H.R. 9698. A bill to amend the Agricultural Adjustment Act of 1938 with respect to the computation of payments for the production of cotton in any drought year, and for other purposes; to the Committee on Agriculture.

H.R. 9699. A bill to amend the Consolidated Farmers Home Administration Act of 1961 in order to establish a special emergency loan program for drought areas, and for other purposes; to the Committee on Agriculture.

By Mr. CRANE:

H.J. Res. 774. Joint resolution: Stable Purchasing Power Resolution of 1971; to the Committee on Government Operations.

By Mr. SCHMITZ (for himself, Mr. ASHBROOK, Mr. BROYHILL of Virginia, Mr. DICKINSON, Mr. RARICK, Mr. ROUSSELOT, and Mr. WAGGONNER):

H. Con. Res. 360. Concurrent resolution expressing the sense of the Congress with respect to the obligations assumed by the United States as a signatory to the Geneva Convention of 1949 Relative to the Treatment of Prisoners of War and the fulfillment of such obligations in connection with the conflict in Southeast Asia; to the Committee on Foreign Affairs.

By Mr. ANDERSON of Tennessee:

H. Res. 529. Resolution to direct the executive branch to take a scientific approach to eutrophication and its relationship to phosphates and phosphate detergents; to the Committee on Interstate and Foreign Commerce.

By Mr. COLLINS of Texas (for himself and Mr. THOMPSON of Georgia):

H. Res. 530. Resolution to direct the Secretary of Health, Education, and Welfare to furnish certain documents to the House of Representatives; to the Committee on Education and Labor.

MEMORIALS

Under clause 4 of rule XXII,

240. The SPEAKER presented a memorial of the Legislature of the State of Oregon, ratifying the proposed amendment to the Constitution of the United States extending the right to vote to citizens 18 years of age and older, which was referred to the Committee on the Judiciary.

PRIVATE BILLS AND RESOLUTIONS

Under clause 1 of rule XXII, private bills and resolutions were introduced and severally referred as follows:

By Mr. HELSTOSKI:

H.R. 9700. A bill for the relief of Anthony John Clark; to the Committee on the Judiciary.

By Mr. DUNCAN:

H.R. 9701. A bill for the relief of Eleftheria Ligdis; to the Committee on the Judiciary.

PETITIONS, ETC.

Under clause 1 of rule XXII,

100. The SPEAKER presented a petition of the mayor and the City Council of Fairbanks, Alaska, relative to overriding the veto of the President of the accelerated public works bill, which was referred to the Committee on Public Works.

SENATE—*Thursday, July 8, 1971*

The Senate met at 12 o'clock noon and was called to order by the President pro tempore (Mr. ELLENDER).

The PRESIDENT pro tempore. The Chair has the pleasure and the honor to present the very first lady ever to lead the Senate in prayer. I present the Reverend Dr. Wilmina M. Rowland, director, educational loans and scholarships, Board of Christian Education, United Presbyterian Church, of Philadelphia, Pa.

The Reverend Dr. Wilmina M. Rowland offered the following prayer:

Eternal God, we thank You for revealing to us that You are our Father, and that all persons are Your children. Sometimes we have called ourselves Your children, but lived as if we thought others were not. When we forget that all persons are members of the family of God, forgive us, we pray. If we have despised other men and women for their ignorance, but denied them the means of knowledge; if we have forced them to fight for what they need, but condemned their aggressiveness; or if we have offered them no opportunities except servitude, but complained because they were nothing but servants, forgive us. Cause us to look within ourselves and see there all that we condemn in others.

O God, who daily bears the burden of our life, we pray for humility as well as forgiveness. As our country plays its part in the life of the world, help us to know that all wisdom does not reside in us, and that other nations have the right to differ with us as to what is best for them.

God, our ruler of the universe, give to every nation what we seek for our own country—concern for the human needs of every man and woman and child, sensitivity to moral issues, strength to be free and to carry the burden of freedom, readiness to accept responsibility and not to evade its consequences, deliverance from cynicism and despair.

And now, for those who serve in this place, we pray that they may go through today's work with faithfulness, strong to do justly, to love mercy, and to walk humbly with You. All this we ask in the name of Him whose life was perfect faithfulness, and an unmeasured outpouring of love. Amen.

Mr. MANSFIELD. Mr. President, I should like to yield the floor at this time to the two distinguished Senators from Pennsylvania.

Mr. SCOTT. Mr. President, today marks a historic first, since this is the first time in the long history of the Senate that the opening prayer has been offered by a minister of the gospel who is a very distinguished servant of God and a very distinguished woman, whose career has carried her far in the councils of the Presbyterian Church and who is honored today, thanks to the suggestion of our distinguished Chaplain, the Reverend L. R. Elson, and with the warm approval of the joint leadership.

Thus, we note this day with a great deal of pleasure.

Mr. President, I ask unanimous consent to have printed in the RECORD a short biography of our Chaplain for the day and yield to my distinguished colleague from Pennsylvania (Mr. SCHWEIKER).

There being no objection, the biography was ordered to be printed in the RECORD, as follows:

Born in Augusta, Ga., Dr. Rowland graduated magna cum laude from Wilson College, Chambersburg, Pa., with a B.S. degree. She holds an M.A. degree from Yale University and a B.D. degree from Union Theological Seminary where she graduated cum laude. In 1957 the honorary degree of Doctor of Humane Letters was conferred upon her by Wilson College.

Dr. Rowland was the twelfth woman to be ordained to the ministry of word and sacrament in the Presbyterian Church which now has over 25 ordained women.

She is the author of "When We Pray," published in 1955 by Friendship Press, and numerous articles and book reviews for national publications. She has also studied at the New School for Social Research and was a staff member of the Merrill-Palmer Institute in Detroit.

Dr. Rowland has also been a teacher in China and delegate to the World Council of Christian Education in 1959. Dr. Rowland has traveled extensively—in Europe, the British Isles, Asia, and South America. At the present she is the Director, Educational Loans and Scholarships of the United Presbyterian Church in the United States, with offices in the Witherspoon Building, Philadelphia, Pa.

Mr. SCHWEIKER. I thank my colleague from Pennsylvania, the distinguished Republican leader, for yielding to me.

I want to associate myself with his remarks and to express my sense of pride that not only all Pennsylvanians but all the people of this country must feel to have this important first, this historic event take place today in the Senate.

It is a real tribute not only to Dr. Rowland, who is very deserving, for a long and outstanding career in religious life and in the ministry, but also to all women everywhere in this country who pursue the ministry as a way of life. It is a tribute to all of them that the Reverend Wilmina Rowland was selected to participate today.

Mr. SCOTT. I thank the distinguished majority leader for yielding this time to us.

Mr. MANSFIELD. Mr. President, so that this event will be marked clearly for what is truly intended, that is a bipartisan token of appreciation to the Reverend Dr. Rowland, let me say that I join wholeheartedly in the remarks of the two distinguished Senators from Pennsylvania.

All I can add is, amen.

MESSAGES FROM THE PRESIDENT

Messages in writing from the President of the United States, submitting nominations, were communicated to the Senate by Mr. Leonard, one of his secretaries.

EXECUTIVE MESSAGES REFERRED

As in executive session, the President pro tempore laid before the Senate messages from the President of the United States submitting sundry nominations, which were referred to the appropriate committees.

(The nominations received today are printed at the end of Senate proceedings.)

THE JOURNAL

Mr. MANSFIELD. Mr. President, I ask unanimous consent that the reading of the Journal of the proceedings of Wednesday, July 7, 1971, be dispensed with.

The PRESIDENT pro tempore. Without objection, it is so ordered.

COMMITTEE MEETINGS DURING SENATE SESSION

Mr. MANSFIELD. Mr. President, I ask unanimous consent that all committees may be authorized to meet during the session of the Senate today.

The PRESIDENT pro tempore. Without objection, it is so ordered.

AUTHORIZATION FOR ALL COMMITTEES TO FILE REPORTS, THAT MESSAGES MAY BE RECEIVED FROM THE HOUSE OF REPRESENTATIVES AND THE PRESIDENT BY THE SECRETARY, AND THAT THE PRESIDENT PRO TEMPORE BE PERMITTED TO SIGN DULY ENROLLED BILLS

Mr. MANSFIELD. Mr. President, I ask unanimous consent that, from the conclusion of business today, until 5 p.m. this afternoon, and between the hours of 10 a.m. and 5 p.m. on Friday, July 9, 1971, all committees be authorized to file reports, that messages may be received from the House of Representatives and the President by the Secretary, and that the President pro tempore be permitted to sign duly enrolled bills.

The PRESIDENT pro tempore. Without objection, it is so ordered.

ORDER OF BUSINESS

Mr. SCOTT. Mr. President, I yield back the remainder of my time.

TRANSACTION OF ROUTINE MORNING BUSINESS

The PRESIDENT pro tempore. Under the previous order, there will now be a period for the transaction of routine morning business, not to exceed 30 minutes, with statements therein limited to 3 minutes.

QUORUM CALL

Mr. MANSFIELD. Mr. President, I suggest the absence of a quorum.

The PRESIDENT pro tempore. The clerk will call the roll.

The second assistant legislative clerk proceeded to call the roll.

Mr. MANSFIELD. Mr. President, I ask unanimous consent that the order for the quorum call be rescinded.

The PRESIDING OFFICER (Mr. STEVENSON). Without objection, it is so ordered.

PROSECUTION OF PERSONS PURLOINING GOVERNMENT SECRETS

Mr. BYRD of West Virginia. Mr. President, last week I addressed the Senate with reference to the harm done the country by the effectuation of a philosophy behind Supreme Court decisions excusing misconduct because of the purity of motive of the actor. It is obvious that if "right" motive and nobility of purpose are to become enshrined as the cornerstone of judging the culpability of persons for their acts, then we have indeed arrived at the point where ends do justify means and courts of law give way to the psychiatrist's couch.

These observations are made in the context of the controversy surrounding the leaking of the so-called Pentagon papers and the newspaper publication of them. A grand jury in Los Angeles has returned an indictment charging Dr. Ellsberg with holding and disseminating the papers illegally. Because that matter is now pending in court I would not wish directly to comment further on this individual or any other person.

But this respect for ongoing court proceedings should not restrain us from noting general principles and the necessity to adhere to them. I do not comment at this time on the substances of the Pentagon papers, but it seems to me that this leak, as well no doubt as other less notorious leaks, are fostered and encouraged by a feeling that "going public" or "going to the country" or some other euphemism for betraying one's Government by spilling its secrets is justified by some higher law of morality. If Government will not do what one personally wants or what one personally sees as the only morally justified course of action, then, as such people see it, that government forfeits our respect and our loyalty and, in their view, we are justified in "turning it around" by any means at our disposal.

No government can function if even a few of its officers and employees harbor this view. There are many activities of Government, to be sure, which should be open and exposed. Much domestic activity is of this type. And there is entirely too much Government material which is labeled "secret," "top secret," and so forth, without proper justification. But when we come to certain aspects of formulation and execution of foreign policy and defense policy, some secrecy is not only necessary, it is also indispensable. Nations do not negotiate with each other in goldfish bowls. If certain indispensable functions cannot be carried out in secret, then the Nation is in trouble.

For that reason, we must cut to the foundation of an attitude that would deprive Government of its ability to conduct foreign affairs and military matters with the degree of secrecy that the particular and special circumstances call for in a given instance. New laws may or may not be necessary; time will tell. But a certainty is that prompt and vigorous and successful prosecution of every person employed in a sensitive Government position who arrogantly takes upon himself the power to expose policies with which he is in personal disagreement is absolutely indispensable. Every person has a right to dissent; but no person, having taken on responsibilities to his Government, should be allowed to carry that dissent to levels which betray vital secrets and violate laws against espionage.

Failure to prosecute for whatever reason can only encourage those with these attitudes. Failure to prosecute will only insure that leaks will become more and more prevalent, more and more harmful. Failure to prosecute can only allow a mantle of respectability to fall upon the shoulders of those who are already being lionized for their "courage" and "higher sense of responsibility."

Thus, the Los Angeles grand jury or other appropriate juries should be pressed to continue their studies of Federal law violations in this case. Everyone who took part in purloining these papers should be prosecuted.

QUORUM CALL

Mr. BYRD of West Virginia. Mr. President, I suggest the absence of a quorum.

The PRESIDING OFFICER. The clerk will call the roll.

The second assistant legislative clerk proceeded to call the roll.

Mr. BYRD of West Virginia. Mr. President, I ask unanimous consent that the order for the quorum call be rescinded.

The PRESIDING OFFICER. Without objection, it is so ordered.

ORDER FOR RECOGNITION OF SENATOR BYRD OF VIRGINIA AND FOR RESUMPTION OF PERIOD FOR TRANSACTION OF ROUTINE MORNING BUSINESS

Mr. BYRD of West Virginia. Mr. President, I ask unanimous consent that at the conclusion of the period for transaction of routine morning business today the distinguished senior Senator from Virginia (Mr. BYRD) be recognized for not to exceed 20 minutes, and that at the conclusion of his remarks there be a resumption of the period for the transaction of routine morning business, for not to exceed 30 minutes, with statements therein limited to 3 minutes.

The PRESIDING OFFICER. Without objection, it is so ordered.

COMMUNICATIONS FROM EXECUTIVE DEPARTMENTS, ETC.

The PRESIDENT pro tempore laid before the Senate the following letters, which were referred as indicated:

REPORTS OF COMPTROLLER GENERAL

A letter from the Comptroller General of the United States, transmitting, pursuant to law, a report on opportunities for improving the automated supply system of the Veterans' Administration, dated July 7, 1971 (with an accompanying report); to the Committee on Government Operations.

A letter from the Comptroller General of

the United States, transmitting, pursuant to law, a report on the community mental health centers program—improvements needed in management, health services and mental health administration, Department of Health, Education, and Welfare, dated July 8, 1971 (with an accompanying report); to the Committee on Government Operations.

A letter from the Comptroller General of the United States, transmitting, pursuant to law, a report on further action by Veterans' Administration could reduce administrative costs and improve service to veterans receiving educational benefits, dated July 8, 1971 (with an accompanying report); to the Committee on Government Operations.

REPORT OF LADIES OF THE GRAND ARMY OF THE REPUBLIC

A letter from the District of Columbia representative, Ladies of the Grand Army of the Republic, Washington, D.C., transmitting, pursuant to law, a report of that organization, for the year 1970 (with an accompanying report); to the Committee on the Judiciary.

PROPOSED LEGISLATION AMENDING THE SUBVERSIVE ACTIVITIES CONTROL ACT OF 1950

A letter from the Attorney General submitting proposed legislation to amend the Subversive Activities Control Act of 1950, as amended (with accompanying papers); to the Committee on the Judiciary.

