Verner E. Suomi
1916–1995

A Man for All Seasons

The photo to the right shows Professor Verner E. Suomi (second from right) and colleagues reviewing the instrumentation for a 1950s experiment that measured the heat budget of an Iowa corn field.

Editor's Remarks

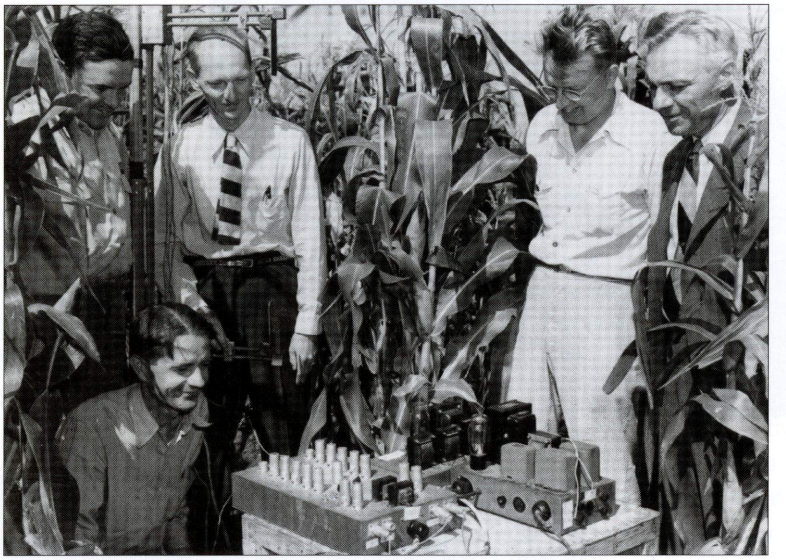
Contents of this memorial volume to Verner E. Suomi were compiled from records at the Space Science and Engineering Center, where Professor Suomi was based for most of his 40-year professional life. We have included his publications, committee work and honors he received. We have also excerpted tributes from colleagues at the University of Wisconsin–Madison. And we have included archived photos which help to document Professor Suomi's career visually.

The centerpiece of this publication is "Suomi's Creative Impact," by SSEC technical editor Russell Hall. This piece highlights Professor Suomi's ideas which, when implemented, have revolutionized weather forecasting and research.

The cover photo was taken of Professor Suomi by Michael Kienitz in 1994. Professor Suomi is holding the prototype instrument he invented and patented to measure the ocean–atmosphere heat flux.

Robert J. Fox, Terri Gregory,
Russell Hall, Jean Phillips, Tony Wendricks;
Space Science and Engineering Center Editorial Committee

Verner E. Suomi
1915–1995



Always One Step Ahead
A Man for All Seasons

Father of weather satellites – Imager of planets – Idea man

Professor of Atmospheric and Oceanic Sciences, of Soil Science,
of the Institute for Environmental Studies, of the University of Wisconsin–Madison

Founding director, Space Science and Engineering Center and
the Cooperative Institute for Meteorological Satellite Studies

International collaborator in global weather experiments

Favorite undergraduate meteorology professor – Creator of useful products for mankind

Heat budget student, from corn field to space

Invented spin-scan camera, to watch the weather move across the face of the Earth

Originated McIDAS to "drink from a fire hydrant" of satellite data

Zealous advocate for nonsmoking – Much honored colleague

Husband to Paula, father to Lois, Stephen and Eric – Friend in deed

A rare mind – Zestful enthusiasm

Determined, with wit, charm, class and style

Professor Verner E. Suomi (second from left) views early photos from the ATS (Applications Technology Satellite) with Professor Robert Parent (far left) and three University and NASA colleagues.

SSEC's Pioneer Venus crew surrounds Professor Suomi and a model of the Net Flux Radiometer, which measured heat flux in Venus' atmosphere in 1978. Left to right: back row, Gene Buchholtz, Bob Herbsleb, Wanda Lerum, Jerry Sitzman and Hank Revercomb; front row, Ralph Dedecker, Verner Suomi, Larry Sromovsky and Bob Sutton. Not shown: Evan Richards, Doyle Ford, and Tony Wendricks.

For a Mentor

Even now, two and a half years after his passing, it seems like only yesterday that Verner was looking over my shoulder, encouraging me to do something that seemed impossible to me but eminently feasible to him. At moments like this, when I try to write something about him, I always come back to the two qualities that made him truly exceptional to me:

- His unbridled optimism that we could do anything that we set our minds to. And it was *always* "we;" I very rarely heard him use the word "I." He absolutely excelled in enlisting people into his cause and making them feel like integral parts of the team. Indeed, most of us got so totally involved that after a while it was "our" plan or program, even though it sprang from his idea and *his* motivation of *us*.

- His enthusiasm for science, for life, for everything that he touched, along with the desire to share that enthusiasm with others. Verner had a most practical understanding of everything scientific, plugged into an incredibly original theoretical model of his universe. His greatest accomplishment was not a scientific achievement, but was his perceptive ability to immediately discern the comprehension level of people and to interact with them at that level in a manner in which true communication was achieved. (This, incidentally, led him to start most of his conversations with me with F=ma.)

After 40 years of association with him, never a day yet passes that I'm not involved in something that bears his imprint. He derived tremendous satisfaction from coaxing people into achieving a new "personal best," doing things that they themselves didn't know they could do. The legacy of Verner Suomi is that he made science exciting, and made you excited to be participating in it with him.

Robert J. Fox, Executive Director,
Space Science and Engineering Center

Tributes

Verner Suomi was a giant of modern science. His inventions were simple and elegant, and their consequences are ubiquitous. Anyone looking at a satellite image of the Earth on the evening weather is looking at the product of a rare mind.

John D. Wiley, Provost, University of Wisconsin–Madison

Even at the height of the Cold War, the nations of the world were collaborating on the Global Weather Experiment, a multiyear program designed to enhance substantially mankind's ability to predict the weather. As I joined in the planning for this bold undertaking, Vern's vision and straightforward enthusiasm were an inspiration, not only for younger scientists such as myself, but also for government officials and diplomats everywhere as they sought peaceful, yet productive, contacts between hostile ideologies. As he remarked at the press briefing introducing the experiment, "Certainly such undertakings cost money, but still less than a hamburger and french fries for every citizen of the United States."

Francis Bretherton, Director, Space Science and Engineering Center; Professor, Departmentof Atmospheric and Oceanic Sciences; University of Wisconsin–Madison

Verner Suomi's accomplishments bore unique signatures of imaginative genius, bold simplicity, unlimited enthusiasm and will to succeed. These skills, together with the mid-century ascent of technology and maturation of meteorology as a science, made for the era of Suomi's success. Suomi was sometimes characterized as a theoretician without equations, who had a way of creating many dreams and making some of them come true. He always admitted that only a few succeeded, but he invited debate, accepted changes, and let others worry about the final details. . . .

. . . [He] loved classroom teaching of undergraduates, and many considered his classes unforgettable. He asked students for curiosity, common sense, and positive attitudes. In return they got spirited explanations of complex phenomena and simple ideas for applications. Ultimately, his ways of thinking took precedence over detailed content. His teaching was no product of fixed procedures; it was an unrepeatable process that was a window into a mind in constant motion. By his example, students learned to inquire more boldly and effectively. . . .

Compilation

Verner Suomi's colleagues on the campus of the University of Wisconsin-Madison contributed these words, with one exception. Some are excerpted from longer pieces written as memorials to Professor Suomi. Some were written specifically for this volume. Those from staff of the Space Science and Engineering Center were written shortly after Professor Suomi died.

These reminiscences and reactions include those from:

- *Officials and faculty of the University of Wisconsin–Madison*
- *The Suomis' pastor*
- *Staff of the SSEC, which Professor Suomi founded and directed for thirty years*

All the statements describe in some fashion the impact of Professor Suomi's personality.

Professor Suomi and Herman La Gow inspect the spinning, polar-orbiting satellite on which the flat plate radiometer flew.

Verner Suomi's instincts to think big and act boldly made him influential in planning major scientific initiatives. They typically involved satellite observations and numerical prediction models developed by others, a marriage of the real world and theory which he deeply appreciated. These projects led to the maturation of global atmospheric science and its coupling with the oceans. . . .

Memorial Resolution of the University of Wisconsin–Madison Faculty, John A. Young, Donald R. Johnson, William L. Smith, Department of Atmospheric and Oceanic Sciences

Approximately one week before Professor Suomi passed away, I visited him in the hospital, [where] he made a special request, . . . [that] each of you were to be personally thanked for making his life so enjoyable and fruitful. . . .

In the 60s, while in [University of Wisconsin's] Science Hall and the days of faculty personally advising undergraduates, one young man reported to Verner Suomi that he was unable to enroll, since he did not have enough money to pay tuition. Without hesitation Professor Suomi offered moneys for his tuition. This young student later finished his undergraduate degree. . . .

Those of us who were privileged to visit with him in the hospital benefited from observing Verner as he approached death as a natural step within the process of life. As in his science with a pragmatic aim of benefiting mankind and being straight to the point, his spiritual desires were pragmatic and straight to the point. In knowing that he would enjoy only a few more days on this earth, his parting remarks on that Tuesday of the last week were to call attention to his prayer. [It is a] childhood prayer known to many of us:

Now I lay me down to sleep,
I pray the Lord my soul to keep,
If I should die before I wake,
I pray the Lord my soul to take. . . .

