place.

But we were also there for the Catalonian Dinner and the Awards presentation.

The following awards were presented:

- Transactions Prize Paper Award
- Letter Prize Paper Award
- Symposium Prize Paper Award
- Interactive Session Prize Paper Award
- Chapter Excellence Award
- Three Student Prize Paper Awards
- Certificate of Recognition

IEEE GRS-S Transactions Prize Paper Award

The GRS-S established the **Transactions Prize Paper Award** to recognize the authors who have published an exceptional paper in the IEEE Transactions on Geoscience and Remote Sensing during the past calendar year. In selecting the paper, other factors considered are originality and clarity of the paper. IEEE membership is preferable. Prize: $2000, equally divided for the authors and a certificate.

The ***2007 Transactions Prize Paper Award*** was presented to ***Ingo Walterscheid, Joachim H. G. Ender, Andreas R. Brenner, and Otmar Loffeld*** with the citation:

For a very significant contribution to the field of endeavor of the IEEE GRS Society in the paper entitled "**Bistatic SAR Processing and Experiments,**" *coauthored by Ingo Walterscheid, Joachim H. G. Ender, Andreas R. Brenner, and Otmar Loffeld, and published in the IEEE Transactions on Geoscience and Re-mote Sensing, Vol. 44, Issue 10, Part 1, Oct. 2006, pp. 2710 - 2717*

Ingo Walterscheid received the Diploma degree in electrical engineering from the University of Siegen, Germany, in 2002.

Since July 2002, he has been a Research Associate at the Research Institute for High Frequency Physics and Radar Techniques (FHR) in the German defense research establishment FGAN. His current research interests are in the areas of bistatic SAR systems and experiments, mono- and bistatic SAR signal theory, motion compensation and bistatic SAR processing.

Since 2004, he has been working toward the Ph.D. degree on bistatic SAR imaging as a member of the International Postgraduate Program "Multi Sensorics" at the Center for

Sensorsystems (ZESS), University of Siegen.

Joachim H. G. Ender received the doctor's degree at the Ruhr-University Bochum, Germany, in electri-cal engineering. Since 1992 he lectures on Radar techniques and signal processing at this university, where he received the "Honorary Professor" award in 2002.

Currently he is the director of the Research Institute for High Frequency Physics and Radar Techniques (FHR) in the German defense research establishment FGAN, which he joined in 1976 after the studying of Mathematics and Physics at the University of Muenster, Germany. At FGAN he is responsible for the research activities in various themes of Radar and Radar counter measures. Further, he serves as a consultant on Radar topics to government and industry and is engaged in academic education. Since 2005 he additionally teaches at the Technical University RWTH-Aachen. For the centre of sensor systems (ZESS) of the university Siegen, Germany, he is speaker of its scientific board and member of the scientific coun-cil of the international postgraduate program. His current research interests are: Architectures of phased array antennas, multi-baseline and wideband processing techniques for across-track SAR interferometry, ground moving target detection with air and space based Radar, inverse SAR for moving target imaging and bistatic SAR processing.

Joachim H. G. Ender is author and co-author of numerous papers and frequently serves as a reviewer for various international journals and conferences. He is one of the founding members of the "European Con-ference on Synthetic Aperture Radar (EUSAR)" which was started in 1996 and takes place every two years, Member at Large of the Sensor & Electronics Technology (SET) panel of NATO-RTO, senior member of IEEE (GRSS), and member of ITG/VDE and DGON.

Andreas R. Brenner received the Diploma degree in physics from the Technical University of Karlsruhe, Germany, in 1987, and the Ph.D. degree in electrical engineering from the RWTH Aachen University, Germany, in 1993. His Ph.D. dissertation focused on image formation in magnetic resonance imaging. Since 1993, he has been the Head of the research group Medical Electronics at the Chair of Electrical En-gineering and Computer Systems, RWTH Aachen University, where he has been working on signal proc-essing and image formation in the fields of magnetic resonance imaging and ultrasonic imaging.

In 2000, he joined the Institute for High Frequency Physics and Radar Techniques (FHR), Forschungsge-sellschaft für Angewandte Naturwissenschaften (FGAN), Wachtberg, Germany. Since 2003, he has been the Head of the Array-Based Radar Imaging department. His current research interests include array-based Radar imaging, multidimensional Radar imaging, ultrahigh-resolution SAR, motion compensation, auto focusing methods, digital beam-forming, and bio-static and multistatic Radar imaging.

Otmar Loffeld received the Diploma degree in electrical engineering from the Technical University of Aachen in 1982, the Eng. Dr. degree, and the 'habilitation' in the field of digital signal processing and estimation theory in 1986, and 1989, respectively, both from the University of Siegen. He received the scientific research award of Nordrhine-Westphalia ("Bennigsen-Foerder Preis") for his works on applying Kalman filters to phase estimation problems such as Doppler centroid estimation in SAR, phase and fre-quency demodulation.

In 1991 he was appointed Professor for digital signal processing and estimation theory at the University of Siegen. Since then he gives lectures on General Communication Theory, Digital Signal Processing, Stochastic Models and Estimation Theory and Synthetic Aperture Radar. He is author of two textbooks on estimation theory.

In 1995 Prof. Dr. Loffeld became a member of the Center for Sensorsystems (ZESS) which is a central scientific research establishment at the University of Siegen. Since 2005 he is the Chairman of that Center. In 1999 he became Principal Investigator (PI) on Baseline Estimation for the X-Band part of the Shuttle Radar Topography Mission (SRTM) where ZESS contributed to DLR's baseline calibration algo-rithms. Prof. Loffeld is PI for interferometric techniques in the German TerraSAR-X mission, and, together with Prof. Ender from FGAN, he is one the PI's for a bistatic spaceborne airborne experiment, where TerraSAR-X will serve as the bistatic illuminator while FGAN's PAMIR system mounted on a Transall airplane will be used as a bistatic receiver.

His current research interests comprise multi sensor data fusion, Kalman filtering techniques for data fusion, optimal filtering and process identification, SAR processing and simulation, SAR-interferometry, phase unwrapping, and baseline estimation. A recent field of interest is bistatic SAR processing. Prof. Loffeld is a member of the ITG/VDE and Senior Member of the IEEE/GRSS.

Three receipients of the 2007 Transactions Prize Paper Award from the IEEE GRS-President, from left: Joachim H. G. Ender, Otmar Loffeld, and Ingo Walterscheid, together with IEEE GRS-S President Leung Tsang and the Awards Chair Werner Wiesbeck

IEEE GRS-S Letters Prize Paper Award

The GRS-S established the **Letters Prize Paper Award** to recognize the author(s) who has published in the IEEE Geoscience and Remote Sensing Letters during the calendar year an exceptional paper in terms of content and impact on the GRS-Society. If a suitable paper cannot be identified from among those published during the calendar year, papers published in prior years and subsequently recognized as being meritorious may be considered. In selecting the paper, originality, impact, scientific value and clarity are factors considered. IEEE membership is preferable. Prize: $1000, equally divided for the authors and a certificate.

The ***2007 Letters Prize Paper Award*** was presented to ***Stéphane Guillaso, Andreas Reigber, Laurent Ferro-Famil, and Eric Pottier*** with the citation:

For a very significant contribution to the field of endeavor of the IEEE GRS Society in the paper entitled "**Range Resolution Improvement of Airborne SAR Images**," *coauthored by Stéphane Guillaso, Andreas Reigber, Laurent Ferro-Famil, and Eric Pottier, and published in the IEEE Letters on Geo-science and Remote Sensing*, Vol. 3, Issue 1, Jan. 2006, pp. 135 - 139

Stéphane Guillaso was born in Marseille, France in 1976. He received the diploma degree in applied physics from the University of Marseille 2, France, the M.S. and Ph.D. in signal processing and telecommunication from the University of Rennes 1, France, in 1999, 2000, and 2003 respectively.

From 2000 to 2003, he has been with the Image and Remote Sensing Group (SAPHIR Team) at the Rennes Institute of Electronics and Telecommunications, working in the field of urban area analysis using polarimetry and interferometry SAR data. In 2004, he joined the Computer Vision and Remote Sensing group of the Berlin University of Technology, for a post-doc on polarimetric SAR Tomography. From October 2006 to January 2007, he was with the Forschungszentrum Jülich, working in the field of hydrology and GPR. Since February 2007, he is with the Geology laboratory of the ENS (Ecole Nationale Supérieure), Paris, France, as a post-doc CNRS (National Center for Scientific Research), developing new approaches in transient deformation measured by SAR interferometry.

His current main research interests are the analysis of polarimetric interferometric SAR data by means of polarimetric, interferometric, and tomographic techniques, with applications to environmental remote sensing and ground movement detection related to geophysical phenomena.

