

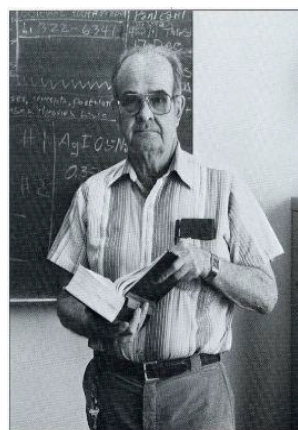
In Memoriam
William G. Finnegan
(1923 – 2011)

The fields of chemistry and weather modification lost a truly dedicated and innovative scientist this past year. William (Bill) Finnegan died in Reno, Nevada, on September 16, 2011 at the age of 87. Bill had retired from the Desert Research Institute (DRI) in 1994, was granted Research Professor Emeritus status, and then came to work at DRI every day that he was able to until late 2010. Until his last year with us he continued to park in our lower parking lot and climb the 80 steps to his office level to “get some daily exercise”. The flow of ideas from Bill never slowed after his third retirement and he continued to talk (and/or argue) science with anyone who had a spare minute. He continued to pursue his research with an idea for the next generation of non-silver-containing ice nucleants with his friend and collaborator Lee Ates at Concho Cartridge in San Angelo, Texas.

Much of the personal information below was provided by John Lewis, taken from many of his conversations with Bill during his last years at DRI.

Bill was born in Dollar Bay on the Upper Peninsula of Michigan. He grew up in the Upper Peninsula during the Great Depression and recollected the enjoyment he experienced taking a small wagon around the area and picking up pieces of scrap copper from the mines and selling it for a little cash. He used that money to buy fishing gear and had wonderful experiences fishing on the shores of Lake Superior. His mother would make him a Cornish pastie (meat and vegetables wrapped in dough covering, something like an apple turnover) and that would be his meal for the day while fishing. Bill's father was a Chief Petty Officer in the Navy and was at sea much of the time. Bill's father was killed on one of the ships in Pearl Harbor during the Japanese attack on December 7, 1941.

As such, he was exempt from military service during WWII. At the time of his father's death, Bill's mother and family resided in San Diego, California. Bill finished high school in San Diego (probably 1942) and decided on a career in chemistry as the result of his outstanding performance in the high school chemistry class. He was accepted into Cal-Berkeley and majored in chemistry. Cal-Berkeley at the time was among the top few schools in chemistry with world-renowned professors (Nobel laureates among them and also Joel Hildebrand). One of the stories he told me led me to believe he was an exceptional student. He took quantum mechanics in the physics department (the top physics school at that time) and received the top grade among a class of mostly physics students. The professor called him into his office at the end of the course and discussed his outstanding performance; but then added, “Bill, I know you received the top grade in this class, but you're a chemistry major. Therefore I must give you a B”. Bill accepted the decision without complaint.



Bill at DRI (mid 1990's) with his beloved handbook of Chemistry and Physics.

During his senior year at Berkeley he heard a seminar from an Ohio State University Professor (Albert Henne) who was a world authority in Freon gases that were used in refrigeration and had many patents. Bill was impressed and asked if he might be considered for grad

school under this professor at OSU. It was during the war and Bill couldn't get into OSU immediately after graduation (related to issues about the war). So, he worked for a camera company in New York (maybe Kodak) for a year, and then started his studies at OSU under Professor Henne. In record time he graduated with the PhD in organic chemistry in 1949. Upon graduation Henne told him: "You're one of the front-runners, Bill, but don't go into teaching, you're a researcher". Bill told me this professor had three rankings for chemists: literature searchers, follower uppers, and frontrunners.

With the help of his professor, Bill obtained a post-doc position in chemistry at Caltech. After his post doc, he took a job in 1950 with the Navy at China Lake Naval Ordnance Test Station (NOTS), later the Naval Weapons Center (NWC) near Ridgecrest in southern California. There he worked in ordnance and was the recipient of several patents. He rose to the maximum grade of a research chemist. After about 1958 and through the remainder of his career at China Lake he conducted basic and applied research on the generation and characterization of artificial ice nucleants. This was the focus of his research for the remainder of his career. Some of his first work related to artificial ice nucleants can be found in reports from the Yellowstone Field Research Expeditions (YRFE) in 1965-67 (see picture below). Collaborations with Pierre St.-Amand and other researchers at China Lake resulted in dozens of papers on ice nucleation, pyrotechnic production of ice nucleants and delivery systems. Much of this groundbreaking work on pyrotechnics was published in a seven part series of articles in the second and third volumes of the Journal of Weather Modification. In all, Bill was coauthor on 10 articles in these two volumes. Also at China Lake, Bill began to study the ice nucleating properties of complexes of silver iodide; research he then continued in his second career at Colorado State.



Bill (left) with Vince Schaefer at the YFRE in February 1965. Photo contributed by Ward Hindman

Dr. Edward (Ward) Hindman collaborated with Bill both at NWC and at CSU. He first met Bill at one of Schaefer's Yellowstone experiments and recalls Bill was a cigar smoker at the time and witnessed the tests of some of his pyrotechnic flares that produced ice-forming nuclei. Ward recalls crossing paths with Bill on several occasions, and he eventually ended up at NWC where Bill advised him on flying a glider. Bill also flew gliders and had built his own. One study that Bill led in 1977 was to determine the ice-forming capacity of the ground clouds produced by the solid rocket motors of the developing Space Transportation System (the Space Shuttle). Ward went to CSU shortly after Bill did and kept in touch after Bill left for DRI. He recalls, "... Bill was never far away. I could phone his DRI office almost any time for an insightful and thorough discussion. My last visit with Bill was in Reno in late December 2006 (see photo below) where he was as unrepentant and audacious as ever in discussing his science. Unfortunately, he no longer drank Scotch but had given up smoking. His motto: plan, characterize and, ultimately, understand!"

