IN MEMORIAM

ROBERT C. MORTON

1915 — 1984

Kenneth A. Potocki*

Member, Principal Professional Staff

Dr. Robert C. Morton was an uncommon man who showed uncommon leadership and technical innovation in his work, uncommon devotion and love to his family and friends, and uncommon expertise at sea.

By the age of 42, Dr. Morton had accomplished more than most men do in an entire career. For his work on the Terrier guided missile, he received the Navy's Distinguished Public Service Award, the highest honor the Navy can bestow upon a civilian. But "R. C. Bob," as he was affectionately referred to by his staff, was only beginning! The Navy was developing its first submarine-launched missile — the Polaris — and Dr. Morton was asked to resolve issues never before addressed: How do you test such a missile? How do you evaluate it? He reacted and the rest is history. With a small cadre of people in the late 1950's, he developed the basic concepts for missile test and evaluation that the Navy still follows today. Under his leadership, that small cadre of people has grown into a large cadre of people, and their expertise in testing and evaluating missile launches has had a significant impact on improving the reliability and quality of the Navy's space power.

Dr. Morton had a saying that "You can't give responsibility — it is taken by those who see a need and react." It is clear that he lived his professional life in this manner. When the Army identified a need for the same type of test and evaluation for its missiles, Dr. Morton reacted, and a new effort was initiated for the Pershing missile. When the Navy exhibited a need for understanding the modern technologies for detecting U. S. submarines, R. C. Morton reacted and combined the talents of scientists, engineers, and experienced Naval officers to address these issues. Dr. Morton reacted in similar ways to the Navy's needs for acquiring oceanographic data and evaluating submarine sonars. There was no problem too difficult for him to undertake, and he attacked each new area with vision, vigor, and enthusiasm. He was tremendously effective in getting a job done. That is why significant national problem areas were entrusted to him for solution.

I would like to relate a story that Dr. Morton loved to tell. When his son Rob was selecting a career field, he told his father that he did not want to do the same thing that Dr. Morton did — he wanted to do something different. He selected oceanography rather than engineering. Surprisingly, while Rob was in graduate school, Dr. Morton started the Submarine Technology Program, and by the time Rob got his Ph.D in 1972, Dr. Morton had 90 people working in ocean-related studies.

With regard to all the work he directed, Dr. Morton had an uncompromising insistence on its integrity. When he knew he was correct, he had a dogged persistence to hold to what was right for the good of the Navy and of the country. Because he was almost always right, he was respected by all of his associates. Because he represented The Johns Hopkins University, he was able to speak as an "independent evaluator," and the Navy appreciated his toughness in addressing difficult issues.

As he managed more and larger programs and his staff grew, Dr. Morton always maintained a strong interest in his staff. He managed through personal interaction and everyone had access to him. His organization was often depicted as a wheel with him at the center and his staff as the spokes. He had a unique style of dealing with people and caring about them all, from supervisors, to engineers, to secretaries, to mail clerks. He was always there, urging you on to do better things, for he realized that once you accepted the status quo, you would make no further progress. He was always able to communicate his enthusiasm for the job to you. This made good people want to be excellent and excellent people want to be superior. His staff respected and loved him and developed a tremendous confidence in and loyalty to him. Whereas he had received awards for his technical accomplishments, his little spontaneous awards — like cork and toothpick sailboats — from friends who cared about him were equally important to his life.

Dr. Morton was also interested in the families of his staff. This was a natural outgrowth of his dedication to his own wife Ruth and children Robert, Roger, Ruth, and Richard. Often, engineers have to spend long periods of time at field test sites. Dr. Morton encouraged them to take their families along because he felt the job should encourage family life and not detract from it.