PROPOSED LEGISLATION PROVIDING OVERTIME PAY FOR CERTAIN EMPLOYEES

A letter from the Chairman of the Civil Service Commission submitting proposed legislation providing for overtime pay for intermittent and part-time general schedule and other salaried employees who work in excess of 40 hours in a week (with accompanying papers); to the Committee on Post Office and Civil Service.

PROGRESS REPORT OF THE NATIONAL ACADEMY OF SCIENCES

A letter from the Executive Director of the National Academy of Sciences reporting on the progress of the Academy in connection with the Clean Air Act Amendments of 1970; to the Committee on Public Works.

PETITIONS

Petitions were laid before the Senate and referred as indicated.

By the PRESIDENT pro tempore:

A joint resolution adopted by the Congress of Micronesia; to the Committee on Finance:

"SENATE JOINT RESOLUTION NO. 14

"A Senate joint resolution respectfully requesting the United States Congress to amend existing tariff laws to allow the same treatment of Micronesian products entering into the United States as is provided for insular possessions of the United States

"Whereas, the United States as an Administering Authority has given and continues to give sympathetic attention to the economic plights of Micronesia as evidenced by annual grant funds to support the administration of the Trust Territory and to carry out public works projects, programs, and services; and

"Whereas, trade and commerce between the United States and Micronesia have been hampered to a large extent by tariff restrictions imposed by the United States on Micronesian products entering the United States proper and its possessions and territories; and

"Whereas, appropriate amendments to the Tariff Schedules of the United States (19 U.S.C.A. 1202) would greatly promote future commercial interchange between the United States and Micronesia and would further advance the well-being of the Micronesian people; now, therefore,

"Be it resolved by the Senate of the Congress of Micronesia, Fourth Special Session, 1971, the House of Representatives concurring, that the United States Congress be and it is hereby respectfully requested to amend its existing tariff laws to allow Micronesian products to enter the United States on the same basis as are the products of United States insular possessions and territories; and

"Be it further resolved that the High Commissioner is hereby requested to use all means at his disposal to support this Senate Joint Resolution before the United States Congress; and

"Be it further resolved that the Secretary of the Interior is hereby respectfully requested to use all means at his disposal to support this Senate Joint Resolution before the United States Congress; and

"Be it further resolved that certified copies of this Senate Joint Resolution be transmitted to the President of the United States; the Speaker of the House of Representatives, the President of the Senate, the Chairmen of the House of Representatives Committees on Ways and Means and Interior and Insular Affairs, and the Chairmen of the Senate Committees on Finance and Interior and Insular Affairs of the United States Congress; the Secretaries of the Departments of State and the Interior of the United States; and the High Commissioner."

A joint resolution of the Legislature of California; to the Committee on Interior and Insular Affairs:

"ASSEMBLY JOINT RESOLUTION NO. 3

"Relative to the creation of a Golden Gate National Recreation Area

"Whereas, Much of the natural beauty and charm of the San Francisco Bay area is a result of the relatively undeveloped state and federal lands located on both sides of the Golden Gate and in Fort Baker, Fort Barry, Fort Cronkhite, Fort Mason, Fort Miley, Fort Scott, Fort Funston, and the San Francisco Presidio; and

"Whereas, These federal lands provide significant open-space areas within the otherwise congested urban San Francisco Bay area; and

"Whereas, There are numerous projects proposed or planned for these federal lands which would be disastrous to the public interest in retaining open-space lands in urban areas; and

"Whereas, Due to expected increase in urban population within the San Francisco Bay area the public need for urban open-space lands will significantly increase with the passage of time; and

"Whereas, It has been proposed that Fort Baker, Fort Barry, Fort Cronkhite, Fort Mason, Fort Miley, Fort Scott, Fort Funston, and much of the San Francisco Presidio be included in a Golden Gate National Recreation Area which would retain the natural open-space character of such federal lands; and

"Whereas, There are many parcels of land owned by various federal agencies, the State of California, the City of San Francisco, and private parties, whose inclusion in this project would create a Golden Gate National Recreation Area of approximately 10,000 acres as the best possible use of such land; now, therefore, be it

"Resolved, by the Assembly and Senate of the State of California, jointly, That the Legislature of the State of California respectfully memorializes the President and Congress of the United States to establish a Golden Gate National Recreation Area, to include those portions of Fort Baker, Fort Barry, Fort Cronkhite, Fort Mason, Fort Miley, Fort Scott, Fort Funston, and the Presidio not essential for the national defense; and be it further

"Resolved, That those additional parcels of federal, state, city, and private land which would create an outstanding national recreation area of more than 10,000 acres be included in the Golden Gate National Recreation Area; and be it further

"Resolved, That the Chief Clerk of the Assembly transmit copies of this resolution to the President and Vice President of the United States, to the Speaker of the House of Representatives, and to each Senator and Representative from California in the Congress of the United States."

A joint resolution of the Legislature of the State of Wisconsin; to the Committee on the Judiciary:

"SENATE JOINT RESOLUTION 46

"Joint resolution ratifying an amendment to the U.S. Constitution relating to voting rights of persons 18 and older

"Whereas, both houses of the ninety-second Congress of the United States of America, at the first session, by a constitutional majority of two-thirds, made the following proposition to amend the Constitution of the United States of America in the following words:

"'S.J. Res. 7

"'Resolved by the Senate and House of Representatives of the United States of America in Congress assembled (two-thirds of each House concurring therein), That the following article is proposed as an amendment to the Constitution of the United States, which shall be valid to all intents and purposes as part of the Constitution when ratified by legislatures of three-fourths of the several States within seven years from the date of its submission by the Congress:

"'Article —

"'SECTION 1. The right of citizens of the United States, who are eighteen years of age or older, to vote shall not be denied or abridged by the United States or by any State on account of age.

"'SEC. 2. The Congress shall have power to enforce this article by appropriate legislation.'; and

"Whereas, the people of the sovereign State of Wisconsin, represented in Senate and Assembly, have studied said proposed addition to the Constitution of the United States and have reached a consensus that the federal government be permitted thus to alter the Constitution of the United States; now, therefore, be it

"Resolved by the senate, the assembly concurring, That said proposed amendment to the Constitution of the United States of America is hereby ratified by the legislature of the State of Wisconsin; and, be it further

"Resolved, That copies of this joint resolution, certified by the Secretary of State, be forwarded by the Governor to the General Services Administration of the government of the United States, in Washington, D.C., and to the presiding officer of each house of the Congress of the United States."

A joint resolution of the Legislature of the State of Alabama; to the Committee on the Judiciary:

"HOUSE JOINT RESOLUTION 10

"Ratifying the proposed amendment to the Constitution of the United States granting citizens eighteen years of age or over the right to vote in State elections

"Whereas, the 92nd Congress of the United States of America at its first Session, in both Houses, by a Constitutional majority of two-thirds thereof, adopted the following proposition to amend the Constitution of the United States of America in the following words to wit:

"'JOINT RESOLUTION

"'Resolved by the Senate and House of Representatives of the United States of America in Congress assembled (two-thirds of each House concurring therein), that the following article is proposed as an amendment to the Constitution of the United States, which shall be valid to all intents and purposes as a part of the Constitution

when ratified by the Legislatures of three-fourths of the several States within seven years from the date of its submission by the Congress:

" 'ARTICLE

" 'SECTION 1. The right of citizens of the United States, who are eighteen years of age or older, to vote shall not be denied or abridged by the United States or by any State on account of age.

" 'SEC. 2. The Congress shall have the power to enforce this article by appropriate legislation.'

"Now, therefore, be it resolved by the House of Representatives of the State of Alabama, the Senate concurring, That:

"1. The proposed amendment to the Constitution of the United States as herein shown be and the same is hereby ratified.

"2. Duly authenticated copies of this resolution shall be forwarded by the Clerk of the House to the Administrator of General Services, Washington, D.C. and to the President of the Senate and the Speaker of the House of Representatives of the Congress of the United States."

A resolution adopted by the Board of Commissioners of Ottawa County, Michigan, memorializing Congress to allow old age assistance and other categorical assistance payments to persons in publicly run care facilities; to the Committee on Finance.

REPORTS OF COMMITTEES

The following reports of committees were submitted:

By Mr. PASTORE, from the Joint Committee on Atomic Energy, without amendment:

S. 2150. A bill to authorize appropriations to the Atomic Energy Commission in accordance with section 261 of the Atomic Energy Act of 1954, as amended, and for other purposes (Rept. No. 92-249).

By Mr. SPARKMAN, from the Committee on Foreign Relations, without amendment:

S. Res. 136. A resolution requesting a negotiating conference in reference to the prices of wheat.

By Mr. MANSFIELD, for Mr. LONG, from the Committee on Commerce, with amendments:

S. 696. A bill to provide for a coordinated national boating safety program (Rept. No. 92-248).

INTERNATIONAL WHEAT AGREEMENT, 1971—EXECUTIVE REPORT OF A COMMITTEE

As in executive session, Mr. SPARKMAN, from the Committee on Foreign Relations, reported favorably, without reservation, the International Wheat Agreement, 1971, Executive F, 92d Congress, first session, and submitted a report (Executive Rept. No. 92-7) thereon, which was printed.

INTRODUCTION OF BILLS AND JOINT RESOLUTIONS

The following bills and joint resolutions were introduced, read the first time and, by unanimous consent, the second time, and referred as indicated:

By Mr. PROUTY:

S. 2233. A bill to authorize a study of the financing of post secondary education in the United States, and for other purposes. Referred to the Committee on Labor and Public Welfare.

By Mr. BEALL:

S. 2234. A bill to amend the Internal Revenue Code of 1954 to remove the 2-year limitation during which an individual may qualify as a surviving spouse. Referred to the Committee on Finance.

By Mr. McGOVERN:

S. 2235. A bill to permit officers and employees of the Federal Government to elect coverage under the old-age, survivors, and disability insurance system. Referred to the Committee on Finance.

STATEMENTS ON INTRODUCED BILLS AND JOINT RESOLUTIONS

By Mr. PROUTY:

S. 2233. A bill to authorize a study of the financing of post secondary education in the United States, and for other purposes. Referred to the Committee on Labor and Public Welfare.

POST SECONDARY EDUCATION FINANCING STUDY ACT

Mr. PROUTY. Mr. President, I introduce for appropriate reference a bill entitled the Post Secondary Education Financing Study Act. I ask unanimous consent that the full text of the bill be printed in the RECORD following my remarks.

The PRESIDENT pro tempore. Without objection, it is so ordered.

(See exhibit 1.)

Mr. PROUTY. Mr. President, on June 30, the Subcommittee on Education of the Committee on Labor and Public Welfare ordered reported to the full committee a higher education bill which I consider to be a landmark measure as great in import and impact as the National Defense Education Act of 1958. I am confident that when this bill is reported by the Labor and Public Welfare Committee, Senators will share my assessment of this measure and hopefully my enthusiastic support of it.

The bill I introduce today anticipates support for the committee's action and looks beyond this landmark measure to distant landmarks as yet uncharted.

The purpose of this bill is simple—it requires the Secretary of the Department of Health, Education, and Welfare to conduct a comprehensive study of the financing of post secondary education. While the purpose of this measure is simple, the problems faced in conducting such a study are complex for the very course of our Nation depends in large measure on our educational processes.

It is not an easy task that this bill proposes, but it is necessary. Coincident with the accolades that the forthcoming higher education bill deserves should be the acknowledgement that while it represents a great step ahead, there remain more steps to be taken.

The bill I introduce today provides a broad mandate for the Secretary's study, yet it, also, specifies certain avenues of investigation.

The measure seeks a general review of the past and present patterns of financial support for education from all sources, private, local, State, and Federal and an investigation of alternate appropriate, future roles for each source.

Earlier I referred to the National Defense Education Act of 1958, and I would like to explore briefly the changes in post secondary education since the passage of that act.

In 1958, students attended public and private universities in about the same numbers. Today there are more than two times the number of students attending public universities as those who attend private universities. By 1980 this ratio is expected to increase to 4 to 1 in favor of public universities. Many of our private colleges are hard pressed financially, experiencing either a "crisis" or a "crunch" as the condition is alternatively described. The need for some form of Federal institutional support is apparent, yet the precise and equitable formula for any general aid seems elusive while a "student following" aid formula is within our grasp. It must, also, be remembered that for the forseeable future Federal institutional aid will have to compete with student aid for precious Federal resources.

In the ordering of our priorities, I believe that we must first consider the financial needs of our young people who are present and potential students.

At the time of passage of the NDEA, most student aid was available only from the few private universities with substantial endowments. Opportunities for higher education were offered only to the affluent or those of moderate means and exceptional ability. Today, through the Federal role begun with the NDEA and expanded significantly with the Higher Education Act of 1965 and amendments thereto, the Federal Government provides some $2 billion annually in student assistance to meet in part the needs of 71 percent of the students who require some type of financial aid in order to enroll, continue or complete their postsecondary education.

Soon the Labor and Public Welfare Committee will report a measure which will provide for the first time a federally assured minimum level of support for every young American, who seeks to continue his education beyond high school.

I shall welcome the passage of this bill particularly, because it embodies the essential element of assurance.

Beyond the minimum level of student assistance to be assured and supplementary grants responding in part or whole to the costs of a student's education lies a problem which I have been weighing throughout the deliberations on the higher education bill.

This problem stems from the vast differences in the costs of education among different types of postsecondary institutions and curriculums. While it is clearly the responsibility of the Federal Government to promote equal educational opportunity for all young Americans, it does not follow that the American taxpayer should be compelled to automatically pay the student's entire bill regardless of the cost of his education. But it is clearly the Federal Government's responsibility to look to ways to help students, who seek a more expensive education, meet these higher costs after other forms of assured and discretionary student assistance are exhausted.

To me it is time to look beyond the present measure of students assistance, which is based solely on present need. I believe education is an investment for the individual as well as the Nation. I know

this investment pays off in tangible and intangible rewards.

It seems to me time to consider additional forms of student assistance that respond to a student's future ability to pay.

I see such additional aid mechanisms taking three possible forms, each of which my bill would require the Secretary of House, Education, and Welfare to investigate.

The first form is income contingent lending, which is known as the pay as you earn—PAYE—system. Simply put, in the PAYE system borrowers are required to repay a certain percentage of their income per $1,000 borrowed and those borrowers who become more affluent, in effect, subsidize those who become less affluent. The percentage of repayment works in the same manner as a life insurance premium.

Many variations of the PAYE proposal have been advanced and Yale University and Duke University now have experienced PAYE plans under way. Governor Gilligan of Ohio has proposed a plan of deferred payments, where the student contributes to the cost of his education after he leaves school.

The PAYE system is alluring in concept, but not without difficulties in implementation. The potential problems are too vast to explore today and are rightly a matter for the study I propose.

