



50

A CELEBRATION

OF THE FIRST
FIFTY YEARS

1962 — 2012

IEEE GEOSCIENCE AND REMOTE SENSING SOCIETY

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Page 1: Image shows a spinning formation of ice, clouds, and low-flying fog off the eastern coast of Greenland. This image was acquired by Landsat 7's Enhanced Thematic Mapper plus (ETM) sensor on May 14, 2001. Image credit: NASA.

This page: Three views of Hurricane Andrew on August 23, 24 and 25, 1992, as the hurricane moves east to west on its track over south Florida and making landfall in a sparsely populated coastal area of Louisiana around 8 a.m. CDT on August 26, 1992. This time-series of images was created with data from the Geostationary Operational Environmental Satellite (GOES-7), which is operated by the National Oceanic and Atmospheric Administration. NASA's GOES Project, which creates GOES images and animations, is located at NASA's Goddard Space Flight Center, Greenbelt, MD. Image Credit: NASA GSFC.

The writers and editors have taken great care to reflect accurate history and detail contained in the *IEEE GRSS 50th Anniversary Commemorative Book, A Celebration of the First 50 Years, 1962-2012*; any errors or misrepresentations contained therein are regretted.

FOREWORD

In 2012 we celebrate the 50th anniversary of the IEEE Geoscience and Remote Sensing Society. The roots of the society can be traced back to February 1962 in Dallas, Texas, when a small group of mostly Texas-based engineers and scientists met for the first time as the Group on Geoscience Electronics (G-GE). The name changed to the IEEE Geoscience and Remote Sensing Society (GRSS) in 1981, at which time the focus became satellite and airborne remote sensing. The current GRSS is very different from the G-GE of 1962. It is now a very successful international society with 3400 members, and the membership continues to grow worldwide every year.

GRSS organizes many significant activities year in and year out. Its very successful annual flagship conference, IGARSS, is held on different continents and is currently attended by approximately 2000 participants. The Society also sponsors several more specialized symposia every year. The GRSS has three high quality technical journals, which are published either monthly or bimonthly, as well as a very successful quarterly newsletter. Additionally, the GRSS has developed a strong portfolio of diverse professional and technical activities for its members. Currently, most GRSS members come from North America and Europe (IEEE Regions 1-6 and 8), but the GRSS Administrative Committee (AdCom) continues to work diligently to promote GRSS activities in Africa, Asia, and Latin America, under the umbrella of the GRSS Globalization Initiative.

This book commemorates the fifty years of the GRSS. It summarizes the history and growth of Society activities through the years. It is important to note that the GRSS is comprised of volunteers. On behalf of the current AdCom, I express my appreciation for the contributions of these volunteers. They have made the journey a success. This book would not have been possible without the commitment and outstanding work of several individuals; in particular, I would like to recognize Keith Carver, Werner Wiesbeck, Kiyo Tomiyasu, David G. Goodenough, Alberto Moreira and Melba Crawford. Lastly, I appreciate the critical contribution of GRSS Executive Director, Tammy I. Stein, who oversaw the project and ensured its success.

Jón Atli Benediktsson
President, 2011-2012
IEEE Geoscience and Remote Sensing Society

CHAPTER 1

Formation and Early Years



Lloyd V. Berkner spearheaded the formation of G-GE.

Few similarities exist between the grass roots gathering of petroleum engineers and scientists in Texas a half-century ago and the 3,500 members who form today's IEEE Geoscience and Remote Sensing Society. The one strikingly important consistency uniting the two, however, is their timeless, collective objective of encouraging and promoting the theory, concepts, and techniques of science and engineering as they apply to the remote sensing of the Earth, oceans, atmosphere and space, as well as the processing, interpretation and dissemination of that information.

The roots of IEEE's Geoscience and Remote Sensing Society date back to the very early 1960s when the Group on Geoscience Electronics (G-GE) formed in 1961 as the 29th technical group of the Institute of Radio Engineers (IRE).

Lloyd V. Berkner, then the President of both the IRE and the American Geophysical Union (AGU), and Robert W. Olson, a Vice President of Texas Instruments Corp. in Dallas, Texas, convened a breakfast meeting of 20 people on April 20, 1961, at the Southwest IRE Conference in Dallas. Most in attendance were engineers and scientists in the growing petroleum industry in the U.S. Southwest. All were using electro-seismic instruments, signal processing and seismic modeling in the never-ending search for oil and natural gas in the rich deposits of Texas, Oklahoma and Louisiana. The United States was still a petroleum-exporting nation in 1961, and scientific instrumentation was an increasingly important tool in assisting petroleum geologists to find new fields and deposits.

All at the meeting were in agreement that the field needed a forum in which potential members could share information and findings and gather on a formal basis with peers. With Berkner, the group had one of the nation's most influential scientists in their corner.

Then a consultant to Texas Instruments in Dallas, Berkner was working closely with Southern Methodist University to develop a Graduate Research Center to address the critical lack of engineers and scientists being educated in American universities. Berkner was a near legend in geophysics. A native of Milwaukee, Wisconsin, he had grown up in

the tiny farm community of Sleepy Eye, Minnesota, and earned his B.S.E.E. at the University of Minnesota in the Twin Cities in 1927. Berkner had learned to fly at the University of Minnesota, and after a year at the Bureau of Standards, he had been appointed to the first Byrd Expedition to Antarctica from 1928-1930 as both an engineer and aviator. During the 1930s, he worked closely with scientists studying the ionosphere, and when war broke out in 1941, Berkner headed the Radar Section in the U.S. Bureau of Aeronautics, and led the Bureau's Electronics Material Branch from 1943 to 1945. When he died in 1967, Berkner held the rank of Rear Admiral in the U.S. Navy Reserve (USNR).

During the postwar years, Berkner served as a tireless advocate of scientific research and education. He was Head of the Section on Exploratory Geophysics of the Atmosphere at Pittsburgh's Carnegie Institute from 1947 to 1951, and worked ceaselessly to foster better relations between the government and the scientific community. While at Carnegie Institute, he successfully proposed the United States spearhead the International Geophysical Year for 1957-1958, due to the preponderance of sunspot activity that year. Berkner's suggestion became the model for the great international programs in geophysics that would follow the inaugural event of 1957-1958.

Lloyd Berkner was so busy in life that he never finished work on his doctorate. In 1961, he was the President of the IRE and the Past President of the AGU. He was a member of the National Academy of Sciences, the New York Academy of Sciences, the American Physical Society, the American Philosophical Society, the Institute of Electrical and Electronics Engineers, and a Fellow of the American Academy of Arts and Sciences.ⁱ When Berkner suggested to the board of IRE that the Institute consider approving the formation of G-GE, approval was quickly forthcoming. On November 15, 1961, IRE formally approved the establishment of the G-GE.ⁱⁱ

In the Beginning

The IRE board followed Berkner's recommendation and named Robert W. Olson as G-GE's first Chairman. Olson, Berkner's colleague at Texas Instruments, had known his mentor since World War II when both worked for the U.S. Navy Bureau of Aeronautics in Washington, D.C. Olson had preceded Berkner to Texas Instruments when he joined Pat Haggerty, the founder of TI, in the Laboratory and Manufacturing Division of GSI, a Dallas predecessor of Texas Instruments, in 1946. Olson helped GSI establish a group of Texas laboratories to assist in developing new seismic, electronic, mechanical and electric products.ⁱⁱⁱ He was an inventor and key member of the scientific team at the renamed Texas Instruments from 1951. Olson filed patents for TI in the 1950s that made the Texas company a leader in the field of electric metering and the development of variable resistance distributed seismometers.

Olson called for the first meeting of the G-GE to be held in Dallas on February 15, 1962. He informed the 21 people in attendance that the main purpose of the meeting involved the organization of an Administrative Committee, which was almost immediately known among the group as the Ad-Com. Olson explained that the purpose of the Ad-Com would be to provide various management tasks, including financial planning, budgeting, recruiting of members, establishing of a publication to be called *Transactions*, selecting an editor for the publication, and setting technical directions.

The IRE board had told Berkner the previous year that the membership of the Group was too narrow, and that G-GE needed to broaden its membership to include those whose fields of interest included oceanography and undersea technology and instrumentation. Still, the Group's first AdCom was heavily weighted toward representation by Texas and petroleum interests. The first nine AdCom members included Olson and Bernard H. List, both of Dallas;

1961

11/15/61
Group on Geoscience Electronics
(G-GE) formally established

Due to the vast number of programs sponsored by various international institutions, the editors have included only a sampling of programs on the timeline to highlight the growth and recognition of geoscience and remote sensing.

1962



1962
Robert W. Olson
Texas Instruments Corp.
Chairman, G-GE

02/15/62
First G-GE meeting
Dallas, Texas, USA

10/16/62
Initial constitution &
by-laws approved

12/11/62
G-GE Houston Chapter
formed

Marian A. Arthur, Sidney Kaufman and Frank C. Smith of Houston; W. Theodore Girn and Robert A. Broding of Tulsa, Oklahoma; W. Harold Mayne of San Antonio; and Harold W. Smith of Austin.^{iv}

Tulsa's Bob Broding was typical of the initial AdCom members. A Minnesota native who, like Berkner, had earned a B.S.E.E. degree from the University of Minnesota, Broding had worked on magnetic firing devices as a member of the Naval Ordnance Laboratory in Washington, D.C., during World War II and had gone into geophysical work in the oil patch following the war. From 1953 to 1963, Broding was a Vice President at Century Geophysical Corp. in Tulsa where his responsibilities included engineering and development of techniques for the manufacture of oscillograph recorders, geophysical instrumentation and equipment for vibration and stress analysis. In 1963, when he was appointed to his second one-year term on the G-GE AdCom, Broding joined Seismograph Service Corp. in Tulsa, where he spent the next seven years overseeing special geophysical developments, including a new marine seismic system.^v

With AdCom in place, Olson called the first AdCom meeting at the Southwest IRE Convention in Houston on April 13, 1962. The Houston meeting resulted in the election of Olson as the Group's first AdCom Chairman, and the addition of three more AdCom members: Ben Melton, A.H. Waynich and Jean Lebel. AdCom approved a draft constitution and by-laws and sent them to the IRE Executive Committee, which lent its approval on October 16, 1962.

The AdCom had met two weeks before, on October 1, 1962, at the fall conference of the Southwest IRE in Dallas. Olson called the meeting for several reasons, including the creation of a budget and a plan of work, election of new AdCom members, as well as the election of a chairman to replace him on

AdCom. After balloting, the 1963 AdCom members included Olson, Broding, Bernard H. List, T. Cantwell, W.E. Gordon, Isadore Katz, S. Kaufman, Jean Lebel, C. Gordon Little, Ben Melton, Edwin B. Neitzel, F.C. Smith Jr., G.H. Sutton, Aubra E. Tilley and A.H. Waynich.

The new Chairman of AdCom was Harold W. Smith of the Electrical Engineering Department at the University of Texas in Austin. Born in Missouri, Harold W. "Skeet" Smith was reared in Texas and earned his B.S.E.E. degree at the University of Texas in 1944. He served during the last year of World War II as a Navy airborne electronics officer and returned to Austin to pursue his M.S.E.E. degree in 1946.

Smith began his teaching career at the University of Texas that year and would be a member of the faculty for the next 44 years. Following the war, he conducted research at the university's Electrical Engineering Research Laboratory (EERL) where his interests involved the study and development of advanced microwave communications and radar systems. His contacts in the G-GE during the 1960s led Smith to shift his research interests from microwave systems to electrical geophysics. Smith was instrumental in developing methods to explore the electrical properties of the Earth's subsurface regions.^{vi}

Smith and AdCom took several steps at that October 1962 meeting in Dallas that would give G-GE a firm foundation in the years to come. They authorized the publication of the *G-GE Transactions* and named Alan W. Trorey as the journal's first Editor. At the time, Trorey was with the California Research Corporation, a subsidiary of Chevron in La Habra. A Vancouver, British Columbia, native and an engineering physics graduate of the University of British Columbia, Trorey gave AdCom its first international presence.

A third individual who joined AdCom at that October 1962 meeting was key to establishing G-GE. Edwin B. Neitzel was elected the first Secretary-Treasurer of AdCom, and he agreed to take on the additional duties of editing G-GE's *Newsletter*. At the time, Neitzel was employed in the Science Services Division of TI; in later years, he would join ARCO Petroleum's Research Department, where his work on marine seismic technology and computerization of geophysical data gained a wide following.

The Group on Geoscience Electronics concluded its first year of business on December 11, 1962, when it approved G-GE's first chapter outside Dallas. The Houston Chapter included a number of founding members of the organization and was headed by L.B. McManis. It would be followed later in the 1960s by the establishment of chapters in Los Angeles, California; Washington, D.C.; Providence, Rhode Island; and Tulsa, Oklahoma.

AdCom's emergence as a forum for those interested in the pursuit of geoscientific and remote sensing technologies laid the foundation for the establishment of G-GE, the forerunner of the Geoscience and Remote Sensing Society.

Early Years

For IEEE's Geoscience Remote Sensing Society, the 1960s were years of slow growth and expansion into other areas. From the beginning, IRE urged G-GE to expand its membership by considering the recruitment of oceanographers and those involved with remote sensing beneath the surface of the world's oceans. During the 1960s, G-GE would further broaden its recruitment efforts to attract meteorologists, climatologists and those interested in the geophysics of the atmosphere.

Key to those recruitment efforts was G-GE's decision to publish a journal dedicated to geoscience electronics. The first issue of the *Transactions on Geoscience Electronics* was published in Dallas in December 1963, just two weeks after President John F. Kennedy was assassinated. The young President had been the driving force in beginning a strong federal encouragement of manned space flight. Kennedy's 1961 pledge to put an American on the moon by the end of the decade would have tremendous implications for the study and funding of geoscience electronics and remote sensing in the years ahead.



Vostok 1, the first manned space flight, lifts off the launch pad at Tyuratam on April 12, 1961, carrying cosmonaut Yuri Gagarin. Vostok 1 completed one orbit of Earth, landing in Russia 108 minutes after launch.



Mercury control personnel monitor Friendship 7, the first U.S. manned orbital flight launched on February 20, 1962. Image credit: NASA.



Launched on October 11, 1968, Apollo 7 was the first manned mission in the American Apollo space program. Image credit: NASA.

1963



1963
Harold W. Smith
University of Texas at Austin
Chairman, G-GE



1963-1965
W.A. Trorey
California Research Corporation
Editor, *G-GE Transactions*

IRE and AIEE merge to form IEEE

G-GE membership: ~800

12/01/63
First issue of *Transactions on Geoscience Electronics* published

1964



1964
A.E. Tilley
California Research Corporation
Chairman, G-GE

G-GE membership surpasses 1,000

1965



1965
Isadore "Is" Katz
Applied Physics Laboratory
Chairman, G-GE

That first issue of what became known simply as *Transactions* contained only four peer-reviewed papers. The first was by the journal's editor, Alan W. Trorey. In his paper, entitled "From Geo-Wireless to Geo-Science Electronics," Trorey wrote "Once upon a time there existed in the English language the prefix geo- with the literal meaning 'Earth' or 'of the Earth.' From this prefix we have, quite naturally, such terms as geology, geotectonics, geophysics — or, more generally, 'geoscience.' Logically then, one would expect 'geo-science' to be a 'science of the Earth.'"^{vii}

Trorey's article continued, noting that two other factors played into IRE's decision to recognize G-GE. "Once upon a time there existed a breed known as 'wireless engineers' (even though wire was not unknown in the devices they created)," Trorey explained. "The electronic vacuum tube turned them (on this continent) into 'electronic engineers' — people who spent much of their time assembling wire and vacuum tubes together in such a way as to permit us all to learn about the virtues of Ovaltine at the twist of a dial."

"Associated with these efforts, however, was the early discovery of an ionosphere, a matter of considerable interest to the 'communication engineer.' Furthermore, it was early realized that extraterrestrial (non-geo-) phenomena have considerable influence on the behavior of the ionosphere. Naturally, these matters required investigation — investigation that carried the communications engineer into many of the fields normally studied by the geoscientist. It did not take much of this to create the 'electronic scientist,' at best a vague term embracing, in varying degree, nearly all branches of science, geo-, or otherwise."^{viii}

Trorey's article in *Transactions* carried the argument one step further, noting that the term "geo-, in modern day parlance, no longer means of the Earth but means anywhere, since that which occurs anywhere may have an effect on Earth. Furthermore,

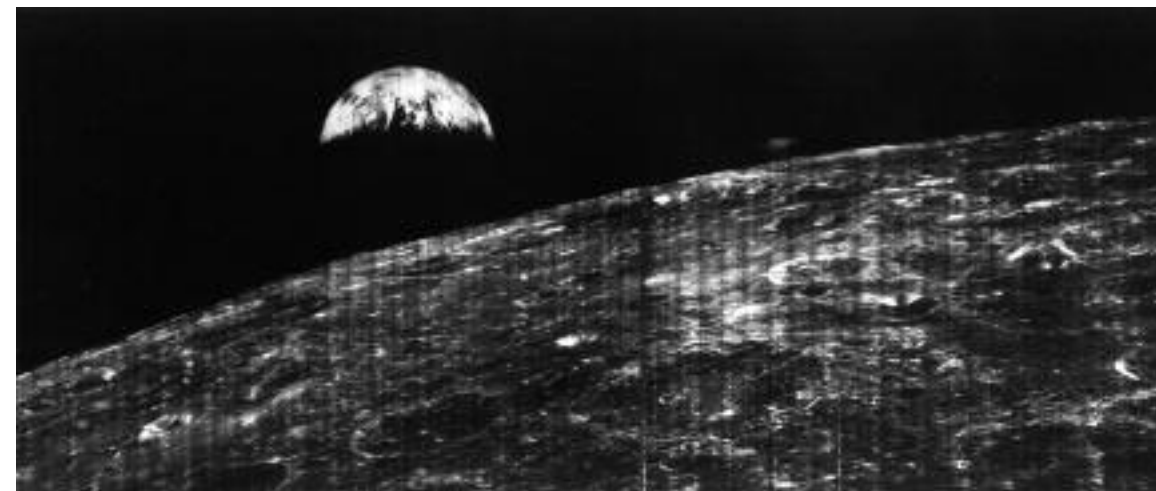
both groups study, in varying degree, nearly all branches of science."^{ix} Trorey's argument was that the Earth and its oceans, its atmosphere and deep space were all grist to the mill that *Transactions* intended to grind.

Trorey's article made a broad-based appeal to scientists and engineers of all stripes to submit papers "of mutual interest to both the electronic scientist and the geoscientist. As we have seen, there is a large area of interest common to the two groups. Both are interested in similar natural phenomena and both are involved with electronic instrumentation used in the study of these phenomena."

"This, then, defines our publication policy. Even though the boundary of this policy is vague at best, it will be the guide used by the editorial staff in deciding whether or not the subject matter of a paper is suitable for publication in the *Transactions*. The papers in this first issue have been selected by attempting to follow this policy."^x

The four papers published in the first issue of *Transactions* illustrated the direction the AdCom wanted to take G-GE. Two of the articles, "Characteristics of Magnetic Tapes Used for Seismic Exploration" by Paul R. Hinrichs and "Field Experiments on the Electrostatic Effect" by AdCom member R.A. Broding and his Tulsa colleagues, S.D. Buchanan and Daniel Hearn, were concerned with the seismic effects of oilfield exploration and development, a topic that was of special interest to most of the pioneer members of G-GE.

The other two articles, however, examined geoscience issues in space and at sea. Glenn L. Brown and Anthony F. Gangi, both managers at the Space-General Corporation in El Monte, California, outlined their research in "Electromagnetic Modeling Studies of Lithospheric Propagation." Ralph Bernstein, a member of the Marine Systems Department at IBM Corp. in Bethesda, Maryland, and C.O. Bowin, Research Associate in geology at the Woods Hole Oceanographic Institute in Massachusetts, dis-



The world's first view of Earth taken by a spacecraft from the vicinity of the Moon. The photo was transmitted to Earth by the United States Lunar Orbiter I and received at the NASA tracking station at Robledo De Chavala near Madrid, Spain. This crescent of the Earth was photographed August 23, 1966, at 16:35 GMT when the spacecraft was on its 16th orbit and just about to pass behind the Moon. Image Credit: NASA.

cussed "Real-Time Digital Computer Acquisition and Computation of Gravity Data at Sea."^{xi}

Transactions, which was distributed to the fewer than 100 members of G-GE in 1963, was an outgrowth of the outstanding journals that IRE and its member Technical Groups had been publishing for more than a half-century. That tradition of editorial excellence would carry over into a new, combined scientific and engineering organization that would represent the interests of both electronic and electrical engineers in the United States and abroad.

Merger

Trorey's attempts to lay the groundwork for the issues that *Transactions* would cover in the years to come were reflected by events occurring outside G-GE. In 1963, the Institute of Radio Engineers (IRE), which had been founded in 1912, and the American Institute of Electrical Engineers (AIEE), which had been founded in 1884, the year following Thomas Edison's demonstration of the three-wire

system at Sunbury, Pennsylvania, merged to form the Institute of Electrical and Electronics Engineers (IEEE).

The IRE had been founded to represent the interest of radio engineers, branching out in the 1930s to welcome engineers working in the growing field of electron tube technology. By 1963, its 90,000 members comprised the majority in the new organization. AIEE members at the time were typically more interested in landline, or wire technology, as well as light and power systems. The blurring of the lines that Trorey had identified in his article in the inaugural issue of *Transactions* was one of the driving forces behind the merger, and the rise of computer science, which was just becoming more and more evident in the early 1960s, made the diffusion of interest in the field even more pronounced.

The G-GE and its successor, GRSS, would be a part of IEEE for the next 49 years and would allow members of the geoscience and remote sensing community to play a role in the affairs of the larger, umbrella organization.

1966



1966-1967
William A. Drews
Pulse Communications Inc.
Chairman, G-GE



1966-1972
Alex Hoffman
Texas Christian University
Editor, *G-GE Transactions*

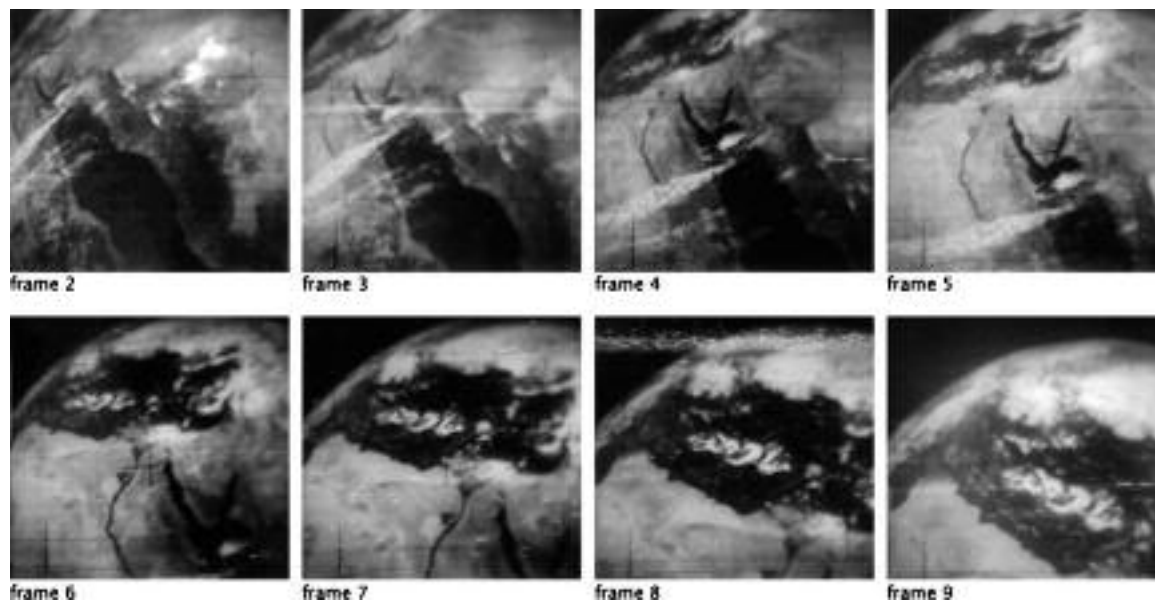
1967

1967
G-GE memberships surpasses 1,500

1968



1968-1969
Edward A. Wolff
Pulse Communications Inc.
Chairman, G-GE



On April 1, 1960, TIROS, a satellite designed by the Radio Corporation of America (RCA), launched to become the nation's first weather satellite. TIROS-1 orbited from pole to pole, snapping photos every 30 seconds, as illustrated in this series of images. The first of the images, labeled "frame 2," shows the Red Sea. The water is black, and vegetated land on either side is also dark-colored. The deserts of the Arabian Peninsula on the east and the Sahara Desert of Africa on the west are light gray. The brightest features in the image are clouds. By frame 6, the Nile River has become the focus of the image, though its distinctive triangular delta is partially covered with cloud. In the last frame, the shore of Egypt and Libya runs along the lower portion of the image, while the focus is on clouds over the Mediterranean Sea. Image Credit: NASA.

Expansion in the 1960s

AdCom took G-GE in directions that would allow the Group to expand in the 1960s. A.E. Tilley, a colleague of Trorey at the California Research Corp., served as Chairman of the AdCom in 1964, and he was succeeded by Isadore Katz, whose specialty was the application of spaceborne synthetic aperture radar to oceanography. Katz was succeeded by W.A. Drews, who served two terms as Chairman of AdCom, in 1966 and 1967. Drews was succeeded by another two-term Chairman, Edward A. Wolff, who served in the office in 1968 and 1969. The Director of Research at Pulse Communications Inc. in Alexandria, Virginia, and later a staffer with the

NASA Goddard Space Flight Center in Greenbelt, Maryland, Wolff was responsible for a major expansion of G-GE's technical presence in the scientific community.

Transactions published its first special issue on oceanographic instrumentation in November 1968. Gilbert Jaffe, Director, Marine Services Department at the Navy Hydrographic Office, was the Guest Editor of the special issue, with the lead article written by Harvey D. Kushner, Director of the Systems Development Division of Operations Research Inc. and an expert in the field of oceanographic mapping. Kushner's lead article, "Oceanographic Instrumentation: A Crisis of National Neglect," quoted Vice President Hubert Humphrey about the nation's woe-

ful lack of funding for meaningful oceanographic instrumentation and placed G-GE firmly in the forefront of scientific organizations that were advocating oceanographic sciences.

Wolff, whose work on NASA's ATS 6 Satellite, one of the first multipurpose communications satellites, brought him into contact with many of the remote sensing scientists in NASA's TIROS weather satellite program in the late 1960s and early 1970s, became an early champion of recruiting geoscience members with an interest in meteorology. Before leaving office at the end of 1969, Wolff spearheaded a second special issue of *Transactions*, this time concerning "Instrumentation for the Orbiting Geophysical Observatory." Guest Editor Enrico P. Mercanti, a New Yorker who joined NASA in the 1960s, was a longtime friend of Wolff. In 1974, the two collaborated on the publication of *Geoscience Instrumentation*, a standard in the field.

Wolff was ably assisted in his mission to expand G-GE by Alex Hoffman, the second editor of *Transactions*. A professor of physics and mathematics at Texas Christian University and a former student of Harold W. Smith, the second Chairman of AdCom, Hoffman succeeded Trorey as Editor in 1966. Hoffman instituted the popular series of special issues in 1967 and increased the frequency of publication to quarterly in 1968. He was a financial manager who was able to increase the number of papers and pages in the publication while holding costs in line.

Wolff's leadership of G-GE during the late 1960s was critical for the Group's future direction. Wolff believed that G-GE should concern itself not only with individual geoscientific disciplines but also with the interactions that would inevitably arise out of those disciplines. His work at Geotronics in Falls Church, Virginia, as well as his later work at NASA Goddard, convinced Wolff that members of G-GE would increasingly become involved in interdisciplinary activities with scientists and engineers working in a host of fields.

"Although land, sea, air, and space are convenient categories for compartmentalizing the interests of G-GE, its members are well aware of the fuzziness of the boundaries and the interrelationships between the regions," Wolff wrote in a 1968 editorial in *Transactions*. "There is interest in the water under the ground and the ground under the water; in the land-air and sea-air interfaces, their effect upon the weather and the effect of the weather on the surface;



NASA's Convair 990, used for early remote sensing experiments, flying over an Ice Island north of Point Barrow, Alaska, in March 1971 (image credit: Bill Campbell, USGS). Interior below: The CV-990 was carrying a suite of microwave radiometers covering the wavelength from 21cm to 0.8cm to study the microwave signature of Arctic Sea Ice. These data were used to form the basis for extraction of sea ice extent with microwave radiometer currently in space.



in the use of space platforms for the measurement of the shape of the earth, atmosphere, and the ionosphere; and for the exploration of natural resources on earth. Also, there are the systems used on land and sea to support the airborne and spaceborne instruments."^{xii}

Wolff's description of the interdisciplinary character of those whose interests were concerned with the development of geoscience and remote sensing systems was right on target. But G-GE, the organization that he so ably headed in the late 1960s, would sometimes struggle to make that vision a reality in the 1970s.