At work, Dr. Morton was unflappable, serious, and determined, and he could exert tremendous pressure on you to get the job done. In a social environment, he was outgoing, cheerful, upbeat, friendly, and humorous. There was never a more pleasant fellow. He enjoyed people and was in his element when he was with them. He could meet a new young scientist and

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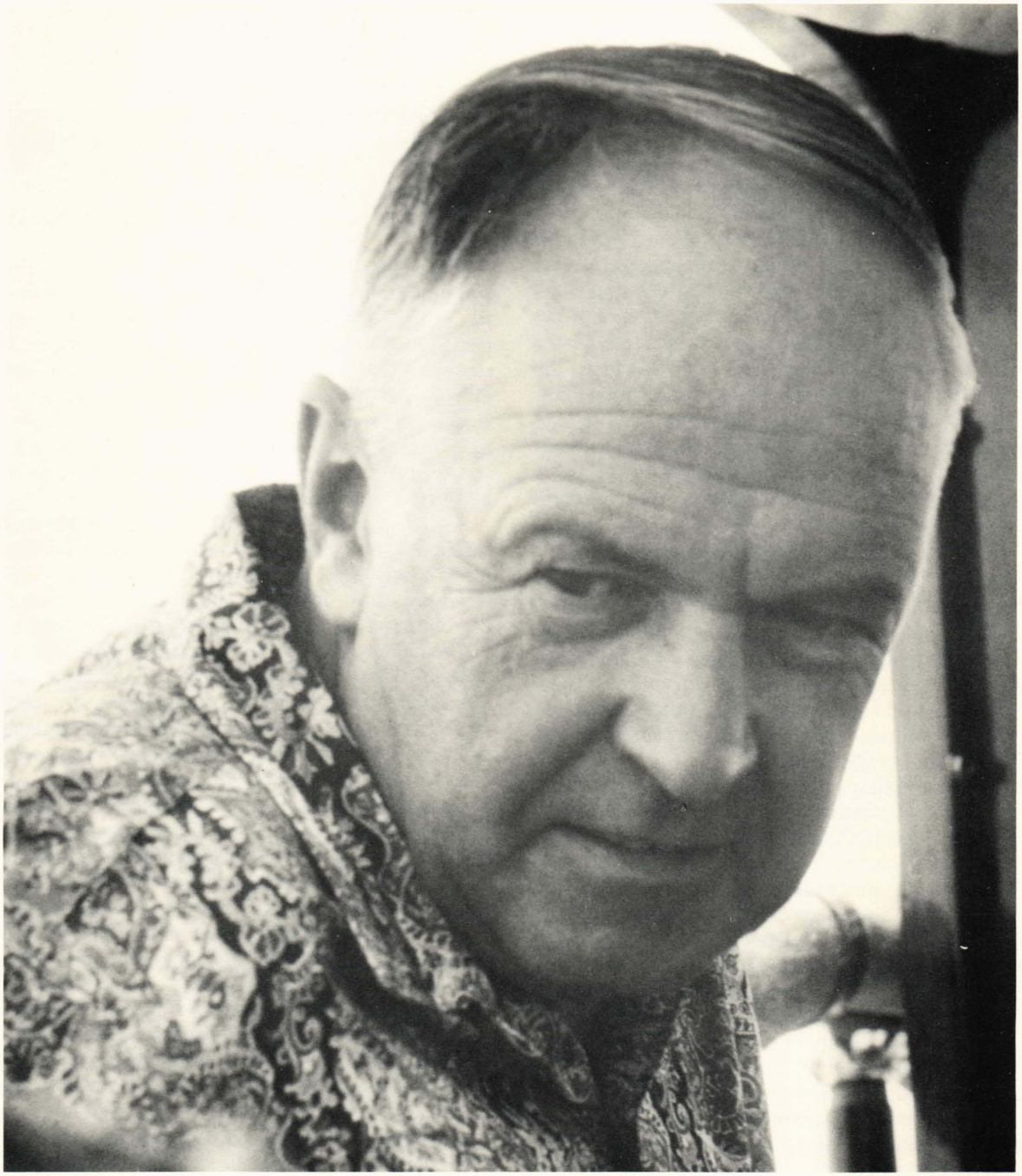

his wife and immediately make them feel like a part of the family. This instant association with people was one of Dr. Morton's true gifts, and it helped forge the strong ties between him and his friends and associates.

Those of us who knew him socially also saw him in a hobby he adored — sailing. It is hard to believe that he was not born and raised on a sailboat because he was always completely relaxed and happy at sea. Rather, he took up sailing in mid-life and, just like everything else he did, he attacked it with uncommon vigor and enthusiasm. Boats and sailing permeated all phases of his family and business life. He taught his children to sail in the waters outside the family home in Sakonnet, R.I. His enthusiasm for the sea rubbed off on all of them, for they are all accomplished sailors. Dr. Morton was proud of his many awards and sailing trophies, but he beamed most brightly when speaking of the many wonderful accomplishments of his family. He was thrilled, for instance, at his son Rob's winning the prestigious Newport-to-Bermuda ocean race in 1982 in the family racing sloop, *Brigadoon III.*

Boats became part of his work life also. In his ocean technologies programs, Dr. Morton obtained enough boats to have as many as five research vessels available for ocean tests at one time. This meant that "Morton's Fleet" — as it was referred to — was larger than that of most developing nations. He had the vision to undertake and accomplish large tasks at sea.