Donald R. Johnson, Director, Division of Earth Sciences, Universities Space Research Association; Associate Director, SSEC

As the Father of Satellite Meteorology, the innovator of the world's geostationary satellite weather surveillance system, Vern made many professional contributions that will truly benefit all of mankind for many generations to come. . . .

. . . He was a professional father, of a large community of younger scientists and former students. I have been truly amazed at the number of scientific colleagues with whom I talked in two weeks who told me what a tremendous inspirational force Vern was on their professional career. Having him as a thesis advisor was enough to land you a good job!

William L. Smith, Chief, Atmospheric Sciences Division,
NASA Langley Research Center;
Associate Director, SSEC

Professor Suomi invented numerous satellite instruments, leading to a better understanding of the earth-atmosphere system and its global circulations. From conducting the first American meteorological experiment ever from a satellite, to investigating the planets with space probes, to inventing the geostationary spin-scan camera, he recorded an extraordinary number of scientific achievements. . . . Two stories illustrate the Suomi legend.

Last month I was visiting with a scientist who worked on the Meteosat [European meteorological satellite]. He recalled his first meeting with Suomi. It came in the middle of the night as the first Meteosat water vapor image was recorded; Suomi was visiting and was there as the image was rectified and displayed. His excitement at seeing the atmosphere displayed in this unique way was infectious. Verner proceeded to explain the many new aspects of the atmosphere that were immediately obvious to him. More than twenty years later, this experience remains a highlight of this French scientist's life.

As I was finishing my doctorate in physics, Professor Suomi showed interest in hiring me for a position in his research center. After a brief introduction, he asked if I knew any meteorology. When I sheepishly responded that I did not, he enthusiastically welcomed me to his team remarking that he preferred that I didn't have any preconceived notions. I became another of Suomi's science disciples. He was always teaching as well as learning. He loved his work and his people. Those who had

Honors

1961 Meisinger Award, for aerological research achievements, by the American Meteorological Society (AMS)
1965 Foreign Member, Finnish Academy of Sciences
1966 Member, National Academy of Engineering, U.S.
1968 Carl-Gustaf Rossby Award, AMS
1970 Foreign Member, Deutsch Akademie der Naturforscher, Germany
1971 Robert M. Losey Award, in recognition of outstanding contributions to the science of meteorology as applied to aeronautics and for his creativity and ingenuity in designing advanced meteorological sensors for satellite applications as exemplified by his spin-scan camera which has made it possible to view the earth's atmosphere as an entity, American Institute of Aeronautics and Astronautics
1975 Foreign Member, International Academy of Astronautics, France
1976 Elected Member, American Philosophical Society
1977 Elected Fellow, Academy of Arts and Sciences
1977 Harry Wexler Professorship of Meteorology, University of Wisconsin-Madison
1977 National Medal of Science, National Science Foundation
1980 Charles Franklin Brooks Award, for his many contributions of wisdom and leadership, both formal and informal, but especially as Councilor and President of the American Meteorological Society, AMS
1980 Exceptional Scientific Achievement Medal for his outstanding accomplishments and contributions to the Pioneer Venus Project, NASA
1980 William T. Pecora Award, for outstanding application of remote sensing of the atmosphere, Society of Exploration Geophysicists

1980 Honorary Membership, Wisconsin Academy of Science, Arts, and Letters
1983 Honorary Degree of Doctor of Science for his major role in ushering in a new age of global weather observations State University of New York–Albany
1984 Franklin Medal for contributions and leadership in the broad field of atmospheric research. For his pioneering vision, research, and leadership in the development of satellite meteorology and for development of the spin-scan camera which has revolutionized weather observation. Franklin Institute, Philadelphia, Pennsylvania
1984 Wisconsin Alumni Research Foundation Senior Distinguished Research Professor, UW-Madison
1985 Commemorative medal for his contributions to international programs in geophysics, Soviet Geophysical Committee
1985 Silver medallion for outstanding pioneering contributions critical to the development of U.S. civil operational satellite systems and services, National Oceanic and Atmospheric Administration, U.S.
1985 Listed in *American Men & Women of Science*
1986 Phi Kappa Phi National Scholar
1986 Listed in *Who's Who in America*
1988 Honorary Member, AMS
1988 Nevada Medal (first recipient), Desert Research Institute
1990 Walter Ahlström Prize (first recipient) for his pioneering work in space-based remote sensing of the global environment, The Walter Ahlström Foundation, Finland
1992 Honorary Member, American Association for the Advancement of Science
1993 38th International Meteorological Organization Prize for pioneering contributions as father of weather satellites, establishing the field of satellite meteorology, World Meteorological Organization

the privilege of working with him remember his lessons, not just about meteorology, but also about life.

W. Paul Menzel, Science Director, Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin–Madison; Team Leader, Advanced Satellite Products Team, National Environmental Satellite Data and Information Service, National Oceanic and Atmospheric Administration

In the spring of 1948 I had been talking to the Dean of Letters and Science for some time about bringing Verner Suomi to the University. There was considerable support from the College of Agriculture, especially after he had visited and demonstrated the kind of instrumentation he was developing, and its application to agricultural meteorology.

When in mid-spring I suggested to the Dean that in order for atmospheric science to develop there should be a separate Department of Meteorology at Wisconsin, Dean Ingraham said, in essence, "Okay, you are it effective July first." There had been reluctance on the part of the Geography Department's chairman to add more staff in meteorology. I then asked whether I could recruit Suomi. I was pleasantly surprised when he said yes.

When I contacted Verner, he had also been contacted with a job offer from Iowa State. Verner consulted a friend who had worked there who told him that when he lived in Iowa he went to Wisconsin for his vacation. So Suomi accepted our offer.

On the 15th of July I drove to Chicago to bring the Suomi family to Wisconsin. The sun was shining in Wisconsin, but rain began at the Illinois line, and was heavy by the time I got to Chicago. After we had loaded and were leaving Chicago, Paula Suomi said, "What a miserable day to be moving!" I replied that she shouldn't fret because the sun shone in Wisconsin. As we crossed the border the sun appeared and the rain stopped. Both Paula and Verner said, near the time of Verner's death, that they remembered that day and that the sun had continued to shine for them all their time in Madison.

On the 100th birthday of the state and of the university, the present Department of Atmospheric and Oceanic Sciences was born—as a department of Meteorology. Now on the sesquicentennial of the state the

Department will celebrate its Golden Anniversary. To me it is also the fiftieth anniversary of a close friendship and collaboration.

Reid A. Bryson, Emeritus Professor, Departments of Geography, and Atmospheric and Oceanic Sciences, and the Institute for Environmental Studies; Senior Scientist, Center forClimatic Research, University of Wisconsin–Madison

Verner Suomi delighted in, as he said, "dabbling around in the wonders of creation." He attributed his gifts as a scientist to God, who he revered and trusted. He had a simple and profound faith in God which gave him the freedom to seek truth with both scientific methodology and a good sense of awe. His goal was to encourage his students to do the same. He lived what he believed.

The Reverend Harvey S. Peters, Senior Pastor, Luther Memorial Church

From staff of the Space Science and Engineering Center

In spite of the fact that he was world renowned, he still took the time to know us all by name and would always have time for a friendly and personal greeting. He treated us all as valued and competent contributors to the center, and in doing so he was able to inspire and motivate us to do just a little bit extra. It is surely this quality in him which made the Space Science and Engineering Center grow to such world prominence.

David E. Jones, Electronics Technician 6

Vern was a pioneer in developing meteorological satellite technology, and was often referred to as the "father of weather satellites." He was my advisor and mentor, and while his innovation and technological creativity was unsurpassed, and will be dearly missed, his inspiration will live on here at UW.

His philosophy was best summed up by the phrase:
"Don't just ask 'why,' ask 'why not?'"

Christopher S. Velden, Researcher

Professor Suomi, center, receives the 38th annual IMO prize from World Meteorological Organization President, Zou Jingmeng (left), and WMO Secretary-General, G.O.P Obasi.

Coming to work for Professor Suomi was the best thing that has happened in my professional life. He encouraged me to publish and to get a Ph.D., and he gave me the opportunity to manage his 4-D graphics project. He cared deeply about the people who worked for him and his strength lifted us all up.

William L. Hibbard, Associate Scientist

Thank you Vern, "Spasibo, Suomi," to misquote a mentor, a friend, and a provocateur. (Vern, as only he could, used the phrase "Spasibo, Sputnik" in his address to the Soviet Space Forum in Moscow on the 30th anniversary of Sputnik in 1987, to say "thank you very much, Sputnik.")

... You have had a very positive impact on my life. The blend of objectivity and chaotic irrationality is enigmatic, but the undiluted dedication to understanding nature (and people, and fun, and exploration, and ego, and obfuscation, at times) is clearly unique. You have set an example, not perfect and God-like, but flawed and yet superhuman–unmatchable.

You engendered the super energy and power that can be unleashed by genuinely inspired interest in solving important problems for mankind (and the challenge of it).

Henry E. Revercomb, Senior Scientist

Pierre Morel, co-organizer of the World Weather Experiment, joined Professor Suomi at the ceremony honoring him as the 38th recipient of the World Meteorological Organization's IMO prize. Festivities were held in Madison, WI, on 13 May 1994.

I will miss the friendly hello and the small pat on the back when a job was well done. I even received a hug on special occasions when he was excited about a project that neared completion and others thought it couldn't be done. ...