1969

04/69

First Annual International Geoscience Electronics Symposium
Twin Bridges Marriott, Washington, DC, USA

1970



1970

Harold S. Field
Geophysical Research Corp
Chairman, G-GE

04/70

Second Annual International Geoscience Electronics Symposium, Twin Bridges Marriott, Washington, DC, USA

CHAPTER 2

Transformation



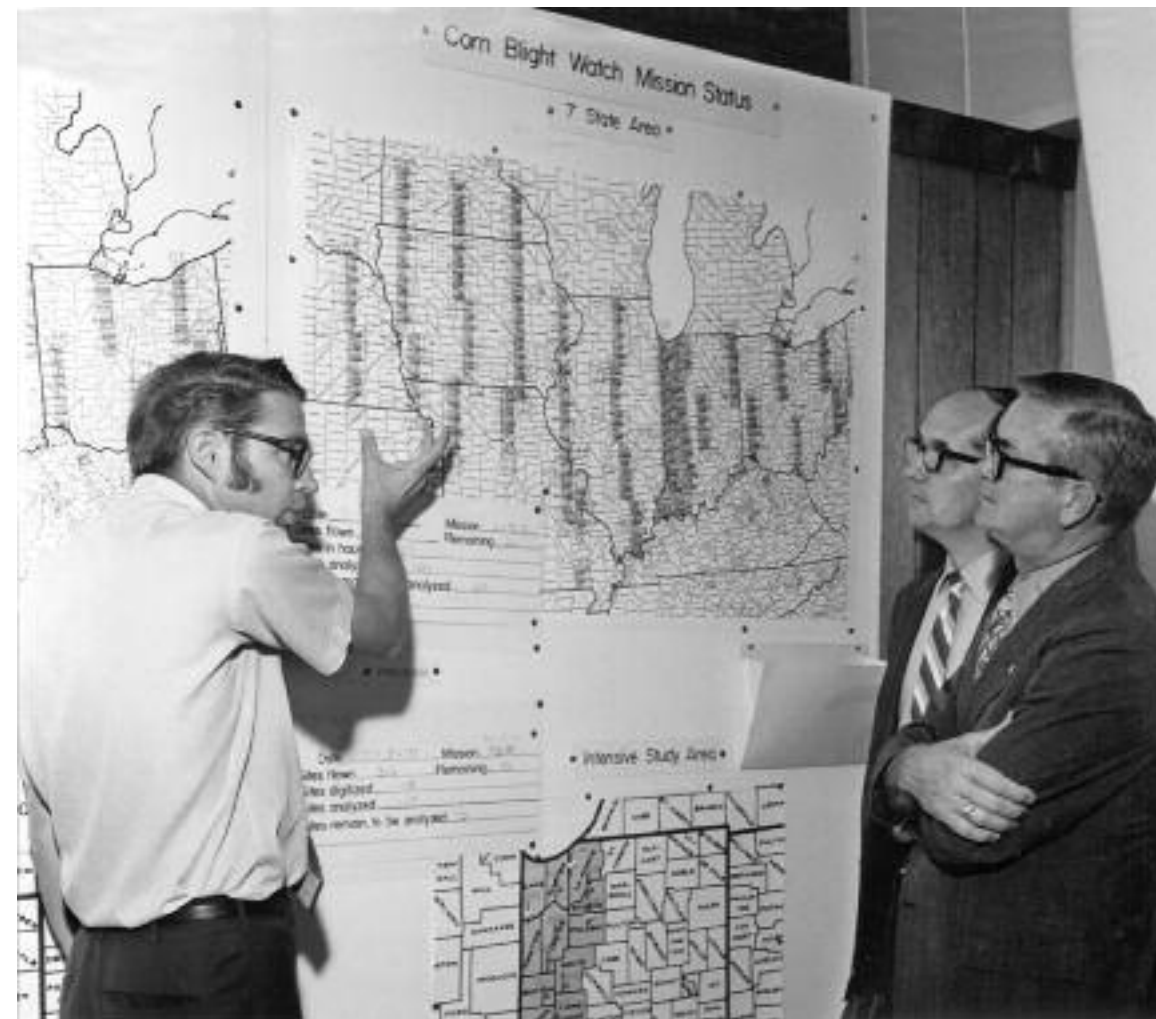
The Earth Resources Technology Satellite (ERTS) mock-up in a space chamber test at General Electric's Space Division. The ERTS program represented a concentrated effort to observe and monitor the limited resources of the Earth, in order to best conserve and utilize the resources in support of a burgeoning world population. The first ERTS was launched in 1972 and was later named Land Remote-Sensing Satellite (Landsat), to better represent the civil satellite program's prime emphasis on remote sensing of land resources. Image credit: NASA.

The 1970s was an era in which geoscience and remote sensing came to the attention of the American public. President Kennedy's pledge to put an American on the moon by the end of the 1960s came to fruition in July 1969 when Astronaut Neil Armstrong took his "giant leap for mankind." A series of NASA Apollo missions to the moon during the 1970s prepared Americans for the reality of navigating in space. Apollo would give way at the end of the decade to the Space Transportation System (STS), which the media would dub the Space Shuttle Program. Space Shuttle *Columbia*, which had been in the planning stages since Armstrong's historic Apollo XI mission in 1969, was delivered to the Kennedy Space Center in 1979; it would carry two astronauts into space and return safely in 1981, the successful beginning of a 30-year Space Shuttle program.

The tremendous expansion of manned and unmanned orbital space traffic in the 1960s and 1970s opened new fields for those whose interests gravitated toward geoscience and remote sensing. Meteorologists increasingly joined G-GE because of their interest in new Doppler radar systems for weather forecasting. In 1967, the U.S. Departments of Commerce, Transportation and Defense sponsored the Joint Doppler Operational Program (JDOP).ⁱ Doppler radar, which had been studied for its effectiveness in penetrating the atmosphere and revealing precipitation, would become an increasingly valuable tool during the 1970s and 1980s for use in predicting the path of severe storms.

Weather satellites were another vehicle for remote sensing that brought many scientists and engineers into the G-GE during the 1970s. The launch of the TIROS-M and TIROS-N (Television Infra-Red Observation Satellite) by the newly created National Oceanic and Atmospheric Administration (NOAA) created a new understanding of the role that satellites could play in remote sensing.ⁱⁱ

A growing number of scientists and engineers working in the field of oceanography came into G-GE, thanks to the strides made during the decade in Synthetic Aperture Radar (SAR). Developed in the 1950s as a military reconnaissance tool, SAR by the 1970s was increasingly being used for monitoring both the land and water surface of the Earth. NOAA and the Jet Propulsion Laboratory (JPL) began the development of the Seasat satellite system in 1974 for oceanographic observation. Launch of Seasat in 1978 was the first civilian application of SAR, and Seasat's success led to inclusion of SAR on several Space Shuttle missions after 1981.ⁱⁱⁱ



Chris Johannsen (left) and David Landgrebe (right rear), Purdue University LARS, discuss the flightlines for the Corn Blight Watch Experiment with Congressman Earl F. Landgrebe (right front) in 1971. All flightlines involved in the CBWE were flown by an AF RB57 at an altitude of 30,000 feet with color and color infrared photography.

AdCom member Kiyo Tomiyasu's involvement with Seasat dated from the early 1970s. One of the few Japanese-Americans to work on his doctorate at Harvard on a U.S. Navy scholarship, Tomiyasu's original field of interest was antenna research. He taught at Harvard following the war, later worked

for GE in Schenectady, New York, and the company's space division in Philadelphia, followed by work on remote sensing from satellites with scientists from the University of Kansas and JPL in California.

1971



1971
John C. Redmond
General Dynamics Corp.
Chairman, G-GE

08/71

Third Annual International Geoscience Electronics Symposium
Twin Bridges Marriott, Washington, DC, USA

“In 1975 I got involved with the first radar from space, Seasat, through JPL,” Tomiyasu explained. “The Lockheed Martin Company at Sunnyvale was involved with the first radar in space. Seasat went through an experimental model, an engineered model, and a flight model — all critical for space flight. Seasat was in orbit for 100 days; it was a great success.”^{iv}

Other G-GE members at the time were also working on Synthetic Aperture Radar (SAR). Charles Elachi, who would go on to head JPL in Pasadena, California, got his start at JPL as a part-time summer academic in the late 1970s with projects utilizing SAR. Elachi’s first job at JPL was working on what would later become the Magellan mission, imaging Venus using SAR. When Seasat was launched in 1978, Elachi was involved in the satellite’s imaging radar.

Elachi was the PI [principal investigator] on the first instrument which flew on the Shuttle flight designated STS-2. “That was the Shuttle Imaging Radar [SIR]-A,” he told a NASA historian in 2007, “and that was the first time we actually used a civilian space radar to do a certain kind of geologic mapping. Then that led to a series of missions of SIR-B, SIR-C, SRTM [Shuttle Radar Topography Mission] for Shuttle radar terrain mapping.”^v

International agencies were also experimenting with SAR. The Canada Centre for Remote Sensing (CCRS) in Ottawa bought a SAR system from the University of Michigan in 1975 and used it for aerial surveys of the Canadian North.”^{vi}

SAR, acquired by both airborne and spaceborne platforms, would become a mature technology by the end of the century, thanks in part to the efforts of G-GE and GRSS members around the world. Processing and calibration problems had been eliminated, and modeling of the imaging process was

much better understood. Sensor and data availability improved dramatically in SAR’s first quarter-century.^{vii}

A seemingly insurmountable hurdle faced G-GE in the mid-1970s, however, due to the scarcity of geoscience and remote sensing professionals necessary to continue and expand the field’s pursuits.

The International Geoscience Electronic Symposium

Interest in the field of geoscience and remote sensing was growing, and an ever-increasing number of scientists and engineers were being hired by NASA, NOAA, JPL and other public and private scientific organizations. However, membership in G-GE was still not much greater than 1,500 members during most of the 1970s. Ed Wolff had increased annual dues 25 percent to \$5.00 in 1969, and Alex Hoffman increased the number of *Transactions* pages to 300 annually in the early 1970s. AdCom also moved to join the prestigious National Telemetry Conference.

G-GE sponsored the First Annual International Geoscience Electronics Symposium at the Twin Bridges Marriott Hotel in Washington, D.C., in mid-April 1969, a month after the Earth orbit of Apollo 9 and five weeks before the lunar orbit of Apollo 10. Charles F. Getman, a marine scientist working with the U.S. Naval Oceanographic Office and active in the Washington Chapter of G-GE served as Steering Committee Chairman of the symposium. More than 375 attendees heard 63 papers presented in 13 technical sessions that covered topics of interest, ranging from earth resources surveys to oceanographic and meteorological remote sensing, instrumentation for seismologic measurements and

the increasingly hot topic of environmental regulation.

The symposium was both a scientific and financial success. IEEE members paid a registration fee of \$17.00, and G-GE cleared nearly \$1,400 on revenues of \$6,800 after paying expenses of just over \$5,400.^{viii}

G-GE sponsored its second annual International Geoscience Electronics Symposium the same April weekend in Washington one year later. The 1970 symposium also was held at the Twin Bridges Marriott, boasting 70 papers presented at 18 technical sections. U.S. Senator Warren Magnuson of Washington gave the keynote address, calling for the creation of a World Environmental Institute to provide an interdisciplinary, global approach to environmental problems. In the Senate, Magnuson was instrumental in the legislative negotiations that would result in congressional passage of the Clean Air Act, the nation’s first major environmental law, late in 1970.

The 1970 symposium also was a financial success, and G-GE made plans to sponsor the third annual symposium in 1971. AdCom was unable to reserve the Twin Bridges Marriott for the mid-April weekend, and reluctantly moved the date for the symposium to late August. Ralph Bernstein, then the manager of the IBM Federal Systems Division in Gaithersburg, Maryland, and Principal Investigator on the Landsat-1 Program, put together a spectacular program.

Willis B. Foster, Deputy Administrator for Monitoring at the newly formed Environmental Protection Agency (EPA), gave the keynote address. There were a number of environmental monitoring panels, an area G-GE had identified as promising for membership recruitment. Fred Gorschboth of IBM’s Federal Systems Division chaired a panel on



Exotech 20B instrument being tested at the Purdue University Agronomy Farm, west of the Purdue campus, before being sent to the USDA in Weslaco, TX (summer of 1970). This site is still used today for calibration of instruments, and evaluation and calibration of satellite data.



Helsinki University of Technology (HUT) team collecting in situ sea ice data in an airborne radiometer campaign, March 1978, Gulf of Bothnia (Baltic Sea). Airborne campaigns have played a vital role in the development of methods for interpretation of satellite radiometer data.

07/23/72
ERTS 1 / LANDSAT 1
launched

12/12/72
NIMBUS 5
launched

05/14/73
SKYLAB
launched

01/22/75
LANDSAT 2 / ERTS 2
launched

04/09/75
GOES-3
launched

1972



1972
Charles F. Getman
US Navy Oceanographic Office
Chairman, G-GE



1972-1976
Stephen Riter
Texas A&M University
Editor, *G-GE Transactions*

1973



1973-1974
Michael L. Sims
National Oceanographic Instrumentation Center
Chairman, G-GE

1974

1975



1975
John W. Rouse Jr.
Texas A&M University
Chairman, G-GE



In 1977 Meteosat-1 was launched on a Delta rocket from Cape Canaveral and moved to its nominal operational location over the equator at 0° longitude. This immediately became part of the operational system for weather forecasting across many countries in Europe. Credits: ESA.

environmental instrumentation, and Fred Bishop and William Shuk co-chaired a workshop on Waste Treatment Process Control Monitoring. Fausto M. Calabria chaired a session on computers in geoscience research, an area that was just coming into its own at the time.^{ix}

The timing of the symposium, however, was ill planned. Late August in Washington was hot and humid, and the United States was in the throes of a deep recession that would last until mid-decade. Stagflation, a nasty combination of economic stagnation and inflation, was rampant in the summer of 1971, and the aviation and aerospace industries, in particular, were feeling the brunt of the situation.

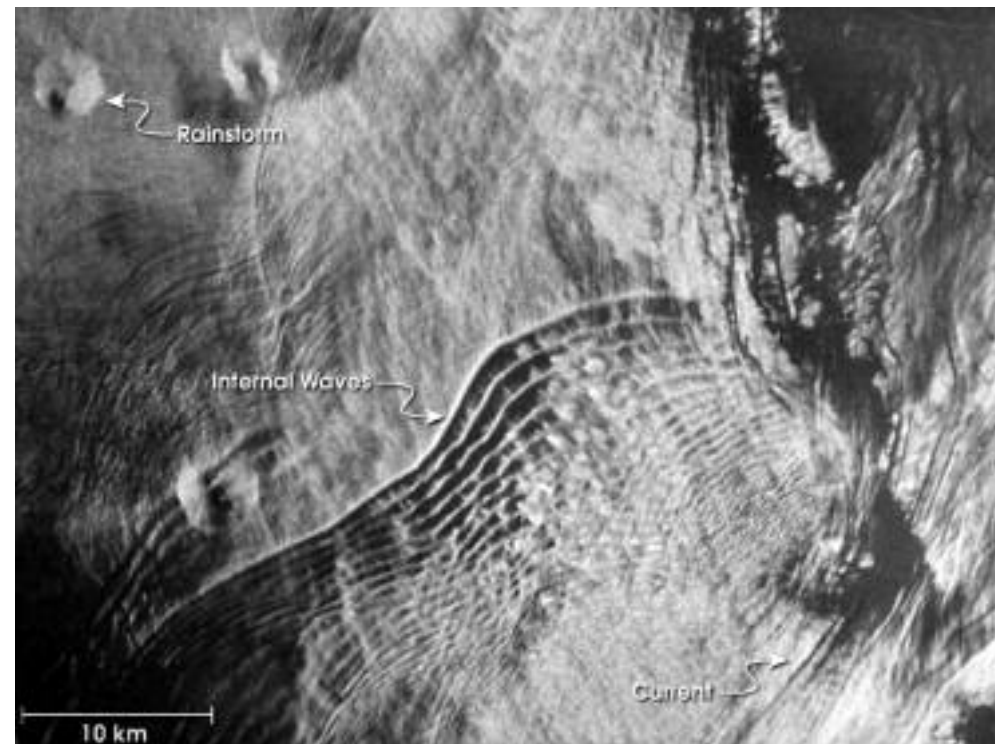
Companies were not spending money to send scientists and engineers to conferences. As a result, the third annual symposium only attracted about 150 attendees, far too few for G-GE and IEEE to break even.* The failure of the 1971 symposium was to have far-reaching consequences for those in the geoscience and remote sensing communities.

The Move to Disband G-GE

As the recession deepened into 1972 and then was exacerbated by the OPEC (Organization of Petroleum Exporting Countries) oil embargo in October 1973, G-GE struggled to remain a meaningful organization. Membership never reached much more than 1,500 in the early 1970s, and fell to a low of 1,200 members in 1975, with some Chapters having as few as four or five members, and others only as many as 30.

Following the 1971 symposium, a faction in IEEE began agitating for consolidation of some of the smaller technical groups into larger societies. Certain members of the IEEE Board wanted G-GE to merge with the Aerospace and Electronics Systems Society (AES). The Washington Chapters of G-GE and AES joined at the time, however, G-GE members quickly reported back to AdCom that they had, in fact, been forced to join a dominant AES chapter.^{xi}

G-GE successfully resisted the IEEE consolidation movement by transforming itself into a more multidisciplinary organization. The Naval Oceanographic Office's Charles Getman, 1972 AdCom Chairman, outlined the approach in a 1973 *Transactions* article. "Traditionally the geophysical environment that has concerned the group has included the earth, water, atmosphere, and more recently, space," Getman wrote. "The interest has been fo-



SEASAT: This first Synthetic Aperture Radar (SAR) [1978] image demonstrated the potential of synthetic aperture radar for oceanographic applications. Image credit: NASA JPL.

cused on the instrumentation systems needed to understand these environments. By systems we mean all the electronics from the sensors to the data display devices. This includes all the various sub-systems and components without which a complete system could not be synthesized. Included for example are sensors, telemetry, communications, transmitters, receivers, data processing, and data interpretation systems."^{xii}

Getman took the issue a step further, however, when he noted that computers were going to have an increasingly important role in how data were gathered and processed.^{xii} "In recent years," he said, "the development of automatic interpretation techniques based upon advances in data processing and

the theory of detection and pattern recognition have necessitated the better understanding of fundamental environmental phenomena by the systems designer. Consequently, there has been an increased emphasis on contributions and activities which bridge the gap between the scientist and the engineer."^{xiii}

The Group benefitted from new leadership that was committed to representing the professional interests of its members. John Rouse Jr., the Director of the Remote Sensing Center at Texas A&M University, had long been interested in the use of satellite remote sensing for earth surface studies of vegetation. The Remote Sensing Center was a major player in the 1970's Great Plains Study that used Landsat-1

11/23/77
METEOSAT 1 launched

03/05/78
LANDSAT 3 launched

06/27/78
SEASAT 1 launched

10/13/78
NIMBUS 7 launched

1976



1976
Clare W. McGillem
Purdue University
Chairman, G-GE



1976-1981
Haralambos "Harry" N. Kritikos
University of Pennsylvania
Editor, *G-GE Transactions*

1977



1977
Jerry Eckerman
NASA Goddard Space Flight Center
Chairman, G-GE

1978



1978-1979
"Alex" A.J. Hoffman
Texas Christian University
Chairman, G-GE

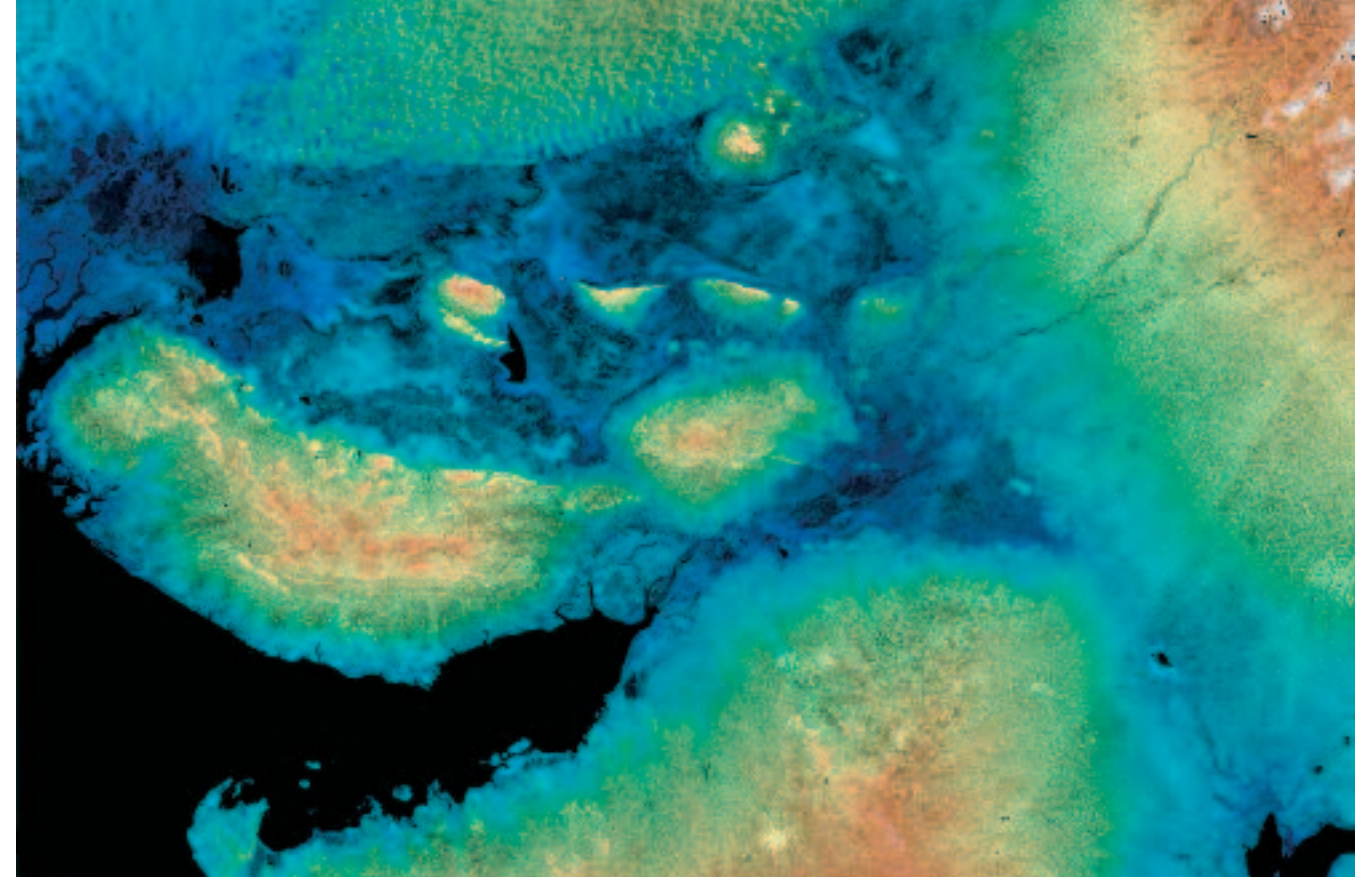


data to create a vegetation index of the Southern Great Plains. In 1971 and again in 1973, Rouse had served as the Guest Editor of two *Transactions* special issues, “Remote Sensing of the Environment” in 1971, and “A Summary of ERTS Experiments” two years later.^{xiv}

Rouse, who served as AdCom President in 1975, came into office on a mission. In his January 1975 President’s Letter in *Transactions*, Rouse wrote that “the AdCom has been reorganized and revitalized. Membership is up. The *Newsletter* is back. G-GE is again actively represented on several conference committees. This has been a good year and next year will be even better!”^{xv}

Rouse had worked closely with Stephen Riter, the Editor of *Transactions* from 1972 to 1976. Riter was associated with the Department of Electrical Engineering at Texas A&M and had long known his Aggie colleague Rouse. When Riter stepped down as Editor in 1975, Rouse and AdCom turned to Haralambos N. Kritikos, one of the nation’s foremost scholars in the study

On May 18, 1980, Mt. St. Helens erupted, leveling over 200 square miles of forest. The eruption left the surrounding landscape barren and the mountain 1300 feet shorter. The Landsat images at left show Mt. St. Helens eight years before the 1980 eruption (top: Landsat 1 image acquired on July 29, 1972, MSS bands 4,7,2); nearly two decades after the eruption (bottom: Landsat 7 image acquired Sept. 7, 1999, ETM+ bands 3,2,1). Image Credit: NASA.



This image shows the area around the January 26, 2001, earthquake in western India, the deadliest in the country’s history with some 20,000 fatalities. The epicenter of the magnitude 7.6 earthquake was just to the left of the center of the image. The Gulf of Kachchh (or Kutch) is the black area running from the lower left corner toward the center of the image. The city of Bhuj is in the yellow-toned area among the brown hills left of the image center and is the historical capital of the Kachchh region. The city of Ahmedabad, capital of Gujarat state, is the radar-bright area next to the right side of the image. The dark blue areas around the center of the image and extending to the left side are low-lying salt flats called the Rann of Kachchh with the Little Rann just to the right of the image center. The textured area north of the Rann (green and yellow colors) is a large area of sand dunes in Pakistan. The image combines two types of data from the Shuttle Radar Topography Mission (SRTM). The image brightness corresponds to the strength of the radar signal reflected from the ground. This image, a mosaic of four SRTM swaths, was acquired by the Shuttle Radar Topography Mission (SRTM) aboard the Space Shuttle *Endeavor*, launched on February 11, 2000. The mission is a cooperative project between NASA, NGA, DoD and the German and Italian space agencies, and was managed by NASA JPL for NASA’s Earth Science Enterprise, Washington DC. Size: 450 by 300 kilometers (280 by 190 miles). Original data resolution: SRTM 30 meters (99 feet). Image credit: NASA/JPL/NGA.

of electromagnetics. A longtime professor in the Moore School of Electrical Engineering at the University of Pennsylvania, “Harry” as he was known to everybody in IEEE, agreed to assume the editorial duties of the *Transactions*. Kritikos would make *Transactions* into one of the best scientific journals of its kind in the next five years.

G-GE would survive the difficult decade of the 1970s by stressing the multidisciplinary focus of the geoscience and remote sensing communities and by providing a forum for scientists and engineers in that community to share their research and common interest through the pages of *Transactions*. By the late 1970s, the federal government would be poised to

drastically increase its funding of geoscience and remote sensing through a multitude of environmental, aerospace, oceanographic, seismic, climatological and meteorological programs. G-GE would of necessity change to meet the challenge and opportunity of that increased scientific funding initiative.



1979

Name changed to Geoscience and Remote Sensing Society

CHAPTER 3

Changes

The Ulaby Factor

Those who were present at the creation of GRSS give much credit to the inspiration of Fawwaz T. Ulaby, the first President of the renamed GRSS. Born in Damascus, Syria, and raised in Lebanon, Ulaby received his B.S. degree in physics from the American University in Beirut and earned a Ph.D. in electrical engineering from the University of Texas at Austin in 1968. Ulaby was long active in the development of high-resolution satellite radar sensors for mapping Earth's terrestrial environment. After a number of years in the Electrical Engineering Department at the University of Kansas in Lawrence, Ulaby joined the University of Michigan faculty in 1984, where he served as the R. Jamison and Betty Williams Professor of Electrical Engineering and Computer Science.ⁱ From 2005 to 2009, Ulaby was the founding Provost and Executive Vice President for Academic Affairs of the King Abdullah University of Science and Technology, a graduate research university being developed along the Saudi coast of the Red Sea. In 2009, he returned to the University of Michigan as the Arthur Thurman Professor of Electrical Engineering and Computer Science.

