

# Tributes to the Late Dr. Walter F. Kosonocky

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I AM among the fortunate people who can say that Walter Kosonocky was their mentor. I am very proud to have been able to collaborate with Walter. He was probably the most inventive person I have ever worked with—he was prolific! He was very intuitive, inventing by analogy and by inspiration—rarely using logical, step-by-step analyses. Once out of grad school, Walter probably never wrote down an equation in his entire life! He didn't like to—he probably could have—he just didn't like it and he didn't need to. He left the more mundane equation-based analyses to his co-workers like me. In our collaborative CCD days, our typical interaction went something like this: Walter would postulate a way to make a better, i.e., faster, more efficient, lower noise device. "I've been thinking....," he would say on many mornings. I would typically have trouble agreeing that Walter's idea would work and would ask him to justify. He would say something like, "Well, I'm not quite sure why, but it just seems...." He knew this was enough to get my pencil and HP21 going. Several days later I would finally work through enough equations that showed that, lo and behold, Walter was indeed correct! Proud that I finally was able to understand just what Walter instinctively knew, I would rush over to his office, excited, saying, "Walter, you were right about so-and-so. I've got the analysis here which proves it!" Walter would look up somewhat surprised and say, "Really? Show me!"

Walter seemed to make everything fun. He always had an exciting project going—either personally or professionally, usually both. He was always upbeat, never down! I often tell the story how he drove right through the NJ Turnpike toll collection booth without stopping as he chattered away excitedly about a new CCD concept as I huddled in the fetal position in the passenger seat!

Walter Kosonocky was a rare man—terribly inventive, constantly upbeat, always looking to help others—to share the credit. He was a true and great friend and colleague—but above all a mentor without peer. We miss Walter very much.

JIM CARNES

It is truly an honor for me to participate in this celebration of the remarkable life and enduring legacy of my good friend Walter Kosonocky. Walter was, of course, not only an outstanding scientist but also an original and creative engineer, strongly motivated to make things that really work. His scientific achievements and awards are numerous and well

known; less well known, perhaps, is that Walter once earned an Emmy award, and I would like to share that story. When I was with RCA in the early 80's, RCA initiated a major corporate program to develop a CCD camera for broadcast TV, and we had established all the technical bases for a high-performance CCD imager well suited for this application including back-illumination, low noise, and blooming control. However, to incorporate all these essential features into a single design was very difficult; about 14 mask levels would be required if we could even do it, and we felt that this would be too many for a manufacturable product. At the critical meeting to decide the issue, I recall noticing Walter, seated at the end of the conference table, starting to develop a definite twinkling of the eye, and he soon interrupted, saying that he had thought of a way to resolve the problem, although at some risk. He then went to the board and outlined an approach which he had conceived in the open meeting, and with which, by inverting our process to put source-drains at the end rather than the beginning, together with some other novelties, he could achieve all the essential design features with only nine mask levels! After some discussion, we adopted Walter's approach, which worked perfectly; this became the design and process used for the CCD imagers in the RCA CCD-1 all-solid-state broadcast TV camera which won the 1985 Emmy award for outstanding technical achievement.

EUGENE D. SAVOYE

I first became acquainted with Walter when we both were members of the technical staff at the David Sarnoff Laboratories in the early 1960's. Later, it was CCD's that were our strong common interest, but at that time it was lunch-hour ping-pong. He had a style that was unique and unforgettable. He was clearly just as interested in making the game fun and a little wild as he was in winning. But before long we found ourselves participating at CCD conferences—on teams that were sometimes quite competitive: RCA and Fairchild. It was a most exciting time. Bell Labs people were extremely interested in what others were starting to do with their initial CCD invention. Texas Instruments was also one of the players in this game and, of course, soon there were many others. At the conferences the debates were often heated and a number of people often got quite steamed up over the pros and cons of the different architectures, the different designs, and the different processes. Walter generally had strong opinions but I do not remember him ever getting really upset in these early

conferences—the way some other key players did. I admired him for his technical wisdom and style then, and I have ever since.

Walter was a prolific author and later a prolific special editor for image sensors for the IEEE TRANSACTIONS ON ELECTRON DEVICES, and in both roles he turned out the highest quality work. I always found it amazing how he could do it all. He knew extremely well the skills needed to work with others to turn out high-quality technical papers. He clearly liked people in the most general sense, and he knew how to make things get done. The work always appeared to be enjoyable to him. It was a great pleasure to work with him on a number of occasions in his role as special editor.

