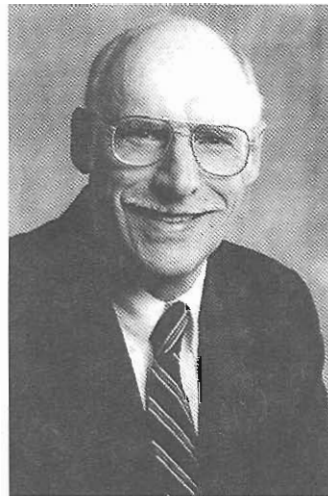


A Pioneer, Advocate, and Articulator of the Science and Engineering of Enhanced Heat Transfer: Professor Arthur E. Bergles on his 65th Birthday

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Professor Arthur E. Bergles

From large scale power boilers to micro-scale heat sinks for microelectronic cooling, from thermal processing of chemical media and materials to HVAC systems, from airborne and space-based cooling systems to biomedical devices, to name a few, heat transfer enhancement today finds a wide range of thermal engineering applications. For more than three and a half decades now, Professor Arthur E. Bergles has been one of its foremost advocates and a pioneering articulator. While his career's research has spanned the field of convective and ebullient heat transfer, Professor Bergles has made very significant and seminal contributions to the field of enhanced heat transfer. He has had a pivotal role in this field by producing the first large review of enhanced heat transfer, and developing the taxonomy for the classification of the various enhancement techniques. For the evaluation and use of these techniques, Art

has conducted numerous fundamental and applied investigations, and has relentlessly pushed for the adoption of enhancement technologies by industry. With his efforts over these 37 years, he has spearheaded a generational evolution in the field. As he aptly points out, from its birth and growth as a *second-generation heat transfer technology*, the present day advanced enhancements represent a *third-generation heat transfer technology* with exciting new frontiers to be explored. In essence, Art truly has defined the field of enhanced heat transfer.

Art Bergles was born on August 9, 1935, in Rhinebeck, New York. He grew up to study mechanical engineering at the Massachusetts Institute of Technology, where he received his SB and SM degrees in 1958, and his Ph. D. in 1962. His career as a professor of mechanical engineering began at MIT, where he had a seven-year stint (1963–70). He then moved to Georgia Institute of Technology (1970–72), and again to Iowa State University. He was at ISU for 14 years (1972–86) as Chair of the Department of Mechanical Engineering, and Anson Marston Distinguished Professor of Engineering. He joined Rensselaer Polytechnic Institute as Clark and Crossan Professor of Engineering in 1986, and later became Dean of Engineering (1989–92) before retiring in 1997. He was a visiting professor at the University of Hannover, the Danish Technical University (twice), and the Technical University of Munich, and was an Academic Guest at Lodz Technical University. Today, while he remains the Clark and Crossan Professor of Engineering, Emeritus, at RPI, due to the de-emphasis of heat transfer research there, he has taken on low-involvement appointments at the University of Maryland (Glenn L. Martin Institute Professor of Engineering), and MIT (Senior Lecturer in Mechanical Engineering). The latter brings him full circle, as it was at MIT that he started his teaching career in 1963.

Professor Bergles' distinguished career has been marked by many significant contributions and accomplishments for which he has been recognized by numerous awards and honors. Most recently, he was elected to Foreign Membership in the Royal Academy of Engineering (UK) and is the recipient of the 2000 ASME Medal. He will be given the Nusselt-Reynolds Prize in 2001. He was accorded the F. Paul Anderson Medal earlier this year, which is ASHRAE's highest technical award. In 1998, he received the Luikov Medal, the highest award of ICHMT, and in 1996 he was made an Honorary Member of ASME, which is its highest recognition. Also in 1996, he was honored with a symposium and festschrift: *Process, Enhanced and Multiphase Heat Transfer*. Rand Afrikaans University, South Africa (1999), and the University of Porto, Portugal (1998), bestowed Art with honorary doctorates—both of which were the first such awards initiated by the respective mechanical engineering departments. He was elected to the National Academy of Engineering in 1992, and he is a Fellow of the ASME (1979), ASEE (1985), AAAS (1988), and ASHRAE (1992). Some of his other recognitions include the ASME-AIChE Max Jakob Memorial Award (1995), ASEE Centennial Certificate and Medallion (1993), AIChE Donald Q. Kern Award (1990), ASEE Benjamin Garver Lamme Medal (1987), SAE Ralph R. Teetor Educational Award (1984), ASME Dedicated Service Award (1984), and the Alexander Von Humboldt Award (1979). He has also been recognized as Honorary Member of the Union of Mechanical and Electrical Engineers and Technicians of Yugoslavia (1993), Fellowship Award of the International Center for Heat and Mass Transfer (1988), 50th Anniversary Award of the ASME Heat Transfer Division (1988), Foreign Member of the Polish Society of Theoretical and Applied Mechanics (1987), and Purdue University Hawkins Memorial Lecturer (1986).