Keith Carver, who succeeded Ulaby as the second President of GRSS, called his predecessor "a pivotal influence" in the development of GRSS. "He was on the electrical engineering faculty at the University of Kansas," Carver said. "He helped develop scatter and back scatter science for microwave remote sensing. He had a fierce intensity and drive to develop GRSS into its present state. Fawwaz is a key person with critical influence on the future development of the Society."ⁱⁱ

Kiyo Tomiyasu recalled getting together in 1970 with Fawwaz Ulaby. Remote sensing did not fit the Geoscience Electronics Group at the time. Keith Carver and Fawwaz had an idea of forming GRSS, and they called me. The next thing I knew, they had petitioned IEEE to form GRSS, with the first conference to be held in Washington D.C."ⁱⁱⁱ

GRSS was an idea whose time had arrived, and Ulaby had clearly seen the potential for the new Society. During the next four years, under the leadership of Ulaby, Carver, McIntosh and Swift, GRSS blossomed into a dynamic organization committed to meeting the needs of the geoscience and remote sensing communities.



Fawwaz Ulaby,
AdCom Member 1978-1987,
President 1980-1981

One of the most significant changes in the history of GRSS took place in 1979 when the Group on Geoscience Electronics AdCom voted to change its name to the Geoscience and Remote Sensing Society. The shift to GRSS was significant in several senses. For one, it recognized the growing linkage between geoscientific disciplines and the increasing number of practitioners in the field of remote sensing. Fawwaz T. Ulaby, then a new member of AdCom and a Professor of Electrical Engineering at the University of Kansas, wrote in the January 1980 issue of the renamed *IEEE Transactions on Geoscience and Remote Sensing* that remote sensing, in the view of GRSS, was defined "to include observations from spaceborne and airborne platforms, as well as seismic recording of the earth's subsurface and sonar mapping of the ocean floor."ⁱ

The second recognition involved the reality that funding of space travel, aeronautical research and oceanographic pursuits during the 1970s had vastly increased the number of people in the fields of geoscientific research and remote sensing. This point was not lost on the AdCom, which would deal with both a surge in membership and of papers submitted to the editors of *Transactions* during the 1980s. The increase in both membership and areas of technical interest allowed AdCom to offer more benefits to members than

had been possible during the lean days of G-GE in the 1970s. GRSS expanded its *Newsletter* under the direction of a series of activist editors in the early 1980s, and the Society instituted a host of annual awards designed to recognize those members who had made contributions both in the field and to GRSS.

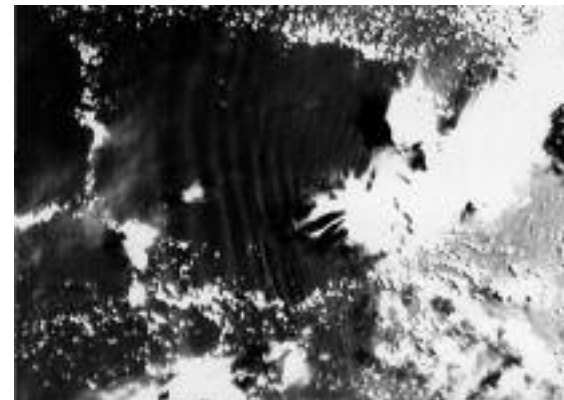
Expanding the Transactions

The 1980 change from a Group to a Society necessitated changes in *Transactions*, the Society's peer-reviewed journal. GRSS published the first issue of the *IEEE Transactions on Geoscience and Remote Sensing* in January 1980 under the stewardship of Editor Harry Kritikos from the University of Pennsylvania. At the time, the *GRSS Transactions* was published quarterly and averaged about 250-300 pages each year. In the early 1980s, Calvin T. Swift, Professor of Electrical and Computer Engineering at the University of Massachusetts at Amherst, succeeded Kritikos as editor.

The number of papers submitted to the editorial board began to climb in 1981 and 1982 with the number of *GRSS Transactions* pages published each year exceeding 500. Paper submissions continued to increase, as membership in the Society grew. In 1984, AdCom and the editorial staff expanded *GRSS Transactions* to a bi-monthly publication, publishing the journal six times a year. In 1986, the number of pages exceeded 1,000 for the first time.ⁱⁱ

Swift, who would guide *GRSS Transaction's* fortunes through some of its most explosive growth, was a 20-year veteran of remote sensing. An MIT undergraduate, he had earned his M.S. degree from Virginia Polytechnic Institute in 1965 and his doctorate from the College of William and Mary four years later. Swift had worked for North American Aviation in the early 1960s and spent much of the next 20 years at NASA's Langley Research Center in Hampton, Virginia, working on plasma-covered an-

Below: Characterization of internal waves in the Andaman Sea captured by IRS-1A on August 31, 1989. The first of the series of indigenous state-of-art remote sensing satellites, IRS-1A, was successfully launched into a polar sun-synchronous orbit on March 17, 1988, from the Soviet Cosmodrome at Baikonur. IRS-1A carries two cameras, LISS-I and LISS-II, with resolutions of 73 meters and 36.25 meters respectively with a swath width of about 140 km during each pass over the country. Image credit: NASA GES DISC.



tennas and microwave remote sensing. In 1981, about the time he took over editorial duties from Kritikos, Swift joined the engineering faculty at the University of Massachusetts at Amherst, where he remained until his retirement in 2001.ⁱⁱⁱ Swift's adept handling of editorial duties as Editor of *GRSS Transactions* through the early 1980s positioned him to be named GRSS President in 1985.

In 1984, Swift had handed editorial duties of *GRSS Transactions* to Fawwaz Ulaby, who would shape the journal's editorial direction for most of the remainder of the 1980s. Ulaby relied on a group of talented technical and associate editors who provided guidance for articles covering a growing number of topics, including atmospheric remote sensing, information processing, electromagnetic subsurface remote sensing, microwave scattering and propagation, passive microwave remote sensing, radar remote sensing, subsurface propagation, optical systems, geophysical signal processing, visible and infrared remote sensing, geodynamics and others.

1980



1980-1981
Fawwaz Ulaby
University of Kansas
President, GRSS



1980
W. Travis Walton
NASA Goddard Space Flight Center
Editor, Newsletter

First issue of *IEEE Transactions on GRSS* was published

The Distinguished Achievement Award 1982-2012

- 1982 Richard K. Moore, University of Kansas
- 1983 Fawwaz Ulaby, University of Kansas
- 1984 David C. Hogg,
NOAA-Wave Propagation Laboratory
- 1985 James R. Wait, University of Arizona
- 1986 Vince Salomonson, NASA Goddard Space
Flight Center
- 1987 Charles Elachi, Jet Propulsion Laboratory
- 1988 Gerard Guyot, INRA-Avignon, France
- 1989 Adrian Fung, University of Texas-Arlington
- 1990 None
- 1991 Erwin Schanda,
University of Bern, Switzerland
- 1992 David Landgrebe, Purdue University
- 1993 R. Keith Raney,
Canada Centre for Remote Sensing
- 1994 Calvin T. Swift,
University of Massachusetts Amherst
- 1995 John Reagan, University of Arizona
Tucson
- 1996 David Staelin,
Massachusetts Institute of Technology
- 1997 Robert McIntosh,
University of Massachusetts Amherst
- 1998 Akira Ishimaru,
Massachusetts Institute of Technology
- 1999 Martti Hallikainen, Aalto University,
Finland
- 2000 Jin Au Kong,
Massachusetts Institute of Technology
- 2001 Wolfgang Keydel, DLR Microwaves and
Radar Institute, Germany
- 2002 Werner Wiesbeck, Karlsruhe Institute
of Technology, Germany
- 2003 Ed Westwater, University of Colorado
- 2004 Paolo Pampaloni, CNR-IFAC, Italy
- 2005 Kamal Sarabandi, University of Michigan
- 2006 David Goodenough, Pacific Forestry
Centre, Canada
- 2007 Giorgio Franceschetti
University of Naples, Italy
- 2008 Leung Tsang, University of Washington
- 2009 Jong-Sen Lee, Office of Naval Research
- 2010 Jakob van Zyl, Jet Propulsion Laboratory
- 2011 Tom Jackson, U.S. Department
of Agriculture
- 2012 Didier Massonnet, Centre National
d'Etudes Spatiales, France

A Newsletter and Awards

Another Society area targeted for expansion and growth during the early 1980s was the *GRSS Newsletter*. Published by G-GE from its earliest days, typically as a mimeographed sheet, the *Newsletter* was a rich lode of information about the Society, its members and the growing technical and scientific interests within these fields. Under the editorial direction of W. Trev Walton, John Crawford and Connie Balanis, the *Newsletter* expanded during the late 1970s and early 1980s to include feature articles about members and their interests, organizational profiles, chapter activities, IEEE news, conference and symposium reports and book reviews. Walton, who served as Editor from 1978 to 1980, worked at the time with NASA's Goddard Space Flight Center and later became Director of the Technology Extension Service at the University of Maryland's Engineering Research Center. Balanis, Editor in 1982 and 1983, was on the engineering faculty of West Virginia University and afterward joined the engineering faculty at the University of Arizona.^{iv}

With the *GRSS Transactions* and the *Newsletter* in capable hands, AdCom moved in 1981 to re-establish an awards program that had been all but abandoned throughout much of the 1970s. Kiyo Tomiyasu proposed that GRSS consider sponsoring a series of annual awards to recognize members for their contributions to the geoscience and remote sensing communities, as well as to the Society. Ulaby and AdCom unanimously supported Tomiyasu's proposal and named the longtime researcher with the General Electric Valley Forge Space Center in Pennsylvania to chair the Society's Awards Committee.^v

Tomiyasu and his committee proposed a series of four annual GRSS awards, including the Distinguished Achievement Award, the Outstanding Service Award, the Best *Transactions* Paper Award, and the Best Symposium Paper Award. In 1982, the committee nominated Richard K. Moore as the first recipient for the GRSS Distinguished Achievement Award and Harry N. Kritikos as the first recipient for the GRSS Outstanding Service Award. Lee K. Balick,



Richard K. Moore, University of Kansas, inaugural recipient of the GRSS Distinguished Achievement Award.

Randy K. Scoggins and Lewis E. Link won the Best *Transactions* Paper Award for their monograph on "Inclusion of a Simple Vegetation Layer in Terrain Temperature Models for Thermal IR Signature Prediction," which appeared in the July 1981 issue of the *GRSS Transactions*.^{vi} Michael T. Halbouty won the 1982 Best Symposium Paper Award for his presentation on "Applications of Remote Sensing to Petroleum Exploration," at IGARSS'81 in Washington, D.C.^{vii}

Moore, the winner of the inaugural Distinguished Achievement Award and Ulaby's colleague at the University of Kansas, was perhaps the most influential practitioner of remote sensing in North America. A graduate of Washington University in St. Louis, he had worked for RCA Victor's Test Equipment Department before World War II testing Navy FM radar altimeters. When war broke out, the Navy sent Moore to pre-radar school at Bowdoin College and to the MIT Radar School, but most of his time was spent as a communications officer aboard a small seaplane tender in the Pacific.^{viii}

He completed a doctorate at Cornell University following the war, doing research of tropospheric and ionospheric propagation and their affects on submarine antennas. Moore moved to Albuquerque to work with Sandia Corporation on radar returns, and when the University of New Mexico was searching for a chair of its Electrical Engineering Department in 1954, Moore accepted the position. During his years at New Mexico, he oversaw the emergence of a topflight Electrical Engineering Department, but he missed the opportunity for pure research.

In 1962, he left Albuquerque for a distinguished professorship at the University of Kansas where he continued his research on radar returns. In 1964, Moore started the interdisciplinary Remote Sensing Laboratory on the Lawrence campus with assistance from NASA and the U.S. Army. Moore headed the facility for most of the next 30 years until his retirement in 1994, involving the Lab in virtually all NASA radar missions during that period. The University of Kansas Remote Sensing Lab pioneered the idea of using radar signals to measure wind vectors on the surface of the ocean, which helped maritime meteorologists make longer-range weather forecasts than previously possible.^{ix}



Harry N. Kritikos, University of Pennsylvania, inaugural recipient of the GRSS Outstanding Service Award.

The Outstanding Service Award 1981-2011

- 1981 Harry N. Kritikos, University of Pennsylvania
- 1982 Fawwaz Ulaby, University of Kansas
- 1983 J. Eckerman, University of Kansas
- 1984 Keith Carver, University of Massachusetts
Amherst
- 1985 Robert McIntosh, University of Massachusetts
Amherst
- 1986 Kiyo Tomiyasu, Lockheed Martin Corp.
- 1987 Alois Sieber, EC Joint Research Centre, Italy
- 1988 David Landgrebe, Purdue University
- 1989 John Reagan, University of Arizona Tucson
- 1990 R. Keith Raney, Canada Centre for Remote
Sensing
- 1991 Klaus Itten, University of Zurich, Switzerland
- 1992 Calvin Swift, University of Massachusetts
Amherst
- 1993 Richard Doviak, University of Kansas
- 1994 Martti Hallikainen, Aalto University, Finland
- 1995 David Goodenough, Pacific Forestry Centre,
Canada
- 1996 Andrew Blanchard, University of Missouri
Columbia
- 1997 Vincent Salomonson, NASA Goddard Space
Flight Center
- 1998 Wolfgang Keydel, DLR Microwaves and
Radar Institute, Germany
- 1999 James Smith, NASA Goddard Space Flight
Center
- 2000 Leung Tsang, University of Washington
- 2001 James Garlin, NASA Goddard Space Flight
Center
- 2002 Tom Jackson, U.S. Department of Agriculture
- 2003 Ram Narayanan, University of Nebraska
Lincoln
- 2004 Charles Luther, Office of Naval Research
- 2005 Wolfgang Boerner, University of Chicago
- 2006 Albin Gasiewski, University of Colorado
- 2007 Jon Atli Benediktsson, University of Iceland
- 2008 Woil Moon, University of Manitoba, Canada
- 2009 William J. Emery, University of Colorado
- 2010 Tom Lukowski, Natural Resources Canada
- 2011 Masanobu Shimada, JAXA, Japan

07/16/82
LANDSAT 4 launched

1981



1981-1984
Calvin Swift
University of Massachusetts Amherst
Editor, *TGRS*



1981
John Crawford
Jet Propulsion Lab
Editor, *Newsletter*

06/8-10/1981
IGARSS'81
Twin Bridges Marriott, Washington, DC, USA

1982



1982-1983
Keith Carver
New Mexico State University
President, GRSS



1982-1983
Connie Balanis
West Virginia University
Editor, *Newsletter*

06/1-4/1982
IGARSS'82
University of Munich
Munich, Germany

Moore's selection as the initial recipient of the GRSS Distinguished Achievement Award established a high bar for those who would follow in his footsteps.

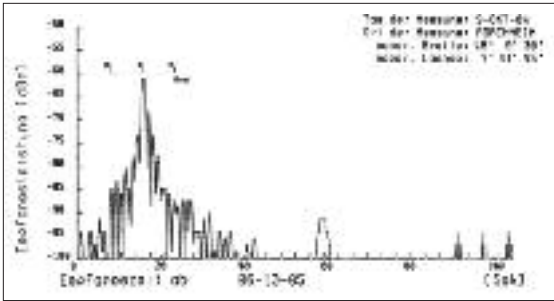
Outstanding Service

The GRSS Outstanding Service Award differed from the Distinguished Achievement Award in that it typically honored a nominee who had made outstanding contributions to the Society. The vast majority of those chosen for the prestigious award during the 1980s were longtime AdCom members, and most served as President of GRSS.

Fawwaz T. Ulaby was the first GRSS member during the decade to be honored with both the Distinguished Achievement Award and the Outstanding Service Award. Ulaby was selected for a second Outstanding Service Award in 1982. R. Keith Raney of the Canada Center for Remote Sensing and Calvin T. Swift of the University of Massachusetts would be honored with both awards during the 1990s.

GRSS was blessed with strong AdCom and presidential leadership during the 1980s. The three presidents who followed Ulaby and guided the Society's fortunes through mid-decade all had ties to the University of Massachusetts at Amherst. Keith Carver, who served as President in 1982 and 1983, was on the Electrical Engineering faculty at New Mexico State University from 1969 to 1983; soon after turning the presidency over to Robert McIntosh in 1984, Carver was named Head of the Department of Electrical and Computer Engineering at the University of Massachusetts, a position he held until 1984 when he returned to teaching on the Amherst campus. Carver retired from teaching at the University of Massachusetts at Amherst in 2005.^x

Bob McIntosh, Carver's successor as GRSS President, spent his entire 31-year professional career



The determination of an antenna diagram of SIR-B in 1985 using ground receivers represented the first time that an antenna diagram of a spaceborne SAR has been measured during flight for calibration purposes. Ground measurement of the SIR-B antenna diagram, during flight October 9, 1984. Received power in dBm versus over flight time in seconds taken within the SIR-B swath near Forchheim, Germany. The region $\pm 10^\circ$ around the main beam corresponds to 15 seconds flight time. Remarkable is the lack of symmetry around the main beam and the relative high side lobe of about 30 dB against the main beam at 60 seconds, probably due to reflections from the Space Shuttle's tail unit. Image Credit: Microwaves and Radar Institute, DLR, Oberpfaffenhofen, Germany.



Visit to the Russian Academy of Sciences Institute for Radio-engineering and Electronics (IRE) microwave sensors laboratory near Moscow in 1988. Research results on passive microwave remote sensing of soil moisture, not available in the open literature at that time, were exchanged. Following this visit, the IRE provided a suite of passive microwave sensors to soil moisture field campaigns conducted in the United States during the early 1990s. Shown are (left to right) Eugene Reutov (IRE), Evgenij Novichikhin (IRE), Alexander Haldin (IRE), Alexander Grankov (IRE), Jim Shuie (NASA), Anatoly Shutko (IRE), Tom Jackson (USDA), and Tom Schmugge (USDA).



John Kerekes honors David Landgrebe at the IEEE Workshop on Advances in Techniques for Analysis of Remotely Sensed Data, hosted at NASA Goddard Space Flight Center, October 27-28, 2003.

at the University of Massachusetts at Amherst where he was named a Distinguished University Professor in 1996. McIntosh, who earned an M.S. degree from Harvard University and a Ph.D. from the University of Iowa, served 17 years as Co-Director of the Microwave Remote Sensing Laboratory on the Amherst campus and was responsible for establishing the Microwave and Electronics Group within the university's Electrical and Computer Engineering Department.^{xi}

McIntosh, who served as GRSS President in 1984, and Calvin T. Swift, who served as Society President in 1985, both served as Co-Directors of the Microwave Remote Sensing Laboratory at the time of their presidencies. Thus, it was no surprise that Swift's presidency was marked by McIntosh's chairmanship of IGARSS'85, which was held on the Amherst campus.^{xii}

Swift was succeeded by another legendary name in remote sensing. David A. Landgrebe, GRSS President in 1986-1987, had just been named the Coordinator of Graduate Programs for Purdue University's School of Electrical Engineering in West Lafayette, Indiana. Landgrebe, a native Hoosier, was a Boilermaker through and through; he earned his

B.S., M.S. and Ph.D. from Purdue, joined the faculty in 1962 and served in a number of positions at the university until his retirement. Landgrebe was a founding member of Purdue's Laboratory for Applications of Remote Sensing (LARS) and was the Lab's Director from 1969 to 1981. In 1995 and 1996, he was Acting Head of Purdue's School of Electrical and Computer Engineering, and in 2003, a GRSS-sponsored workshop was held in his honor to highlight his contributions to the analysis of multispectral and hyperspectral remote sensing.^{xiii}

R. Keith Raney, who earned his M.S. in electrical engineering at Purdue in 1962, the same year that David Landgrebe was awarded his Purdue doctorate, succeeded his old classmate as GRSS President in 1988 and served two terms. Raney, who earned his doctorate at the University of Michigan in 1968, was the first Canadian resident to serve as GRSS President. At the time, he was associated with the Canada Centre for Remote Sensing and was heavily involved with the conceptual design of the world's first digital processor for the Synthetic Aperture Radar.^{xiv}

The renamed Society and its vastly expanded range of offerings for members prospered during the 1980s under the leadership of Ulaby, Carver, McIntosh, Swift, Landgrebe, Raney and the other members of AdCom. When Fawwaz Ulaby proposed to AdCom in 1979 that the Group re-organize itself as GRSS, the organization had fewer than 1,500 members. Ten years later, when R. Keith Raney handed over the reins to his successor, the Society boasted nearly 2,500 members.^{xv} More importantly for future growth potential was the fact that an increasing number of members were, like Raney, from outside the United States. Thanks to the growing popularity of IGARSS, GRSS was becoming more and more a truly international Society.

03/01/84
LANDSAT 5 launched

10/05/84
ERBS launched

1982

07/08/82
Japan Council Chapter formed

1983

06/29/83
Denver Chapter formed

08/31-09/02/1983
IGARSS'83
San Francisco Hilton
San Francisco, California, USA

1984



1984
Robert McIntosh
University of Massachusetts Amherst
President, GRSS



1984-1985
Andrew Blanchard
University of Texas Arlington
Editor, Newsletter

08/27-30/1984
IGARSS'84
European Parliament Building
Strasbourg, Germany

CHAPTER 4

International Outreach

The 10-year hiatus between conference symposia sponsored by the Geoscience and Remote Sensing Society and its predecessor was an unfortunate outcome of the financial hardships resulting from the 1971 conference at the Twin Bridges Marriott in Washington, D.C.

Then President Fawwaz Ulaby had brought the matter to the forefront in 1980 when he spearheaded a major initiative to have the Society sponsor an annual international conference to bring together the global community of scientists and executives concerned with geoscience and remote sensing. Ulaby argued that the new symposium series, which would be called the International Geoscience and Remote Sensing Symposium (IGARSS), would announce to the scientific community that GRSS could represent the interests of those studying remote sensing, instrumentation and information processing. Furthermore, he noted, a symposium could help increase membership and make the Society a leader in the growing field of remote sensing.ⁱ

Ulaby's arguments about increasing membership were backed by experience. After increasing through much of the 1960s, the membership had peaked at 1,757 in 1970. But then, the Group had lost more than 500 members during the next four

years. By 1974, membership had fallen to a low of 1,242. The reorganization of the Group into the Geoscience and Remote Sensing Society after 1977 had helped restore membership. By 1980, GRSS had recovered all of the 500 members it had lost earlier in the decade.ⁱⁱ

One of the key members who Ulaby relied upon to carry out his plan was Keith Carver. A Kentucky native, Carver had earned his M.S. and Ph.D. degrees in electrical engineering from Ohio State University and was in the midst of a 15-year stint on the electrical engineering faculty at New Mexico State University in Las Cruces. His research in microwave antennas, printed circuit antennas, microwave remote sensing, synthetic aperture radar and synthetic aperture radiometers had earned him an appointment in 1981 as the Microwave Remote Sensing Manager at NASA Headquarters in Washington, D.C. Along with the NASA job came an appointment to the Technical Staff at JPL in Los Angeles.ⁱⁱⁱ

Carver had been a longtime member of the Geoscience Electronics Group and was slated to succeed Ulaby as President of GRSS in 1982. Ulaby, who had been elected General Chair for the first IGARSS in 1981, asked Carver to serve as Technical



Extensive coverage of the Bering Glacier, October 1986, from Landsat 5/TM. The study examined the likelihood of increased earthquake activity in southern Alaska as a result of rapidly melting glaciers. Image credit: NASA/Goddard Space Flight Center Scientific Visualization Studio.

A new era in space flight began on April 12, 1981, when the first shuttle mission was launched — STS-1, *Columbia*. Image credit: NASA.



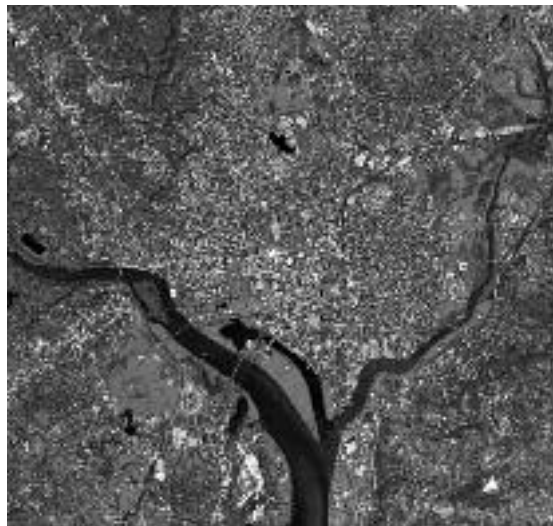
Chair for the symposium. Carver recalled that when the newly renamed GRSS announced that it was sponsoring its first conference symposium in Washington during the second week of June in 1981, AdCom held its collective breath.

“GRSS in 1981 had just changed from the Geoscience Research Group,” Carver explained. “There is no question that the AdCom was hesitant about that first IGARSS meeting in Washington.”^{iv} But Ulaby and Carver were convinced that a remote sensing symposium in the nation’s capital would be a success. “The time was right,” Carver said. “There was a huge amount of energy in NASA. The Shuttle program was just starting. So many of the new remote sensing and satellite programs were just getting started at the time.”^v

Indeed, the 1980s was a time of tremendous advancement in the science of remote sensing. NASA, NOAA and the USGS were spearheading remote sensing based initiatives in the United States, and a host of other international agencies, including CCRS, ESA and JAXA were making significant contributions to the field of remote sensing. The Earth Resources Technology Satellite (ERTS) was focusing new interest on advances in solid-earth sensing, atmospheric and oceanographic remote sensing and new sensor systems.^{vi}

When IGARSS’81 opened at the Twin Bridges Marriott the end of that first week in June, more than 400 members of GRSS were in attendance. The first symposium of the modern era of GRSS was a resounding success. IGARSS’81 was well attended by international members of the Society, and the symposium offered sessions in all technical areas of interest.

The symposium received strong support from the scientific community. The keynote speaker at the banquet was U.S. Senator Harrison Schmitt of New Mexico. Schmitt’s appearance at IGARSS’81 was



This image of Washington, D.C., was acquired on June 1, 2000, by the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), a Japanese sensor flying aboard NASA’s Terra spacecraft. The scene encompasses an area 14 km wide by 13.7 km in extent. The 15-meter spatial resolution of the ASTER VNIR channels allows us to see individual buildings, including the White House, the Jefferson Memorial, and the Washington Monument.



U.S. Senator Harrison Schmitt, New Mexico, IGARSS’81 banquet keynote speaker.

emblematic of the nation’s love affair with space travel in the early 1980s. Schmitt, a geologist, was the 12th and last of the Apollo astronauts to walk on the surface of the moon.

Schmitt, whose presentation to IGARSS related his experiences with remote sensing in the Apollo Program, validated the work the Society and its members were doing in the nation’s space initiative, which had evolved into the Space Shuttle program — what NASA called the Space Transportation System (STS). *Columbia*, the first fully functional Shuttle orbiter, had blasted into space from the Kennedy Space Center in mid-April 1981, less than two months before Society delegates gathered at the Twin Bridges Marriott for IGARSS’81. A significant percentage of those in attendance were working with NASA and space contractors to develop remote sensing systems for the Shuttle program.

In 1981 many in the Society were working with the first three iterations of Shuttle Imaging Radar,

SIR-A, SIR-B, and SIR-C, programs that would continue on through the mid-1990s. Others were developing passive microwave remote sensing systems that looked earthward from satellites rather than outward into space.^{vii} All would find topics to pique their interest at IGARSS.

Participants and GRSS members who had been unable to attend eagerly purchased copies of the two-volume *Proceedings* of nearly 1,460 pages that were published in late summer of 1981. For Ulaby, Carver and AdCom, the success of IGARSS’81 presented a solid foundation upon which to build for the future. The presence of delegates from 16 countries reaffirmed Ulaby’s perception that GRSS should become an international organization. Ulaby had long argued that the parent IEEE was a transnational organization with members from around the world. If GRSS truly wanted to be a global organization, it needed to hold its meetings and symposia overseas.



Attendees raise their glasses to a successful IGARSS’82 held in Munich, Germany — the first European and internationally held IGARSS symposium; also the site for IGARSS’12. Left to right: Johann Bodechtel (IGARSS’82 Chair), Keith Carver, Mrs. Taranik, J.V. Taranik, Representative Seitz (Bavarian Government), and Alois Sieber.

Alois Sieber (standing on the right), Joint Research Centre, served as the first European and international AdCom member, 1981-1986 and 1996-1997, Vice President 1984-1985; he was a co-investigator for the SIR-B experiment and with the first European remote sensing satellite ERS-1, facilitated IGARSS’82 (Munich), IGARSS’84 (Strasbourg) and IGARSS’86 (Zurich), and inaugurated the European Chapter of GRSS.

