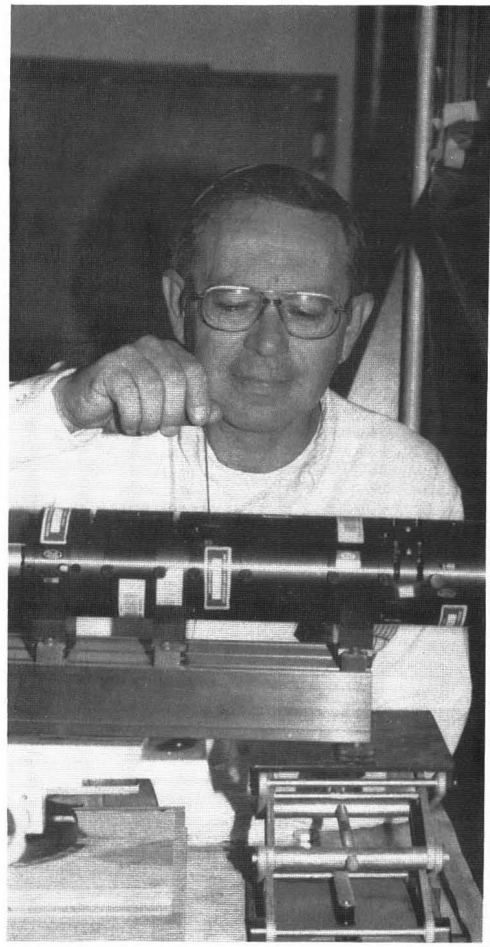
ChE educator



Neil, above, circa 1967, with his "homemade" equipment and today, at right, in a more modern lab setting.

NEIL BERMAN
of Arizona State University

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When Neil and Sarah Berman first arrived in Phoenix in September of 1964, in a car with no air conditioning, they wondered how anyone could live there. Neil joined the chemical engineering faculty at Arizona State University as planned, however, and four years later they bought their first air conditioned car in order to take their two month old son Dan on a trip to Texas.

Chemical engineering at ASU was just beginning when Neil joined the faculty. The College of Engineering was established in 1956 and the first chemical engineering professor, Cas Reiser, arrived in 1958, followed by Sam Craig in 1960. Gene Sater and the first graduates came in 1962. When Neil Berman was hired in 1964, the department had enough faculty to become accredited and to establish a chapter of AIChE. Teaching loads were high (three or more courses each semester), lab space for both teaching and research was scarce, and graduate students were difficult to get.

Since then, the department has expanded to include biomedical and materials engineering and has twenty-three full-time faculty with a well-respected, established graduate program.

Neil is a native of Milwaukee, Wisconsin (born in 1933). He attended what was then the University of Wisconsin in Milwaukee (Extension) for two years and then completed his BS in chemical engineering at U.W. Madison. There was a three-year gap in his uni-

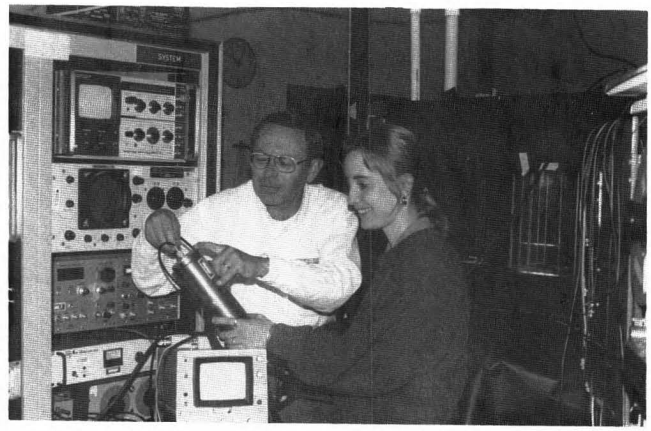
Neil continues to have an interest in air pollution and works with both students and government on the current problems in Arizona. The scientific problems concern the extremes of mixing that occur in the desert, from shallow ground-based temperature inversions at night to vigorous instability in [midday].

versity education while he worked for Standard Oil Company in California and subsequently served as a sanitary engineering officer in the U.S. Army in Puerto Rico. As the army staff at Rodriguez Army Hospital in San Juan was reduced he took on jobs ranging from restauraunt inspector to company commander. Neil, however, rarely talks about anything in Puerto Rico except playing tennis with Charley Paserell. Charley has probably forgotten all about it, since he was only fourteen at the time.