Dr. Guillaso has received the best oral presentation award for a paper on polarimetric SAR interferometry, during the Propagation Conference in 2001. He also co-authored one paper, which has received the third prize of the EUSAR 2006 Student Paper Competition.

Andreas Reigber (M'02) was born in Munich, Germany, in 1970. He received the diploma degree in physics from the University of Constance, Germany, in 1997, and the Ph.D. degree from the University of Stuttgart, Germany, in 2001.

From 1996 to 2000, he has been with the Microwave and Radar Institute of the German Aerospace Center (DLR), Oberpfaffenhofen, Germany, working in the field of polarimetric SAR tomography. In 2001, he joined the Antenna, Radar and Telecom Laboratories of the University of Rennes 1, Rennes, France, for a postdoc on Radar polarimetry and polarimetric interferometry. Since 2002, he is research associate at the Computer Vision and Remote Sensing Group of the Berlin University of Technology, Germany, where he is coordinating the activities of the group in the field of SAR remote sensing.

His current main research interests are the various aspects of multi-modal SAR, like SAR interferometry, SAR polarimetry, SAR tomography and time-frequency analyses, but also hyperspectral remote sensing and the application of computer vision and machine learning approaches in remote sensing.

Dr. Reigber has received the IEEE TGRS Transactions Prize Paper Award in 2001 for a work on po-larimetric SAR tomography, as well as the EUSAR 2000 Student Prize Paper Award for an article on SAR remote sensing of forests. He also co-authored two papers, which have received the first prize of IGARSS 2005 student paper competition and third prize of the EUSAR 2006 student paper competition.

Laurent Ferro-Famil (M'00) received the laurea degree in electronics systems and computer engineer-ing, the M.S. degree in electronics, and the Ph.D. degree in 1996, 1996, and 2000, respectively, all from the University of Nantes, France. Since 2001, he has been an Assistant Professor at the University of Rennes I, Rennes, France. He is a member of the Radar Polarimetry Remote Sensing group of the Insti-tute of Electronics and Telecommunications of Rennes (I.E.T.R). His current activities in education con-cern analog electronics, digital communications, microwave theory, and polarimetric Radar imaging. He is especially interested in SAR signal processing, Radar polarimetry theory, and natural media remote sensing from polarimetric interferometric SAR data, with applications to segmentation, classification, electromagnetic scattering modeling, physical parameter inversion, and time frequency analysis.

Eric Pottier (M'95, SM'06) received the MSc and Ph.D. in signal processing and telecommunication from the University of Rennes 1, respectively in 1987 and 1990, and the Habilitation from the University of Nantes in 1998.From 1988 to 1999 he was an Associate Professor at IRESTE - University of Nantes, Nantes, France where he was the Head of the Polarimetry Group of the Electronic and Informatic Systems laboratory. Since 1999, he has been a Full Professor at the University of Rennes 1, France, where he is currently the Deputy Director of the Institute of Electronics and

Telecommunications of Rennes (I.E.T.R – CNRS UMR 6164) and also Head of the Image and Remote Sensing Group – SAPHIR Team. His current activities of research and education are centered in the topics of analog electronics, microwave theory and Radar imaging with emphasis in Radar polarimetry. His research covers a wide spectrum of areas from Radar image processing (SAR, ISAR), polarimetric scattering modeling, supervised/unsupervised polarimetric segmentation and classification to fundamentals and basic theory of polarimetry.

Since 1989, he has supervised more than 50 research students to graduation (MSc and PhD) in Radar Po-larimetry covering areas from theory to remote sensing applications. He has chaired and organized 31 sessions in International Conferences and was member of the Technical and Scientific Committees of 19 International Symposium or Conferences. He has given 33 invited presentations at international conferences and 16 in national conferences. He has published 7 book chapters, 38 papers in refereed journals and more than 250 papers in conference and symposium proceedings. He has presented advanced courses and seminars on Radar Polarimetry to a wide range of organizations. He received the Best Paper Award at EUSAR2000 for his research activities, co-authored with J.S. Lee (U.S. Naval Research Laboratory), in the topic of polarimetric unsupervised segmentation of POL-SAR data.

The recipients of the 2007 Letters Prize Paper Award, from left: Eric Pottier, Laurent Ferro-Famil, Andreas Reigber, and Stéphane Guillaso with the IEEE GRS-S President Leung Tsang and Werner Wiesbeck.

IEEE GRS-S Symposium Prize Paper Award

The GRS-S established the **Symposium Prize Paper Award** to recognize the author(s) who presented at the past GRS Symposium (IGARSS), an exceptional paper in terms of content and impact on the GRS-S. In selecting the paper, other factors considered are originality, clarity and timeliness of the paper. Prize: $1000, equally divided among the authors, and a certificate.

The 2007 Symposium Prize Paper Award was presented to ***Chris Ruf, Sidharth Misra, Steven M. S. Gross, and Roger De Roo*** with the citation:

For a very significant contribution to the field of endeavor of the IEEE GRS Society in the paper entitled "**Detection of RFI by its Amplitude Probability Distribution**," *coauthored by* **Chris Ruf, Sidharth Misra, Steven M. S. Gross, and Roger De Roo**, *and presented at the 2006 International Geoscience and Remote Sensing Symposium, July 2006 in Denver/USA, IGARSS´06 Proceedings.*

Christopher S. Ruf is Professor of Atmospheric, Oceanic & Space Sciences and Electrical Engineering & Computer Science and Director of the Space Physics Research Laboratory at the University of Michigan. He received the B.A. degree in physics from Reed College and the Ph.D. degree in electrical and computer engineering from the University of Massachusetts. He has worked previously at Intel Corpora-tion, Hughes Space and Communications, the NASA Jet Propulsion Laboratory, and Penn State University. During 2000 he was a Guest Professor at the Technical University of Denmark. His research interests include earth, planetary and solar microwave remote sensing. He is currently involved with microwave radiometers on the TOPEX, Jason, OSTM, WindSat, GPM, Aquarius and Juno spaceflight missions, with the NRAO FASR solar radio telescope, and with the development of ground and airborne prototypes of synthetic thinned aperture radiometers and RFI mitigation methods. He has received three NASA Certificates of Recognition (1990, 1992(2)) and four NASA Group Achievement Awards (1993(2), 1994, 2004), as well as the 1997 GRS-S Transactions Prize Paper Award and the 1999 IEEE Judith A. Resnik Technical Field Award. Prof. Ruf is a Fellow of the IEEE and a member of the AGU, AMS and URSI Commission F. He has served or is serving on the editorial boards of the IEEE GRS-S Newsletter, AGU Radio Science, IEEE Transactions on GRS and the AMS Journal of Atmospheric and Oceanic Technology.

Sidharth Misra received the B.E. degree in electronics and communication from Nirma Institute of Technology, Gujarat University, India in 2004 and the M.S degree in Electrical Engineering and Computer Science - Signal Processing from the University of Michigan, Ann Arbor in 2006. He is currently working as a Research Assistant at the Electromagnetic Systems group, Danish National Space Center, Technical University of Denmark, Lyngby. He was previously a Research engineer for the Space Physics Research Laboratory, University of Michigan, Ann Arbor, working on the analysis and implementation of the agile digital detector for RFI mitigation. He has also worked on Oceansat-II for the Space Application Center, Indian Space Research Organization, Ahmedabad. He is currently involved with RFI analysis for CoSMOS - an airborne campaign preparing for SMOS at DTU. His research interests involve signal detection and estimation, filter design, and image processing.

Steven M. S. Gross is a member of the engineering staff

of the Space Physics Research Laboratory at the University of Michigan. He received the B.S. degree in electrical engineering in 1990, the M.S. degree in electrical engineering in 1993, and the M.B.A. degree in 2000, all from Michigan State University. Prior to joining SPRL, he was a member of technical staff in the High Energy Physics group at Michigan State University and at the TRW Corporation. His primary engineering activities involve high-speed digital logic and field-programmable gate array design. Mr. Gross is the recipient of a 2004 NASA Group Achievement Award as a member of the Lightweight Rainfall Radiometer Instrument Team.

Roger D. De Roo received the B.S. in Letters and Engineering degree from Calvin College, Grand Rap-ids, MI, in 1986, the B.S.E., M.S.E., and Ph.D. degrees from the University of Michigan in 1986, 1989, and 1996 respectively, all in electrical engineering. His dissertation topic was on the modeling and measurement of bistatic scattering of electromagnetic waves from rough dielectric surfaces. From 1996 to 2000, he was employed as a Research Fellow at the Radiation Laboratory in the department of Electrical Engineering and Computer Science (EECS) of the University of Michigan, investigating the modeling and simulation of millimeter wave backscattering phenomenology of terrain at near grazing incidence. Since 2001, he is employed as an Assistant Research Scientist in the department of Atmospheric, Oceanic, and Space Sciences (AOSS) at the University of Michigan. His current research interests include digital correlating radiometer technology development, including radio frequency interference mitigation, and inversion of geophysical parameters such as soil moisture, snow wetness and vegetation parameters from Radar and radiometric signatures of terrain. He has supervised the fabrication of numerous dual-polarization microcontroller-based microwave radiometers. He is a member of IEEE and AGU.