02/22/86
SPOT 1 launched

1985



1985
Calvin Swift
University of Massachusetts Amherst
President, GRSS

Membership reaches 2000 and continues to climb through the early 1990s



1985-1988
Fawwaz Ulaby
University of Michigan
Editor, *TGRS*

10/07-09/1985
IGARSS’85
University of Massachusetts
Amherst, Massachusetts, USA

10/18/85
Southeastern Michigan Chapter formed

1986



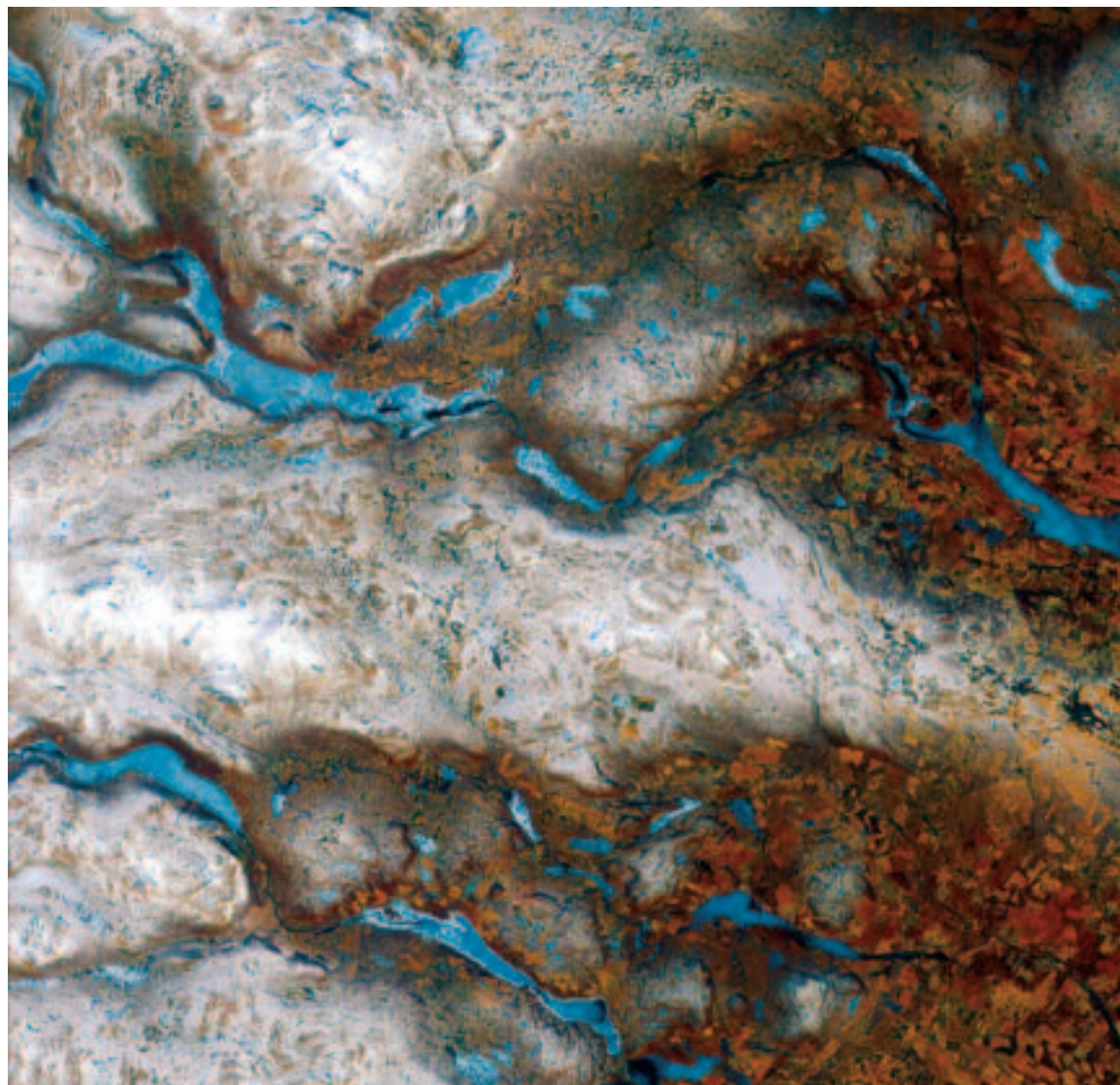
1986-1987
David Landgrebe
Purdue University
President, GRSS



1986
Richard Newton
Texas A&M University
Editor, *Newsletter*

02/18/86
Washington/
Northern Virginia
Chapter formed

09/08-11/1986
IGARSS’86
University of Zurich Irchel
Zurich, Switzerland



Iced Lakes in Sweden as viewed from the Spot Satellite (instrument: HRVIR) acquired May 9, 2006. Image credit: ESA.

02/19/87
MOS-1 / MOMO-1
launched

03/17/88
IRS 1A
launched

1987



1987-1990
J.B. (Way) Holt
Jet Propulsion Laboratory
Editor, *Newsletter*

05/18-21/1987
IGARSS'87
University of Michigan
Ann Arbor, Michigan, USA

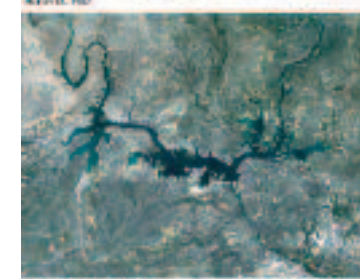
1988



1988-1989
Keith Raney
Canada Centre for Remote Sensing
President, GRSS



In July 2003, the Kazakhstan government, with funding from the World Bank, began a massive restoration project for the Aral Sea. Once the fourth largest lake on Earth, the Aral Sea has shrunk dramatically over the past few decades as the primary rivers that fed the Sea have been diverted and tapped nearly dry for cotton farming and other agriculture. The diversion process began in the 1960s, and by 1989, Landsat satellite imagery (left image) showed that the northern and southern half of the sea had already become virtually separated. The image at right was captured by the Moderate Resolution Imaging Spectroradiometer (MODIS) on the Aqua satellite on August 12, 2003, and it shows the rapid retreat of the Sea's southern half, now partitioned into eastern and western halves, both of which may face the same bleak future. The Landsat image is a combination of six scenes, down-sampled to match the resolution of the MODIS image at 250 m resolution. The six scenes were collected by Landsat 4's Thematic Mapper sensor in four passes: July 22, August 7 and 16, and September 7, 1989. Image credit: NASA.



Right: This pair of Landsat images of the Amistad International Water Reservoir shows the changes in the lake level between 1987 and 2000. The early image in the spring of 1987 shows a healthy supply of water behind the dam, but by late 2000, water levels had dropped dramatically. This trend has continued and even intensified since these images were acquired by Landsat 4's Thematic Mapper (TM) sensor on March 31, 1987, and Landsat 7's Enhanced Thematic Mapper Plus (ETM+) sensor on December 6, 2000 and May 16, 2001. The images were joined to make a seamless mosaic, with dates chosen outside times of maximum water use so that water level changes are dominated by long-term trends rather than seasonal demand. Image credit: NASA.

IGARSS'82 and Beyond

Ulaby's argument was buttressed by the presence at IGARSS'81 of three key individuals from what at the time was the Federal Republic of Germany, or West Germany. Alois Sieber, Wolfgang Keydel and Franz Schlude were all associated in 1981 with the German Aerospace Center (DLR). They were joined by colleagues Philipp Hartl of the University of Berlin and Johannes Bodechtel of the University of Munich. The West German members proposed to host IGARSS'82 in Munich in June 1982 with Bodechtel offering to serve as General Chairman of the symposium. The West German Embassy hosted a reception at the National Air and Space Museum during IGARSS'81 where, just across Independence Avenue from NASA Headquarters, the West German Charge d'Affaires for Science and Technology announced that IGARSS'82 would be hosted by the Federal Republic of Germany in the old capital city of Bavaria, Munich.

IGARSS'82 was another resounding success, and GRSS was on the road to continued growth in the years ahead. The success of the symposium in Munich created impetus for a formal proposal that would shape the history of the Society over the next quarter century. "We came up with the idea of holding IGARSS in North America in odd-numbered years and overseas during even-numbered years," explained Keith Carver. "We knew that the Europeans were aware of the Remote Sensing Society, but so many of them at the time were in the Photogrammetry Society. The remote sensing and satellite programs both here and abroad were just getting started at the time."^{viii}

IGARSS'83 came back to the United States, to the San Francisco Hilton in late August, and went to the European Parliament Building in Strasbourg, France, exactly one year later for IGARSS'84. The rest of the 1980s saw the Society's symposium switch back and forth between the United States and Europe — IGARSS'85 at the University of Massachusetts at Amherst; IGARSS'86 at the University of Zurich-Irchel in Zurich, Switzerland; IGARSS'87 at the University of Michigan in Ann Arbor; and IGARSS'88 in Edinburgh, Scotland.^{ix}

IGARSS departed from the odd-even system in 1989 when IGARSS'89 was held in Vancouver, British Columbia. Although in North America, U.S. members argued for a U.S. site in 1990, with AdCom acceding to the request. IGARSS'90 convened on the campus of the University of Maryland at College Park in late May amid a spectacular display of spring blossoms. The symposium resumed the overseas alternating schedule in early June 1991 when delegates enjoyed a week in Helsinki, Finland. The symposium returned to the United States in 1992, to Houston, Texas, and made its first foray to Asia when IGARSS'93 was held in Tokyo, Japan, in late May.^x

During the 1980s the symposia established GRSS as the voice of remote sensing in the global scientific community. All were financially successful, with average attendance between 350 and 400 people. Attendance grew dramatically with 865 people registered for IGARSS'89 in Vancouver and averaged nearly 800 attendees each year between 1990 and 1995.^{xi} This growth in attendance also brought about a significant venue shift, moving the symposia from the typical university setting to a hotel or convention center venue beginning in 1995 and continuing through the present time.

07/05/88
OKEAN 1
launched

05/04/89 06/27/89
MAGELLAN RESURS F-02
launched launched

1988

09/12-16/1988
IGARSS'88
University of Edinburgh
Edinburgh, Scotland

1989



1989-1991 07/10-14/1989
Richard Doviak IGARSS'89
University of Kansas University of British Columbia
Editor, TGRS Vancouver, BC, Canada

Munich



This spaceborne radar image of Munich, Germany, illustrates the capability of a multi-frequency radar system to highlight different land use patterns in the area surrounding Bavaria's largest city. The Munich region served as a primary "supersite" for studies in ecology, hydrology and radar calibration during the Spaceborne Imaging Radar-C/X-Band Synthetic Aperture Radar (SIR-C/X-SAR) missions. Scientists were able to use these data to map patterns of forest damage from storms and areas affected by bark beetle infestation. The image was acquired by SIR-C/X-SAR onboard the space shuttle *Endeavor* on April 18, 1994. SIR-C/X-SAR, a joint mission of the German, Italian, and United States space agencies, is part of NASA's Mission to Planet Earth. Image credit: NASA JPL.

Mention the word "Munich" to a veteran of GRSS, and a smile will inevitably play across his or her face. "The second IGARSS meeting attracted about 400 people," said David Goodenough, who at the time was a Chief Research Scientist at the Canada Centre for Remote Sensing. "That was the one in Munich. Oh, we had a lot of fun. Good beer. An excellent meeting. The 1982 symposium established IGARSS as the conference in remote sensing."ⁱⁱ

Goodenough would go on to become 1992-1993 President of GRSS and to attend dozens of IGARSS conferences in the intervening years since 1982, but his memories of Munich and some of the early IGARSS meetings are shared by dozens of his contemporaries.

For Keith Carver, one memory involved carrying around the *Proceedings*, then one thin volume which later evolved into a multi-volume collection of papers presented at the conference. "Over the

years," he said, "a number of other meetings were spun off from those early IGARSS conferences. There were all sorts of workshops on technical aspects of remote sensing."ⁱⁱⁱ

Carver still marvels at the evolution of IGARSS from the conferences held in the early 1980s at Washington, D.C., Munich and San Francisco. "Today, IGARSS is so very broad in its outlook, and it encompasses such a wide focus of interest."^{iv}

For Kiyo Tomiyasu, the Society's oldest living member as GRSS approaches its 50th anniversary, IGARSS'82 in Munich ushered in a new era for GRSS.

"You have to remember that in the early 1980s, we only had a few hundred members in the Society," he said. "Today, there are something like 3,500 members. This growth is due to the international aspect of the Society that was first manifested at Munich."^v

CHAPTER 5

Maturation



Wilkins Ice Shelf as captured by ERS-1 on January 13, 1992. Image credit: ESA.

01/22/90
SPOT 2 launched

1990



1990-1991
John Reagan
University of Arizona
Tucson
President, GRSS

When David Goodenough assumed the presidency of GRSS in 1992, the Society was still operating with an organizational structure it had followed since the 1960s. Goodenough, like all of his predecessors, served a year as Vice President, was elected President for one year, which was renewable for a second year, and then served three years as Past President. “Anyone stepping into that role is making a commitment for seven years,” Goodenough said.

Goodenough, then the second Canadian resident to serve as GRSS President, had spent 18 years with CCRS in Ottawa, where he worked with the Society’s only previous Canadian President, R. Keith Raney. In 1991, about the time he was first named GRSS Vice President, Goodenough had joined the Pacific Forestry Centre in Victoria, British Columbia, Canada, as a Senior Research Scientist.ⁱ

Goodenough had served his term as Vice President under John Reagan, Professor of Optical Sciences in the Engineering Department at the University of Arizona in Tucson. Reagan, who earned his B.S. and M.S. in electrical engineering from the University of Missouri at Rolla, and his Ph.D. at the University of Wisconsin, had joined the faculty of the University of Arizona in 1967, shortly after which he was awarded his doctorate. He would spend the next four decades in teaching and research at the university, primarily in the application of laser radar and solar radiometry for atmospheric sensing.

Goodenough’s service on AdCom also brought him in contact with Andrew J. Blanchard, his successor as GRSS President in 1994-1995. Blanchard encompassed the academic, consulting and industrial component of geoscience and remote sensing. A University of Southwestern Louisiana undergraduate, Blanchard had earned his M.S. degree from Colorado State University and his Ph.D. degree in electrical engineering from Texas A&M University in 1977. From 1977 to 1979, he was the Supervisor of the Remote Sensing Group in the Exploration Research Division of Conoco, Inc. in Ponca City, Oklahoma. At the time of his service as GRSS Vice President and President, Blanchard was Director of the Strategic Technology and Research Center (STAR Center) at the Houston Advanced Research Center.ⁱⁱ

Through their work together on AdCom, Goodenough and Blanchard became lifelong friends. “When I was President, the Vice President was Andy Blanchard,” Goodenough said. “Andy and I worked



The fifth hurricane of the active Atlantic season in 2004, Hurricane Jeanne, takes aim at the Bahamas after leaving 1000 dead in the Dominican Republic and Haiti. This storm image was acquired by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA’s Terra satellite on September 24, 2004. In this image, Hurricane Jeanne was a Category 2 storm with sustained winds near 160 kilometers per hour (100 mph) and stronger gusts. As the storm progressed and strengthened, it became the fourth hurricane in 2004 to strike the east coast of Florida, making landfall on Sunday, September 26, as a Category 3 storm with sustained surface winds of 110 mph. Image credit: NASA GSFC MODIS Rapid Response Team.



Melba Crawford Bill Emery Steven Reising Kamal Sarabandi Karen St. Germain Kiyo Tomiyasu David Weissman
20+ Years of Service

Pictured above are AdCom members who have served 10+ years (also James Gatlin and Tom Jackson, page 39); not pictured are Past Presidents: Andrew Blanchard, Albin Gasiewski, David Goodenough, Martti Hallikainen, Charles Luther, and Werner Wiesbeck, each with 20+ years of service; Jon Atli Benediktsson, Keith Carver, Jerry Eckerman, Nahid Khazenie, David Landgrebe, Clare McGillem, Anthony Milne, Alberto Moreira, Keith Raney, John Reagan, Michael Sims, Leung Tsang and Fawwaz Ulaby, each with 10+ years of service.

together to restructure GRSS. We needed more Vice Presidents. We had to convince AdCom to change. The new structure became President, Executive Vice President, and Vice Presidents for basic areas. It is still the structure today.”ⁱⁱⁱ

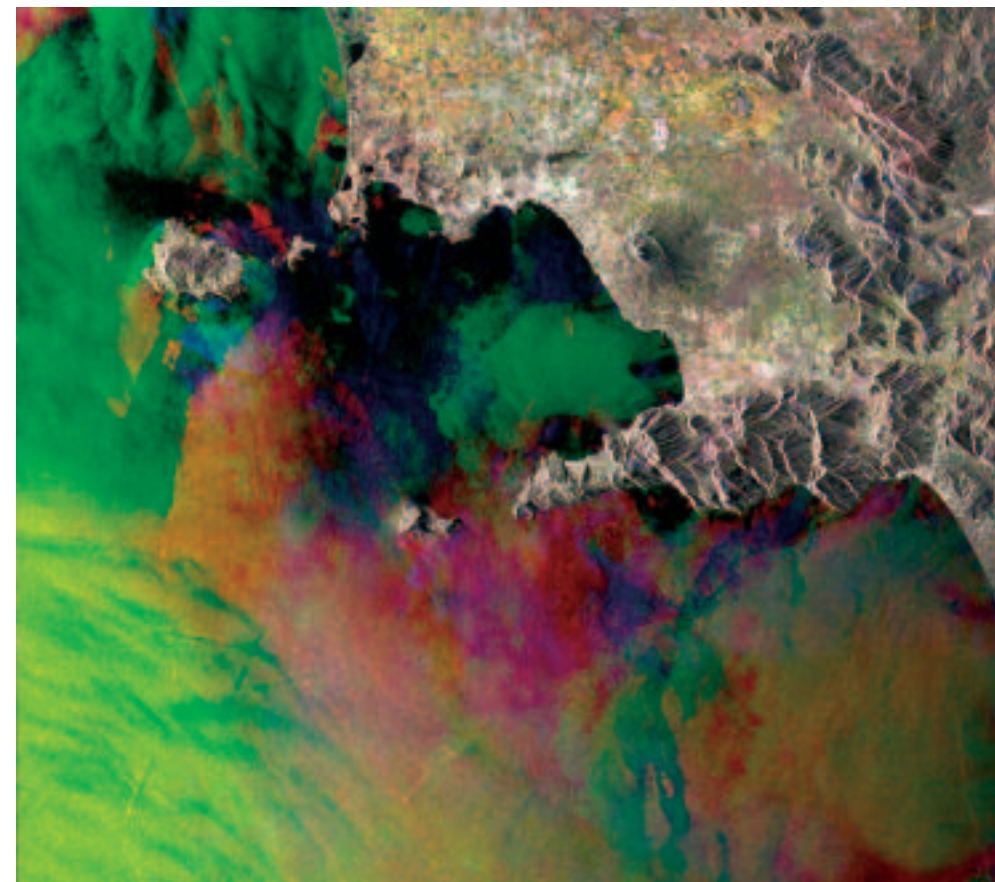
In 1995, GRSS instituted an Executive Committee, consisting of the President, an Executive Vice President and four functional Vice Presidents responsible for Operations (replaced with Publications in 2010) Technical Committees, Meetings and Symposia, and Professional Activities. The expanded governance structure recognized that the President’s attention should be directed toward major issues; Vice Presidents gave GRSS much more of a focus on operational areas in the years ahead.

The 1995 establishment of an Executive Committee and restructuring of AdCom laid the groundwork for the strong vibrant organization that continues to this day. No one AdCom member is ever idle; each member serves in some capacity.

There are currently 25 voting members — 18 elected plus three journal editors, a financial officer, secretary and two past presidents.

The remaining non-voting members — 37 people as the Society prepared to celebrate its 50th anniversary in 2012 — serve in some specific capacity, such as technical committee chairs, conference chairs, national committee liaisons, regional liaisons, and heads of special committees such as education, Fellow and Senior member search and evaluations, globalization, awards, WEB, and publicity. “These are all volunteers, most working at a fulltime job or retired, and fulfilling these additional obligations on the side.”^{iv}

Because of the large size of AdCom in proportion to the Society’s membership, many serve for years in critical, behind-the-scenes positions never receiving the accolades they deserve. There are many more longtime members of AdCom who have not served as President than those who have, exemplifying one of the Society’s greatest strengths.



Naples, Italy, as captured by ERS-1 SAR on June 20, 2004. Image credit: ESA.

The Role of Technical Committees

A second major restructuring of how GRSS governed itself occurred in 1994 when AdCom made the decision to form Technical Committees. The initial group of Technical Committees was formed to address Data Fusion, Data Standardization and Distribution, and Instrumentation and Future Technology. Technical Committees formed later addressed Frequency Allocation, Data Archiving, and International Imaging Spectroscopy. Much of

the work to create those initial Technical Committees occurred during meetings at IGARSS’94 at Caltech, under the direction of Charles “Chuck” Luther.

Most on AdCom consider Chuck Luther to have been the champion of forming Technical Committees. Luther joined AdCom in 1993. Then the Scientific Program Officer at the Office of Naval Research (ONR) in Arlington, Virginia, he and his team were heavily involved in microwave remote sensing of sea ice. An electrical engineering graduate

02/07/90
MOS 1B / MOMO 1B launched

02/28/90
OKEAN 2 launched

06/04/91
OKEAN 3 launched

05/21/91
RESURS F-10 launched

08/29/91
IRS 1B launched

07/17/91
ERS-1 launched

02/11/92
JERS 1 / FUYO 1 launched

1990

05/20-24/1990
IGARSS’90
University of Maryland College Park
Maryland, USA

GRSS membership surpasses 2,500

1991

06/03-06/1991
IGARSS’91
Helsinki University of Technology
Espoo, Finland

07/08/91
South Africa Chapter formed

1992



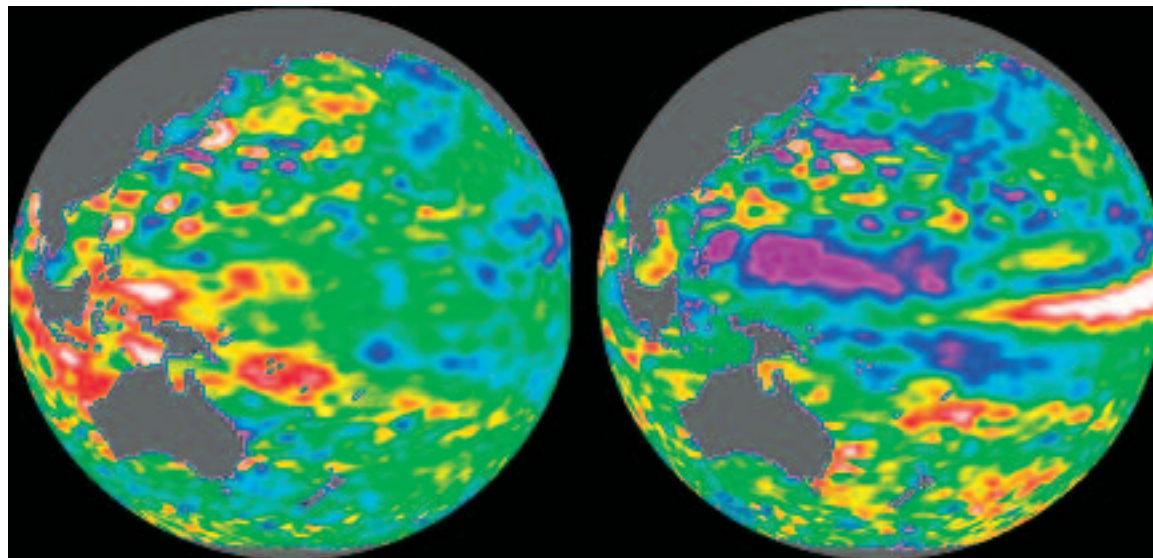
1992-1993
David Goodenough
Pacific Forestry Centre
Canada
President, GRSS



1992-1995, 2001-2002
James A. Smith
NASA Goddard Space Flight Center
Editor, TGRS



1992-1994
Ram Narayanan
University of Nebraska
Editor, Newsletter



Above: These images of the Pacific Ocean near Indonesia were produced using sea surface height measurements taken by the U.S.-French TOPEX/Poseidon satellite. The images show sea surface height relative to normal ocean conditions during December 1996 and August 1997. In December 1996 (left image), red and white areas indicate the presence of warm, higher than average sea level around Indonesia. At this time, massive amounts of warm water were detected around Indonesia by the TOPEX/Poseidon satellite. The warm, wet air from this water fed the normally heavy rainfall in this region. By August 1997 (right image), the sea level had dropped well below average as shown by purple areas (sea level at least 18 centimeters [7 inches] below normal). The warm water had shifted east toward the west coast of North and South America, taking the rains with it. Image credit: NASA.

Right: The 1992 Landers earthquake was a magnitude 7.3 earthquake that occurred on June 28, 1992, with an epicenter near the town of Landers, California. The quake was the largest earthquake to have occurred in the contiguous United States in 40 years. Of significance to the remote sensing community, displacement caused by the earthquake was evident for the first time through synthetic aperture radar (SAR) interferometry — the capturing image was published in *Nature* (1993), recognizing the contribution by Didier Massonnet, Marc Rossi, Cesar Carmona, Frederic Adragna, Gilles Peltzer, Kurt Feigl and Thierry Radaute, Centre National d'Etudes Spatiales, France. Image credit: ESA.



of North Carolina A&T University, Luther had helped develop flight simulators as a U.S. Air Force officer in the early 1960s and had moved to the Naval Electronics Systems Command in 1965 before joining ONR in 1972. That same year, he earned his M.S. degree in electrical engineering at George Washington University.^v

The creation of Technical Committees did a great deal to create grass-roots interests in issues that are important to GRSS. “The Technical Committees are as small as 50 members or as large as 200 plus, and AdCom members from the time of their onset agree the Technical Committees have allowed GRSS to extend its depth to the membership.”^{vi}



James Gatlin
20+ Years of Service



Tom Jackson

A Persistent Problem

Reagan, Goodenough and Blanchard faced a persistent problem with finances during the first half of the 1990s. The U.S. had experienced a short, sharp recession in 1991, and many academic institutions and government agencies reduced spending as the Bill Clinton White House worked hard to balance the federal budget during the President’s first term in office from 1993-1997. The conservative Republican sweep in the 1994 Congressional off-year elections put further pressure on the Administration to cut spending.

When Reagan, Goodenough and Blanchard served as President during the 1990s, GRSS had little money in the bank. With an IGARSS budget of \$1.5 million, AdCom asked itself what would happen if one should fail? AdCom agreed that GRSS had to have reserves to survive two consecutive IGARSS failures. The Society carefully managed expenses on journals and conferences. Since that period, almost all the conferences have had a positive balance, and some have returned major revenue

to the Society.^{vii} The appointment and continuing service of James Gatlin as the Society’s Chief Financial Officer helped GRSS grow its reserves from literally nothing to where it stands today. Likewise, Tom Jackson served as the Society’s Secretary for much of the 1990s into the 21st century and continuing today, maintaining a recognized consistency and efficiency in stored data. These long-term assignments provide continuity in critical ongoing processes and give GRSS much-needed stability in key administrative roles.