After the army, Neil attended the University of Texas at Austin where he earned his PhD working with John McKetta. He also received a MS in chemical engineering and an MA in math from the University of Texas. While in Austin, he met his wife, Sarah, and they were married on June 3, 1962—Jefferson Davis' birthday—the day after Neil's PhD commencement.

After completing his PhD, Neil went to work at du Pont Central Research in Wilmington, Delaware. They had last hired a chemical engineer about fifteen years before and didn't really know what one was good for, so they presented him with problems that the chemists and physicists considered impossible. Neil wasn't as successful as the other chemical engineers at solving such problems until they asked him to try to make CrO_2 at conditions less severe than 350 atm in a sealed platinum tube. Not knowing any better, he proceeded to put the precursors in an open steel cup and insert the cup in a closed pressure vessel. He found that the reaction ended when the pressure reached 15 atm and the products had the desired ferromagnetic properties. He left du Pont for ASU before his original experiment was commercialized as magnetic tape.

While at du Pont, Neil noticed the first report of velocity measurement by Laser Doppler Velocimetry, and after he settled at ASU, he decided to build a similar instrument. Fortunately, the Army had sent a group of officers to ASU to obtain masters degrees in mechanical engineering, and several of them helped build the first instrument. It was extremely difficult to align the optical system, so to test the system he searched for a flow experiment which would stay in alignment throughout the experiment. The ideal experiment was entrance flow. One experiment led to another, and polymer flows were also analyzed. Since Dan Jankowski, a faculty member at ASU, was interested in stability, Neil's next research topic was



Neil and his daughter, Jenny, take time out to share a little lab talk and experimentation.

pipe flow stability. Neil broadened his scope to turbulent flow during two summmers at NASA Lewis working with John Dunning.

Although Neil gives the appearance of working by himself, in real life he does best in collaboration with others. He has a long list of associations starting with the Army officers who built his equipment and followed by Gene Cooper who came from NASA to ASU, John Dunning at NASA, Bill George then at Penn State, H. Usui of Japan, H. Tan and Guou of China, and currently H. W. Bewersdorff of West Germany. He feels fortunate to have had the right colleagues and students on hand at the right times.

At NASA Lewis, John Dunning and Neil measured the velocity fluctuations in turbulent flow to test the applications of LDV. Several limits in laminar flow had been previously studied by John. In turbulent flow, it was clear that turbulence represented a frequency modulated (FM) signal, but there was a noise component present in addition to the turbulence. This noise component had been extensively studied at Bell Labs many years before, and a similar analysis for LDV turbulent signals was made by Bill George and John Lumley. There was a difference between these two analyses that Neil could not figure out, so he asked Bill George if he could come to Penn State on his sabbatical to continue work on the problem. Bill agreed. The discrepency was quickly resolved and the NASA experiments finally interpreted, but Bill did not have a functioning Laser Doppler instrument since homemade ones continued to have alignment difficul-

ties. Neil turned to the other current research topic of interest in the aerospace department at Penn State—drag reduction by polymers.

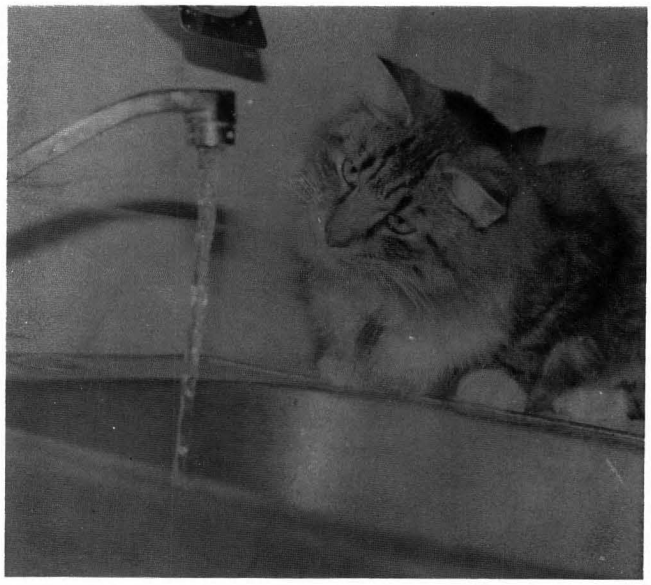
Several important experiments in this area were developed through discussions (sometimes called shouting matches by observers) between Bill George and Neil, and the experiments were carried out with the aid of personnel in the Applied Research Laboratory at Penn State. Neil and Bill proved, at least to their satisfaction, that the time scale was the important parameter in the interaction between high molecular weight polymer molecules and turbulence. The clever experiment developed required that the direction of change be one way for a time scale and the other way for a length scale and did not depend on the absolute scale of the experimental numbers.