The recipients of the 2007 Symposium Prize Paper Award seem to be quite happy, from left: Sidharth Misra, Roger De Roo, and Chris Ruf with the IEEE GRS-S President.

IEEE GRS-S Interactive Session Prize Paper Award

The **Interactive Session Prize Paper Award** was presented for an exceptional paper posted in an Inter-active Session of the Past International Geoscience and Remote Sensing Symposium (IGARSS). The award is a companion to the Symposium Prize Award. A special committee designated by each IGARSS assesses all papers posted in the Interactive Sessions. The special committee scores papers on readability ease, comprehension ease, clarity, background adequacy, originality, significance, impact, etc. Those papers with the high scores are screened by the GRS-S Awards Committee to select the prize paper. Prize: $750, equally divided among the authors, and a certificate.

The ***2007 Interactive Session Prize Paper Award*** was presented to **Brent Allen Williams and David Long** with the citation:

For an exceptional paper posted in the Interactive Session of the International Geoscience and Remote Sensing Symposium IGARSS'06 entitled "**An Improved High Resolution Wind Ambiguity Removal Procedure for SeaWinds,**" *coauthored by* **Brent Allen Williams and David Long**, *and presented at the 2006 International Geoscience and Remote Sensing Symposium, July/Aug. 2006 in Denver/USA, IGARSS´06 Proceedings.*

Brent A. Williams received the B.S. degree in electrical engineering from Brigham Young University, Provo, UT, in 2005. He is currently pursuing the Ph.D. degree in electrical engineering at Brigham Young University.

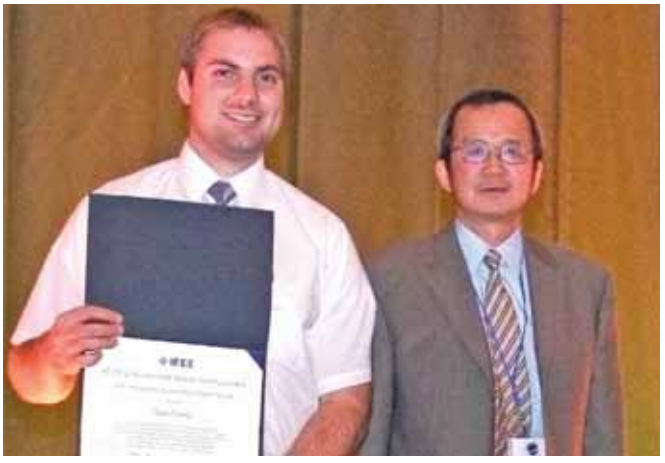
Since 2005 he has worked in the Microwave Earth Remote Sensing Laboratory exploring ultra high reso-lution ocean wind scatterometery. His current research interests are in estimation, ambiguity removal, and validation of ultra high resolution wind fields derived from the SeaWinds scatterometer. Mr. Wil-liams is a member of Eta Kappa Nu.

David G. Long obtained the Ph.D. in Electrical Engineering from the University of Southern California in 1989. From 1983 to 1990 he worked for NASA's Jet Propulsion Laboratory where he developed ad-vanced Radar remote sensing systems. At JPL he was the Project Engineer on the NASA Scatterometer (NSCAT) project, which flew from 1996 to 1997. He also managed the SCANSCAT project, the precursor to SeaWinds, which was launched in 1999 and 2002.

He is currently a Professor in the Electrical and Computer Engineering Department at Brigham Young University where he teaches upper division and graduate courses in communications, microwave remote sensing, Radar, and signal processing and is the director of the BYU Center for Remote Sensing. He is the principle investigator on several NASA-sponsored research projects in remote sensing. He has numerous publications in signal processing and Radar scatterometry. His research interests include microwave remote

sensing, Radar theory, space-based sensing, estimation theory, signal processing, and mesoscale atmospheric dynamics. He has over 290 publications.

Dr. Long has received the NASA Certificate of Recognition several times. He is an Associate Editor for the IEEE Geoscience and Remote Sensing Letters.



The recipient of the 2007 Letters Prize Paper Award Brent Allen Williams together with the IEEE GRS-S President Leung Tsang.

IEEE GRS-S Chapter Excellence Award

The Geoscience and Remote Sensing Society presented the Chapter Excellence Award this year for the second time.

The ***2007 Chapter Excellence Award*** was presented to the ***IEEE GRS South Italy Chapter*** with the citation:

"*For excellence as a GRS-S Chapter demonstrated by exemplary activities during 2006*".

For the South Italy GRS-S Chapter their Chairman Maurizio Migliaccio received the Award (in the middle)

Student Prize Paper Awards

This year two GRS-S Student Prize Paper Awards and for the first time the **IEEE Mikio Takagi Student Prize** were presented.

GRS-S Student Prize Paper Awards

The GRS-S **Student Prize Paper Awards** were established in 1998. The two Awards are intended to recognize the best student papers presented at the IEEE International Geoscience and Remote Sensing Symposium (IGARSS). It is believed that early recognition of an outstanding paper will encourage the student to strive for greater and continued contributions to the geoscience and remote sensing profession.

Ten excellent papers were preselected by the Awards Committee in cooperation with the Technical Program Committee. At IGARSS '07 in Barcelona 10 of the students presented their papers in a special session on Tuesday morning and a jury, nominated by the GRS-S Awards Chair, evaluated the papers and ranked them for the awards.

The ***Second 2007 GRS-S Student Prize Paper Award*** was awarded to ***Karan Jumani*** with the Citation:

For the paper "**An Investigation of PN Sequences for Multi-static SAR/InSAR Applications**"

His advisor is Kamal Sarabandi from the **University of Michigan at Ann Arbor**.

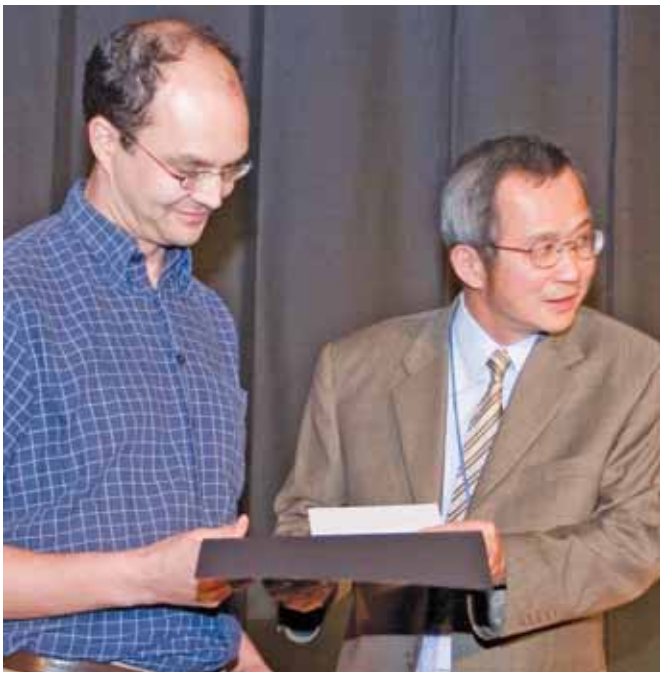
Karan Jumani receives his GRS-S Student Prize Paper.

Karan Jumani was born in Bangalore, India in 1982. He received a Bachelor of Engineering degree from the Visvesvaraya Technological University, India, and a Master of Science degree from the University of Michigan, Ann Arbor, USA. His field of research involves the use of spread spectrum codes in the Radar imaging of distributed targets.

The ***First 2007 GRS-S Student Prize Paper Award*** was awarded to ***Stefan Sauer*** with the Citation:

For the paper "**Multibaseline POL-InSAR Analysis of Urban Scenes for 3D Modeling and Physical Feature Retrieval at L-Band**"

His advisor is Prof. *Eric Pottier* from the **University of Rennes, France**.



Stefan Sauer receives his Student Prize Paper Award from the GRS-S President Leung Tsang.

Stefan Sauer (S'06) studied mathematics and computer science at Berlin University of Technology (TU Berlin), Germany. Supported by an Erasmus scholarship he spent one year at the Mathematics department of the University of Nantes, France. In 2003, he received the diploma degree in mathematics from TU Berlin. Currently, he is pursuing Ph.D. degree in signal processing and telecommunications in the SAPHIR team at the Institute of Electronics and Telecommunications of Rennes, University of Rennes 1, France. The first one and a half years, his Ph.D. work was supported by the AMPER research training network of the European Commission. His research interests are in the area of Synthetic Aperture Radar (SAR) signal processing, and in particular multibaseline polarimetric interferometric SAR data analysis. The research work consists of applying spectral analysis techniques to investigate multibaseline POL-InSAR measurements of urban areas for 3D-Modeling and physical feature extraction.