Dr. Robert C. Morton was an uncommon man who showed uncommon leadership and technical innovation in his work, uncommon devotion and love to his family and friends, and uncommon expertise at sea. However, one of the most exciting aspects of Dr. Morton's life is the impact he has had on our lives. That impact will thrive and multiply in the future, leaving a legacy very few can match. We will always feel him urging us on to better things, and we appreciate the gift of having shared in his life.

A. Kossiakoff

Chief Scientist, Director Emeritus

Bob Morton was like an oak — tall, strong, unswayable — someone to look up to, to depend on. He had mellowed a bit with age, but his vitality and vigor showed no prospect of diminishing. Nor did it occur to anyone that it would ever be otherwise. So it is a shock now to see a large empty space where he once stood so tall in the forest.

But all I have to do is to close my eyes, and the memories come flooding back. Memories from a close collaboration and friendship of 35 years, years in which we shared many challenges, disappointments, and triumphs, as well as times when we relaxed and enjoyed life together. One of the happy memories was about a day, when our children were still small, that we stopped at the Morton's summer house on our way back from vacationing on Cape Cod. It is a lovely house, on the shore of Sakonnet Bay, R.I., where the Morton family spent as much of the summer as they could manage. Bob had just bought his first boat, which later turned out to be the beginning of a lifelong love affair with sailing. Though it was a rather ordinary looking rowboat with an outboard motor, he was tremendously pleased with it and insisted that everyone go for a ride around the Bay. The day was beautiful, the children enjoyed the boat, the beach, and each other, as did we all. As always, Bob and Ruth were wonderful hosts; their warm, relaxed charm and humor made everyone feel welcome and at ease. For dinner Ruth served a huge ham with all the trimmings, and we ate and talked until dark. When we were putting the kids to bed, my son said, "Gee, this place is the greatest! Next year why don't we spend our whole vacation here?" Those were exactly our own sentiments.

The memories of our work together are no less vivid. We were both deeply involved in the transition of Terrier from a test vehicle into an operational weapon, a process in which Bob played a leading part as Terrier Prototype Engineer. Those were exciting and adventurous times, when rockets and missile guidance systems were not as predictable as they are today but had a will of their own, sometimes doing surprising and startling things, especially when the tests were being witnessed by high-ranking officials.

In 1952, Bob was asked to form a small group to plan and coordinate the complex task of integrating the Terrier (and later the Tartar) with the launcher, fire control system, and other shipboard elements of the combat system with which the new generation of guided missile ships were to be armed. This was another pioneering task, requiring firsthand knowledge of the ship environment and complex equipment developed entirely independently of one another. With no authority over the subsystem developers, it was the responsibility of Bob's Terrier Systems Group to do everything possibly to make them all fit together perfectly and work as a unified system. This was not only accomplished astonishingly well, as was demonstrated by the historic tests aboard the first guided missile ships — U.S.S. *Boston* and *Canberra* — but Bob was instrumental in persuading the Navy to make key changes to the original specifications in the interests of shipboard maintainability. He was a system engineer par excellence.

Important and difficult as these achievements were, Bob Morton's greatest challenge and opportunity to make a major contribution to the nation came in 1958, when the Navy asked APL to expand its technical assistance to the newly established Special Projects Office to devise a program to analyze and evaluate the performance and operational readiness of the Polaris Fleet Ballistic Missile System. It was a task of the ut-

most national priority and of great technical difficulty — a truly pioneering effort never attempted previously or equaled since. The design of the instruments, test procedures, data analysis methods, and assessment methodologies was on a scale of precision and complexity unknown in the history of weapons testing. The task took years of effort and many millions of dollars to accomplish, but it succeeded in all of its objectives. Aided by a core of dedicated people, Bob provided the vision, balance, rigor, and leadership necessary to conceive the plan, translate it into doable tasks, assemble and motivate the staff, and direct the program through the years of its development.

