Hendrick C. Van Ness (1924-2008)
Rensselaer Polytechnic Institute

Hendrick C. Van Ness was best known as an author of the classic text *Introduction to Chemical Engineering Thermodynamics*, which since 1959 (2nd edition) has had world-wide sales of over 666,000 copies. No other chemical-engineering text has been so long in print and reached so many students.

Hendrick C. Van Ness

Van Ness received B.S.(1944) and M.S.(1946) degrees from the University of Rochester. His M.S. thesis advisor was Joseph J. Martin, later (1971) President of AIChE. The thesis was on *The Effect of Agitation on the Rate of Dissolution of Salts in Water*. The war-induced shortage of teachers and the flood of returning World-War-II veterans provided him at age 21 entry into the academic world, and he served as a full-time Instructor in Engineering (1945--1947), teaching not only Unit Operations for chemical engineers but Mechanics and Strength of Materials for mechanical engineers as well. Then came two years (1947-1949) employment as a chemical engineer with a major engineering company. In 1949 he began as a doctoral student at Yale University. The D. Eng. degree was granted in 1953. His thesis advisor was Barnett F. Dodge, an eminent thermodynamicist, who in 1955 was President of AIChE. The thesis was on *The Effects of Hydrogen at High Pressure on the Mechanical Properties of Metals*. It should not escape notice that neither thesis had anything to do with thermodynamics.

Then followed four years (1952-1956) as an Assistant Professor at Purdue University, devoted primarily to teaching, including assignments to his first courses in thermodynamics. Moreover, he began writing as coauthor of the 2nd edition of the aforementioned text, the first edition having been authored by Joe Mauk Smith and published in 1949.

All this was prologue and preparation for the productive years following 1956 at Rensselaer Polytechnic Institute, where he found the intellectually challenging specialty of thermodynamics a promising outlet for scholarship. His 33-year active career at Rensselaer mixed effective teaching with an intensive research program focused on the thermodynamic properties of liquid mixtures and their relation to vapor/liquid equilibrium. The focus was on measurement, analysis, and correlation of thermodynamic data. The goal was to maximize the return in useful information for the investment in experiment. To this end, new experimental devices were developed for the rapid measurement of accurate data, most notably a dilution calorimeter for heats of mixing and a total-pressure cell for vapor/liquid equilibrium. Both proved to be prototypes, exploited in other laboratories. Jointly with experiment Van Ness developed efficient and effective techniques for rational data reduction, correlation, and consistency testing, all topics of fundamental importance. Several dozen published articles contributed to the experimental, theoretical, and pedagogical foundations of chemical-engineering thermodynamics. Then too, there was *that* textbook, with the second edition published in 1959, the 3rd in 1975, the 4th in 1987; then in retirement, the 5th in 1996, the 6th in 2001, and the 7th in 2005. The last three were coauthored by the late Professor Michael M. Abbott. There were other books as well – in total, six separate titles and 13 separate editions. Moreover, Professors Van Ness and Abbott coauthored the "Thermodynamics" sections of the 5th through 8th editions of *Perry's Chemical Engineers' Handbook* and the 3rd and 4th editions of the *Kirk-Othmer Encyclopedia of Chemical Technology*.

During the academic year 1958-1959 Van Ness was Visiting Fulbright Lecturer in Chemical Engineering at King's College, University of Durham, Newcastle-upon-Tyne, England (later, University of Newcastle-upon-Tyne). In 1966 he spent a term as Visiting Professor at the University of California, Berkeley, and in 1977, a term as Visiting

Professor at Danmark's Tekniske Hojskole, Lyngby, Denmark. He became a Fellow of AIChE in 1974, received the Phillips Lecture Award from Oklahoma State University in 1978, and the Warren K. Lewis Award of AIChE in 1988 for "distinguished and continuing contributions to chemical-engineering education." In 1994 he was the first engineer elected by the International Union of Pure and Applied Chemistry to present the Rossini Lecture, "in recognition of outstanding contributions to chemical thermodynamics." The lecture was presented at the 13th International Conference on Chemical Thermodynamics, Clermont-Ferrand, France. Till 2008 he held the title Institute Professor Emeritus of Chemical Engineering at Rensselaer Polytechnic Institute.

Profile

In 1630 Kiliaen Van Rensselaer, a merchant in Amsterdam and a member of the Dutch West India Company, purchased from the Indians a large tract of land in what later became the capitol district of New York State. He enlisted families to settle the land under contract to him, thus establishing what has been called *Holland on the Hudson*. He was the *Patroon*, and the colonists were his *tenants*, the only feudal system exported to America. Among the tenants arriving in 1641 was one Hendrick Van Ness, his son, daughter-in-law, and two grandchildren. In 1956, 315 years later, his eleventh-generation namesake joined the faculty of the school established by the eighth and last Patroon, Stephen Van Rensselaer.