2007 IEEE Mikio Takagi Student Prize

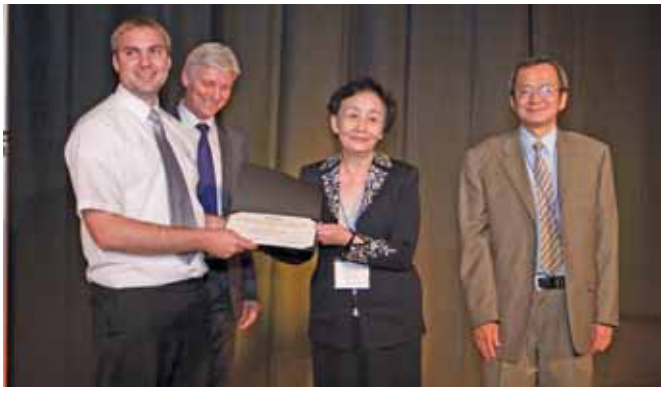
The **IEEE Mikio Takagi Student Prize** was established in 2006. It is to recognize a student who has presented an exceptional paper at the IEEE Geoscience and Remote Sensing Symposium (IGARSS). It was presented in 2007 for the first time.

The **2007 IEEE Mikio Takagi Student Prize** was presented to **Brent A. Williams** with the Citation:

For the paper "**Hurricane Wind Field Estimation from SeaWinds at Ultra High Resolution**"

His advisor is Prof. David G. Long from Brigham Young University, Provo, UT.

Brent A. Williams received the B.S. degree in electrical engineering from Brigham Young University, Provo, UT, in 2005. He is currently pursuing the Ph.D. degree in electrical engineering at Brigham Young University. Since 2005 he has worked in the Microwave Earth Remote Sensing Laboratory exploring ultra high resolution ocean wind scatterometery. His current research interests are in estimation, ambiguity removal, and validation of ultra high resolution wind fields derived from the SeaWinds scatterometer. Mr. Williams is a member of Eta Kappa Nu.



We were very happy to have the donator of the prize, the wife of Mikio Takagi with us to hand the award to Brent A. Williams together with the IEEE GRS-S President Leung Tsang (right) and the Awards Chair Werner Wiesbeck (back).

Certificate of Recognition

A Certificate of Recognition is presented to **Siri Jodha Singh Khalsa** with the citation:

"*For his dedication and contribution to standardization in support of Earth Observations*."

Siri-Jodha Singh Khalsa (SM) received a B.A. in Physics from the University of California, Irvine, and his Ph.D. in Atmospheric Sciences from the University of Washington, Seattle. His early work in boundary layer turbulence and tropical air-sea interaction evolved into an interest in large scale inter-decadal trends in atmospheric structure revealed in satellite sounding records. Since 1993 he has supported NASA's Distributed Active Archive Center (DAAC) at National Snow and Ice Data Center (NSIDC) where he performs science evaluation and algorithm support for cryospheric data products from NASA's Earth observing satellites. He is also engaged in research on methods of remotely sensing glacier change as part of the GLIMS project. S.J.S. Khalsa is the IEEE/GRS-S liaison to ISO/TC211. He is chair of the IEEE Committee on Earth Observations (ICEO) Standards Working

Group, and leads several IEEE-initiated activities supporting standards and interoperability for the Global Earth Observing System of Systems (GEOSS).

Certificates of Recognition are always a special highlight of the Awards Banquet. Siri-Jodha Singh Khalsa together with the IEEE GRS-S President Leung Tsang (right) and the Awards Chair Werner Wiesbeck (left).

The IGARSS 2007 Chairman Ignasi Corbella hands the Captain's insignia to the IGARSS 2008 Chairman John Kerekes and Co-chairman Eric Miller. IGARSS goes from a harbor city to a harbor city.

Congratulations to all 2007 Award Recipients

We, the GRS-S Awards Committee, would like to take this opportunity to encourage more active participation of the GRS-S members in the nomination process of the GRS-S Awards, especially the Distinguished Achievement Award, the Outstanding Service Award and the Education Award. The nomination requires only an endorsement from the nominator, a candidate biography, a curriculum vitae and a proposal for the citation to be mailed or sent to the Awards Committee Chairperson. We are looking forward to seeing excellent technical and service contributions from Society members during this current awards cycle.

In keeping with tradition, the banquet was concluded when the IGARSS 2007 Chairmen Ignasi Corbella turned over the responsibility for the International Geoscience and Remote Sensing Symposium to the IGARSS 2008 Chairman John Kerekes and Co-chairman Eric Miller, with best wishes for the conference in Boston, USA. IGARSS 2007 has been extremely successful in terms of participants, science, and management. The hurdles are high, best wishes for IGARSS 2008.

See you next year, July 7-11, in Boston, U.S.A.

Werner Wiesbeck

ANNOUNCEMENT
EDITOR IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING
EDITOR IEEE GEOSCIENCE AND REMOTE SENSING LETTERS

The IEEE GRSS Administrative Committee (AdCom) has formed a search committee to fill the positions of Editor for the IEEE Transactions on Geoscience and Remote Sensing (TGRS) and Editor for the IEEE Geoscience and Remote Sensing Letters that are due to expire in January 2008. If you would like to be considered for either position, please send a C-V and cover letter to the search committee chair, Dr. Karen St. Germain (Karen.Stgermain@noaa.gov) before February 1, 2008.

IGARSS'07 in Barcelona

by Ignasi Corbella, General Chairman

The 2007 IEEE International Geoscience and Remote Sensing Symposium (IGARSS'07) was held this past summer from July 23rd to July 27th at the International Convention Center of Barcelona. It was the end of a long process that started in 2000 when the first proposal was presented by the local organizing committee to the AdCom in Hawaii. These many years of work and dedication were recompensed by the success of the conference.

General view of the plenary session with President Leung Tsang talking to the audience.

The true starting point had been the technical program committee (TPC) meeting that this year was held in Karlsruhe (Germany) on February 23rd. The TPC, formed by 30 people, selected more than 2000 papers after a review process involving about 340 reviewers. The selected papers were presented throughout the IGARSS week in eleven parallel oral sessions both in the morning and in the afternoon, as well as in 59 interactive sessions. There were a wide variety of subjects, including active and passive remote sensing, microwave and optical technology, image and data processing, electromagnetic theory, emission modeling and many others. In parallel with the technical sessions, the exhibition area was open from Tuesday to Thursday. A total of 28 leading-edge companies and organizations, in 42 booths, exhibited their most up-to-date products and services. The total number of IGARSS'07 attendees, including exhibitors but excluding accompanying persons, was 1529, which is the largest figure ever of any past IGARSS.

Tutorials and workshops were scheduled for Sunday July 22nd. Two full-day and three half-day tutorials were organized and had good attendance due to the high quality of the speakers and the subject interest. As it was done in previous years, the GEOSS workshop (GEOSS System and Interoperability) was held in parallel with the tutorials and experienced a very high attendance.

The opening ceremony began with a welcome from the IGARSS'07 general chairman, the vice-chancellor of the "Universitat Politècnica de Catalunya" (host institution of the LOC) and a representative of the Catalonia Government. Afterwards, Leung Tsang, as GRSS president gave some words of introduction and the IEEE president-elect, Dr. Lewis Terman, made an interesting speech about the IEEE vision for the future and contributions to Earth observation. The 2007 fellowship recognitions and awards were efficiently presented by the GRSS awards chair, Dr. Werner Wiesbeck, on this ocasion together with the director of IEEE Division IX, Dr. Rich Cox.

Plenary session panel. From left to right: I. Corbella, J. Pearlman, D. Muchoney, G. Stephens and S. Bruzzi. At the screen talking J. Schmetz.

The keynote speakers of the plenary session were consistent with the theme of the conference "Sensing and Understanding our Planet". They all focused their presentations on Earth Observation and all are leading experts in the field: Dr. Johannes Schmetz, Head of Meteorological Division of EUMETSAT spoke about "Operational Observations of Weather and Climate with Meteosat and Metop"; Dr. Stefano Bruzzi, Head of Coordination Service of the Directorate of Earth Observation of the European Space Agency gave a presentation on the "Challenges and Prospects for the European Earth Observation Landscape"; Dr. Graeme Stephens, principal researcher of the Cloud-Sat mission and professor at Colorado State University talked about the "Challenges of Observing Climate Change from Space"; Dr. Doug Muchoney, from GEOSS spoke about the "Progress and Plans of the Global Earth Observation System

of Systems"; and finally, Dr. Jay Pearlman, the chair of the IEEE Committee on Earth Observation gave us a report on this committee and on GEOSS.