However, I should point out two essential components required to insure the success of a PAYE system. First, is the need for actuarial accuracy in estimating the future income profile of any group of lenders. Second, is the need for a large capital base to begin a PAYE system. Here there are many alternatives to consider. It may be that PAYE plans could be developed with the various States providing the capital base. Perhaps the Federal Government could provide the capital or serve as the guarantor of sound State or institutional PAYE plans.

If full protection of the fiscal integrity of the Social Security Trust Fund could be assured, the trust fund might be used as a capital base with the fund investing in students as well as Federal paper. Alternatively a quasi-public corporation could be set up as a capital base for a PAYE system. The alternatives are vast and exciting to explore and I am hopeful that this study I propose will explore them completely.

The second form of student assistance referred to in my bill is less complex than the PAYE system, because it would retain the concept of a fixed obligation contained in the existing national defense student loans and guaranteed student loans. I propose that the Secretary investigate the desirability and feasibility of graduated repayment schedules for federal or federally insured student loans. At present many students are reluctant to assume debts on a fixed repayment schedule of equal installments, because such installments are excessively burdensome in the early, low-income years. If loan programs could be adjusted on a graduated basis, the installments would respond to ability to pay with smaller installments in the early, low-income years and larger installments in the later, high-income years. Such a readjustment of present loan programs would, I believe, make them more attractive to students.

The third form of loan assistance required to be studied by my bill is similar to the second. It would take into consideration the borrower's income in the repayment process by either deferring or cancelling the repayment in any given year if the repayment exceeded a certain percentage of the borrower's annual income.

As with the second form of student assistance, this form would reduce the anxiety of potential, young borrowers about large repayments during times of small incomes.

Mr. President, all three of the new forms of student loan assistance I propose that the Secretary of Health, Education, and Welfare study are based on the same concept—the recognition that the ability to repay a student loan is more properly a product of a student's future earnings than of a student's present need.

I am hopeful that the study I propose will be conducted and result in a favorable determination as to a source or sources of capital and the ability to predict future earning profiles for large groups of borrowers.

I should note, Mr. President, that my bill specifies these three proposed forms of student assistance only as part of a general study of alternative forms of student assistance. Thus, it is likely that the study would yield other new forms of assistance for Congress to consider.

What is to me most important is that we constantly have before us new ideas and concepts on financing postsecondary education together with a clear view of the past flow and projected need for financial support from the various sectors of our economy.

My bills proposes to provide Congress and the Nation the new ideas and concepts and at the same time an overview of the financial history, present condition, and future needs of postsecondary education.

I would suggest that I cannot foresee the development of one single form of student aid responding to the varying needs of our diverse student population. On the contrary, I envision the continuation of a package of Federal student aid programs which should begin with assured grants and move gradually toward loan programs. The Federal responsibility is now and should remain to provide a floor of postsecondary educational support for every young American. Beyond that, the Federal Government, in concert with the States, localities and private sections, should in every way possible, insure the availability of assistance for every young American to go as far as he wishes in pursuit of his education.

In March of 1970, President Nixon said:

> No qualified student who wants to go to college should be barred by lack of money. That has long been a great American goal; I proposed we achieve it now.

Mr. President, with the measure shortly to be reported by the Labor and Public Welfare Committee, we shall be able to achieve this "great American goal." But historically, we, as a people, have set new goals as soon as old goals are met. Today, I foresee the day when not only is a postsecondary education available to all who seek it, but the means are available for every young American to pursue his education as far as he chooses within the limits of his ability.

The study I propose today looks to the goal beyond the goal we are about to reach and I am anxious to proceed to respond to the needs of a changing student, a changing educational system, and a changing Nation.

EXHIBIT 1

S. 2233

A bill to authorize a study of the financing of postsecondary education in the United States, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Post Secondary Education Financing Study Act".

STATEMENT OF PURPOSE

SEC. 2. It is the purpose of this Act to authorize a study of the impact of past, present, and anticipated private, local, State, and Federal support for postsecondary education, the appropriate role for the States in support of higher education, alternative student assistance programs, and the potential Federal, State, and private participation in such programs.

SEC. 3. (a) The Secretary of Health, Education, and Welfare (hereinafter referred to as the "Secretary") shall conduct a thorough study and investigation of the impact of past and present support and the appropriate level of future support for higher education from private sources and from Federal, State, and local governments.

(b) In conducting such investigation and study, the Secretary shall consider—

(1) alternative models of State and local support for postsecondary education;

(2) new Federal initiatives to complement alternative State and local programs; and

(3) alternative forms of student assistance, including—

(A) loan programs based on income contingent lending;

(B) loan programs which utilized fixed, graduated repayment schedules; and

(C) loan programs which provide for cancellation or deferment of part or all of repayment in any given year based on a certain level of a borrower's income; and

(4) the potential Federal, State, local, and private participation in such programs.

SEC. 4. In order to carry out the provisions of this Act, the Secretary is authorized to—

(1) enter into contracts with institutions of higher education and other appropriate individuals, public agencies, and private organizations;

(2) appoint and fix the compensation of such personnel as may be necessary;

(3) employ experts and consultants in accordance with section 3109 of title 5, United States Code;

(4) utilize, with their consent, the services, personnel, information, and facilities of other Federal, State, local, and private agencies with or without reimbursement; and

(5) consult with the heads of such Federal agencies as he deems appropriate.

SEC. 5. Not later than December 31, 1972, the Secretary shall report to the President and Congress the results of the investigation and study authorized by this Act, together with such recommendations, including recommendations for legislation, as he deems appropriate.

(1) alternative models of State and local support for postsecondary education;
(2) new Federal initiatives to complement alternative State and local programs; and
(3) alternative forms of student assistance, including—
(A) loan programs based on income contingent lending;
(B) loan programs which utilized fixed, graduated repayment schedules; and
(C) loan programs which provide for cancellation or deferment of part or all of repayment in any given year based on a certain level of a borrower's income; and
(4) the potential Federal, State, local, and private participation in such programs.

SEC. 6. There are authorized to be appropriated such sums, not to exceed $5,000,000, as may be necessary to carry out the provisions of this Act.

By Mr. BEALL:

S. 2234. A bill to amend the Internal Revenue Code of 1954 to remove the 2-year limitation during which an individual may qualify as a surviving spouse. Referred to the Committee on Finance.

Mr. BEALL. Mr. President, I send to the desk a bill designed to correct an "inequity" in our Federal tax laws with regard to widows with children. This bill would extend to such widows on a permanent basis the right to continue to take advantage of the joint return tax rate.

Under present law, a widow may file a joint return for the taxable year in which her spouse dies. In addition, a widow, who has not remarried and who maintains a household for a dependent child or stepchild, may also use the joint return tax rate for 2 additional taxable years following the year in which the spouse died. Certainly the death of a father to a family is not only a great personal loss, but often is an economic disaster for a family. This problem was brought to my attention by a Maryland constituent, Mrs. Richard Schwartz, who had this to say about the problem:

The family's greatest casualty is the loss of the father, companion, head of household and bread-winner. Yet the widow and children are taxed at a higher rate on the income received than couples filling joint income tax returns.

Why can't widows claim the true loss (casualty) of income? Because this inequity requires action by Congress for any change. The widows do not have a lobby representing their cause in Congress. They are too busy trying to make up for the loss of a father to their children and supporting and educating the children to the best of their ability.

Thus this precludes the widows organizing as a group to lobby Congress for a tax that meets 'ability to pay'. This has always been a basic principle underlying the income tax laws of the United States. The widow with children pays 20% more taxes for equivalent income than other family units.

Is not the loss of a father the greatest loss the family experiences; and yet the family pays 20% greater tax for this loss.

I agree, Mr. President, that the loss of the father in most cases is a great economic blow to a family, a family which then needs as much help as it can in order to continue, following the loss of one who is normally the principal breadwinner.

To do equity for such widows with minor children and to ease her problems and burdens somewhat, I introduce this measure today and would hope that the Senate Finance Committee and the Congress will give favorable consideration to it.

By Mr. McGOVERN:

S. 2235. A bill to permit officers and employees of the Federal Government to elect coverage under the old-age, survivors, and disability insurance system. Referred to the Committee on Finance.

SOCIAL SECURITY AND FEDERAL EMPLOYEES

Mr. McGOVERN. Mr. President, in 1966, Representative Eugene J. Keogh of New York introduced a bill to give Federal employees the option of coming under the Federal social insurance system. This year the same bill has been introduced in the House of Representatives by Representative JAMES H. SCHEUER of New York as H.R. 1665.

Many Federal employees are actively seeking to have this option and there is no plausible reason why it should be denied to them. If Federal employees are denied the opportunity to join the social security program, they are denied certain important benefits available to other Americans. In effect, they are the object of discrimination simply because they work for the Federal Government. That discrimination should now end.

When he first introduced the bill, Representative Keogh made a comprehensive statement on the subject. I ask unanimous consent that his remarks on May 25, 1966, be printed in the RECORD at this point, together with the text of the bill that I have introduced today.

There being no objection, the remarks and bill were ordered to be printed in the RECORD, as follows:

ELECTIVE COVERAGE OF FEDERAL EMPLOYEES UNDER THE SOCIAL SECURITY SYSTEM

Mr. KEOGH. Mr. Speaker, I have today introduced legislation to permit Federal employees to elect to come under the Federal social insurance system established by title II of the Social Security Act. I hope this legislation will resolve, finally, the question of coverage of the single largest group of employees in the United States who have been denied the privilege of obtaining the benefits of our very fine and very sound old-age, survivors, and disability insurance protection. This is a matter which has been under consideration by boards and bureaus, committees and commissions, both in, and out, of the Congress, for more than 15 years. It has been considered by Cabinet-level commissions, by departments of Government, and by the Committee on Ways and Means on numerous occasions. It is time for action and not another 15 or 10 or 5 years or even 1 year of discussion. Our Federal Government, as the largest single employer in the United States, can ill afford to continue in the anomalous position of refusing to permit its employees this protection which it has afforded to 95 percent of all the other citizens of the United States. I believe the legislation which I have today introduced resolves the problems fairly, equitably, and in the best interests of both the employees and the U.S. Government.

In brief, the solution embodied in my bill is to permit Federal employees to make a choice as to whether they will come under the social security system in addition to their civil service retirement coverage. Private employees get social security coverage in addition to whatever private pension they may have. New employees would have 2 years from the date of their employment within which to file a certificate indicating their desire for such coverage. Existing employees would likewise have 2 years to make such election. This election generally can be retroactive for a 1-year period if the employee so chooses and if he pays the tax due. In addition, in order that employees might have a further opportunity, because of changed family or financial conditions, and so forth, to elect coverage, the bill provides that at the end of a 5-year period, each employee will have one further chance to elect coverage. There would be 6 months within which to elect coverage at that point.

The bill provides that the employee shall pay the employee tax. This would be done by the employer—the Federal agency—withholding the appropriate amount.

Mr. Speaker, without going into further detail of this bill, permit me to point out that with regard to its actuarial soundness, it follows the precedent established last year when coverage was extended to 1½ million individuals who receive earnings in the form of tips and gratuities by providing that only the employee share of the tax shall be payable and that the employer share shall not be payable. Therefore, there would be no budgetary impact. It would not cost the Federal Government a single penny. The Chief Actuary of the Social Security Administration testified that extension of social coverage to be the 1½ million individuals who receive earnings in the form of tips by payment of the employee share of the tax was an actuarially sound solution to that coverage problem. This would be equally true of extension of coverage to Federal employees because they are, as a group, generally conceded to be superior risks in terms of insurance actuarial considerations. I believe the majority will elect coverage. There would be no adverse selection, because they would have to come in at one of two points in time, or be barred from coming in.

Therefore, the solution which my bill embodies is actuarially sound; it is in the interest of the employees because it permits them to make the election in their own interest; and it is in the interest of the U.S. Government not only from a budgetary point of view but also because it closes the final large gap of coverage which remains under the social security system and removes the quite legitimate criticism that the U.S. Government has denied its own employees coverage which it has mandatorily extended to employees of private organizations and employers.

Mr. Speaker, I shall use every parliamentary means at my command to secure favorable consideration of this legislation during this session of the 89th Congress.

S. 2235

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 210 of the Social Security Act is amended by adding at the end thereof the following new subsection:

"ELECTIVE COVERAGE OF SERVICE PERFORMED BY FEDERAL OFFICERS AND EMPLOYEES

"(p) The term 'employment' shall, notwithstanding the provisions of subsection (a), include service otherwise excluded from such term by paragraph (5) or (6) of such subsection which is performed during the period for which a certificate, filed pursuant to section 3121(r) of the Internal Revenue Code of 1954, is in effect with respect to such service."

SEC. 2. Section 3121 of the Internal Revenue Code of 1954 (definitions relating to tax under Federal Insurance Contributions Act) is amended by adding at the end thereof the following new subsection:

"(r) ELECTIVE COVERAGE OF SERVICE PERFORMED BY FEDERAL OFFICERS AND EMPLOYEES.—

"(1) WAIVER OF EXCLUSION.—Any individ-

ual performing service which (without regard to this subsection) is excluded from 'employment' by paragraph (5) or (6) of subsection (b) may file a certificate (in such manner and form and with such official as may be prescribed by regulations made under this chapter) certifying that he elects to have the insurance system established by title II of the Social Security Act extended to service described in paragraphs (5) and (6) of subsection (b) performed by him. For purposes of this chapter other than for purposes of the taxes imposed by section 3111, the term 'employment' shall, notwithstanding the provisions of subsection (b), include service otherwise excluded from such term by paragraph (5) or (6) of such subsection which is performed by him during the period for which such certificate is in effect.

"(2) TIME FOR FILING CERTIFICATE.—

"(A) INITIAL FILING PERIOD.—Any individual who desires to file a certificate pursuant to paragraph (1) must, except as provided in subparagraph (B) of this paragraph, file such certificate before the close of the second calendar year ending after the date of the enactment of this subsection during one or more calendar quarters of which he was paid remuneration of $50 or more for service described in paragraph (5) or (6) of subsection (b) which (without regard to this subsection) is excluded from 'employment'.

"(B) ADDITIONAL FILING PERIOD.—An individual who could have filed a certificate pursuant to paragraph (1) during the initial filing period provided by subparagraph (A) of this paragraph but did not do so may file such certificate at any time during the six-month period beginning five years after the close of such period.

"(C) NOTICE TO EMPLOYER.—An individual filing a certificate pursuant to paragraph (1) shall give such notice thereof to the head of the Federal agency or instrumentality in or by which he is employed, at or before the time of filing such certificate, as may be prescribed in regulations made under this chapter.