I have a feeling that from now on it won't surprise me if I feel a light pat on my back when I do a good job and when I turn around, there won't be anyone there.

Gene M. Buchholtz, retired Electronics Technician 6

I believe that Dr. Suomi's greatest asset was his ability to communicate. He could put complex ideas and feelings into a few effective words .... Some examples: 1) He said that the amount of money you receive from a research proposal is inversely proportional to the weight of the proposal,

and he proved it. 2) When he hired me, he told me my job would be to keep him out of jail and financially solvent, *in that order!* 3) The universal forces of nature, according to Dr. Suomi, were defined as Gravity and Greed. He said, if you were fighting either one, you were in big trouble. (And he chose to be a satellite guy and built a house with a flat roof? I guess he enjoyed a little trouble.)

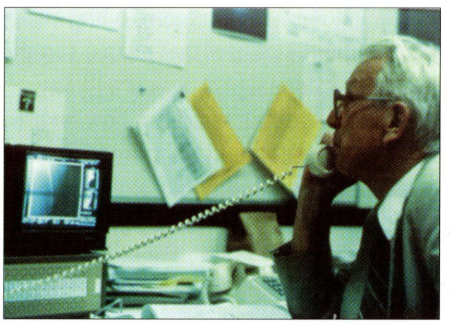
John P. Roberts, Assistant Director

During ingest of the first GOES-8 images here at SSEC (the first and only place to get them, I think), … I ran off to my office's Sun McIDAS-X UNIX workstation to display the first image.

Shortly after getting an image, folks from all over the building started to pour in, … and yes, Professor Suomi showed up. He sat down, and started giving me instructions to show him portions of the image. …

It was an experience I'll never forget—I was showing the man who developed the technology for doing geostationary satellite imagery this! He had me redisplay the images over key points to see how clear the key points were. Afterwards, he got up and commented that this satellite cost more than all of the other satellites built before it. He then thanked me and left.

Matthew A. Lazzara, Research Specialist



During a telephone interview at the Jet Propulsion Laboratory, Professor Suomi views a picture of Neptune sent to Earth by Voyager 2 in August 1989. The picture shows the first cloud shadows on any planet besides Earth; it led to an understanding of Neptune's circulation.

Suomi's Creative Impact

Vital Statistics

Born, 6 December 1915
Died, 30 July 1995
Married Paula Meyer, 1941
Father of Lois, Steven, and Eric

B.S., 1938, Winona Teachers' College, Winona, MN
Hired by Department of Meteorology, University of Wisconsin–Madison (UW–Madison), 1948
Ph.D., 1953, University of Chicago
Chair, Department of Meteorology, UW–Madison, 1950–52, 1954–57
Associate Program Director for Atmospheric Sciences, National Science Foundation, 1962
Chief Scientist, U.S. Weather Bureau, 1964
Founded SSEC, 1965
Began GARP with Jules Charney and Pierre Morel, 1970s
Brought to SSEC a group of researchers from the National Oceanic and Atmospheric Administration (NOAA), 1977
Founded jointly with NOAA, the Cooperative Institute for Meteorological Satellite Studies at SSEC, 1980

Developed flat plate radiometer to measure Earth's heat balance, late 1950s
First meteorological experiment on Explorer VII, 1959
Conceived spin-scan camera technology for geostationary orbit, 1963
Proposed a Visible Infrared Spin-Scan Radiometer Atmospheric Sounder, 1971
Directed development of McIDAS, 1970s
Member, Venus/Mercury Imaging Science Team, 1973
Member, Mariner/Jupiter/Saturn Imaging Science Team
Member, Pioneer Venus Science Steering Group and directed Net Flux Radiometer development, late 1970s
Advised on use of GPS for meteorology, 1990s

"You've certainly gotten a lot of mileage out of freshman physics." According to Dr. Verner Suomi, this was a comment he heard more than once over the course of his career and he was proud of it. Using a unique combination of determination, hard work, inspiration, and those freshman physics, Suomi became known as the "father of satellite meteorology." His research and inventions have radically improved forecasting and our understanding of global weather.

Verner Suomi didn't set out to invent satellite meteorology. In fact, he described his education as "a mess." Growing up in Minnesota, he wanted to be an engineer. But with finances limiting his choices for higher education, he wound up at a teacher's college. After teaching high school science for several years, he enrolled in a Civil Air Patrol course at the start of World War II. There, he got his first exposure to the new field of meteorology.

This new love led him to the University of Chicago, where he continued his meteorology studies and trained air cadets in basic forecasting. By 1948 he was one of the first faculty members in the Department of Meteorology at the University of Wisconsin in Madison, an institution at which he would spend most of the rest of his professional life.

Suomi received his Ph.D. from the University of Chicago in 1953. For his doctoral thesis, he measured the heat budget of a corn field, a subject that Suomi himself admitted was none too glamorous. But measuring the difference between the amount of energy absorbed and the amount of energy lost in a corn field led him to thinking about Earth's heat budget. The obvious way to measure such a thing was to use satellites, which, by the mid-1950s, were emerging as a meteorological tool. "When I first began my work with meteorological satellites, no one in the Department of Meteorology seemed particularly interested; but they didn't try to impede progress in the field for which I'm forever thankful."

By 1959 Suomi's flat plate radiometer was in orbit. Using both satellite observations of the Earth's heat balance and atmospheric cooling rates measured by net flux radiometersondes on weather balloons, Suomi established the important role played by clouds in absorbing radiated

solar energy. These studies set the stage for the full-scale integration of satellites into the field of meteorology.

Suomi and Robert Parent, a professor in electrical engineering, started the Space Science and Engineering Center (SSEC) in 1965 with funding from NASA and the National Science Foundation. SSEC was to become a hotbed of invention and research, and it was where Suomi's most important and lasting innovation, the spin-scan camera, was born.

As early as 1963 Suomi had understood the benefits that could be gained by observing a single weather phenomenon at frequent intervals. But these kind of observations just weren't possible using the existing, low polar-orbiting satellites. Then he read about NASA's new geostationary Advanced Technology Satellite (ATS); 22,000 miles out in space, this satellite would move in an orbit above the equator at the same speed as the Earth spins. For Suomi the spin-scan idea was suddenly simple: "the weather moves, not the satellite."

This "gadget," as Suomi affectionately called all his inventions, allowed scientists to observe weather systems as they developed instead of glimpsing small bits at odd intervals. Satellite sensing technology was suddenly transformed from the production of interesting snapshots into the gathering of meaningful, quantitative data. It is no exaggeration to say that this invention revolutionized satellite meteorology. The weather satellite images that the public around the world sees on the evening news and relies on to protect them from natural disasters are a direct result of Suomi's invention.

Suomi and Parent saw their spin-scan camera launched on ATS-1 in 1966. Mounted aboard the spin-stabilized satellite, the camera scanned a small strip of the Earth with each rotation. By tilting the camera slightly for the next rotation, an image of Earth could be created in less than 30 minutes.

Now it was possible to measure and track air motion, cloud heights, rainfall, even pollution and natural disasters. This technology soon became an operational necessity. It helped to improve the accuracy of forecasting and has saved many thousands of lives over the years. While the original spin-scan design is no longer in use in the United States,

Committees

The committees on which Professor Suomi served are listed alphabetically by organization. Where the parent organization is known, it is given first in bold. Years in which Professor Suomi served are given where known. Unless otherwise mentioned, committees are based in the United States. This list is not comprehensive. "Committee" is abbreviated.

American Academy of Arts and Sciences
Council Nominating Comm., 1982–1984

American Meteorological Society
President, 1967
Planning Commission, 1981–1985
Education and Manpower Commission, Ad Hoc Comm., 1985

Committee On Space Research
Working Group VI, Panel A on Weather and Climate, 1973–1974

Global Atmospheric Research Program
U.S. Committee for the Global Atmospheric Research Program, Joint Organizing Comm., Chair, 1969–?

Joint Scientific Committee
Comm. on Climatic Changes and the Ocean, Working Group on Satellite Observing Systems for Climate Research

National Academy of Sciences
Interdepartmental Comm. on Atmospheric Sciences (ICAS), Select Panel on Weather Modification, 1965–?
Geophysics Film Committee, 1981–1984
Comm. on Science Engineering and Public Policy (COSEPUP), Research Briefing Panel on Atmospheric Sciences, 1982–?

National Advisory Committee on Ocean Atmosphere
Chair, 1971

National Aeronautics and Space Administration
Science and Mission Requirements Working Group for System Z, 1983(?)–?

Earth Observing System Science Steering Comm., 1984(?)–?
NASA/University Relations in Space Science Study Group, 1984
Space and Earth Sciences Advisory Comm., Task Force on the Scientific Uses of Space Station, 1984-1985

National Center for Atmospheric Research
Chair, Panel on Scientific Use of Balloons, 1961–1964

National Oceanic and Atmospheric Administration
Joint U.S./People's Republic of China Working Group on the Atmospheric Protocol, 1979–1981

National Research Council
Geophysical Research Forum
Board on Atmospheric Sciences and Climate (BASC), NOAA Review Panel
Commission on Physical Sciences, Mathematics and Resources, BASC, Panel on Climate-Related Data, 1982–1985
Space Applications Board, Comm. on Practical Applications of Remote Sensing from Space, 1983–1984

National Science Foundation
Advisory Panel on Weather Modification, 1959–1964

University Corporation for Atmospheric Research
Mesoscale Steering Comm., National STORM Program, 1981
Board of Trustees, 1982–1985
Board of Trustees Budget and Program Comm., 1986
Board of Trustees Executive Comm., Member-at-Large, 1986
UNIDATA Steering Committee
UNIDATA, Local Hardware-Software System (LOHSS) Working Group, 1985–?