The scientific program was packed with interesting and state-of-the-art presentations, both oral and interactive. Poster presentations were accessible during the entire day in the common area shared with the oral presentation rooms. Authors of posters were required to be present only during their poster session. These sessions were scheduled every day from Monday to Thursday after the oral sessions, so that no timing conflict occurred. This was surely one reason why we had one of the most successful poster sessions of past years in terms of our small number of "no-shows".

The technical program chairman Adriano Camps checking for possible poster no-shows.

The final program book was made smaller than in previous editions and more user-friendly. All attendees were given a gift towel with the full image of IGARSS'07 and a nice hand bag.

The social program included traditional Catalan exhibitions. On Monday, just after the ice-breaker reception there was a demonstration of "Castellers", a long tradition of Catalonia. On Thursday evening there was the welcome concert with a choir featuring traditional Catalan songs. The venue of the concert was a spectacular hall in a building that is one of the jewels of Barcelona. The traditional soccer match was very popular and was played in a field that was walking distance from the conference center.

The most important social event was the awards banquet. It was held at a historical building near the Barcelona port where ships were once constructed. A naval museum now occupies the place and the banquet attendees were invited to visit it. The IEEE GRS-S awards, the IEEE Mikio Takagi Student prize and a Certificate of Recognition were presented during the banquet by Werner Wiesbeck in a simple but emotive ceremony.

At the end, following tradition, the IGARSS'07 general chairman passed the responsibility for next year's conference to the chairmen of IGARSS 08, Dr. Eric Miller and Dr. John Kerekes with a gift symbolizing their nomination as captain and helmsman of the IGARSS ship. Our best wishes for a successful symposium in Boston 08.

General view of the awards banquet with Leung Tsang addressing the attendees.

It would be unfair not to recognize that this conference was only possible thanks to the financial support given by many institutions. The IGARSS organizing committee would like to especially thank the following: Universitat Politècnica de Catalunya, Institut Cartografic de Catalunya, ESA, NASA, JAXA, ONR, NPOESS, Ministerio de Educación y Ciencia, Generalitat de Catalunya and Ajuntament de Barcelona.

Eric Miller (left) and John Kerekes (right) ready to drive the IGARSS 08 boat to a good port.

Admittedly, there was a tremendous amount of work in order to make IGARSS'07 a successful event. Fortunately, the local organizing committee was an exceptional team: The Finance Chair, Francesc (Xicu) Torres; the Technical Program Chair, Adriano Camps with the support of Toni Broquetas and Adolfo Comeron; the Exhibits Chair, Jordi Mallorquí; the Local Arrangements chairpersons, Nuria Duffo, Mercè Vall-llossera and Albert Aguasca; the Tutorials

chair, Xavier Fàbregas; computer support, Josep Maria Haro and the web master, Sebastián Blanch. Without this team, any attempt to organize such a huge symposium would have simply been impossible. The local committee has worked enthusiastically over long periods of time and several hours per day in order to provide the support that has made the success of IGARSS'07 possible.

It should also be mentioned that the team at CIMNE has been in charge of all the details, even the smaller ones. Special mention is given to Cristina, Marta and Angel (Cruchi) who have always been ready to help. Cristina in particular carried upon herself a huge responsibility. The hours she dedicated to IGARSS are simply uncountable.

And last but not least, the continuous support and fantastic help given by the AdCom, and especially from the VP of Meetings and Symposia, Melba Crawford, must be recognized.

The local organizing team celebrating the success of IGARSS just after the banquet.

We look forward to seeing you again for IGARSS 2008 in Boston!

Cover Information *continued from page 3*

The WB-57 was in straight and level flight at 62,000' altitude during the coastal crossing. Measurements were made by a hybrid radiometer consisting of the mechanically steered antenna and analog receiver electronics of the NOAA/ETL Polarimetric Scanning Radiometer (PSR) [1] and the digital high order moment detector and data system of the U-Michigan Agile Digital Detector (ADD) [2]. PSR was operating in a conically scanning mode at a constant 55° angle of incidence. ADD measures the first four moments of the electric field amplitude associated with the brightness temperature. The second moment is the digital equivalent of a conventional square-law detector. The kurtosis (the fourth central moment divided by the square of the second central moment) is a derived data product. It is sensitive to the presence of non-thermal microwave radiation and, in particular, to manmade radio frequency interference (RFI).

The transition at the coastline from land to water is clearly identifiable in the brightness temperature image because of the large difference in their emissivities. Small coastal islands in the Gulf of Mexico are similarly visible. Discrete "hot spots" in the brightness temperature image are likely a result of RFI sources on the ground. The strongest ones appear as distinctive red and white points in the image. Weaker RFI may also be present, but its presence is masked by the natural variability of the background brightness temperature. The value of the kurtosis for natural thermal emission is approximately 3 and does not change with brightness temperature [2]. For example, the coastal transition from land to water has no effect whatsoever on the kurtosis image. The kurtosis of non-thermal RFI sources, on the other hand, is markedly different and stands out prominently in the image. This is the first known image of microwave kurtosis. The high sensitivity of the kurtosis to non-thermal signals, combined with its independence from variations in the thermal signals, makes identification of even extremely low level RFI sources much easier and more reliable.

[1] Piepmeier and Gasiewski, IEEE TGRS, 39(3), 606-622. 2001.

[2] Ruf, Gross and Misra, IEEE TGRS,44(3), 694-706, 2006.

Image credits: WB-57 photo by D. Boprie. WB-57 flight line by AS&M Data Systems. TB and kurtosis images by A. Warnock and C. Ruf.

IGARSS'07 Soccer Match

by Roberto Sabia

The IGARSS'07 soccer match was held in the international homeland of soccer, and undoubtedly the presence of *Camp Nou*, the impressive Barcelona *futból* cathedral, just few kilometres away, contributed to create a "soccer fever" atmosphere that everyone could soak up. Even though you could hardly spot a would-be Leo Messi, or a prospective Ronaldinho, among the attendees, the overall effect was an enjoyable and entertaining sunny afternoon of football.

After all, the objective was to gather the GRS community in a trans-sensor, multi-cultural, multi-gender event and figure out how well remote sensing people deal with the ground.

Stretching before the match

Logistics and event organization

The IGARSS'07 soccer match was played on Wednesday, July 25, 2007, starting at 6:30 PM, at "Campo municipal Agapito Fernandez" facilities, which were within walking distance from the convention centre. It was planned to be 7-on-a-side soccer played on a 'last-generation' artificial turf. The "call for papers" for this event had large attendance and was almost fully-booked with nearly 60 persons subscribed, and the few last-minute cancellations were counterbalanced by an almost equal number of onsite registrations.

Due to the number of participants, the soccer match was rather conceived as a soccer tournament. Thus, the event was arranged as a small league, consisting of 6 teams with an average of 10 players each. These teams were divided into two groups that played, following the IGARSS spirit, in "parallel sessions" on two adjacent fields.

Matches lasted 25 minutes each. To ensure a balanced competition, the different teams were arranged according to some self-evaluations previously provided from the different players. The tournament formula was chosen to guarantee at least two matches for each player.

Getting informed

Not less than 20 countries were represented in the competition, among them: Spain, France, U.S.A., Germany, Italy, England, Holland, China, Japan, Russia, Turkey, Denmark, Colombia, Malaysia, India, Perú, Canada and South Korea.

Mr. Pablo Blanco and Dr. Gerard Margarit of the Polytechnic University of Catalonia (UPC) in Barcelona, whose commitment to the tournament was acknowledged, abandoned their research duties for a day and were appointed referees of the contest.

At least 15-20 people watched the competition, supporting players or simply sitting back and relaxing, thus contributing to create such a lively atmosphere.

To enhance our connection to football champions, renowned European soccer teams were chosen in a compromise between soccer tradition and t-shirt color availability (generating some low-correlation matching). Hence, the following teams participated at the competition: Barcelona, Inter, Real Madrid, Chelsea, Manchester United, and Bayern Munchen.

Preliminary round

In group A, Chelsea started playing against Barcelona in a quite vibrant match that ended up with the defeat of the "local" team. Chelsea took the lead by placing the game at 2-0, and then did their best to hold on and wrap up the match. Pushed by its best player, Brazilian Rafael Zandona, Barcelona had an opportunity and managed to move the score

IG07 soccer participants

Willing to watch great football

Barcelona-Chelsea

to 2-1, but ultimately could not do anymore.

Soon after, Chelsea vs. Real Madrid developed into a very open game, with precarious scoring, and eventually tied at 2-2. This match was full of emotion and characterized by a controversial goal from a missed save by the Chelsea goalkeeper. On the play, it appeared that the goalkeeper's line was crossed; nevertheless, the referee (mistakenly?) denied the goal with the complaints of Real Madrid players (and immediately generating a chorus of "Yes, it crossed" "No, it did not" in the stands crowd). In the end, the decision was reversed and Chelsea secured the valuable point.