"(3) EFFECTIVE PERIOD OF CERTIFICATE.—A certificate filed by an individual pursuant to this subsection shall be effective with respect to all calendar quarters beginning with the calendar quarter in which it is filed; except that such certificate may be effective beginning with any of the 4 calendar quarters immediately preceding the calendar quarter in which it is filed if (A) the individual so requests in the certificate (specifying one of such 4 calendar quarters) and (B) the certificate is accompanied by an amount equal to the taxes which would have been payable under section 3101 with respect to all service described in paragraphs (5) and (6) of subsection (b) which was performed by him during the quarter so specified and all subsequent calendar quarters ending before the calendar quarter in which the certificate is filed if such service had not been excluded from 'employment' at the time it was performed. An election made pursuant to this subsection shall be irrevocable."

SEC. 3. (a) Section 205(p)(1) of the Social Security Act is amended (1) by striking out "and including service" and inserting in lieu thereof "including service", and (2) by inserting after "to which the provisions of section 210(o) are applicable," the following: "and including any service to which the provisions of section 210(p) (relating to elective coverage) are applicable,".

(b) Section 3122 of the Internal Revenue Code of 1954 (relating to Federal service) is amended—

(1) by striking out "and including service" and inserting in lieu thereof "including service" in the first sentence;

(2) by inserting after "to which the provisions of section 3121(p) are applicable," in the first sentence the following: "and including any service to which the provisions of section 3121(r) (relating to elective coverage) are applicable,"; and

(3) by adding at the end thereof the following new sentence: "The Secretary or his delegate shall prescribe such regulations and establish such procedures as may be appropriate to insure that the heads of the various Federal agencies and instrumentalities know at all times which of their employees are performing service to which the provisions of section 3121(r) are applicable; and, notwithstanding the first sentence of this section, such regulations and procedures may permit the Secretary or his delegate to make the determinations described in such sentence and provide for the collection of the tax imposed by section 3101, with respect to an employee performing such service, in a case where it is not feasible for the head of the Federal agency or instrumentality involved to do so."

SEC. 4. The amendments made by this Act shall apply only in the case of service with respect to which certificates are filed (pursuant to section 3121(r) of the Internal Revenue Code of 1954, as added by section 2 of this Act) in calendar quarters beginning more than 20 days after the date of the enactment of this Act.

ADDITIONAL COSPONSORS OF BILLS AND JOINT RESOLUTIONS

S. 77, S. 278, S. 1781, AND S.J. RES. 15

Mr. NELSON. Mr. President, I ask unanimous consent that at the next printing of Senate Joint Resolution 15, the name of the Senator from Alaska (Mr. STEVENS) be added as a cosponsor.

I also ask unanimous consent that at the next printing of S. 1781, the Clean Water Financing Act, the names of the Senator from Oregon (Mr. HATFIELD) and the Senator from Utah (Mr. Moss) be added as cosponsors.

Also, I ask unanimous consent that at the next printing of S. 278, a bill to control shoreline erosion, the name of the Senator from Michigan (Mr. GRIFFIN) be added as a cosponsor.

I also ask unanimous consent that at the next printing of S. 77, the Mined Lands Restoration and Protection Act, the name of the Senator from Illinois (Mr. STEVENSON) be added as a cosponsor.

The PRESIDING OFFICER (Mr. STEVENSON). Without objection, it is so ordered.

S. 1311

At the request of Mr. PEARSON, the Senator from Massachusetts (Mr. BROOKE) and the Senator from Minnesota (Mr. HUMPHREY) were added as cosponsors of S. 1311, the Newsmen's Privilege Act of 1971.

S. 2097

At the request of Mr. PERCY, the Senator from Delaware (Mr. BOGGS) and the Senator from Wyoming (Mr. HANSEN) were added as cosponsors of S. 2097, a bill to create a Special Action Office for Drug Abuse Prevention in the Executive Office of the President.

S. 2223

Mr. BYRD of West Virginia. Mr. President, at the request of the distinguished Senator from North Dakota (Mr. BURDICK), I ask unanimous consent that his name be added as a cosponsor of S. 2223, a bill to amend the Consolidated Farmers Home Administration Act of 1961, and for other purposes.

The PRESIDING OFFICER (Mr. STEVENSON). Without objection, it is so ordered.

FEDERAL ELECTION CAMPAIGN ACT OF 1971—AMENDMENT

AMENDMENT NO. 238

(Ordered to be printed and to lie on the table.)

INDEPENDENT ELECTIONS COMMISSION

Mr. PEARSON. Mr. President, I offer an amendment to the campaign finance reform bill (S. 382) recently reported out of the Rules and Administration Committee.

Before doing so, however, I want to commend the Rules Committee and the Commerce Committee for reporting a bill that goes far toward meeting the problems posed by current campaign practices. I have long believed that these practices are a blight on our political system. The cost of effective campaigning has soared beyond all reasonable bounds. The money poured into campaigns has more than doubled over the past decade, but the percentage of popular participation in elections has actually declined. In effect, elective office today is practically closed to the citizen of modest means, unless he is willing to put himself in debt to wealthy donors. The situation cries desperately for reform.

Early this year I offered, with my colleague Senator GRAVEL, a bill that I thought would remedy these failings. The bill now before us differs in several respects from what I then proposed, but I think it nonetheless attacks the problem usefully, and I hope that the Senate will approve it.

S. 382 would lower media rates for political advertising during a campaign period. It would impose spending limits on selected media, and it would require full and frequent disclosure of campaign receipts and expenditures. These are strong provisions. If enforced, they would stand as the landmark reforms of this Congress.

But that little phrase "if enforced" is a crucial one. Enforcement, in my judgment, is the essential element in campaign reform. History vividly illustrates this fact. Campaign finance regulation has been on the books since 1925. But the enforcement of law has been so consistently and notoriously weak that its authority and purpose have been forgotten. I hope we can learn something from our past mistakes.

What does effective enforcement require? It requires the clean delineation of procedures to be followed once a violation is detected. S. 382 does this. But above all it requires the establishment of an entity to carefully and diligently ferret out violations of law, an agency that can be counted on to follow up these violations without regard to partisan considerations. In the field of campaign finance, laden as it is with partisan overtones, these are not easy requirements to meet. In order to give credibility to this legislation we must insure that its enforcement agency is clearly free of political influence.

S. 382 would establish a registry in the General Accounting Office for this purpose. This approach is an improvement over the present practice of leaving enforcement responsibility with the Secretary of the Senate and the Clerk of the House. But reestablishment of pub-

lic confidence in the electoral process demands a truly independent means of recordkeeping, disclosure, and enforcement. This task cannot be accomplished with full public confidence if it is assigned to employees of the Congress or even to an agency that is an arm of the Congress. It must be completely independent.

Mr. President, I draw the Senate's attention to a letter from the Comptroller General to the distinguished chairman of the Commerce Committee, Mr. MAGNUSON, an excerpt of which is included in the Rules Committee report. In it, the Comptroller General states:

It is the position of the General Accounting Office that we should not be given the responsibility for any audit, investigative and enforcement duties in connection with campaign fund reporting. We consider that the effectiveness of our Office depends in large measure upon a reputation for independence of action and objectivity of view. Not only must we remain free from political influence, but we must zealously avoid being placed in a position in which we might be subject to criticism, whether justified or not, that our actions and decisions are prejudiced or influenced by political considerations. We are, therefore, apprehensive of any measure that might place us in a position where we might be subject to such criticism, the inevitable result of which would be a dimunition of congressional and public confidence in our integrity and objectivity.

Because our relationship to the Congress closely resembles that of principal and agent, we especially wish to avoid being placed in the anomalous situation of having to investigate and report on our principal. Over the years this Office has had frequent and recurring associations with many of the various committees of the Congress as well as with many of the individual members thereof. Our relationship has been most harmonious. However, we are fearful that the relationship would be severely impaired were we required to investigate, inquire into, and report on individual members of the Congress concerning campaign funds and expenditures.

We agree that there is a need for legislation relating to the disclosure and financing of Federal election campaign costs, but strongly recommend that the administration of any legislation in this area not be placed in the General Accounting Office.

Clearly, Mr. President, GAO should not bear this heavy responsibility. The head of GAO even is opposed to it. These policy decisions must be made by persons completely free of employer-employee relationships.

My amendment would establish a five-man Federal Elections Commission with members serving 10-year terms so staggered that a new member would be appointed by the President with Senate approval every 2 years. No more than three members of a single political party could serve on the commission simultaneously. The commission would be required at specified times to compile and publish reports on campaign expenditures and receipts, grouped in categories that would facilitate public scrutiny. It would issue a campaign bookkeeping manual and establish uniform accounting and reporting procedures. It would have the power to investigate charges of illegal activity in Federal campaigns and to subpena evidence. And it would report possible violations of law to the Justice Department for action.

Mr. President, it should be clear that an independent commission is better suited to this task than a registry in the GAO. GAO performs too many other important and delicate functions to be exposed to the occasional squalls of abuse and controversy that will inevitably beset any agency that presides over campaign finance. The enforcement agency should stand on its own, bearing the full consequences of its decisions.

Mr. President, I urge the Senate adopt this amendment. It would give needed muscle ot the important provisions set forth in S. 382. It would dramatize our determination to depart from past practices. It would lend credibility to our announced intent to open political campaigns to objective scrutiny. And it would constitute an important step toward the kind of responsive government we all seek.

NOTICE CONCERNING NOMINATIONS BEFORE THE COMMITTEE ON THE JUDICIARY

Mr. HRUSKA. Mr. President, the following nominations have been referred to and are now pending before the Committee on the Judiciary:

Gerald E. Murch, of Maine, to be a member of the Board of Parole for the term expiring September 30, 1977.

Maurice H. Sigler, of Nebraska, to be a member of the Board of Parole for the term expiring September 30, 1972, vice Walter Dunbar, resigned.

William T. Woodard, Jr., of North Carolina, to be a member of the Board of Parole for the term expiring September 30, 1977.

On behalf of the Committee on the Judiciary, notice is hereby given to all persons interested in these nominations to file with the committee, in writing, on or before Thursday, July 15, 1971, any representations or objections they may wish to present concerning the above nominations, with a further statement whether it is their intention to appear at any hearing which may be scheduled.

HEARINGS ON JUDICIAL DISQUALIFICATION

Mr. McCLELLAN. Mr. President, on behalf of Mr. BURDICK, chairman of the Judiciary Committee's Subcommittee on Improvements in Judicial Machinery, I wish to announce hearings for the consideration of S. 1553 and S. 1886 pertaining to judicial disqualification.

The hearing will be held on July 14, 1971, beginning at 10 a.m. in room 6202, New Senate Office Building.

Those who wish to testify or submit a statement for inclusion in the record should communicate as soon as possible with the Subcommittee on Improvements in Judicial Machinery, room 6306, New Senate Office Building (extension 53618).

ADDITIONAL STATEMENTS

THE FOLLY OF MILITARY AID TO PAKISTAN

Mr. McGOVERN. Mr. President, when the conflict in East Pakistan broke out, I urged that the United States remain strictly neutral while insuring that humanitarian services were provided to those suffering from the ravages of war and the preceding cyclone.

Assurances were given by the Government that the United States was not providing military aid to Pakistan because of the freeze that had existed even before the outbreak of the conflict on March 25. Now we see that our economic aid continues to favor one side against the other and that we have actually decided to send military assistance to the Pakistan Government.

This decision is incredible. We have not learned the lesson of Vietnam, if we insist on taking sides in another Asian civil war.

We are mistaken to provide military aid to either side and to provide economic aid only to one side.

And the administration is once again misleading both the Congress and the American people, by first saying that it will not provide military assistance and then, when the initial expression of public interest has passed, agreeing to provide such aid.

Mr. President, I ask unanimous consent that an editorial "Helping To Kill More Bengalis" from the Washington News of June 30, an article "Death in 'Golden Bangla Desh'" from the New York Times of May 20, and my own statement of April 9 be printed in the RECORD at this point.

There being no objection, the material was ordered to be printed in the RECORD, as follows:

[From the Washington Daily News, June 30, 1971]

HELPING TO KILL MORE BENGALIS

The Administration's decision to send more economic and military aid to the brutal, repressive regime in Pakistan is as shortsighted as it is inhumane.

The testimony before Congress, the State Department admitted its fear that shutting off the flow of arms to Pakistan would be resented "as sanctions and intrusion."

What, we ask, is so bad about sanctions against mass murder and genocide? For that is exactly what the West Pakistani-dominated army committed against the helpless Bengalis of East Pakistan.

In its treacherous attack starting March 25, the Pakistani army slaughtered 200,000 Bengalis and sent six million refugees fleeing for their lives into India. It is morally unjustified to send more weapons to such a regime.

With its talent for justifying the unjustifiable, the State Department explains that halting economic aid would remove our "leverage" with Pakistan—altho we have almost no leverage now.

Also, stopping our arms shipments would cause Pakistan to turn to other suppliers, like communist China. However, the department admits that China has never stopped furnishing weapons to Pakistan.

Sen. Edward M. Kennedy, D-Mass., has called all this "doubletalk, incompetence, or both"—and he's right.

Our partners in the international effort to prevent the Pakistani economy from collapsing are not as timid as the United States. The World Bank, Britain, Canada, Belgium and others favor withholding economic aid until the military regime reaches a political settlement with East Pakistan.

But not the United States.

Pakistan is, of course, desperately poor and can use all the help it can get. But the trouble with aid now is that it props up the

government and helps it maintain the army of occupation in East Pakistan.

The Bengalis in the east voted overwhelmingly for home rule in the only free election in Pakistan's history. Instead they got the genocidal assault by the western army, which is still shamefully going on.

History suggested, however, that West Pakistan from 1,000 miles away cannot forever subjugate the Bengali people. What we are doing by sending arms to Pakistan is to make sure the Bengalis will remember that American weapons murdered them during the birth pangs of their beloved Bangla Desh (Bengali nation).

[From the New York Times, May 20, 1971]

DEATH IN "GOLDEN BANGLA DESH"

(By Homer A. Jack)

KARACHI, PAKISTAN.—Poet Rabindranath Tagore wrote many years ago: "I love you my golden Bangla Desh. . . . O Mother, during spring the fragrance of your mango groves maddens my heart with delight . . ." This spring there is only the stench of death in the mango groves of East Pakistan/Bangla Desh as many hearts are maddened by massacre.

Firm figures of massacre in East Pakistan, as anywhere, are hard to verify. Some say thousands, others insist on two hundred thousand. Probably 50,000 is a conservative estimate. Numbers of refugees are more obtainable: 650,000 in four Indian states on May 1.

The refugees from East Pakistan insist that those massacred were Bengalis—Moslems, Hindus, Buddhists, Christians living in East Pakistan who were systematically eliminated by the Pakistan Army immediately after March 25 when negotiations for the autonomy of East Pakistan broke down. The West Pakistanis insist those massacred in the "east wing" were Biharis—Moslems originally from Bihar and other Indian states who migrated to East Pakistan after partition but had not yet been absorbed into the Bengali culture.