The early 1990s ushered in another major change, shifting the administrative configuration to a more formal structure. AdCom had known for a number of years that the conferences were getting too large and too complex to be operated solely through a volunteer organization. In 1993 GRSS hired a Conference Facilitator, who assisted the IGARSS teams to maintain consistency in organizational structure and operations, manage budgetary and reporting requirements, and archive corporate data. In doing so, AdCom provided much needed support to team members while offering security to

08/10/92
TOPEX-POSEIDON launched

09/20/93
IRS-1E launched

09/26/93
SPOT 3 launched

10/05/93
LANDSAT 6 launched:
failed to achieve orbit

04/09/94
STS-59 (*Endeavor*):
deployed SRL-1 — SIR-C/X-SAR and MAPS

09/30/94
STS-68 (*Endeavor*):
deployed SRL-2

10/15/94
IRS P2 launched

1992

05/26-29/1992
IGARSS’92
South Shore Harbor Resort
Houston, Texas, USA

1993

03/29/93
Houston Chapter formed

05/19/93
Toronto Chapter formed

08/18-21/1993
IGARSS’93
Kagakuin University
Tokyo, Japan

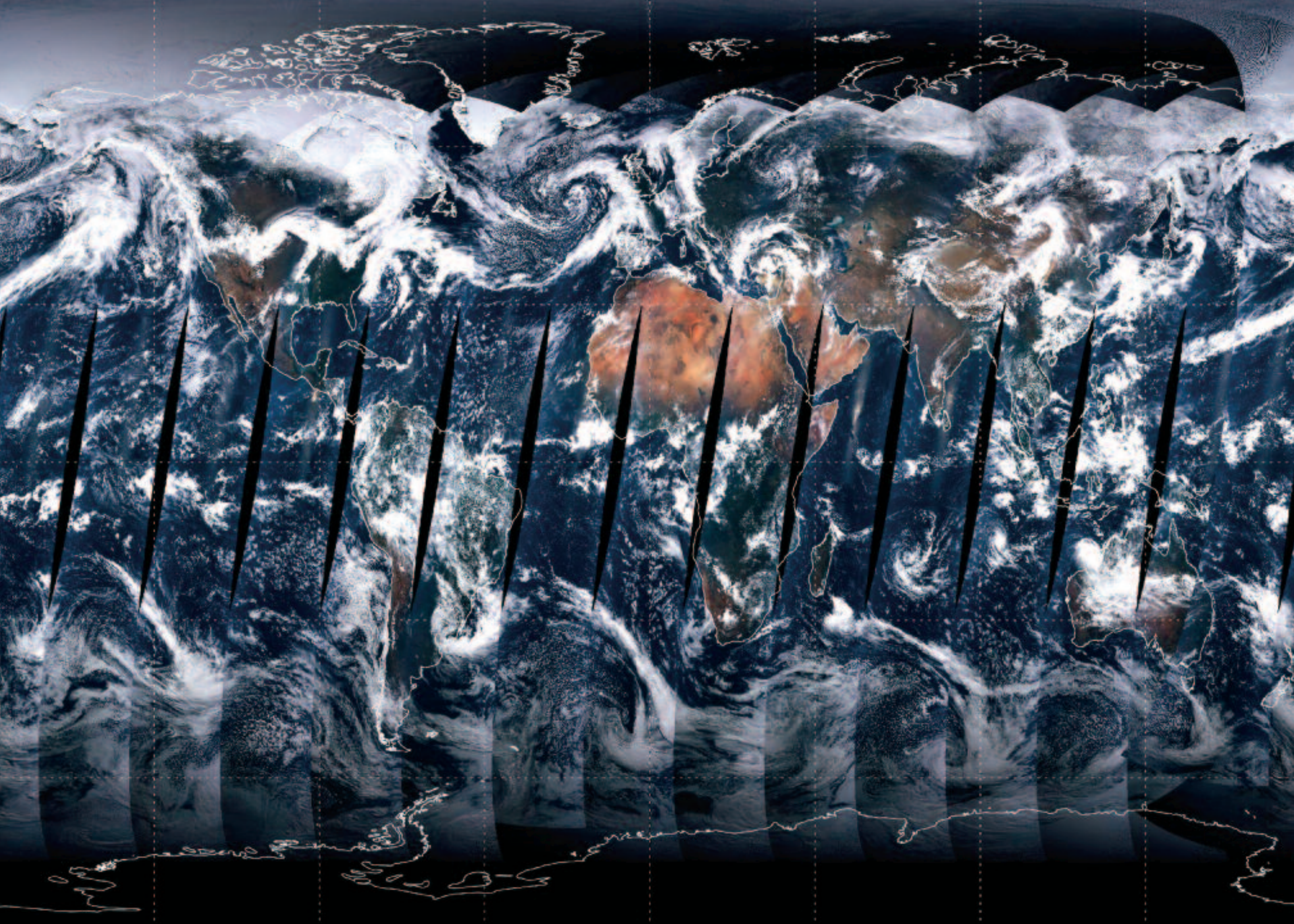
1994



1994-1995
Andrew Blanchard
Houston Advanced Research Center
President, GRSS

02/10/94
Atlanta Chapter formed

08/8-12/1994
IGARSS’94
California Institute of Technology
Pasadena, California, USA



Right: April 1994, Ron Hartika with a graduate assistant from the University of Michigan Radiation Lab deploy an array of point targets at the Calibration Super Site, Racoon, Michigan.

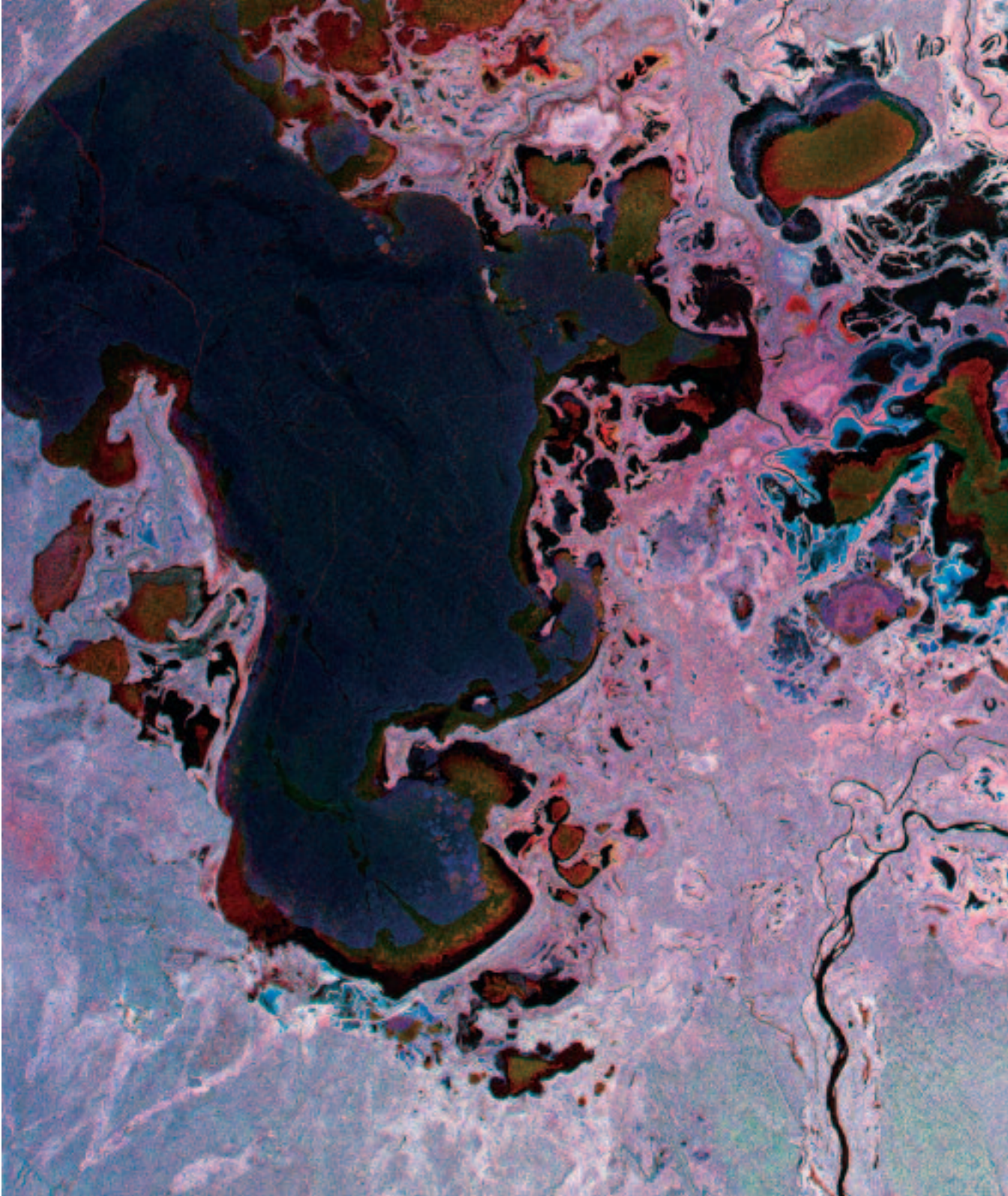
Below: Passive microwave radiometers developed by Cal Swift at the University of Massachusetts for Tom Jackson of USDA were deployed to collect extended time series of soil moisture during a major field campaign – Southern Great Plains 1997 (SGP97) in Oklahoma. Truck-based tower systems provide controlled condition observations of specific parameters. Shown are Tom Jackson (USDA), Peggy O’Neill (NASA), and Chip Laymon (USRA).



Center page spread (40–41): This spectacular, full-color image of the Earth is a composite of the first full day of data gathered by the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard NASA’s Terra spacecraft. MODIS collected the data for each wavelength of red, green, and blue light as Terra passed over the day lit side of the Earth on April 19, 2000. Terra is orbiting close enough to the Earth so that it cannot quite see the entire surface in a day, resulting in the narrow gaps around the equator. Although the sensor’s visible channels were combined to form this true-color picture, MODIS collects data in a total of 36 wavelengths, ranging from visible to thermal infrared energy. Scientists use these data to measure regional and global-scale changes in marine and land-based plant life, sea and land surface temperatures, cloud properties, aerosols, fires, and land surface properties. The Antarctic, surrounded by clockwise swirls of cloud, is shrouded in darkness because the sun is north of the equator at this time of year. The tropical forests of Africa, Southeast Asia, and South America are occluded by clouds. The bright Sahara and Arabian deserts stand out clearly. Green vegetation is apparent in the southeast United States, the Yucatan Peninsula, and Madagascar. Image credit: NASA GSFC MODIS Atmosphere Team.



Right: 1991; Sampling to quantify the biomass of vegetation (in this case grass at the USDA in Beltsville, MD). Data were used to develop and validate models for the microwave remote sensing of soil moisture. Pictured are Roger Lang, Peggy O’Neill, Anatolij Shutko, Nainder Chauhan, Bhaskar Choudhury and Tom Jackson.



This color composite time-series image taken by Radarsat is made up of three images acquired on May 4 (red), May 10 (green), and May 17 (blue), 1996. The Peace-Athabasca Delta is one of the world’s largest inland freshwater deltas, located in Alberta Province, covering some 3,900 square kilometers. The overlap of colors indicates the different stages of lake-ice breakup on the three different dates. By May 17, the ice cover has completely disappeared on the mid-sized lakes on the right side of the image but still covers a large area of Lake Claire on the left side of the image. Image credit: Canadian Space Agency.



Left: AdCom members work through the business at hand at a meeting in 1986. Left to right: Keith Raney, Verne Kaupp, Keith Carver, Fawwaz Ulaby and David Landgrebe.

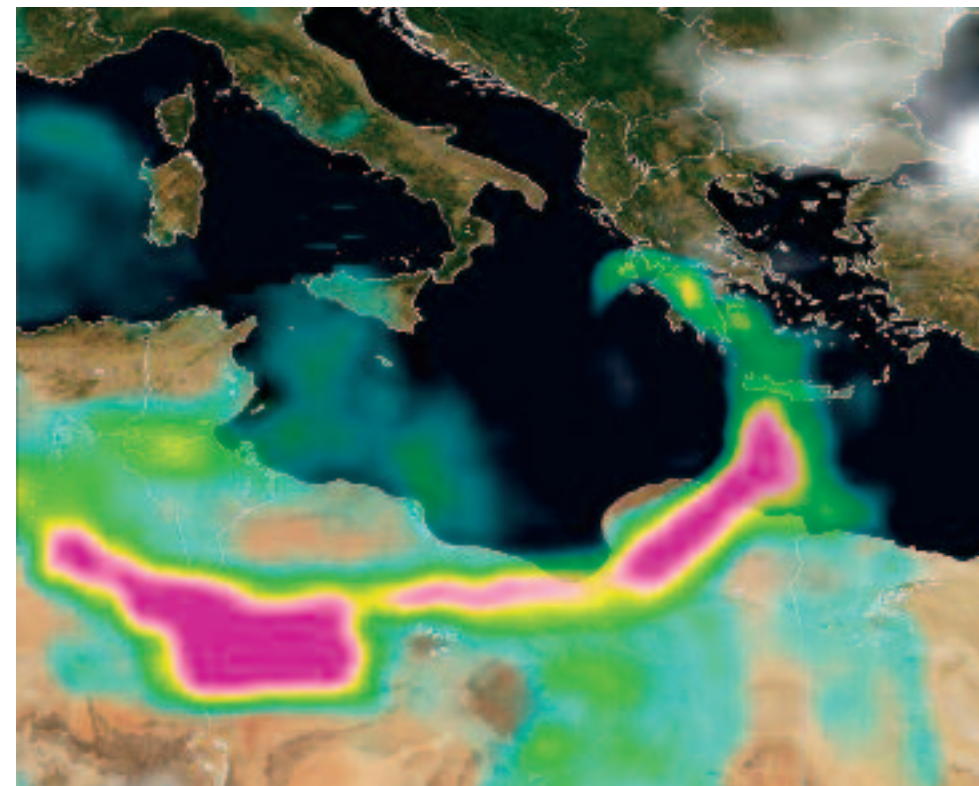
Right: GRSS strategic planning was initiated at the November 1997 AdCom meeting held in Helsinki, Finland. Left to right: Werner Wiesbeck, Charles Luther, Jim Gatlin, Martti Hallikainen (President), Andrew Blanchard, David Goodenough, Nahid Khazenie, Kiyo Tomiyasu, Tom Jackson, Leung Tsang and Albin Gasiewski.



In the late 1990s, AdCom expanded to increase the manpower needed to oversee the exponential growth in Society activities. Pictured is the full AdCom, including voting and non-voting members, at the July 2011 AdCom meeting held in Vancouver, BC, Canada.

the Society's investment. "We were all volunteers," Andy Blanchard said. "We needed some professional help. We had to let loose of management oversight directly from AdCom. That was the first step in our developing a capability of more depth."^{vii}

In that period of time during the 1990s, IGARSS went from a paper-driven to an electronic-based symposium, and from university to conference center venues due to the growth in attendance. In spite of its growth and the need for overall professional conference planning assistance, the planning and decision-making remained the respon-



Besides laying waste to huge areas of forest, fires burning in Greece in August 2007 released pollutants that traveled across the Mediterranean Sea and into Africa. This image shows tiny solid or liquid particles suspended in air observed by the Ozone Monitoring Instrument (OMI) on NASA's Aura satellite layered on the photo-like Blue Marble composite image. On August 26, 2007, aerosols from the fires on the southwestern coast of Greece took a fairly direct route across the Mediterranean Sea to the western part of the Libyan coast. A large pool of smoke collected over the Gulf of Sirte, off the Libyan coast. Another pocket of thick aerosols appears over Algeria. Image credit: NASA.

sibility of the local committees, making each IGARSS unique to its locale, yet consistent in excellence year-to-year.

The 1990s was a period of exponential growth for the Society. AdCom meetings evolved from a dozen volunteers gathered for one day in a small conference room in the early to mid 1990s to 50-60 volunteers attending a two-day working meeting three times per year. The logistical complexity of

scheduling and conducting the meeting also increased.

The organizational structure was updated once again in 2008 with the hiring of an Executive Director for AdCom, a position created to lend assistance to the President in the day-to-day management of the AdCom, to oversee AdCom logistics as meeting attendance grew dramatically and to provide specified focus to special initiatives.

04/21/95
ERS 2
launched

11/04/95
RADARSAT 1
launched

12/28/95
IRS 1C
launched

1995



1995-1996
Sivaprasad Gogineni
University of Kansas
Editor, *Newsletter*

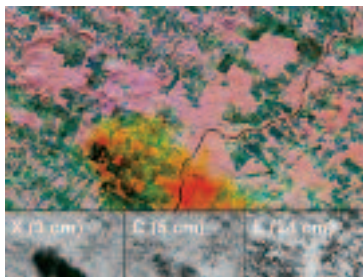
05/24/95
Ukraine Chapter
formed

07/10-14/1995
IGARSS'95
Congress Center
Firenze (Florence), Italy

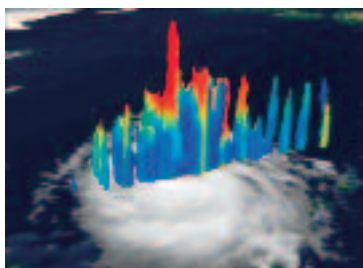
08/24/95
Boston Chapter
formed

CHAPTER 6

Diversity



Deployed from STS-59 (*Endeavor*) in 1994, the SIR-C/X-SAR instrument was the first multi-frequency polarimetric space borne synthetic aperture radar. The image highlights multi-frequency SAR image of tropical forest (Amazonas, Brazil) showing forest, clear cuts and the attenuation effect of a thunderstorm in different frequency bands (blue: X-band, red: L-band, green: C-band). Image credit: DLR/ASI/NASA.



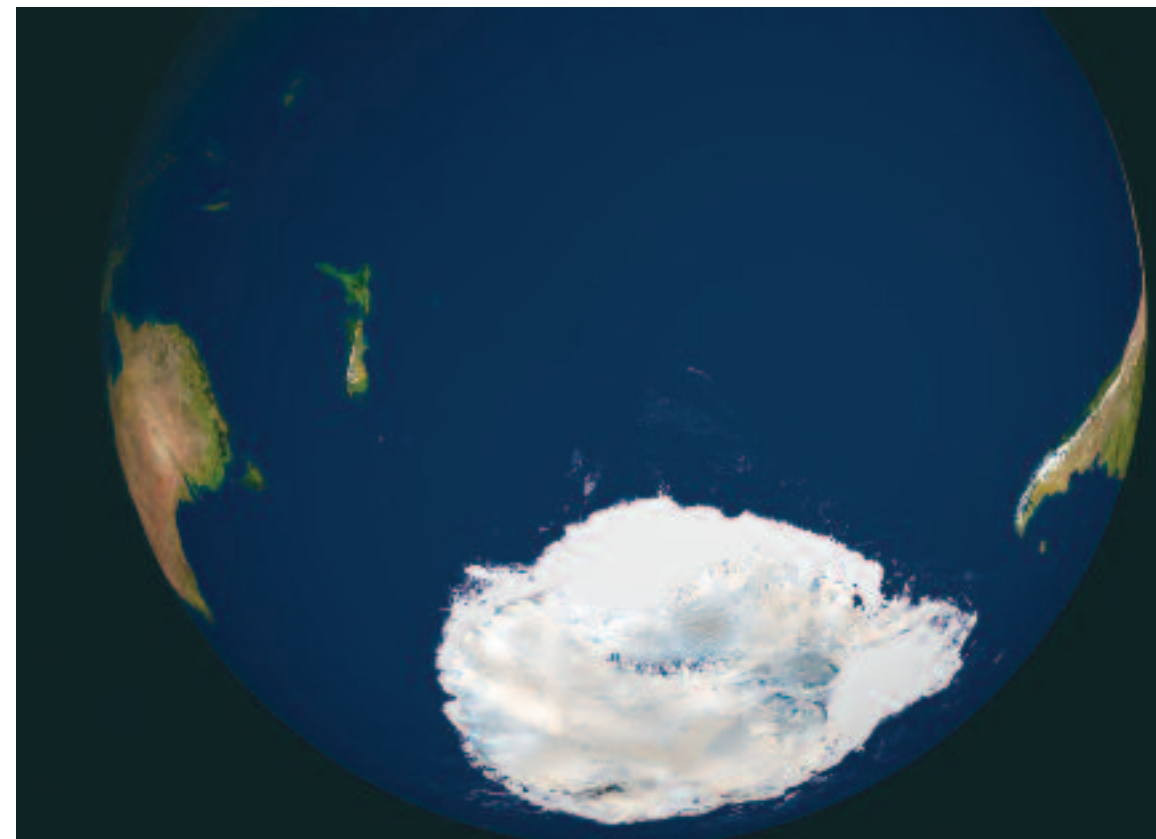
These compelling images are from Hurricane Bonnie showing a cumulonimbus storm cloud, towering like a sky scraper, 59,000 feet (18 kilometres) into the sky from the eyewall. These images were obtained on Saturday, 22 August 1998, by the world's first spaceborne rain radar aboard the Tropical Rainfall Measuring Mission (TRMM), a joint U.S.-Japanese mission launched November 27, 1997, from the Japanese Space Center, Tanegashima, Japan. Image credit: NASA GSFC Scientific Visualization Studio.

And Through the mid 1990s, GRSS was dominated by white males predominantly from North America, which was understandable, given the reality that most Society members were engineers or scientists who made their living from university engineering departments, the natural resources industry, consulting firms and government and military agencies such as NASA, NOAA and ONR. But that model was about to change. Changing that model became a priority for the Society leadership.

The Society moved from a North America-centered organization to a truly international organization, seeking greater gender, racial and geographical diversity during the 1990s. IGARSS had been a true international gathering of scientists and engineers since 1982, and the annual conference's global reputation had only accelerated during the late 1980s and into the 1990s. IGARSS'88 was held in Edinburgh, Scotland, followed by IGARSS'89 in Vancouver, British Columbia, Canada; IGARSS'91 in Helsinki, Finland; IGARSS '93 in Tokyo, Japan; and IGARSS '95 in Florence, Italy.ⁱ

However, it was only with the selection of the Society's first European president in 1996 that GRSS began to legitimately lay claim to being a truly international scientific society. Martti T. Hallikainen, who served on AdCom from 1988 to 2006, as General Chairman of IGARSS'91 and as President in 1996-1997, had been educated and worked in both Europe and the United States. Hallikainen earned his Doctor of Technology degree from the Faculty of Electrical Engineering at Aalto University in Espoo, Finland, in 1980. In the early 1980s, he was a postdoctoral fellow at the Remote Sensing Laboratory at the University of Kansas in Lawrence, and returned to Aalto University as a Professor of Space Technology in 1987. Immediately prior to his term as GRSS President in 1996 and 1997, Hallikainen was a Visiting Scientist at the European Union's Joint Research Centre, the Institute for Remote Sensing Applications, in Italy in 1993 and 1994.ⁱⁱ In the 21st century, Hallikainen would serve as a Visiting Scientist with JPL and the NASA Goddard Space Flight Center.

Hallikainen easily bridged the narrowing gap between the space science communities in Europe and the United States, serving at various times during the past 20 years as a member of the ESA's Earth Science Advisory Committee, Vice Chair of the Finnish National Committee for Space Research, and Secretary General of the European Association of Remote Sensing Laboratories.ⁱⁱⁱ



December 18, 2003: Antarctica is the coldest and most remote continent on Earth. It is also home to one of the most Mars-like places that scientists can study without actually traveling to the fourth planet. By studying this place, researchers think they might gain insight into how life on Mars might either survive now or have developed in the past. It is called the Don Juan Pond, and it's one of the saltiest, coldest bodies of water on Earth. The zoom passes through four different resolution data sets including data from Terra, Landsat, and IKONOS. This treatment uses an IKONOS inset that is enhanced to show detail. Image credit: NASA/Goddard Space Flight Center Scientific Visualization Studio, Landsat 7 Project Science Office; MODIS Rapid Response Team, NASA Goddard Space Flight Center.

Hallikainen's term as President was followed by another first for GRSS when Nahid Khazenie took the reins as the Society's first female president in 1998. Khazenie, a Senior Scientist with the Naval Research Laboratory (NRL), brought to the position a new dimension combining collaboration with government, academia and industry to promote groundbreaking research and systemic reform within educational systems throughout the world. Khazenie received her undergraduate degree from Michigan Technological University in Houghton, followed by an M.S. degree in electrical and computer engineering and mathematics and a Ph.D. in mechanical engineering and operations research at the University of Texas at Austin in 1987. She remained at the University of Texas as a Research Scientist following her doctorate, focusing on research in remote sensing applications in agriculture and oceanography. Khazenie left Austin to work at the NRL in Monterey and

eventually NASA, where she served as Earth Science Enterprise Education Programs Manager.^{iv}

Khazenie's tenure as President of GRSS employed innovative management strategies that encouraged the advancement of women and minorities in science and technology, both within GRSS and IEEE. She served on the IEEE Education Board and was an eloquent voice on IEEE's Women in Engineering Committee.^v

However, Khazenie was not the first female to serve on AdCom. She was preceded by JoBea (Way) Holt, employed at JPL and an elected member of AdCom from 1990 through 1995. Holt served as *Newsletter* Editor from 1987-1991, Vice President in 1992, General Co-Chair for IGARSS'94, and was a co-founder of KidSAT, a program conceived in 1993 and designed by a team of scientists, educators and engineers to share astronauts' unique views of Earth with middle school students.



JoBea (Way) Holt
1990-1995

Through their work, Way and Khazenie paved the road for other women on AdCom.

Karen St. Germain, currently with the Office of the U.S. Secretary of Defense, was formerly at NRL where she was part of the team that built the WindSAT sensor and NPOESS where she served as the Chief of the Data Products Division. She was an elected member of AdCom from 1997 through 2011, Vice President of Meetings and Symposia from 1998-2001, Vice President of Operations from 2001-2009, IGARSS 2000 Technical Co-Chair, and IGARSS'10 General Co-Chair. Melba Crawford of Purdue University, whose research focuses on hyperspectral remote sensing, was elected to AdCom in 1998, served as Vice President of Meetings and Symposia from 2004-2010, and currently serves as Executive Vice President.



Nahid Khazenie
1992-2002, 2005-2007



Diane Evans
2006-2008



Karen St. Germain
1997-2011



Mahta Moghaddam
2011-present

Expanding this unique group was Diane Evans of JPL, who worked as a project scientist for the shuttle imaging radar and was an elected member of AdCom from 2006 through 2008; and serving in their first terms on AdCom during this anniversary year, Mahta Moghaddam of the University of Southern California is internationally recognized for her work in remote sensing of soil moisture under vegetation and at depth, and is a member of the NASA SMAP team; and Gail Skofronick-Jackson, Deputy



Melba Crawford
1998-present



Gail Skofronick-Jackson
2012, first term

Project Scientist for the Global Precipitation Mission (GPM) at NASA Goddard Space Flight Center, whose work focuses on microwave satellite remote sensing of the atmosphere, with a focus on precipitation and vertical profiles of clouds.

One does not need to look far beyond the forefront of AdCom to see the influence of women within the Society. Many continue to impact the gender diversity, both in Society leadership and in the fields of geoscience and remote sensing including Sonia Gallegos of NRL who is widely known in the area of optical sensing of the ocean and serves as liaison to Latin American organizations and representation; Linda Hayden of Elizabeth City State University where she developed a satellite receiving facility and is co-organizer of the GRSS Minority Student Travel Program and advocate of educational programs; Monique Bernier of the Institut National de la Recherche Scientifique Centre Eau, Terre, Environnement, General Co-Chair for IGARSS'14 to be held in Quebec City, Quebec, Canada; Lori Mann Bruce and Jenny Du both of Mississippi State University, Data Fusion Technical Committee Co-Chairs, 2003-2005 and 2009-2012, respectively; and Sandra Cruz-Pol as *Newsletter* Associate Editor.

Khazenie's successors, Werner Wiesbeck, who served as President in 2000 and 2001, and Charles A. Luther, who served as President in 2002 and 2003, further increased the geographic and racial diversity of the Society leadership. Wiesbeck, then the Director of the Institut fuer Hoechstfrequenztechnik und Elektronik at the Karlsruhe Institute of Technology, Germany, had been instrumental in creating a true international environment for IGARSS during the 1980s and 1990s.^{vi} Wiesbeck served as a voting member on AdCom from 1992 to 2000 and is still active today. He introduced many of his European colleagues to GRSS and exemplified the global



MSTP participants and sponsors — Genec Smith, James Sims, Linda Hayden (sponsor), Remata Praveena and Nicholas Lewis — present at IGARSS'02 in Toronto, Ontario, Canada.



MSTP participants and sponsors of IGARSS'05 in Seoul, Korea.

scientific and engineering community that was embodied in the GRSS membership.

Chuck Luther was the first African-American to serve as President and was a driving force in the Society's efforts to promote science and engineering to the minority community. During his presidency, Luther worked tirelessly to increase the number of minority members in the Society and their participation in Society symposia.

03/21/96
IRS-P3 launched

07/02/96
TOMS-Earth Probe launched

08/17/96
ADEOS / MIDORI launched

08/01/97
ORBVIEW 2 / SEASTAR
launched

08/23/97
LEWIS / SSTI
launched: failed

09/29/97
IRS 1D
launched

11/27/97
TRMM
launched

12/24/97
EARLYBIRD
launched

1996



1996-1997
Martti Hallikainen
Aalto University
Finland
President, GRSS



1996-1999
Leung Tsang
University of Washington
Editor, *TGRS*

05/27-31/1996
IGARSS'96
Cornhusker Hotel & Burnham Yates Conference Center
Lincoln, Nebraska, USA

1997



1997-1999
Chris Ruf
Pennsylvania State University
Editor, *Newsletter*

08/03-08/1997
IGARSS'97
Singapore International Convention and Exhibition Centre
Singapore

08/20/97
Russia Chapter formed



Above: Lorenzo Bruzzone received the inaugural Student Prize Paper Award in 1998 while a student at the University of Genoa, Italy.

Below: Francesca Bovolo, center, from the University of Trento, Italy, becomes the first woman to win the Student Prize Paper Competition with her presentation “A Novel Theoretical Framework for Unsupervised Change Detection Based on change Vector Analysis in Polar Domain” at IGARSS’06 in Denver, Colorado. She is joined by her advisor Lorenzo Bruzzone (left) and GRSS President Leung Tsang (right).