University of Alaska
Geophysical Institute, Advisory Board, 1984–1986

University of Wisconsin–Madison
Library Comm., 1964–1966 (Chair, 1966)
Dept. of Meteorology, Curriculum Comm., 1966–1970

World Meteorological Organization
JSC/CCCO Working Group on Satellite Observing Systems, 1987(?)–?

Suomi's basic concept has been adopted for many satellites and space probes. These were built for NASA and the National Oceanic and Atmospheric Administration, as well as the European Space Agency and the Japanese Meteorological Agency.

By 1967 the spin-scan pictures were in color and by 1971 work had begun on an instrument that would profile the atmosphere's temperature and water vapor from geostationary satellites. The Visible-Infrared Spin-Scan Radiometric Atmospheric Sounder (VAS) was a modification of the original spin-scan design with additional detectors for the proper spectral bands. By observing temperature and moisture structures, Suomi hoped to improve the prediction of severe weather.

When the VAS was finally launched in 1980 aboard the GOES-4 satellite, it performed with the accuracy Suomi had predicted in his original 1971 proposal. The geostationary sounder remains the only instrument able to observe severe storms over regions of hundreds of thousands of square miles. Suomi's work proved both the need for sounders and their feasibility. This technology is continued today with the GOES-8, -9 and -10 sounder instruments.

With the advent of these new tools, the flow of meteorological data quickly became an overwhelming flood. Experiments conducted under the Global Atmospheric Research Program (GARP) added to the already vast amount of data. To make sense of all this, or as he put it, to try "to get a drink from a fire hydrant," Suomi became the driving force behind the development of a computer system that could gather and handle the vast amount of imagery and data.

The Man-computer Interactive Data Access System (McIDAS), like so many of his ideas, just popped into his head. As he watched a football game on television, he realized that what he really wanted was an "instant replay of weather pictures." He wanted to slow them down, replay them, and have a computer analyze them. With this simple concept, he went to SSEC's engineers and programmers. In 1972 Suomi introduced McIDAS.

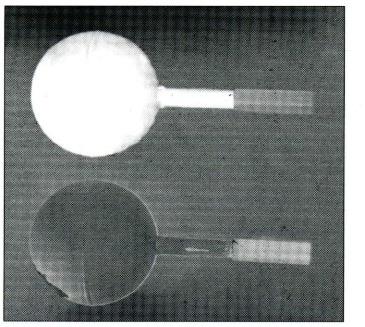
McIDAS proved invaluable in analyzing wind data collected during the First GARP Global Experiment (FGGE) in 1978. Instrumental in

planning the experiment's objectives and processes, Suomi came up with the idea of using observed cloud movement to determine wind speed and direction, especially over the tropics. McIDAS is in use today by the National Storm Prediction Center, the National Weather Service, the National Transportation Safety Board, NASA Goddard Space Flight Center, and many other government agencies and private companies, including meteorological centers in Spain, Australia and Japan.

Dr. Suomi's interest in satellite meteorology wasn't confined to Earth. After developing ways to measure Earth's atmospheric circulation, it seemed a natural extension to apply this technology to space probes. He was involved in the exploration of Venus, Jupiter, Saturn, and Uranus. Dr. Suomi and other scientists at SSEC designed and built net flux radiometers and other instruments that were used aboard the Pioneer probe to Venus in 1978 and on other probes.

While Dr. Suomi was indeed "a giant of modern science," as UW–Madison Provost John Wiley described him, he never let his intellect stand in the way of communicating clearly. He was first and foremost a teacher, able to explain difficult concepts clearly and without condescension. The list of his former students reads like a "Who's Who" of the younger generation of meteorologists. His enthusiasm and encouragement may yet have a far greater impact than his monumental achievements.

Russell Hall, Editor, SSEC



The difference in temperature between the two balls is a measure of the radiation absorbed by Earth's atmosphere. This simple meteorological experiment was the first to fly on any satellite. Knowledge received from it is basic to an understanding of the Earth's heat budget.

Publications

Copies of publications can be obtained from The Schwerdtfeger Library, 1225 W. Dayton St., Madison, WI 53706 or via e-mail: jean.phillips@ssec.wisc.edu. Works on which Professor Suomi appears as first author are listed first. This is a comprehensive list of Verner Suomi's publications, with these exceptions: It does not include final reports upon which are based articles in juried publications (such as the Bulletin of the American Meteorological Society*). Nor does it include reports in which Professor Suomi is listed only as principal investigator. Most proposals are also omitted.*

To present as many publications as possible, we took slight liberties with AMS style, such as the following: Organizations, such as the National Aeronautics and Space Administration or the Space Science and Engineering Center, are abbreviated—NASA or SSEC—including in titles. We also eliminated spaces between initials—V. E. becomes V.E.

To obtain a complete list, without these innovations and in a larger type size, please write Terri Gregory, SSEC, 1225 W. Dayton St., Madison, WI 53706, or e-mail terri.gregory@ssec.wisc.edu.

Suomi, V.E., n.d.: ATS-I Spin Scan Cloud Camera Experiment in Japan [16 mm film, b/w]. Meteorological Research Institute of Japan and the Radio Research Laboratory of Japan, 5 min.

—N.d.: Detailed views of mesoscale cloud patterns filmed from ATS-I [16 mm film, silent, color]. T.T. Fujita, and W.A. Bohan, producers. National Aeronautics and Space Administration (NASA) and Environmental Science Services Administration (ESSA), 9 min.

—N.d.: The radiation balance of the Earth from a satellite. [NSF USNC IGY Project 30.11].

—1953: The heat budget over a cornfield. Ph.D. thesis, University of Chicago.

—1956: Energy budget studies at the earth's surface and development of the sonic anemometer for power spectrum analysis. Department of Meteorology, UW–Madison, various paging.

—1957: Double-psychrometer lift apparatus: UW. *Exploring the atmosphere's first mile, Vol. 1.* Pergamon Press, 183-187.

—1957: Heat storage variations: UW. *Exploring the atmosphere's first mile, Vol. 1.* Pergamon Press, 79-80.

—1957: Radiation measurements. *Exploring the atmosphere's first mile, Vol. 1.* Pergamon Press, 81-82.

—1957: Soil temperature integrators: UW. *Exploring the atmosphere's first mile, Vol. 1.* Pergamon Press, 24.

—1957: Sonic anemometer: UW. *Exploring the atmosphere's first mile, Vol. 1.* Pergamon Press, 256-266.

—1957: UW net radiometer. *Exploring the atmosphere's first mile, Vol. 1.* Pergamon Press, 95-98.

—1961: Differential cooling from satellite observations. *Proceedings of the International Meteorological Satellite Workshop,* Washington, DC, NASA and US Dept. of Commerce, Weather Bureau.

—1962: Observing the atmosphere–a challenge. *Proc. of the IRE*, **50,** 11, November, 2192-2197.

—1966: Letter to Sigmund Fritz, Director of Meteorological Satellite Laboratory, National Environmental Satellite Center, ESSA. Madison, WI.

—1966: A proposal to ESSA, Dept. of Commerce for continuation of studies in atmospheric energetics based on aerospace probings: January 1, 1966–December 31, 1968. Weather Bureau—ESSA proposals. Dept. of Meteorology, UW–Madison, 15 pp.

—1968: Letter to John E. Naugle, NASA. Madison, WI (SSEC).

—1968: Proposal to NASA for a comprehensive research program in space applications for meteorology using satellites. NASA science proposals. SSEC, UW–Madison, 10 pp.

—1969: Recent developments in satellite techniques for observing and sensing the atmosphere. *The Global Circulation of the Atmosphere.* Royal Meteorological Society, 222-234.

—1971: Meteorological instrumentation. *Encyclopedia of Science and Technology.* McGraw-Hill.

—1972: The acquisition of meteorological data. *Meteorological Challenges: A History.* Information Canada, 159-177.

—1973: Constant level balloon sub-system for the southern hemisphere. SSEC, UW–Madison, Madison, WI.

—1975: Atmospheric research for the nation's energy program. *Bull. Amer. Meteor. Soc.,* **56,** 10, October, 1060-1068.

—1975: Cloud motions on Venus. *Conference on The Atmosphere of Venus.* New York, NY, National Aeronautic and Space Administration, 42-58.

—1975: GARP: Dreams into realities. *Review of Space Science Astronautics and Aeronautics,* October, 14-16, 76.

—1975: Man-computer Interactive Data Access System (McIDAS): Continued development of McIDAS and operation in the GARP Atlantic Tropical Experiment. Final report Contract NAS5-23296 for period August 1973 to December 1974. SSEC, UW–Madison.

—1975: A proposed radiation parameterization scheme for climate models. The physical basis of climate and climate modelling: *Report of the International Conference in Stockholm,* Geneva, World Meteorological Organization (WMO), Global Atmospheric Research Programme (GARP), 181-182.

