The Philosophical Society of Texas

PROCEEDINGS

1978

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PROCEEDINGS

OF THE ANNUAL MEETING

AT HOUSTON

DECEMBER 8 and 9, 1978

XLII

AUSTIN

THE PHILOSOPHICAL SOCIETY OF TEXAS

1979

THE PHILOSOPHICAL SOCIETY OF TEXAS FOR THE COLLECTION AND DIFFUSION OF KNOWLEDGE *was founded December 5, 1837, in the Capitol of the Republic of Texas at Houston, by* MIRABEAU B. LAMAR, ASHBEL SMITH, THOMAS J. RUSK, WILLIAM H. WHARTON, JOSEPH ROWE, ANGUS MCNEILL, AUGUSTUS C. ALLEN, GEORGE W. BONNELL, JOSEPH BAKER, PATRICK C. JACK, W. FAIRFAX GRAY, JOHN A. WHARTON, DAVID S. KAUFMAN, JAMES COLLINSWORTH, ANSON JONES, LITTLETON FOWLER, A. C. HORTON, I. W. BURTON, EDWARD T. BRANCH, HENRY SMITH, HUGH MCLEOD, THOMAS JEFFERSON CHAMBERS, SAM HOUSTON, R. A. IRION, DAVID G. BURNET, *and* JOHN BIRDSALL.

The Society was incorporated as a non-profit, educational institution on January 18, 1936, by George Waverley Briggs, James Quayle Dealey, Herbert Pickens Gambrell, Samuel Wood Geiser, Lucius Mirabeau Lamar III, Umphrey Lee, Charles Shirley Potts, William Alexander Rhea, Ira Kendrick Stephens, and William Embrey Wrather. December 5, 1936, formal reorganization was completed.

Office of the Society is in the Texas State Library, (Box 12927, Capitol Station) Austin, 78711.

The Philosophical Society of Texas

HOUSTON, SITE OF THE FIRST GATHERING OF THE PHILOSOPHICAL SOCIETY OF TEXAS on December 5, 1837, was selected for the December 8 and 9, 1978, meeting, the 141st anniversary of the Society. The first meeting was attended by twenty-six Texans who met in the early Capitol of the Republic. The 1978 meeting held at the Cohen House on Rice University Campus and in the Galleria Plaza Hotel was attended by approximately 250 registered members and guests.

President Frank E. Vandiver had splendid assistance from the program and local arrangements committees, and members and guests were generous with praise for the Houston meeting.

At the Friday night banquet President Vandiver announced the following new members of the Society:

Charles William Duncan, Jr.
Joe J. Fisher
Ralph Hanna
Mrs. George A. Hill III
Mrs. May Dougherty King
Harris Masterson

New Honorary Life Members:

C. Stanley Banks, Sr.
William A. Kirkland
Rupert N. Richardson

A Special Award of the Directors was given to Herbert P. Gambrell "for more than forty years of service (Secretary, President, etc. etc. without pay)."

Silent tribute was paid to the following members of the Society who have died since last year's meeting:

Mrs. Virginia Leddy Gambrell
Mrs. Percy Jones
Lucius Mirabeau Lamar III
Chauncey Leake
Dossie Marion Wiggins

Attendance at 1978 Annual Meeting

Members attending included: Misses Cullinan, Duff, Hargrave; Mesdames Dudley, Hill III, Johnson, King, Knepper, Lee, Moore, Randall, Jr., Symonds, Wortham; Messrs. Thomas D. Anderson, William Leland Anderson, Andrews, Ashworth, Bean, Bennett, Beto, Blocker, Butler, Caldwell, Clark, Coke, Crook, Daniel, Davis, Denius, Dick, Doty, Dougherty, Doyle, Dugger, Fisher, Fleming, Frantz, Garrett, St. John Garwood, Gordon, Gray, Gresham, Hall, Hanna, Harrison, Hart, Harte, Heinen, Hershey, Hill, Hoffman, Holtzman, Hook, Hunt, Jaworski, Jeffers, Kelsey, Kempner, Sr., Dan Kilgore, William Kilgore, Kirkland, Law, Levin, Lindsey, Lord, Lovett, McCorquodale, McGinnis, McKnight, Maguire, Margrave, Masterson, Matthews, Mills, Page, Pool, Pressler, Jr., Ragan, Randall III, Richardson, Schachtel, Sealy, Sears, Sharp, Shirley, Shuffler II, Smith, Jr., Sprague, Spurr, Topazio, Vandiver, Walker, Watkins, Gail Whitcomb, James Whitcomb, Wilson, Winfrey, Winters, Woodson, Worden, Wozencraft, Wray, Wright.

Guests included: Mr. and Mrs. Bill Akers, Mr. and Mrs. Herbert Allen, Ralph Anderson, Mrs. Thomas D. Anderson, Mrs. William Leland Anderson, Mrs. Mark Edwin Andrews, Mrs. W. B. Bates, Mrs. William B. Bean, Mrs. J. M. Bennett, Mr. and Mrs. Thomas E. Bentley, Mrs. George John Beto, Mr. and Mrs. Jack Blanton, Mrs. Truman Blocker, Mr. and Mrs. Bob Brinkerhoff, Dr. Roger J. Bulger, Mrs. Clifton Caldwell, Margaret D. Cashman, Mrs. Edward Clark, Mrs. Henry C. Coke, Jr., Mr. and Mrs. John Cooper, Ralph Cousins, Mrs. Rorick Cravens, Mrs. William H. Crook, Mrs. Price Daniel, Mrs. Morgan J. Davis, Mrs. Franklin W. Denius, Mr. and Mrs. B. I. Dethloff, Mrs. Ezra William Doty, Mrs. J. Chris Dougherty, Mrs. Gerry Doyle, Mrs. Joe J. Fisher, Mrs. Durwood Fleming, Babette Fraser, Mrs. Jenkins Garrett, Susan Garwood, Mrs. W. St. John Garwood, Mrs. William E. Gordon, Mrs. John E. Gray, Mrs. Newton Gresham, Mrs. Walter Hall, Mrs. Richardson Hamilton, Mrs. Ralph Hanna, Mrs. James P. Hart, Chris Harte, Mrs. Edward H. Harte, Dr. Ruth Hartgraves, Mr. and Mrs. W. D. Hawkins, Mrs. Erwin Heinen, Mrs. L. B. Herring, Mrs. J. W. Hershey, Mr. and Mrs. George A. Hill IV, Mrs. Philip G. Hoffman, Mrs. Wayne Holtzman, Mrs. Harold S. Hook, Mrs. Wilmer Hunt, Virginia Kirkland Innis, Mrs. Leon Jaworski, Mrs. Leroy Jeffers, Sallie Matthews Judd, Mrs. Mavis P. Kelsey, Mrs. Harris L. Kempner, Sr., Mr. and Mrs. James L. Ketelsen, Chris Kilgore, Mrs. Dan E. Kilgore, Mrs. William J. Kilgore, Mrs. Thomas H. Law, Mrs. William C. Levin, Mrs. John H. Lindsey, Dr. and Mrs. Harry M. Little, Jr., Mrs. W.

Grogan Lord, Mrs. H. Malcolm Lovett, Mr. and Mrs. S. M. McAshan, Jr., Mrs. Malcolm McCorquodale, Tom McDade, Mrs. Jessie B. McGaw, Morton McGinley, Mrs. Robert C. McGinnis, Mrs. Joseph W. McKnight, Margarete F. McKnight, Mrs. Jack Maguire, Mrs. John L. Margrave, Anne Maschka, Mrs. Harris Masterson, Mrs. Watt R. Matthews, Beverly Maurice, Mrs. Ballinger Mills, Jr., Mr. and Mrs. Joe Nalle, Mrs. Louis Charles Page, Mrs. Herman P. Pressler, Jr., Mrs. Cooper K. Ragan, Mrs. Edward Randall III, Fairfax Randall, Risher Randall, Margaret Scarbrough, Mrs. Hyman J. Schachtel, Dr. and Mrs. Irving Schweppe, Mr. and Mrs. W. E. Scott, Mrs. Tom Sealy, Mrs. William G. Sears, Mrs. Dudley C. Sharp, Mrs. Preston Shirley, Mrs. Ralph H. Shuffler II, Mrs. Frank C. Smith, Jr., Josephine Sparks, Mrs. Olive Spitzmiller, Mrs. Charles C. Sprague, Mrs. Stephen Spurr, Robert R. Sterling, Mr. and Mrs. W. M. Thompson, Jr., Mrs. Virgil W. Topazio, Robert L. Tuttle, Bubba Vandiver, Mrs. Frank Vandiver, Babette Warren, Mrs. Edward T. Watkins, Mrs. Walter Prescott Webb, Mrs. Gail Whitcomb, Mrs. James Lee Whitcomb, Mrs. Logan Wilson, Mrs. J. Sam Winters, Mrs. Benjamin N. Woodson, Mrs. Sam P. Worden, Mrs. Frank M. Wozencraft, Mrs. A. J. Wray, Mrs. James S. Wright.

SYMPOSIUMS

NATIONAL DEFENSE

Address

WILLIAM P. CLEMENTS, JR.

It's a pleasure to be your speaker at this welcoming dinner. It would be inappropriate for me to do any official welcoming on behalf of the State of Texas, but I am privileged to welcome my fellow members of this Society to its 141st Annual Meeting, and I am delighted to welcome home Charles Duncan, my successor as Deputy Secretary of Defense.

We are very fortunate to have another Texan as Deputy Secretary of Defense, and we are even more fortunate to have that Texan be Charles Duncan. For the year after I left the Pentagon and before I became a candidate for public office here in Texas, I met regularly with Charles to assure the continuity of our national security programs. Charles has my full and unqualified support, and he knows it.

Many of you may not be familiar with the role of the Deputy Secretary of Defense. Since you will be hearing from Charles tomorrow, you might be interested in knowing something about the job.

The Deputy Secretary of Defense is appointed by the President, not the Secretary of Defense. He is one of seven members of the National Security Council. The others are the President, the Vice-President, the Secretary of State, the Secretary of Defense, the Chairman of the Joint Chiefs of Staff, and the National Security Advisor to the President. The Deputy Secretary of Defense has an independent reporting channel to the President. He is the "general manager" of the Department of Defense.

And since most of you will spend tomorrow discussing our national security, it might also be appropriate for me to refresh your memory about how that department works; to discuss the challenges it faces; and to examine some current deficiencies in the way we now face those challenges.

First of all, the Department of Defense is a national institution. It is non-partisan. It is something quite apart from the political hustle of the other departments. It is "across the river," out of the District of Columbia, in more ways than one. The Congress has gone to great pains to assure the non-partisanship of our defense programs, because national security crosses party lines. We have only one Department of Defense, and we all must make it work.

What does it do? The mission of our Department of Defense is to support the foreign policy of the United States. Every President has reconfirmed the prime objective of that policy to be assuring the security of all our citizens. A Texan and former Vice-President, John Nance Garner, put it succinctly years ago. He said: "The first function of government is to safeguard the lives and property of our people." Texans today certainly agree.

My research during the spring of this year showed that 88 percent of the people of Texas want the military forces of the United States to be clearly superior to those of the Soviet Union; not just "roughly equivalent" or "minimum essential," but "clearly superior" to the U.S.S.R. This view is not universally held in the United States today, certainly not in Washington.

The Department of Defense, charged with providing this security, is huge. It is huge in terms of budget. The DoD budget is now over $125 billion per year, larger than the budgets of all 50 state governments put together. The department is huge in terms of people. It directly employs three million people — two million in uniform and another million civilians — and it indirectly employs or impacts countless millions more through its procurement actions. The department is huge in terms of the personnel management problems posed by the people-intensive nature of defense. Over half of our defense budget goes into personnel costs. At the cutting edge it is tough to automate the job of the American G.I. So elsewhere in the system it is imperative that we simplify, automate, or eliminate every non-combat support job we can.

The department is huge in terms of its technical challenges. The defense research and development budget alone is over $11 billion. More importantly, technology is the American crown jewel. We have a clear, definable ten-year lead in most areas of technology. That lead is rooted in our industrial technology base, fueled by our free enterprise system. It is absolutely essential that we stimulate and encourage that system.

American security has always been dependent on technology. The birth of our nation was not marked by some huge riot or the fall of a fortress. It was marked by an "information processing event" — "one if by land and two if by sea," which triggered Paul Revere's ride into history. From those days forward our nation has been symbolized by an eagle, not the brute force of the Russian bear, nor the unending mass of the Chinese dragon. America's symbol is the eagle, which makes up in vision, agility, and skill what it lacks in mass and force.

By use of that technological base, we can maintain our national security in a cost-effective manner — if we don't fritter away our advantage over time. For instance, U.S. advances in microcircuitry, turbines, computer science, and nuclear physics have produced the Cruise missile — a whole new problem for the Soviet Union.

U.S. advances in mechanical engineering, fluid mechanics, and acoustics have produced the Trident submarine — a submersible ship the size of the Washington Monument, inaudible to swimmers a few yards away.

U.S. leadership in the aircraft industry produced the B-1 bomber — an immense improvement in penetration capability over our ageing B-52's, without any corresponding loss in range or payload.

U.S. leadership in chemical engineering, inertial instruments, and electronics has produced a plan for the M-X — a new ballistic missile with a ten-fold improvement over our current Minuteman's ability to attack the Soviet war machine.

But such technology must be seized and exploited if we are to maintain our security in a manner we can afford.

The problems of the Pentagon are also huge in terms of the challenge we face. Since the advent of the Brezhnev administration in 1964, the Soviet Union has dedicated steadily increasing resources to military programs. The annual rate of growth is now over 6 percent. By 1970, despite their vastly inefficient economic system and a gross national product only one-half of ours, Soviet military expenditures exceeded ours for the first time. By 1975 their expenditures on strategic offensive nuclear forces was twice ours, and in the field of ballistic missiles, seven times ours. By now Soviet military spending has reached 150 percent of ours, consuming 16 percent of their GNP. The U.S. devotes 5.5 percent of its GNP to national security. As a result of all these Soviet expenditures we are now significantly outnumbered in tanks, tactical aircraft, artillery tubes, combatant ships, ballistic missile submarines, numbers of missiles, missile throw weight, and virtually every other measure of military power except technical sophistication.

All of these problems impose one overwhelming necessity, and that is continuity — consistency of purpose. The problems are so large, and the solutions are so complex, that no major weapon system can now be developed and deployed in less than eight to ten years. Yet no secretary of defense, nor deputy secretary of defense for that matter, has ever served longer than four years. There is no way a new President can decree a new weapon system — even if he does so in his inaugural address, with instant funding from Congress —

and then see it deployed even during his second term. Starts and stops and delays and diversions are destructive to our security and hideously wasteful of our national treasure.

An effective plan for national security requires a clarity of vision and a steadfastness of purpose that is unfortunately lacking in our current President.

The Carter administration has adopted a nuclear fuels policy that has greatly disturbed our friends and allies — Germany, France, Brazil, and Japan.

The B-1 has been cancelled, after spending $3 billion and producing the first three aircraft, without any quid pro quo of any sort from the Soviet Union.

The M-X ICBM modernization program has been delayed indefinitely.

Cruise missile deployment has been delayed and is being negotiated away in SALT.

Our intelligence community is in disarray. A major satellite intelligence system, developed and deployed at a cost of billions of dollars over the past decade, without Soviet knowledge, has been compromised by intelligence procedures as porous as Swiss cheese.

Our allies in Europe and Latin America are disturbed and confused by the randomness of our policies.

We are re-establishing relations with Cuba while that nation spreads chaos and misery throughout the third world.

The Navy's shipbuilding program, with the longest lead times of all, has been emasculated.

The neutron weapon system has been dangled before our NATO allies like a trinket on a string.

A defense authorization bill has been vetoed to preclude the modernization of our carrier force.

MIG-23's have been tolerated in Cuba on the lame excuse that they are not wired for nuclear weapons, which no one really knows to be a fact.

And now the Middle East totters on the brink of instability, with mixed signals and uncertainty as to American purpose the prime cause.

All of these things have come to pass, but they are only a prelude to the most important single issue to come before this administration — the Strategic Arms Limitation Talks.

There is no way to over-emphasize the gravity of the impending SALT treaty, because it only ratifies Soviet nuclear preponderance while crippling any opportunity for ourselves or our allies to recover.

Current SALT II proposals do not count the Soviet Backfire bomber as a strategic system. The Backfire is supersonic, it has an unrefueled range of over 6,000 nautical miles, and every picture of a Backfire I have seen shows it to be equipped with an inflight refueling probe. Yet we are asked to rely on a letter from Chairman Brezhnev that the Backfire will not be deployed against us.

The corollary is even worse: Backfire is not a threat to the U.S. because it will only be used to reduce Western Europe to rubble.

SALT II apparently will limit Cruise missile range to a few hundred miles. Last year the B-1 was cancelled in reliance on air-launched cruise missiles. Now we are about to limit Cruise missile range so as to require a penetrating bomber — like the B-1, the reasoning seems somewhat circular.

Our security is interdependent with that of our NATO allies. Yet we appear to be limiting the range of ground-launched cruise missiles as well. The result? The Soviets can threaten all of Western Europe with their new, mobile SS-20 missiles, while any GLCM deployed in Western Europe will be unable to reach the Soviet Union. To make matters worse, we may also be planning to limit even the transfer of Cruise missile technology to our NATO allies, thus preventing them from balancing the SS-20 threat themselves.

The proposed agreements try to limit ranges, testing, and modernization. Such agreements simply cannot be verified, and agreements with the Soviets that could not be verified have been death traps for a generation that has gone before us.

The agreements propose to limit technology. This may be the most dangerous concept of all, for it is only by our brains, not brawn, that we have survived as a nation. We must maintain the technological capability to respond to any SALT violations, should they occur. Our ability to do so can be a most powerful deterrent to such violations occurring in the first place.

The SALT agreements, as currently drafted, are wrong for this country.

The President must understand his fundamental responsibility to maintain our security. He, and his successors, must have the sort of armed force in back of them that John Kennedy had in the Cuban missile crisis of 1962. With one hand, the President should junk this proposed treaty, get a new negotiator, and start afresh. With the other hand he must develop and deploy a modern, 1980's set of strategic systems. The currently proposed SALT agreement is a mistake. I predict it will not be ratified by the United States Senate.

