DAVID ATLAS

1924–2015

Elected in 1986

"For contributions, inventions, leadership, and public service in the application of radar and electromagnetic engineering to meteorology."

BY ROBERT J. SERAFIN AND RICHARD E. CARBONE

For more than 50 years DAVID ATLAS was among the most influential people in the field of meteorology and a leading figure in the subdiscipline of radar meteorology. Researcher, inventor, laboratory leader, and educator, his contributions were both broad and deep. He passed away November 10, 2015, at age 91.

A member of Tom Brokaw's *Greatest Generation* (Random House, 2001), Dave was born May 25, 1924, the third child of Isadore and Rose Jaffee Atlas, immigrants from Poland and Russia, respectively. His family was of less than modest means, though there was always food on the table. The extended family was a closeknit clan centered mostly in the East New York section of Brooklyn.

Dave did well in public school, revered his teachers, and was highly motivated by them. He edited the Spanish magazine, presided over the Pan American Club, and graduated at age 16. His attempts to play the accordion led to the realization that he had no natural talent for it. He went on to marry Lucille Rosen, and they raised two children, Robert and Joan.

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He planned to be an electrical engineer when he entered the City College of New York, where his special joy was freshman physics. While a student, he held a job at Western Electric where he worked on a production line for the munificent salary of $35 per week, nearly as much as his father made.

The events of December 7, 1941, changed his plans, as they did for millions of people around the world. He accelerated his education with a heavy courseload and summer school, expecting to join the military in some capacity. Soon thereafter he applied to premeteorology training in the Army Air Corps, despite not knowing exactly what meteorology entailed—prior to this he apparently had little if any interest in it. He was rejected, but reapplied—giving the same information—and was accepted.

He reported for active duty at New York University, where Louis Battan became his roommate, best man, and lifetime friend and colleague. Dave finished first in class and was commissioned second lieutenant in 1944. The Weather Instrument Training School then introduced him to basic electronics as preparation for Harvard/MIT Radar School.

A major factor that set the stage for his career was the GI Bill, whose financial assistance enabled him to earn his DSc in 1955 from MIT. At the time he was also working as chief of the Weather Radar Branch at the Air Force Cambridge Research Laboratory (AFCRL). A mere two years later he received the Meisinger Award, his reputation having grown by leaps and bounds in what was now broadly recognized as an exciting new branch of meteorology.

Among his early and very significant accomplishments was his invention of the isoecho contour mapping concept in 1947, while he was a member of the All Weather Flying Division at Clinton Air Force Base in Wilmington, Ohio. A patent was granted in 1953. The isoecho contour method was the first to quantize and thus quantify weather radar reflectivity information on cathode ray tubes. This relatively simple concept was in widespread use for decades both on commercial aircraft and ground-based operational weather radars and by the research community. It was not until the advent of color displays in the

early 1970s that isoecho displays began to be replaced. Indeed, many airline pilots objected strongly to the loss of the traditional CRT displays when color technology became available.

Dave recruited Roger Lhermitte from France to AFCRL. Their early collaborations with Doppler radar led to outstanding discoveries. On the occasion of the first Doppler velocity-azimuth display measurements, Lhermitte attached an audio speaker to the Doppler output. Dave said, "To our astonishment and exquisite pleasure on 2 Dec 1957, we heard and tape recorded the Doppler shift as it varied in pitch from near zero frequency when it was pointed crosswind, to high frequencies when it was pointing either up- or downwind." This set the stage for several decades of Doppler radar research and development and ultimately operational applications.

Somewhat to Dave's dismay, the United States was unable to install a national Doppler radar network until the 1990s, but this was followed by the deployment of airport terminal Doppler radars. These two operational radar systems have dramatically improved short-term weather warnings and saved thousands of lives and billions of dollars' worth of damage.

In 1972 he joined the National Center for Atmospheric Research (NCAR). There he was the founding director of the Atmospheric Technology Division (ATD), which provided a broad range of observational and computational facilities for research community use. He brought a vision to NCAR that included a state-of-the-art array of next-generation observing facilities. There would be Doppler radars, automated surface stations, next-generation sounding systems, lidars, acoustic sounders, and new airborne instruments, including an airborne Doppler radar. Dave's major contributions were to get the ball rolling by articulating his vision and hiring staff, including the authors of this tribute.

Within two years there were two transportable C-band Doppler radars that became a mainstay of university research for about two decades. The Portable Automated Mesonetwork (PAM) was the first fully automated mesonet reporting its data via radio telemetry and later via satellite. The new radars and PAM helped to transform the way field experiments were

conducted because the real-time data displays greatly facilitated knowledge of "present weather." This improved understanding of the initiation, growth, and decay of convective storms, extratropical cyclones, tropical rainfall, and other phenomena. Detection of hazardous windshear and microbursts using these radars led to agency deployment of Doppler radars for aviation safety in the United States and internationally, undoubtedly saving countless lives.