“Chuck Luther challenged the Society to address racial imbalance and inspired us to develop a minority student travel program,” explained a long-time AdCom member. “He pointed out that there were very few minority students attending our sessions at IGARSS and proposed the travel grant program to help develop the professional pipeline, which continues to support students today.”^{vii}

Strong Growth

For GRSS, the 1980s and 1990s were eras of strong growth, in membership, in chapter formation and in IGARSS participation. Membership peaked in the early 1990s at just under 3,000 members before decreasing to approximately 2,500 for the remainder of the decade. This was still double the number of members when the Group became a Society in 1981.

Chapter organization was very strong in the period between 1985 and 1995. By 1995, the Society had 11 chapters in Boston/Springfield, Massachusetts, Atlanta, Southeastern Michigan, Washington/Northern Virginia, Los Angeles and Oakland, Houston, Denver, Toronto, and Tokyo. Most Society chapters were organized jointly with other IEEE chapters from groups such as the Antennas and Propagation Society or the Aerospace and Electronics Society. Once GRSS had restructured in the 1990s, the Society was able to offer its chapters a

wide range of services, including distinguished speakers in the fields of geoscience and remote sensing.

Two new awards, adding to the four already in place, were introduced in this time period: the first, the Student Prize Paper Competition, instituted in conjunction with IGARSS’98 in Seattle, and the second, the IEEE GRSS Education Award, in 2002. In an effort to increase participation and interest from students, AdCom approved the Student Prize Paper Competition, bringing recognition to the top student presentations at the annual symposium. Prizes for the winners are now awarded each year at the IGARSS banquet.

The inaugural Student Prize was awarded to Lorenzo Bruzzone from the University of Genoa in Italy for his paper and presentation entitled “Classification of Remote Sensing Images by Using the Bayes Rule for Minimum Cost.” Bruzzone continued his pursuit to become a Professor of Telecommunications at the University of Trento, Italy, teaching remote sensing, pattern recognition, radar and electrical communications. Just eight years later, Bruzzone’s student, Francesca Bovolo from the University of Trento became the first female to be awarded first place in the Student Prize Paper Competition. Bruzzone has also served as an AdCom member and *Newsletter* Editor since 2009 and 2010, respectively, bringing his growth from student to active leadership within the Society full circle.

AdCom established the GRSS Education Award in 2000 to recognize individuals who have made significant educational contributions in terms of the innovation and extent of overall impact at any level of education. The inaugural award was granted to Nahid Khazenie at IGARSS’02 in Toronto, Canada, recognizing her significant outreach in education, which focused on collaboration of government, academia and industry and promoting groundbreaking research and systemic reform within education systems throughout the world.

Another element of Society growth manifested itself through the inauguration of small conferences and workshops. Small conferences trace their inception to a request made by Paolo Pampaloni at the 1998 Seattle AdCom meeting to consider co-sponsoring the Specialist Meeting on Microwave Radiometry and Remote Sensing of the Environment (MicroRad) to be held in Florence, Italy, in March 1999. AdCom agreed to the request, launching GRSS into co- and technical sponsorship of a grow-

Education Award

- 2002 Nahid Kahzenie, NASA**
- 2003 David Landgrebe, Purdue University**
- 2004 William Emery, University of Colorado**
- 2005 Dominic Solimini, Università Degli Studi di Roma tor Vergata, Italy**
- 2006 Fawwaz Ulaby, University of Michigan**
- 2007 Eric Pottier, University of Rennes, France**
- 2008 Yoshio Yamaguchi, Niigata University, Japan**
- 2009 V. Chandrasekar, Colorado State University**
- 2010 Ya-Qiu Jin, Fudan University, China**
- 2011 Richard Bamler, DLR, Germany**
- 2012 Motoyuki Sato, Tohoku University, Japan**

ing number of small conferences and workshops, sponsoring or co-sponsoring in 1999 alone MicroRad and three additional small conferences: the Conference on Remote Sensing Education (CORSE) in Boulder, Colorado, in July; the International Conference on Agropoles and Agro-Indus-



Students and youth of all ages were invited to participate in a special program at IGARSS’08 in Boston, Massachusetts, introducing them to the fields of geoscience and remote sensing. The initiative, led by Dr. Linda Hayden (top left), of Elizabeth City State University, allowed students to visit with exhibitors, participate in a scavenger hunt, receive hands-on GPS training and create crafts centered around the Earth and its resources. One hundred students participated in the outreach program in 2008; the number increased to 400 local high school students at IGARSS’09 held in Cape Town, South Africa.



Attendees gather for a group photo at the 6th International Workshop on the Analysis of Multi-Temporal Remote Sensing Images (MultiTemp2011) held July 12-14, 2011, in Trento, Italy.



Jon Atli Benediktsson, General Chair for WHISPERS 2010, held June 14-16, 2010, in Reykjavik, Iceland, accepts the WHISPERS totem from Jocelyn Chanussot, General Chair for WHISPERS 2009 held August 26-28, 2009, in Grenoble, France.

Left: Call for papers announce coming conferences and workshops as exemplified by the announcement which preceded the 10th Specialist Meeting on Microwave Radiometry and Remote Sensing of the Environment (MicroRad2008) held in Florence, Italy, March 11-14, 2008.

trial Technology Parks in Brazil in November; and the Littoral Remote Sensing Conference in Greece.

In the 21st century, GRSS has co-sponsored or technically sponsored hundreds of small conferences on various topics of interest to the Society. Some have become re-occurring sponsorships, including MicroRad, URBAN, the Atmospheric Transmission Models Meeting, WHISPERS (Workshop on Hyperspectral Image and Signal Processing: Evolution in Remote Sensing) and Multi-Temp.

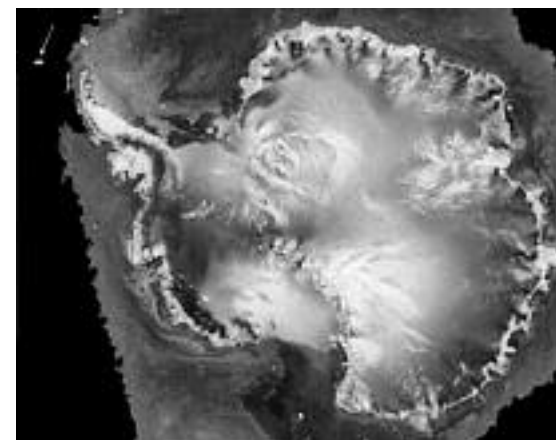
GRSS' involvement has continued to increase over the past decade. A record 18 small and specialty conferences and workshops were co-sponsored by the Society in 2010, with 17 small and specialty conferences co-sponsored in 2011. GRSS continues to serve the international remote sensing community in building effective collaboration and upholding internationally accepted technical standards through small and specialty symposia, conferences and workshops.

Likewise, the Society's growth was evidenced in IGARSS, held each year during the 1990s sometime between May and August, becoming a highly anticipated Society function. By the mid-1990s, the increased number of papers at IGARSS necessitated that the *Proceedings* become a multi-volume work – and the major line item in the annual conference budget. In 1994, IGARSS teams began issuing the *Proceedings* on an optional CD-Rom and by 2002 printed volumes were eliminated altogether, freeing revenues to be spent on conference activities, rather than printing.

Also indicative of this growth were the technology-driven shifts in communication — snail mail to email and faxed conference submissions in 1992 (staff members recall receiving courier packages on Christmas day from individuals pushing the deadline for conference abstract submission); elimination



2002: Under the direction of Jim Maslanik, project PI, employees of Aerosonde (Australia) prepare a UAV plane to fly out of Barrow, Alaska, on a project jointly funded by the US Navy and NASA.



February 20, 2002: NASA's orbiting SeaWinds radar instrument, flying aboard the QuikScat satellite, monitors Iceberg B10A, which snapped off Antarctica and has since drifted into a shipping lane. Iceberg B10A, which measures about 38 by 77 kilometers (about 24 miles by 48 miles), was spotted by the Instrument during its first pass over Antarctica, demonstrating SeaWinds' all-weather and day-night observational capabilities. Image credit: NASA.

02/10/98
GFO / GEOSAT
launched

03/24/98
SPOT 4 launched

1998



1998-1999
Nahid Khazenie
Naval Research Laboratory
President, GRSS

02/06/98
Ottawa Chapter formed

03/12/98
Beijing Chapter
formed

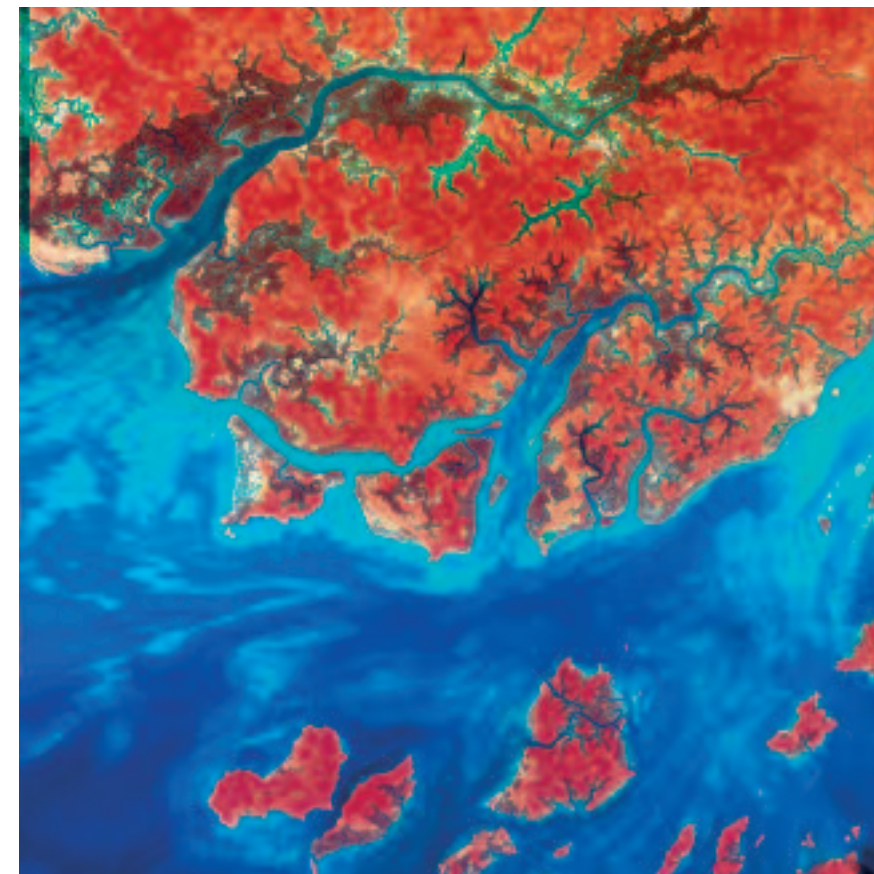
07/6-10/1998
IGARSS'98
Sheraton Seattle
Seattle, Washington, USA

07/17/98
Italy (Central) Chapter formed

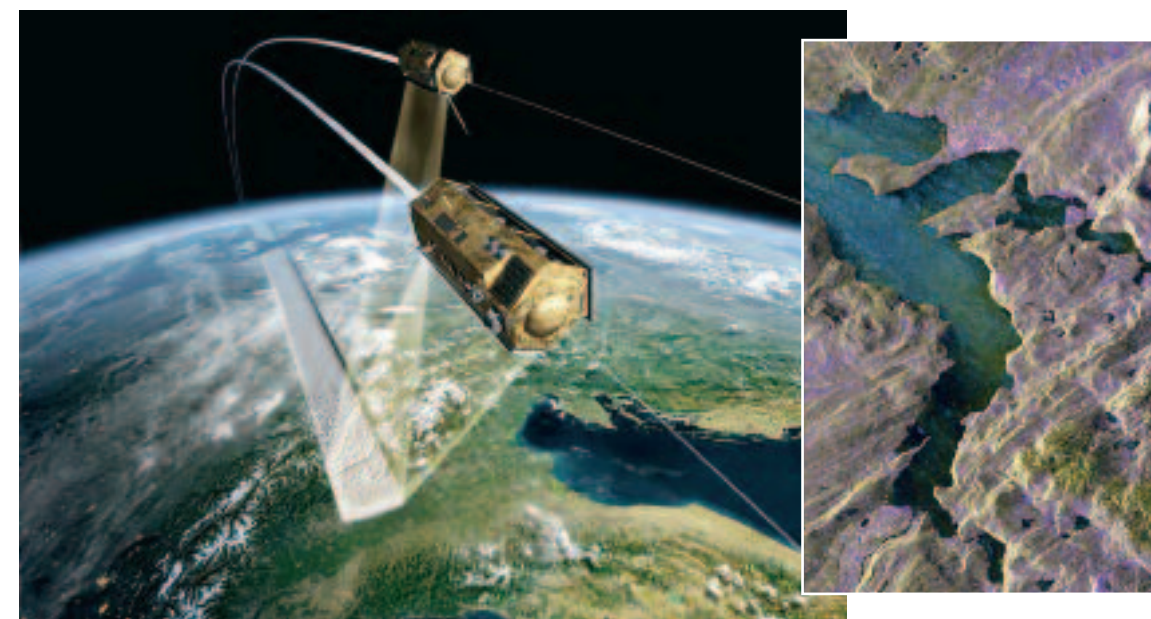


Left: February 20, 2002: The image reflects a large low-pressure system off Australia's southern coast. This true-color image was acquired by the Sea-viewing Wide Field-of-view Sensor (SeaWiFS), flying aboard the Orbview-2 satellite. Image credit: NASA Goddard Space Flight Center and ORBIMAGE.

Below: Snow-kissed alps as captured by MERIS on Envisat on January 16, 2012. Image credit: ESA.

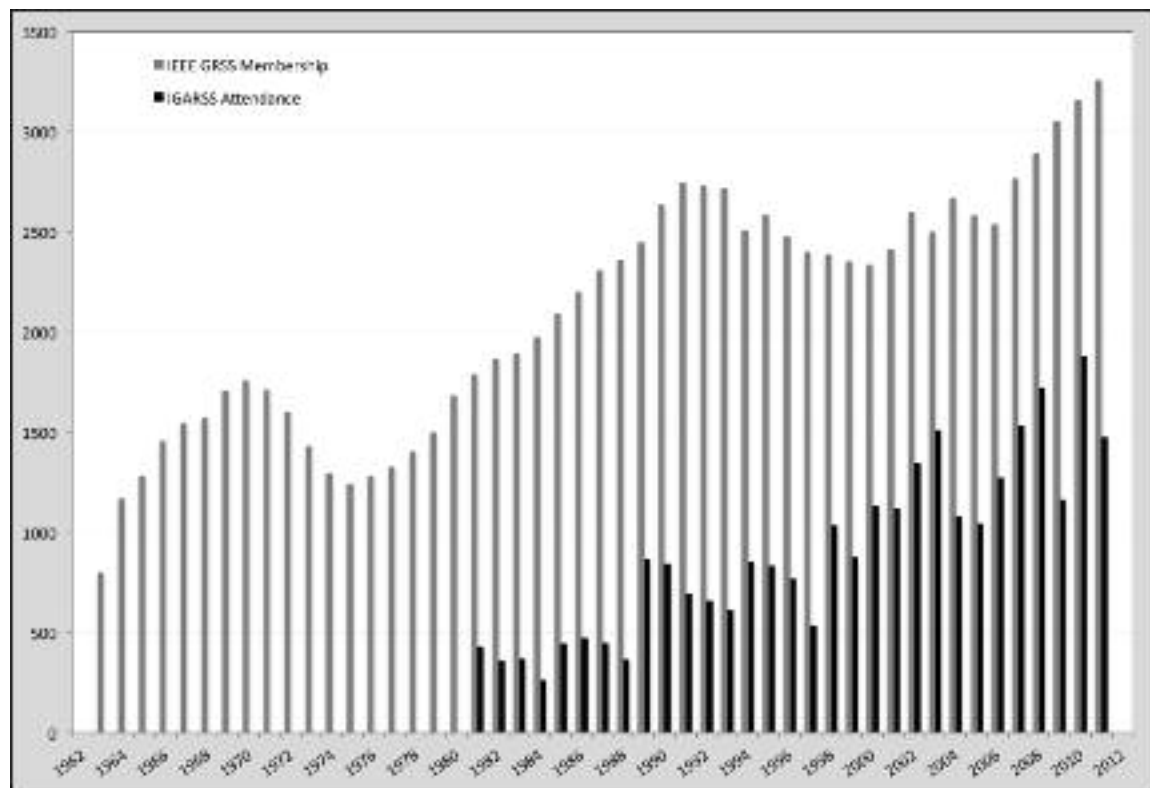


This Landsat 7 image of Guinea-Bissau, a small country in West Africa, shows the complex patterns of the country's shallow coastal waters, where silt carried by the Geba and other rivers washes out into the Atlantic Ocean. This is a false-color composite image made using infrared, red and blue wavelengths to bring out details in the silt was taken using Landsat 7's Enhanced Thematic Mapper plus (ETM) sensor on January 12, 2000. Image Credit: NASA/USGS EROS Data Center.



Above: TerraSAR-X and TanDEM-X — First spaceborne bistatic SAR mission in close formation flying (launched in 2007 and 2010, respectively; distance between the satellites varies between 200 and 500 m). Image credit: DLR.

Inset: TanDEM-X dual polarization image of the Norwegian fjords. Image credit: DLR.



of oversized paste-up pages used for full paper submissions, submitted electronically beginning in 1994; and use of electronic announcements in lieu of mailed brochures to market the Society’s conferences and workshops beginning in 2009.

Significant shifts also occurred in organization of the technical program. In the early to mid-1990s, the Technical Program Meeting (TPC), held approximately six months prior to an IGARSS, had 50+ reviewers gathering for two days to review topically-sorted hardcopy abstracts and to form cohesive sessions. Post-it notes labeled by session titles were shuffled across a white board grid until the flow of a

technical program appeared. Beginning in 1998, the review process and TPC remained, but the grid shifted to a computer-based program, and in 2002, reviews were performed online prior to the TPC. In 2008, significant changes continued in the review and scheduling process with the introduction of a fully e-based online review, scheduling and programming system, which reduced the TPC to one day with fewer attendees who focused primarily on tweaking the technical program already in place.

In 2010 and 2011, the IGARSS teams explored technologies for recording and live streaming sessions on the internet, as well as archiving and pro-

A tradition at each IGARSS for the past 30 years, the annual soccer game has exploded from two teams, North America versus the Rest of the World, to a tournament requiring referees, team t-shirts and score boards.



Eni Njoku, team North America, takes on a team member from the Rest-of-the-World at IGARSS’94 in Pasadena, California.



Continuing the annual soccer tradition at IGARSS’08 in Boston, Massachusetts.

viding to members via the GRSS website. The exponential rate of advances in personal electronic devices and applications provides new capability that is being adapted for GRSS conferences.

The key to IGARSS success over the course of its lifetime is found not only in the quality of technical presentations, but also in the attendee impact as experienced in the unique memories associated with each in venue, special events and various social opportunities. Memories are an integral part of the GRSS and IGARSS experience.



Team USA-1 takes the tournament trophy at IGARSS’10 in Honolulu, Hawaii.

04/15/99
LANDSAT 7 launched

04/27/99
IKONOS 1 launched

05/26/99
OCEANSAT 1 / IRS-P4 launched

05/26/99
TUBSAT launched

06/20/99
QUIKSCAT launched

07/17/99
OKEAN-O 1 launched

09/24/99
IKONOS 2 launched

10/14/99
ZY-1 / ZI YUAN 1 / CBERS 1 launched

12/18/99
TERRA /EOS AM-1 launched

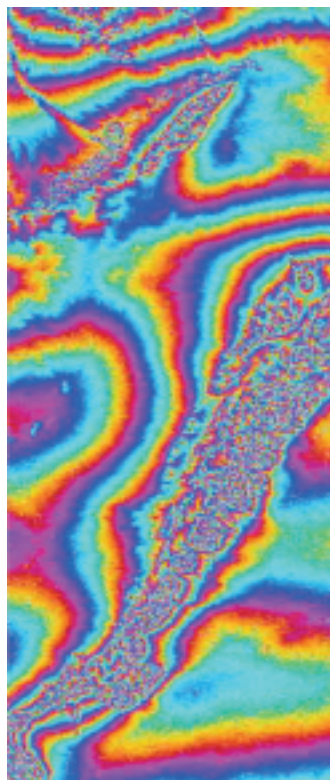
1999

28 June - 2 July 1999
IGARSS’99
Congress Centrum Hamburg
Hamburg, Germany

CHAPTER 7

Growth

2000: Shuttle Radar Topography Mission (SRTM) — First spaceborne single-pass interferometric SAR mission over White Sands, NM, produced just one day after the launch of STS-99 *Endeavor*. Image credit: DLR.



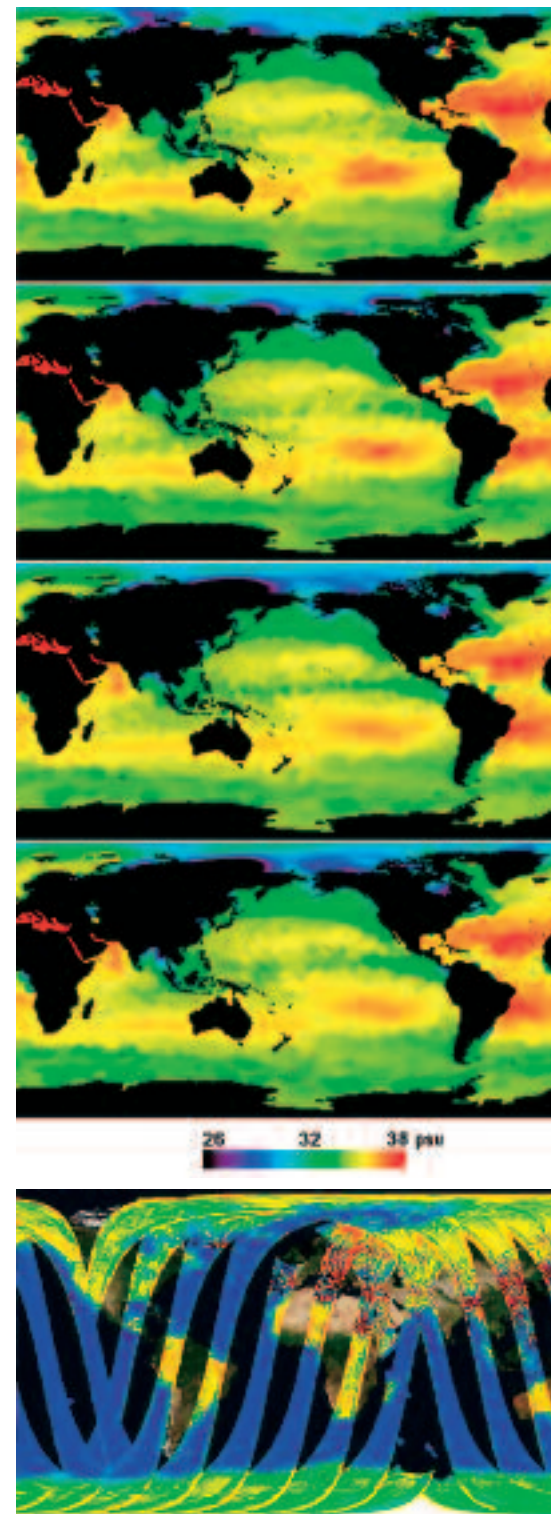
GRSS ushered in the 21st century with a whale of a party. IGARSS 2000, the Society's 20th anniversary symposium, held at the Hilton Hawaiian Village in Honolulu in late July 2000, was an outstanding Society symposium, both from work and social perspectives.

The symposium, which attracted 1,134 attendees from 44 countries, adopted the theme of *Taking the Pulse of the Planet*. Co-Chairs David Goodenough and Andy Blanchard — the first time that GRSS had appointed co-chairs from the AdCom for the annual event — garnered sponsors from around the world, including GRSS, NASA, ONR, CSA, NRC, JAXA and URSI.

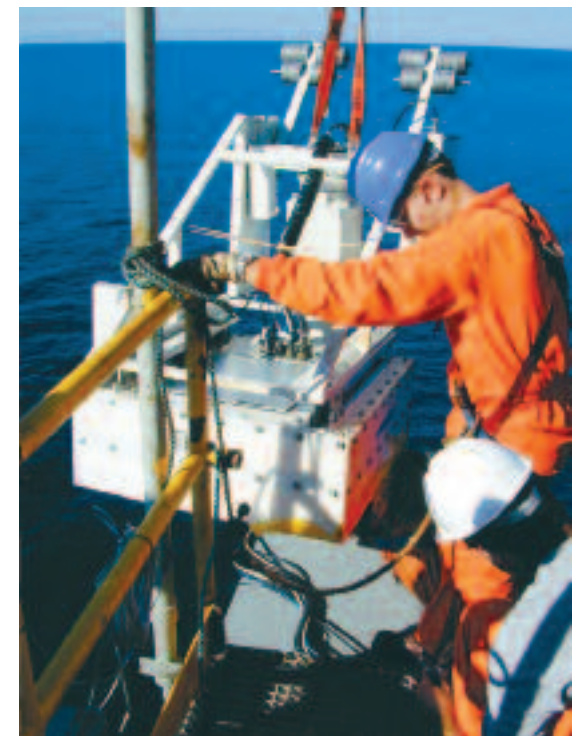
Goodenough and Blanchard's symposium team included Al Gasiewski and Karen St. Germain as the Technical Program Co-Chairs; Martti Hallikainen handling finances; Ram Narayanan in charge of exhibits; and Eni Njoku overseeing publications and publicity duties — all members of AdCom at the time.ⁱ More than 80 GRSS members served on the Technical Program Committee.

The softbound version of the IGARSS 2000 *Proceedings* consisted of more than 4,000 pages packaged on a single CD-Rom and in an optional seven-volume set.

With IGARSS 2000, AdCom agreed to fund the planning for the conference including a black tie awards banquet held at the conference venue, the Hilton Hawaiian Village. Guests, including the IEEE President, were awed by the keiki (young girls), gifting orchid wristlets to all the ladies in attendance, and partook in photo opportunities with the Royal Family, including actor portrayals of King Kamehameha and his court, or surfing on realistically improvised waves.

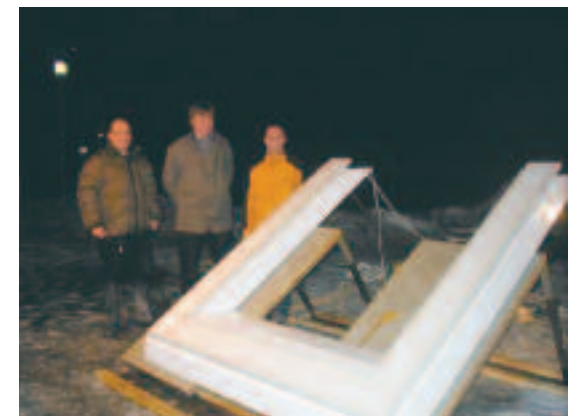


This image is the first data sent to Earth by the MIRAS instrument on ESA's SMOS satellite, launched on November 2, 2009. It was acquired as part of the initial functional verification test since the instrument was switched on November 17. The image depicts non-calibrated brightness temperature values color coded from blue (low) to red (high). Image credit: ESA.



Installing the UPC LAURA L-band polarimetric microwave radiometer at Casablanca Oil Rig for field experiment in preparation of SMOS (2001).

Left: Simulated seasonal sea-surface salinity maps derived from SMOS (2009). Image credit: ESA.



Helsinki University of Technology developed the world's first two-dimensional interferometric airborne radiometer, HUT-2D, for remote sensing in 2005. It served as proof of concept for ESA's SMOS (Soil Moisture Ocean Salinity) satellite's payload, the MIRAS radiometer, launched in 2009. The HUT-2D system, consisting of 36 receiver/antenna pairs and a correlator, is shown here during a night-time measurement of the Cygnus signature in order to validate the Flat Target Transformation processing technique. Radiometer operators from left to right: Tuomo Auer, Kimmo Rautiainen and Juha Kainulainen.



Jim Smith participates in the Chinese Dragon Dance at IGARSS 2000 with hopes of being bestowed good luck.



The keiki honor IGARSS 2000 banquet guests and the "Royal Family and Guard" with traditional hula dances.



