



Looking Back, Looking Forward

Kishin Moorjani

One celebratory occasion is exciting enough, but to have two come together is indeed exhilarating. With the appearance of this issue of the *Technical Digest* we welcome the new millennium and we also mark the 125th anniversary of the founding of The Johns Hopkins University. It is said that sight of the future is enhanced when informed by the past; in our case, the twin occasions *demand* that we look back to look forward.

The story of the generous gift by a prominent Baltimore merchant and investor, Johns Hopkins, for the establishment of the university bearing his name is well documented and has been told often and well, but perhaps never so fully and attractively than by Mame Warren.¹ Her volume portrays in words and photos the many men and women who, over the last 125 years, have risen to the bold vision of one person to give Hopkins its present prestige and presence. From its beginnings in Baltimore, Johns Hopkins today has an official presence on three continents. The reach of knowledge created within its schools, institutes, and laboratories extends truly across the globe.

As Stephen Jay Gould points out in his erudite book, *Questioning the Millennium*,² the recording of time has been quite arbitrary. This applies particularly to the establishment of the year 1 A.D., without which the end of the second and beginning of the third millennium loses, if not its excitement, at least its precision. Nevertheless, however imprecise such markings may be, they do provide a convenient time in the collective conscience to reflect and speculate on what is to come and what has drifted away in the flow of time.

Judging from the number of books that have appeared in the past few years with the title “End of” (the reader is invited to fill in a word of his/her choice—among the more daring ones being history, science, and even complaint!), one might conclude that entirely too much attention has been paid to the past. But that may be because the past, at least, appears more certain. (There of course has been a volume by a Nobel laureate called *The End of Certainty*,³ which will make the lives of future authors more difficult when they write at the turn of the 22nd century or the third millennium.) But the futurists have not been far behind. It is astonishing how the future is almost always seen to be brighter than the past. The visibility of the granularity of history, however, depends on the timescale one uses; on the timescale of years and decades, in contrast to centuries and millennia, human progress appears more oscillatory though hopefully with an upwardly moving slope on a time line of “progress.”

The articles in this issue on “Millennial Challenges” are based mostly on a special colloquium series held at APL during the year 2000. The purpose was to invite distinguished scholars and leaders of diverse backgrounds to share with us their considered thoughts, measured views, and perhaps even educated speculations about the 21st century. The topics of interest were defined largely by the work of the Laboratory: national security, space science and technology, and education. Even in these fields our choices necessarily had to be further limited.

On the subject of national security, colloquia were presented by speakers from our major DoD sponsor, the Navy and the Defense Advanced Research Projects Agency (DARPA). VADM Michael Mullen and RADM Rodney Rempt describe in their articles the Navy in the 21st century, with VADM Mullen providing a broad prospective view on “Surface Warfare” and RADM Rempt concentrating on “Theater Air and Missile Defense.” Both talk of future technological challenges and provide details on specific systems. But the major change foreseen is the transformation of the Navy into an *offensive* maritime power that will operate as part of a Joint force. The emphasis will be on littoral operations as opposed to the blue water Navy of the past. Knowledge superiority and international collaborations are seen to be of paramount importance.

These points are also discussed by Dr. Frank Fernandez in his article on future programs at DARPA. He describes the changing nature of the threat to national security such as the ability of even an individual to wage biological war; the dependence on our partners along with the equally important dependence in the future on critical technologies that are developed outside the United States owing to increased globalization; and the question of affordability of new technology where rising costs can well lead to bankruptcy. Dr. Fernandez offers insights into how technological innovation by itself is not enough and how its integration into systems depends crucially on people who are zealots in their cause and on those who champion the cause through the quagmire of established bureaucracies.

VADM Mullen, RADM Rempt, and Dr. Fernandez all appreciatively recall the significant contributions of APL staff members to national security in the past, and eagerly solicit, nay expect, continuing fruitful interactions through all the forthcoming changes.

Despite the invention of the telephone, television, and computer, Robert Skinner Jr. persuades us in his article that the 20th century was indeed the century of transportation technology. Furthermore he affirms that, at least during the first few decades of the 21st century, we should not expect the type of dramatic changes in transportation that accompanied the introduction of automobiles and aircraft at the turn of the last century. Nevertheless, Mr. Skinner does see the

introduction of information technologies, at home and in “smart” highways, as bringing quantitative changes in transportation.

In his article, the Honorable Daniel Goldin offers a far-ranging and far-reaching dream for NASA in the 21st century. The goal is not evolutionary progress but revolutionary systems for accessing deep space to understand our universal heritage and to improve life on Earth. Dr. Goldin describes a whole array of advanced technologies, well beyond those we can confidently expect in the next decade or so, that will be needed to conduct this great human adventure. He sees advances in biology as crucial to the technological revolution of this century.