In recent months, I have moved from the category of innocent

businessman or former government employee to a new category: winning politician. From this new vantage point I would like to offer the President some advice.

If he does not recognize and act on the dangers of a stop and start weapons policy; if he does not start afresh with SALT; if he does not unambiguously support our friends overseas; national security will, for the first time, become a prime issue in a presidential election. Specifically, national security will become the number one issue in 1980, and it will destroy this president politically as surely as Col. Saunders cooks chickens.

You may wonder whatever happened to the famous rubber chicken. The Mayor of Amarillo gave it back to me. After the election I sent it to Charles Duncan's office and asked that it be delivered to the President.

I want him to be on notice that we Texans mean business when it comes to our national security.

I. SCIENCE, TECHNOLOGY, AND NATIONAL DEFENSE

Moderator: JOHN L. MARGRAVE, *Houston.* Professor of Chemistry, Rice University.
Panelists: PAUL F. WALKER, Harvard University.
DONALD M. KERR, U. S. Department of Energy.
ROBERT R. FOSSUM, U. S. Department of Defense.

EMERGING TECHNOLOGY AND NATIONAL DEFENSE

PAUL F. WALKER

The subject of our panel this morning, as Dr. Margrave, our moderator, has said, is "Science, Technology, and National Defense." It is no over-statement to say that this is a Pandora's Box of difficult issues; it combines the complexities of scientific discovery and innovation, the elusive and imponderable factors of international security relations, and the heightened emotions and biases of national defense commitments versus other social priorities. Our addressing this complex topic today reminds me of a story of the difficulty of such problem-solving along rational lines.

Three scientists, as the story goes, were once marooned on a desert island, their only food several sealed cans of beans. The problem was how to get the cans opened. One scientist, the mechanical engineer, devised a fulcrum which failed. The second scientist, the chemical engineer, planned to heat the cans over an

open fire, but this failed. The third scientist, a political scientist and economist, the so-called "rational planner," said: let's assume we have a can opener and work from there. Needless to say, his assumption failed.

I hope today that we need not become sidetracked into questionable or irrelevant assumptions, as the marooned social scientist, but rather can present a provocative and productive debate on the subject of technology and defense; perhaps we might even get the first can of beans open.

I will address my remarks today along three related lines: first, the present status of U.S. military forces and spending; second, emerging technology and the nuclear sphere; and thirdly, new technology and possible consequences for the non-nuclear, conventional forces. I will also offer a few general concluding remarks.

Present Status of U. S. Military Forces

The United States today fields a sizeable military force throughout the fifty states, on the high seas, and in a good portion of the world's 150 or so states. Indeed, most serious military analysts agree that the U.S. is militarily second-to-none in overall military capability, both nuclear and non-nuclear. Where it clearly is not number one is in numbers of ground forces, where the People's Republic of China, the Soviet Union, and India outrank the United States. Vietnam is a close fifth in land armies, with other smaller countries, such as the Koreas and Taiwan, following next; this seems to reflect individual geographic circumstances rather than world influence.

Other facts of American military might, rough indices of U.S. military predominance in the world, might be cited: Military spending is now rising above $120 billion annually, matched by only one other country — the Soviet Union. U.S. weapons exports are now in the $12-15 billion range annually, accounting for a third or more of world military transfers. And the U.S. retains its treaty commitments in the military sphere with forty-one foreign countries, with over 500,000 troops serving abroad.

Let's look more specifically at the forces deployed by the United States. In the nuclear sphere there are both tactical and strategic weapons. Strategic offensive weapons consist of the so-called "Triad" of forces: bombers, land- and sea-based intercontinental ballistic missiles. We currently maintain 1054 land-based ICBMs, 656 sea-based SLBMs in 41 submarines, and 350-plus long-range, strategic bombers (B-52s and FB-111s). In addition, there are about 480 strategic tankers to refuel the bombers in mid-air. The total number

of strategic nuclear warheads and bombs, all at least three times larger than the weapon dropped on Hiroshima, is 10-12,000.

On the strategic defensive side, U.S. forces are relatively limited: a hundred or so aircraft interceptors, some strategic reconnaissance and electronic warfare aircraft, and long-range, early-warning radars and satellites. This small force reflects the absence of any non-missile nuclear threat to the U.S. and the impossibility of defending against a nuclear missile attack.

In the tactical nuclear weapons field, the U.S. currently possesses an estimated 22,000. Intended for use in local theaters of combat, for example Europe or Korea, these systems consist of air-to-surface missiles, surface-to-surface missiles, land mines, and rockets and projectiles of various kinds; 7,000 of these are deployed throughout the European theater.

The other side of the defense coin — the conventional forces — are more varied and therefore more difficult to categorize. American land forces consist of 17-plus ground divisions and three marine divisions, totaling some one million active soldiers and marines; of course, there are thousands of assorted pieces of equipment attached to the division — tanks, artillery, trucks, missiles, jeeps, rifles, and the like. The Air Force comprises some 8700 total aircraft in 375 squadrons; about one-third of these are tactical aircraft in 110 squadrons for air combat, long-range interdiction, support of ground troops such as in Europe, and aerial reconnaissance. The remainder of the aircraft are special purpose planes, such as trainers, reserves, airlift, and strategic systems.

The U.S. surface and subsurface fleet of naval ships consists of over 550 vessels today, 175 of which are either major gun and missile ships — cruisers, destroyers, and frigates — or aircraft carriers. The remainder, close to 400, consist of submarines — strategic missile subs, anti-sub attack submarines, and patrol anti-ship submarines — amphibious warfare ships, fleet support vessels, and Coast Guard cutters and frigates. The Navy also deploys a sizeable air force of its own: about 1350 fighter, attack, and reconnaissance aircraft in 126 squadrons to serve the 13 aircraft carriers. Still a fourth tactical airforce, in addition to the Air Force, Army and Navy contingents, is the 900 aircraft of the Marine Air Wings, most serving as ground attack support for Marine landings.

It should be clear from the above brief facts that the U.S. military establishment is one of the largest businesses in the world today. It includes over three million active employees, two-thirds of whom are uniformed; this is down, however, from the 3.7 million active-

duty military and civilian employees of 1960, as well as the five million at the height of the Vietnam involvement in 1968, ten years ago. If one were to include the indirect-hire civilians in the totals, that is, those whose salaries with contractors depend on the Defense budget, today's total would come to somewhere between five and six million people employed by the military.

Now what does this mean in U.S. dollars? Aside from the numbers of troops and equipment, what are we spending today to defend the United States, its allies, and its treaty commitments? Our present defense budget is about $125 billion in current terms. To place this figure in perspective, the U.S. defense budget is larger than the Gross National Product of all but nine countries in the world (the United States, the People's Republic of China, U.S.S.R., Britain, France, West Germany, Italy, Japan, and Canada). The U.S. defense budget is about the size of the GNP of Brazil or, to use another example, of the GNP of the six countries of South Asia combined (Afghanistan, Bangladesh, India, Nepal, Pakistan, and Sri Lanka). A budget of $125 billion places the U.S. fifth in the world in military expenditures per capita — about $450 per U.S. citizen — outranked by the Mideast nations of Israel, Oman, Saudi Arabia, and Qatar.

Defense spending has, nevertheless, fallen over the last decade since Vietnam as a portion of several indices: from 9.3 to 5.1 percent of U.S. GNP; from 43.3 to 23.1 percent of federal outlays; and from 29.5 to 15.2 percent of public outlays. If one looks at the defense budget over the longer term, however, namely the last three-quarters of a century from prior to World War I, one obtains a quite different perspective. Our present level surpasses all other historical periods, including World War I and Korea, except the war eras of World War II and Vietnam. We are gradually approaching the spending levels reached at the height of Vietnam, although force levels have been considerably reduced. At the present rate of spending, it is projected by the Department of Defense that five years hence — in 1983 — we will be investing about $175 billion (in current terms) annually in the military.

What are we to think about this present status of military force deployment and spending? Is it adequate for defense, particularly in view of the Soviet modernization of forces? Are there better alternatives to a minimum 3-5 percent real rise in annual spending on defense? It is clear from the historical record that we are now entering a relatively high plateau, with a gently rising slope, of military expenditures during peacetime. This appears unprecedented in the history of the United States. This rising plateau is a result of

several interactive factors, some more controllable than others. First to be cited is that inscrutable factor called inflation; the $75 billion rise in defense spending since 1964 can largely be accounted for through price increases. The second factor is the volunteer army concept; in 1968 the entering soldier received less than $100 in monthly take-home pay. That same army private today has a starting salary almost four times that amount; fortunately for cost factors, the active duty military has been reduced 40 percent since 1968.

A third important factor in defense cost escalation is the rising price of sophisticated technology. We will discuss this more fully in the next few minutes. And the final important point regarding continued high defense expenditures is the perception that the United States still faces a continued — and perhaps expanded — foreign military threat, namely from the Soviet Union.

I will argue forthwith that, indeed, there *are* better alternatives with regard to this high level of peacetime military spending. Better defense for the United States might be bought for fewer dollars, particularly when one examines the new and sophisticated technology for making war, presently on the battlefield as well as on the drawing board and in the test laboratory.

Emerging Nuclear Technology

Let us first look at the nuclear side of the military coin: that is, nuclear systems, new nuclear technology, and nuclear deterrence. Since the first Polaris nuclear ballistic missile submarine, the *George Washington,* was commissioned in December, 1959, American offensive strategic nuclear forces have consisted of a so-called "Triad" of systems: ICBMs or land-based, intercontinental ballistic missiles; SLBMs or submarine-launched ballistic missiles; and long-range bombers. Defensive systems, as mentioned earlier, have not been emphasized due to the lack of a bomber threat to the United States, the technical infeasibility (at least up to the present) of an anti-ballistic missile or ABM system, and the general acceptance of the system of mutual assured destruction (what some call the "MAD" system).

In one sense, these strategic nuclear deterrent systems of the U.S. have remained static over the last decade; that is, the number of missile launchers has remained constant at 1710 since 1967 — 1054 ICBMs and 656 SLBMs. Ceilings were placed on these launchers in the SALT I agreements of 1972. In many senses, however, the weapon systems have changed; there has been constant qualitative improvement in warheads, guidance systems, and com-

mand and control hardware. What has received most attention is the dramatic rise, in quantitative terms, in numbers of warheads on land- and sea-based missiles. The single 10-15 megaton warheads of the early ICBMs, for example the Titan II missiles (of which there are 54 actively deployed), have given way to the multiple warheads of the newer systems. The Minuteman III ICBM currently carries three reentry vehicles, while the Poseidon SLBM carries 10-14 warheads, all independently targetable (called "MIRVs" in military terminology). Although the number of bombers has dropped to under 400, the overall number of strategic reentry vehicles has risen from 1000 in 1963 to over 10,000 today. This is solely a result of MIRVing; since SALT I was signed over five years ago, the U.S. has deployed on the average three new warheads a day in its ICBMs and SLBMs.

The only nuclear threat to the United States, the Soviet Union, has likewise been modernizing and upgrading its strategic forces. Having deployed the Badger, Bison, and Bear strategic bombers in the mid-1950s, the USSR entered the ICBM era with the SS-6 Sputnik launches in the fall of 1957. It also had diesel submarines with 300-nautical-mile-range, nuclear-capable cruise missiles in the late 1950s. It was not, however, until 1967 that the Soviets began deploying the more capable SS-9 Scarp ICBM and a modern, nuclear submarine equipped with ballistic missiles of longer range. The United States thus maintained clear numerical superiority throughout the 1960s in the strategic field. This was also the case qualitatively; for example, it was not until 1969 that the Soviets began introducing solid propellants in their strategic missiles (the first being the SS-13) instead of the dangerous and difficult liquid propellant used in older ICBMs; the U.S. first used solid propellants in the Minuteman I and Titan II ICBMs in the early and mid-1960s.

Throughout the 1960 decade, the Soviets sought to catch up, at least numerically, with U.S. deployments of strategic systems. By 1971 they met their goal; whereas the U.S. had levelled off at 1710 strategic missile launchers in 1967, the Soviets have presently fielded close to 1500 ICBMs and a little over 900 SLBMs, for a total of 2400. Including bombers, the Soviet strategic launcher total comes to about 2521 in 1978. This is over 400 launchers above the American total of 2090, but the simple numbers overlook the qualitative problems of Soviet forces. For example, of the 135 Soviet strategic bombers, 100 are the world's only turbo-prop bombers, slow and vulnerable to attack. Of the 1477 land-based launchers, 1200 are the obsolete liquid-fuel type. The Soviets also

have as yet reportedly not deployed any MIRVs on their nuclear submarines, although we first put the 14-warhead Poseidon C-3 MIRVed missile to sea in 1971.

After two and one-half years of negotiations, the Soviet-American Strategic Arms Limitation Talks (SALT) produced in 1972 an ABM Treaty and an Offensive Arms Agreement. The Agreement sought to place a cap on the numbers of ICBM and SLBM launchers: 1710 for the U.S., and 2498 for the U.S.S.R., with some trade-off allowed between land-based and sea-based missiles. The unequal numbers, apparently to the advantage of the Soviets, were more than made up for by American qualitative superiority and the 380 U.S. strategic bombers not covered in the agreement. The ABM Treaty limited the deployment of anti-ballistic missile systems to two sites, each with a maximum of 100 launchers and interceptors; this limit was cut to one site and 100 launchers by an ABM Treaty Protocol in 1976.

The proposed Vladivostok Accord, signed by President Ford and Premier Brezhnev in November 1974, but never ratified by either side, sought to limit further the numbers of strategic launchers to 2400. This would have included strategic bombers as well. Vladivostok also sought to put a ceiling on the numbers of MIRVed missiles — a proposed limit of 1320. The rumored SALT II agreement, probably forthcoming in the next few months, will place similar limits on launchers and MIRVed missiles, as well as other weapons such as the Soviet Backfire bomber and the U.S. cruise missile.

Without getting into a full discussion of SALT and arms control, which we can do in questions and answers if you like, let me make a few general comments. SALT has pleased no one fully. Conservatives argue that we have given away too much, primarily because of the unequal numbers in the agreements. Liberals, on the other hand, have argued that SALT has not limited anything except an ABM system which was already of questionable value. What SALT has done, however, on the positive side is to promote detente — the atmospherics of international relations; its past value has therefore been more political than military. This value is not inconsiderable in view of the fact that much of Soviet-American relations is based on perceptions.

Where SALT has been most blatantly lacking is in the area of qualitative development of nuclear systems. Although numbers have been capped in some ways, nuclear technology continues to be improved and deployed. In many ways these are positive developments:

for example, enhanced command, control, and communications (C^3), improved safety launch mechanisms, and the like. But in at least three broad areas, emerging strategic technologies have potentially destabilizing implications. Those areas are: first, fractionation or MIRVing where the number of warheads is increased per missile; second, higher yield-to-weight ratios in warheads and increased payloads of missiles, affording essentially more "bang" or explosive capability per warhead and per missile; and thirdly, the ever-improving accuracies of reentry vehicles making them more effective hardened silo killers.

Let us first consider fractionation. Early ICBMs and SLBMs carried one warhead, although the idea of multiple warheads arose as early as the 1950s during U.S. consideration of means to penetrate a hypothetical Soviet ABM. The first multiple warhead configuration to be deployed was by the U.S. in 1964: the Polaris A-3 MRV (multiple reentry vehicle) with three warheads of 200 kilotons each. In 1970 the Minuteman III ICBM became operational with three warheads; these were improved over the Polaris version in that they could be independently targeted (MIRVs rather than MRVs). And in 1971 the Poseidon C-3 missile was put to sea with 14 independently targetable warheads of about 40 kilotons each. Thus out of 1710 ICBM and SLBM launchers, a figure which has remained steady since 1967, the U.S. over the last eight years has increased its warhead count five-fold. Including the bombers, there are now over 11,500 strategic nuclear warheads actively deployed on 2,090 missiles and bombers. The Soviets are far behind in fractionation, but since 1974 have been actively MIRVing their systems. Their only such SLBM is the SSN-6, of which a late 1973 model has 2-3 MRVs; a new SLBM (SSN-X-18) has been tested with three MIRVs. In the ICBM field, the Soviets seem particularly good at producing a large variety: they currently field at least eight different designs in twenty varied models, of which many of the 1975 and later models have from 4-10 MIRVs. The Soviets today deploy about 4000 warheads and bombs on some 2500 strategic systems. This is one-third the number of U.S. warheads, but this margin will most likely diminish over the coming years.

Both the U.S. and the U.S.S.R. are continuing to develop increasingly fractionated warheads. We are talking about 17 warheads on the Trident II SLBM and eight warheads on the MX ICBM. What this means is that, although the potential target system — cities, power plants, military installations — in either the United States or the Soviet Union changes very little, the number of weapons to destroy those targets has risen many-fold.

A second potentially destabilizing development in nuclear systems is the effort by both sides to design missiles which carry more payload and explosive punch. The so-called "Fat Man" and "Little Boy" weapons of Hiroshima and Nagasaki were in the range of 14 kilotons. The smallest strategic nuclear warhead today is three times that yield, with some rising as high as 25 megatons — 1800 times the Hiroshima blast. Increased yields are brought about by improved engineering in the weapons design; increased payloads on missiles are being created by improved engine thrust and cold-launch techniques; this latter system is designed so that a larger volume missile can be placed into an old silo without major modification.

In combination with fractionation, increased yield-to-weight ratios opens up a greater area of damage to nuclear weapons. For example, if we assume five pounds per square inch overpressure will destroy an area, then the area that could be destroyed by the Hiroshima bomb was about 3 square miles. The 1965 Minuteman II ICBM warhead can destroy an area of 72 square miles; the Minuteman III with a triple Mark 12A warhead can destroy 88 square miles. And the proposed MX ICBM with eight MIRVs of improved yields will have the potential to destroy 235 square miles.