Myrna Gatlin, accompanied by her husband and AdCom member, Jim Gatlin, is presented with an orchid wristlet by the keiki.

amid record-breaking temperatures that had a tight grip on much of Europe. Didier Massonnet, the General Chair, unveiled the theme of *Learning from Earth's Shapes and Colors*, and was the first IGARSS to exceed 1,500 participants. A CD-Rom containing 4,700 pages constituted the *Proceedings* with no printed volumes produced.ⁱⁱⁱ

IGARSS'04, under the direction of Verne Kaupp, was back in North America, but this time at



Eni Njoku, Simon Yueh, and Bill Wilson relaxing at the IGARSS'03 banquet.

the Egan Conference Center in Anchorage, Alaska. The University of Missouri-Columbia, the Geophysical Institute at the University of Alaska-Fairbanks, the National Polar-Orbiting Operating Environmental Satellite System, Raytheon, the U.S. Geological Survey, ITT Industries and the IEEE Ocean Engineering Society joined the traditional sponsors for the Alaska symposium, which celebrated the theme of *Science for Society: Exploring and Managing a Changing Planet*. Though the late September conference, a date driven by summer cruise vessel season in Alaska, resulted in a slight



The cartoon side of Niels Skou revealed at the IGARSS'03 banquet.



Exhibitors create an air of excitement as they present new products and results, and build continuing relationships with their regular support of IGARSS; shown here are a few from the exhibit showcase at IGARSS'04 in Anchorage, Alaska, including representatives from ENVI, NPOESS and JAXA.

02/11/00
STS-99: (Endeavor) deployed SRL-3

11/21/00 **11/21/00** **11/21/00** **12/05/00**
QUICKBIRD 1 EO-1 SAC-C EROS A1
launched launched launched launched

09/21/01
ORBVIEW-4
launched

10/18/01 **12/07/01**
QUICKBIRD 2 JASON 1
launched launched

2000



2000-2001
Werner Wiesbeck
University of Karlsruhe,
Germany
President, GRSS



2000-2002
Steven Reising
University of Massachusetts
Amherst
Editor, Newsletter

07/24-28/00
IGARSS 2000 (20th Anniversary)
Hilton Hawaiian Village
Honolulu, Hawaii, USA

11/09/00
Spain Chapter
formed

2001

07/09/01
Seoul Chapter formed

07/9-13/2001
IGARSS'01
University of New South Wales
Sydney, Australia

drop in attendance, still 1,078 delegates from 42 countries made the trek to the Land of the Midnight Sun for the conference.^{iv}

In 2005, IGARSS was held in Seoul, Korea. Its theme of *Harmony Between Man and Nature* emphasized use of remote sensing as a tool to provide the world a way to view global economic and environmental change. IGARSS'06 in Denver, Colorado explored the theme of *Remote Sensing – A Natural Global Partnership*, focusing on the widespread distribution and interoperability of remote sensing and environmental data. IGARSS'07 returned to the continent of Europe when it was held in Barcelona, Spain. *Sensing and Understanding Our Planet* was the theme, which reported on the continuing advances in understanding the basics of earth science. IGARSS'08 in Boston, Massachusetts, developed the theme of *Remote Sensing: The Next Generation*, emphasizing the geoscience interests of children, undergraduate students and young professionals, and included a special youth interactive exhibit and session attended by local students.

Delegates gathered at the foot of Table Mountain in Cape Town, South Africa, for IGARSS'09, to focus on the theme of *Earth Observations – Origins to Applications*, and returned to the Hilton Hawaiian Village in Honolulu, Hawaii, for IGARSS'10, celebrating the symposium's 30th anniversary and focusing on the theme of *Remote Sensing – Global Vision for Local Action*.

The global reach of GRSS was perhaps best illustrated during the first decade of the 21st century by the spread of Society chapters around the world.



Wooil Moon, IGARSS'05 General Chair, and his wife, Wanhee, in traditional Korean dress greet attendees.

James Shell, a U.S. Air Force Officer and Ph.D. student at Rochester Institute of Technology studies the IGARSS'04 program; he received his Ph.D. in 2006 with a thesis entitled "Polarimetric Remote Sensing in the visible to Near Infrared."



Ignasi Corbella welcomes attendees to the IGARSS'07 plenary session in Barcelona, Spain. Panel members seated left to right: Gregori Vázquez (Universitat Politècnica de Catalunya [UPC] Rector representative), Ramon Moreno (UPC Director General of Research), Lewis Terman (IEEE President Elect), Leung Tsang (GRSS President), Rich Cox (IEEE Division IX Director) and Werner Wiesbeck (GRSS Awards Chair).



Ignasi Corbella (right) "passes on" conference duties to the IGARSS'08 General Co-Chairs, John Kerekes (left), Rochester Institute of Technology, and Eric Miller (middle), Tufts University.



Above and left: IGARSS'08 (Boston) participants gather for informal discussions during the breaks.



Attendees enjoy a western carnival atmosphere and games at the Opening Reception of IGARSS'06 in Denver, Colorado.



Interactive (poster) presentations offer individual presenters the opportunity to speak one-on-one with attendees, detailing their research pursuits to a focused audience as is shown at IGARSS'99 (top) and IGARSS'10 (below).



Left and below: Keiki welcome guests at the IGARSS'10 reception at the Hilton Hawaiian Village in Honolulu, Hawaii. Masanobu Shimada (JAXA), Ridha Touzi (CCRS), Paul Smits (JRC / IGARSS'10 Co-Chair) and Yves-Louis Desnos (ESA / IGARSS'12 Co-Chair) enjoy the calm and camaraderie.



During the early 2000s, GRSS added U.S. chapters in Eastern North Carolina in 2003, upstate New York in 2007, Metro Los Angeles in 2009 and Alaska in 2010. The Society, however, tripled the number of new chapters during the decade overseas, including Spain in 2000, Seoul in 2001, Germany and Southern Italy in 2003, Taipei and the United Kingdom in 2004, Quebec and Vancouver in 2005, France in 2007, and Islamabad in 2008. The Society closed the first decade of the new century by adding chapters in Australia/New South Wales and Nanjing, China, in 2010, and continued its ever-expanding reach with chapter additions in Croatia and Saudi Arabia in 2011, and in Delhi, India, early in 2012.

New Publications

From its inception as G-GE in 1962, GRSS has stayed true to its mission of providing a place for its members to communicate research and information from their fields of interest in geoscience and remote sensing. For much of its history, the *IEEE GRSS Transactions* has been the preeminent peer reviewed journal in the field.

As wireless internet connections have brought the world closer in the 21st century, the need for instant dissemination of important information for the geoscience and remote sensing communities has become much more important. To meet this requirement, GRSS established *IEEE Geoscience and Remote Sensing Letters* as a quarterly publication for its members under the leadership of AdCom member and inaugural Editor, Bill Emery.

Popularly called *GRSL*, the *Letters* format emphasized rapid turn-around for shorter, high-impact papers on the theory, concepts, and techniques of

science as they apply to the sensing of the Earth, oceans, atmosphere, and space; and the processing, interpretation, and dissemination of that information.^v

The dramatic increase in submissions to the *Transactions* that began in the 1990s and continued throughout the first decade of the 21st century led AdCom to explore the establishment of new peer-reviewed journals.

By 2006, *Transactions* had ballooned to 3,736 pages and 343 articles. In 2007, the journal printed seven special issues.

A growing number of those articles and special issues reflected the increasing interest in application themes. The *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing (J-STARS)* began as a quarterly publication under Ellsworth LeDrew as Editor and Kun-Shan Chen as Deputy Editor to “address current issues and techniques in applied remote and *in situ* sensing, their integration, and applied modeling and information creation for understanding the Earth. Applications are for the Earth, oceans and atmosphere.”^v

A venue for peer-reviewed papers on a variety of application themes in Earth observation and remote sensing, *J-STARS* quickly established a reputation for cutting-edge research in such topics as



William Emery
University of Colorado
inaugural Editor of *Letters*

03/01/02 ENVISAT launched	03/17/02 GRACE 1 & 2 aka Tom & Jerry launched	05/04/02 SPOT 5 launched	05/04/02 AQUA / EOS PM-1 launched	05/15/02 HY-1 / HAI YANG 1 launched	12/14/02 ADEOS-2 / MIDORI 2 launched
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2002



2002-2003
Charles Luther
Office of Naval Research
President, GRSS

06/24-28/2002
IGARSS'02
Westin Harbour Castle Hotel
Toronto, ON, Canada



Ellsworth LeDrew
University of Waterloo
Ontario, Canada
inaugural *JSTARS* Editor



Kun Shan Chen, National
Central University, Taiwan
inaugural *JSTARS*
Deputy Editor

observations, forecast data, simulated information, data assimilation, and Earth information techniques to address science and engineering issues relating to the Earth system.

New Blood

As in any organization, the success of the Society in the 21st century relies upon the new blood in AdCom who have taken up the mantle of leadership. All of those who have served as President of the Society have had years of experience on AdCom, chairing committees, serving as Editor of one or more of the Society's publications, or chairing IGARSS. For example, Albin J. Gasiewski, GRSS President in 2004 and 2005, is an example of the scholarship and dedication it takes to head the Society. Gasiewski, who earned his B.S. and M.S. degrees from Case Western University in Cleveland, Ohio, and his doctorate from MIT, spent much of the 1990s as a faculty member within the School of Electrical and

Computer Engineering at the Georgia Institute of Technology in Atlanta. At Georgia Tech, Gasiewski developed and taught courses in electromagnetics, remote sensing, instrumentation and wave propagation. In 1997, he joined NOAA's Earth Systems Research Laboratory in Boulder, Colorado, and about the time he stepped down as GRSS President, Gasiewski was appointed a Professor of Electrical and Computer Engineering at the University of Colorado in Boulder. Gasiewski was named Director of the CU Center for Environmental Technology, and he served as the Co-Chair of IGARSS'06 in Denver.

Leung Tsang, GRSS President from 2006-2007, was the Editor of *Transactions* from 1996-2001, at which time he served as an *ex officio* member of AdCom. He has served as a member of AdCom since that time, and he was the General Chairman of IGARSS'98 in his adopted hometown of Seattle.^{vi} In his professional career, Tsang bridges the gap between the United States and his native China. Professor and Associate Chairman for Education in the Electrical Engineering Department at the University of Washington where he has taught for 28 years, Tsang also is an Honorary Professor of Electrical Engineering at The City University of Hong Kong and an Adjunct Professor at Zhejiang University, China.^{vii}

The Society's first Australian President, Anthony K. Milne, was elected in 2008 and served a second term in 2009. The Visiting Professor of Geography and Remote Sensing in the School of Biological, Earth and Environmental Sciences at the University of New South Wales in Sydney, Milne also served as the Remote Sensing Science Manager of the Australian government-sponsored Cooperative Research Centre for Spatial Information from 2003 to 2010.^{viii} In his spare time, Milne has served

as a Co-Director of a private Australian company, Horizon Geoscience Consulting Pty., Ltd., since 2002.

Milne, who earned his doctorate at the University of Colorado, became a member of AdCom in 2002. He was Chair of the Society's Membership Committee in 2004 and 2005, and took on the leadership of the GRSS Globalization Initiative after stepping down from the presidency. Milne's interests have encompassed radar remote sensing, vegetation assessment and the mapping of wetlands across much of the Pacific region.^{ix}

Milne's successor as President in 2010, Alberto Moreira, ably illustrated the global nature of geoscience and remote sensing in the 21st century. A Brazilian who earned his B.S.E.E. and M.S.E.E. from the Aeronautical Technical Institute in his native country, Moreira crossed the Atlantic to earn his doctorate in engineering from the Technical University of Munich in 1993. From 1996 to 2001, he managed the SAR Technology Department of the Microwaves and Radar Institute at the German Aerospace Center (DLR) and since 2001 has served as its Director.^x

A participant in 19 IGARSS conferences, Moreira is serving as the General Co-Chair of IGARSS'12 in Munich. He has served as a member of AdCom from 1999-2010, in various executive committee positions from 2004-2010, and as Past President in 2011. Moreira was the founder and Chair of the German Chapter of GRSS, and he served as an Associate and Guest Editor of *Transactions* beginning in 2005.

The Society's 2011-2012 President, Jon Atli Benediktsson, is another Society executive whose academic credentials and career accomplishments straddle several continents. Benediktsson earned his

undergraduate degree in electrical engineering from the University of Iceland in Reykjavik and then earned a M.S.E.E. and a doctorate in electrical engineering from Purdue University in West Lafayette, Indiana. Currently the Pro Rector for Academic Affairs and a Professor of Electrical and Computer Engineering at the University of Iceland, Benediktsson has held a wide variety of visiting positions with universities and research institutions internationally during the past 20 years. He also served as Chairman of the energy company Metan Ltd. from 1999 to 2004, and is a co-founder of the biomedical company, Oxymap.^{xi}

Benediktsson's involvement with GRSS has mirrored the Society's progress since the restructuring of governance in the mid-1990s. From 1996 to 1999, he served as the Chair of the GRSS Technical Committee on Data Fusion, the founding Chairman of the IEEE Iceland Section and as the Section's Chairman from 2000 to 2003, and he was named Vice President of Technical Activities for the Society in 2002 and Vice President for Professional Activities in 2008. He has been Associate Editor and Editor for the *GRSS Transactions* and *GRSS Letters* for much of the 21st century, and he was the first Chair of the *J-STARS* Steering Committee.

GRSS has long been a Society that values the accomplishments of its senior members and holds them out as role models for junior members. That was never more true than in the 21st century, and as the Society approached its 50th anniversary in 2012, GRSS could look forward to a future in which the up-and-coming members of AdCom could strive to match the accomplishments of those who proceeded them and who so ably steered the affairs of the Society into the second decade of the 21st century.

01/06/03 CORIOLIS launched	01/13/03 ICESAT launched	06/26/03 ORBVIEW-3 launched	09/27/03 NIGERIASAT-1 launched	09/27/03 UK-DMC / BNSCAT launched	09/27/03 BILSAT-1 launched	10/17/03 IRS-P6 / RESOURCESAT launched	10/21/03 ZY-1 2 (CBERS2) launched
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04/18/04 SHIYAN 1 / TANSUO 1 launched	05/20/04 ROCSAT-2 launched	06/29/04 SAUDISAT-2 launched	07/15/04 AURA / EOS Chemistry 1 launched	11/18/04 SHIYAN 2 / TANSUO 2 launched	12/24/04 SICH-1M launched
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2003



2003-2008
Jon Atli Benediktsson
University of Iceland
Editor, *TGRS*



2003-2006
Adriano Camps
Universitat Politècnica de
Catalunya-Barcelona, Spain
Editor, *Newsletter*

04/25/03
Italy (South)
Chapter formed

07/21-25/2003
IGARSS'03
Centre de Congres Pierre Baudis
Toulouse, France

05/22/03
Germany Chapter
formed

10/13/03
Eastern North Carolina
Chapter formed

2004



2004-2005
Albin Gasiewski, NOAA
President, GRSS

01/04
IEEE Geoscience and
Remote Sensing Letters
(*GRSL*) introduced



2005-2008
William Emery
University of Colorado
Editor, *GRSL*

05/03/04
Taipei Chapter formed

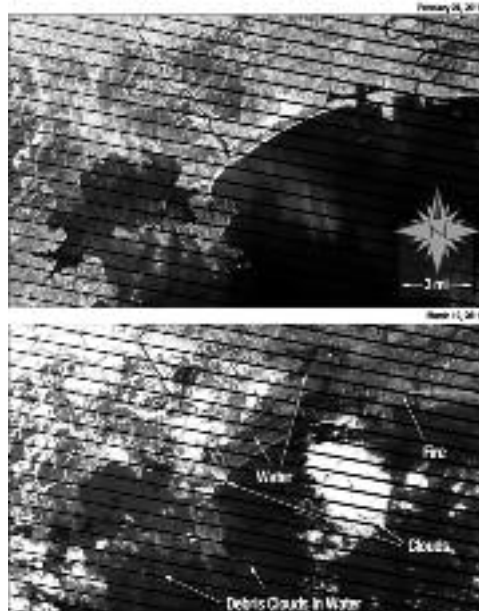
09/01/04
UKRI Chapter formed

09/20-24/2004
IGARSS'04
Egan Convention Center
Anchorage, Alaska, USA

CHAPTER 8

Today and Tomorrow

As GRSS enters its 50th year, the Society “continues to do well on all fronts,” noted Jon Atli Benediktsson in his 2011 year-end message to the members.ⁱ



A magnitude 8.9 earthquake off the coast of Sendai, Japan, struck on March 11, 2011 and triggered a massive tsunami. The tsunami’s waves reportedly reached heights of up to 13.5 feet. This caused flooding and mass destruction in the city of Sendai. In this Landsat-7 image, Sendai is shown before the tsunami (on February 24, 2011; top) and after (on March 12, 2011; bottom). Image credit: NASA.

More than 1,400 delegates attended IGARSS’11 in Vancouver, Canada, which highlighted the theme *Beyond the Frontiers: Expanding Our Knowledge of the World*. Vancouver became the acting host city for IGARSS’11 when Sendai, Japan — the original host site — was ravaged by a massive earthquake and tsunami in March 2011. With only five months before the conference opening, the host team under the direction of Motoyuki Sato as General Chair and Yosio Yamaguchi and Ya-Qiu Jin as Technical Co-Chairs, and with the support from the leadership of AdCom, an alternative site was quickly identified. In the ensuing months, a seamless shift from one venue to another located continents apart unfolded with little or no loss in projected attendance — a testament to the continued interest and growth of the annual symposium.

GRSS continued its policy of sponsoring specialty symposia around the world, including JURSE 2011 in Munich in April, the Atmospheric Transmission Models meeting in Lexington, Massachusetts, and WHISPERS 2011 in Lisbon, Portugal, both held in June, and MultiTemp 2011 in Trento, Italy, in July. The Globalization Initiative chaired by Tony Milne continued its groundbreaking work of promoting GRSS activities in Asia, Africa and Latin America. Milne and his team concentrated on Asia in 2011, bringing a GRSS workshop on Forest Monitoring, Carbon and REDD+ to the 2011 Asian Conference on Remote Sensing in Taipei, Taiwan.

Benediktsson reported “our three journal publications — *TGRS*, *GRSL* and *J-STARs* — continue to be very successful in terms of quality, timeliness and relevance for the remote sensing community.”ⁱⁱ *GRSL* expanded to six issues in 2011, and *J-STARs*, which saw submissions triple during the year, will expand to six issues in 2012.

Finally, Benediktsson noted that GRSS will continue to focus on establishing local GRSS chapters in an effort to strengthen GRSS activities for its members and to promote a continued and sustained GRSS impact. In short, Benediktsson reported that a half-century after

it got its start at a breakfast meeting in Texas, GRSS continues to fulfill its mission of advancing science and technology in geoscience, remote sensing and related fields, using conferences, education and other resources.

The Importance of Strategic Planning

What the Society will look like in 5, 10 or 20 years from now is of vital importance to AdCom’s response to change. As a result, the Society focuses closely on strategic planning to meet the challenges and opportunities of the future.

Martti Hallikainen is generally credited with initiating a formalized strategic planning process in 1997 during his presidency. Since then, GRSS has used its strategic planning process on an annual basis to map the Society’s direction. “The success or failure of the process is based upon a contingent of people looking to the future,” said Andrew Blanchard, the Past President who currently heads the Society’s strategic planning.ⁱⁱⁱ

AdCom remains a key to directing and nurturing the strategic planning process that is increasingly global in scope and requires different approaches to thinking about the future. The rapid growth of European space exploration, coupled with a growing emphasis on space exploration and sensing technology in the Pacific Rim countries means a truly global future for the Society.

“There are a whole lot more players around the world today,” Blanchard said. “If we went back to Martti Hallikainen’s presidency, we would all realize how much we underestimated the international component of the Society today.”^{iv}

In 2012, for the first time, the Society plans to start looking two decades into the future, into the early 2030s. That exercise will look at how to nurture professionals in the field 20 years from now, and how to manage volunteerism. Blanchard said he “cannot see the Society staying the same in 20 years. There are going to be additional applications in what we do to medicine, disease control. We are going to ask how we can speed up that process.”^v

Blanchard and his colleagues on the Strategic Planning Committee say they expect to see a much broader clientele of participants and users 20 years in the future, and they expect that globalization will be even more pronounced than it is today. “Who does what we are doing today is an even more important issue to address,” Blanchard said. “This community needs to be younger. The young people are here to take us to the future.”^{vi}

A final question that the strategic planning process hopes to answer is what IEEE is going to look like 20 years down the road, and how and where does GRSS fit into that structure.



Alberto Moreira, Wolfgang Boerner, Christoph Heer and Sebastian Riegger gather at the IGARSS’08 plenary session.

	05/05/05 CARTOSAT launched	08/26/05 MONITOR-E launched	10/08/05 CRYOSAT launched: failed	10/27/05 BEIJING-1 / TSINGHUA 2 launched	10/27/05 TOPSAT launched
2005	03/28/05 Quebec Chapter formed	05/23/05 Vancouver Chapter formed	07/25-29/2005 IGARSS’05 Convention & Exhibition Center (COEX) Seoul, Korea		



Symposia social events give not only participants opportunities to renew friendships they also provided vignettes for family and friends to enjoy the sites and sounds of unique destinations. Wolfgang Keydel, Fawwaz Ulaby and his wife enjoy a humorous moment at IGARSS'87.

Right: Pictured at the IGARSS 2000 opening reception, Maria Petrou (second from left) and son, Sebastiano Serpico, Lorenzo Bruzzone, Jon Atli Benediktsson with son, Mirella Castiglione and family.



Friendships best characterize the community that is represented by GRSS as portrayed by the group who participated in the post-conference tour of Australia following IGARSS'01 in Sydney.



Longtime AdCom members make an interesting observation about the tremendous influence that GRSS and its members wield within IEEE. The parent organization has 410,000 members worldwide and a staff of 1,000 people operating the Institute's Piscataway, New Jersey, headquarters.

At any given time only one percent of IEEE members can be designated a Fellow of IEEE. Fellows have to be nominated with five to eight references. That list goes to a corporation level Fellow Committee. It can have as many as 30 more people



1987: Grad students from the Microwave Remote Sensing Lab at the University of Massachusetts Amherst find humor in the moment. Left to right: Christoph Borel, Chris Ruf (future AdCom member and Editor), Ivan Popstefanija, Ram Narayanan (future AdCom member, Editor, and IGARSS'96 General Chair), David McLaughlin, and Alan Tanner. Not pictured: Their advisors, Robert (Bob) McIntosh and Calvin Swift.



IGARSS'03 participants enjoy a local café in Toulouse, France.

who review the nomination. Everybody is accomplished. It is a major achievement for an individual to become an IEEE Fellow.^{vii}

It is this sense of achievement also embodied in the Society's pantheon of awards that creates an image of an organization advancing the frontiers of science. However, it is the network of friends and colleagues that sets GRSS apart and makes it a vehicle to establish lifelong friendships.

Lifelong Friendships

Through IGARSS, members build friendships that last a lifetime. Members are quick to tell an acquaintance that they have been to 19 IGARSS conferences, or that the first IGARSS conference they attended was at Munich in 1982, and they are looking forward to going back to Munich for IGARSS'12.

"For many of these conferences, people bring their spouses," David Goodenough noted, a typical reaction. "Spouses build their own network. They are having a ball, with evening receptions, exhibits and the like."^{viii}

Goodenough still fondly recalls IGARSS'01 in Australia. He described a two and a half week tour around Australia, which took place in conjunction with the conference. Thirty-four members participated, extending relationships beyond convention center walls.

It is these friendships that best characterize the community that is represented by GRSS. Keith Carver, whose time in the Society goes back to the days before 1980 when it was still a Group, said GRSS is first and foremost a professional network, "but you get to know people and their families. I did an awful lot of that myself. I kept updating those contacts every year."^{ix}

01/24/06	04/15/06	04/25/06	04/26/06	04/28/06	04/28/06	06/15/06	07/28/06
ALOS /DAICHI	FORMOSAT-3 FM1-FM6	EROS-B / EROS-B1	YAOGAN 1 / RSS1	CALIPSO	CLOUDSAT	RESURS-DK1	KOMPSAT-2 /ARIRANG-2
launched	launched	launched	launched	launched	launched	launched	launched

01/10/07	01/10/07	04/11/07	04/17/07	04/17/07	05/25/07
CARTOSAT-2	LAPAN-TUBSAT	HAIYANG 1B /HY-1B	EGYPSAT 1 /MISR 1	SAUDISAT 3	YAOGAN 2 / JB-5 2
launched	launched	launched	launched	launched	launched

2006



2006-2007
Leung Tsang
University of Washington
President, GRSS

07/31-08/04/2006
IGARSS'06
Colorado Convention Center
Denver, Colorado, USA

2007



2007-2009
David Kunkee
The Aerospace Corporation
Editor, *Newsletter*

03/13/07
France Chapter formed

05/27/07
Rochester/Binghamton/
Buffalo/Ithaca/Syracuse
Chapter formed

Leung Tsang perhaps puts it best when he notes “you make friends from all over the world. People work very closely on a common goal — technology for the benefit of society. Remote sensing is very important for humanity. We are serving humanity.”^x

Andy Blanchard describes the Society as “a true sense of family. We deal with technical issues on a daily basis, but these are personal friends we have gotten to know in dealing with those issues. There is an overwhelming sense that says ‘let’s do good,’ but let’s also remember who we are — a family.”^{xi}

The More Things Change

Those who have participated in the life of GRSS during the past decades have been witness to changes that would have not even been thought of 30, 40 or 50 years ago. No one at that first gathering in 1962 could have envisioned logging on to an IEEE GRSS website and tapping into billions of pieces of information that the internet can make available at a keystroke.

Leung Tsang has been involved in GRSS editorial duties for much of his long career with the Society. To him, one of the biggest changes has been the proliferation of information published in the Society’s journals. “When the original journal started in 1980 it was 300-400 pages a year,” he said. “Now, the three journals publish 7,500 pages a year. It is a reflection of how much is going on in the field.”^{xii}

For Kiyo Tomiyasu, “The aspect that surprised me was the rapid growth of international participation. Every nation is doing something with remote sensing.”^{xiii}

For Werner Wiesbeck, the changes in technology have been little short of astounding. “At the be-



Paul Smits, Karen St. Germain and Andrew Blanchard pose for the camera while they enjoy a relaxed moment.



Keith Carver and Kiyo Tomiyasu toast to the festivities and friendships.

ginning,” he said, “we used one fixed antenna for remote sensing. We have antennas now that are phased array and digital beamforming, and we have gone to new polarimetric applications. Twenty years ago we did not have those. They are now much more sophisticated, resulting primarily from the work of our members. There have been numerous improvements in remote sensing from the members of our Society.

Two years ago, the TanDEM-X satellite was launched from Germany. It is the most advanced in civilian use. Many others will follow.”^{xiv}

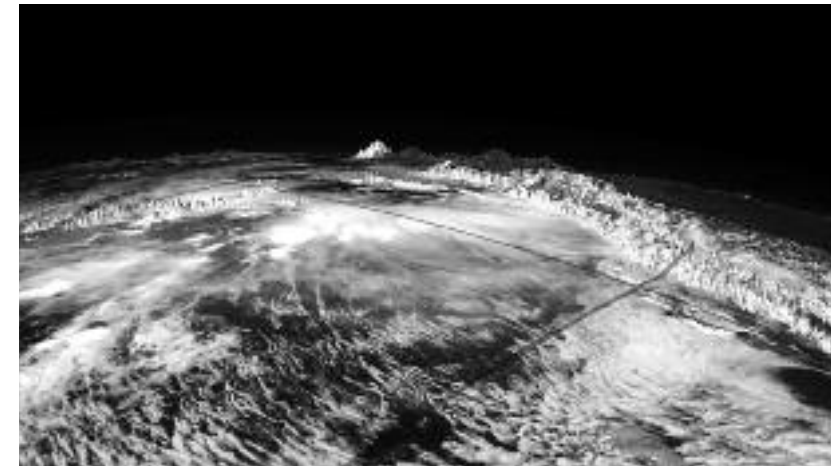
There are many other changes that make the Society unrecognizable to those whose involvement with GRSS ended decades ago. Until the mid-1990s, there were only North American presidents of the Society. Since then, Martti Hallikainen, Werner Wiesbeck, Tony Milne, Alberto Moreira and Jon Atli Benediktsson have brought the GRSS presidency to new continents. In the mid-1990s, the Society served about 2,500 members and struggled with an annual budget of well under \$1 million. Today, as GRSS prepares to celebrate its golden anniversary, the Society serves 3,500 members with reserves of more than \$5 million.

For Andrew Blanchard, the Society has both changed dramatically and remained the same since 1981 when G-GE reorganized into GRSS. “It changed in its behavior and its structure,” he said,

“but it remained the same in the personal interface. Those core attributes remain the same.”^{xv}

Blanchard added that GRSS is strong and thriving today because it made three major accomplishments in the past 30-plus years. The Society became more professional. It recognized that GRSS was an international society. And it focused on real strategic planning. “There has been a lot of opportunity and equal amount of challenges,” he said. “We’ve been fortunate that we have had a core of excellent people involved, current members as well as those coming up through the ranks.”