In the last match of the group, Real Madrid, disheartened with the tie from Chelsea in the previous match, never appeared to get back into their game, and was surprisingly defeated by Barcelona. Despite having no chances to play the final match, Barcelona managed to save their honor and won the match by the score of 2-0, thus giving Chelsea the access to the final!

In group B, the matches were not as challenging in general. In the debut match, Bayern Munchen in unusual green equipment opened the scoring and managed to bury the ambitions of Inter Milan by winning 2-1, in an encounter that was probably the best of the group.

In the following two matches, Manchester United came into the play, and exhibited a focused back four, especially the US-Catalan duo Kefauver-Pesquer who limited the effectiveness of the opponents' strikers. Hence, in the Manchester-Bayern match a good shot from the outside area by De Miguel was enough to overcome the "German" side, in a disappointing match with several mistakes on both sides, and where goalkeepers were only occasionally tested.

In the last match Manchester United controlled the remaining ambitions of Inter Milan, a team that never looked very dangerous. The "Red devils" could have won by a bigger margin, but they created only half-chances and scored just once in a 1-0 match. As a result Manchester United passed through the round with clean sheets.

The Final

As a result of the outcomes from Group A and B, Manchester United and Chelsea gained the right to play the final match for the title of IG07 soccer champion.

Most of the other players joined the crowd on the grandstands and after a brief time-out the final match started. The match lasted about 30 minutes and was directed by Mr. Blanco as the two "British" sides justified their presence in the final, demonstrating that the two best teams were competing for the title.

Chelsea imposed its rhythm and had a superb start in the

Bayern Munchen just scored against Inter

Critical moment in Manchester-Inter with a blue sea background

Real Madrid - Barcelona: "el clásico"

Chelsea celebrating the first goal against Manchester in the final match

first half of the match, led by the German striker Auer who was well partnered by Italian midfielder Ruello, a perfect combination of strength and speed.

On the other side, Manchester could blame its weariness on having to play three straight matches. Accordingly, the first half ended with Chelsea leading by a score of 2-0, both goals having been scored by Auer.

In the second half, ManUnited tried to gather its last efforts in order to draw the match, and managed to push the score to 2-1 with an angled shot from the outside area. Manchester was lifted by the goal but in an attempt to equalize the match left acres of free space to Chelsea.

Chelsea was dangerous on the counter-attack shooting several times goalwards. Through the outstanding play of their goalkeeper who marked at least two outstanding saves, Manchester narrowly avoided additional goals.

Eventually, already into injury-time, Ruello struck with a perfect trajectory on a rebound and wrapped up the match concurrently with Manchester surrendering in a final score of 3-1.

Mr. Blanco's whistle closed this year's edition of the IGARSS Soccer match with a well deserved win for the Chelsea team.

The final ceremony awarded medals to the winners and the participants; a funny moment occurred when someone discovered that due to a typo on the reverse of medals, the event was referred to as the "IGARSS soccer MATH". This was not without some unwilled irony. Bocadillos, soft-drinks, laughter and match analyses closed the event at 9 pm. Remember, Boston is not too far away.

Keep training.

IGARSS'07 soccer match tournament scheme and results

Group A	
Barcelona - Chelsea	1-2
Chelsea - Real Madrid	2-2
Real Madrid - Barcelona	0-2
Group B	
Bayern Munchen - Inter	2-1
Manchester United - Bayern Munchen	1-0
Inter - Manchester United	0-1
Final match	
Chelsea - Manchester United	3-1

Referee Blanco whistles the end of the competition

Chelsea Awarded

GRS-S WEB CORNER

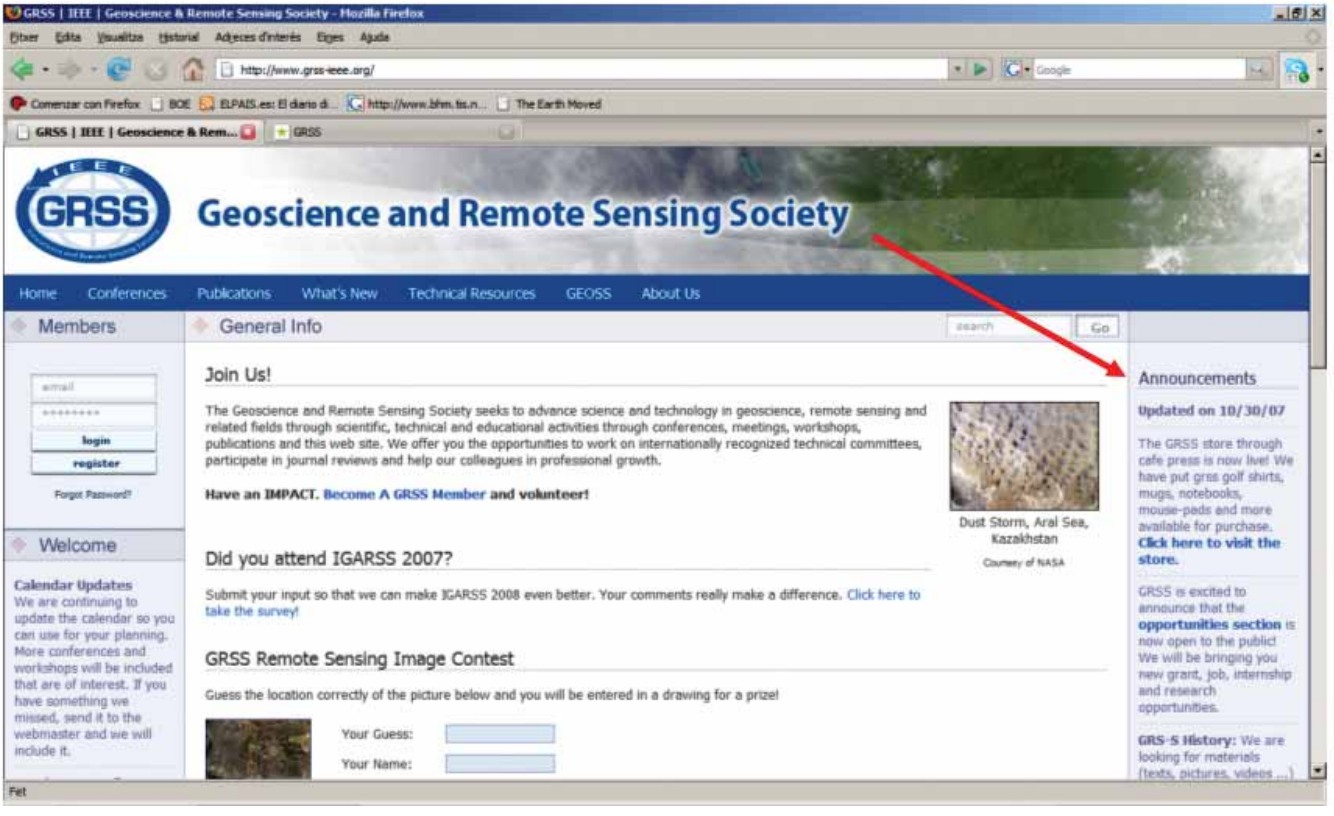
Prof. Adriano Camps, Universitat Politècnica de Catalunya
GRS-S web master

Hello everybody from this new section of the GRS-S Newsletter. As you may have appreciated, the web site is now stable in its structure. However, since I took over the GRS-S web site this year, some new initiatives have been undertaken and I would like to take advantage of this section to make them better known to you. The GRS-S web site, as the Newsletter, are alive, but depend very much on your contributions and the use you want to make out of them so that they become real useful instruments for you and the Society. Please take a look at the right-hand side column of the home page of our web site: http://www.grss-ieee.org/ for new announcements, which I summarize below:

- First, we have now made the **on-line lectures and opportunities section** open to the public in an attempt to bring you grants, jobs, internship and research opportunities that may be of interest.
- Second, we have started collecting materials for **two new sections**:
  - **GRS-S History**: we are looking for materials (texts, pictures, videos ...) to illustrate the history of GRS-S through the IGARSS conferences, other GRS-S sponsored or co-sponsored conferences and workshops, AdCom and Chapters Meetings, or simply individuals whose story may be of interest to the rest of the society.
  - We are also working on a new page to highlight **Ph.D. Dissertations** by our student or former student members. The current plan is to publish dissertations in English and to maintain them online for at least three years.
- And finally, through Cafe Press, we have set-up a **GRS-S store** where you can find quality merchandise with the GRS-S logo printed on it. T-shirts, mugs, notebooks, mouse-pads, caps … and more are available for purchase.