A third important technological development in strategic missile systems is continually improving accuracies. A few years ago accuracies of ballistic missiles with ranges of 6,000 miles and speeds of 20,000 miles per hour were judged in nautical miles. These accuracies are now presented in tenths of nautical miles and hundreds of feet. For example, the Titan ICBM is estimated to have a circular error probable (CEP) of 0.5 nautical miles; the later Minuteman II has an accuracy of 0.2 nautical miles; the Minuteman III is in the range of 0.15 nautical miles; and the proposed MX ICBM is in the 0.05 nautical mile range. Soviet systems are similarly improving but in the range of about one-half as accurate as U.S. missiles. These accuracy improvements are a result of several interrelated factors: improved inertial guidance systems, more sophisticated reentry vehicle shields and designs, and enhanced geographic mapping through satellite techniques. I recall a prediction made to me a few years ago by Charles Stark Draper, the founder of Draper Labs at M.I.T. in Cambridge and a leader in missile guidance since World War II; he hypothesized that, given sufficient money and time, accuracies over a 6,000 mile range of an inch or less would become possible. Can you imagine a Soviet ICBM from Moscow hitting this speaking podium?

What do these technological developments — rising numbers of

warheads, and increasing yields and accuracies — mean for nuclear deterrence and Soviet-American strategic relations? In general, it means the *continued dominance of the offense* in the nuclear sphere. Strategic defense, be it anti-ballistic missile systems or more exotic innovations such as laser and particle-beam weapons, appear to offer no good alternatives for the next decade or more for adequate defense of nuclear attacks. These developments also bode well for the increasing *ascendency of the offense;* by that, I mean that even small, hardened targets such as missile silos can in some cases now be successfully attacked in a nuclear attack.

The most direct result of this ascendency of the nuclear offense is the increasing vulnerability of land-based systems, namely ICBMs, one leg of both the Soviet and American Triads. This is not so serious a consequence, however, as some analysts would have us believe, particularly for the U.S. Worst case analysis predicts that by 1985 or 1990, a Soviet first strike might destroy 90 percent of U.S. ICBMs. This still leaves at least 100 warheads, possibly as many as 800, in the land-based inventory. Assuming 50 percent attrition for the other two legs of the Triad, such a strike also leaves 5000-plus warheads in the air and at sea — many times an adequate deterrent force.

Worst case analysis for the Soviet side of the nuclear equation is more worrisome, at least for the hypothetical Soviet planner. With three-fourths of their warheads in land-based missiles, 90 percent vulnerability of ICBMs becomes a more serious problem. This is all the more so in view of the obsolescence of the Soviet turbo-prop strategic bombers, the unreliability, as reported by our Joint Chiefs of Staff, of their nuclear missile subs, and the trailing capabilities of our attack subs. The worst case for the Soviets in 1985, after a U.S. first strike, could possibly be 150 ICBMs surviving, no bombers, and a few submarines — a total of 200-1000 warheads, nevertheless still a powerful deterrent force.

It should be clear from these points that, if allowed to continue, these technological drives may in this century jeopardize the system of mutual assured destruction, a system which has helped to prevent nuclear conflict for twenty years now. Nuclear weapons will become designed — and intended — more for war-fighting and limited, selected options than for deterrence. Today the deterrent function is the primary one, at least as stated in the official reports of the Department of Defense. Mutual deterrence, the capability of both the Soviets and Americans to wreak "unacceptable damage" upon each other after absorbing a first nuclear strike, is an abhorrent

system. It places millions of innocent civilians, indeed society as a functioning entity, at total risk. Yet until a better system to deter nuclear war arrives, we would do well to strive to maintain it.

This can be done in a number of ways: through SALT-type agreements, regulating quantitative growth in nuclear systems; through qualitative limitations such as test flight bans of new warhead designs and total nuclear weapons test bans, including both underground and so-called "peaceful nuclear" explosions. We can discuss these options later in more detail if people would like.

In order to maintain a stable deterrent system, planning should also be given to reducing the present Soviet and American arsenals, many times over an adequate deterrent force. In the early 1960s, then Secretary of Defense Robert McNamara sought to answer the elusive question of "what is an adequate deterrent?" He decided that the U.S. must retain a second-strike force capable of destroying one-third of the Soviet population and three-fourths of its industry. Today this population and industry resides in 300 Soviet cities; are 11,000-plus warheads necessary for assuring retaliatory destruction of these 300 targets? Doubtful, even under worst-case analysis assumptions.

New Technology and Non-Nuclear Forces

Let me turn my attention now from the nuclear sphere to the conventional battlefield for a few moments. Without going into the complex details of troop deployments and equipment inventories, I will concentrate on a new and emerging technology which may very well change the future of conventional warfare and offer increased opportunities for cost efficiencies. This technology is what is broadly called "precision guided munitions" — PGMs — or "smart" missiles. Whereas I argued that new technologies are giving the decisive advantage to the offense in the nuclear area, PGMs appear to be giving the decisive advantage to the *defense*.

This is an important change in warfare since World War II when the terrible ascendency of the offense in warfare was proven by the tank, the aircraft, and the battleship. This smart technology is based on breakthroughs in microelectronics, symbolized by the small pocket calculator. This electronic circuit miniaturization, combined with improved warhead and guidance design, has now shown that a target which can be seen, either visually or through various sensing devices, can be hit; and that which can be hit today, can in all probability be destroyed or at least knocked out of action.

The past history of air, land, and sea conventional warfare has

shown that it takes thousands of bullets, bombs, and projectiles to destroy important enemy targets. In World War II, for example, it is estimated to have required 300,000 bullets to kill a single infantryman. In Vietnam, thousands of pounds of modern explosive were expended to destroy bridges and similar targets judged of strategic importance. Smart weapons differ from these past firing and bombing practices in two major ways: first, their probability of kill per individual round is many times greater; and second, their individual cost is also much higher.

An analogy can be made between smart weapons and nuclear weapons. It took the U.S. Air Force only one weapon and one bombing run to do to Hiroshima in 1945 what it had taken thousands of bombs and runs to do earlier to Dresden. The nuclear bomb proved more expensive than a conventional bomb, yet many times more effective in killing power. This is, however, where the analogy stops. There is an essential difference between nuclear devices and smart weapons; that is that the former improve their deadly efficiency mainly through greatly enhanced explosives, whereas the latter improve their kill probability through accuracy and terminal guidance.

Every war seems to offer live field tests of new weapons. The 1967 Mideast War was perhaps the first publicly cited example of the precision of smart weapons. If you recall, a Russian-developed Styx surface-to-surface missile, 20 feet long and capable of flying subsonicly for 20 nautical miles, was fired by the Egyptians in a surprise attack and sunk an Israeli destroyer, the *Elath.* The cost effectiveness of this event is striking: namely, a $20,000 missile knocking out a system worth $150 million, 7500 times its cost. It allegedly took three or four Styx missiles to hit the *Elath;* yet, given the early 1959 design of the missile, the effectiveness of this early smart missile was remarkable and did not go unnoticed among intelligence circles, particularly Israeli. Israel itself has now developed its own, more sophisticated smart missile, the Gabriel; twelve feet long, it has a range of 26 nautical miles, a high explosive warhead, and terminal, semi-active homing guidance. The Israeli Navy has also changed in recognition of the future of smart weaponry. The two Israeli destroyers, the *Elath* and the *Yaffo,* each 362 feet in length and 2500 tons full displacement, are gone from active inventory; in their place are 18 fast attack craft (six more under construction) in the range of 150 feet in length and 250 tons full displacement, one-tenth the displacement of the destroyers. These are also being outfitted with the Gabriel smart missile.

A second vivid demonstration of smart missiles came in May

1972, when an American F-4 fighter-bomber destroyed the famous Than Hoa and Paul Doumer bridges in North Vietnam with the Hobo and Maverick smart homing missiles, also costing in the $20,000 range. Eighteen aircraft had been lost over the prior six years seeking to destroy these bridges with conventional bombs.

The most recent and widespread use of precision guided weaponry was the 1973 Mideast war. The Soviet-made, surface-to-air SAM missiles proved quite effective, when used in combination to cover a variety of altitudes, against Israeli aircraft; 90 Israeli fighters were brought down in two days. Similarly, smart anti-tank missiles such as the Soviet Sagger proved effective in the land tank battles. In one battle, for example, the small, 25-pound, infantry-fired, wire-guided Sagger helped destroy 130 Israeli tanks of the 190th Armored Brigade in several hours of fighting. As one chronicler of the war described the Sinai battle: "Hundreds of guiding wires of antitank missiles lay strewn across the road as if a giant spiderweb had collapsed."

These lessons of the Middle East have apparently not been lost on the U.S. Department of Defense. William Perry, the current Assistant Secretary of Defense Research and Engineering, emphasized R & D in smart weapons in his latest annual report; he asserted that "precision-guided munitions" offer the "single greatest potential for force multiplication" and "the potential of revolutionizing warfare." Perry's prediction of a revolution in warfare is perhaps an exaggeration, but there should be no doubt that smart technologies will affect the future battlefield in significant fashion.

In what direction is the PGM technology headed? — towards higher accuracy, lighter weight and more miniaturization, and improved penetrating warheads for use against hardened targets. This is not unlike our earlier predictions for nuclear weapons. The early precursor of the modern smart weapons was the bazooka-type gun. Once a target came into view, it could be aimed and fired with a higher probability of kill than, for example, the grenade. The drawback of these weapons was that once fired, their course could not be changed. Thus, the tank had a chance of outranging or outmaneuvering the rocket, if seen in time, just as the ship did the approaching torpedo.

The first generation of smart missiles was wire-guided; they could be maneuvered towards the target by the firer, as long as he kept the target in view; the maneuvering tank could thereby be followed and hit, as long as it did not disappear from view or successfully engage the soldier in a counter barrage. Camouflage and counter-

firing techniques, however, have proven effective against these early smart projectiles.

The more sophisticated smart weapons now have self-contained guidance systems in the missile itself rather than in the soldier-held launching mechanism. The umbilical cord has been cut, so to speak. The new weapons are now appropriately labeled "fire and forget" and "shoot and scoot," indicating their ability to home on a target without requiring continual viewing by the firer. The soldier or the aircraft may now aim, fire, and then run for cover or engage additional targets.

These weapons, as they are further developed and deployed, appear to offer a high probability of kill with a single shot. For example, the TOW anti-tank missile, an early wire-guided model, is estimated to have a single shot kill probability of 80 percent; the Maverick air-to-surface missile, now produced in several versions with optical and infrared homing mechanisms, is advertised to have had a 92 percent success rate in tests.

New, precision-guided weapon systems will not offer a cheap, technological fix to everyone's defense needs. But, in combination with elaborate planned schemes for target acquisition on the battlefield and at sea, they cannot help but to change the art of warfare. I was given an indication of this conclusion in a tour of an armored unit two years ago; the commander pointed out, in discussing tank war games, how the point system had changed since the 1973 Mideast war. Previously positive points were awarded to tank crews for hypothetical kills on the battlefield; now, negative points are also awarded for the number of seconds a tank remains visible.

A premium has been placed on the modern warfighter who remains visible for any period of time; in other words, visible means vulnerable. If an object or enemy can be seen, it can be hit with good probability today; and if it can be hit, it can be destroyed. Of course, there are defenses against smart weapons: camouflage, smoke, decoys, sintered armor, and possible anti-smart smart missiles. Yet none of these schemes offers an adequate alternative to the increasingly precise weapons.

What does this technological development mean for the conventional battlefield? First, it is becoming clear that placing many delicate eggs, such as human beings and high technology, in big baskets, such as aircraft carriers, tanks, and slow aircraft, is both dangerous and cost-ineffective. The Israeli Navy, as pointed out, has seemed to learn this fact. We experienced this even as early as World War II when every aircraft carrier hit by two or more kamikaze planes was

forced to retire for repairs; similarly, in Vietnam, over a seven-year period 22 U.S. warships were damaged by North Vietnamese gunfire. Of these, six were sufficiently damaged to require shipyard repair. And these cases involved projectiles much "dumber" than the "smart" weaponry of today and the future.

Emphasis will be placed more and more on high firepower, high mobility, evasive tactics, and moderately priced systems; the battlefield will become untenable for many of today's weapons: the aircraft carrier, the large surface warship, the lumbering tank and armored personnel carrier, and the fighter aircraft. There, of course, will probably always be a place for some of these obsolescing weapons behind the lines of battle, out of fire from the enemy. But the battle of the not-too-distant future will belong to the fleet-footed infantry teams with precision rockets and laser designators, perhaps in lightly armored, jeep-type vehicles; to the highly maneuverable aircraft with side-looking radar and long-range, terminally guided missiles; to the mobile artillery team with terminally guided submunitions in their artillery shell casings; and to the silent submarine and quick missile patrol boat with long-range cruise missiles at sea.

Second, although it still may be too early to tell, these developments would seem to offer an advantage to the defense in any future conventional conflict. In contrast to the offense dominance in the nuclear sphere, the defense will come to dominate the conventional theater. Granted, smart weapons will also find appropriate usages in an offensive mode. But offensive attacks must come into the open to advance; and on tomorrow's battlefield, visibility — either by sight, heat, sound, or light sensing — will mean high vulnerability. Such a situation may, in fact, tend to stabilize future military balances in local theaters. It would serve neither side well to attack first, for success would be doubtful; and weapons procurements will be judged more defensive than offensive in nature.

Some Concluding Remarks

Now that we have touched upon some future directions of both the nuclear and conventional forces, I will try to make a few general, but quite pertinent, remarks which might serve to arouse some debate and discussion.

First, with regard to *nuclear strategy:* The U.S. Secretary of Defense Harold Brown, in his most recent report to Congress, emphasized the fact that ". . . deterrence of nuclear war is our most fundamental defense objective . . . ." Reiterating his long-standing policy, President Carter stated in his December 1st press conference:

> Our nuclear policy basically is one of deterrence; to take actions that are well known by the American people and well known by the Soviets and other nations, that any attack on us would result in devastating destruction of the nation which launched an attack against us. So the basic policy is one of deterrence.

Mutual deterrence, the nuclear strategy which evolved from our espousal of "massive retaliation" once the Soviets gained a long-range nuclear delivery capability, posits each side with the ability to inflict unacceptable damage upon the opponent after riding out a first nuclear strike. Such enormous and terrible threats have helped to prevent nuclear war for twenty years or more.

Since the early 1960s — and perhaps even earlier — a secondary goal of U.S. nuclear policy has been to have options other than massive nuclear retaliation. This has been called by various names: limited war options, flexible response, and the like. Such limited nuclear war options — the ability to retarget missiles in a short period of time, to launch a limited number of warheads — may well add to the credibility of the U.S. nuclear deterrent as long as they remain secondary to mutual assured destruction.

Yet the new technologies which we have spoken about here are not necessary for mutual deterrence and limited flexible options. Very high kill probabilities against hardened targets, and large numbers of warheads, go beyond any rational criteria for sufficiency in nuclear deterrence; they are leading us (as much as I hate to say it) down the rosy path to a nuclear war-fighting capability which may very well weaken nuclear deterrence. The alleged secondary goals of nuclear strategy — essential equivalence, flexible response, or perhaps even nuclear superiority — are displacing mutual deterrence as the primary objective.

A second and related conclusion I would like to make today regards what we call *"the numbers game"* in military relations. Assessments of military balances, be they in Europe, in Korea, in SALT, or overall defense budgets, have deteriorated in the mid-twentieth century to counting and comparing quantities of items, sometimes identical, sometimes quite different. Thus we compare Soviet ruble budgets with American dollar budgets, tanks with tanks, warheads with warheads, ad infinitum. Is this the correct approach? — judging military capability on *input* rather than *output?* No other industry is run in this fashion; does General Motors compete with Chrysler Corporation according to budget and input comparisons — who is spending more, who is using more steel, who is consuming more energy? Or do they judge success more on output — numbers of cars produced and sold, profit margins, etc.?

We must get away from such input analysis in defense — at times a costly and dangerous approach. What we called "planning, programming, and budgeting" or "systems analysis" in the 1960s, and "zero-based budgeting" today is the more efficient, productive, and safer approach. This can be accomplished all the more easily now given the "dominance of the offense" in the nuclear sphere and the "ascendency of the defense" in the conventional sphere, as described earlier. For example, basic to asking the question: Do we need a new MX ICBM? is the question, Will the MX enhance mutual deterrence or is it more appropriate to other nuclear strategies? Basic to the question, Do we need a fourteenth aircraft carrier? is the question, Are aircraft carriers still viable in today's modern warfighting scenario? And fundamental to the question, Should we produce and deploy more tanks in Europe? is the issue, Are tanks still the best defense against tanks or should smart, anti-tank weapons be more widely integrated into NATO forces?

These are all minor examples of the basic output analysis approach needed for U.S. defense policy: What are our foreign policy goals and treaty commitments? And what forces are needed to meet those goals and commitments?

A third point, which I have overlooked for sake of brevity up to now, is escalating defense *costs*. Individual weapon systems, both nuclear and conventional, have risen in cost manyfold since World War II; this is partly a result of inflation, but also a function of the high and sophisticated technologies involved. The fighter aircraft of World War II may have cost a couple of hundred thousand dollars; today a modern fighter may be as high as $25 million. The F-14 Navy fighter, for example, now costs more than a couple of carrier squadrons in World War II.

Five years ago the M-60 tank cost $300,000; today it costs over twice that sum, and the new XM-1 is estimated at $1.5 billion. A modern aircraft carrier costs $2 billion to build, another $3 billion to outfit, and may run as high as $10 billion in lifetime costs.

Nuclear systems are similarly becoming expensive. The B-1 bomber was estimated in the $100-200 million range. A Trident submarine costs $2 billion. And replacement systems for U.S. land-based missiles are estimated at $30-50 billion. These costs alone, in an era of rising demands, competing priorities, and diminishing resources, demand that any new military system — or any product for that matter — be closely scrutinized for need and cost-effectiveness. Such rising costs, and an apparent rising American fiscal con-

servatism, will seriously affect U.S. national security planning. For example, in the nuclear realm we will eventually accept limited vulnerability of the land-based systems and may even depart from what former Secretary of Defense James Schlesinger disparagingly described as "the canonical logic of the Triad." In the conventional realm, expensive and vulnerable systems such as the aircraft carrier and surface ship will give way to more defensive and cheaper, cost-effective equipment.