Astronomy, along with its more recent cousin astrophysics, is a science with the longest history and the most distinguished pedigree (I am discounting alchemy as a science, although that is not entirely accurate). This is indeed a subject that is imbued with vibrancy, particularly when approached within the “Looking Back, Looking Forward” paradigm. Professor Virginia Trimble in her article goes back to the origin of problems that have fascinated scientists throughout at least the last two millennia, vividly describes monumental controversies, arrives at what can be affirmed with assurance today, and distills that which is unknown and will hopefully be known during the new millennium. The subject of the article demands a poetic scientist (or a scientific poet) to do it full justice, and Professor Trimble more than meets the challenge.

The next three articles are by leaders in education. Dr. William Brody argues that the quality revolution that has affected the manufacturing and service industries will influence education and research during the next century. The localized model of education in which students and teachers gather in a fixed location will be complemented, though perhaps not replaced, by an extended model, in time and in space, where students using already available communications technologies learn at their own convenience from their place of choice. The effects will be seen far beyond the classroom though. A research university without walls with a global orientation will enforce novel collaborations among narrowly focused experts and researchers.

Dr. Shirley Ann Jackson in her article goes beyond the difficulties she personally encountered in acquiring a scientific education to emphasize the sheer necessity of educating women scientists and engineers if we are to maintain our world leadership. She clearly articulates the problems, provides the remedies, and draws a strategic road map to infuse greater numbers of women at all levels of technical education. In the process, Dr. Jackson makes a strong case for improving science education for everyone, men and women alike, not only because it will contribute to a strong economy but for its spirit of human adventure.

Lastly, Dr. Steven Muller, who has often written thoughtful essays on timely subjects in the pages of this journal, reflects on the interplay of technology and society in the new century. He is fully aware not only of what new technologies can do *for* us but also *to* us. Dr. Muller brings into sharp focus the sociological impact of new technologies by raising physical, political, social, and ethical issues, and urges that these issues themselves be scrutinized by scientific analysis to better understand the revolution in our human condition.

Perhaps not surprisingly, the subject of “Information Technologies,” in its broadest interpretation, pervades all nine articles. The trio of technologies—bio, info, and nano—will undoubtedly precipitate change at a hitherto unknown pace. The authors detail how every aspect of our lives, individually and collectively, will be dramatically transformed by these technologies. Information, however, is unlikely to be the only commodity that will easily flow across national borders; so too will diseases

and arms. People crossing borders, national and conceptual, will continue and with luck, the men and women of the new millennium will garner the courage, goodwill, and wisdom to rise to the challenges posed by porous boundaries—but not without vigorous struggles.

REFERENCES

- ¹Warren, M., *Johns Hopkins Knowledge for the World, 1876–2001*, Johns Hopkins University Press, Baltimore, MD (2000).
- ²Gould, S. J., *Questioning the Millennium: A Rationalist's Guide to a Precisely Arbitrary Countdown*, Harmony Books, New York (1997).
- ³Prigogine, I., *The End of Certainty: Time, Chaos, and the New Laws of Nature*, Free Press (1997).

ACKNOWLEDGMENTS: My thanks to my colleagues who were instrumental in arranging speakers for the “Millennial Challenges” series: Richard Constantine for VADM Mullen and RADM Rempt, Ernest Holmboe for Dr. Fernandez, Dennis Kershner for Mr. Skinner, Tom Krimigis for the Honorable Goldin, and Gwendolyn Boyd for Dr. Jackson. Ms. Laura Tye interacted ably and efficiently to coordinate schedules and articles with the staff in the offices of the speakers. Anyone who has tried knows the travails of translating spoken sentences into coherent text, for which Ms. Ronnie Good deserves much acclaim.

THE AUTHOR



KISHIN MOORJANI, a member of the Principal Professional Staff, is a theoretical physicist who has spent most of his research career at APL in the Milton S. Eisenhower Research Center (now Research & Technology Development Center). He has authored/co-authored over 130 publications including a monograph on *Magnetic Glasses* (Elsevier Publ: 1984) which has been translated into Chinese. He was a co-recipient of the first R. W. Hart Award honoring Excellence in Independent Research and Development in 1988 and has received several publication awards for outstanding papers. Dr. Moorjani has served as Group Supervisor of Condensed Matter Sciences, lectured widely, overseen a number of M.S. and Ph.D theses, and held numerous research, teaching, and consulting positions both in the United States and abroad. He chairs the Applied Physics Program in the JHU Whiting School of Engineering and the APL Colloquium Committee and is the series editor for monographs by APL authors published by Oxford University Press. Since 1993, Dr. Moorjani has been Editor-in-Chief and Chair of the Editorial Board for the *Johns Hopkins APL Technical Digest*.