RUDY DYCK

I had the privilege to know Walter for 25 years as a professional, professor, and friend. I found Walter to be an outstanding professional, always exercising respect for others, competent, and generous with his time to his friends. He was not only a teacher to the students, but also showed compassion for their problems and gave advice for their aspirations.

I can clearly remember the meetings I had with Walter at the IEEE conferences where we carried on interesting discussions on CCD's, photodetectors, and MOSFET's over a few drinks and laughs.

I am also grateful to Walter during our visit to Taipei in the mid 1980's where I got seriously sick. Walter helped to change my flights and get me back home to Canada. I will miss Walter.

SAVVAS CHAMBERLAIN

I have had the privilege of working with Walter Kosonocky since 1975, when he became the principal designer of metal-silicide infrared detectors at the RCA David Sarnoff Research Laboratory. Walter was a "hands on" designer always ready with new ideas. Under his lead, platinum silicide detector arrays were scaled from 2000 detectors to more than 300 000 detectors, while detector element sizes were reduced eight-fold. There was no bound to Walter's enthusiasm. This is best illustrated by the night when the 244×160 PtSi arrays were first demonstrated in a camera. After some initial imaging tests in the laboratory, Walter had his co-workers point the camera out an open window. Shortly thereafter, Walter drove his BMW onto the lawn in front of the laboratory and proceeded to drive in circles. Images were taken of Walter with his car window open and closed and with his head out of the moon roof. The field test ended with the arrival of the RCA police, who had no sense of the historical importance of the infrared measurements in progress. Fortunately, Walter published some of the infrared images taken that night, giving us a record of his outstanding technical accomplishment, his enthusiasm, and his sense of humor.

FREEMAN SHEPHERD

As a graduate student in the early 1970's, I first became aware of Walter as one of the original contributors to the theory and applications of CCD's. As the years passed, many of the pioneers moved on, but CCD's remained dear to his heart. Far from being aloof and remote, I found Walter to be a very warm, friendly, and gregarious individual. He was a brilliant individual, constantly inquiring, pushing, and stressing the limits of the technology. Several years ago, my wife and I had an enjoyable stroll with Walter through a marketplace in Mainz, Germany. We needed a snack. Walter bought some bananas, and pointed out that they were the ultimate food source. "They come prepackaged with a variety of nutrients and protein." This anecdote was one of Walter's human contributions I will never forget. In October, at the European Southern Observatory conference, Walter was still exploring and pushing CCD technology in new and innovative ways. His contributions to the base of human scientific knowledge are significant. He was a top banana among us. As an individual and a scientist, Walter will be sorely missed by our community.

DICK BREDTHAUER

In 1979, Walter interviewed me after I graduated from RPI and invited me to join the electronic imaging team at RCA Labs in Princeton, NJ. His enthusiasm for his work in the infrared and visible imaging areas motivated everybody at RCA Labs. He influenced many engineers, including myself, to join this team and to contribute with him to many significant developments in broadcast cameras, infrared cameras, remote sensing, and signal processing.

I remember that the team enjoyed the development challenges and always looked forward to the many technical and philosophical discussions that Walter led during the day, at lunch breaks, and during long evening hours in the lab. Walter's contributions to the field of electronic image sensors are well known and documented in many technical publications and patents. In addition, Walter coached many members of the RCA team and the rest of the technical community that attended his conferences to make other significant technical contributions in the area of silicon process development, process monitoring, and signal processing.

The work that he did and the enthusiasm he generated among others has influenced in no small measure the imaging and display circuit technologies that were then in design and are now in use in personal computers for multimedia applications.

I am one of many IEEE members that will miss Walter the Evangelist of Electronic Imaging.

HAMMAM ELABD

It is an honor to have the opportunity to write this short note to Walter's tribute. I had known Walter's work for many years from the number of technical articles which he had written on CCD's before I had a chance to actually meet him personally. This happened at the IEEE Conference on Electron Devices in Washington, where I was presenting a paper on a new CCD device. I was very nervous since this was my first time in front

of such a prestigious audience and I could not wait until the question portion was over. Suddenly, a person raised a hand in the audience and said, "I am Walter Kosonocky from RCA and would like to know ...." Several thoughts immediately raced through my mind such as: now comes the embarrassment, or now everybody will find out that I actually know very little about the CCD's. After I answered, Walter's comment was, "You actually may have something there and I would like to talk to you after the session is over." Our friendship has grown since then.