A fourth and final remark I would like to make concerns the rising destructiveness of war. We must doff our rational planner hat every so often and reflect that as the world grows no larger, the destructiveness of weaponry does, especially in the nuclear weapons area. Every system, be it a business, industry, consumer item, bureaucracy, or whatever, meets its external limits sooner or later. We are finding this now in national security planning. More dollars, more warheads, or more megatonnage does not necessarily mean more security; in fact, it very well may mean less security.

I invite your questions and comment. Thank you.

TECHNOLOGY AND NATIONAL SECURITY POLICY

DONALD M. KERR

There is an aspect of the current relationship between technology and national defense which is of growing concern to me. A fashionable notion appears to be developing that technology is inimical to human values in general and therefore is contrary to our national interest and to the hopes of all peoples for a peaceful world. Some of you may have seen the recent series of articles in *Science* magazine titled "Technology Creep and the Arms Race." The thrust of the articles — that the arms control problem posed by advancing technology should be resolved by restraining development — is misleading. The problem is our imperfect perception of the implications of a given development. National security policy has many elements of which the two most important at present are defense requirements and arms control considerations. In evaluating the relationship between them, for example in relation to the Strategic Arms Limitation Talks and Comprehensive Test Ban negotiations, it is technology which can give us the factual basis for accepting a given option. I would like to discuss with you today my view of the role of applied science in our society and its relationship and contribution to our national security posture.

Technology does not have a life of its own. It is man-made and inextricably bound up in the total societal structure of any de-

veloped nation, providing the tools for the constant improvement of the quality of human life which we have grown not only to expect but to demand. Technology is not, as some believe, the bastard offspring of war; rather, it develops from a symbiotic relationship between military and civilian needs. Over time, technology has been largely evolutionary, not revolutionary. Revolutionary breakthroughs have been few but significant in altering our sense of space and time — the electric light, telephone and steam engine, the airplane, radio, the transistor, and a few others. The current developments in genetic engineering might qualify as recent breakthroughs in technology. Most recent advances in technology have been the product of gradual interlocked steps, one leading to the next, with the impetus for each step depending as much upon the previous step as upon external stimulus. The external stimulus itself can be either a military requirement or a civilian need. In many cases, technology has given us the key to cost reduction, in response either to the competitive pressures of the marketplace or the increased budgetary constraints placed upon the military. In the latter case, it may be that only aggressive and innovative technology can maintain a credible deterrent posture at a cost our society can bear.

Let me give you an example of technology where the same development can be used in two different ways with dramatically disparate implications. In the field of data transmission and communication, we are on the verge of major use of data encryption for civilian application. This is a technique similar to systems which have been in use in the military for some time which allow secure communication between users. There are two opposing views of such security — on the one hand it ensures *privacy* of communications for legitimate enterprises, such as an exchange of information between you and your bank; on the other hand it can provide a cloak of *secrecy* for numerous illicit enterprises. While it is possible that the problem will be solved by developing a discriminating mechanism, for the moment at least the technology will support, with total impartiality, either application.

Let us look at some examples of technological processes as they occur in different areas — weapons derived technology; general technology with weapons application; and technology almost exclusively civilian in its import.

Two examples associated with nuclear weapons programs are the development of Permissive Action Links (PAL) and the development of seismic detection devices. PAL devices, numerically coded locks which provide positive control over the arming and firing of

a nuclear weapon, are designed to prevent its unauthorized use. Their development has improved the safety and security of nuclear weapons, and they have since found a larger application in safeguarding the transport and storage of nuclear materials.

The development of seismic sensor systems is an excellent example of how technology advances by synthesis of the existing state-of-the-art in several different areas. During the Vietnam War, responding to a requirement for devices which could be implanted covertly to sense movement of enemy forces, one of our laboratories drew on and adapted existing technology in earth penetrators, hardened packaging, seismic detectors, and data transmission to put together systems that responded to the need. This development, in turn, served as the take-off point for a sensor technology that plays an important role in verification of arms control agreements. Not only has this technology enabled us to pursue agreements limiting nuclear testing, it also has helped the U.S. Field Mission in Sinai to keep the peace between Israel and Egypt. In these cases, we see technology originally developed in response to a military requirement also serving the other aspect of national security policy, arms control.

The symbiosis between military and civilian requirements is most evident in technological developments with parallel or sequential weapons and civilian applications. Three major examples, among many, spring to mind — microelectronics, inertial navigation, and small jet engines. In each case an initial military impetus was followed by widespread civilian development and application, driven by the needs of the civilian marketplace. As commercial requirements improved the technology, there was a return on the investment in the military area. Thus, small jets developed for military application provided the basis for the development of business jet aviation. In turn, the boom in business jet travel spurred continuing improvement in small jet technology — improvements which contributed greatly to the development of our present cruise missile technology. Clearly, military and civilian applications of many technologies share a common technological base; advances in one produce spin-off applications to the other; advances in either enlarge the base for both.

The role of technology for purely civilian application is obvious. The contributions of technology to medicine — surgical instruments, radiology equipment, the electron microscope — are telling examples of how technology can enhance the quality of life. So potentially are the technologies of alternate energy supplies such as solar energy systems, controlled fusion, and coal conversion. Yet even in these there is a symbiosis of military and civilian needs. Better medical care

and adequate energy supplies benefit national security as well as civilian well-being.

Having looked at these examples of the advance of technology, we can reaffirm that the development of technology does not stem from the military complex alone. Even when it is developed in response to military stimulus, technology benefits society as a whole on two distinct levels. First of all, militarily, technology can provide us the weapon systems that will deter a potential aggressor. Secondly, the non-military application of spin-offs from military development improves the quality of life.

History is replete with lessons of the importance of technology to national security, of nations that survived because of it, and of nations that went under for lack of it. The ancient Hittites had a generally cruder culture than the Babylonians and Egyptians. But their better engineered chariots and iron weapons defeated the slower chariots and bronze weapons of their foes; the Babylonian Empire crumbled and the proud Egyptians paid tribute to the Hittites. And the Byzantines survived for centuries against greater Saracen forces largely because their unique technology of "Greek fire" reduced Saracen battle fleets to ashes. Or consider the technology of the longbow and the military application the English made of it at Crecy. Perhaps the 14th Century elite of France — knights in armor — saw the longbow as socially destabilizing. Whatever the reason, they did not develop the technology that made knights in armor militarily extinct.

In more modern times, consider the role that radar played in the World War II Battle of Britain. Had the British not developed this technology the "few" of the Royal Air Force Fighter Command probably would have been no match for the Luftwaffe. And consider the atomic bomb itself. Had the Allies not been pursuing the technology and not appreciated its enormous potential, they would probably not have gone all-out to destroy the Norsk-Hydro heavy-water plant. German nuclear scientists might have developed the first bomb. This last example of the value of pursuing technology, the understanding which it can give us of the actions and options of our adversaries and of the potential threats which may face us, is one which is given little attention; yet in a world in which we have committed ourselves not to be the aggressor it may represent the key to our survival. The progress of our own technology allows us to anticipate developments which might be used against us. A current example is our understanding of the effects of multi-megaton nuclear weapons. Though we do not deploy such weapons ourselves, our

understanding of the effects allows us to harden our systems and our defenses to make them survivable in that environment.

Those who see technology as an inimical force yearn for a return to a simpler time — a time when the world was not beset by the problems which face it today. I think we can all sympathize to some degree with such nostalgia but to succumb to a neo-Luddite hatred of technology would be dangerous in the extreme. One of the great forces in the world today is the aspiration, indeed the demand, of the Third World for a better life. It would be difficult to convince a Third World nation that it would be better off if the United States or any other nation stopped technological progress. Yet, that is what restraining the technology of national security would entail — a brake on development as a whole. One cannot restrain technology selectively. It is too complex, too interdependent, for the effect of a restraint in one field not to be felt in other areas. Suppose we had restrained the development of microelectronics in order to control its contribution to the development of nuclear weapons systems — contributions which have led to reduction in warhead size and increased accuracy. Putting aside the discussion of whether or not such weapons developments benefited our security and world stability, those same restraints would have held back the development of microelectronics in all the other fields where it has been such a dynamic force — communications, data handling, medicine.

Let me draw a parallel. We have all heard the old saw: "Everyone talks about the weather but no one can do anything about it." The weather is recognized as an elemental force over which we have little control. Yet man has learned to live with his weather environment and to cope with the effects of weather. I believe that technology has also become an elemental force in our society — one which man must learn to understand and shape to his ends. We must control the impact of our technology by controlling its application — not its development.

In our current national security policy deliberations, two subjects have received much attention — SALT and the Comprehensive Test Ban negotiations. In both cases the domestic debate has been deficient and neither clearly defined nor clearly joined. The publicity and the fervor which have attended these discussions have underscored the symbolic importance of the decisions. However, the focus on the symbolism and the emphasis on the political factors have both served to reduce the visibility of technical considerations. The technical experts have been divided — a fact which points to deep differences in subjective policy judgments rather than technical

disagreements. In reviewing the arguments pro and con for the treaties, it appears that the terms of reference for the basic arguments on both sides differ. Those in favor of the treaties have taken what might be called the global view and argue that any measure which imposes controls on nuclear weapons deployment and development would act to reduce general worldwide concerns about the stability of deterrence and nuclear proliferation. Those who oppose the treaties focus on the negative effects on U.S. national security of the advantages for the U.S.S.R. which might result.

During the discussions about the treaties there has been no definition of the future role to be played by technology. Technology is potentially capable of making some contributions which could have a significant impact on the strategic environment of both SALT and CTB. Evolving technology may even within the framework of SALT constraints produce better weapons with their potential for maintaining a stable strategic balance; it may act positively to reduce the threat of proliferation by strengthening the confidence of friends and allies in the U.S. nuclear deterrent; it may provide means to reduce war losses; and finally, it may lead to safer, more effective nuclear devices.

It is possible that the redirection of research and development as a consequence of a CTB will be in a direction that provides better support for U.S. foreign policy. For example, many significant developments in naval technology in the 1920s and 1930s were the consequences of efforts to build around arms limitation agreements reached at the Washington Naval Conference of 1921-1922; the patrol bomber and long-range submarine both owe their advanced stage of development at the beginning of World War II to the constraining provisions of the Washington agreement.

An extra effort to apply advanced technology to non-nuclear weapons could result in systems better suited for crises in which political constraints on use of nuclear weapons remained operative. On the other hand, a CTB could lead both sides to stockpile unproven weapons. Lack of confidence in reliability would not only be destabilizing but could also have a negative impact on the willingness of both sides to continue the process of reducing the numbers of nuclear systems. Complete confidence in the reliability of our remaining systems is necessary to the acceptance of reductions. Lack of confidence could force us to compensate for perceived unreliability with an open-ended increase in the number of systems. Also, there are potential incompatibilities between current proposed U.S. arms control policies and our commitment to provide for the continued

security of Western Europe. Early strategic arms limitation efforts excluded non-strategic weapons. However, once parity in strategic weapons is achieved, Europeans might be uncertain about U.S. intentions. We might be left with Western Europe driven in the direction of becoming a "Big Finland" as the result of lowered confidence in the U.S. nuclear umbrella.

In both the SALT and CTB arenas, as well as in a more general sense, we have not only neglected the possible contribution of technology to the discussion. In fact, some go to the extreme of ascribing to technology the responsibility for the difficulties which beset us in trying to develop control mechanisms for the nuclear genie. We must realize that no amount of rhetoric can put the genie back in the bottle — nuclear weapons and the threat which they pose are a fact of life. We must find political solutions to the problem of controlling them. Rather than attempting to stifle technology, we should encourage increased investment in innovative technology which will support our national security options by creating policy alternatives.

This is not to say that technology, any technology, should be applied willy-nilly. Responsible leadership cannot say, "Damn the consequences of technology — full speed ahead!" It must weigh the possible consequences of applying a technological advance. It must choose among technologies in determining allocation of national resources. It must exercise judgment to determine whether a proposed application furthers over-all objectives.

This is the role of policy, and it is policy-makers who must reconcile the pursuit of improved weapons technology with the pursuit of arms control. In these twin pursuits they must recognize certain technological realities. I think all of us will agree that arms control agreements must be verifiable; otherwise they would pose unacceptable risks to our national security. Our sensor technology allows us to verify quantitative arms control agreements — that is, it allows us to count missiles, aircraft, armored vehicles and the like. But qualitative arms control agreements are essentially unverifiable — our sensor technology cannot tell us the contents of a missile nose cone, the range of a bomber capable of delivering atomic bombs, the penetrating power of the projectiles carried by a tank. Therefore, the arms control agreements we seek should be quantitative, not qualitative. And prudence demands that we assume a potential adversary is pursuing the qualitative improvement of his weaponry just as prudence demands we pursue improvements that seem sensible to us. Certainly we should not impose qualitative arms control on ourselves, which is what the doom-criers of "technology creep"

seem to be advocating. For if we do, not only would we deny ourselves the civilian sector spin-offs of advances in military technology. More important, we would be putting our national security at risk. We dare not assume that the Soviet Union will suddenly cease its pursuit of improved weaponry — even if we can verify that the numbers of Soviet weapons remain within agreed limits. To make such an assumption is to lay ourselves open to the possibility — indeed, probability — of technological surprise. If we throttle our own developments, we could some day be confronted with a threat embodying technology we were not even aware of.

There is a final point to be made in favor of pressing forward with our technology. Deterrence depends as much upon the perception by your adversary of your political will as it does upon his view of the capability and structure of your forces. The pursuit of technology and the willingness to bear its cost sustains a perception of your resolve. Only a vital, innovative technology can provide the necessary support to the visible elements of our resolve — testing programs, exercises and vigorous research and development programs. The U.S.S.R. demonstrates its resolve by committing 12-15 percent of its GNP to defense — our matching resolve must be to maintain our technological superiority.

DEFENSE RESEARCH AND ENGINEERING EFFORT

ROBERT R. FOSSUM

Ladies and Gentlemen, it's a pleasure to be with you this morning. As I walked in, I noticed that each name tag has the city in Texas from which each of you come. It's a pleasure for me to tell you that my name tag says "Robert Fossum, El Paso," rather than Washington, D. C.; I am happy to be among my friends from Texas even though I'm no longer a resident.

This morning I would like to share with you some of my views on a very special part of the defense research and engineering effort which has been underway since 1958. Of course this effort is centered in the Defense Advanced Research Projects Agency. Our major function in this agency is to adapt modern technology to the requirements and needs of the future armed services. I will illustrate this by some specific projects that we have undertaken to provide more effective weapons in the decades beyond 1990.

In the defense sector, just as in the commercial sector, effectiveness is related to productivity. It is related to the productivity of people and of machines. Historically, there have been three visible revolutions of a technological nature over the past 150 years. The first

of these, the industrial revolution, increased substantially the productivity of the individual worker. The second revolution of significance I would call the management revolution which began in the early part of the century and increased substantially the productivity of the industrial process and of the machines themselves. The third revolution, which has been underway for the past 15 to 20 years, is the information processing revolution. This revolution — although it is too early to evaluate it completely — will result, in my opinion, in even greater increases in the productivity of organizations and of individuals. In the Department of Defense we face the problem of effectively adapting the output and, in some cases, even leading the output, of these revolutions to defense problems. A natural question arises, why should Defense have a special requirement to adapt to these revolutions and even to push these revolutions? In particular, why won't the adaptation process occur naturally? A succinct answer to this question was given almost 100 years ago by a highly perceptive person named Alfred Thayer Mahan. Mahan states, in his classic study *The Influence of Sea Power on History 1660-1783,* the following:

> The unresting progress of mankind causes continual change in weapons and with that must come a continual change in the manner of fighting. The seaman who carefully studies the causes of success or failure will observe that changes in tactics have not only taken place after changes in weapons, which is necessarily the case, but that the interval between such changes has been unduly long. This doubtless arises from the fact that an improvement in weapons is due to the energy of one or two men, while changes in tactics have to overcome the inertia of a conservative class, but it is a great evil. It can be remedied by a candid recognition of each change, by careful study of the powers and limitations of the new weapon, and a consequent adaptation of the method of using it to the qualities it possesses, which will constitute its tactics. History shows it is vain to hope that military men generally will be at pains to do this but that the one who does will go into battle with a great advantage.

This perceptive statement can be best illustrated by an historical land warfare example which occurred in the early phases of World War II.

In June, 1939, even as today, it was fashionable not only in the military but in the press to present almost monthly assessments of the balance of military power between the Western Allies and the Germans. These assessments, interestingly enough, were based upon what might be called the output of the industrial revolution, that is, an assessment of the productivity of individuals. As a consequence, assessments themselves were primarily in terms of the numbers of

men, horses, tanks and airplanes on each opposing side. Briefly, it appeared that, in terms of the number of men, the Allies exceeded the Germans; in the number of horses, the result was the same. Surprisingly enough, even in the number of tanks and armored vehicles the Allies were superior in numbers; and in the case of airplanes, it was very difficult to make the comparison. One could say, in terms of numbers, there was an equal number of aircraft in the West as there was in the East. I remember clearly listening to such assessments as a child in El Paso on Radio Station KTSM. And what was astonishing to me, given these assessments, was that by June of 1940 the battle of France was over. France was defeated and England seemed to be in deep trouble.

In retrospect we know that the assessments were wrong because they were made primarily on the basis of the output of the industrial revolution, that is, the increased productivity of individuals. The Germans, however, had adopted the output of the management revolution, thus changing the process of warfare, whereas the French and the English had failed to adopt the output of that revolution. That is to say, they had failed to change the process of using weapons, that is the tactics of the use of weapons. The Germans had become skilled in the process of warfare through combined armored and air warfare. The French had failed completely in understanding and managing the end-to-end process. In retrospect, the French failures can be listed. First, there was inadequate reconnaissance. The main thrust of the German advance through Belgium and Luxembourg was not recognized. Second, there was inadequate command and control of the forces. In particular, communications structure was so sluggish that a typical message from a regiment in the front lines took 24 hours to find its way to general headquarters. Third, there was inadequate decision-making on the part of almost every general officer. The battle unfolded with such rapidity that it overwhelmed the decision-making ability of the French general officers. Finally, the French Army had inadequate mobility. Major portions of the supply were horsedrawn and in the armored vehicle case, rail transport was heavily depended upon.

