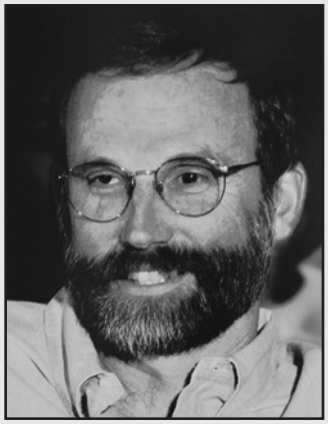
G.K. GILBERT AWARD

Presented to Philip R. Christensen



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Citation by Ronald Greeley

I first met my friend and scientific colleague, Phil Christensen, during the Viking mission to Mars in 1976. Those were indeed heady times, with the first successful landings on the Red Planet, and the successful operation of two spacecraft in orbit, with all four spacecraft operating concurrently. Phil was part of Hugh Kieffer's *Thermal Infrared Mapping Spectrometer* team, which allowed him not only to hone his skills in the science of IR remote sensing, but also to learn the complexities involved with flight-qualified planetary instruments. After coming to Arizona State University, Phil was able to put those skills to use through his innovative application of the IRTM data to solve some of the mysteries of Mars, as well as to position him to propose successfully the *Thermal Emission Spectrometer* (TES) instrument for the ill-fated *Mars Observer* (MO) mission.

Anyone who has suffered a spacecraft failure can relate to the agony experienced by Phil and his team during the attempted insertion of *Mars Observer* into Mars orbit. The silence was deafening, awaiting the never-received signal from MO; later analysis indicated that the spacecraft had experienced a catastrophic explosion. Not to be deterred, Phil worked diligently to build the case for a re-flight to achieve the original science objectives of the MO mission. Although it would take three subsequent orbiters to meet this overall goal, Phil's TES experiment was selected among the first to fly on the highly successful *Mars Global Surveyor* spacecraft.

The scientific achievements from the TES experiment are too numerous to list here, but we can highlight one that stands apart from all the others, and which was critically important for planetary geology, and that was the proposed identification of hematite in specific locations on Mars based on TES data. If this hypothesis could be shown to be correct, it would have profound implications for the history of Mars and the evolution of its surface. Based on this hypothesis, one of the *Mars Exploration Rover* (MER) sites was selected to test the idea and provide "ground truth" for the IR remote sensing data. As is well known now, the MER *Opportunity* results confirmed the existence of hematite and, coupled with other observations, have shown the critical role played by water in Mars' surface history.

Allow me to segue into what I believe is a unique accomplishment by Phil. During the operation of TES, he and his technical and scientific teams developed concepts for a "mini-TES," capable of operating from Mars' surface to complement observations from orbit, as well as a "next-generation" IR instrument, the THEMIS (Thermal Emission Imaging System). Mini-TES was proposed as part of the MER Athena payload, while THEMIS was proposed for the Mars Odyssey orbiter. All of these experiments were selected for flight, leading to what I believe is unprecedented in planetary science by a PI—the operation of four instruments all operating concurrently: TES on *Mars Orbiter*, Mini-TES on *Spirit* and *Opportunity*, and THEMIS on *Mars Odyssey*.

Throughout this period of intense instrument development, operation, and data analysis, Phil conducted front-line research in terrestrial remote sensing and field work, and trained a cadre of students and post-docs who today are leading planetary scientists. Incredibly, at the same time, Phil and his team developed the premier NASA education and outreach program for Mars, leading to thousands of teachers and students who are now better equipped to understand the Red Planet and planetary science in general. As part of this activity, Phil was invited by China to show-case Mars exploration, representing the first University to do so. Attending by some thousands of visitors, the exhibit helped pave the way for China to join the "deep-space" club for planetary exploration.

In summary, Phil has set the "gold standard" for planetary geology through his scientific discoveries, development of successful leading-edge instruments, community service contributions, and training of the next generation of scientists. Ladies and gentlemen, I am honored to present the 2008 recipient of the G. K. Gilbert Award by the Planetary Geology Division of GSA, Professor Phil Christensen.

Response by Philip R. Christensen

Let me begin by expressing how deeply honored I am to be receiving the G.K. Gilbert award. When I am asked what it is I do, I always respond by saying that I am a geologist - not a Mars scientist, or a geophysicist, or an instrument builder - so receiving this award from the Geological Society of America is truly an honor. I would like to specifically thank Ron Greeley and all those who supported my nomination, and Ron for his very generous introduction. This award is especially meaningful to me because I have long admired G.K. Gilbert and have been intrigued by many of the same scientific questions that he pursued throughout his career. I grew up in the west, having been born in Utah and lived in Kansas and California. Each summer my family would drive across the west to visit our scattered relatives, and during those long drives I spent many hours looking out the window of our car at the mountains and landforms. I didn't realize it at the time but I was becoming a geologist. Much like Gilbert, I was fascinated by the western landscape and wondered at its formation and history. My family liked to explore out of the way places and we probably traveled many of the same routes that Gilbert did, seeing landscapes that have not changed much since his time. When I was 12 my parents gave me a telescope and, again like Gilbert, I spent countless hours looking at the Moon. The only features I could see with my small telescope were the craters, and in reading the few books about the geology of the Moon I quickly learned of Gilbert's early hypothesis for crater formation and his role in shaping our understanding of the Moon's history. Finally, like Gilbert I have worked to bring quantitative analysis to geology. Hugh Kieffer instilled in me the understanding that in order to study the planets it is necessary to make quantitative measurements and apply quantitative models. Following Hugh's inspiration I have spent much of my career working to build instruments that give us the data we need to advance our knowledge of the processes by which planetary surfaces evolve.

The past 30 years have been a remarkable period in planetary exploration, and I consider myself to be very fortunate

to have participated in this modern age discovery. Throughout these years many people have inspired me, and many more have contributed to the results that have defined my career. Hugh Kieffer has played a remarkable role, from the job he gave me cutting up Mariner 9 images as an undergraduate, to his mentoring me through graduate school, to his willingness to point me in the right direction but let me find my own way as I attempted to build flight hardware. Ron Greeley provided a wonderful opportunity for me at ASU and I have benefited greatly from his guidance. From Ron I have learned the importance of participating in the exploration process. Ray Arvidson, Bruce Jakosky, Rich Zurek, Arden Albee, and Mike Malin are among the many who have inspired and tempered my thinking and provided encouragement and stimulation. Finally, I would like to sincerely thank my wife Candace and our kids Kevan and Alexandra who have led me to understand what is truly important in life.

One of the greatest pleasures I've had over the past 25 years has been the opportunity to work closely with a remarkable group of engineers, including Still Chase and Steve Silverman. This experience has made a deep impression on me about the benefit, and personal enjoyment, that comes when scientists and engineers work closely with a shared vision.

The future of planetary geology is remarkably bright. In my lifetime our perception of Mars has changed from a point of light in the night sky to a complex planet we are coming to know as well as our own. The images we have of Mars rival the views I had out the window of our family car, and the data being acquired will allow us to investigate Mars in the same way and to the same depth that geologists investigate the Earth. We are now asking questions about Mars that are as complex as those that Gilbert asked about the American west over 100 years ago. I am extremely proud to have helped form a new generation of geologists who are pressing these questions forward. Their talent and enthusiasm give me great confidence that the next 30 years will see an explosion in our understanding of our solar system and the increasing application of geologic methods to planets beyond our own. In closing, let me say again how honored I am to have received this award, how rewarded I feel at having had the opportunity to work with a remarkable group of students and young scientists, and how excited I am about the future of planetary geology.