Walter was very supportive and always giving encouragement to others. He has been a source of motivation for many engineers working in the CCD field and particularly to those who were born in other parts of the world as Walter was. Walter's achievement is an inspiration to all of us who came to this country to have a chance of participating in the semiconductor technology revolution which is in progress today. His success is yet another example of what a person can accomplish in America if he tries hard. Walter will certainly be missed by many.

JERRY HYNCEK

I met Walter for the first time in the Spring of 1983. I was visiting Sarnoff and felt very privileged to meet one of the fathers of the CCD. I remember telling him that I was using Tompsett's fill-and-spill circuit in my CCD chips. Walter pointed to a plaque on the wall and said "Tompsett got the name, I got the patent." Walter, of course, had many patents on CCD's. I am often reminded of my favorite for small-signal CCD CTE when I drive over the concrete LA river channel. In the dry season, the water trickles down a small gutter channel in the center of the main river channel. The idea has resurfaced several times in recent years under different names, but like many other ideas, Walter had it first. Besides being a world-class inventor, Walter also had a great intuitive grasp of CCD device physics. I remember him telling me that noise in a fill-and-spill circuit is less than normal kTC noise by a factor of  $\sqrt{2}$  "because the electrons only flow in one direction." Experimentally, it seems he is right, but I sure would like to see that derived from first principles!

I had a chance to interact with Walter many times in both visible and infrared sensor circles. We always had interesting mixed technical and personal discussions like discussing APS while snorkeling in the Caymans. I have always had great respect for Walter. One of the highlights of my career was when I showed Walter an APS device running at JPL. He turned to me, shook my hand, and said that we really had something important. I am very glad to have known Walter for the dozen-plus years since we first met. Thanks, Walter, for the advice and help over those years. I think of you often.

ERIC R. FOSSUM

During my very first trip to the United States at the end of 1984, I visited David Sarnoff Research Center at Princeton, and my host at that time was Walter Kosonocky. Although I was only a minor player in the CCD game, the great CCD

pioneer treated me very nicely and spent a lot of his time with me discussing new developments in the imaging world. At that time my admiration for Walter grew very much. Our relationship was more or less like that of a father and son in the CCD world. Later, we met each other several times at various conferences and workshops. I do not know whether it was his initiative or mine, but at every occasion we saw each other, we had at least once lunch or dinner together. So it was the last time I saw him during a workshop near Munich last October, only a couple of weeks before he passed away. Fixed agenda points during our conversation were always his grandchildren. He showed pictures of them and was very proud about the kids. His grandchildren and my children are about the same age. So besides CCD's we had also other subjects in common. During our last meeting in October, Walter also made his plans clear to me about the time after his retirement. He explained that retirement was approaching faster and faster, and that he still had so many things to do. Unfortunately, he did not have the luck to complete all his plans. Walter will be remembered as a CCD pioneer with his heart in the right place. He was a great man, and will be missed by all of us.

ALBERT J. P. THEUWISSEN

The Walter Kosonocky that I knew was the good soldier and happy warrior in pursuit of electronic imaging. The ferment swirled around him and his place was often not easy and not obvious. But he pursued it with all he had, he continually sought to understand the big picture, he believed in it and he kept and radiated his positive attitude and good humor. I'll remember the Walter who proudly showed off the RCA CCD broadcast camera promotional video though the product was canceled, who was keeper of the survey talk on CCD technology and who challenged his graduate students to pursue thesis research that encompassed all aspects of image sensor design. I was fortunate to get a glimpse into Walter's roots. I saw the New Jersey Institute of Technology, where he studied and taught and which abutted the high school he attended. I saw him through his graduate students. The last time I saw him was a long walk along the San Francisco waterfront with him and one of these students. He talked of his growing up amidst literal war and the challenge of finding a shelter when the bombing started and strategies for survival. He told anecdotes of his days as a young researcher seeking his way between industry and government research. It needs to be remembered that the electronic imaging that we hope will become ubiquitous and profitable here in the late 1990's is the result of the work of many over three decades in a process that had fits and starts, disappointments, and changes of direction. Walter put a human face on this work for me and added a great sense of wonder and joy to pursuing it.