Clearly, the French failed to adapt to many of the precepts of the management revolution which occurred after World War I. The precepts neglected include the gathering of adequate information, rapid communication of this information to decision-makers, concise and clear decisions by the decision-makers, and the bringing to bear in concentration of the forces necessary to implement the decisions. These inadequacies clearly demonstrate the lack of adaptation of

the results of the management revolution into the military. I hope, ladies and gentlemen, this example demonstrates clearly the thesis set forth by Admiral Mahan 100 years ago that, in fact, the output and lessons of technology revolutions are not easily adapted into the military service without substantially pushing the technology by the developers.

Today, the movement of technology worldwide in terms of invention and application is extremely rapid. We not only have the problem of adaptation of this technology to the military, but the problem of where to push our limited research and development resources so that they increase military effectiveness or productivity. I assert that our major push should be in areas of maximum asymmetries, that is, where our technology will allow us to develop weapons which cannot be met in kind by our adversaries. We must select those areas in which we are presently superior to our adversaries and insure that weapons systems based on the technology are our primary R and D thrust. Examples of this include advanced mobility concepts; advanced concepts for machine destruction, that is, the destruction of war machines rather than people themselves; advanced command, control and surveillance systems in order to gather the information and process that information in a way that takes advantage of the information processing revolution; and, finally, insuring that better decisions are made in a rapidly unfolding warfare environment. Let me briefly review for you some of the Defense Advanced Research Projects Agency projects addressing each one of these areas.

First, the problem of adequate mobility. We presently have under development an air vehicle which we call X-Wing. The unique characteristics of X-Wing are that it operates as a helicopter, with the consequent vertical mobility at low speeds, and can operate as a fixed wing aircraft for higher speeds and longer ranges. The technology involved in the airplane is primarily materials science and electronics and fluid mechanics of control theory. The materials science problems involve building extremely stiff wings of modern carbon composite structures. The electronics and control problem involve the control of the flow of air through the wings for low and high speed operation. Specifically, the wings use a well-known principle of circulation control known as the coanda effect for lift and lift modulation. In order to control the lift in an asymmetric fashion during the transition from helicopter flight, it is important to modulate the air flow very carefully.

In the area of battlefield mobility we have under construction,

in cooperation with the Army, a high mobility gun platform that is lightly armored. The purpose of this vehicle is to enable the Army to examine the utility in battle of high agility and mobility as opposed to the conventional wisdom of heavily armored tanks. The platform, in addition, will carry a DARPA-developed rapid fire, high-velocity penetrator. A key part of this program is also the development of an advanced low-fire control system that will allow the gun to fire effectively while the vehicle is underway.

In the areas of machine destruction, our primary effort is in two areas. The first is the demonstration of a system concept called Assault Breaker. Assault Breaker makes use of a ballistic missile to deliver semi-smart submunitions to the rear areas behind an enemy armored breakthrough attempt. The weapon will attack large numbers of concentrated armor as it moves forward to exploit a breakthrough. This advanced technology makes use of modern integrated circuits, modern surveillance technology, etc., and synthesizes these technologies into an integrated system configuration. The second area is the development of what we call fire and forget missiles whose circular error probability is very small. This means that if we are successful, missile systems can be developed which require no manned target designators in order to achieve a true "fire and forget" weapon system.

Our major thrust in command and control and communications is to develop communication architectures that are relatively invulnerable to disruption by jamming or physical attack by the enemy. This means that the system must include highly dispersed communication nodes which are by themselves survivable and communications architectures which allow rapid reconstitution automatically. We are accomplishing these objectives through the use of computer-based communications architectures based on a concept called packet switching. These architectures will, we believe, be used in most backbone service communications systems by the end of the nineties. We are presently conducting experiments with the Army in North Carolina using such radio sets.

As I mentioned before, the battle will unfold very rapidly and require quick decisive decisions. The information processing revolution will allow us to help general and flag officers make such decisions by allowing them easy and rapid access to critical information. The key word is *easy* access. It is a truism that information which is difficult to retrieve will not be used in decisions. Our program aims toward adapting to the individual commander, rather than asking him to adapt to the technology.

In conclusion, I have tried to share with you a basic problem faced by the Department of Defense and the Service technologists in achieving adoption of technology and to relate some of our advanced concepts now in exploratory development. It is clear that we must push high leverage technology very hard if we are to redress growing imbalances in the force balance trends.

Thank you, ladies and gentlemen, for inviting me to share these thoughts with you.

II. DEFENSE IN A DEMOCRACY

Moderator: DUDLEY C. SHARP, *Houston.* Former Secretary of the Air Force.

Panelists: JOHN M. MAURY, Former Assistant Secretary of Defense.
EVERITT DONALD WALKER, Chancellor, University of Texas System.
RALPH W. COUSINS, President, Newport News Shipbuilding and former Commander of the Atlantic Fleet.

WHAT HINDERS CIA FROM DOING ITS JOB?

JOHN M. MAURY

A wise veteran of White House councils has said that the greatest danger to peace in our time could be an ill-informed American President.

Small wonder, then, that the President reportedly has expressed concern over Central Intelligence Agency performance with regard to the potentially explosive situation in Iran. But it is difficult to see how any intelligence service could function effectively in the face of the coincidence of circumstances which have conspired over the past several years to disrupt and demoralize the agency.

The roots of many of today's problems lie at the door of agency management. The preemptory dismissal of hundreds of skilled and experienced officers has profoundly affected morale, resulting in the voluntary retirement of hundreds of others.

CIA, and indeed our entire national security apparatus, is victim of the theology, prevalent in parts of the present administration, which holds that official secrecy, like military strength, is, by definition, immoral or sinister. The resulting restraints and inhibitions have seriously eroded intelligence initiative. This unilateral disarmament in the midst of intense intelligence warfare with foreign adversaries has had little effect in reassuring the agency's domestic critics, and even less in encouraging reciprocal restraint on the part of the KGB. It has, however, resulted in considerable disenchantment among friendly foreign intelligence services whose valuable collaboration with us in the past had been based on the belief that the CIA was ready and able to take the lead in providing the Free World with protection against surprise and subversion.

But perhaps as damaging to the long-term effectiveness of our intelligence services as any of the above has been the irresponsible zeal of the American media in exposing the secrets, attacking the purposes and distorting the facts regarding our intelligence activities.

This is not to suggest that there is anything unhealthy in the adversary attitude of the media toward any government agency which

operates clandestinely. Nor is it surprising that the media have not yet recovered from the euphoria — indeed the arrogance — of their success in vitally affecting the conduct and outcome of a major war and contributing to the downfall of two Presidents. But just as the press has been so effective in dramatizing events in Indochina and uncovering mischief in the White House, so should its own performance be subject to scrutiny. The corruptive effects of power are not limited to government alone.

Among recurring, seriously misleading themes appearing in the news or editorial pages of influential publications have been the following:

CIA is a sort of "rogue elephant," operating beyond the control of President or Congress. In fact, as both the Church and Pike committees concluded, CIA, in the words of the Pike report, "has been highly responsive to the instructions of the President and assistant to the President for national security affairs." And the agency has always reported to Congress precisely in accordance with procedures laid down by the Congress itself.

CIA was a witting accomplice in the Watergate burglary. In fact, as the Rockefeller Commission concluded, CIA had no reason to know that the assistance it lent Howard Hunt (documentation, camera, recorder) would be used for improper purposes. Moreover, CIA Director Richard Helms refused to allow any agency operations in Mexico to be used as a pretext to obstruct post-Watergate investigations.

CIA has been involved in illegal drug traffic. In fact, as John Ingersoll, director of the Bureau of Narcotics and Dangerous Drugs, stated in response to a Congressional inquiry, CIA has been the bureau's "strongest partner" in uncovering foreign sources of illegal narcotics.

In addition, there have been numerous false or misleading individual news items. A few examples:

A front-page item appearing in the New York *Times* in 1969 alleging that there had been "at least one confirmed battle death in Laos — when an American CIA agent was killed by gunfire at an advanced post." As a subsequent embassy investigation made clear, the "CIA agent" turned out to be a five-day old premature baby of the family of an employee of Air America, the CIA-controlled contract air carrier. The story was especially mischievous because of the strict U.S. policy, in line with the Geneva accords to which the U.S. was a party, against any combat involvement by U.S. personnel in Laos.

Washington *Post* item in 1976 by a member of the *Post* editorial staff describing the so-called Penkovsky Papers as "precisely the coarse fraud, a mixture of provocative invention and anti-Soviet slander that the Soviet authorities . . . claimed it was at the time."

In fact, having been the CIA officer in charge of the Penkovsky operation, I have assured the *Post,* as their senior editors were assured when they originally serialized the Papers, that virtually every word in them attributed to Penkovsky was his own.

Washington *Star* headline in 1976, "CIA Goal: Drug, Not Kill, Anderson." In fact, the story said only that the White House had consulted a "former CIA physician" about drugging Jack Anderson "to discredit him."

A number of press stories alleging CIA introduction of swine flu virus into Cuba. Although flatly and publicly denied by the agency in both press releases and assurances to Congressional committees, most of these allegations have never been retracted.

Quite as damaging as some of the false and misleading stories have been disclosures of sensitive operational information. It is difficult to see how the public interest is served by revelations which destroy the fruits of important, dangerous and expensive intelligence undertakings, strain diplomatic relations or embarrass individuals, organizations or foreign governments that have provided the agency with valuable assistance. Who is served by publication of details of the efforts of the *Glomar Explorer* to salvage wreckage of a Soviet submarine? As Eric Sevareid, commenting some time ago on press stories of the interception of foreign communications and of submarine reconnaissance in foreign waters, asks: "Were these two stories information that people had a right to know and benefited by knowing? Only a rather exotic cult of editorial thinkers would say yes."

The media have been ever ready to make instant celebrities of those former CIA employees who, for whatever motives, chose to violate their solemn secrecy commitments, sabotage sensitive and important operations and jeopardize the careers and personal safety of former colleagues by "telling all." Typical among these has been the recent idol of the talk shows and book reviews, John Stockwell. The mindless zeal with which some of the media have accepted uncritically his unsubstantiated allegations would befit the accolades heaped upon the pronouncements of Fidel Castro by Radio Havana. Lost in the avalanche of publicity is the fact that while still in the agency he failed to present his complaints to the inspector general or other senior officials, or to report them to the appropriate over-

sight committees of the Congress; and that some of his allegations are outright falsehoods, such as the especially serious claim that ". . . the CIA's recent record includes the assassination of Patrice Lumumba; Ngo Dinh Diem, the South Vietnamese President; Rafael Trujillo Monila, the Dominican Republic President; General Rene Schneider, the commander of the Chilean Army."

The "tell all" fraternity is not limited to junior or middle-grade officers who were probably ideologically or emotionally unfit for the demands of the intelligence business in the first place. It includes, at least in some degree, a former director, William Colby, who defends his record of going beyond the traditional bounds of security on the ground that only in this way could the agency's reputation be cleared and its critics reassured.

Among Colby's bitterest critics have been some former members of the high priesthood of secrecy, the counter-intelligence clique. Perpetrators and victims of the myth of the omnipotent KGB, their basic assumption is not only that all our security agencies are penetrated (probably true, at least to some degree), but that most of what we take to be reliable intelligence is being fed to us by Soviet deception artists. It is ironic that some of these self-proclaimed guardians of the agency's security conscience should, in an apparent effort to settle old scores and cover past fiascos, now turn up in the ranks of the "kiss and tell" brotherhood along with the likes of Messrs. Marchetti, Agee, Snepp, Stockwell. See for example *Legend: The World of Lee Harvey Oswald* by Edward Jay Epstein.

There is also the problem of news selection and news suppression. A case in point is the coverage of hearings on CIA and the media at the beginning of this year by a subcommittee of the House Select Committee on Intelligence. Although several former CIA officials testified, there had been no significant cases where news disseminated to foreign audiences by CIA had contaminated stories destined for American readers. I noted that despite lengthy investigations by other Congressional committees and numerous cries of alarm by editors and commentators, not one significant case of such contamination had been identified. Typical headlines the next day, however, was this in the Washington *Star,* "U.S. Media Took Stories Planted by CIA as Genuine."

There was also my own testimony that while there was little evidence of CIA corrupting the American media, there was good reason to believe that the KGB had been quite active in this regard. I cited a top secret manual entitled "The Practice of Recruiting Americans in the U.S.A. and Third Countries" published by the First

Chief Directorate of the KGB and listing, in order of priority, twelve categories of recruitment targets. The first was government employees with access to classified information. The second was members of the media. I referred to evidence that Soviet efforts in this regard had been quite successful.

On the use of journalists in the collection of intelligence, Eugene Paterson, president of the American Society of Newspaper Editors, warned that CIA use of even foreign journalists "could lead to the death of our American Dream." However, neither he nor any media representatives cited a case where a CIA connection had either contaminated news disseminated in the U.S. or interfered with the obligations of an American journalist to his publisher or his public. Nor did anyone explain how the American Dream would be placed in mortal jeopardy by CIA recruitment of a Tass correspondent.

Over a dozen reporters were present during the hearings. They provided extensive coverage of the testimony of media representatives, but no testimony critical of the media or challenging allegations of CIA corruption of the media, or of KGB penetration of the media.

This is a sorry record. It brings to mind the words of Thomas Jefferson when, in 1807, he wrote to his friend John Norvell of Kentucky:

"Nothing can now be believed which is seen in a newspaper. Truth itself becomes suspicious by being put into that polluted vessel."

But the purpose of recounting this record here is not to suggest a solution to the problem of irresponsible journalism. Rather, it is to identify a source of disturbing disarray in our first line of defense and to warn those concerned about the effectiveness of the CIA of the future not to be misled by media-created myths regarding the CIA of the past. These myths have already generated public and political pressure for cures worse than the disease, or legislative restrictions and public exposures which would damage the agency's effectiveness even more than it has been damaged already.

But there is one measure which might do much to restore the effectiveness of all our intelligence services — the passage of legislation providing meaningful protection for sensitive intelligence sources and methods. Our basic espionage law is woefully inadequate. In order to convict under it, the government must prove that the disclosure of classified information was done with "intent, or reason to believe" that it was "to be used to the injury of the United States or to the advantage of any foreign nation." Thus if even the most sensitive information, such as the identity of agents or the details

of intelligence collection techniques, are revealed publicly, conviction is often impossible unless the defendant is caught in *flagrante* with a foreign agent. It is ironic that we have laws providing prison sentences for revelation of information on such matters as crop statistics, bank loans, Internal Revenue data, Selective Service records, export controls, patents, relief rolls, and even insecticide formulas; but intelligence employees can, with impunity, violate their sworn commitments, betray their organization and destroy the careers and jeopardize the lives of former colleagues by "telling all." They can destroy the effectiveness of valuable and costly technical collection systems which have been years in the making. And in doing all this, they can be assured of fame and fortune.

If these instant celebrities crave future adventure and reward, they can develop, and some undoubtedly have developed, mutually profitable relationships with foreign intelligence services. Their appeal as targets for recruitment stems not only from their knowledge of our own intelligence operations; with their ready access to the media and lecture halls, they are ideally situated "agents of influence." In this capacity they are uniquely qualified to serve what a former Soviet intelligence officer has described as one of the KGB's highest priority objectives, "to put out the eyes of our enemy by discrediting and disrupting his intelligence service."

All this is not to suggest anything as drastic as the British Official Secrets Act or the espionage laws of most other democratic countries. All that is proposed is a bill which would cover only information specifically designated by the director of Central Intelligence or the heads of the other intelligence agencies as relating to intelligence "sources and methods" — the identities of agents or the details of technical collection systems. It would have no applications to other categories of classified material. And it would be binding only on those individuals who, by virtue of employment with an intelligence agency, voluntarily assumed the obligation to protect source and method information.

In considering such legislation, it may be appropriate to recall the comment of General George Washington who, just over 200 years ago, wrote in a letter to Colonel Elias Dayton: "The necessity for procuring good intelligence is apparent and need not be further urged — all that remains for me to add is that you keep the whole matter as secret as possible. For upon secrecy, success depends in most enterprises of the kind and for want of it, they are generally defeated, however well planned."

HIGHER EDUCATION IN NATIONAL DEFENSE

EVERITT DONALD WALKER

Dr. Vandiver, Mr. Sharp, distinguished panel members, and fellow members of The Philosophical Society of Texas.

Today, to the day, marks my full year as a member of this distinguished society. The year has brought me some very pleasant surprises and a number of honors which I probably do not deserve but for which I am deeply grateful. And there is nothing that I am more grateful for than the honor of being associated with the members of the Philosophical Society. That has been a source of daily pride and satisfaction to me.

This meeting also marks one of the first public addresses I have made since assuming the office of Chancellor of The University of Texas System.

Someone asked me not long ago what it feels like to be Chancellor of one of the largest, and most diverse educational institutions in the nation. I replied that I am constantly reminded of Harry Truman's description of serving in the Presidency.

"A President," he wrote in his memoirs, "either is constantly on top of events or, if he hesitates, events will soon be on top of him. I never felt that I could let up for a single moment."

And then he added: "Being a President is like riding a tiger. A man has to keep on riding or be swallowed."

Well, that's sort of what it's like to be Chancellor of The University of Texas System.

Today I have been asked to speak on the role of higher education in national defense. I can think of no more appropriate way to begin than to recall those words of H. G. Wells, who wrote: "Human history becomes more and more a race between education and catastrophe."

Those words really say it all. Not only does our educational system make major contributions in keeping our defense establishment strong and up-to-date, but it also generates much of the wisdom which contributes to an atmosphere of peace and understanding among the many cultures of the world — the best guarantee there is that we can *avoid* war.

On the conventional level, The University of Texas System — like all major educational institutions — contributes to our national defense program in several ways: One, direct military training courses through the use of physical and academic facilities on individual campuses; two, the execution of research and development

grants of federal funds, directed toward specific military systems; and three, the many side-benefits of normal research programs that can be applied to defense techniques, intelligence and military needs.

The University of Texas at Austin has strong Reserve Officers Training Corps curricula for the United States Army, Navy and Air Force. Army ROTC programs are also taught at our University of Texas campuses at El Paso, San Antonio and Arlington.