After two years at the helm of ATD Dave was asked to assume leadership of the National Hail Research Experiment (NHRE), a weather modification program aimed at demonstrating the effectiveness of hail suppression, initially motivated by claims of success in the Soviet Union. After several years of field experimentation it appeared to Atlas that no positive effect on the suppression of hail would be detectable, if only because of the great natural variability of hailstorms. To the dissatisfaction of the weather modification community, Dave felt strongly that experimental evidence was sufficient to temporarily cease cloud seeding to analyze existing data and reexamine the basic hypotheses for hail suppression.

Faced with federal program manager resistance, however, Dave resigned from the NHRE directorship as a matter of principle. He was later vindicated by major NHRE successes, gained from new understanding of deep moist convection more generally, but statistically failing to suppress hail.

During his tenure at NCAR Dave was elected president of the American Meteorological Society (AMS). His term was marked by a focus on atmospheric science and public policy. As president-elect in 1974 he, and Lucille, were part of the first post–Cultural Revolution scientific delegation to the People's Republic of China. This historic visit was the forerunner of decades of scientific collaboration between the two countries.

In 1977 he left NCAR for the Goddard Space Flight Center (GSFC), where he was given carte blanche to build the new Goddard Laboratory for Atmospheric Sciences (GLAS) and established a new vision for atmospheric research programs. He placed scientific excellence at the top of his priorities, attracting 35 new scientists to GLAS, among them Michael

King, Joanne Simpson, Louis Uccellini, Antonio Busalacchi, and many others who became prominent in their fields.

Dave's interests quickly broadened to encompass the full spectrum of active and passive remote sensing of the atmosphere, oceans, and Earth's surface. He played an important role in defining the Tropical Rainfall Measuring Mission (TRMM), working closely with Simpson and colleagues from Japan to implement the first meteorological radar in space. TRMM has provided unprecedented detail on the structure and distribution of rainfall and improved estimation of cumulative rainfall over tropical oceans—information essential for understanding the Earth's energy budget and water cycle.

Among Dave's principal written legacies is *Radar in Meteorology* (AMS, 1990), which he produced and edited from proceedings of the Louis Battan Memorial and 40th Anniversary Radar Meteorology Conference. The conference format was designed by Dave, working closely with the AMS Committee on Radar Meteorology. Tutorial papers were written and delivered by the foremost experts in the field. Thanks to Dave's dogged determination (and prodding of authors), the book is the most comprehensive collection of contributions in this field ever produced under one cover.

It is informative to examine Atlas' extensive publication record from the viewpoint of peer interest in his work. Among more than 230 papers, his most highly cited works span 40 years, 1953–1993. They originated in similar proportion at each of his principal affiliations: AFCRL, the University of Chicago, NCAR, and GSFC. His most frequently cited publication overall is the 160-page *Advances in Radar Meteorology* (1964), the first textbook type of publication that reviewed Doppler signal theory in depth. It was a treasure trove of empirical relationships among reflectivity factor, attenuation, water content, and rainfall rate and presented some novel interpretations of the radar equation, complications of Mie scattering, and multiple wavelength responses to hydrometeors.

The Atlas papers can be topically grouped in four broad categories:

- microwave scattering and attenuation properties of hydrometeors
- techniques for reduction of bias and uncertainty in radar rainfall estimation
- studies related to atmospheric turbulence and mesoscale air flow
- studies related to radar echoes in optically clear air.

Dave retired from NASA in 1984, but his enthusiasm for science and discovery never waned. After retirement he contributed substantially to the understanding of tropical rainfall processes through his many collaborative papers on TRMM-related topics. He became interested in microburst and windshear detection for aviation safety and invented and patented a technique through which low-level windshear could be detected with fan-beam air traffic control radars at airports.

He was an AMS fellow and honorary member, and, in addition to the Meisinger Award, received the society's Cleveland Abbe Award for Distinguished Service to Atmospheric Science (1983), Carl-Gustav Rossby Research Medal (1996), and honorary membership for the totality of his contributions. In 1991 he was selected as AMS Remote Sensing Lecturer, which was renamed the Remote Sensing Prize in 2008 and again renamed the David and Lucille Atlas Remote Sensing Prize beginning in 2017. In 2011 he received the NAE's prestigious Founders Award.

Dave's achievements were the result of his many qualities—persistence, intellect, creativity, enthusiasm, and love for science. As a taskmaster, there is little doubt he elevated the accomplishments of others to levels they might not otherwise have achieved. Another factor that shaped his career is perhaps best described as "serendipity," a term he often used. In his memoir, *Reflections* (AMS, 2001), he wrote that he "began to realize that one had to be opportunistic and flexible to exploit events when they occurred."

Dave set out to become an electronics engineer but was drawn into meteorology by his assignment to service in war. It turned out that his multidisciplinary education and training

had prepared him ideally for the emerging field of radar meteorology. He used his innate talents and a lot of hard work to accomplish the rest.

Dave loved his wife, children, and grandchildren. He skied (water and snow) and played tennis. His curiosity extended to spirituality and religion.

This man who set very high professional standards was also a man with great compassion for others, who would do almost anything to help a friend. He touched the lives of hundreds, perhaps thousands of people worldwide. There are many of us who can claim to have been a friend and colleague of Dave Atlas, a privilege and honor that we cherish greatly.