I would like to close this brief summary by encouraging you to use the Forum to ask or discuss issues that may be of interest to other GRS-S members, and to answer the survey about IGARSS 2007 to express your opinions about it.

Enjoy and use it!



CALL FOR PAPERS

TGARS Special issue on Data Archiving and Distribution

A Special Issue of the IEEE Transactions on Geoscience and Remote Sensing (TGARS) devoted to Data Archiving and Distribution has been approved recently by the TGARS Editorial Board. There have been a number of developments in data and information systems and associated technologies that address data archiving, distribution, search and access, information management, and related areas over the last decade. Increased numbers of technical sessions and paper presentations at the IEEE Geoscience and Remote Sensing Symposia (IGARSS) and other conferences are an evidence of the amount of work in progress and arriving at maturity. The purpose of this special issue is to report on the advances in several areas pertaining to data archiving and distribution.

The technology covered by this special issue includes recent developments of all aspects of remote sensing data archiving, information management, search and access, and specialized services for data users, such as on-demand processing and visualization. Enabling technologies such as high-speed computation, data base management, data mining, information extraction, evolving standards, middleware for data access, web services to facilitate collaborative science, etc. will be covered. The emphasis will be on the development of these technologies and their applications for the extraordinary volumes of Earth remote sensing data that have been growing rapidly over the past decade.

Papers are solicited in the following (and related) areas: International standards, System evolvability, System interoperability, Web services, Information extraction to support content-based search and access, On-demand processing for data reduction and improvement in information access, Product virtualization and on-demand product generation, On-line data analysis systems, Collaborative computation, Measurement-based data and information systems, Visualization, and Long-term preservation of remotely sensed data.

Prospective authors should follow the regular guidelines of the IEEE Transactions on Geoscience and Remote Sensing, as listed in the back cover of the Transactions. Authors should submit their manuscripts electronically to http://mc.manuscriptcentral.com/tgrs. Instructions for creating new accounts, if necessary, are available on the login screen. Please indicate in your submission that the paper is intended for Special Issue by selecting "DAD Special Issue" from the pull-down menu for manuscript type. Questions concerning the submission process should be addressed to tgars-editor@ieee.org. Inquiries concerning the Special Issue should be directed to the Guest Editors:

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Submission Deadline: January 31, 2008

ESA-EUSC 2008:

Image Information Mining - pursuing automation of geospatial intelligence for environment and security

Honorary Conference for Dr. Klaus Seidel
March 4-6, 2008
ESRIN – Frascati (Italy)

European Space Agency
European Union Satellite Centre

esa GRSS

ESA-EUSC 2008 Chair:
M. Datcu, DLR -German Aerospace Center

Abstract submission:
Before October 15, 2007
Extensive abstract
Email: mihai.datcu@dlr.de copy Sergio.DElia@esa.int

Register:
Before February 1, 2008

Registration fees:
Free of charge (up to available seats)

Web Address:
http://earth.esa.int/rtd/Events/ESA-EUSC_2008/index.html

INTERNATIONAL CONFERENCE
ON
RADIO SCIENCE
ICRS-2008
25TH – 29TH February 2008
JODHPUR, INDIA

U.R.S.I. ICRS GRSS

DEPARTMENTS OF GOVERNMENT OF INDIA AND RAJASTHAN

TOPICS TO BE COVERED IN CONFERENCE:

- Electromagnetic Metrology
- Fields and Waves
- Radiocommunication Systems and Signal Processing
- Electronics and Photonics
- Electromagnetic Noise and Interference
- Wave Propagation and Remote Sensing
- Ionospheric Radio and Propagation
- Waves in Plasmas
- Radio Astronomy
- Electromagnetics in Biology & Medicine

IMPORTANT DATES:
Submission of Summary (500 words): 15 September 2007
Notification of acceptance: 15 October 2007
Submission of full paper for publication in conference proceedings: 15 December 2007
Email: info@radioscience.org, opncalla@yahoo.co.in
Website: www.radioscience.org, www.icrsju.org
Contact: Prof. O.P.N. Calla, Chairman, ICRS-2008

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Geospatial Dimensions of Emergency Response Symposium

March 10-12, 2008 • Washington State Trade & Convention Center • Seattle, Washington

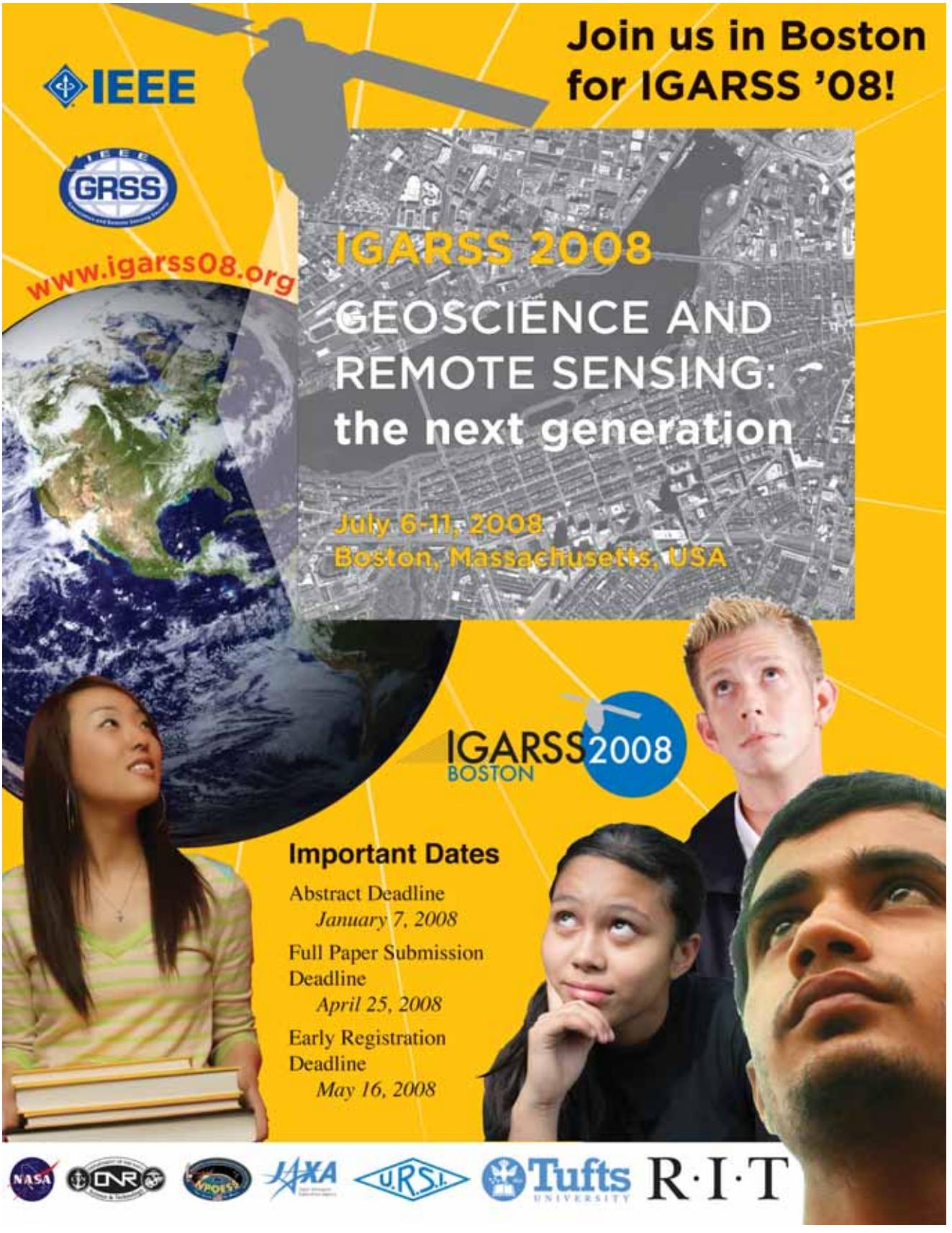
Don't miss the first-ever symposium to address the application of mapping technologies such as geographic information systems (GIS), GPS, and remote sensing to emergency and disaster response.

The conference will kick off with a four-hour seminar followed by a series of technical sessions. The symposium is being held in parallel with GITA's Geospatial Infrastructure Solutions Conference 31. There will be a shared exhibit floor and registration, and social events will be open to attendees of both conferences.

Visit gita.org/ers for more information!

Supporting Organizations:

Delta State University · gita · GRSS · HI - SC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EUSAR, the European Conference on Synthetic Aperture Radar, is an international conference dedicated to SAR techniques, technology and applications. The first EUSAR was held in the year 1996 in Königswinter, continued 1998 in Friedrichshafen, 2000 in Munich, 2002 in Cologne, 2004 in Ulm, and 2006 in Dresden.