Our Permian Basin campus at Odessa offers a Marine Corps Platoon Leader's Program plus a Marine Woman Officer's Candidate Program. As befits a democracy, these courses are all voluntary, of course. Those students who do sign up for the military curricula are required to make minimum commitments to the sponsoring military branch in exchange for the financial and academic benefits they receive.

The ROTC programs are good programs. The students benefit, the university benefits, and obviously, our national defense benefits.

Research contracts, funded by the military branches, are another important way that the UT System contributes to the national defense. Our research labs benefit from these contracts, too — and so does the nation as a whole. We, for example, have made great strides in research and development of military communication systems for the United States Navy at our Applied Research Laboratory in Austin. Sonar and radar systems are constantly being improved, made more effective through instruments that can generate clearer, stronger signals. Radar, incidentally, originally developed as a war instrument, is one of the direct benefits to us all, as it enables air flight in blind or obscured weather conditions.

Now I know that military research, conducted by higher education, is considered evil by a few of our citizens — and some of our students. There are those who believe that our educational institutions are somehow corrupted by such research.

But I think that just the reverse is true. I think our free society — a basically civilian society — is strengthened and protected by the way we conduct our research. Few would deny that we live in a dangerous world — a world that demands constant vigilance. In such a world, military research is absolutely a necessity for our survival.

We educators believe that our democracy is better served through academic research than by the military doing its own. We take a broader view toward eventual benefits to *all* mankind. Military research has only one purpose.

Just as we are the thinkers, the innovators, the creators of defense systems, so are we the world's strongest proponents of peace. We not

only are obliged to honor our government's request to assist in designing defense systems, we are obliged to furnish the wisdom that would ultimately make those systems obsolete, unneeded in the first place.

We are also the peacemakers, in other words.

How many times we've read of our nation's great university scientists developing weapons and then advising our leaders not to use them!

Consider, now, such activities in our democracy as they would compare to similar situations in a less tolerant society. A closed society with a secretive military personality does not allow criticism, or dissent. A Communist system, particularly in matters of defense, may be more efficient in its research and development — because of its secretiveness and its intolerance of criticism — but a free academic system builds in a conscience with every machine of war.

Non-defense oriented research is another major contribution of higher education to national defense — perhaps in the long run, the most significant of all.

The number of research programs currently under way in all of The University of Texas System institutions alone, in all our fields and interests, is enormous. Add to this the research being done in the labs of the other fine universities in the state, then multiply all that by the research universities in the 49 other states. The total is a staggering amount of brilliant minds and dedication at work.

Both pure research and applied research result in knowledge and scientific developments that have applications and spin-offs often undreamed of at the time the research was taking place. Some of these applications and spin-offs benefit us in our daily lives, in a thousand ways. Some of them turn out to have vital military applications.

We of The University of Texas System are proud of the contracts our component institutions have, for instance, with the National Aeronautics and Space Administration and of the direct benefits our nation's defense systems have received as a result of our research efforts on interplanetary scientific devices and systems. Our Marine Science Institute, headquartered at UT in Austin, has a scientific package on Mars — the result of a joint NASA-UT project. We are also involved in exotic earth-scan photographic survey projects with NASA. Military intelligence benefits from such developments are obvious.

But let me shift our focus for a moment to take a broader view of the University's role in national defense.

National security requires that we understand our fellow man and his culture so that the pressures that might cause war will be recognized and relieved before catastrophic explosion occurs. The leaders in all countries must use their intellect to rise above the notion that the only solution to differences is to battle. Lasting peace comes more from educated leaders who have both the necessary understanding and the required diplomacy to avoid war than the ability to fight war. The turmoil in the Middle East is perhaps a good example. If lasting peace is to be realized there, it will almost certainly be more through the understanding and diplomacy of leaders such as President Sadat and Prime Minister Begin, who are both highly educated leaders, than through a permanent victory on the battlefield. (In fact, history shows us that there is no such thing as a permanent victory on the battlefield.) Our universities must play an important role in this activity of communication and understanding between nations.

There is another defense system, often overlooked as such, which is vital to the protection and well-being of our society. And that is the American economy. Its strength and its vitality not only provide the tax revenues that support our traditional defense establishment, but it also is the very bedrock of our standard of living, of the strength of the dollar, of our industrial development, and of our trading position throughout the world. There is nothing that our potential enemies would like better than to see the collapse of our economic system — for if that ever happens, we will have been defeated without ever having fired a shot — without ever having had to test our defense system.

I think that no one would dispute me when I say that our system of higher education is the very fuel that runs the engine of that economy. Educated men and women who run our businesses and industries . . . researchers and engineers and scientists whose efforts are constantly turning out new and improved products and new applications for old ones — these people are on the front line of America's defense effort as well.

Defense must also be the product of our daily struggle against disease, poverty, hunger, and other human indignities.

Thus, in our roles as teachers and researchers, we must also further the quest for knowledge that will result in the betterment and protection of mankind. We have multitudes of problems demanding researched defenses against them.

Perhaps the horrors in Guyana, a shattering human event that reeled our senses just three weeks ago, can provide a lesson. Research

is under way to unlock the secrets of the human mind and tell us why otherwise intelligent human beings would take their own lives on such a massive scale that we still have difficulty believing that it really happened.

Perhaps the incredible human suffering brought about by recent earthquakes in Central America, Mexico and the Middle East will accelerate research for defense and warning systems against the destructive evils of our mother planet. Our university research scientists, here and in Russia, have made great progress in this critical area. In fact, as you probably have read, a team of UT scientists last year accurately predicted both the location and the magnitude of last week's quake in Mexico. Obviously, with such a success, we need to press forward in this vital area of research.

Perhaps our medical scientists, flush with total victory over smallpox and the eventual total elimination of polio, can accelerate their research for defense against cancer, multiple sclerosis, and other mysterious afflictions of the human organism. They will — if we help them.

The same goes for our research scientists who are concerned with developing better food and fiber to feed and clothe the growing population on a planet that grows smaller in all ways, day by day.

So you see, the role of higher education in national defense is much, much broader than that of training military leaders and improving their weapons systems. In reality, it touches into every aspect of our society. Because a whole, healthy and strong society is the best guarantee we have that our weapons systems will never have to be used.

Thank you very much.

THE MILITARY-INDUSTRIAL COMPLEX AND ITS RELATION TO DEFENSE

RALPH W. COUSINS

At the outset today I want to let you know how pleased I am to be here today, taking part in this discussion of a subject that is so vitally important to all of us, to our country, and to future generations in this country — problems of defense in a democracy today.

I think a British air marshal, Sir John Slessor, summed up the present situation in our country beautifully when he said, some years ago, in a debate in Britain that, "It is customary in democratic countries to deplore expenditures on armaments as conflicting with

the requirement for social services. There is a tendency to forget that the most important social service that a government can do for its people is to keep them alive and free."

Certainly the social problems we have today stemming from such things as slum housing in our larger cities, the problems caused by high unemployment of young people living in our urban ghettos, are far more real and easier to understand — to most people — than the threat from an unseen and distant buildup of Soviet armed forces — even though there is today very little serious argument about the reality of the immense growth of Soviet military strength.

At the same time, most of us would agree, I think, if we stop to think, that given our heritage of individual freedom and liberty, that any form of government other than a free and democratic one, would certainly be unacceptable to us.

So I believe it's unthinkable to any of us that any person, or any group of people, would knowingly, willingly, let the armed forces of this country regress into a condition where they cannot guarantee the defense, guarantee the freedom, of this country.

And yet, by default, we — you and I — could stand passively on the sideline and let it happen. How many serious, thoughtful, discussions do any of us take part in on the subject of our defense and armed forces? Very few — very, very few.

We'll read a superficial story, or article, in *Time* or *Newsweek* from time to time — usually at "budget time" and more often than not with a snide and gratuitous comment included that the brass hats in the Pentagon have trotted out the Soviet bogeyman again to scare Congress and buttress their requests for funds for their pet projects — all designed to fight the last war over again.

Most of us are far more concerned about such things as inflation, or the energy bill, or the Middle East situation, than we are about the condition of our own defenses — even though we know very well how important defense is.

So I am pleased, immensely pleased, that this group of community leaders, influential people, is talking seriously today about the problems of defense in a democracy.

The subject given me today — the Military-Industrial Complex and Its Relation to Defense — is, I suppose, one that seemed natural for me to tackle in view of my being a "former Naval person" — as Winston Churchill used to say — and in light of my job today as president of a major shipyard, and thus, presumably able to see both sides of the coin.

In the first place, I might point out that when you look at Newport News Shipyard's record of what might be called hand-to-hand combat with the Navy — in court and in every other arena — for the last few years — then you must agree that we have been doing everything we can to put to rest the spectre of a sinister military-industrial group, in the manner of the Krupp Geselchaft and the Wehrmacht, conspiring to start a war and make billions in the process.

Somehow the Pentagon and Newport News don't quite fit that picture.

Beyond that, and quite seriously, the statistics, the *facts,* simply don't support the misconception so many have that defense contractors habitually make inordinate profits.

Bill Clements did a lot of good things, in my opinion, while he served in the Pentagon as Deputy Secretary of Defense, and right up near the top of the list was a research project that he authorized called "Profit '76."

He directed that a survey be made of all the companies having sizeable defense contracts with the government — more than 200 companies. He wanted to get an idea of both the level of investment these contractors had in their plant doing defense work and the profitability of these contractors compared to their counterparts not involved in defense work.

The survey found that the five-year average of government-oriented profit centers was 4.7 percent, for profit, before taxes on sales, and this was exactly 2 percent below the Federal Trade Commission's reported average for all other major industry over the same time period.

The survey also found, and I'm not surprised, that shipbuilding was the least profitable of all defense industries, with a five-year average profit of 2.9 percent on sales. *(Before taxes!)*

Concurrently with the survey, 31 major financial institutions in the country were queried concerning their view of defense industries as an investment risk and, as you might guess, the consensus was that defense business was not sufficiently profitable for the risks involved.

Several good things happened as a result of that survey, not the least of which was that the cost of capital to a defense contractor is now recognized as an allowable cost of doing business and this is reflected in the Revised Cost Accounting Standard No. 414.

But in the light of those statistics anyone foolish enough, or patriotic enough, to be thinking about doing business with the gov-

ernment these days should think very hard about what he or she is getting into. The profits, potential profits, may very well not be worth the bureaucratic morass one finds oneself immediately bogged down in.

The Armed Services Procurement Regulations, called ASPR, and now grown to three volumes, becomes the guidebook for all you do.

You immediately become host to a group of resident auditors from the Defense Contracts Audit Agency — 26 of them permanent houseguests in the case of the shipyard.

Beyond that, in our case, we have a resident group from the Navy, uniformed and civilian, known as the Supervisor of Shipbuilding Office, helping us to build the ship, inspecting the ship at every step in its construction, playing a role which, by its own charter, is called "aggressive involvement."

Perhaps I make it all sound worse than it is — though I wonder if that's really possible.

After all, we do sign those contracts with the government of our own free will — no one twists our arms.

And I can say that as a result of our "skirmishing" with the Navy, the more recent contracts we have signed with the Navy have far more equitable terms and conditions than earlier contracts did — and we have far better coverage now for things over which we have no control, so that our exposure, our risk, is more in line with the modest profits we know we are likely to earn.

Some features of our government contracts are very good. We receive "progress payments" *each week,* based on the percentage of completion we achieve over the prior week, so that cash flow can be far better than it is in some other businesses.

We are paid for material as we purchase it so that we don't have a lot of capital tied up in inventory.

If the whole bureaucratic system of government contracting can be streamlined, and there are those in government trying to do that, and if there were men of goodwill administering the system, and that isn't completely the case today, then industry may continue to involve itself in government contracts.

I hope so, for as Bill Clements said, the defense contractors which make up our industrial base are absolutely vital to our national security.

But unless government finds a better way to deal with the defense industry, then any good businessman, with any choices, is going to say, as Sam Goldwyn used to, "Include me out," and look for some-

place else to invest his capital — someplace where he has a reasonable chance to get a decent return on equity.

Putting aside for the moment the subject of the military-industrial complex, or the subject of the military's business relationship with industry, there are one or two other points that I want to discuss because I think they are central to the subject we are talking about this afternoon.

You have heard me say how terribly important it is, in a democracy like ours, for men and women like you to have an informed, up-to-date understanding of the major issues relating to the size and shape of our armed forces and our defense establishment.

Not to be informed about these things is, it seems to me, to default to others, a relatively few others, who may make decisions that are best made by more rather than fewer people.

And keeping informed about the important elements involved in the national defense is, I'm sure, increasingly difficult.

The Strategic Arms Limitations Talks between our country and the Soviets are a case in point. Nothing more important, nothing understood less, I'm certain. And here's a case where the Administration, for its own reasons, has done little or nothing to help us understand all the complex tradeoffs involved. We are merely assured from time to time that "progress is being made" — that "we're getting close to signing a treaty."

Still, all of us here could, if we would take the trouble, learn enough about SALT to have an informed opinion about it. And we should.

There is certain to be a very sharp debate on the subject when the treaty goes to the Senate for ratification. And you can be sure the Administration will have a full court press on trying to muster support for the agreement. It seems to me everyone here should be able to have an opinion on the matter and be ready to speak to his or her Senator about it, supporting it or opposing it, but not ignoring it.

Take the issue of whether or not our Navy should build more nuclear-powered aircraft carriers. It's a burning issue in the Pentagon and to only a slightly lesser degree in Congress.

You may recall that Congress, by a narrow margin, authorized a nuclear carrier last fall, only to have President Carter veto the whole bill in order to kill the nuclear-powered aircraft carrier.

He evidently doesn't seek Henry Kissinger's advice on these things since Kissinger said in an address last March that "in the crises in which I was involved, the use of naval power — particularly carrier

power — turned out to be almost invariably the crucial element. I cannot imagine reducing the number of our carriers. If anything, I think we should increase it."

I'm not here today to argue for the nuclear aircraft carrier — only to say that it's an important defense issue and that more people should have something more than a vague intuitive feeling that while a huge nuclear carrier may be useful it may also be "too vulnerable," or perhaps "too expensive."

More vulnerable than what? More expensive than what? Compared to what? And more importantly, "what is the threat" to our country and "what do we need to defend against that threat?"

Those are the time-tested questions a military man asks at the outset in any deliberation on what military characteristics, or specifications, a weapon system would have. "What is the threat?" and "What must we have to counter it?"

And lacking the patience, or desire, to start from those basic questions and think through what weapon system we should have, the easy course of action is to opt for something that is at least inexpensive — as if that should be the primary criteria of equipment involved in something so serious, so important, as our national defense.

Recently one of the military services, anxious to get good marks from the office of the Secretary of Defense I presume, proudly announced that a major new weapon system would be "designed to cost!" Never mind whether it would be useful or not, it would be designed to cost "X" dollars and therefore you could buy "Y" of them with a budget of "Z" dollars. Very neat — and totally unrelated to any rational approach to national defense.

In previous forums like this, I've talked about people who want a strong national defense but are loathe to pay for it, and that's what I call "a near-terminal case of wanting it both ways."

An easy solution to the problem of aircraft carriers being expensive — and this solution is one that is in vogue in several circles in Washington — is to build a number of small, less expensive, carriers. And that solution comes with the built-in added attraction, revealed like a blinding flash of truth hitherto unknown, that two or three smaller ships can be in more places at the same time than one large one.

That's all very fine, of course, if the mission of the carrier is no more than to "show the flag" — gunboat diplomacy revisited if you will — or useful perhaps in foreign ports to have tea-dances on the quarterdeck under an awning — provided the natives are friendly.

Never mind if these smaller ships' usefulness is absolutely nil in a rough sea in the North Atlantic in winter in the face of the kind of opposition the Soviets can put to sea today.

The small ship — the something-for-nothing syndrome — is compounded these days by the mirage on the horizon — and it's been there for the last thirty years — of a V/STOL type aircraft, one that can take off and land vertically, making everything that floats, every small ship, a do-it-yourself aircraft carrier.

Never mind that there isn't anything — and I repeat, anything — a conventional aircraft can't do better than a V/STOL aircraft — except possibly land on the White House lawn.

Somehow the idea of small carriers and V/STOL aircraft has caught the fancy of all the "instant experts" in Washington who haven't spent any time at sea in carriers.

I make too much of these points, perhaps, but I dwell on them because I think they are representative of simplistic, and fatally flawed, solutions to the difficult problems of planning for defense in an increasingly complex and expensive world. And the single most fatal step in this disastrous process is wishing away the threat when you find it is expensive to counter.

I'm certain that it's increasingly difficult for people to choose wisely which weapon systems are selected for development and which of those under development should be carried all the way through development and into production.

It's difficult enough for the people in uniform and for the civilians in the Secretary of Defense's office working closely with the military, and it's even more difficult for our representatives in Congress to know which things to authorize and fund, and terribly difficult for you and me to decide whether they have chosen wisely. But I think it's important for us to try — there's a lot at stake.

And I think the average Congressman, or Senator, would be reassured if a larger segment of his constituency were to show an interest in and take a position on the difficult defense decisions he has to vote on.

And I don't see how it can do anything but help for all of you to ask your Congressman or Senator how he voted on defense issues and why he voted the way he did.

And the more discussions there are like this one today, and the more you and your friends and business associates talk about the issues involved in national defense, the more likely it is the right decisions will be made in Washington.

Address

DEFENSE SPENDING

CHARLES W. DUNCAN, JR.

President Vandiver, distinguished guests, ladies and gentlemen:

It is a great personal pleasure for me, as a Texan, to be back home tonight in Texas and in Houston. And it is an honor to address this distinguished group of citizens, and to be a new member as well.

I am particularly glad that this year you have devoted this annual meeting to the subject of our national defense. It is a significant topic, one that is increasingly topical. I have been very impressed with each of the presentations. It is a fact, and it has been amply evident at this meeting, that people of good intention have widely varying judgments on defense issues — SALT, defense spending levels, the threat resulting from the Soviet military buildup, the net military balance, and others.