—1976: Wind determination from geostationary satellites. *Proc. Symposium on Meteorological Observations from Space: Their Contribution to the First GARP Global Experiment,* Philadelphia, PA, COSPAR, World Meteorological Organization (WMO), 188 pp.

—1977: The need for climate monitoring. *Energy and Climate.* National Academy of Sciences, 128-132.

—1980: Short-term forecasting and services. *The Atmospheric Sciences: National Objectives for the 1980s.* National Academy of Sciences, 64-68.

—1981: The impact of meteorological satellites on FGGE. *International Conference on Early Results of FGGE and Large-Scale Aspects of its Monsoon Experiments,* Tallahassee, FL. WMO, (1-4)–(1-10).

—1981: The role of satellites in the study of the ocean surface energetics. *Workshop on Applications of Existing Satellite Data to the Study of the Ocean Surface Energetics,* Madison, WI, SSEC, UW–Madison, 3-4.

—1982: Preparation of a composite surface stress data set for the Summer Phase of MONEX. Final project report. National Science Foundation Atmospheric Science Programs Grant ATM 7913097, 15 October 1979–30 November 1981. SSEC, UW–Madison, Madison, WI.

—1985: Some possibilities on an observing system for the world climate. *Monitoring Earth's ocean, land, and atmosphere from space: Sensors, systems, and applications.* (Abraham Schnapf. Progress in astronautics and aeronautics series.) American Institute of Aeronautics and Astronautics, 305-346.

—1992: Aqua and the planet, GEWEX and the role of TRMM. *The global role of tropical rainfall: Proc., International Symposium on Aqua and Planet.,* Tokyo, A. Deepak Publishing, 15-31.

Suomi, V.E. and R.J. Parent, n.d.: A proposal to the NASA for a supplement to contract NAS 5-9677 for research and development on a ground station system for the spin-scan camera. NASA ATS proposals. Dept. of Meteorology, UW–Madison, 10p., figures, appendixes.

—N.d.: A simple high capacity digital output data storage system for space experiments. 9 pp.

—1964: Initial proposal to NASA for an ATS technological experiment. NASA ATS proposals. Dept. of Meteorology, Dept. of Electrical Engineering, UW–Madison, 4 pp., figures.

—1964: Studies in atmospheric energetics based on aero-space probings (Contract WBG-10). Dept. of Meteorology, UW–Madison, 66 pp.

—1966: A proposal to the NASA for color spin scan camera for ATS-C. NASA ATS proposals. SSEC, UW–Madison, 12 pp., figures, appendixes.

—1968: A color view of planet earth. *Bull. Amer. Meteor. Soc.,* **49,** 2, February, 74-74.

Suomi, V.E., and P.M. Kuhn, 1956: Energy budget data: Project Prairie Grass, O'Neill, Nebraska, July-August 1956. Dept. of Meteorology, UW–Madison, 14 pp.

—1957: Annual report for the study of differential heating of air columns. Dept. of Meteorology, UW–Madison, various paging.

—1958: An economical net radiometer. *Tellus,* **10,** 1, February, 160-163.

—1960: A note on the "Use of an economical thermal transducer as a net radiometer." *Bull. Amer. Meteor. Soc.,* **41,** 1, January, 32.

—1964: Balloon-borne radiometersonde. *Annals of the International Geophysical Year, Vol. 32: Meteorology.* Pergamon Press, 81-86.

Professor Suomi (right) reviews satellite data with Professor Parent, in the 1960s. At that time, the data were received on an analog data recording system.

Suomi, V.E. and C.B. Tanner, 1958: Evapotranspiration estimates from heat-budget measurements over a field crop. *Transactions, American Geophysical Union,* **39,** 2, 298-304.

Suomi, V.E., and W.C. Shen, 1963: Horizontal variation of infrared cooling and the generation of eddy available potential energy. *J. Atmos. Sci.*, **21,** 1, 62-65.

Suomi, V.E., and W.P. Birkemeier, 1965: A study of the lower atmosphere using scattering of microwaves (NSF Grant GP667). Dept. of Meteorology, UW–Madison, various paging.

Suomi, V.E., and K.J. Hanson, 1968: Weather in motion. SSEC, UW–Madison, various paging.

Suomi, V.E. and S.K. Cox, dir., 1969: 1968 Barbados experiment movie—May, June, and July [16 mm, b/w]. ESSA, BOMEX Project Office, 12 min.

—1970: The study of radiation in a tropical atmosphere (ESSA Grant E22-60-69G). Dept. of Meteorology, UW–Madison, 100 pp.

Suomi, V.E. and T.H. Vonder Haar, 1969: Geosynchronous meteorological satellite. *Journal of Spacecraft and Rockets,* **6,** 3, 342-34.

—1972: Reply to "Comments on measurements of the earth's radiation budget from satellites during a five-year period." *J. Atmos. Sci.*, **29,** 3, 602-607.

Suomi, V.E., and K.J. Buress, 1971: Technical report on a prototype Boundary Layer Instrumentation System: Final report (part 3) on the Boundary Layer Instrumentation. Study. SSEC, UW–Madison, 60 pp.

Suomi, V.E., and D.W. Martin, 1971: On the requirements of a Boundary Layer Instrumentation System for the GARP Atlantic Tropical Experiment: Final report on the Boundary Layer Instrumentation Study (Task Order Number 3 to STAG contract E-127-69(N)). SSEC, UW–Madison, 25 pp.

Suomi, V.E., and R.J. Krauss, 1977: Supporting studies in cloud image processing for planetary flybys of the 1970's (Semi-annual progress report on NASA grant NGR 50-002-189). SSEC, UW–Madison, various paging.

—1978: The spin scan camera system: Geostationary meteorological satellite workhorse for a decade. *Optical Engineering,* **17,** 1, January/February, 6-13.

Suomi, V.E., and S.S. Limaye, 1978: Venus: Further evidence of vortex circulation. *Science,* **201,** 4355, 15 September, 1009-1011.

Suomi, V.E., and W.P. Menzel, 1980: The UW VAS data processing system. A final design report under NASA Contract NAS5-21965. SSEC, UW–Madison, 16 pp., figures.

Suomi, V. E, and D.P. Wylie, 1984: A comparison of FGGE wind observations in the tropics with general circulation model similarities. Final project report to NASA, Grant NAG 5-301, 1 April 1983–31 March 1984. SSEC, UW–Madison, 22 pp.

Suomi, V.E., and J.T. Young, 1985: The meteorological interactive data display system. *NASA/MSFC FY-85 Atmospheric Processes Research Review, Huntsville, Al, and Columbia, MD, 1985,* NASA, Scientific and Technical Information Branch, 120 pp.

Suomi, V.E., T.T. Fujita, V.J. Oliver, ? Gentry, and ? Simpson, dir., n.d.: 1968 hurricane watch experiment [16 mm film, color]. Satellite Meteorology Research Project of the Geophysical Sciences Dept. of the University of Chicago. NASA and ESSA, 12 min.

Suomi, V.E., T.T. Fujita, and V.J. Oliver, n.d.: Tornado situations over the United States, 23 April 1968 [16 mm film, color]. ATS-III Tornado Watch Experiment and Satellite Meteorology Research Project of the University of Chicago. NASA and ESSA, 9 min.

Suomi, V.E., A.F. Hasler, and J.A. Kornfield, directors, n.d.: Mesoscale cloud motions from ATS synchronous satellites [16 mm film, b/w]. NASA and ESSA, 12 min.

Suomi, V.E., A. F. Hasler, and J.A. Kornfield, J., n.d.: Weather in motion from the ATS-I synchronous satellite [16 mm film, b/w]. J. Lund, producer, Dept. of Photography, UW-Extension, 12 min.

Suomi, V.E., A. F. Hasler, R. J. Parent, and J. A. Kornfield, directors, n.d.: Weather in motion and in color from ATS-III synchronous satellite [16 mm film and 3/4 inch videotape, color]. NASA and ESSA, 10 min.

Suomi, V.E., R. J. Parent, and T.T. Fujita, n.d.: First color movie of the planet Earth from 22,300 miles over Brazil [16 mm film, color]. NASA and ESSA, 11 min.

Suomi, V.E., M. Franssila, and N.F. Islitzer, 1954: An improved net-radiation instrument. *J. Meteor.,* **11,** 4, August, 276-282.

Suomi, V.E., J.A. Businger, and P.M. Kuhn, 1958: Note on radiative divergence as determined by the "black ball." *J. Meteor.,* **15,** 4, August, 411-412.

Suomi, V.E., D.O. Staley, and P.M. Kuhn, 1958: A direct measurement of infra-red radiation divergence to 106 mb. *Quart. J. Roy. Meteor. Soc.,* **84,** 360, 134-141.

Suomi, V.E., R.J. Parent, and L.H. Horn, 1962: Studies in atmospheric energetics based on aerospace probings for United States Weather Bureau, Dept. of Commerce. Weather Bureau—ESSA proposals. Dept. of Meteorology, UW–Madison, 8p., appendix.

Suomi, V.E., K.J. Hanson, and R.J. Parent, 1967: The 'Chirp' digital radiosonde. *J. Appl. Meteor.,* **6,** 1, February, 195-198.

Suomi, V.E., K.J. Hanson, and T.H. Vonder Haar, 1967: The theoretical basis for low-resolution radiometer measurements from a satellite. Studies in atmospheric energetics based on aerospace probings, Annual report-1966 (WBG-27). Dept. of Meteorology, UW–Madison, 79-100.