A visitor to Karachi finds the Pakistan economy going downhill, martial law declared in the West and East, and a Government desperately trying to show a return to normalcy among the 75 million people in East Pakistan. All in Karachi are deeply upset about the massacre of the Biharis, not by the army, but by some members of the autonomy-cum-secessionist Awami League; however, almost all deny any massacre of the Bengalis by the army.

West Pakistanis feel the whole situation is an Indian plot—Indian "infiltrators" (soldiers without uniform), Indian ammunition, even Indian (not Pakistan) refugees—aided by a few "antistate elements."

A visitor to Delhi finds an India united as seldom before in recent history with the people pressing Prime Minister Indira Gandhi to recognize Bangla Desh (the independent state of East Bengal) and to give the "freedom fighters" arms. The Indian press emphasizes the massacre of Bengalis. India is obviously taking every political and psychological advantage of the situation, yet so far is acting with great restraint.

In Calcutta and especially at the border, one sees thousands of recent refugees—only one-quarter in camps. Optimistic cabinet ministers of the Bangla Desh Government plead for recognition and arms. Refugees show how West Pakistan has treated East Pakistan as an internal colony for 2 years. They feel their country can no longer remain as part of an integrated, two-wing Pakistan since the events of March 25.

Sheik Mujibur Rahman's Awami League won 98 per cent of the seats for the National Assembly in East Pakistan during the first national election since independence in 1947. Sheik Mujib campaigned on a six-point platform calling for autonomy, not secession. Apparently the military rulers of Pakistan, aided by the powerful bureaucracy and some industrialists, refused to submit to this major transfer of power. On March 25 they declared martial law, banned the Awami League, arrested Sheik Mujib, and their army began the massacre. Before and after this army action, some elements in East Pakistan apparently indulged in their own massacre in this seldom nonviolent subcontinent.

Why the unconcern about East Pakistan in the U.S., the U.N. and the world? Are Americans unconcerned merely because Moslems are again killing Moslems and, in any case, no white Americans are involved? Or because, for once, no ideology appears involved, at least not Communism? Or are Americans unconcerned because East Pakistan could easily become a second Vietnam?

Why the unconcern at the U.N.? In an era of norms against genocide, are events in East Pakistan merely an "internal" matter and not a clear violation of the rights of man? Is this situation still "domestic" if it endangers the peace of the world, with Indian and Pakistani armed incursions into each other's territory, not to mention possible intervention by the big powers?

Why the unconcern from the nonaligned nations? Does each nation have its own Bangla Desh in its belly? Can no process be devised by the international community to face squarely the "autonomy plus" of peoples in the 1970's, so a people, such as the East Bengalis—separated by language, culture, and one thousand miles—can opt for freedom if it is truly a free choice?

Bangla Desh struggles to be born. The green and red flag, with an outline of the country's borders in gold, flies over the headquarters of Pakistan's former deputy high commissioner in Calcutta. And the "freedom fighters have adopted Tagores song for their national anthem: "I love you my golden Bangla Desh . . .

Will the U.S., the U.N. and the world do nothing?

STATEMENT OF SENATOR MCGOVERN

The warfare and violence in East Pakistan is a new source of concern for an already troubled world. From the information available, it appears that a full-scale civil war, likely to last for some time, is now underway.

I urge that the United States government refrain completely from intervening in the war between the Pakistan forces and those of Bangla Desh. The embargo on the sale of arms and military supplies to Pakistan, in effect since 1965, should be maintained in force without any exceptions.

Economic assistance cannot be provided to only one side. Our government should work to insure that our economic aid can continue to reach the people in both West Pakistan and the area known as Bangla Desh. If this proves impossible because of the unwillingness of the authorities in control of any region to permit the free flow of such aid, then I ask that the U.S. Government suspend all such economic assistance.

The complete suspension of economic aid would be a tragedy for the people in the Bangla Desh area who were the victims of the recent cyclone. They desperately need housing materials, food and medical supplies. Undoubtedly other people in Bangla Dest require food and medical supplies. I hope that such assistance could be channeled to those in need through the International Red Cross or through CARE and the Catholic Relief Services, which, I understand, continue to operate in Dacca.

The lesson that the United States should have learned in the years since World War II and especially as a result of our experience in Vietnam is that we have no right and no duty to intervene in civil wars. But we should use our best efforts to insure that assistance for humanitarian purposes reaches all those in need.

In addition, if the events now taking place in East Pakistan become a threat to international peace and security, I urge that the United States ask the United Nations to give the earliest consideration to steps to end hostilities.

THE DEATH OF DOROTHY KABIS, TREASURER OF THE UNITED STATES

Mr. DOLE. Mr. President, last week the Nation, the Nixon administration, and the Republican Party lost a gracious and charming lady, Mrs. Dorothy Kabis, Treasurer of the United States.

Her untimely death last Saturday has deprived America and the administration of a devoted public servant who was widely admired for the ability and energy she brought to her job. Her pleasant personality and talent for working with people will be missed by all with whom she had dealings in Government.

Her death is also a great loss to the Republican Party and particularly the Federation of Republican Women which she led as president longer than any other person. Within the party she was warmly regarded by professional workers and volunteers alike, for she was always eager to do whatever she could to promote the best interests of her party and her country. And during her 5 years as head of the Federation of Republican Women she continually strove to unite the party and stimulate its growth among women in every part of the country.

Dottie Elston Kabis, as many of us knew her, was active in a great variety of activities outside the Government and the GOP; she was a member of the Methodist Church, the Grange, and gave of herself generously to many other civic groups.

In this age of heightened interest in the contributions which women can make to the affairs of business, Government, and society, Dorothy Kabis was an outstanding example to women everywhere of the value and importance their participation holds for the Nation.

Her death is a loss to us all.

TAIWAN BUYS VOTES WITH U.S. FUNDS

Mr. McGOVERN. Mr. President, although U.S. policy toward the People's Republic of China is under careful review, we are at the same time giving the Chiang Kai-shek regime millions of dollars each year to buy votes to keep its seat in the United Nations.

The essence of the arrangement is that Taiwan offers foreign assistance to third countries, mostly in Africa, using funds generated by our Public Law 480, or Food for Peace program. Taiwan gets the credit—and support for its effort to keep Peking out of the United Nations—and the United States foots the bill.

The program, called "Project Vanguard," was initiated in 1967, even though we ostensibly ended economic assistance to Taiwan, with great fanfare, in 1965. Under the agreement concluded in 1967, the United States sells farm commod-

ities to Taiwan on a concessional basis and accepts local currency in payment. But then 50 percent of the funds are turned back over to Taiwan, and are used to supply agricultural assistance to some 23 African nations.

Through this setup, the United States paid 75 percent of the cost of Taiwan's Vanguard program—or about $18.2 million—in fiscal years 1968 through 1970. In January of this year we signed a new agreement with the same basic provisions, except that Taiwan's own contributions are expected to rise somewhat. At least half of our Food for Peace funds will still be left at Taiwan's disposal.

This cozy arrangement is an obnoxious perversion of the Food for Peace program. It involves the United States in international bribery. Certainly it cannot be reconciled with a sincere interest in resolving the United Nations issue or in encouraging the People's Republic to assume her proper place in the world community.

The administration should move immediately to end this strange form of assistance to the Chiang Kai-shek regime.

PROBLEMS IN THE MIDDLE EAST

Mr. PACKWOOD. Mr. President, I have just returned from a trip to the Middle East, where I had an opportunity to view, firsthand, the strategic areas in and around Israel. For this reason, I was shocked to learn this morning that two persons had been killed and 30 wounded by Arab rockets just after my departure.

This heinous act is further evidence that the United States must not impose a solution on the Middle East. The Arabs and Israelis must be left alone to work this out. Israel's unique geography makes it imperative that any settlement be designed to safeguard its interests.

The lesson that Vietnam should have taught the United States is that this Nation is neither omnipotent nor omniscient in the world. The day has passed when we could make it our business to impose American solutions on every problem area in the world. While our dynamic, fast-moving history has conditioned us to quick solutions, in the realm of foreign affairs quick solutions often spell disaster.

We should be willing to supply—without fanfare—the Israelis with sufficient weapons to enable them to provide for their own defense. But we should not have to start every year by debating this question anew. The time has come for us to make a firm commitment of continuing assistance to Israel—a commitment which will enable this little democratic nation to survive.

Mr. President, I ask unanimous consent that an article about the latest Arab shelling of Israel, published in this morning's Washington Post, be printed in the RECORD.

There being no objection, the article was ordered to be printed in the RECORD, as follows:

ROCKETS HIT ISRAELI CITY, KILLING TWO

TEL AVIV, July 7.—Arab-launched Katyusha rockets ripped into the Tel Aviv suburb of Petah Tikva tonight, killing two persons and wounding 30 others, Israeli police reported.

A hospital for the chronically ill received a direct hit, and other rockets fell in a schoolyard, the radio said.

A police spokesman said three or four rockets fell on the town of 15,000, which is about six miles east of here.

[In Beirut an Arab commando spokesman said that Jordanian tanks and armored cars tried to force their way into Palestinian commando positions in northern Jordan tonight and opened heavy fire on a refugee camp in the area.

[The spokesman said it was the third time the army had tried to force its way into commando positions during the day and added that heavy shelling was continuing late tonight.]

The rocket attack was the first in the area—Israel's most densely populated—in years, and the first guerrilla incident in the region since last November, when two bomb blasts in Tel Aviv's central bus station killed one person and wounded more than 20 others.

Today's attack occurred at 10:30 p.m. local time (4:30 p.m. EDT.)

One rocket crashed into a hospital for the chronically ill, most of whose patients are elderly. Others hit nearby buildings, including a house where a 5-year-old girl was killed.

Petah Tikva lies within rocket range of the Israeli-occupied West Bank of the Jordan River captured by Israel during the Six Day War of June, 1967.

Defense Minister Moshe Dayan, who often flew helicopters to the scene following an outbreak of violence, was reported to have visited both the hospitals where the injured were taken, arriving within about two hours of the attack.

Dayan told newsmen it was impossible to prevent such a shelling. He said all Arab West Bank villages within range of the suburb had been placed under an immediate curfew.

[Earlier today the commandos accused Jordanian troops of intercepting one of their groups returning from an operation in Israeli-occupied territory in the Nazar area, near the northern Jordan City of Irbid.

[Later a spokesman accused Jordanian troops of shelling all commando positions in northern Jordan and a refugee camp in the area for three hours at noon today.

[He said the Gaza Camp was "isolated from the world" and added that a child was killed by the Jordanian shelling.

[In a final statement tonight the commando spokesman said that tanks and armored cars had tried for the third time to force their way into commando positions and that shelling was continuing.]

THE PENTAGON PAPERS

Mr. McGEE. Mr. President, few people in the Nation have rationally assessed the impact of the publishing of the Pentagon Papers by the New York Times. Fewer people have rationally assessed the future ramifications of this action and the possible consequences it has for the world as a whole. But one man, who has done just this, offers some very disturbing views which cut through the emotionalism surrounding the publication of this admittedly biased 47-volume study and confronts us all with some very stark realities.

On Tuesday of this week, a lengthy article on an interview with Dr. Walter W. Rostow was published in the Summer Texan, a University of Texas student newspaper.

Dr. Rostow, whom I hold in the greatest esteem, points out what really is a stake in the world at this moment in history. A very delicate balance is being maintained and this balance must be pursued if true world peace is ever to be achieved.

Dr. Rostow assesses the flaws, not only in the Pentagon Papers themselves, but also the conclusions drawn by the New York Times concerning these papers.

A very gifted individual has presented us with his views which hold ominous tones for the future.

I, therefore, ask unanimous consent that the article be printed in the RECORD.

There being no objection, the article was ordered to be printed in the RECORD, as follows:

ROSTOW BLASTS TIMES FOR MISLEADING PUBLIC: DOCUMENT CITED AS PARTIAL EVIDENCE

(Editor's Note: The following is an interview with Walt Rostow, who served as a special assistant for national security affairs under President John F. Kennedy, chairman of the Department of State's Policy Planning Council from 1961–66 and as special assistant on Southeast Asia to President Lyndon B. Johnson from 1966–69. Dr. Rostow teaches at the University.)

(By Ann Bennett and Miles Hawthorne)

Walt W. Rostow, professor of economics and history, in an interview Thursday accused The New York Times of misleading the American public with its analysis of the controversial Pentagon papers, a study commissioned during the Johnson Administration by then-Secretary of Defense Robert McNamara.

The study is an analysis of U.S. involvement in Southeast Asia from World War II to mid-1968 and includes 4,000 pages of official documents.

The Pentagon account, Rostow said, "is an uneven report based on partial evidence lacking the most critical evidence, that is, the President's mind, his consultations with his leading advisers and his consultation with the congressional leadership.

"But the worst of it, in my judgment, is what The New York Times did in its first three articles. It proceeded from this limited evidence to draw conclusions which are in no way warranted by the evidence itself."

He added that the first three articles in The Times series by Neil Sheehan "will be studied in journalism schools as a classic example of the distortion in the relationship between headlines, lead writing, editorials and evidence."

Rostow pointed out that The Times makes essentially three charges dealing with policy in 1964 and 1965.

The first was that in 1964 President Johnson planned to increase the number of U.S. troops in Vietnam to enlarge the American role in the war but concealed his plans.

"But the evidence itself shows that what happened in 1964 was simply that normal contingency planning was conducted," Rostow said.

"When I came down to Washington with President Kennedy in January of 1961, there already existed a major contingency plan should we have to fight to honor the SEATO treaty, known as SEATO Plan 5, and that plan was under constant revision."

Rostow said, in his opinion, the first "great technical journalistic error" made by The Times was "to mistake routine contingency planning . . . for decisions of the President."

The second charge in The Times articles "which was blazoned in headlines was that a consensus was arrived at in September (1964) to bomb North Vietnam and that this was held because the President wanted to await the election."

He explained that although the date in The Times was wrong, "there was a meeting held in September on the subject and the conclusion of that meeting was against

bombing. What they did decide was that they would make a contingency plan in case there were major attacks on U.S. units in Vietnam or special attacks on the South Vietnamese."

Concerning the third charge that Johnson concealed his decision to put major U.S. troop units into Vietnam in April, Rostow said, "The decision in April was to enlarge the protection of the DaNang air base by putting in two Marine battalions plus some logistical forces. This was not announced for security reasons until the troops were in place, when a routine announcement was made."

It is this April troop commitment that is often referred to as the point of no return in the U.S. involvement in Southeast Asia, the point at which the United States began the shift from a defensive to an offensive position.

Rostow said the change in mission was "simply that the American forces would be permitted to go out and rescue a South Vietnamese unit within 50 miles of the base if it was in trouble. This was simply to put more distance between the Communist forces and the base, and it was not a change of policy. The basic decision on troops came at the end of July 1956, and it was fully revealed by Johnson.