To carry out an unusual task, Bob Morton organized his staff in an unorthodox manner that violated every commonly accepted rule of organization. In fact, for the first five years, the entire staff was organized into a single group, with no formal subdivisions, growing until it numbered 140 people. And yet there appeared to be no confusion and the productivity was extraordinary. Despite the lack of formal structure, there were designated leaders, responsibility was clearly allocated, and communications were extremely effective. The whole group worked as a team, with everyone participating in the field operations as well as in the analysis of test data. Bob Morton characteristically organized it to suit the special needs of the task and his knowledge of how people thought and worked together, and stubbornly resisted attempts to make his organization conform to everyone else's.

I only realized much later that Bob recruited, organized, and directed his technical team just as he did the crews of his racing boats. Sailing is the human endeavor that requires the most exacting precision of action on the part of a group of people against an infinite variety of constantly changing demands, one where all must perform flawlessly and in complete unison. In a crack sailing crew, all members know their parts perfectly and execute in unison by a sense of team play born of long and arduous training. There is always a captain, but he does not issue orders; he communicates subtly and does his full share of the labor. This model was ideally suited to the very special task that Bob and his staff had to do, and he had the wisdom to use it despite pressures to the contrary.

What Bob has left behind him is much more enduring than the many memories that his friends and coworkers will always carry with them. Something of his spirit lives on in all of us who knew him. But perhaps his most significant legacy is the extraordinarily capable and successful team of people who are today carrying on the tradition of professional excellence and service for which he stood. They number in the hundreds — a generation of young scientists and engineers, most of them selected by Bob himself and trained in the demanding tasks that were part of the job of evaluating the most important element of security of our country and perhaps of the world. It is a legacy few can match.

Levering Smith

Vice Admiral, U.S. Navy, Retired

It was not our first meeting, but in hindsight this one was special because Bob Morton and I then established a rapport and method of operating that served us both well for 25 years. Having accepted the task of preparing a Laboratory group to evaluate Polaris system performance, he sought help in getting component test data from subsystem contractors because those data would provide a basis of understanding later subsystem tests. Concurring that such understanding would be essential and that there would be inadequate time to gain it later, I agreed to request that the data be furnished. At the same time, we agreed that the request would provide only temporary results unless his group could work with the subsystem contractors so that they saw the Laboratory as helping rather than hindering them.

Bob very seldom needed help because what he proposed to do was founded in a clear understanding of current and foreseen problems that were in the interest of all to solve or forestall. Much of the time it wasn't within our means to provide the resources he clearly justified, but he was patiently persistent, as well as farsighted and, when necessary, willing to start out in a small way. Recognition that crew training for the Nuclear Powered Fleet Ballistic Missile Submarine Program should be an important aspect of Demonstration and Shakedown Operations grew out of standard procedures developed for use only with that operation and from introducing casualties to test crew readiness for missile firing. The need for instrumentation to record performance on patrol and on operational flight tests was recognized but was not acceptable to the operating forces until poor test performance was unexplainable; jury-rigged instruments served until better ones could be developed and installed, leading gradually to today's precision instruments. Similar stories are behind accuracy evaluation leading to SATRACK, behind sonar performance evaluation leading to SPAN, and, I am sure, behind many more quietly introduced contributions that I haven't discovered yet.

Always at the bottom was a need to understand observed performance — a need that Bob and I shared those many years and that drew us even closer together.

Richard Creswell

Supervisor, Administrative Services Department

I worked for Bob Morton for nearly 20 years, and there are so many things about him that stand out in my mind that it would take a book to adequately describe him. But here are a few of the odds and ends that are so vivid in my memory of him.

First, Bob had an incomparable style. He had an uncanny knack for knowing his people, their attributes, and their limitations. He knew their families, and he knew about their personal problems. But the main thing he knew was how to fit the right person with the right job. He also knew how to challenge people and to keep them interested and motivated to do the very best job within their capabilities. One can simply look around the Laboratory and can see many of his former colleagues in positions of management.