Suomi, V.E., T.H. Vonder Haar, R.J. Krauss, and A.J. Stamm, 1971: Possibilities for sounding the atmosphere from a geosynchronous spacecraft. *Space Research,* **11,** 609-617.

Suomi, V.E., L.A. Sromovsky, R.J. Krauss, and A.J. Stamm, 1972: SMS sounder specification: Final report under extended NASA contract NAS5-21607. SSEC, UW–Madison, 85 pages.

Suomi, V.E., W.E. Shenk, and J. Moody, 1973: Advanced Applications Flight Experiment: Advanced atmospheric sounder and imaging radiometer. NASA, Goddard Space Flight Center, unpaged.

Suomi, V.E., R.J. Krauss, S.S. Limaye, and D.R.Phillips, 1976: *Atmospheric Dynamics of the Planets (Volume One - Venus UV Cloud Motions).* SSEC, UW–Madison, unpaged.

Suomi, V.E., F.R., Mosher, and D.P. Wylie, 1977: Final report on phase I of development of satellite image processing techniques for the First GARP Global Experiment. SSEC, UW–Madison, 36 pp.

Suomi, V.E., P.R. Julian, V. Lally, W. Kellogg, and C. Cote, 1977: The TWERL experiment. *Bull. Amer. Meteor. Soc.,* **58,** 9, 936-948.

Suomi, V.E., W. Massman, B.B. Hinton, and J. Afanasjevs, 1978: Scientific investigations of Tropical Wind, Energy conversion and Reference Level Experiment (TWERLE). Final technical report, NASA grant NSG 5126 for the period July 1976–September 1977. SSEC, UW–Madison, 43 pp.

Suomi, V.E., L.A. Sromovsky, and H.E. Revercomb, 1979: Preliminary results of the Pioneer Venus Small Probe Net Flux Radiometer Experiment. *Science,* **205,** 4401, 6 July, 82-85.

—1980: Net radiation in the atmosphere of Venus: Measurements and interpretation. *J. Geophys. Res.,* **85,** A13, 30 December, 8200-8218.

Suomi, V.E., F.R. Mosher, D.P Wylie, J.H. Chu, S.S. Limaye, A.M. LeBlanc, and V.D. Condella, 1981: Development of satellite image processing techniques for the First GARP Global Experiment: Final report on NASA contract NAS5-23462. SSEC, UW–Madison, 363 pp.

Suomi, V.E., R.J. Fox, S.S. Limaye, and W.L Smith, 1983: McIDAS III: A modern interactive data access and analysis system. *J. Climate Appl. Meteor.,* **22,** 5, May, 766-778.

President Jimmy Carter presents Professor Suomi the National Science Medal in 1977.

Suomi, V.E., R.J. Krauss, W.L. Hibbard, and J.T. Young, 1985: A design study for a three-dimensional display computer terminal for meteorological information. NASA/MSFC FY-85 Atmospheric Processes Research Review, Huntsville, Al, NASA, Scientific and Technical Information Branch, 121 pp.

Suomi, V.E., S.S. Limaye, and D.R. Johnson, 1991: High winds of Neptune: A possible mechanism. *Science,* **251,** 4996, 22 February, 929-932.

Suomi, V.E., S.A. Ackerman, D.W. Martin, C.C. Moeller, and B.B. Hinton, 1993: TRMM research status report. SSEC, UW–Madison, 6 pp.

Suomi, V.E., S.A. Ackerman, B.B. Hinton, and D.W. Martin, 1994: TRMM-related research: Tropical rainfall and energy analysis experiment. TRMM final report for the first three years of NASA grant NAG5-1586. SSEC, UW–Madison, 11 pp.

Suomi, V.E., L.A. Sromovsky, and J.R. Anderson, 1996: Measuring ocean-atmosphere heat flux with a new in-situ sensor. *Conference on Air-Sea Interaction, 8th, and Symposium on Global Ocean-Atmosphere-Land Systems (GOALS),* Atlanta, GA, American Meteorological Society, 38-42.

Afanasjevs, J., N. Levanon, S.D. Ellington, R.A. Oehlkers, V.E. Suomi, and M.C. Poppe, Jr., 1975: Raw data digitizing and recording system for the Omega-sonde wind finding ground station. *IEEE Trans. Geosci. Electronics*, **GE-13,** 4, October, 158-162.

Afanasjevs, J., W.J. Massman, R.A. Oehlkers, B.B. Hinton, and V.E. Suomi, 1979: Extended record length of atmospheric data gathered via Nimbus-6. *IEEE Trans. Geosci. Electronics*, **GE-17,** 4, October, 308-313.

Barrett, E.W., and V.E. Suomi, 1949: Preliminary report on temperature measurements by sonic means. *J. Meteor.,* **6,** 4, August, 273-276.

Blackadar, A.K., R.J. Reed, V.E. Suomi, J.W. Townsend, C. Hosler, H.A. Panofsky, and S. Rosenthal, 1970: The major unresolved problems facing the atmospheric sciences and the resultant need for observation, a panel discussion. *Meteor. Monogr.,* **11,** 33, October, 450-455.

Bryson, R.A., and V.E. Suomi, 1950: Midsummer renewal of oxygen within the hypolimnion. Report to the UW Lake Investigations Committee, Part III and Part IV. Dept. of Meteorology, UW–Madison.

Bryson, R.A., V.E. Suomi, and C.R. Stearns, 1952: The stress of the wind on Lake Mendota. Report to the UW Lake Investigations Committee, 6. Dept. of Meteorology, UW–Madison.

Bryson, R.A., R.J. Deland, L.H. Horn, H.H. Lettau, R.A. Ragotzkie, S.A. Rossby, W. Schwerdtfeger, V.E. Suomi, and E. Wahl, 1963: *Meteorology at Wisconsin: A plan for the future.* Dept. of Meteorology, UW–Madison, 21 pp.

Burns, S.G., and V.E. Suomi, 1972: Proposed sea surface meteorological instrumentation system for the U.S. GARP Atlantic Tropical Experiment (STAG contract 2-35116). SSEC, UW–Madison, various paging.

—1973: Boundary Layer Instrumentation System task three sea trials report (STAG contract 2-35116). SSEC, UW–Madison, various paging.

Bushnell, R.H., and V.E. Suomi, 1961: Experimental flight verification of the economical net radiometer. *J. Geophys. Res.*, **66,** 9, September, 2843-2848.

Businger, J.A., and V.E.Suomi, 1958: Variance spectra of the vertical wind component derived from observations with the sonic anemometer at O'Neill, Nebraska in 1953. *Arch. Meteor. Geophys. Bioklimatol., Serie A: Meteorologie Und Geophysik,* **10,** 4, 415-425.

Businger, J.A., V.E. Suomi, and H.A. Panofsky, 1958: Studies on the structure of turbulence. Final report Contract AF 19(604)-1384. Dept. of Meteorology, UW–Madison, 61 pp.

Byers, H., V.E. Suomi, W. Nordbert, et al., 1967: A review of the meteorological objective and requirements of the Apollo application "A" mission (NAS 1.2:967). NASA, Office of Space Science and Applications, 32 pp.

Chatters, G.C., and V.E. Suomi, 1975: The applications of McIDAS. *IEEE Trans. Geosci. Electronics,* **GE-13,** 3, July, 137-146.

Cox, S.K., J.A. Maynard, and V.E. Suomi, 1968: Inadequacy of conventional radiosonde baseline procedures in the tropics. Research in atmospheric radiation: Annual report (WBG-88, 1966-1967). Dept. of Meteorology, UW–Madison, 51-70.

—1968: Radiosonde temperature-baseline inaccuracy. *J. Appl. Meteor.,* **7,** 4, August, 691-696.

Cox, S.K., K.J. Hanson, V.E. Suomi, and T.H. Vonder Haar, 1968: Scientific objectives and data requirements for radiation studies during BOMEX. Studies in atmospheric energetics based on aerospace probings, Annual report-1967 (WBG-27). Dept. of Meteorology, UW–Madison, 143-152.

Cox, S.K., K.J. Hanson, and V.E. Suomi, 1973: Measurements of absorbed shortwave energy in a tropical atmosphere. *Solar Energy*, **14,** 2, January, 169-173.

Darkow, G. L., V.E. Suomi, and P.M. Kuhn, 1958: Surface thermal patterns as a tornado forecast aid. *Bulletin of Meteorological Sciences,* **39,** 10, October, 532-537.

Gehrels, T., V.E. Suomi, and R.J. Krauss, 1972: The capabilities of the spin-scan imaging technique. *Space Research XII.* Akademie-Verlag, 1765-1769.

Godfrey, D., G.E. Hunt, and V.E. Suomi, 1983: Some dynamical properties of vortex streets in Saturn's atmosphere from analyses of Voyager images. *Geophys. Res. Lett.,* **10,** 9, September, 865-868.

Goodman, H.M., F.R. Mosher, T. Stewart, and V.E. Suomi, 1981: Meteorological significance of cloud tracked winds during DST-5 and DST-6. SSEC, UW–Madison, various paging.

Greaves, J.R., G. DiMego, W.L. Smith, and V.E. Suomi, 1979: A "special effort" to provide improved sounding and cloud-motion wind data for FGGE. *Bull. Amer. Meteor. Soc.* **60,** 2, February, 124-127.