GRSS will continue its mission to encourage and support its members, who work with the theory, concepts and techniques of science and engineering as they apply to the remote sensing of the earth, oceans, atmosphere and space, as well as the processing, interpretation and dissemination of that information as GRSS moves forward toward its next 50 years.



Associated with tropical thunderstorms are broad fields of cirrus clouds that flow out of the tops of the vigorous storm systems that form over warm tropical oceans. These clouds play a role in how much infrared energy is trapped in Earth’s atmosphere. This image over Central America, produced in support of NASA’s Tropical Composition, Cloud and Climate Coupling (TC4) mission, shows a tropical storm system over Central and South America on August 2, 2006, as measured from multiple satellite sensors, including Aqua MODIS, CloudSat and CALIPSO. The land topography is also exaggerated by a factor of ten. Image credit: NASA GSFC Visualization Studio and MODIS Rapid Response Project.

06/07/07
COSMO-SKYMED 1
launched

06/15/07
TERRASAR-X
launched

09/18/07
WORLDVIEW 1
launched

09/19/07
CBERS-2B / ZI YUAN 2B
launched

12/14/07
RADARSAT 2
launched

04/28/08
CARTOSAT-2A
launched

04/28/08
IMS-1
launched

06/20/08
OSTM/JASON2
launched

09/06/08
HJ-1A / HJ-1B
launched

09/06/08
GEOEYE 1
launched

10/01/08
THEOS
launched

2007

07/23-27/2007
IGARSS’07
Centre de Convencions Internacional de Barcelona
Barcelona, Spain

2008



2008-2009
Anthony Milne
University of
New South Wales,
Australia
President, GRSS



2008-2010
Ellsworth LeDrew
University of Waterloo,
Canada
Editor, J-STARS

06/09/08
Islamabad Chapter formed

07/01/08
J-STARS first
issue published

07/07-11/2008
IGARSS’08
Hynes Veterans Memorial Convention Center
Boston, Massachusetts, USA

IEEE GRSS Fellows

1962 Richard K. Moore	1991 David C. Munson
1962 Kiyo Tomiyasu	1991 R. Keith Raney
1967 Arthur Uhler	1991 John K. Schindler
1969 Merrill I. Skolnik	1991 W. Ross Stone
1972 Laveen Kanal	1991 David E. Weissman
1973 Akira Ishimaru	1992 John S. MacDonald
1973 Edward A. Wolff	1993 Weng C. Chew
1974 Jack E. Bridges	1993 Irving Engelson
1974 Irene C. Peden	1993 Martti T. Hallikainen
1976 Leonard J. Porcello	1993 Wolfgang M. Keydel
1977 Morrel P. Bachynski	1993 Thomas A. Seliga
1977 David Landgrebe	1994 Werner Wiesbeck
1978 Ching C. Li	1995 Andrew J. Blanchard
1980 Fawwaz T. Ulaby	1995 Balusu Lakshmana Deekshatulu
1981 George F. McClure	1995 Anthony W. England
1982 Richard La Rosa	1995 David M. Le Vine
1983 Ralph Bernstein	1995 Eni G. Njoku
1983 Eric Herz	1995 James R. Rowland
1983 Calvin T. Swift	1995 Peter W. Staecker
1984 Wolfgang M. Boerner	1996 Nader Engheta
1984 Hitoshi Mochizuki	1996 Franz W. Leberl
1985 Adrian K. Fung	1996 John Richards
1985 Yahya Rahmat-Samii	1996 James A. Smith
1986 Gary S. Brown	1997 David G. Goodenough
1986 Keith R. Carver	1997 Jong-Sen Lee
1986 William F. Croswell	1997 Philip W. Rosenkranz
1986 Martti E. Tiuri	1997 Zong Sha
1987 Adam Kozma	1998 Daniel L. Alspach
1988 Chi-Hau Chen	1998 Yoji Furuhashi
1988 Chester S. Gardner	1998 Dennis L. Knepp
1988 Harry N. Kritikos	1998 Louis J. Lanzerotti
1988 Roger H. Lang	1998 Vincent V. Salomonson
1988 John A. Reagan	1998 William J. Wilson
1988 Felix Schwering	1999 Sivaprasad Gogineni
1988 Marwan Simaan	1999 Le Roy C. Graham
1988 Ingo Wolff	1999 W Linwood Jones
1990 Dick J. Doviak	1999 Paolo Pampaloni
1990 Charles Elachi	1999 Jakob J. Van Zyl
1990 Leung Tsang	2000 Anthony Freeman
1990 Dusan S. Zrnic	2000 Hugh D. Griffiths

2000 Soo-Chang Pei	2007 Kun-Shan Chen
2000 Kamal Sarabandi	2007 Victor C. Chen
2000 Dale. L. Schuler	2007 Grace A. Clark
2001 Moeness M. Amin	2007 Melba M. Crawford
2001 Shane R. Cloude	2007 Robert T. Menzies
2001 Patrick E. Mantey	2007 Paris W. Vachon
2001 Ram M. Narayanan	2008 Curt H. Davis
2001 Leslie M. Novak	2008 Joel T. Johnson
2001 Chris S. Ruf	2008 Fuk K. Li
2001 Thomas J. Schumugge	2008 David G. Long
2001 Ed R. Westwater	2008 Jay S. Pearlman
2002 Andrew K. Chan	2008 Waymond Scott
2002 Gianfranco DeGrandi	2009 Francis X. Canning
2002 Albin J. Gasiewski	2009 Ian G. Cumming
2002 Thomas J. Jackson	2009 Jaideva Goswami
2002 Nahid Khazenie	2009 Mahta Moghaddam
2002 Yoshio Yamaguchi	2009 Yisok Oh
2003 William J. Emery	2009 Helmut Rott
2003 Wooil M. Moon	2009 Sebastiano B. Serpico
2003 Niels Skou	2009 Felix J. Yanovsky
2003 James R. Wang	2009 Simon H. Yueh
2003 Tat Soon Yeo	2010 Lorenzo Bruzzone
2004 Jan I. Askne	2010 Diane L. Evans
2004 Jon Atli Benediktsson	2010 Soren N. Madsen
2004 Chandrasekar V. Chandra	2010 Motoyuki Sato
2004 Ya-Qiu Jin	2010 John F. Vesecky
2004 Yasuo Kuga	2010 Valery U. Zavorotny
2004 Russell J. Lefevre	2011 Donald E. Barrick
2004 Alberto Moreira	2011 Adriano Camps
2004 Paul G. Steffes	2011 Paul D. Gader
2004 Harry B. Wallace	2011 Maria Greco
2004 Thomas T. Wilheit	2011 Arun Hampapur
2005 Richard Bamler	2011 Anthony K. Milne
2005 Steven J. Franke	2011 Eric L. Mokole
2005 Gary G. Gimmetstad	2011 Eric Pottier
2005 Qing Huo Liu	2011 Paul A. Rosen
2006 Kultegin Aydin	2011 Masanobu Shimada
2006 Donald T. Farley	2012 Jocelyn Chanussot
2006 Rene M. Garello	2012 Stephen L. Durden
2006 Eastwood Im	2012 Malcolm L. Heron
2006 Luis G. Kun	2012 John D. Mathews
2006 Ellsworth LeDrew	2012 Eric L. Miller
2006 Charles A. Luther	2012 Simonetta Paloscia
	2012 J. Scott Tyo

01/23/09	02/24/09	03/17/09	07/14/09	07/29/09	07/29/09	09/17/09	09/23/09	10/08/09		11/02/09		04/08/10	06/21/10	07/12/10	07/12/10	08/24/10
GOSAT launched	OCO launched	GOCE launched	RAZAKSAT launched	DUBAISAT-1 launched	DMC-2 / UK-DMC 2 launched	SUMBANDILASAT launched	OCEANSAT-2 launched	WORLDVIEW-2 launched		SMOS launched		CRYOSAT-2 launched	TANDEM-X launched	CARTOSAT 2B launched	ALSAT 2A launched	TIANHUI 1 launched

2009



2009—
Chris Ruf
University of Michigan
Editor, *TGRS*

GRSS membership surpasses 3,000



2009—
Paolo Gamba
University of Pavia, Italy
Editor, *GRSL*

07/13-17/2009
IGARSS'09
University of Cape Town
Cape Town, South Africa

08/25/09
Metropolitan Los Angeles Chapter formed

2010



2010
Alberto Moreira
German Aerospace Center
President, GRSS

02/22/10
Nanjing Chapter formed



2010—
Lorenzo Bruzzone
University of Trento, Italy
Editor, *Newsletter*

04/16/10
Australia Capital Territory
Chapter formed

07/26-30/2010
IGARSS'10 (30th anniversary)
Hilton Hawaiian Village
Honolulu, Hawaii, USA

IGARSS Through the Years

YEAR, LOCATION – GC: GENERAL CHAIRS; TC: TECHNICAL CHAIRS

- 1981 Washington, DC – GC: Fawwaz Ulaby; TC: Keith Carver
- 1982 Munich, Germany – GC: Johann Bodechtel; TC: Philipo Hartl, Wolfgang Keydel
- 1983 San Francisco, CA – GC: Keith Carver; TC: Don G. Rea, David E. Weissman
- 1984 Strasbourg, France – GC: Preben Gudmandsen; TC: Wolfgang Keydel
- 1985 Amherst, MA – GC: Robert McIntosh; TC: Calvin Swift
- 1986 Zurich, Switzerland – GC: Harold Haefner; TC: Klaus Itten
- 1987 Ann Arbor, MI – GC: Fawwaz Ulaby; TC: Keith Carver
- 1988 Edinburgh, Scotland – GC: Don D. Hardy; TC: P.D.L. Williams
- 1989 Vancouver, Canada – GC: John S. MacDonald; TC: Jim Gower
- 1990 College Park, MD – GC: Vincent Salomonson; TC: Jim Smith
- 1991 Helsinki, Finland – GC: Martti Hallikainen; TC: Martti Tiuri
- 1992 Houston, TX – GC: Andrew Blanchard; TC: Adrian Fung, Alois Sieber
- 1993 Tokyo, Japan – GC: Mikio Takagi; TC: Sadao Fujimura
- 1994 Pasadena, CA – GC: JoBea Way, Dan McLeese; TC: Eni Njoku
- 1995 Florence, Italy – GC: Paolo Pampaloni; TC: Piero Bruscatlioni
- 1996 Lincoln, NE – GC: Ram Narayanan; TC: Robert McIntosh, Calvin Swift
- 1997 Singapore – GC: Lim Hock; TC: Yeo Tat Soon
- 1998 Seattle, WA – GC: Leung Tsang; TC: Yasuo Kuga, Dale Winebrenner
- 1999 Hamburg, Germany – GC: Werner Alpers; TC: Richard Bamler, R. Winter
- 2000 Honolulu, HI – GC: Andrew Blanchard, David Goodenough; TC: Albin Gasiewski, Karen St. Germain
- 2000 Sydney, Australia – GC: Anthony Milne; TC: John Richards, M. Lewis
- 2002 Toronto, Canada – GC: Ellsworth LeDrew; TC: David Goodenough, Tom Lukowski
- 2003 Toulouse, France – GC: Didier Massonnet; TC: Jean Claude Souyris
- 2004 Anchorage, AK – GC: Verne Kaupp; TC: Craig Dobson, Curt Davis, Tom Lukowski
- 2005 Seoul, South Korea – GC: Wooil Moon; TC: S.H. Lee, William Emery
- 2006 Denver, CO – GC: Albin Gasiewski, Chandrasekar V. Chandra; TC: Gary Wick, William Emery
- 2007 Barcelona, Spain – GC: Ignasi Corbella; TC: Adriano Camps
- 2008 Boston, MA – GC: John Kerekes, Eric Miller; TC: Dara Entekhabi, Steven Reising
- 2009 Cape Town, South Africa – GC: Harold Annegarn; TC: Michael Inggs, Roger King
- 2010 Honolulu, HI – GC: Karen St. Germain, Paul Smits; TC: David Kunkee, Paolo Gamba
- 2011 Vancouver, Canada – GC: Motoyuki Sato; TC: Yoshio Yamaguchi, Ya-Qiu Jin
- 2012 Munich, Germany – GC: Alberto Moreira, Yves L. Desnos; TC: Irena Hajnsek, Helmut Rott

Administrative Committee (AdCom)
Through the Years

GROUP ON GEOSCIENCE ELECTRONICS

- EFFECTIVE FEBRUARY 15, 1962 — Arthur, Broding, Girn, Kaufman, List, Mayne, Olson (C), F. Smith, H. Smith; ADDED APRIL 13, 1962: Lebel, Melton, Waynich.
- EFFECTIVE JANUARY 1963 — Broding, Cantwell, Gordon, Katz, Kaufman, Lebel, List, Little, Melton, Neitzel, Olson, F. Smith, H. Smith (C), Sutton, Tilley (VC), Waynich.
- EFFECTIVE JANUARY 1964 — Broding, Cantwell, Drews, Ferguson, Gordon, Hickley, Jaffe, Katz, Lebel, List, Little, Melton (VC), Neitzel, Ohman, Sutton, Tilley (C).
- EFFECTIVE JANUARY 1965 — Broding, Cantwell, Drews, Ferguson, Gordon, Hickley, Jaffe (C), Katz, Lebel, List, Little, Neitzel (VC), Ohman, Ross, Sutton.
- EFFECTIVE JANUARY 1966 — Cantwell, Drews (C), Ferguson, Field, Gordon, Green, Hickley, Jaffe, Little, Katz, Ohman, Ross, Tilley, Wolff (VC).
- EFFECTIVE JANUARY 1967 — Drews (C), Ferguson, Field, Green, Hefer, Hickley, Hill, Jaffe, Katz, Neitzel, Ohman, Ross, Ringenbach, Silverman, Ward, Wolff (VC).
- EFFECTIVE JANUARY 1968 — Drews, Field, Getman, Green, Hefer, Hickley, Hill, Jaffe, Neitzel, Redmond, Ross, Ringenbach (VC), Silverman, Ward, Wolff (C).
- EFFECTIVE JANUARY 1969 — Drews, Field (VC), Getman, Green, Hefer, Hill, Jaffe, Lacoss, Redmond, Ringenbach, Silverman, Tiffany, Ward, Williams, Wolff (C).
- EFFECTIVE JANUARY 1970 — Bernstein, Drews, Field (C), Getman, Green, Hill, Jaffe, Lacoss, Mercanti, Redmond (VC), Sims, Tiffany, Williams, Wolff.
- EFFECTIVE JANUARY 1971 — Bernstein, Drews, Field, Getman (VC), Green, Hill, Jaffe, Lacoss, Mercanti, Redmond (C), Rouse, Sims, Tiffany, Williams.
- EFFECTIVE JANUARY 1972 — Bernstein, Drews, Getman (C), Green, Hill, Jaffe, Lacoss, Mercanti, Miyasaki, Rouse, Sims, Tiffany, Williams (VC), Wolff.
- EFFECTIVE JANUARY 1973 — Bernstein, Green, Hill, Jaffe, Lacoss, Mercanti, Miyasaki, Redmond, Riter, Rouse (VC), Sims (C), Wolff.
- EFFECTIVE JANUARY 1974 — Bernstein, Field, Getman, Hoffman, Katz, Lacoss, Mercanti, Miyasaki, Redmond, Riter, Rouse (VC), Sims (C), Tiffany, Williams, Wolff.
- JANUARY 1975 — Anuta, Bernstein, Eckerman, Field, Getman, Hoffman, Katz, Kritikos, Lacoss (VP), Mercanti, Miyasaki, Perlis, Redmond, Riter, Rouse (P), Sims, Tiffany, Williams, Wolff.
- JANUARY 1976 — Anuta, Bernstein, Eckerman (VP), Gangi, Hoffman, Kritikos, Lacoss, McGillem (P), Perlis, Riter, Schell, Sims, Waite.
- JANUARY 1977 — Eckerman (P), Gangi (VP), Hoffman, Musa, Shanks, Sims, Sobti, Walton.
- JANUARY 1978 — Eckerman, Gangi, Hoffman (P), Klemas, Kritikos (VP), Landgrebe, McGillem, Musa, Perlis (VP), Shanks, Sims, Sobti, Ulaby, Walton.

04/20/11
RESOURCESAT 2
launched

06/10/11
SAC-D/AQUARIUS
launched

08/17/11
NIGERIASAT 2
launched

08/17/11
RASAT
launched

08/17/11
SICH 2
launched

10/12/11
MEGHA-TOP-
IQUES launched

12/17/11
PLEIADES 1
launched

12/17/11
SSOT /FASAT-
CHARLIE launched

2011



2011-2012
Jon Atli Benediktsson
University of Iceland
President, GRSS



2011—
Jocelyn Chanussot
Grenoble Institute of Technology, France
Editor, J-STARS

02/19/11
Alaska Chapter formed

07/24-29/2011
IGARSS'11
Vancouver Convention Center
Vancouver, BC, Canada

10/2011
Saudi Arabia and
Croatia Chapters form

2012

01/03/12
Delhi Chapter formed

07/22-27/2012
IGARSS'12
International Congress Centre
Munich, Germany

GEOSCIENCE AND REMOTE SENSING SOCIETY

JANUARY 1979 — Jerry Eckerman, Anthony Gangi, Alex Hoffman (**P**), Victor Klemas, Haralambos Kritikos (**VP**), David Landgrebe, Clare McGillem, Samuel Musa, Harlan Perlis (**VP**), John Shanks, Michael Sims, Arun Sobti, Fawwaz Ulaby, Travis Walton.

JANUARY 1980 — Keith Carver, Richard Doviak, Jerry Eckerman, Anthony Gangi, Alex Hoffman, Victor Klemas, Haralambos Kritikos (**VP**), David Landgrebe, Jeffrey Lytle, Clare McGillem, Samuel Musa, Harlan Perlis (**VP**), John Shanks, Michael Sims, Arun Sobti, Fawwaz Ulaby (**P**), Travis Walton.

JANUARY 1981 — 1981: Victor Klemas, Haralambos Kritikos, David Landgrebe, Fawwaz Ulaby (**P**); 1982: Richard Doviak, Jeffrey Lytle (**2VP**), Robert McIntosh; 1983: Keith Carver (**1VP**), Jerry Eckerman, Dan Held, Sam Shanugam, Alois Sieber, Calvin Swift, J.V. Taranik, Travis Walton.

JANUARY 1982 — 1982: Richard Doviak, Jeffrey Lytle (**1VP**), Robert McIntosh; 1983: Keith Carver (**P**), Jerry Eckerman, Dan Held, Sam Shanmugam, Alois Sieber, Calvin Swift, J.V. Taranik, Travis Walton; 1984: Lloyd Breslau (**2VP**), Victor Klemas, David Landgrebe, John Reagan, Fawwaz Ulaby.

JANUARY 1983 — 1983: Keith Carver (**P**), Jerry Eckerman, Dan Held, Sam Shanmugam, Alois Sieber, Calvin Swift, J.V. Tarnik, Travis Walton; 1984: Lloyd Breslau (**2VP**), Victor Klemas, David Landgrebe, John Reagan, Fawwaz Ulaby; 1985: Connie Balanis, Charles Elachi, Jeffrey Lytle (**1VP**), Robert McIntosh, Keith Raney.

JANUARY 1984 — 1984: Victor Klemas, David Landgrebe, John Reagan, Fawwaz Ulaby, Travis Walton; 1985: Connie Balanis (**2VP**), Charles Elachi, Jeffrey Lytle, Robert McIntosh (**P**), Keith Raney; 1986: Keith Carver, Jerry Eckerman, Alois Sieber (**1VP**), Calvin Swift, Kiyo Tomiyasu.

JANUARY 1985 — 1985: Connie Balanis, Charles Elachi, Jeffrey Lytle, Robert McIntosh, Keith Rany; 1986: Keith Carver, Jerry Eckerman, Alois Sieber (**VP**), Calvin Swift (**P**), Kiyo Tomiyasu; **1987:** Francois Becker, Preben Gudmandsen, Wolfgang Keydel, David Landgrebe, Fawwaz Ulaby.

JANUARY 1986 — 1986: Keith Carver, Jerry Eckerman, Alois Sieber, Calvin Swift, Kiyo Tomiyasu; **1987:** Francois Becker, Preben Gudmandsen, Wolfgang Keydel, David Landgrebe (**P**), Fawwaz Ulaby; **1988:** Ralph Bernstein, Andrew Blanchard, Wing Chew, Verne Kaupp, Keith Raney (**VP**).

JANUARY 1987 — 1987: David Goodenough, Preben Gudmandsen, Wolfgang Keydel, David Landgrebe (**P**), Fawwaz Ulaby; **1988:** Ralph Bernstein, Andrew Blanchard, Wing Chew, Verne Kaupp, Keith Raney (**VP**); **1989:** Keith Carver, Josef Cihlar, JoBea Way Holt, Klaus Itten, Kiyo Tomiyasu.

JANUARY 1988 — 1988: Andrew Blanchard, Wing Chew, Verne Kaupp, Arthur Ludwig, Keith Raney (**P**); **1989:** Keith Carver, Josef Cihlar, JoBea Way Holt, Klaus Itten, Kiyo Tomiyasu; **1990:** Anthony England, David Goodenough, Martti Hallikainen, David Landgrebe, John Reagan (**VP**).

JANUARY 1989 — 1989: Keith Carver, Josef Cihlar, JoBea Way Holt, Klaus Itten, Kiyo Tomiyasu; **1990:** Anthony England, David Goodenough, Martti Hallikainen, David Landgrebe, John Reagan (**VP**); **1991:** Andrew Blanchard, Roger Lang, George Ludwig, Keith Raney (**P**), Vince Salomonson.

JANUARY 1990 — 1990: Anthony England, David Goodenough (**VP**), Martti Hallikainen, David Landgrebe, John Reagan (**P**); **1991:** Andrew Blanchard, Michael Hardesty, Roger Lang, George Ludwig, Vincent Salomonson; **1992:** Josef Cihlar, Craig Dobson, Klaus Itten, Kiyo Tomiyasu, JoBea Way Holt, Keith Raney (**PP**).

JANUARY 1991 — 1991: Andrew Blanchard, Michael Hardesty, Roger Lang, George Ludwig, Vincent Salomonson; **1992:** Josef Cihlar, Craig Dobson, Klaus Itten, Kiyo Tomiyasu, JoBea Way Holt, Keith Raney (**PP**); **1993:** David Goodenough (**VP**), Martti Hallikainen, John Reagan (**P**), Mikio Takagi.

JANUARY 1992 — 1992: Craig Dobson, Nahid Khazenie, James Tilton, Kiyo Tomiyasu, JoBea Way Holt (**VP**), Keith Raney (**PP**); **1993:** James Gatlin, David Goodenough (**P**), Martti Hallikainen, Mikio Takagi; **1994:** Andrew Blanchard, Michael Hardesty, Roger Lang, Vincent Salomonson, Werner Wiesbeck, John Reagan (**PP**).

JANUARY 1993 — 1993: James Gatlin, David Goodenough (**P**), Martti Hallikainen, Mikio Takagi, James Tilton; **1994:** Andrew Blanchard (**VP**), Michael Hardesty, Roger Lang, Vincent Salomonson, Werner Wiesbeck, John Reagan (**PP**); **1995:** Albin Gasiewski, Nahid Khazenie, Charles Luther, Kiyo Tomiyasu, JoBea Way Holt.

JANUARY 1994 — 1994: Andrew Blanchard (**P**), Michael Hardesty, Roger Lang, Vincent Salomonson, Werner Wiesbeck, John Reagan (**PP**); **1995:** Albin Gasiewski, Nahid Khazenie, Charles Luther, Kiyo Tomiyasu, JoBea Way Holt; **1996:** J. Curlander, James Gatlin, Martti Hallikainen (**VP**), Mikio Takagi, James Tilton, David Goodenough (**P**).

JANUARY 1995 — 1995: Albin Gasiewski, Nahid Khazenie, Charles Luther, Kiyo Tomiyasu, JoBea Way Holt; **1996:** J. Curlander, James Gatlin, Martti Hallikainen (**VP**), Mikio Takagi, James Tilton, David Goodenough (**PP**); **1997:** Andrew Blanchard (**P**), Michael Hardesty, Ram Narayanan, Vincent Salomonson, Werner Wiesbeck.

JANUARY 1996 — 1996: James Gatlin, Martti Hallikainen (**P**), Eni Njoku, Mikio Takagi, James Tilton, David Goodenough (**PP**); **1997:** Michael Hardesty, Ram Narayanan, Vincent Salomonson, Alois Sieber, Werner Wiesbeck; **1998:** Albin Gasiewski, Tom Jackson, Nahid Khazenie (**EVP**), Charles Luther, Kiyo Tomiyasu, Andrew Blanchard (**PP**).

JANUARY 1997 — 1997: Michael Hardesty, Ram Narayanan, Vincent Salomonson, Alois Sieber, Werner Wiesbeck; **1998:** Albin Gasiewski, Tom Jackson, Nahid Khazenie (**EVP**), Charles Luther, Kiyo Tomiyasu, Andrew Blanchard (**PP**); **1999:** James Gatlin, David Goodenough, Martti Hallikainen (**P**), Eni Njoku, Karen St. Germain.

JANUARY 1998 — 1998: Albin Gasiewski, Tom Jackson, Nahid Khazenie (**P**), Charles Luther, Kiyo Tomiyasu, Andrew Blanchard (**PP**); **1999:** Melba Crawford, James Gatlin, David Goodenough, Eni Njoku, Karen St. Germain; **2000:** Ram Narayanan, Kamal Sarabandi, Haruhisa Shimoda, Vern Singhroy, Werner Wiesbeck (**EVP**), Martti Hallikainen (**PP**).

JANUARY 1999 — 1999: Melba Crawford, James Gatlin, David Goodenough, Eni Njoku, Karen St. Germain; **2000:** Ram Narayanan, Kamal Sarabandi, Haruhisa Shimoda, Vern Singhroy, Werner Wiesbeck (**EVP**), Martti Hallikainen (**PP**); **2001:** Andrew Blanchard, Albin Gasiewski, Tom Jackson, Nahid Khazenie (**P**), Charles Luther.

JANUARY 2000 — 2000: Ram Narayanan, Kamal Sarabandi, Haruhisa Shimoda, Vern Singhroy, Werner Wiesbeck (**P**), Martti Hallikainen (**PP**); **2001:** Andrew Blanchard, Albin Gasiewski, Tom Jackson, Charles Luther (**EVP**), Alberto Moreira; **2002:** Jon Atli Benediktsson, Melba Crawford, David Goodenough, Karen St. Germain, David Weissman, Nahid Khazenie (**PP**).

JANUARY 2001 — 2001: Andrew Blanchard, Albin Gasiewski, Tom Jackson, Charles Luther (**EVP**), Alberto Moreira; **2002:** Jon Atli Benediktsson, Melba Crawford, David Goodenough, Karen St. Germain, David Weissman, Nahid Khazenie (**PP**); **2003:** William Emery, Martti Hallikainen, Verne Kaupp, Kamal Sarabandi, Werner Wiesbeck (**P**).

JANUARY 2002 — 2002: Jon Atli Benediktsson, Melba Crawford, David Goodenough, Karen St. Germain, David Weissman, Nahid Khazenie (**PP**); 2003: William Emery, Martti Hallikainen, Verne Kaupp, Kamal Sarabandi, Leung Tsang; 2004: Andrew Blanchard, Albin Gasiewski (**EVP**), Tom Jackson, Charles Luther (**P**), Anthony Milne, Nahid Khazenie, Werner Wiesbeck (**PP**).

JANUARY 2003 — 2003: William Emery, Martti Hallikainen, Verne Kaupp, Granville Paules, Kamal Sarabandi, Leung Tsang; **2004:** Andrew Blanchard, Albin Gasiewski (**EVP**), Tom Jackson, Charles Luther (**P**), Anthony Milne, David Weissman, Werner Wiesbeck (**PP**); **2005:** Melba Crawford, William Gail, David Goodenough, Steven Reising, Karen St. Germain, Paul Smits.

JANUARY 2004 — 2004: Andrew Blanchard, Albin Gasiewski (**P**), Tom Jackson, Anthony Milne, Granville Paules, David Weissman, Werner Wiesbeck (**PP**); **2005:** Melba Crawford, William Gail, David Goodenough, Steven Reising, Karen St. Germain, Paul Smits; **2006:** Martti Hallikainen, Ellsworth LeDrew, David LeVine, Alberto Moreira, Kamal Sarabandi, Leung Tsang (**EVP**), Charles Luther (**PP**).

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