But whatever one's judgment may be, defense is occupying the attention of the American public to an increasing extent. This is good. The SALT negotiation has not yet been concluded yet it is already being intensely debated. There is considerable evidence that public attitudes toward defense spending are changing. For the first time since meaningful soundings were first taken ten years ago, the polls show that more citizens favor increasing rather than decreasing the defense budget. Thirty-six percent, according to a recent Harris Poll, want more defense, 18 percent less. Bill Clements said 88 percent in Texas want more. Nevertheless, it is clear from the public debate on the issue that it is still a subject of controversy, and resistance to defense spending is active within many groups and constituencies. This is the subject I thought I'd talk about tonight. It's the subject that I've been most actively involved in for the past few weeks, and will be through January.

I could have talked about many others mentioned last night or today — the AVF, the present and its future, various aspects of a possible SALT II Agreement, the resource allocation process with Department of Defense — the trade-off between aircraft carrier task forces and Army modernization. In thinking about my subject, I was reminded of the story of the traveling preacher in the West who arrived in a small church to find only one cowboy in the congregation. He suggested foregoing the sermon, but the cowboy said, "Preacher, if I was out on my wagon loaded with hay, on a cold

snowy winter day, and found only one starving cow, I wouldn't let the critter starve." The preacher went ahead with the sermon which lasted a full three hours, then asked the cowboy how he liked it. The cowboy said, "Preacher, if I was out on my wagon loaded with hay on a cold snowy winter day, and found only one cow, I wouldn't let the critter starve, but I wouldn't throw the whole load on her either." So I'll confine myself to defense spending.

Although many people do not seem to realize it, the trend for many years in this country was to decrease defense spending, though there was an upward bulge attributable to Southeast Asia. In the early 1960s defense was about 10 percent of our Gross National Product. Today it is about 5 percent. In the 1960s it represented nearly half the federal budget. In recent years it has been about a quarter of the budget.

Defense spending today is about the same in real dollars as in the early 1960s. Even after moving up in the last year of the Ford Administration, and the first two years of the Carter Administration. *Inflation* and our *national security posture* concern most Americans. Both are related to defense spending.

A key to the fight against inflation is to control federal spending, to reduce the deficit. We are in the midst of the 1980 budget cycle. The President has stated publicly his goal of reducing the federal deficit to $30 billion. To accomplish this means that some departments will have less budget growth, or have a flat budget, or even a negative growth.

Social programs will suffer. Let me tell you, the press reports are accurate. The fight is tough. The special interest groups are active; they are exerting tremendous political pressure.

I support the President's efforts to control federal spending, to reduce the deficit, and to reduce the level of government intrusion into our personal lives.

The President will have to make so many hard decisions that won't be universally popular. This is today's Washington environment. It is in this environment that we in the Department of Defense seek a budget increase in real terms, for fiscal year 1980. I would like to discuss the reasons we think it is necessary to take this position.

National defense is a vital part of our overall national security position, which depends on much more than military strength. National security has many component strengths: such as economic, technological, national cohesion and will, the soundness of our foreign policy, the dependability of our allies, and others.

We lead the Soviets in all of these strengths except military strength, where we are roughly comparable. The one output of their society where they do well is to improve their military strength. They must see military strength as a political tool to help them achieve foreign policy objectives, to engage in political coercion. This has obvious impacts in the Middle East, Africa, and elsewhere.

We live in a world of increasing interdependence. We could not escape that fact if we wanted to. Our political and economic relationships with other nations are terribly important. We are the leader of the Free World, another fact we cannot escape. We must exercise that leadership wisely, and with concern for the needs of our allies as well as ourselves.

There is a direct relationship between defense spending and three issues I want to call to your attention tonight.

The first is the steady continuing military buildup on the part of the Soviets over the past 15 years.

The second is the state of our own military capability today.

And finally, I want to say something about what those two trends mean for the future.

We cannot define Soviet intentions with high confidence. Nevertheless, there can be no doubt that Soviet military power today is much greater than it was in the 1960s. There has been a steady increase in Soviet military spending during each of the past 15 years. The annual rate of increase has averaged between four and five percent in real terms. Their present spending total has exceeded ours since 1970, and now substantially exceeds our own. By how much is not certain: it could be by as much as 40 percent. It certainly exceeds ours by at least 25 percent.

I think it's important to emphasize that the Soviet rate of increased spending has *not* been affected by U.S. spending levels. Nowhere is there any evidence that they will reduce their forces if we make unilateral reductions.

As a result of these steadily rising outlays, Soviet armed forces have improved substantially. The Soviet defense establishment has expanded by about a million men. More than 1,000 ICBM launchers and more than 900 modern submarine-launched ballistic missile tubes have been added to Soviet strategic nuclear forces. Soviet medium-range attack forces now have the mobile, MIRVed SS-20 intermediate-range ballistic missile and the backfire bomber. Soviet conventional forces — land, naval and air — have all grown substantially in size. In quality of equipment, they have narrowed and in some cases closed the gap with the West.

In short, the Soviets have made undeviating and enormous military strides during the past 15 years. We cannot ignore them.

At the same time, we should not exaggerate where the Soviets stand in relation to the United States and its allies as of today. The Soviets have not achieved overwhelming military power. They have had to develop their defense capabilities out of an economy that is much less efficient than ours. We don't believe their expenditures are always efficient, or properly directed. In fact, we think they have made some major mistakes in resource allocation. Their allies are less reliable and less capable — though better integrated — than ours. We have read about Romania this week. Also the Soviets find it necessary to station as much as 25 percent of their ground and tactical airpower facing the People's Republic of China. This fact contributes to some already difficult geographic problems.

What about our own capabilities? In the strategic nuclear balance, the situation today is one of essential equivalence. The United States is ahead in some areas: deliverable warheads, heavy bomber payload, submarine quality, and generally (but decreasingly) in missile accuracy. The Soviets lead in some others: missile throw-weight, missile numbers (both ICBMs and SLBMs) and total number of delivery vehicles. Neither the Soviet Union nor the United States, as I said, has a clear military advantage; our forces are essentially equivalent. Neither is in a position today to exploit its strategic weapons without encountering unacceptable risks. Each can inflict catastrophic retaliation on the other today.

In the tactical nuclear area, the Soviets hold an advantage in medium-range bombers (such as the Backfire) and in intermediate-range ballistic missiles; we have an advantage in battlefield systems, nuclear artillery, short-range missiles, and tactical aircraft.

With the Soviets and ourselves in general nuclear balance, conventional forces take on added importance. Geographically, Europe is the most important area for us and, within Europe, the central front is the key. It is where the greatest concentration of assets — both human and material — lie adjacent to each other on opposite sides of the border between East and West. This importance is reflected in the commitment we undertook in 1977, and reiterated this year, in company with all other NATO allies, to increase real defense spending annually for several years with a goal of three percent per year.

In addition to increased spending, we are working on a set of long- and short-term initiatives, to correct problems of command and control, equipment interoperability, and inefficiencies through

duplicated research and development efforts and small production bases. Budgets representing 90 percent of the NATO total budget have committed to real growth with a goal of 3 percent. This is real progress.

As I see it, the Soviets cannot have, in the conventional area, a high confidence of succeeding in a blitzkrieg attack; on the other hand, NATO cannot have a high confidence in stopping such an attack at the outset. To have high confidence, NATO needs to increase its own readiness, and we need to be able to reinforce far more rapidly than in the past. Let me add that emphasis on the Central European front implies no neglect of the Alliance's northern and southern flanks, which are also of vital importance and in some ways harder to defend.

We are, of course, concerned with more than Europe. In the Far East, although the Soviet Union has committed itself to a major upgrading of its forces, the developing U.S. and Japanese relationships with Mainland China have prevented the Soviets from translating military power into political influence. Our principal allies in East Asia — Japan and the Republic of Korea — endorse and support our role in the region. In Korea, we will maintain our security commitment, proceed carefully and flexibly with ground force withdrawals, and maintain the balance on the Korean Peninsula. With the exception of the 2nd Infantry Division in Korea, our forces in the Pacific will not be reduced. They will be improved qualitatively.

What about forces in other areas of the world, such as the Persian Gulf? These requirements cannot be ignored. Deploying and sustaining substantial forces in that relatively remote and underdeveloped area — should that ever become necessary — would be difficult. This stresses the importance of mobility.

The Soviets pose a real threat to our sea lines of communication through both land-based air and submarines, but we should be able to win a conflict for sea control both in the Atlantic and the Pacific. In particular, our anti-submarine warfare capability and our counter-anti-submarine warfare capability both exceed those of the Soviets substantially.

That is a quick summary of today's net military assessment between East and West. In considering net assessments it's important to remember that it's much more than a static set of numerical comparisons. It's a dynamic mix of judgments involving forces arrayed against forces — tanks versus anti-tank weapons, aircraft versus air defenses — the relative quality of manpower, training,

leadership, tactics, doctrine. Our view is that we have rough equivalence. The troubling aspects are the trends in both the strategic and tactical nuclear area, and the need to respond along with our allies in the area of conventional forces to the continued and relentless Soviet military buildup. We definitely cannot sit on our hands, and we do not intend to.

For these reasons, the Administration has emphasized that we need to increase our defense effort in real terms.

We are not interested in some hypothetical world championship. What we seek to maintain at all times is — first — strategic capability of sufficient power so that we can retaliate effectively after a nuclear attack on the United States or its allies. We also have the objective, in conjunction with our allies, to defend simultaneously against one major and one minor non-nuclear attack.

That is our national strategy, and the basis on which we plan our forces. This is what it's been for a number of years. If we can continue to execute that strategy, then we've done our job well. If we can't, it is my view that we have serious problems.

Where we stand today in implementing national strategy is, to an important extent, a function of decisions made by our predecessors, just as our decisions now will greatly affect our posture five to ten years from now. Bill Clements mentioned last evening that it takes ten years to develop and deploy a new weapon system. I mention this because in assessing our current capabilities, we are not really passing judgment on our decisions. Instead, we have the fleeting luxury of grading someone else's handiwork. Before long, it is our own that will be graded in turn. This brings me to my final point. Soviet military expenditures cannot continue to rise — and U.S. defense outlays cannot flatten or decline — without a dangerous tilt in the balance of power and a weakening of the U.S. deterrent. The United States may be more efficient and ingenious than the Soviet Union and I think we are. But a large and continuing disparity between the two defense efforts is bound to have damaging effects in the future.

We have got to think about certain programs now:

— We have to consider the question of survivability of the Minuteman force — with or without a Strategic Arms Limitation Agreement. A survivable land-based missile is essential to our strategic deterrent.

— As Soviet ground and tactical air forces are further modernized and become more proficient, NATO will have to do the same.

We do not want to have to resort to nuclear options.

— We must modernize our theater nuclear forces.

Obviously, maintaining our defense posture will not become any cheaper. We will still have the investment and operating expenses required by the current force structure. We will undoubtedly have new programs to fund as well. Replacement of the Minuteman force, although it has excited the most attention in public, is only one (and not necessarily the most expensive) of the possibilities ahead of us.

Clearly, we are going to have to give greater attention to materiel and personnel readiness in our general purpose forces. We are already taking steps to pre-position more equipment and stocks in Europe, so as to reduce the deployment times of our reinforcements. But we must also improve our long-range airlift, our sealift, and otherwise increase our worldwide mobility.

More generally, we have to recognize that we no longer can rely on large amounts of time to fill out, train, and otherwise make combat-ready the active duty forces of the United States. Strategic mobility and combat readiness are now essential.

Most important of all, we understand very well that the defense establishment cannot function effectively without the loyalty and dedication of our military personnel. These qualities have always been needed. They will be needed even more as we move toward more highly technical weapons systems and higher states of readiness. While defense will become more automated, it will never be run by robots. We depend on people.

We, in defense management, necessarily have a number of very important concerns. But we know that the welfare of our military personnel must be our first consideration. It's important that the American people be reminded, by all of us, that our military personnel are a national asset. If we do our job well, and they do the same, the proficiencies for which they train so diligently will never be called upon. That's deterrence.

In summary, we can execute our national strategy today, but the trends are not satisfactory. Come what may, we must not be, and must not be perceived to be, second to any nation in military strength. We must be first, when and where it counts. That is our goal. I hope that it's your goal, too, and that we will have your support.

Thank you.

N E C R O L O G Y

VIRGINIA LEDDY GAMBRELL
1910 - 1978

Editor's Note: *On April 3, 1978, Virginia Leddy Gambrell (August 7, 1910-March 14, 1978) was buried in the Texas State Cemetery in Austin. Herbert Gambrell requested that Dorman Winfrey, who succeeded Virginia as secretary of the Society, deliver remarks at the graveside ceremony. At the request of Herbert and several Philosophical Society members who attended the services, the following is printed.*

YESTERDAY MORNING I CAME ACROSS THE FOLLOWING IN OUR hymnal at University Christian Church. I was reminded immediately of Virginia Leddy Gambrell and I want to share what I read with you this afternoon:

> When our use of this world is over and we make room for others, may we not leave anything ravished by our greed or spoiled by our ignorance, but may we pass on our common heritage fairer and sweeter through our use of it, undiminished in fertility and joy, that so our bodies may return in peace to the great mother earth who nourished them and our spirits may round the circle of a perfect life...

Here in the Texas State Cemetery, a good many of the markers commemorate the military deeds of Texans. I have considerable difficulty imagining Virginia Gambrell in a uniform, but the battles that she fought in the cause of Texas were no less important than those fought by these soldiers.

During the 1930's Virginia Gambrell was one of the brigade of young Texans who changed the popular view of Texas history from the sometimes garrulous recollections of those who had taken part in events to a dynamic and open area of inquiry and consideration. For a good many years the Gambrells' names were synonymous with quality Texas history, with the Philosophical Society of Texas, and various other endeavors that gave Texans a new view of their state and of being Texans. The Dallas Historical Society and the Hall of State became splendid examples that others could follow.

Virginia performed all her work on a highly professional level and in the 1940's when a new organization named American Association for State and Local History was organized, she was one of the early vice-presidents. This organization held its national meeting in Austin a few years ago, and it was personally gratifying to me and others to realize how much that Association owes to the friend we honor here this afternoon.

Virginia Gambrell was part of a long tradition of Southern and Western women who have possessed not only beauty and charm but also backbones of steel. The combination has long been a formidable one.

One day last year the Gambrells dispatched some boxes of materials that dated to the years that she was a member, secretary, and chairman of the Texas Library and Historical Commission during and after World War II. And I was reminded quite forcibly once again how much she had to do with transforming the State Library from a weak and chronically underfunded agency to the rank it holds today. One set of minutes reports considerable discussion concerning an activity that the Commission could not decide whether to approve or not to approve. Finally, she ended discussion by saying to the five men on the board (two were lawyers) that there was a law on the matter and that the Commission would have to make its decision on the basis of the law. Again and again, Commission minutes record that after discussion rambled on it was she who put forth a motion for official action. At times, the motion was based on a specific piece of legislation. At other times, she cited fiscal realities. On still other occasions, she cited good library or historical practice.

Standing here today, I've been speaking of the impact that Virginia Gambrell had upon the people who perhaps knew her only slightly. Individually and together she and Herbert have made the lives of their friends richer. Her work touched so many persons — the youth who visited the Hall of State, the improved archival and library standards she supported, the thousands who read her books, and the vast population of this State who use State Library services; the blind and physically handicapped, scholars, genealogists, historians, and the citizens on the farms and in the cities who use the State Library network to secure a wanted book. Her good work for so many years has made library service today better for all our people. And the State of Texas is paying honor now to this Faithful Public Servant with burial here in this sacred State Cemetery.

Let us pray.

> Almighty God, we know that Thou art a generous Father and we thank Thee for the great gift of the life of Virginia Gambrell, a life of beauty, kindness, service, one who promoted warm friendships and fellowships. We thank Thee for all the ties that bind her to us and to the people throughout this entire State.
>
> And Almighty God, Whose love is everlasting, and Who can turn the shadow of death into daybreak: help us to

receive Thy word with believing hearts, that, through the comfort of Thy Word, we may have hope and be lifted above our darkness into the light and peace of Thy presence; through Jesus Christ. Amen.

For a detailed account of Virginia Gambrell's years of dedicated service to Texas and the Philosophical Society, members can refer to the fine article on, "The Gambrells" by Willis Tate and Lon Tinkle in the PROCEEDINGS of the Philosophical Society of Texas, Vol. XXXIX, 1976, pps. 47-52.

MRS. PERCY JONES
1892 - 1978

MRS. PERCY JONES, A VICE-PRESIDENT OF THE PHILOSOPHICAL SOCIETY OF TEXAS, died at her Abilene home October 14, 1978.

A happy, vibrant woman who brought pleasure to those around her, Mrs. Jones was described by her hometown newspaper as "Abilene's most generous — and quietest — philanthropist." The paper continued: "She was marked with perceptive insight, intelligent understanding and innate goodness, a woman in whom providence blended the propensity and the capacity to help those who are in need."

Seemingly in good health, Mrs. Jones had played bridge the night before, bidding and making a grand slam. Death from a heart attack came suddenly as she was dressing to go out for dinner with a friend, Dr. Rupert N. Richardson, a former president of The Philosophical Society.

Funeral for Mrs. Jones was at the Episcopal Church of the Heavenly Rest in Abilene, with private burial services at Abilene.

A native of Abilene, Mrs. Jones was the former Ruth Legett, daughter of Lora Bryan and K. K. Legett, pioneer West Texans. She was educated in public schools in Abilene, attended Randolph-Macon Women's College in Virginia and received her bachelor's degree from Simmons College, now Hardin-Simmons University, in 1913. McMurry College conferred on her in 1978 the honorary degree of Doctor of Humanities.

She was married to a young Welsh civil engineer, Percy Jones, on December 25, 1915. The couple had three children, a son, Dodge, and two daughters, Judy, now Mrs. John Matthews of Abilene, and Edith, now Mrs. Peter O'Donnell of Dallas.

Her interest in the walfare of others was shown by Mrs. Jones early in her life. As a 20-year-old, she undertook to finance and direct a home economics class for Abilene Negroes. She continued this interest throughout her life. It was long an open secret that any black youngster in Abilene could look to her for financial help in his quest for advanced education.

After her son's early death, a foundation bearing his name, the Dodge Jones Foundation, was established in his memory. Through the foundation, Mrs. Jones and her family built a career of active service and financial dedication to the improvement of life. Her benefactions were many — gifts to the West Texas Rehabilitation Center, gifts to libraries, gifts to the Hendrick Medical Center, including a magnificent new Retirement Center. Most of her giving was done anonymously.