Hammel, H.B., R.F. Beebe, E.M. DeJong, S.S. Limaye, L.A. Sromovsky, V.E. Suomi, et al., 1989: Neptune's wind speeds obtained by tracking clouds in Voyager images. *Science,* **245,** 22 September, 1367-1369.

Hanson, K.J., and V.E. Suomi, 1968: The inspace, absolute calibration of ATS-I cloud camera. Studies in atmospheric energetics based on aerospace probings, Annual report-1967 (WBG-27). Dept. of Meteorology, UW–Madison, 153-178.

Hanson, K.J., T.H. Vonder Haar, and V.E. Suomi, 1967: Reflection of sunlight to space and absorption by the earth and atmosphere over the United States during spring 1962. *Mon. Wea. Rev.,* **95,** 6, June, 354-362.

Hanson, K.J., S.K. Cox, V.E. Suomi, and T.H. Vonder Haar, 1970: Radiation experiment in the vicinity of Barbados (Final report on NSF grant GA-12603). SSEC, UW–Madison, 100 pp.

Hibbard, W.L., D.A. Santek, and V.E. Suomi, 1990: Management and display of four-dimensional environmental data sets using McIDAS. A final report to NASA, contract #NAS8-36292, February 28, 1986–August 31, 1990. SSEC, UW–Madison, 8 pp.

Houghton, D.D. and V.E. Suomi, 1978: Information content of satellite images. *Bull. Amer. Meteor. Soc.*, **59,** 12, December, 1614-1617.

Houghton, D.D., C.B. Chang, D.K. Lee, G.F. Sill, V.E. Suomi, R.D. Thomas, Jr., and T.A. Wilson, 1981: Utilization of satellite and radar data in short range prediction models (NSF Grant ATM77-20231. Dept. of Meteorology, UW–Madison.

Kornfield, J.A., A.F. Hasler, K.J. Hanson, and V.E. Suomi, 1967: Photographic cloud climatology from ESSA III and V computer produced mosaics. *Bull. Amer. Meteor. Soc.,* **48,** 12, December, 878-883.

Professors Suomi and Parent pose with Explorer VII satellite. The black ball is part of their heat budget experiment.

—1968: Ray analysis of the refraction of microwaves propagated between satellites in a spherically stratified atmosphere. Studies in atmospheric energetics based on aerospace probes, Annual report-1967 (WBG-27). Dept. of Meteorology, UW–Madison, 61-104.

Kuhn, P.M. and V.E. Suomi, 1958: Airborne observations of albedo with a beam reflector. *J. Meteor.,* **15,** 2, April, 172-174.

—1960: Infrared radiometer soundings on a synoptic scale. *J. Geophys. Res.*, **65,** 11, November, 3669-3677.

—1964: Radiometersonde technical manual. Dept. of Meteorology, UW–Madison, 16 pp.

—1965: Airborne radiometer measurements of effects of particulates on terrestrial flux. *J. Appl. Meteor.,* **4,** .2, April, 246-252.

Kuhn, P.M., G.L. Darkow, and V.E. Suomi, 1956: A mesoscale investigation of pre-tornado thermal environments. Dept. of Meteorology, UW–Madison, various paging.

Kuhn, P.M., V.E. Suomi, and G.L. Darkow, 1959: Soundings of terrestrial radiation flux over Wisconsin. *Mon. Wea. Rev.,* April, 129-135.

Levanon, N., and V.E. Suomi, 1971: A radioaltimeter for balloons and some meteorological applications. Meteorological measurements from satellite platforms: Annual scientific report on NAS5-11542, 1969-1970. SSEC, UW–Madison, 38-53.

Levanon, N., P.R. Julian, and V.E. Suomi, 1977: Antarctic topography from balloons. *Nature,* **268,** 11, August, 514-515.

—1978: Antarctic ice topography and 150 mb circulation from the Nimbus-6 TWERLE experiment. *Space Research,* **18,** 1978, 43-46.

Levanon, N., F.G. Stremler, and V.E. Suomi, 1974: A new approach to lightweight radar altimeters. *Proceedings of the IEEE June*, 784-792.

Levanon, N., R.A. Oehlkers, S.D. Ellington, W.J. Massman, and V.E. Suomi, 1974: On the behavior of superpressure balloons at 150 mb. *J. Appl. Meteor.,* **13,** 4, June, 494-504.

Levanon, N., J. Afanasjevs, R.A. Oehlkers, and V.E. Suomi, 1975: An aneroid pressure sensor for constant-level balloons. *J. Appl. Meteor.,* **14,** 6, September, 1125-1134.

Levanon, N., J. Afanasjevs, S.D. Ellington, R.A. Oehlkers, and V.E. Suomi, 1975: The TWERLE balloon-to-satellite data transmitting system. *IEEE Trans. Geosci. Electronics,* **GE-13,** 1, January, 39-52.

Levanon, N., Y. Eyal, P.R. Julian, D. Shea, V.E. Suomi, and W.J. Massman, 1979: Daily high-latitude 150 mb pressure maps from TWERLE and Rawinsondes, part 1: 16 November 1975–31 January 1976. NCAR Technical Note NCAR/TN-141+STR, 89 pp.

Limaye, S.S., and V.E. Suomi, 1977: A normalized view of Venus. *J. Atmos. Sci.,* **34,** 1, January, 205-215.

—1981: Cloud motions on Venus: Global structure and organization. *J. Atmos. Sci.,* **38,** 6, June, 1220-1235.

Limaye, S.S., H.E. Revercomb, L.A. Sromovsky, R.J. Krauss, D.A. Santek, and V.E. Suomi, 1982: Jovian winds from Voyager 2: (I) Zonal mean circulation. *J. Atmos. Sci.,* **39,** 7, July, 1414-1432.

Limaye, S.S., V.E. Suomi, C.S. Velden, and G.J. Tripoli, 1991: Satellite observations of smoke from oil fires in Kuwait. *Science,* **252,** 5012, 1536-1539.

Limaye, S.S., L.A. Sromovsky, and V.E. Suomi, 1992: Cloud motions on Neptune from Voyage 2 images. *Adv. Space Res.,* **12,** 11, (11)19-(11)22.

Martin, D.W., and V.E. Suomi, 1972: On the scientific requirements of sea surface measurements for the GARP Tropical Experiment (STAG contract 2-35116). SSEC, UW–Madison, 18 pp.

—1972: A satellite study of cloud clusters over the tropical north Atlantic Ocean. *Bull. Amer. Meteor. Soc.,* **53,** 2, February, 135-156.

Murray, B.C., M.J. Belton, G.E. Danielson, M.E. Davies, G.P. Kuiper, B.T. O'Leary, V.E. Suomi, and N.J. Trask, 1971: Imaging of Mercury and Venus from a flyby. *Icarus,* **15,** 153-173.

Murray, B.C., M.J. Belton, G.E. Danielson, V.E. Suomi, 1974: Mariner 10 pictures of Mercury: First results. *Science,* **184,** April, 459-461.

—1974: Mercury's surface: preliminary description and interpretation from Mariner 10 pictures. *Science,* **185,** 12 July, 169-179.

Murray, B.C., M.J. Belton, G.E. Danielson, V.E. Suomi, et al., 1974: Venus: Atmospheric motion and structure from Mariner 10 pictures. *Science,* **183,** 29 March, 1307-1314.

Parent, R.J., H.H. Miller, V.E. Suomi, and W.B. Swift, 1960: Instrumentation for a thermal radiation budget satellite. *Proc., National Electronics Conference,* Chicago, IL, National Electronics Conference, Inc.

Parks, S., D.N. Sikdar, and V.E. Suomi, 1974: Correlation between cloud thickness and brightness using Nimbus-4 THIR data (11.5 micron channel) and ATS-3 digital data. *J. Appl. Meteor.,* **13, 3,** April, 402-410.

Phillips, D.R., E.A. Smith, and V.E. Suomi, 1972: Comments on "Automated technique for obtaining cloud motion from geosynchronous satellite data using cross correlation." *J. Appl. Meteor.,* **11,** 4, June, 752-754.

Revercomb, H.E., L.A. Sromovsky, and V.E. Suomi, 1982: Reassessment of net radiation measurements in the atmosphere of Venus. *Icarus,* **52,** 2, 279-300.

—1985: Net thermal radiation in the atmosphere of Venus. *Icarus,* **61,** 3, March, 521-538.

Revercomb, H.E., L.A. Sromovsky, and V.E. Suomi, and R.W. Boses, 1985: Thermal net flux measurements on the Pioneer Venus entry probes. *Adv. Space Res.,* **5,** 9, 81-84.

Sabatini, R.R., and V.E. Suomi, 1962: On the possibility of atmospheric infrared cooling estimates from satellite observations. *J. Atmos. Sci.,* **19,** 4, July, 349-350.

Schoffer, P., and V.E. Suomi, 1961: A direct current motor integrator for radiation measurements. *Solar Energy,* **5,** 1, January-March, 29-32.

Schubert, G., C.C. Counselman, J. Hansen, S.S. Limaye, V.E. Suomi, et al., 1977: Dynamics, winds circulation and turbulence in the atmosphere of Venus. *Space Sci. Rev.,* **20,** 4, June, 1-33.

Schubert, G., C., Covey, A. Del Genio, L.S. Elson, S.S. Limaye, H.E. Revercomb, L.A. Sromovsky, V.E. Suomi, et al., 1980: Structure and circulation of the Venus atmosphere. *J. Geophys. Res.,* **85,** A13, 30 December, 8007-8025.