R. DANIEL McGRATH

It was a great pleasure to be one of Walter's Ph.D. students. His great personality and his attitude toward science taught me how to work with other people and how to do research. For all of his students in the group at the Electronic Imaging

Center at New Jersey Institute of Technology, Walter was like the father of a big family. He went out of his way to help his students with any problem they met. On numerous occasions while I was studying in his group he displayed kindness to other people. One of his students left the group in the middle of his studies to go to another university. After he transferred, he did not get along with his new advisor. He called Walter to ask for help. Walter talked to his new advisor over the phone and gave the student a good recommendation. Another student in the group had financial problems during his studies; when Walter learned of this, he wrote a personal check, which he

gave to the student to help him continue his research. Toward research, Walter believed that everything should be worked out perfectly—even view graphs. For a presentation, every figure created on a computer was moved millimeter by millimeter until it looked perfect. For those figures which needed to be pasted manually, he could find millimeter misalignments on an entire page. Walter was my advisor, but to me, he was more like a friend, like a father. He was one of the most important people in my life.

GUANG YANG



**Walter F. Kosonocky** (M'65–SM'70–F'76) received the B.S. and M.S. degrees in electrical engineering in 1955 and 1957, respectively, from the Newark College of Engineering, Newark, NJ, and the Sc.D. degree in engineering in 1965 from Columbia University, New York.

From April 1987 to November 1996, he was a Distinguished Professor in the Electrical Engineering Department and holder of the Chair in Optoelectronics and Solid-State Circuits at the New Jersey Institute of Technology, Newark. From 1955 through March 1987, he was employed at the David Sarnoff Research Center (formerly RCA Laboratories), Princeton, NJ. He became a Member of the Technical Staff in 1956, and was appointed Fellow of the Technical Staff in 1979. From April 1987 to November 1996, he was associated with the David Sarnoff Research Center as a Consultant on Solid-State Image Sensors. At the Center, he was engaged in research on solid-state devices, circuits, and systems applications. This work included: from 1955 to 1961, development of ferrite memories and investigations on parametric and tunnel diode digital circuits; from 1961 to 1970, applications of lasers as switching devices, optical hologram memories, and MOS sensor arrays; from 1970 to 1977, the development of charge-coupled devices for memories, signal processing, and image sensors; and from 1977 to 1996, the development of processing and designs for infrared CCD imagers with platinum silicide Schottky-barrier photosensors. He was an author or coauthor of 77 technical papers and was issued 47 U.S. patents.

Dr. Kosonocky shared four RCA Laboratories Outstanding Achievement Awards (in 1959, 1963, 1980, and 1984) and two David Sarnoff Awards for Outstanding Technical Achievement (in 1981 and 1984). In 1985, he received the IEEE J. J. Ebers Award for “pioneering and innovative contributions to the development of charge-coupled devices and Schottky-barrier infrared image sensors.” He was a member of Tau Beta Pi, Eta Kappa Nu, Sigma Xi, SPIE, and SPSE. From 1973 to 1977, he was Chairman of the Solid-State Circuits Committee of the IEEE Circuits and Systems Society. From 1974 to 1978, he was Chairman of the Integrated Circuits Technology Committee of the IEEE Electron Devices Society. He served on the Technical Program Committees of the 1977 International Electron Devices Meeting, and, from 1976 to 1981, the International Solid-State Circuits Conference, where he served as Technical Program Chairman in 1979. From 1979 to 1982, he was Chairman of the IEEE TRANSACTIONS ON ELECTRON DEVICES. He was also the Guest Editor of Joint Special Issues of the TRANSACTIONS ON ELECTRON DEVICES on VLSI Technology for April 1979, August 1980, and April 1982, and on Solid-State Image Sensors for August 1985. He was Chairman of the 1981 Symposium on VLSI Technology, and, starting in 1985, was Chairman of the IEEE Executive Committee for this Symposium. He was the Technical Program Chairman of the 1984 Electronic Imaging Conference (EIC) and the Chairman of the 1985 EIC.