Bob Morton was truly a clairvoyant who could see potential applications that most people easily missed. He was usually 10 years ahead of everyone else. For example, the things he saw back in the 60's when he pushed the Mk 113 Fire Control System ultimately led to the APL Submarine Technology Program. I vividly recall his steadfast insistence that the program would lead to innovative oceanographic research. He kept hammering this home despite one obstacle after another, including Navy criticism of our leasing the *Sinbad*, APL's first oceanographic research vessel. Despite monumental obstacles, both within and outside the DoD, he always managed to succeed. His programs started modestly, and he always pursued them in a very practical manner. Invariably, he would use his personal charm to cut through red tape, bureaucratic barriers, and technical apathy to push his ideas to fruition. The major technical efforts evolving from his foresight and wisdom include the Submarine Technology Program; the Ocean Data Acquisition Program, the Pershing Program, the Sonar Evaluation Program, the Ocean Engineering Program, TACAMO, and the Range Safety Program.

One of the things Bob Morton was so good at was sifting through the trivia and keeping his technical ship on course. This was evident whenever he called his top technical people together to discuss a new problem. As always, when a group of independently thinking scientists gather in one room, there is a tendency to drift off into tangential topics. Although he never discouraged this because good ideas often would evolve, he was able to keep everyone's mind focused on the primary subject at hand. From many such technical gatherings, he could identify tomorrow's leaders and those whom he would later select to work on special projects.

He encouraged his young engineers to see him at any time with any kind of problem — technical, administrative, or personal. His door was always open. And, if on occasion he got bored with the lack of drop-ins, he would wander the corridors just to see how his people were getting along. He really cared about them.

L. P. Montanaro

Head, Strategic Systems Department

I first met Bob Morton in the Cape Canaveral area during the late fifties. I was a young Naval officer, a participant in the Navy/contractor team working on development of the Polaris Weapon System. Bob, Kirk Dahlstrom, and a small group of colleagues from APL were responsible for developing the initial System Demonstration Analysis Program (which later became known as the Demonstration and Shakedown Operation). While Bob's efforts were concentrated on the first underwater launch operation, it was clear, even at that time, that in his mind the System Demonstration Analysis Program was to be merely the beginning of the operational system evaluation program, and that more meaningful system effectiveness measurements would be obtained after the system was deployed and subjected to the operational environment.

A few years later when I left active Naval service and came to APL to work with Bob, I learned from him a deeper and more fundamental understanding, not only of the logic employed in developing a comprehensive system evaluation, but more important, that the real practical value of the system evaluation process comes from the analysis of pertinent raw or fundamental system performance data. I learned, further, that the understanding of system processes that came from these analyses led to performance factor quantification, more efficient utilization of the existing system, and the development of system improvements.

As far as I know, Bob never compromised on his insistence that acquiring unbiased system input, intermediate, and output data was the real key to successful system understanding. This, when coupled, modulated, and interposed with a preplanned and logical analysis sequence or procedure, constituted the heart of technical evaluation program planning as he knew it. An important aspect of the plan he envisioned was that the evaluation program was to be conducted by an informed independent evaluation team reporting to an organizational level that had the authority to take effective action. It took a man of Bob's stature to steadfastly propose, develop, and — more importantly — implement this approach to operational system evaluation for the Submarine-Launched Ballistic Missile forces. Perhaps, because it made so much sense, but probably because it meant so much to the security of the country at the time, he shrugged off the often vocalized position that the Navy couldn't afford such a comprehensive system evaluation; Bob took the position that we couldn't afford *not* to do it. Interestingly enough, I hear arguments today that the Navy can't afford more complete test and evaluation programs for new systems that the country has spent billions of dollars developing.

It's noteworthy to reflect that Bob didn't always convince others initially. His tenacity, I suppose some called it stubbornness, usually prevailed in the end. For example, if memory serves, I would note that the first series of Polaris operational tests in the early sixties was conducted with missiles in which no missile data telemetering systems were installed. When some tests yielded unexplained test failures, the cost of this omis-

sion was clearly demonstrated, and modifications were quickly made to instrument subsequent missiles.

The concept, methods, and procedures for operational system evaluation that Bob Morton developed have been refined through the years and applied to a number of nationally important complex systems. He had the strength, conviction, and drive to leave a very important imprint.