Shenk, W.E., V.E. Suomi, F. Von Bun, F. Hall, W. Esaias, and M. Maxwell, 1986: Ideas for a future Earth observing system from geosynchronous orbit. *Proc. Conference on Satellite Meteorology/Remote Sensing and Applications, 2nd,* Williamsburg, VA, American Meteorological Society, 508-513.

Sikdar, D.N., and V.E. Suomi, 1969: An objective technique of evaluating mesoscale convective heat transport in the tropics from geosynchronous satellite cloud photographs. Studies in atmospheric energetics based on aerospace probings: Annual report 1968. SSEC, UW–Madison, 1-35.

—1971: Time variation of tropical energetics as viewed from a geostationary altitude. *J. Atmos. Sci.,* **28,** 2, March, 170-180.

—1972: On the remote sensing of mesoscale tropical convection intensity from a geostationary satellite. *J. Appl. Meteor.,* **11,** 1, February, 37-43.

Sikdar, D.N., V.E. Suomi, and C.E. Anderson, 1970: Convective transport of mass and energy in severe storms over the United States—an estimate from a geostationary altitude. *Tellus,* **22,** 5, 521-532.

Sikdar, D.N., J.A. Young, and V.E. Suomi, 1972: Time-spectral characteristics of large-scale cloud systems in the tropical Pacific. *J. Atmos. Sci.,* **29,** 2, March, 229-239.

Smith, B.A., G.A. Briggs, G.E. Danielson, V.E. Suomi, et al., 1977: Voyager imaging experiment. *Space Sci. Rev.,* **21,** 103-127.

Professors Parent and Suomi build a 1960s satellite instrument.

Smith, B.A., L.A. Soderblom, R.F. Beebe, V.E. Suomi, et al., 1979: The Galilean satellites and Jupiter: Voyager 2 imaging science results. *Science,* **206,** 23 November, 927-959.

Smith, B.A., L.A. Soderblom, T.V. Johnson, V.E. Suomi, et al., 1979: The Jupiter system through the eyes of Voyager I. *Science,* **204,** 1 June, 3-31.

Smith, B.A., L.A. Soderblom, R.F. Beebe, J. Boyce, G. Briggs, A. Bunker, S.A. Collins, C.J. Hansen, T.V. Johnson, J.L. Mitchell, R.J. Terrile, M. Carr, A.F. Cook, II, J. Cuzzi, J.B. Pollack, G.E. Danielson, A.P. Ingersoll, M.E. Davies, G.E. Hunt, H. Masursky, E. Shoemaker, D. Morrison, T. Owen, C. Sagan, J. Veverka, R. Strom, and V.E. Suomi, 1981: Encounter with Saturn: Voyage 1 imaging science results. *Science,* **212,** 10 April, 163-191.

Smith, B.A., L.A. Soderblom, R. Batson, V.E. Suomi, et al., 1982: A new look at the Saturn system: The Voyager 2 images. *Science,* **215,** 4532, 504-536.

Smith, W.L., V.E. Suomi, W.P. Menzel, H.M. Woolf, L.A. Sromovsky, H.E. Revercomb, C.M. Hayden, D.N. Erickson, and F.R. Mosher, 1981: First sounding results from VAS-D. *Bull. Amer. Meteor. Soc.,* **62,** 2, February, 232-236.

Smith, W.L., V.E. Suomi, F.X. Zhou, and W.P. Menzel, 1982: Nowcasting application of geostationary satellite atmospheric sounding data. *Symposium on Nowcasting,* Hamburg, W. Germany, Academic Press, Inc., 123-135.

Smith, W.L., G.S. Wade, W.P. Menzel, V.E. Suomi, R.J. Fox, C.S. Velden, and J.F. LeMarshall, 1984: Nowcasting: Advances with McIDAS III. *Nowcasting 2: Mesoscale observations and short-range weather forecasting,* Norrkoping, Sweden, European Space Agency, 433-438.

Sromovsky, L.A., H.E. Revercomb, and V.E. Suomi, 1975: Earth radiation budget measurement from a spinning satellite: Conceptual design of detectors (NASA contract NAS-1-13204). SSEC, UW–Madison, 1975, Various paging.

—1985: New atmospheric temperature results from the Pioneer Venus entry probes. *Advances in Space Research (Presented at COSPAR, IAU, IAGA and IAMAP Plenary Meeting, 25th, Workshop on the Atmosphere of Venus: Recent Findings, 3rd,* Graz, Austria, **5,** 9, 37-40.

Sromovsky, L.A., H.E. Revercomb, and R.J. Krauss, V.E. Suomi, 1980: Pioneer Venus Small Probes Net Flux Radiometer Experiment. *IEEE Trans. Geosci. and Remote Sensing,* **GE-18,** 1, January, 117-122.

—1983: Voyager 2 observations of Saturn's northern mid-latitude cloud features: Morphology, motions, and evolution. *J. Geophys. Res.,* **88,** A11, 1 November, 8650-8666.

—1985: Temperature Structure in the Lower Atmosphere of Venus: New Results Derived from Pioneer Venus Entry Probe Measurements. *Icarus,* **62,** 3, June, 458-493.

Sromovsky, L.A., V.E. Suomi, J.B. Pollack, R.J. Krauss, S.S. Limaye, T. Owen, H.E. Revercomb, and C. Sagan, 1981: Implications of Titan's north-south brightness asymmetry. *Nature,* **292,** 5825, August, 698-702.

Sromovsky, L.A., H.E. Revercomb, V.E. Suomi, S.S. Limaye, and R.J. Krauss, 1982: Jovian winds from Voyager 2, Part II: Analysis of eddy transports. *J. Atmos. Sci.,* **39,** 7, July, 1433-1445.

Stremler, F.G., N. Levanon, and V.E. Suomi, 1970: Applications of radio altimetry to balloons. *AFCRL Scientific Balloon Symposium, 6th, Air Force Cambridge Research Laboratories, (AFCRL 70-0543),* Bedford, MA, US Air Force, Air Force Cambridge Research Laboratories, 91-99.

—1972: A radio altimeter for balloon atmosphere sounding. *Symposium on Meteorological Observations and Instrumentation, 2nd,* San Diego, CA, American Meteorological Society, 132-137.

Tanner, C.B. and V.E. Suomi, 1956: Lithium chloride dewcel properties and use for dew-point and vapor-pressure gradient measurements. *Transactions, American Geophysical Union,* **37,** 4, August, 413-420.

—1958: A maximum-minimum dew-point hygrometer. *Transactions, American Geophysical Union,* **39,** 1, February, 63-66.

Tomasko, M.G., R. Boese, A.P. Ingersoll, S.S. Limaye, V.E. Suomi, et al., 1977: The thermal balance of the atmosphere of Venus. *Space Sci. Rev.,* **20,** 389-412.

Tomasko, M.G., P.H. Smith, V.E. Suomi, L.A. Sromovsky, H.E. Revercomb, et al., 1980: The thermal balance of Venus in light of the Pioneer Venus mission. *J. Geophys. Res.,* **85,** A13, 30 December, 8187-8199.

Vonder Haar, T.H., and V.E. Suomi, 1969: Satellite observations of the earth's radiation budget. *Science,* **163,** 14 February, 667-669.

—1971: Measurements of the earth's radiation budget from satellites during a five-year period, Part I: Extended time and space means. *J. Atmos. Sci.*, **28,** 3, April, 305-314.

Vonder Haar, T.H., I. Dirmhirn, and V.E. Suomi, 1965: An inflight re-calibration of channel 3 on TIROS IV (NASw-65). Dept. of Meteorology, UW–Madison, unpaged.

Vonder Haar, T.H., K.J. Hanson, U. Shafrur, and V.E. Suomi, 1968: Phenomenology of convective ring clouds in the tropics derived from geosynchronous satellite observations. *International Conference on Cloud Physics,* Toronto, Canada, University of Toronto, 549-554.

Wang, J.Y., and V.E. Suomi, 1957: The Phyto-climate of Wisconsin, #1. The growing season. Agriculture Experimental Station, UW, 21 pp.

—1958: The Phyto-climate of Wisconsin, #2. Temperature: Normals and hazards. Agriculture Experimental Station, UW, 39 pp.

Weinstein, M. and V.E. Suomi, 1961: Analysis of satellite infrared radiation measurements on a synoptic scale. *Mon. Wea. Rev.,* **89,** 11, November, 419-428.

Bibliography

The following pieces include interviews with Professor Suomi and obituaries and memorials about him.

Conversation in Madison, Wisconsin, edited by Paul F. Twitchell. *GEWEX News,* **4,** 3, August 1994, 4-6.

The *Bulletin* Interviews: Professor V. E. Suomi, prepared by H. Taba. *WMO Bulletin,* **36,** 4, October 1987, 253-263.

Verner E. Suomi, 79, Pioneer in Weather Forecasting, Dies; by David Stout; Obituary, *New York Times;* August 1, 1995.

The Man Who Put the Eye in the Sky, by Nina Malmsten, *The Milwaukee Journal,* December 20, 1987.

I often say, rock the boat.
But before you rock it, do three things:
measure the freeboard on the boat,
notice the state of the sea,
and the distance to shore.
Only then rock the boat.

Verner E. Suomi, 1988

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