"I think that if you simply take The New York Times or any other reputable reporting of that period, you will find that the American people were extremely well informed of what was going on, of the debates in the Administration, of the choices being made."

The fundamental question that must be asked about the Pentagon papers and The Times articles, Rostow said, is "did the President, as reported in the New York Times of 1964–65 mislead the people, or did the New York Times of 1971 mislead the people as to how they were informed of that period."

In reference to the Pentagon report, Rostow said, "I'm afraid our obsession with all these papers and what they contain, which they don't, will weaken us at a moment when our eyes should be fastened on the possibilities for peace: the SALT talks, the Middle East and the opportunities opened up by the new mood in Peking. We need a strong, purposeful America to translate these possibilities into solid agreements.

"Right now we look like a stumbling giant. And I'm afraid that we'll encourage the hawks in Moscow and Peking, Cairo and Hanoi.

"I'm not predicting any catastrophes because of these papers, but I do think we are in danger of diminishing the chances for bringing the world a lot closer to a stable peace," he added.

Rostow explained that he feared this "period of self-flagellation" over the contents of the Pentagon study might push the nation toward isolationism which "could lose us the greatest opportunities for moving towards peace since the end of World War II."

He said, "If we pull out of Asia and tear up our pact . . . I find it very hard to believe that India and Japan will not go nuclear, and if they do I don't see how other countries will avoid it. The whole nonproliferation treaty is at stake.

"What we want is a balance in Asia in which no single power out there dominates. This is why Asian regionalism is so important—that is to say, the collaboration of Japan, Korea, Australia and all the others—because if they work together they will be able to form not a hostile bloc against China but a body of people and nations which will not tempt China—will balance China."

When asked about the "domino theory," a phrase coined during the Eisenhower Administration referring to a concept whereby the fall of South Vietnam would result in the Communist takeover of the rest of Asia, Rostow said, "This wasn't a theory—it almost happened."

As an illustration, Rostow read from a speech he had presented before the Global Strategy Discussions at the Naval War College in June. He said the "panorama of Asia in 1965" included South Vietnam "on the verge of defeat and takeover; Indonesia in confrontation with Malaysia, out of the United Nations, making common cause with Peking, eager to complete what both Djakarta and Peking described as a 'pincer movement' to take over the whole of Southeast Asia . . .; and a Peking official proclaiming that 'Thailand is next.'"

The Times articles reveal that Johnson asked the CIA about the credibility of this theory to which the agency replied that "with the possible exception of Cambodia, it is likely that no nation in the area will quickly succumb to communism as a result of the fall of Laos and South Vietnam."

Rostow said this statement did not constitute a rejection of the domino theory, but merely that it "was not certain that Thailand would fall immediately.

"If you ask me did I and do I believe that the fate of all Southeast Asia is at stake in the struggle in Vietnam and in the viability of the American commitment to Thailand and to Southeast Asia, my answer is yes, I do."

He explained that the Russians and the Chinese, "given their interests," would be unable to ignore the vacuum he believes would be created by an American withdrawal from Southeast Asia.

"Then when they move, after they have committed themselves, the American people will realize the danger, and then we'd come roaring back late and convulsively and, quite possibly, in a nuclear environment.

"But," Rostow continued, "the fundamental question to me is whether Asia matters to the U.S. I think it does—I believe that it will matter increasingly."

He then explained what he calls the "Atlanticist view," which he believes is at the core of most anti-Vietnam war sentiment.

"People in effect say, 'all this pain we're taking is not worth it for those brown devils out there—they're not that important.

"The future of Asia will be at least as important in your lives and in your children's lives as Europe. Now I think that if you strip away a lot of the passion of the debate on Vietnam this issue is down at the bottom," he said.

Looking back on the policy decisions of the early '60's, Rostow said, "I think the greatest mistake was that the U.S. did not insist immediately, with whatever force was required, on the enforcement of the Laos Accord of 1962."

It was the North Vietnamese continued infiltration through southern Laos and the presence of their forces in northern Laos in violation of the agreement, he explained, that led to air operations in 1964 involving U.S. planes supporting Laos forces, trying to keep the North Vietnamese out of the heavily populated Mekong Valley. These included pilots of Air America, a pseudo-private airline run by the CIA. "These operations (known, according to the Times, as Plan 34A) were undertaken to harass the North Vietnamese guerillas who were infiltrating South Vietnam," Rostow said.

The 34A operations, the Times reports, included flights over North Vietnam by U–2 spy planes, kidnaping of North Vietnamese citizens for intelligence information, parachuting sabotage and psychological warfare teams into the North and commando raids over North Vietnam and Laos.

The Times reported that Operation 34A and the Tonkin Gulf incident in August, 1964, resulted in the suggestion of a policy to provoke the North Vietnamese.

The Tonkin incident, involving an attack by North Vietnamese PT boats on the American destroyers *Maddox* and *C. Turner Joy*, the Pentagon study reports, was "an important threshold in the war," resulting in U.S. reprisal air strikes with "virtually no domestic criticism."

Sheehan wrote, "The study makes it clear that the physical presence of the destroyers provided the elements for the Tonkin clash. And immediately after the reprisal air strikes, the Joint Chiefs of Staff and Assistant Secretary of Defense John McNaughton put forward a 'provocation strategy' proposing to repeat the clash as a pretext for bombing the North."

According to Rostow, the "provocation strategy" was "simply some staff fellows scratching their heads about whether we should have such a policy.

"But I assure you, there wasn't," he added.

"What happened was that in the time of President Kennedy, in the face of infiltration from the north, raids were begun on the North to harass them."

He added that the Tonkin Gulf incident was totally independent of these raids. "Those fellows were not sent up there (the Turner Joy and Maddox) for any other purpose than to gather electronic intelligence in international waters—just the way the Russians do, we do and other people do."

When asked how long he thought the U.S. economy could support the war in Southeast Asia, Rostow replied, "It has never been an economic problem at home. The peak cost was $25 billion—that was out of a near trillion-dollar economy and now it's way down—$16 or $17 billion.

"There are plenty of reasons for trying to get the war over, but I don't think the economic one is fundamental."

Of the use of defoliants in the war, he said, "South Vietnam has had the largest harvest in its history this year. This is not a country that has suffered an ecological disaster. The criticism of their use is grossly over-done."

Reviewing the last decade, he commented, "Although the nations and peoples of Asia have gathered strength, they will require a diminishing level of American support.

"The anxiety in Asia is that we will pull out too fast. I know of no Asian leader who does not believe that if we withdraw our commitments prematurely to the SEATO treaty, that the whole area, down to Singapore and possible Indonesia, will lose its independence."

When asked how he felt about his involvement in the war, Rostow said he saw his role in the policy-making as "Not very important. President Kennedy's views on Asia were formed independently of mine. I am grateful and proud that I could work with President Johnson from 1966 on. But again, I believe his views were formed independently of mine."

FREEDOM FLIGHTS FROM CUBA TO THE UNITED STATES

Mr. DOLE. Mr. President, one of the great landmarks to man's individual freedom in the history of the world is to an All-Volunteer Armed Force.
United States.

Seldom in the history of the world has one nation done so much for the individual freedom of so many, selflessly and without ulterior motive.

Therefore it came as a shock to many of us that in the name of economy and jobs an effort was being made to end these flights, even though there are about 40,000 more Cubans who have signified that they prefer freedom in the United States to paradise in Castro's Communist Cuba.

Mr. President, there is no way in the world to equate money or material things with freedom. Any man who has once

lost his can tell you that. Last year, in one of the great moral blunders in our history, we turned an escaped refugee sailor back to his Russian masters. The shame of that deed will linger a long time.

Now, multiply that, if you will, by 40,000, because the proposal, in the name of jobs and economy, was a proposal to condemn 40,000 freedom loving men and women to lifetimes of slavery. Who, here, is willing to participate in such a deed.

Mr. President, much has been said about the freedom airlift, much has been said about how the Cuban refugees have integrated into American life; there is little I can add.

But I can urge those who first presented the amendment, which was later withdrawn, to reconsider. Our country was founded and has been built on one foundation—freedom. The torch of freedom in New York Harbor has beckoned millions to these shores.

Symbolically that torch shines brightly in Florida today for those 90 miles away who know what it is to be denied freedom.

Mr. President, I hope that this Chamber will never put money ahead of freedom and that no man who seeks to be free will be turned from these shores because he could not, and would not, pay the price.

If such happens, Mr. President, the loss to the heart and the soul of America would be more than free Americans could ever regain. And we would be a smaller country and a lesser people for it.

ECONOMICS, FREEDOM, AND THE DRAFT

Mr. McGOVERN. Mr. President, the selective service legislation remains before Congress. I continue to believe that the best course for Congress would be the complete transfer from conscription to an All-Volunteer Armed Force.

As Senators well know, the case for an All-Volunteer Armed Force was made by the Gates Commission. Robert Eisner, a professor of economics at Northwestern University, has written a perceptive and compelling review of the Gates Commission report for the publication Public Policy.

Mr. President, I ask unanimous consent that the review by Professor Eisner be printed in the RECORD.

There being no objection, the review was ordered to be printed in the RECORD, as follows:

REVIEW ARTICLE: ECONOMICS, FREEDOM, AND THE DRAFT

(By Robert Eisner) *

"The question then will amount to this; whether it be just in a community, that the richer part should compel the poorer to fight for them and their property for such wages as they think fit to allow, and punish them if they refuse?" Benjamin Franklin [1]

The Report of the President's Commission on an All-Volunteer Armed Force is a sober, well-balanced presentation of the view that elimination of the draft is feasible and desirable, along with a set of concrete recommendations on how to accomplish this end in the immediate future. While the auspices of a president committed in principle to elimination of the draft might have led us to expect such a report, it is noteworthy that the recommendations of the Commission, under the chairmanship of Thomas Gates, former Secretary of Defense, and consisting of a wide variety of generally conservative and distinguished civilians and former military leaders, were unanimous.[2]

The Commission calls for a basic pay increase amounting to $2.68 billion and other increases in budget expenditures for proficiency pay, reserve pay, additional medical corps expense, and recruiting, ROTC and miscellaneous costs, bringing the gross budget increase to $3.24 billion. Of this, $540 million would be recovered in federal income tax collections, thus implying a net cost to the Treasury of $2.7 billion. Assuming provision of these additional funds to be effective July 1, 1970, the Commission envisioned transition to an all-volunteer force by July 1, 1971. The increased budget costs would relate mostly to raising the basic pay of military personnel in the first two years of service from $180 a month to $315 a month or, including total compensation, from $301 a month to $437 a month. Total compensation of officers in their first two years would be raised from $717 a month to $869 a month. In addition, the Commission would "make comprehensive improvements in conditions of military service and in recruiting" and would "establish a standby draft system by June 30, 1971 to be activated by joint resolution of Congress upon request of the President."

President Nixon is quoted as saying, "We have lived with the draft so long that too many of us accept it as normal and necessary" (p. 11). Yet, as we are reminded, the draft does not have a long tradition in our history as a free nation. The federal government never employed conscription in peacetime or in any war until the Civil War. Then, instituted relatively late, the draft resulted in major riots and accounted for only a tiny proportion of the armed forces actually engaged in that combat. Indeed, it was not until 1917 and World War I that conscription ever became a major source of our armed forces. Immediately after World War I the draft ended and we returned to all-volunteer, and very small, armed forces. A new draft law was enacted in 1940 after the beginning of World War II but was allowed to lapse after the end of that war, only to be succeeded, after some interval, by our first peacetime conscription, in 1948. As we approach our 200th anniversary as a nation, therefore, we find that over little more than a quarter-century have we ever raised any of our armed forces by conscription and, indeed, over most of that period most of the armed forces were volunteers.

If ample support for the draft is not to be found in our historical traditions—there is even some hint in the Commission's report that its constitutionality, at least in peacetime, was accepted on the basis of rather thin precedent, and one may wonder how a "strict constructionist" Supreme Court might decide the matter—its economic rationale is virtually nonexistent. The simple fact is that conscription or "slave labor" is not an efficient way to run a business. Arguments that the draft costs less money or, conversely, that volunteer forces would cost more, are readily seen to involve a confusion between budgetary costs and real costs to the economy. "Conscription is a tax," the report points out, and a most inequitable tax at that. It is actually a tax in kind, which may be viewed, as the Commission puts it, as "the difference between the pay that the inductee or reluctant volunteer actually receives as a first-term serviceman and the pay that would be required to induce him to enlist" (p. 25). This tax in kind is no less real and frequently more onerous and inequitable than the justly abhorred tithes and the *corvée* to work on the roads and other public works which finally disappeared in the Western world with the French revolution. The Commission estimates a total implicit tax on draftees and draft-induced volunteers of $2.0 billion, implying an average tax rate of 48% of the income that draftees and draft-induced enlistees would have earned in civilian life. This compares with an effective tax rate of only 15% of gross income for civilians earning *comparable income*.[3] Aside from the fact that this is a very high tax rate, it is concentrated arbitrarily on a tiny proportion of the total taxpaying population and, indeed, on only 8% of the male population reaching age 19 each year. We can only argue that taxes are lower with the draft because we ignore this tax in kind. Taxes may indeed be less to the rest of us who are not drafted, but that is because we in effect tax the draftees to pay for their own services.

That the *real* cost of an all-volunteer force would in many aspects be less than can readily be seen. First, of course, by securing volunteers and paying enough so that we could choose those most qualified (and indulging in differential pay where appropriate to get the right person for the right job) we should clearly be able to get men who are better qualified and better motivated for the work at hand than those who are dragged off, in some cases almost literally kicking and screaming, at the whim of local draft boards or by the caprice of chance.

But further, volunteers would be likely to serve longer than draftees. On the basis of initial enlistments alone, volunteers serve three-year terms, whereas we have not found it appropriate to require more than two years of draftees. In addition, those who chose military service of their own free will are much more likely to re-enlist for further duty than those who are forced into the service, and statistics confirm this amply. Since it takes a minimum of six months to train each new serviceman, the longer terms of service and greater re-enlistment of volunteers will imply that (1) a smaller total force will be necessary to have any given "effective" force, past the period of traineeship, and (2) a smaller proportion of trained officers and men will have to be allocated to the training of new recruits. And if in the

---

*The reviewer is indebted to Mark V. Pauly for helpful comments.

[1] Quoted in *The Report of the President's Commission on an All-Volunteer Armed Force* (Washington, D.C.: Government Printing Office, February 1970, xiv +211 pp., paperback, $1.25), p. 24.

[2] Members, in addition to Gates, included Thomas Curtis, Frederick Dent, Milton Friedman, Crawford Greenwalt, Alan Greenspan, General Alfred Gruenther, Stephen Herbits, Father Theodore Hesburgh, Jerome Holland, John Kemper, Jeanne Noble, General Lauris Norstad, W. Allen Wallis, and Roy Wilkins. Wilkins, who missed a number of meetings because of illness, did not sign the report but also endorsed "the basic idea of moving towards an all-volunteer armed force."