James C. Lynch

Supervisor, APL Field Office at Cape Canaveral

Bob Morton was a supreme motivator. He surrounded himself with the best. Not one to settle for satisfactorily qualified personnel, he sought excellence. He insisted on having on his staff people who not only could accomplish the tasks at hand, but also could see beyond the immediate and achieve far more than had initially been expected of them. With people of that caliber around him, he inspired independent effort; a desire to take responsibility; standards of excellence, clarity, and attention to detail; and recognition for solid technical endeavors.

He set standards of good taste that characterized his personal and professional life. He was always courteous, never acted in anger, and never became involved in open confrontations. A serious, contemplative man, he was at the same time warm, vigorous, and able through imagination and good humor to keep his staff and associates at ease in the most trying circumstances.

Bob was dedicated to satisfying the technical needs of APL and the Navy, but he also had a burning desire to ensure that the Laboratory set high priority on meeting the needs of the staff and their families. He sought reasonable allowances for staff members and their families when they were assigned to the severe working conditions at field test sites or on research vessels. In return, he expected his staff to set aside petty personal differences and work toward the common mission goal of APL.

Bob was a master at listening. He knew that effective communication requires not only transmission, but receipt of ideas as well. He made a point of circulating among all levels of personnel, both military and civilian, to identify and address problems and to accomplish solutions.

Loyalty was a dominant value in his world. Those of us who knew him well recognized that quality as a source of inner strength when representing "the Boss." To all of this, one must add Bob's unique approach to preparing lower echelon staff members for future leadership roles. Opportunities for leadership were constantly thrust at them early in their careers at the Laboratory. They did not have to wait year after year for the chance to show they had the stuff that separates the "Indians" from the "chiefs." Those who showed leadership qualities quite often felt they were on a fast escalator as they were assigned increasingly responsible tasks. Aside from the monetary awards, which always were forthcoming, there was the immense satisfaction of knowing you were recognized by Bob as somebody special.

Just prior to his death, I asked him what he missed most about his work as supervisor of the Strategic Systems Department. His reply was given in typical Bob Morton fashion: "People!" He missed "the involvement, the interaction, the satisfaction of seeing people achieve." Bob Morton missed his people, but he left them with a legacy of good will that can never be replaced.

Albert M. Stone

Principal Professional Staff

Robert Morton spent the last several years of his life as a Senior Fellow of the Applied Physics Laboratory, a designation of which he was immensely proud, as well he should be. The appointment by President Muller reads: "Senior Fellows at APL form a very distinguished group, being few in number and recognized as having made truly exceptional contributions to the accomplishments, reputation, and strength of that institution." No better person could be chosen to personify these qualities.

Bob and I shared a somewhat secluded office suite those last couple of years, which gave us opportunity for calm and dispassionate discussion on all sorts of topics. Prominent in my memory is his quiet pride and concern for his family — his wife and the 4 R's, the children. Not surprisingly, his concern too for the future of APL was genuine and profound. Thus in his capacity as Senior Fellow, he forged several outstanding contributions which I would like to relate.

The Senior Fellows were charged by the Director to suggest a long-range plan for APL, extending into the next generation. From his unique store of wisdom and experience, Bob wrote probably the most significant chapter in the Senior Fellows' report, *APL in the Twenty-First Century*. His chapter was entitled "Relationship of the Laboratory with the Military." With his usual clear vision and tenacity of belief, he held to the view that the world and country would not and could not continue on their steadily expanding strategic courses and that the next generation of Americans would not tolerate the instability associated with an indefinite buildup of weapons of mass destruction. Thus, an organized effort should be mounted to turn APL's attention gradually toward significant civilian programs of national consequence in the twenty-first century. The Laboratory ought to set its sights on major systems programs that, he said, are more than likely to arise from initial thrusts into small, but potentially revolutionary, technical ventures.

His contributions to the Laboratory during this last period of his life were also of the highest quality. Besides his painstaking and brilliant work on *APL in the Twenty-First Century*, he served on the APL Development Fund Committee, where, as usual, his practicality and skepticism helped to focus the available resources on as significant a group of undertakings as possible.

These, then, are the features I recall from my last years of close association with Bob Morton. Of course, I had known him over 35 years; we had traveled together to California, Mexico, and England; we had served together on a number of boards and committees within the Laboratory. But, not until we were Senior Fellows together did I truly come to appreciate his sagacity, his tenacity when he felt that he was right, his rigid honesty, and his inner warmth and sympathy for all his colleagues, his staff, and his friends.