EUSAR has accompanied the worldwide evolution of high resolution imaging radar, both airborne and space-borne, and has helped to establish an international community of SAR engineers and scientists. As in previous years, **EUSAR 2008** will provide a forum for exchanging information and discussion on a wide variety of SAR topics, representing the latest SAR developments.

You are cordially invited to participate in **EUSAR 2008**, and visit the beautiful city of Friedrichshafen.

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More information
http://www.eusar.de

2007 Asia-Pacific Microwave Conference (APMC 2007)

11-14 December 2007
Grand Hyatt Erawan Hotel, Bangkok, THAILAND

ECTI Association MTT-S GRSS IET EIC EuMA URSI

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Faculty Position in Aerosols and Climate

In support of the Purdue University initiative in Climate Change Research and the Purdue Climate Change Research Center (PCCRC), the College of Science and the College of Agriculture invite applicants for a tenure track faculty position at the rank of Assistant Professor in the area of Aerosols and Climate. We seek candidates who are using experimental, observational (ground, air and space based; in-situ or remotely sensed), or numerical modeling methods applied to the study of (i) aerosol microphysical processes, (ii) the production, transport and fate of anthropogenic or biogenic aerosols, (iii) the impact of aerosols on the hydrologic cycle, including cloud formation and precipitation, (iv) the impact of aerosols on ecological systems such as croplands and forests. The position is expected to be a joint appointment between the Department of Earth & Atmospheric Sciences (EAS) in the College of Science and an appropriate department in the College of Agriculture. We seek to expand the strengths of the PCCRC and complement the EAS core research areas of climate & extreme weather (CLEW) and atmosphere-surface interaction (ASI).

Candidates must have completed the Ph.D., and postdoctoral experience is preferred. The appointee is expected to develop and maintain a vigorous, externally funded, internationally recognized research program and to teach and mentor students at the undergraduate and graduate levels. Screening of applications will begin November 1, 2007, and the search will continue until the position is filled. Additional information on EAS can be found at http://www.purdue.edu/eas and information on PCCRC can be found at http://www.purdue.edu/climate.

APPLICATION PROCESS: Submit (1) a cover letter, including the names of three people who have been asked to send letters of reference by the position closing date; (2) a curriculum vita; and (3) statements of research and teaching experience and interests. Application materials can be emailed in PDF format to glenda.c.bauer.1@purdue.edu with the subject line "Aerosols and Climate Position" or sent via postal mail to:

Glenda C. Bauer, Faculty Search Coordinator
Purdue University
PCCRC
503 Northwestern Ave
West Lafayette, IN 47907

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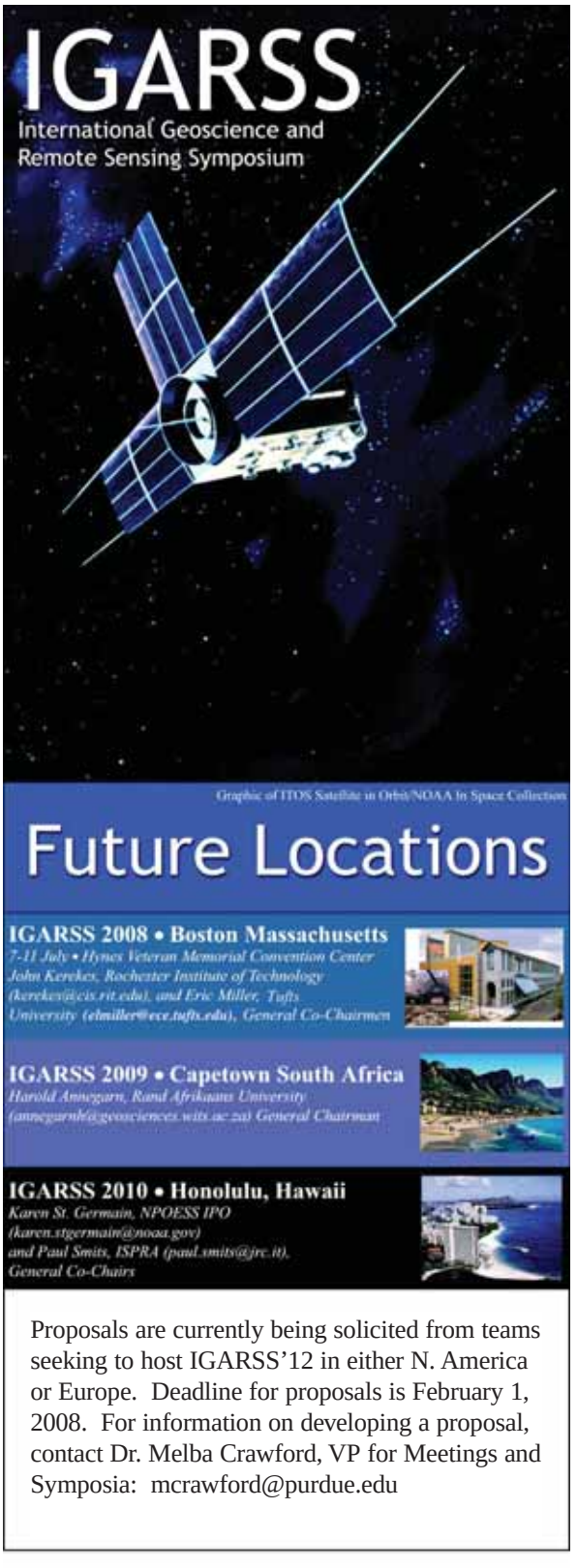

Proposals are currently being solicited from teams seeking to host IGARSS'12 in either N. America or Europe. Deadline for proposals is February 1, 2008. For information on developing a proposal, contact Dr. Melba Crawford, VP for Meetings and Symposia: mcrawford@purdue.edu

UPCOMING CONFERENCES

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

Name: **Int. Joint Conferences on Computer Information, Systems Science, and Engineering**
Location: (e-conference)
Dates: December 3 – 12, 2007
Contacts: Toshio Fukuda, Tarek Sobh, Khaled Elleithy
Email: fukuda@mein.nagoya-u.ac.jp or sobh@bridgeport.edu
URL: http://www.cisse2007online.org/

Name: **Asia Pacific Microwave Conference (APMC 2007)**
Location: Grand Hyatt Erawan Hotel, Bangkok, THAILAND
Dates: December 11 – 14, 2007
Contact: Monai Krairiksh
URL: http://www.apmc2007.org/

Name: **International Conference on Environmental Research**
Location: Bhopal, India
Dates: December 28 – 30, 2007
Email: info@icer07.org
URL: http://www.icer07.org/

Name: **International Conference on Radio Science**
Location: Jodhpur, India
Dates: February 25 – 29, 2008
Contact: Prof. O.P.N. Calla, Chairman, ICRS 2008
Email: infop@radioscience.org or opncalla@yahoo.co.in
URL: http://www.radioscience.org or http://www.icrsju.org

Name: **ESA-EUSC 2008: Image Information Mining – pursuing automation of geospatial intelligence for environment and security**
Location: ESRIN – Frascati, Italy
Dates: March 4 – 6, 2008
Contact: M. Datcu, DLR – German Aerospace Center
Email: mihai.datcu@dlr.de copy Sergio.Delia@esa.int
URL: http://earth.esa.int/rtd/Events/ESA-EUSC 2008/index.html

Name: **Geospatial Dimensions of Emergency Response Symposium**
Location: Washington State Trade & Convention Center, Seattle, Washington
Dates: March 10 – 12, 2008
Contact: (303)337-0513
Email: info@gita.org
URL: http://www.gita.org/ers

Name: **10th Specialist Meeting on Microwave Radiometry and Remote Sensing for the Environment**
Location: Hotel Baglioni, Florence, Italy
Dates: March 11 – 14, 2008
Contact: Simonetta Paloscia, Giovanni Macelloni
Email: info@microrad2008.org
URL: http://www.microrad2008.org

Name: **7th Annual European Conference on Synthetic Aperture Radar (EUSAR)**
Location: Graf-Zeppelin-Haus, Friedrichshafen, Germany
Dates: June 2 – 5, 2008
URL: http://www.eusar.de

Name: **International Microwave Conference (IMS)**
Location: Atlanta, GA
Dates: June 15 – 20, 2008
URL: http://www.ims2008.org

Name: **The 12th International Conference on Ground Penetrating Radar**
Location: University of Birmingham, UK
Dates: June 16 – 19, 2008
Contact: Christopher Rogers, Univ. of Birmingham, UK
Email: submissions@gpr2008.org.uk
URL: http://www.GPR2008.org.uk

Name: **International Geoscience and Remote Sensing Symposium (IGARSS'08)**
Location: Boston, MA
Dates: July 6 - 11, 2008
Contact: John Kerekes, Eric Miller
URL: http://www.IGARSS2008.org

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