[3] The Commission's comparison may be a bit overstated here, as a more appropriate measure of the implicit tax might have been the amount of their civilian income that draftees would have been willing to pay in additional taxes to avoid military service, thus eliminating from our calculations the "income effect" of the higher remuneration that *would have been* necessary to induce them to volunteer. See my review of J. C. Miller III, ed., "Why the Draft? The Case for a Volunteer Army," *American Economic Review*, LVIII (September 1968), esp. p. 953.

armed forces, as in most other organizations, skill and ability tend to increase after the first two years of service, the average capability of more experienced volunteers should be greater than that of relatively less experienced draftees.

Further savings may be expected from the proper attribution of costs that might come from recognizing the true price of military personnel. Economies might run in the direction of substituting machinery, civilians, and women for servicemen whom military planners may prefer when their costs or purchase price are reckoned as $301 a month, the current total remuneration to draftees.

It is the "opportunity costs," what draftees would be earning and producing as civilians, rather than what they are paid as involuntary military personnel, which begin to give a measure of the real cost to the economy of conscripted servicemen. And the total cost to the economy of conscription is really even higher. For every draftee and reluctant volunteer taken out of civilian production there are many other young civilians who are prevented from fulfilling their optimal role in the economy because of the existence of the draft. These would include, for example, large numbers of reluctant students, who avoid military service at a cost of both the livelihood which they might otherwise earn in full-time work and the expenses of educational services that they may not have wanted, may not enjoy, and may not use.

The Commission's report states and "answers" a number of "objections" which have been raised to an all-volunteer force. We have already discussed the matter of cost. Regarding the question of flexibility, it is pointed out that "military preparedness depends on forces in being, not on the ability to draft untrained men" (p. 13), and provision for a standby draft is in any event recommended.[4] On the matter of the danger of developing a powerful military caste, it is explained that shifting to an all-volunteer force would have only a marginal impact on the composition of the services, since most current enlisted men and a very large proportion of officers have been recruited voluntarily; the most pervasive change in moving to an all-volunteer army would be to substitute volunteers for draftees among the very lowest-ranking and least influential first-term enlisted men.

Taking up the touchy issue that an all-volunteer army may become overwhelmingly black, the Commission concludes, after examining enlistment and draft rates, that for the current type of mixed force of draftees and volunteers the proportion of blacks might go as high as 15.1 percent, as against 16.0 percent for an all-volunteer force. On consideration of the preponderance of whites among the population and the higher acceptibility rate of whites for military service (with current and prospective physical and educational standards), the likelihood of a dominantly black volunteer force turns out to be an arithmetical myth. It may be added that the Commission is probably correct in suggesting that its basic recommendation of higher rates of remuneration would be more likely to increase the proportion of white volunteers than of black volunteers since, sadly, for many young blacks, current miserable rates of military remuneration are already higher than civilian alternatives. It may finally be pointed out that, from the standpoint of blacks, serving as volunteers at higher pay will certainly be superior to the current situation in which, whether as draftees or as volunteers, they are paid at rates which would be considered the rankest exploitation anywhere else in our relatively prosperous economy.

The Commission takes up two related if somewhat contradictory objections, that "an all-volunteer force would stimulate foreign military adventures, foster an irresponsible foreign policy, and lessen civilian concern about the use of military forces" (p. 17), and that the higher defense budget necessary to provide for an all-volunteer force would force the Department of Defense to cut back expenditures in other areas or cut back the total forces that will be kept in readiness. The Commission arguments on the latter point may well be quoted:

"The contention that an all-volunteer force is undesirable because it would result in smaller defense forces raises a serious issue regarding the conduct of government in a democracy. Conscription obscures a part of the cost of providing manpower for defense. When that cost is made explicit, taxpayers may decide that they prefer a smaller defense force. If so, the issue has been resolved openly, in accord with the Constitution, and in the best tradition of the democratic process. Those who then argue that too little is being devoted to national defense are saying that they are unwilling to trust the open democratic process; that, if necessary, a hidden tax should be imposed to support the forces they believe are necessary . . ." (pp. 19–20).

The somewhat contrary concern that an all-volunteer force may lead to a more and unduly aggressive foreign policy is perhaps not so easily dismissed. The paradoxical possibility exists that the lesser real cost of volunteer forces will make them more dangerous. One may argue that there will be more inclination to get involved in foreign adventures—as the world's policeman, in common parlance—if we are not inhibited by the immediate cost of a balky and less efficient army of conscripts. The American youth rebellion, clearly at least partially fueled by concern over the draft, may well have something to do with the shift from escalation to de-escalation of our unpopular venture in Southeast Asia. With a volunteer system it may well be possible to find a small minority of the population with a taste for adventure, combat, and perhaps brutality, who would prove a ready instrument of a dangerous and adventurous foreign policy. We have seen them elsewhere, but in the best of nations, after all, there may be some proportion of sadists of storm-trooper mentality. Would a system of self-selection, at what the Commission points out would not necessarily require much greater pay than we have now, result in such a force? Might irresponsible leaders use such a force with relatively little economic cost and with the main body politic relatively unconcerned?

One answer to this question may be that there is no substitute for the responsibility of an enlightened citizenry in a democratic society. Those of us who are concerned less our nation take an imperial road to disaster must look to the democratic process to block that road, and not to the constraints of the tyranny and arbitrariness of conscription somehow to make it sufficiently unpleasant to be avoided. One may wonder, moreover, whether a system of all-volunteer armed forces would not prove a better and quicker signal of the costs, to be matched against the benefits, to be ascribed to activities in which our armed forces might become involved. Indeed, the Commission's report is perhaps understandably silent on some of these matters. It does point out well that the costs of an all-volunteer force would depend substantially upon the size of the force to be maintained. For armed forces of two million men it argues plausibly that, at least in peactime, no increase in budgetary costs would be necessary, although, even for such a force, the rates of remuneration should be raised on grounds of equity. As our force becomes larger, however, costs rise not merely because we have to pay more men but because we have to raise rates more to recruit larger forces. "Thus the net additional budget expense required to maintain an all-volunteer force equivalent in strength to a 2.5 million man mixed force on a stable, continuing basis is about $2.12 billion per year. For the 2.0 million man force the comparable figure is $1.47 billion; for the 2.25 million man force it is $1.74 billion; and for the 3.0 million man force, $4.55 billion" (p. 194).

But what the Commission has neglected to highlight is that an all-volunteer force might well make the budgetary cost a clear function of our foreign and military policies. There would be ample volunteers even at low rates of pay for a small peacetime force. The Defense Department is reported to have argued, however, that at almost no reasonable rate of pay might there be sufficient volunteers to fight our war in Vietnam.[5] (If this is so, what an indictment of our policies!) I can well imagine that, with an all-volunteer force, rates of pay would have to be adjusted as our foreign entanglements changed. The economic costs of dirty and unpopular wars would become readily clear. It is perhaps instructive to hypothesize a free market for volunteers very much like the stock market for capital assets. If supply and demand equilibrated both markets we might find that war scares would drive stock prices down, at the prospect of higher taxes, and the price of volunteers up, at the anticipation of both higher demand and lower supply from young men who are interested in a *peaceful* military career.

One may raise technical questions here and there. How reliable are surveys, which have endeavored to distinguish true volunteers from "reluctant volunteers" who would not have enlisted if they had not faced the more unpleasant imminent alternative of the draft? In using census data of wages and salaries by age of employee in comparing military and civilian compensation by years of service (Table 5–11, pp. 53–55), is truly comparable civilian compensation possibly understated? For unlike career soldiers, civilians with, say, eight "years of service" may include many, with varied work experience, who lack the qualifications to hold on to a single job. And related to these issues, but fundamental to the Commission's recommendations, how reliable are the estimates of elasticities of supply of volunteers? We are promised, in the near future, reports of the technical analyses underlying the conclusion that relatively inexpensive increases in compensation would bring forth large additional numbers of volunteers. The Commission's conclusion here, and its critical review of quite different estimates, in the 1966 Department of Defense study, that an all-volunteer force of 2.65 million men would add $4 billion to $17 billion per year to the defense budget (Appendix C), are persuasive but not unchallengable.

I would argue, however, that these tech-

---

[4] One may wonder whether this is an injudicious concession, contrary to the broader aims and principles underlying the Commission's report. Forcing young men to register every year for a standby draft may raise some of the same questions of conscience that arise with a draft in being. It would appear that arrangements for a draft, if ever its reinstitution were requested, could be made during the time of Congressional deliberation and debate. Registration could then take place promptly when and if the new draft were enacted.

[5] A *New York Times* dispatch dated March 14, 1970, declared: "An all-volunteer armed force is both desirable and feasible, top Pentagon officials say. But if the Selective Service System is dropped while American casualty rates remain high in Vietnam, they say they doubt whether sufficient numbers of men will volunteer, regardless of pay."

48-059 O - 72 - pt. 18 - 51

nical questions are small in the light of a larger issue which the Commission, perhaps out of a desire to preserve unanimity, did not fit to stress. For the logic of freedom and the logic of efficiency argue that the more expensive in budgetary terms an all-volunteer armed force would be, the more inexcusable it is to continue the draft. The more it would cost to convert to an all-volunteer armed force, the greater is the hidden tax so outrageously imposed on draftees. The greater the budgetary cost of an all-volunteer force, the greater are the real economic dislocations and losses created by the draft. The greater the cost of an all-volunteer force, the higher, by their own revealed preference, is the value of the liberty which we are taking from our young men when we draft them. And the higher the budgetary cost of an all-volunteer armed force, the greater is the true cost and the more likely the self-delusion, in the pursuit of the policies to which our armed forces are committed.

While all this might have been proclaimed, and the tedium, tyranny and terror, along with sheer waste in any system of slavery, and military slave labor in particular, might have been stated boldly, *The Report of the President's Commission on an All-Volunteer Armed Force* is a fine and remarkable document for what it does say. It shows clearly that the end of the draft is feasible and desirable and argues effectively that the shift to an all-volunteer armed force should be begun virtually immediately and could be completed by July 1, 1971. Elimination of the draft and the move to an all-volunteer armed force has long had the support of outstanding Vietnam doves such as Senators George McGovern and Mark Hatfield and of more than one outstanding hawk such as Barry Goldwater. Senate Majority Leader Mike Mansfield has voiced his endorsement of the report and opposition to extension of the draft. If President Nixon would act now on the findings and recommendations of his own Commission, we might find a bipartisan coalition for successful action to restore freedom and the prospect of freedom to millions of Americans.

THE PRESIDENT'S ENERGY MESSAGE

Mr. GRAVEL. Mr. President, all the people of Alaska will be extremely interested in reviewing and watching developments on President Nixon's message of the other day on the supply of energy for the United States.

As is well known, Alaska has vast discovered energy resources awaiting development, and it is to be hoped that the administration's announced attention to the overall problem of energy supplies will be followed by useful action. Last month testimony on the message was taken by the Interior and Insular Affairs Committee on which I am honored to serve.

We now need the administration to spell out in greater detail a full strategy and plan to achieve the stated goal of adequate energy production at acceptable cost to the environment. I would like to offer a number of remarks around three subjects mentioned in the President's message—oil exploration and development, coal technologies, and nuclear power generation and its alternatives.

I. OIL

While the President referred to "efforts already underway to develop the fuel resources of Alaska" the fact is that the orderly and expanded development of Alaska's rich oil heritage has been arrested and frustrated by the Federal Government and the Federal courts now for 3 years. Some of the obstacles thrown in the way have been legitimate and some have not. At any rate the President's new concern over domestic energy issues—except for the Canadian case I could find no reference to the several international options that are open to us to help alleviate the problem—should bode well for moving ahead on the Alaska front.

The State of Alaska has half the Continental Shelf area of the United States, and this area is geologically promising of oil provinces. Accelerated oil and gas lease sales on these Federal lands is welcomed so long as there are stringent controls to safeguard Alaska's valuable fisheries resources also found there. Still more immediate—and closer to shore—would be the timely settlement of the long-outstanding court dispute over whether the State of Alaska or the Federal Government owns the highly promising offshore oil lands of lower Cook Inlet in southcentral Alaska.

The President's message spoke also of "appropriate leasing programs" for Federal lands where "the Government should be able to recover the fair market value of these resources." Though not mentioned specifically, a prime candidate for such action should be naval petroleum reserve No. 4 located just west of the great oil discoveries of Prudhoe Bay.

Pet No. 4 has been known and initially explored since 1923 and at one time probably had some real—but never used—place in our national security arrangements. Whatever this role was, it is widely acknowledged to have long since disappeared and only governmental inertia and some bureaucratic struggles between the Navy Department and the Department of the Interior have kept us from taking the public interest action of leasing the field into the private sector with the U.S. Treasury recovering the fully allocated costs associated with the enterprise all these years.

Mr. President, this could be simply done through congressional authorization and I hope that this will happen. Last time I looked at the figures the actual historical costs to government for Pet No. 4 were about $60 million, and this could be very rapidly recovered. I look forward to the administration coming forward with such a plan as part of the follow-on to its energy message.

While one direction of emphasis in the message was the locating of new oil supplies and the boosting of the nuclear alternative, reference to fully exploiting known oil supplies was noticeably absent. I refer particularly to hand-ups in the exploration, production, and transporting of the huge oil and gas finds on the north slope in Alaska.

Here we have billions of gallons of low sulfur content crude oil waiting for a transport system to be permitted and in place in order to supply the great energy demands the President spoke about to the rest of the United States. What of this "restriction" of supply? What can the administration be expected to do to unravel this before the Nation's energy crisis is further heightened and Alaska's economy is further depressed? As the President said in his message, "To move from geological exploration to oil and gas well production now takes from 3 to 7 years." Indeed it does. Perhaps tomorrow's witnesses before the Interior and Insular Affairs Committee will enlighten us on these points.

In a related part of the administration's energy message we find two statements that seem to me to bear very much on the Alaska pipeline issue:

> The development of the new technology required to minimize environmental damage can further delay the provision of additional energy.

And elsewhere:

> Industry should play the major role in this area, but government can help by providing technical leadership . . .

Mr. President, I agree with both these statements and would only hope that the administration is bending all its agency efforts toward a rapid resolution of any outstanding obstructions to getting out the Alaska oil and a timely issuance of the pipeline permit supported and concurred in by all relevant facets of the Federal Government.

II. COAL

I was pleased to hear the President strongly emphasize the importance of coal, as well as oil and gas, in meeting the growing national demand for energy and the increasing emphasis on cleaner fuels.