After returning to ASU with a much greater foundation in turbulence and signal analysis, Neil began work on two aspects of turbulent mixing—air pollution and drag reduction. Air quality in the Phoenix area had been perceived to be declining, but no one was studying the problem. Some undergraduate students were interested, however, and agreed to locate the data and run the computer programs. This air pollution research has had very little financial support over the past fifteen years, but has involved many students who have gone on to careers in the environmental area.

Neil's involvement with air pollution research in the middle 1970's led to some publicity in the local newspapers (partly due to his friendship with a local reporter) and to his subsequent appointment to the governor's commission on Air Quality. He pointed out to local authorities that the wind speed instruments originally installed at the monitoring stations had too high a starting speed to be of any use in Phoenix. He also suggested that wintertime daylight savings time had advantages in reducing pollution.

Neil continues to have an interest in air pollution and works with both students and government on the current problems in Arizona. The scientific problems concern the extremes of mixing that occur in the desert, from shallow ground-based temperature inversions at night to vigorous instability in the middle of the day. Critical aspects of the air pollution problem include how the inversion sets in during the evening rush-hour in winter, creating high levels of CO, and how the inversion breaks up in the morning in summer, diluting the reactants which produce photochemical oxidants.

In his drag reduction research after his return from Penn State, Neil studied the role of molecular weight distribution. The experiment was to separate



Hoppalong Catsidy Berman, always ready to investigate running water and its vortices.

molecular weights using gel chromatography, to analyze the fractions, and to measure the drag reduction ability. The analysis and drag reduction measurements had to be done simultaneously and soon after collection from the column, to avoid degradation. Nothing was automated, so the group consisted of Neil, two graduate students (John Yuen and Sharam Elihu), and Neil's children (Jenny and Dan). This difficult experiment required density, viscosity, and concentration measurements in addition to the pipe flow part.

Dr. Usui came from Japan to show Neil how to make a pipe test section from mylar film. A few years later, Hung Tan spent a year measuring velocities in a submerged jet and developing a new experimental technique for laser velocity measurements. It seems that a year's collaboration results in at least three papers, but it takes a while to write them. Neil has personally written most of his nearly 100 papers beginning with the first draft. Only about 10% were jointly written, although joint authors contributed in other ways. Sarah, Jenny, and Dan have all helped with the proofreading, and Jenny co-authored one of his papers.

In addition to his research work, Neil has taught most of the undergraduate courses at ASU at one time or another. He has also taught graduate courses. Currently he is teaching transport phenomena and special courses in air pollution, math, turbulent transport and mass transfer. Some of his former students accuse him of not being able to speak without at least three blackboards to fill with equations. He is currently

Graduate Studies Coordinator for the department and has been active in university and community service as well. He has served three terms on the faculty senate where he chaired the Personnel Committee and was a member of the Executive Committee and the Academic Affairs Committee. He has also served on numerous special committees and search committees. He is a recipient of the Distinguished Research Award from ASU. This award recognized Neil's excellent research program by funding a visiting scholar (Bob Kabel of Penn State) to take over Neil's teaching assignments for a year, allowing him to devote all of his time to research and to working with graduate students.

Neil has always tried to involve everyone around him in his work. His children grew up helping him in his lab. Sarah has, on more than one occasion, been offered offices in the local section of AIChE for her dedication in accompanying him to meetings for so many years. Now, he finally has a pet who shares his interest in turbulence; Hoppalong Catsidy, the newest addition to the family, is always ready to investigate running water and the vortices formed when it flows down the drain. □

ChE book reviews

ENGINEERING EDUCATION AND PRACTICE IN THE UNITED STATES
National Academy Press, 2101 Constitution Avenue, NW, Washington, DC 20418

Reviewed by
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Southeastern Massachusetts University

At the request of the National Science Foundation, the National Research Council embarked on a major study of engineering education and practice in the United States. A distinguished 26-member committee drawn from education, business, and industry was appointed in 1982. Fifty additional persons on nine panels prepared background papers for the committee. In 1985 the National Academy Press began publishing a nine-volume paperback series of reports from the committee and its panels. The general report of the committee, *Engineering Education and Practice in the United States: Foundations of our Techno-Economic Future*, was reviewed in the Spring 1986 issue of *Chemical Engineering Education*. Subsequent volumes were published on undergraduate and graduate engineering education. This review

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