Retired Professor Lew Grant recalls first meeting Bill at a weather modification conference and was impressed with his work. This was research with F. K. Odencratz, W. S. McEuwan and Pierre St. Amandin the 1966-1968 period,

involving the chemical and physical properties of industrial particles. This work also included investigations of the mechanisms for multiplication of atmospheric ice crystals and the apparent charge distribution on laboratory crystals. Lew and others thought it was great that they were able to get him come to CSU in 1978. At CSU he worked with another chemist, Mike Corrin. Lew indicates that the two were a good combination for the work in nucleation; they connected on the chemistry, which the program was weak in at that time. Mike provided solid academics and Bill provided hands on laboratory research, innovative ideas, and invaluable contributions working with graduate students. Lew notes "Bill had a one track commitment to his area of research. This included research to help understand the basics of the nucleation processes, improving and testing weather modification devices, and involving and encouraging the students that he was working with. And, perhaps most important of all, he was a friend to many of us at CSU."



Bill with Ward Hindman in Reno in December 2006. Photo contributed by Ward Hindman

Dr. Paul DeMott recalls Bill's influence on his career, and the careers of many other CSU graduate students. Paul notes that Bill's research focus at CSU was to bring his special perspective, shaped by a career in chemistry and a legacy of research in the development of

pyrotechnic ice nuclei generators, toward the understanding of how ice nucleating aerosols work, and how to potentially engineer these to benefit weather modification. In the process he also became interested in the influence of aerosol chemistry on ice crystal processes following nucleation, an interest he continued at DRI. Paul stated, "I think I could paraphrase Bill's mantra to be that conventional approaches were the bane of discovery. He challenged all around him to abandon classical approaches in their search for new knowledge, and in that regard he was an inspiration to me, more so than he ever knew. His approach was to use chemical kinetics, and analysis of the rates of formation of new ice crystals, as they depend on cloud droplet concentrations and/or water supersaturation, to discern how ice crystals formed in a cloud setting, whether that be in the laboratory or in the atmosphere. He beat the drum hard that the weather modification community needed to consider the possible mechanisms by which ice crystals formed, as much as considering the numbers of ice nuclei generated on the basis of mass of material consumed. Also, Bill was fond of pointing out that when a solution or propellant mix containing silver iodide or silver iodate was combusted, the product was not necessarily silver iodide alone, but reflected the chemical products of the mix.



Bill, looking a bit skeptical, wearing his Thunderbird award at the WMA meeting in Reno in 2002

This information was shown to affect how the nucleant acted to form ice crystals, and was used to engineer ice nuclei with specific properties; for example, to possess the highest efficiency possible and/or to act via a certain ice nucleation mode such as condensation freezing. This research was showcased at the AMS Weather Modification Conference in Park City, Utah, in 1984 and in publications during this time. Bill was proud of this work and some of us were the beneficiaries of his basic ideas and promotion. That these things were taken to heart, to some extent at least, is still reflected in the seeding agents applied in current cloud and precipitation modification projects. Also while at CSU, Bill improved facilities, initiating addition of measuring systems and automation aspects that made possible some unique experiments using the CSU continuous expansion cloud chamber during the mid- to late 1980s.”

The following thoughts from Paul about Bill were also common among the many of us who got to know his more personal side. Paul notes that “the time at CSU was a heady time for me to be a graduate student, an understudy/disciple of someone who loved to think and explore and was never discouraged by a result he did not yet understand. We ran hundreds of experiments with endless alterations based on an almost daily assessment of new results discussed in a smoky room over morning coffee and donuts, or during one of multiple weekly lunches at restaurants that reflected Bill’s love of ethnic cuisine. There was burrito day, Greek day, Chinese food day, etc... Bill ultimately gave up smoking in favor of his health, but I will forever see him bantering with the group of us gathered each morning, that cigarette bobbing in his mouth. I think most important to know is that Bill was a generous man when it came to sharing knowledge, humor, encouragement, or anything. He hosted dinners at his home that

made me aware that, not only was cooking and food a hobby, but he was a plants person as well, specializing in indoor succulents and orchids, I believe. Overall, I will remember Bill for his personality as a restless thinker, wandering the halls in search of a good conversation or someone to bounce an idea off of, and a scientist who made significant contributions to the fields of ice nucleation, ice crystal formation, and weather modification.”

With weather modification studies on the decline at CSU, Bill was invited to DRI to continue work in weather modification. He arrived there in 1985 and worked on issues related to ice crystal characteristics and growth processes, the effects of salt impurities on ice growth processes, charge separation on ice crystals and further work on artificial ice nucleants. He always thought that there was a better chemical for cloud seeding than what was currently being used. He shared his knowledge freely, as is evidenced by the many parenthetical remarks, “(from W. Finnegan, private communication)”, regarding the cloud seeding formulation chosen by a project. He certainly had a lot of those “private communications”. There are few people who have had as many significant impacts on the field of weather modification in a career that spanned six decades. We all were privileged to have known Bill and will certainly miss him.

Remembrances of Bill Finnegan were contributed by colleagues at DRI (John Lewis, Steven Chai, Randy Borys and Arlen Huggins), former Colorado State colleagues (Paul DeMott, Lewis Grant, and Bob Rilling) and former China Lake and CSU colleague and friend Ward Hindman.