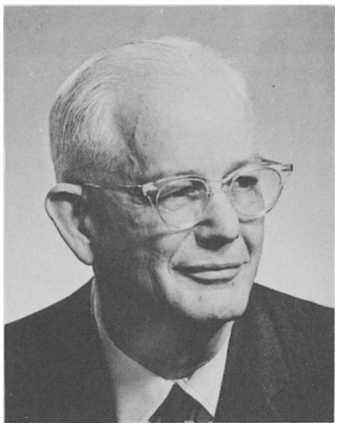
COMMENTARY

NUCLEAR TECHNOLOGY AT THE QUARTER-CENTURY POST



Twenty-five years have passed since December 2, 1942 when the world's first nuclear reactor became "critical." That event marked the birth of a new technology that led swiftly to a new era in military theory and operations and eventually became the basis of a vast new industry.

With shock I realized that the young PhD with whom I was discussing this recently had not yet been born when the sweep of that recorder pen announced that CP-1 had reached criticality. He knew the history of nuclear science and technology in detail from its origin, but it was a vicarious knowledge obviously lacking that depth of emotional response that would never be lost from his parents' instinctive reaction to nuclear affairs. They had been psychologically conditioned by the sudden stark intrusion of "the bomb" and its totally devastating effects; he had not. His entire existence had been in a world in which nuclear applications are recognized and play a role of ever increasing importance. To him, nuclear technology is commonplace.

This is so even with respect to his reaction to "the bomb" itself and its use. He approves or disapproves according to his belief in an overriding military need for mass destruction, not according to the nuclear nature of the weapon nor the enormous devastation that a single device can wreak, for he recognizes that equally great havoc had been wrought by military measures long before the atomic bomb. To his generation the realities of the nuclear weapon, however feared and hated, do not cast an aura of evil over all nuclear applications in the way the bomb colored the reactions of such a large segment of the parent generation.

The irrational public fear of all things nuclear is rapidly waning, in part due to effective education with respect to nuclear matters. However, I suspect this waning results more from the inexorable biological calendar: the youth mature, the mature age, and the elders die. With this shift in the cyclorama of human population, the attitudes portrayed on front stage inevitably change. In this case, they have clearly shifted to the advantage of nuclear innovation, whatever its specific nature. Nuclear applications in all of their diverse varieties now face a future wide open for explosive growth if we continue to have the inventive wit to conceive, the technological ability to develop, and the humanistic skill to market the resulting innovations effectively. At this quarter-century post, I have little doubt about the inventive wit or the technological ability; however, the humanistic skills may well prove to be another matter.

I have stressed this matter of the public, its reaction to nuclear applications, and the continuing need for its education in matters nuclear, for now our problems in the nuclear field are no longer overwhelmingly scientific and technological. Despite the steady decline of irrational fear on the part of the public, our problems, which spring from purely human origins, nonetheless command most serious attention.

We as scientists and technologists are prone to forget or to ignore the fact that the final step in the process of developing any innovation is that of gaining public acceptance for it whether emotional prejudice has reared its ugly head or not. Without such acceptance, it makes no difference how technically elegant the development may be, it is societally useless, and the effort expended in producing it is largely wasted.

Time was when the gaining of public acceptance for an innovation was the sole responsibility of a sales organization. Sales knowledge and understanding of the basic characteristics of the innovation were easy to acquire. As a practical necessity, selling was

based almost exclusively on an established technique deemed applicable for any job. What was to be promoted was not important; it was the sales system that counted, and it worked.

Today there is an increasing flood of cases in which this established mode of achieving public acceptance is no longer valid, and for which it consequently fails to work with certainty. The highly sophisticated technological innovations now being introduced, such as most of the nuclear applications with which we are concerned, simply do not fit within the system. Here the product or process is almost always alien to everyday experience, its characteristics and behavior are beyond the comprehension of the normal sales organization and of the public, and, while its benefits are easy to visualize, the possibility of drawbacks, their nature and effects, the seriousness of their consequences, etc., constitute a mystery to the salesmen involved who find themselves in much the same position as do some teachers who graduate with brilliant records in education. They are veritable masters of teaching method and do well, say, with simple arithmetic. Let the New Math appear, however, and they suddenly discover that they have nothing to teach. The teacher may be able to bone up in time to salvage his position, but the salesman and his bosses would face an almost insuperable task in achieving an adequate degree of technical competence in time to fulfill their responsibilities unaided. If they are to succeed they must have the active constructive support of the scientists and engineers who conceive and develop the innovations for which public acceptance is being sought.

This situation poses that first humanistic problem for which we must find a solution. How can the knowledge and understanding of the scientific community be combined with the communication skills of the marketing community to provide a truly effective means for achieving public acceptance of sophisticated technological innovation? It will not be simple. However, the once improbable interdisciplinary project within science and engineering has now become a common mode of operation. The next step, carrying on truly intercultural endeavors which integrate the efforts of science, technology, and the social and humanistic disciplines into a single closely knit activity, should be no less achievable. We must either succeed or see our scientific and technological momentum dissipate.

However, even signal success in this intercultural effort would only point a possible way toward amelioration of the host of other serious humanistic problems we face. Headed for major trouble is any democratic society whose whole economic structure depends upon constant improvement of an already outstandingly high level of proficiency in science and technology but whose citizenry is largely scientifically and technologically illiterate. The only satisfactory answer is to abolish the illiteracy that is the source of the difficulty. This does not mean the endowment of every citizen with full technical competence. However, it is not clear what level of intellectual accomplishment in science and technology is required to guarantee that literacy does obtain. Solving this basic problem for the vast majority of the citizenry is obviously a task for the total scientific and engineering community, not just the nuclear segment thereof. But the participation of others does not reduce our responsibility. We have an enviable record for leadership in many areas not strictly nuclear. Now another major challenge comes indirectly. Is it too much to hope that by December 2, 1992 we will find that in trying to solve our own needs for gaining public acceptance for our nuclear wares we have also cleared a path to the solution of the more fundamental problem of technical literacy? One thing is sure. Should this hope be realized, no contribution that we could make to human progress and the welfare of our democratic society could outweigh its long term significance.