Art's contribution to the scientific archival literature has been very extensive, and he has published more than 350 papers (a number that is still growing) and 24 books or edited volumes. He has presented over 325 invited lectures and seminars at US and foreign universities, professional societies, and industrial institutions. Art has continued this busy productivity to this day, and he has published more than 30 papers (most presented at conferences), edited two books, and given 24 seminars since "retiring" from

RPI in 1997. In order to free up time, and compensate for what he calls his “marginal secretarial skills,” he has almost dropped reviewing papers, having done about 800+ formal reviews. This activity is underscored by the fact that Art is or has been an editor or on the editorial board of *Applied Mechanics Reviews*, *Bulletin of the International Center for Heat and Mass Transfer*, *European Journal of Mechanical Engineering*, *Experimental Thermal and Fluid Science*, *Heat Transfer Engineering*, *Heat Transfer–Asian Research*, *Heat Transfer–Soviet Research*, *HVAC&R Research*, *International Journal of Heat and Mass Transfer*, *International Journal of Heat and Technology*, *International Series in Heat and Mass Transfer*, *Journal of Engineering Physics*, *Journal of Heat Transfer*, *Journal of Thermal Science*, *Latin American Applied Research*, and *Springer Mechanical Engineering Series*. He has been the Advisory Editor of the *Journal of Enhanced Heat Transfer* ever since its inception in 1993, and has also contributed several articles that have been published in it.

Professor Bergles’ entire career has been in universities, where he has supervised over 80 Ph.D. dissertations, MS theses, and degree research project reports. A large part of this work has indeed been devoted to enhanced heat transfer. His supervision style has always reflected a balance between the need to educate and train graduate students, and the demands of the research project. He would challenge students to achieve more and delve deeper into the process or phenomenon under study, as well as engage them in extended discussions so that they could grow professionally. This educational approach also extended into the many courses Art taught at both the undergraduate and graduate levels. His lectures were always well prepared with clear explanations of major points, and displayed his keen desire to pass on his knowledge to the students. One of the first courses on enhanced heat transfer was developed and introduced by him at RPI, and most of his other courses always contained some elements of this field. Art’s commitment to education has extended beyond the classroom through the many short courses (50) he has offered to industry, professional societies, and universities. He has always emphasized the applied aspects of fundamental research, and the eventual transfer of technology for applications in industry. In achieving this balance, he has constantly encouraged more and better interactions between researchers and universities on the one hand, and designers and industrial organizations on the other.

Art Bergles has also been extremely active in many professional organizations, most prominently in ASME, AIChE, ASHRAE, ASEE, and ICHMT. This includes chair of the ASME Heat Transfer Division, representative to the Assembly for International Heat Transfer Conferences, and chair of the NSF Advisory Committee for Chemical, Biochemical, and Thermal Engineering. He was chosen to be the chair of the US study group to develop a cooperative program in heat and mass transfer with the former USSR. In fact, Art’s leadership has extended beyond the heat and mass transfer community, as he was President of ASME (1990–91), member of the ASME Board of Governors, and member of the NSF Advisory Committee for Engineering, among many other offices. To this day, despite his apparent “retirement,” he continues to be involved with professional affairs. Art just concluded a term as chair of the Leadership Development Intern subcommittee of the Committee of ASME Past Presidents, and as chair of the Executive Committee of the International Center for Heat and Mass Transfer. He was a co-organizer of the International Thermal Sciences Seminar, Bled, Slovenia (June 2000).

In his personal life, Art and Penny celebrated their 40th wedding anniversary this year. They now live on Cape Cod, MA, in what Art calls “a rather technical house.” This is calling upon all of his manual skills: carpentry, electrical, painting, and plumbing. Furthermore, Art’s struggle to clean out the office and laboratories at RPI is hampered by Penny’s stern warning, “Under no circumstances, bring anything home.” They have endowed a professorship in thermal sciences at Iowa State University, where Art spent much of his career. Both sons (Eric and Dwight) are married, and Art and Penny now have a grandson.

To this day Art Bergles continues tirelessly in the giving of his time and efforts to advance science and engineering in general, and the heat transfer field in particular. The viability of heat transfer, and therefore enhancement, is very much on his mind. He regularly addresses that subject and the over-dependence on computation at the expense of real experimentation. In his words “progress [in heat transfer as well as its enhancement] will depend on an expansion of capability in both experimentation and computation as well as synergistic interaction,” and he further emphasizes “experimentation is still a vital art needed for direct resolution of transport phenomenon in complex enhanced geometries, as well as bench-marking of computer codes.” While there have been some health problems in recent years (or as he says “the warranty is running out”), Art is ever optimistic about the future, especially enhanced heat transfer. Today, in the beginning of a new millennium and as he turns 65, he carries on his professional involvement quite selflessly. Though he often quips “the spirit is willing, but the flesh is weak, or as my friends in Russia translate it ‘The vodka is good, but the meat is rotten’.” Many of us (his colleagues, friends, and admirers) in the enhanced heat transfer as well as the general heat transfer and mechanical engineering community worldwide, however, would like to wish him many more wonderful miles on his exemplary journey. And on behalf of his numerous friends and colleagues, I wish Art a very happy birthday with many more returns of the day!