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IN REMEMBRANCE OF NOVAK ZUBER

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My first meeting of Novak Zuber was in 1957. He was a teaching assistant for Myron Tribus in a thermodynamics class I took based on information theory, an approach that I still do understand despite Novak's help. But, when Arnold Sommerfeld (1967), the German theoretical physicist, was asked why he had never written a book on thermodynamics, he supposedly answered: "Thermodynamics is a funny subject. The first time you go through it, you don't understand it at all. The second time you go through it, you think you understand it, except for one or two small points. The third time you go through it, you know you don't understand it, but by that time you are so used to it, it doesn't bother you anymore."

It was during his graduate studies at UCLA that he became involved in boiling heat transfer and two-phase flow as part of a research project that supported the development of the nuclear submarine. His work on the project led to his development of a hydrodynamic approach to predict the critical heat flux and the heat flux at minimum film boiling. A research assistantship often is what guides a student into a particular area of study. In this case, it moved Novak's area of interest from aerodynamics to multi-phase flow. His drift flux model came later.

Novak was fond of the phrase "tracks in a straight line" and he certainly did track in a straight line. Whatever he did was done with a creative intensity that defied logic. Many of you know about his leading the advisory group composed of the top people in the numerical computation area that led to the Nuclear Regulatory Commission (NRC) supporting the development of a two-fluid approach for large-systems computer codes. This was followed by a period of continuous self-incrimination for initiating something that to this day is not a complete success.

It was Novak who undertook the task of determining how certain large-break loss-of-coolant-accident (LOCA) predictions were made in the TRAC code, and of developing something called phenomena identification and ranking tables (PIRT) to guide the process. Novak realized at the outset that such an undertaking would be difficult. He spent several weeks studying group dynamics and came to the conclusion that he somehow had to get the participants to interact in a civil manner. A social interaction before any technical meetings was the best first step. This turned out to be an evening of heavy

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drinking with me being carried home for having challenged him in his own home. Another aspect of the PIRT development was the need for detailed information about the code to be evaluated. The national laboratory involved in the project refused to generate the information without an exorbitant amount of funds and Novak's immediate supervision agreed in acquiescing to political pressure. Novak waited until his supervisor was on vacation and cut off the funding until the laboratory agreed. For this he was commended by the Chairman of the NRC and then asked to retire. As you know, the word compromise does not exist in Montenegrin.

This particular exercise led to an interest in scaling and how one might put the PIRT process on a sound footing. What really kicked it off were something called direct containment heating (DCH) and the results of testing done at Sandia National Laboratories (SNL) (Albuquerque, NM). The SNL testing seemed to indicate that DCH was real (making a certain nuclear plant event a catastrophe) and Novak questioned the scaling from small tests to large containment buildings. To address this issue, Novak developed a general scaling approach he called fractional scaling analysis (FSA), which was applicable from the molecular scale to the nuclear power plant scale. He was able to show that the DCH problem was not the catastrophe it had been thought to be. A NRC report was prepared but never published, although the results have appeared in a number of papers by Novak and his colleagues.

Novak was an outspoken visionary and an undeniable optimist who produced elegant real-world solutions for his visions and considered engineering and science as the highest professional calling. His personal tools were a brilliant mind, knack for simplification, hard work, relentless attention to detail, and untouchable integrity. Aside from Novak's professional accomplishments, he was a fascinating person with a keen mind and a strong sense of responsibility to the technical community. He was brutally honest and straightforward with scientists/engineers and never lost sight of the need for practicality. His many talks were laced with admonitions to young engineers telling them that they had a responsibility to do the right thing. He had no patience for engineers who did not present their views in an honest and forthright manner. His concern for the education of young engineers led to the establishment of the Kerze-Cheyovich Research Fellowship at UCLA.

Many of us suffered his scorn when we came up short, and we were better for it. He would call me in the middle of the night to tell me that my Advisory Committee on Reactor Safeguards (ACRS) reports were wrong—and why they were wrong. Novak Zuber tracked in a "straight line," and those of us who knew him well knew what he meant when he used that phrase. At a small luncheon to celebrate his 90th birthday he gave each of us a copy of Stephen Hawking's book, *The Dreams That Stuff Is Made Of*. He never gave up.

It is with a great deal of sadness that I say goodbye to Novak Zuber. In his honor, we are going to try and put together a more comprehensive story of the life of Novak Zuber. I would like to enlist your aid in this task. Knowing that many of you have had

personal experiences with him, I would like to invite you to share them with us so that we can document them and prepare a more lasting tribute to the life of Novak Zuber. If you would like to share your personal experiences, please can contact me by e-mail (catton@ucla.edu). Also, we are planning to dedicate a small library to Novak Zuber in order to house his technical books, which numbered in the thousands.

REFERENCES

Angrist, S. W. and Helper, L. E., *Order and Chaos—Laws of Energy and Entropy, Basic Books*, 1967.