The foundation originated and supports "The Bridge," a unique self-help program whereby those in need can find a "bridge" to a better life through education. The foundation gave Abilene land for a new park, built a swimming pool located in a black area of town, and enclosed a pool for a state institution, Abilene State School.

Her interests were not restricted to Abilene: they extended across the Southwest and included varied activities, from blood banks to brush control.

She was a member of the Board of Visitors which assists in financing work of the M. D. Anderson Hospital and Tumor Institute in Houston. She participated in charitable work at Dallas, where she long maintained a second home. And she was involved in an enlightened ecological program, the care of West Texas land through research by the Renner Research Center and mesquite control projects undertaken at Texas Tech University.

Mrs. Jones held membership in many literary and historical groups, including a life membership in the Texas State Historical Association.

Surviving Mrs. Jones are a sister, Mrs. Julia Pickard, her two daughters, seven grandchildren and three great-grandchildren.

Mrs. Jones bequeathed her property to the Dodge Jones Foundation and to the O'Donnell Foundation of Dallas so that their charitable work could continue.

—K.D.

LUCIUS MIRABEAU LAMAR III
1898 - 1978

LUCIUS MIRABEAU LAMAR III, SON OF LUCIUS MIRABEAU, AN engineer, and Georgia Hopson Lamar, died in New Orleans Louisiana, on October 4, 1978, and was buried in Mission Burial Park in San Antonio in the Lamar Plot, alongside his mother and father. Lamar was born on August 21, 1898, in Mexico City. He was a descendant of the Supreme Court Justice L. Q. C. Lamar, brother of Mirabeau B. Lamar, founder of the Philosophical Society of Texas.

The young Lamar spent his youth in Mexico, Eagle Pass and San Antonio. During World War I, at the age of 19, Lamar enlisted in the United States Army. He was awarded the Bachelor of Arts degree with honors from Rice in 1920 and his law degree from the University of Texas. The Texas Bar Association awarded Lamar a certificate of merit for more than fifty years service.

On December 28, 1926, Lamar married Marta Elizabeth Barnes, a native Texan, in New York City. The couple lived in San Antonio for a time and later moved to Dallas where their two children were born.

Lamar in 1929 began his long service with Standard Oil of California. He retired as vice-president and general counsel in 1963. He made New Orleans his place of residence for 36 years.

When plans were being formulated in Dallas to reorganize the Philosophical Society, Lamar was one of the incorporators who completed the task on December 5, 1936.

Lamar was an avid reader and wrote poetry as did Mirabeau B. Lamar. He had literary ability and wrote an account of his family background and early life in *Shards,* published in 1968.

At the time of his death Lamar was survived by his devoted wife Marta, son Dr. Lucius Mirabeau Lamar IV, and daughter Mrs. Barbara Lamar Zimmerman.

—H.P.G.

CHAUNCEY DEPEW LEAKE
1896 - 1978

DR. CHAUNCEY LEAKE, A LONG-TIME MEMBER OF THE TEXAS PHILOSOPHICAL SOCIETY, died on January 11, 1978, in San Francisco at the age of 81. He had attended the last meeting of our

organization in Galveston the previous month and filled in the second day of the program for Polykarp Kusch, who was unable to come. Many will recall his delightful talk on the satisfactions of living at various stages from infancy to old age. The night before his death he was honored at his beloved Bohemian Club, where he presented a number of his poems, composed over the years.

Dr. Leake had a full, interesting and exciting life with many close friends and associates. In a short resumé of his career, published in the *Annual Review of Pharmacology and Toxicology* in 1976 and entitled, "How I Am" he outlined his academic career, which began as a student at Princeton, majoring in chemistry, biology and philosophy. During his senior year in 1917 he was given leave to join the armed services and was soon assigned to the Chemical Warfare Service, which had its investigative laboratories in physiology and pharmacology at the University of Wisconsin. After World War I he remained at Madison for graduate work, switching from the study of toxic gases to anesthetic agents and blood regulation in anemias. He began to publish in the scientific journals early in his career, even before receiving his Ph.D. degree, and, in the mid '20's, he became involved in medical history and ethics. Perhaps one of his most important historical publications during this time was a translation of William Harvey's 1628 *De Motu Cordis,* which went through five editions up until 1970.

From physiology Dr. Leake switched primarily to pharmacology, and he helped in the establishment of the first residency training program in anesthesia in this country at the University of Wisconsin before transferring, in 1928, to the Medical School of the University of California in San Francisco. From his laboratories came many distinguished professors of pharmacology who began their work under Dr. Leake as graduate students, stimulated not only by experimentation and teaching but by many informal, scientific and vigorous (to use Chauncey's term) philosophical discussions in the California redwoods area, where a picnic and lecture area was set up, complete with a blackboard on a large tree. During World War II attention again turned to War Gases, with particular emphasis upon a protection of civilians following potential exposure.

In 1942 Dr. Leake and his family came to the University of Texas Medical Branch in Galveston as head of Pharmacology and Executive Director. He continued to write and to teach, and he also became associated with the Institute for Advanced Study at Princeton, where he prepared a translation of the Hearst Medical Papyrus, and Egyptian drug formulary dating from approximately 1550 B.C. Dur-

ing his 13 years in Galveston he was responsible for growth of the student body and faculty, physical expansion of the campus, a tremendous development of library facilities, support of laboratory and clinical research and encouragement of school and civic cultural projects, including the history of medicine. In all of these efforts his wife, Elizabeth, a former laboratory colleague, participated; and the Leakes continued in Galveston their former life style in San Francisco, sharing their social life with students and faculty and bringing to the campus a host of nationally and internationally famed scientists. Incidentally, during his tenure in Galveston he helped to organize the M. D. Anderson Tumor Clinic and Hospital in Houston.

After leaving the Medical Branch in 1955, the Leakes went for several years to Ohio State University in Columbus and then returned to the University of California in San Francisco, where he was given the responsibility of coordinating research and training for medical students and where he continued to lecture on medical history and philosophy. He returned to Galveston on a number of occasions for seminars sponsored by the Chauncey Leake Society and maintained close friendships with many of the faculty and townspeople.

He was a world traveller and lecturer and was honored by many organizations, including the American Association for the Advancement of Science, of which he was elected president in 1961.

Following Dr. Leake's death, memorial services were held at the University of California Medical Center and at the University of Texas Medical Branch where many of his colleagues spoke, and where a memorial fund has been established in the Institute of Medical Humanities in the names of Elizabeth and Chauncey Leake. Mrs. Leake died in May, 1977, and the fund was actually initiated by Dr. Leake at the time of the December Philosophical Society meeting as a tribute to his wife.

The Leakes are survived by two sons, Dr. Wilson Leake of Seattle, and Chauncey Leake, Jr., of New York City.

—T.G.B.

MERTON MELROSE MINTER
1903 - 1977

MERTON MELROSE MINTER WAS BORN IN JEWETT, TEXAS, January 3, 1903, and died after a brief illness in San Antonio, Texas, September 5, 1977. He was the son of Percival A. and Louella (Owens) Minter. He attended Corsicana High School, received his B.A. degree from the University of Texas at Austin in 1925, and

his M.D. degree from the University of Texas Medical Branch in 1928. During medical school, he was a member of Phi Chi medical fraternity and Alpha Omega Alpha national honorary medical fraternity. After an internship at the Research Hospital in Kansas City, Missouri, and a Preceptorship in Internal Medicine under Dr. Lee Rice, he entered practice in San Antonio in 1935, at the Minter Clinic. He continued post-graduate studies, at intervals, for many years at Cook County Hospital in Chicago, Harvard, the Mayo Clinic, and other prestigious places. He became a diplomate of the American Board of Internal Medicine in 1940, and a Fellow of the American College of Physicians in 1943. Throughout his long practice of medicine, he set high standards, and achieved them by hard work, continuous attention to the medical literature, and constant interaction with other good physicians. He was a gentle and sensitive physician and citizen, and his patients loved and admired him. Because of his outstanding character and personality, he was a leader at every level of his professional career — President of the staff at Santa Rosa Hospital (1941-1952), Chairman of the Board of Trustees of the Texas Medical Association (1950-53), President of the International Medical Assembly (1953), President of the Bexar County Medical Society (1954), President of the Texas Diabetes Association (1958), and President of the Texas Academy of Internal Medicine (1959). He was a consultant to the Air Force, the Veterans Administration, airlines, and railroads.

Dr. Minter was a most active person in the affairs of his community, being a member of such clubs as San Antonio Country Club, St. Anthony Club, and the Argyle Club. He actively supported such community affairs as the Fiesta, and was a member of the Fiesta Commission and the Texas Cavaliers. He supported the arts, the educational system, and scientific research in his adopted city, serving on the Board of Trustees of the Southwest Foundation for Research and Education since 1953 and as its Chairman from 1954 to 1956.

Dr. Minter maintained a life-long association with the University of Texas. After graduation, he became a life member of the Ex-Students Association, a life member of the Texas Dads' Association, and the Medical Branch Alumni Association (of which he was a past-president). He was appointed to the Board of Regents of the University of Texas System by Governor Allan Shivers in 1955 for a six-year term, and was Chairman of the Board from 1959 to 1961. He was a friend of the late Erle Stanley Gardner, creator of the famous Perry Mason detective stories, and persuaded him to present

his complete collection to the University. He received a Distinguished Alumnus Award from the University in 1970.

Although Dr. Minter participated in, and contributed to, many important developments within the University of Texas System during his tenure on the Board of Regents, the most significant for San Antonio was gaining authorization for the Medical School there in 1959. He became a member of the Board of Trustees of the San Antonio Medical Foundation in 1956, and it was partly through the planning and hard work of that organization that the Medical School was located in San Antonio. He remained a member of the Board of the Foundation until his death, and was its Chairman from 1971 on.

Dr. Minter was a devoted family man and always retained time for his wife, the former Katherine Huntress, whom he married in 1931, and for his two sons, Merton Melrose Minter, Jr., and Alan Huntress Minter. He and Katherine had four grandchildren.

It can be said of Dr. Minter that he was a good man, in every sense of the word. He was honest, industrious, reliable, a devout person, and considerate in his dealings with others. He was also an intellectual in every sense of the word, constantly learning new things and demonstrating his insight and curiosity about professional matters and non-professional alike. He understood his fellowman and his needs, and dealt with them in a compassionate manner. He was a worthy member of the Philosophical Society, and we will miss him.

—F.H.

DOSSIE MARION WIGGINS
1895 - 1978

DOSSIE MARION WIGGINS, SON OF ROBERT BRUCE AND RUTH A. (JORDAN) WIGGINS, was born in Crowley, Louisiana, on December 9, 1895. He moved with his parents at an early age to Canadian, Texas, where he received his elementary and secondary education. He attended Goodnight Junior College, transferring to Hardin-Simmons University in Abilene, where he received his bachelor's degree in 1919. Afterward he moved to Burkburnett, where he served as principal and coach at the high school.

Wiggins married Winnie Kinard of Memphis in 1918. She died December 26, 1975.

He served in the army during World War I and following the war served as principal and coach at Vernon for a year. He then returned

to Canadian, where he was principal and coach for two years before becoming superintendent.

Between 1925 and 1930, Wiggins received his master's degree at Yale University, took graduate work at the University of Chicago, and returned to Yale for his Ph.D. Associated with Hardin-Simmons University after 1926, he returned to Abilene in 1930, remaining there until 1935 as professor of education and dean of students. In 1935 he became president of the Texas College of Mines, now the University of Texas at El Paso, a post that he held until he became president of Texas Tech University in 1948.

While Wiggins was president of Texas Tech, the institution launched a building program made possible by a switch of the State's ad valorem tax from Confederate widows' pensions to college building and initiated the doctoral program. Also begun was a campus beautification program. Although he left the field of higher education when he resigned as president of Texas Tech in 1952, he did not lose his interest in it. From 1965 to 1969 he served as a member of the Coordinating Board, Texas College and University System, and was a member of the Board of Directors of the Texas Tech University Foundation and a trustee of Hardin-Simmons University.

In 1943 Hardin-Simmons University awarded him the LL.D. and in 1952 Texas Tech did so.

Wiggins resigned his position as president of Tech in 1952 to become associated with Citizens National Bank (now Texas Commerce Bank). He served as president from 1960 to 1961, and became chairman of the Executive Committee in 1962. He remained a member of the board until his death.

He married Louise Resley of El Paso in March, 1977.

Wiggins was a member of the Medical Research Foundation Board of Texas, former director of West Texas Chamber of Commerce, and former president of the Lubbock Chamber of Commerce.

He also was a Baptist and a member of Phi Delta Kappa, Kappa Delta Pi, Phi Delta Theta, Lubbock Country Club and Lubbock Club.

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PAST PRESIDENTS

* Mirabeau Buonaparte Lamar	1837-59
* Ira Kendrick Stephens	1936
* Charles Shirley Potts	1937
* Edgar Odell Lovett	1938
* George Bannerman Dealey	1939
* George Waverley Briggs	1940
* William James Battle	1941
* George Alfred Hill, Jr.	1942
* Edward Henry Cary	1943
* Edward Randall	1944
* Umphrey Lee	1944
* Eugene Perry Locke	1945
* Louis Herman Hubbard	1946
* Pat Ireland Nixon	1947
* Ima Hogg	1948
Albert Perley Brogan	1949
* William Lockhart Clayton	1950
* A. Frank Smith	1951
* Ernest Lynn Kurth	1952
* Dudley Kezer Woodward, Jr.	1953
* Burke Baker	1954
* Jesse Andrews	1955
James Pinckney Hart	1956
Robert Gerald Storey	1957
* Lewis Randolph Bryan, Jr.	1958
W. St. John Garwood	1959
George Crews McGhee	1960
* Harry Huntt Ransom	1961
* Eugene Benjamin Germany	1962
Rupert Norval Richardson	1963
* Mrs. George Alfred Hill, Jr.	1964
* Edward Randall, Jr.	1965
* McGruder Ellis Sadler	1966
William Alexander Kirkland	1967
* Richard Tudor Fleming	1968
Herbert Pickens Gambrell	1969
Harris Leon Kempner	1970
* Carey Croneis	1971
Willis McDonald Tate	1972
* Dillon Anderson	1973
Logan Wilson	1974
Edward Clark	1975
Thomas Hart Law	1976
Truman G. Blocker, Jr.	1977
Frank E. Vandiver	1978
Price Daniel	1979

*Deceased

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ALBRITTON, CLAUDE CAROL, JR. (JANE), Hamilton Professor of geology, emeritus, and senior scientist, The Institute for the Study of Earth and Man . . . . . *Dallas*

ALLBRITTON, JOE LEWIS (BARBARA), lawyer; board chairman, Pierce National Life Ins. Co.; president, Houston Citizens Bank and Trust Company; director, Southwest Public Service Company; trustee, Baylor University, Baylor Medical College . . . . . *Houston*

ALLEN, WINNIE, retired archivist, University of Texas Library . *Hutchins*

ANDERSON, ROBERT BERNARD, partner, Carl M. Loeb Rhoades and Company; former secretary of the treasury; former tax commissioner, Texas . . . . . *New York*

ANDERSON, THOMAS D. (HELEN), lawyer . . . . . *Houston*

ANDERSON, WILLIAM LELAND (ESSEMENA), retired financial vice president of Anderson, Clayton & Co.; former president of Texas Medical Center, Inc.; awarded Navy's Distinguished Civilian Service Medal in 1945 . *Houston*

ANDREWS, MARK EDWIN (LAVONE), president, Ancon Oil and Gas Company; former assistant secretary of the navy . . . . . *Houston*

ARMSTRONG, ANNE LEGENDRE (MRS. TOBIN), former U. S. ambassador to Great Britain . . . . . *Armstrong*

ARMSTRONG, THOMAS REEVES, Armstrong Ranch; former president, Santa Gertrudis Breeders Association . . . . . *Armstrong*

ASHWORTH, KENNETH H., commissioner of higher education, Texas College and University System; former executive vice president of the University of Texas in San Antonio and vice chancellor for academic affairs of the University of Texas System . . . . . *Austin*

BAKER, REX G., JR., lawyer . . . . . *Sugar Land*

*BANKS, STANLEY (ANNE), lawyer; former chairman, Texas Library and Historical Commission . . . . . *San Antonio*

BEAN, WILLIAM BENNETT (ABIGAIL), director, Institute for Humanities in Medicine and Harris Kempner Professor of Medicine, University of Texas Medical Branch . . . . . *Galveston*

BENNETT, JOHN MIRZA, JR. (ELEANOR), chairman, National Bank of Commerce and City Public Service Board; director, Texas and Southwestern Cattlemen's Association; Major General, USAFR . . *San Antonio*

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BLOCKER, TRUMAN G., JR., surgeon; acting president, University of Texas Health Science Center at Houston; consultant to the Surgeon General . . . . . *Houston*

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BROWN, GEORGE RUFUS (ALICE), retired chairman, Brown and Root, Inc. . . . . *Houston*

BROWN, JOHN R., senior judge, Fifth Circuit Court of Appeals . *Houston*

BUSH, GEORGE, former director, Central Intelligence Agency; former ambassador to United Nations; former congressman . . . *Houston*

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BUTLER, JACK (MARY LOU), editor, Fort Worth *Star-Telegram* . *Fort Worth*

CALDWELL, JOHN CLIFTON (SHIRLEY), rancher; former chairman, Texas Historical Commission; director, Texas Historical Foundation . *Albany*

CARMACK, GEORGE (BONNIE), associate editor, San Antonio *Express-News* . . . . . *San Antonio*

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CARRINGTON, PAUL (FRANCES), lawyer; past president, Dallas Chamber of Commerce; past president, State Bar of Texas . . . . *Dallas*

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CLARK, EDWARD (ANNE), lawyer; former Secretary of State of Texas; former United States ambassador to Australia . . . . . *Austin*

CLARK, RANDOLPH LEE, president, University of Texas M. D. Anderson Hospital and Tumor Institute; professor of surgery, University of Texas Health Science Center at Houston . . . . . *Houston*

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