Hendrick C. Van Ness began life in 1924 on Manhattan Island in New York City, but at age four was transported to the eastern-New York village of Greenwich, where his father took over his grandfather's practice as a country lawyer. There he attended school, K through 12, graduating valedictorian of his class in 1941. Completely innocent in such matters, he took the advice of a family friend and entered upon the course of study in chemical engineering at the University of Rochester. As a consequence of the bombing of Pearl Harbor on December 7, 1941, his course of study became an accelerated three-year war-time program leading in 1944 to the B.S. He continued at Rochester until 1947, spending a year as a Teaching Assistant and two years as an Instructor. Of this adventure, he says that "with the returning war veterans as students, I was often the youngest person in the classroom, but there was never any question of who was the teacher and who was the taught. Nevertheless, I discovered that teaching is the ultimate learning experience."

Van Ness spent the next two years employed by a major engineering company. A useful interlude, it convinced him that teaching was his calling. In the Fall of 1949 he enrolled as a doctoral student at Yale University. "My prior teaching experience provided superb preparation for advanced study, and the course work motivated me to transcribe class notes into detailed expositions of the subject matter. This activity provided an outlet for my attachment to the English language, and laid the foundation for later contributions to the literature of chemical engineering. In those days, doctoral research served to demonstrate an ability to carry a significant project to a successful conclusion. This counted for more than the research itself, with no expectation that the topic of research would be a lifelong concentration. Thus it was that thermodynamics played no part in my doctoral research. That interest grew out of teaching assignments" – Van Ness. Teaching was always a major component of Van Ness's scholarship. And out of teaching grew the writing of books, greatly expanding the range of his teaching.

The most celebrated of his books is *Introduction to Chemical Engineering Thermodynamics*, which has been a standard text for chemical engineers for more than a half century. Its first edition, published by McGraw-Hill in 1949, was written by Joe Mauk Smith, but the six following editions have been coauthored by Professor Van Ness. It is a text designed for student understanding, but maintains the rigor of sound thermodynamic analysis, and carries treatment far enough to allow application to significant practical problems. Its general appeal to teachers, students, and practicing chemical engineers is surely the basis for its long-time success. The considerable evolution of both the teaching and content of chemical-engineering thermodynamics over the past 50 years is fully reflected in changes made in successive editions of the text. Less obvious is the reverse: the major influence that many of the changes, indeed innovations, have had in shaping and stimulating the evolution. All coauthors have of course contributed, but Professor Van Ness is everywhere recognized as the first among equals for the more recent editions. Moreover, he is responsible for molding the material into a clear and coherent entity with a uniform writing style. It is not only a contribution to the chemical-engineering literature, but also a literary contribution, and a significant influence in the education of the majority of the world's chemical-engineering students.

Research played an important role in Van Ness's career, primarily through an intensive program focused on the thermodynamic properties of liquid solutions. Based solidly on experiment, it required the development of new devices for property measurements that were both accurate and rapidly obtained. Graduate degrees were granted to 34 students who obtained experience from this work. One device was a dilution calorimeter for measurement of heats of mixing of liquids. The first publication to report data from this instrument presented results representing a total of 54 isotherms at three temperatures, at least doubling the world's supply of quality data of this kind. A major innovation was the incorporation of a thermoelectric cooling module to allow taking data for both exothermic and endothermic systems. Many sets of data were published, including an 11-part series of papers that reported both heat-of-mixing and vapor/liquid-equilibrium data for ternary systems and their constituent binaries.

Van Ness's first publication, appearing in the initial issue of the AIChE Journal in 1955, dealt with applications of the then-new Redlich/Kwong equation of state. Several early papers reported experiments in heat and mass transfer. Another half-dozen, developed out of his teaching experience, laid the foundation for future research. Ultimately, some 50 papers were published focusing on various aspects of thermodynamics, some based on experiment and some on theory. A paper coauthored with Professor Abbott was the first paper in the initial issue of *Fluid Phase Equilibria* in 1977. Still active, he coauthored a 2008 paper in the same journal.

Van Ness is indeed a bright star in the history of the Chemical and Biological Engineering Department at Rensselaer. Each year, the department honors a rising star in our profession with the Van Ness Lecture Award. Many recipients have already made their mark.

What of the future? Professor Van Ness was neither an optimist nor a pessimist, just a realist, and commented: “Civilization faces monumental problems, not yet fully comprehended by the masses nor adequately addressed by governments. Sustainability, a topic of intellectual discussion, is promoted only by minimal efforts. Sustainability means nothing more than a state of dynamic equilibrium, with the earth as part of a (more-or-less) steady-state solar system. There can be no doubt that eventually sustainability will prevail. The question is: *What* can possibly be sustained in the face of human pursuits? Obvious limits are imposed by finite resources, some of which already approach an imbalance of supply and demand. Indeed, limits may even now have been passed. The earth's resources are almost certainly inadequate to support indefinitely six billion individuals, the number already living on earth, in the lifestyle enjoyed by middle-class Americans, a lifestyle dependent on abundance and waste. Aspirations may abound, populations may work to that end, and may even enjoy limited success, but wasteful lifestyles are unlikely to endure. Even isolated populations may well dissipate their resources trying to remain isolated. The success of our economic system depends on abundance of resources. What will work in a world of scarce supply? What form of government can be effective where citizen survival is in doubt? Perhaps mankind will adapt peacefully and learn to prosper on a far more limited scale, but given human nature, wars of annihilation seem about as likely. In any event, the world in several decades looks to be a very different place.”