The importance of our coal reserves is often minimized in discussions of national energy demands. Yet, the 1,600 billion tons of mapped and explored coal reserves in the United States amount to approximately 90 percent of our recoverable fossil fuel energy reserves, while ultimate U.S. coal reserves are estimated to be in the neighborhood of 3,200 billion tons.

My own State of Alaska has coal reserves in excess of 265 billion tons, with about 50 percent of this total being either of bituminous or subbituminous grades.

In strong contrast to its large reserves, total U.S. coal consumption in 1970 came to just over 605 million tons, with Alaska's contribution amounting to only about 0.6 million tons.

ESTIMATED COAL RESOURCES OF ALASKA

[In millions of short tons]

Coal field	Bituminous	Subbituminous and lignite	Total
Northern Alaska	19,292	100,905	120,197
Nenana		6,938	6,938
Jarvis Creek		76	76
Broad Pass		64	64
Matanuska	137		137
Susitna		2,395	2,395
Kenai (Homer District)		318	318
Total	19,420	110,696	130,125

Source: Barnes, Farrell F., Coal Resources of Alaska, U.S.G.S. Bulletin 1242-B, Washington, D.C., 1967.

Alaska's coal industry has a long history. In fact, the first coal mine on the Pacific coast of North America was probably one opened in 1855 by the Russians at Port Graham on the southwest tip of the Kenai Peninsula. However, although there were large known coal deposits in Alaska, very little development took place prior to World War I because

the Federal Government refused to permit anyone to obtain title to coal lands or even to mine the coal under a lease agreement. As a result, Alaskans who were living near excellent beds of coal were forced to pay extremely high prices to have coal shipped in from a foreign country.

This situation was obviously untenable. Following an American tradition established much earlier in Boston, the citizens of Cordova held a "Coal Party" and dumped a considerable amount of coal into the bay. Like its predecessor, this "Party" also attracted much attention and was a significant factor in the passing of a coal-leasing law in 1914.

The era of sustained coal production in Alaska came with the completion of the Alaska Railroad to the Matanuska coalfield in 1916 and to the Nenana coalfield in 1918. Production rose quickly to 60,000 tons in 1920 and continued its upward trend to reach 174,000 tons by 1940. During World War II and up to the midfifties, Alaska coal production underwent further rapid increases until after 1953 when it began to fluctuate between 650,000 and 900,000 tons annually.

In 1967, a total of 925,000 tons of coal was mined in Alaska. However, the conversion from coal to natural gas by the Anchorage military bases had a dramatic impact on coal production which fell to 750,000 tons in 1968 and still further to approximately 667,000 tons in 1969. Mine closures occurred, particularly in the Matanuska Valley where 95 percent of the coal market was lost following the conversion to gas by the military bases. Prominent among these closures was the Evan Jones Coal Co.'s Jonesville mine which had been in continuous operation since 1922.

Thus, despite its having almost 10% of the nation's reserves, Alaska's coal production now accounts for only about one-one thousandth of the national total.

If there is indeed a national energy crisis, as the President's message assumes, then it is not only Alaska's oil and gas reserves that are available to help abate this situation, but also her coal.

Even today, coal is a much underrated energy source. In 1969, energy generated by bituminous and anthracite coals accounted for 20.5 percent of the national total. Still more impressive is the place of coal in the generation of electric power. In 1970, out of a total national production of approximately 596 million tons of coal, some 320 million tons were used by the country's electric utilities and accounted for 46.4 percent of all electric energy produced. By contrast, oil accounted for 11.8 percent; gas for 24.1 percent and nuclear power for a mere 1.4 percent of the Nation's electric energy production.

Should the nuclear liquid metal fast breeder reactor demonstration program advanced for 1980 be unsuccessful in reducing radioactive pollution to acceptable levels, and this appears likely at the present time, it is probable that the United States will have to devote its energies to the development of thermonuclear fusion and solar energy—the subjects of my concluding remarks.

However, even if the breeder reactor demonstration was deemed acceptable, it would not be until 1990 when a significant impact from this form of power generation would be felt. Since the economic development of thermonuclear fusion and solar power now appear to be longer range developments, the net result would be a greater demand for fossil fuels over a longer period.

This increased demand could be met through a national energy policy which utilized the full range of fossile fuels. Indeed, there is a growing realization within the fossil fuels industry of the interdependence of these energy resources. The removal of sulfur oxides and the conversion of coal into clean gas capable of being transported through existing natural gas pipelines in energy-deficient areas is such an example of this interdependence and can also serve to provide a greater balance between energy demands and the environment.

The President also stressed the need for further development of coal liquefaction techniques to convert coal into clearer liquid fuels; as well as magneto-hydroelectric power cycles which convert coal and the other fossil fuels into energy more efficiently.

Thus, to meet the increasing national energy demands, I urge that increased research and development of our fossil fuels be undertaken to produce an adequate supply of clean energy while we at the same time pursue more advanced methods, such as fusion and solar energy, toward making these sources assume a large portion of increasing demands for power in the United States.

III. NUCLEAR

I predict that President Nixon's energy message last Friday will produce a moral struggle of classic and colossal proportions between love and money, between humility and arrogance, between everyone who appreciates the wonder of life on earth and others who are willing to gamble with it in return for some fleeting engineering thrills and monetary advantages.

I am referring to the Presidential blessing given to nuclear fission. Mr. Nixon called it, "our best hope today" for lots of electricity.

Nuclear electricity has more than Mr. Nixon's blessing. It has the political clout of 17 billion business dollars already invested in it, plus a development subsidy of about 3 billion tax dollars.

Today I wish to make only two points:

First. A decision to promote nuclear electricity, which inevitably creates grotesque amounts of radioactive waste, is a gamble with the planet which requires ethical judgment and moral debate of the strongest nature.

Second. The nuclear gamble simply is not necessary; man already knows how to produce all the electricity he could want from sunlight, safely. The crucial difference between solar electricity and nuclear electricity is a $3 billion Government subsidy to the nuclear interests—with a request from Mr. Nixon for an additional $2 billion for developing the plutonium "breeder." Mr. Nixon's energy message gave lipservice to solar electricity and to other alternatives like fusion—but he gave all the dollars to fission.

THE MORAL PROBLEM

Mr. Nixon's announcement Friday is an endorsement of what AEC Chairman Glenn Seaborg calls "the plutonium economy of the future." Let me describe what that grim phrase really means.

It means an economy and a civilization depending for energy primarily on a substance widely acknowledged to be the most devastating pollutant which man knows how to create: Plutonium-239.

A single particle of radioactive plutonium about the size of a dust particle, inhaled and stuck in the lung, can cause lung cancer and kill you.

A single pound of plutonium is a quantity which represents the maximum permissible "body-burden," or dose, for 700 million people.

One large nuclear power plant, either "breeder" or conventional, produces over 600 pounds of plutonium every year—an amount equivalent to the maximum permissible lifetime body-burden for 420 billion people.

The AEC hopes to license about 1,000 nuclear plants within the next 29 years, and they will make a quantity of plutonium every year equivalent to 420 trillion maximum permissible doses.

AEC Commissioner Larson has said that a loss-rate of 1 or 2 percent of the plutonium inventory is "unavoidable"—October 1969, WASH 1147, cited in Science, April 9, 1971. Does this mean we can expect the loss of four to eight trillion lifetime doses of plutonium every year?

Any plutonium particles escaping into the environment will circulate for 24,000 years before losing half their radioactive harmfulness. That is forever, in human time-scales. Furthermore, it means that annual plutonium contamination will be cumulative.

The plutonium hazard alone is obviously on a scale which is incomparable with other pollution problems, or with anything like highway hazards. The potential risk compares with nuclear or chemical/biological warfare.

Plutonium losses may be augmented by plutonium thefts, for black-market atomic bombs. AEC Commissioner Larson has said:

> A market for such illicit materials is bound to develop . . . and I fear such growth would be extremely rapid once it begins. Such a theft would quickly lead to serious economic burdens to the industry and a threat to national security.

The massive security checking and regimentation required in attempting to prevent losses and thefts might well put a severe strain on personal freedoms.

President Nixon, and all of us, need to examine the concept of a "plutonium economy" carefully indeed, and in many aspects.

In addition to plutonium, large amounts of long-lived fission products, like stronium-90, are produced inside all nuclear powerplants—both "breeder" and conventional. That is a fact of physics, and better engineering cannot change it. A single nuclear powerplant—1,000-megawatts electrical—simply produces as much long-lived radioactivity every year as would the explosion of about 1,000 Hiroshima bombs.

Mr. President, I have two memos ex-

plaining the reactor-bomb comparison in detail. I ask unanimous consent that they be printed at the end of these remarks as supplement No. 1.

Nuclear enthusiasts intend to keep all this radioactive poison confined and separated from the biosphere for the next 50 generations. They are not moral monsters, and their intentions are good. The central question, one which Mr. Nixon did not present, is this:

Even if men everywhere agree, which they do not, to try to keep all radioactive garbage contained in perpetuity, can man succeed?

The amount of radioactive poison involved requires 99.9 percent success. If we achieve only 99.9 percent success, we will have poisoned the planet radioactively for all life to come.

Can the engineering community guarantee even 99 percent success? Such a promise would defy belief. And who is willing to gamble the planet on the basis of an engineering promise?

Engineers have a law, called Murphy's law: "If anything can go wrong, it will go wrong."

When 525 members of the national society of professional engineers were polled a year ago, almost 60 percent answered "yes" when asked whether there is a valid reason for the public to be worried about nuclear plants.

The senior member of the Joint Committee on Atomic Energy, Representative CHET HOLIFIELD, acknowledged last year again that "the construction and operation of nuclear reactors are very, very complex, costly, and inherently dangerous matters."

We see just the tip of the iceberg in the recently revealed uncertainties about the emergency core cooling system—which is one essential engineered safety system standing between today's nuclear powerplants and potential radioactive calamities.

Weight ought to be given to the warning issued in April by Dr. Hannes Olof Alfven, who won the 1970 Nobel Prize for physics:

> In my opinion, the dangers associated with the fission energy have not received necessary attention . . . if a reactor goes out of control, the consequences may be terrible. Even if extreme safety precautions are taken, the large quantities of radioactive material in them constitute a permanent danger . . . in a full scale fission programme, the radioactive waste will soon become so enormous that a total poisoning of our planet is possible. Under such conditions, safety margins which are acceptable in other fields, are inadequate. It is not evident whether the waste problem can be solved in a satisfactory way.
>
> If solar energy or fusion energy were available now at comparable cost, no one would use fission energy (for peaceful purposes). . . . If this is achieved, the fission reactor, especially the breeder, will be of interest only as a danger which must be eliminated as soon as possible.
>
> The views expressed here are shared by many competent physicists. They are basically different from those on which the present policy is based. An important decision about the future energy policy of the USA—and the whole world—should not be made until a thorough discussion has taken place involving advocates for all the three different alternatives (solar, fusion, fission) for solving the energy problem.

Mr. Nixon's personal opinion that fission represents "our best hope today" is only that—a personal opinion. His decision to back the breeder will surely fuel a sizzling moral debate. As far as radioactivity is concerned, the "breeder" is even more hazardous than conventional nuclear plants—not less.

Decisions about fission are urgently needed because, every day, man is creating additional radioactive garbage which he cannot get rid of. He can only move it from one place to another. A so-called "clean" or "zero-release" reactor simply means that the thing is engineered to put the radioactive problem somewhere else.

Providing there are no accidents beforehand, the radioactive waste moves out from a "clean" nuclear powerplant in special casks which each requires 30 to 100 tons of lead to shield the world from its contents.

The radioactive waste moves over roads and rails into a full reprocessing plant hundreds or thousands of miles away, where deadly accidents continue to be a possibility. In a "plutonium economy," each nuclear reprocessing plant will have an inventory of more liquid radioactive waste than we can comprehend: about as much as would be produced by exploding a half-million Hiroshima bombs.

Has any engineer convinced Congress that not even a fraction of 1 percent of it will ever get loose? Do we feel completely confident that accidents, leaks, carelessness, and sabotage are impossible? When the stakes are so high, these are questions urgently demanding answers.

In a few weeks, the European Nuclear Agency plans to make its third dump of radioactive waste into the North Atlantic; the dumps will be increasing in size, and accelerating in frequency. Radioactive pollutants in the ocean are even more dangerous than nerve gas. Nerve gas can become chemically neutralized, but radioactivity can be neutralized in no way. Only time—sometimes centuries—can eliminate the hazard.

The United States no longer dumps radioactive waste directly into the ocean, because it is "more economical" to use the land, according to the AEC booklet "Radioactive Wastes"—May 1967.

In this country, we continuously pump, dump, and dribble low- and intermediate-level radioactive waste directly into the ground. If future monitoring detects trouble, it may be too late for any remedy.

High-level wastes—the most intensely radioactive ones—are accumulating in leak-prone tanks. There is talk about burying them, solidified, in salt-mines. No safety tests have yet been made using real radioactive waste. Solidified wastes will remain radioactive for a thousand years, and may require human attention generation after generation—for instance, in order to remove the heat which the wastes will generate in the caves. No one can be sure what will happen down there.

Meanwhile, the U.S. Atomic Energy Commission is still moving ahead with the idea of dumping 25 million gallons of high-level radioactive slurry into red-rock along the Savannah River, below the Tuscaloosa Aquifer—in spite of a warning in 1966 from a committee of the National Academy of Sciences that the project is unavoidably dangerous.

When man starts filling the earth's seas and burrowing into the earth's crust with radioactive garbage, he is taking a chance with the very livability of this planet for any kind of life. That is obvious.

How can such a bamble be justified? Does this generation of human beings have the conceit to leave behind a radioactive legacy which just might poison the planet once and for all, and finally?

I should like to quote a passage from the last speech of the late Adlai Stevenson:

> We travel together, passengers on a little spaceship . . . preserved from annihilation only by the care and, I will say, the love we give our fragile craft.

The whole plutonium proposition may be one of man's most grotesque ideas . . . and also one of the most absurd. Contrary to a well-nurtured myth that man must take the radioactive gamble because there is no other way to produce lots of electricity, we do have an attractive, inherently safe alternative to nuclear energy if we want abundant electricity. We would have a "sunshine economy" instead of a "plutonium economy," and we could have it even faster.

AN ATTRACTIVE ALTERNATIVE

Man has known for many years how to make sunlight into electricity. We have been doing it reliably for ten years in the space program. Plenty of solar energy reaches the surface of the earth too—plenty to spare.

The annual incidence of solar energy on earth is about 25 times greater than the energy stored in the world's entire coal reserves. That is annual and inexhaustible solar energy.

About 10 trillion kilowatt-hours of solar energy fall every year on Death Valley alone. That amounts to about five times more electrical energy than is currently generated in the whole United States.

According to Drs. Norman Ford and Joseph Kane in the University of Massachusetts Physics Department at Amherst:

> For technical reasons, we can not recover more than about 40% of that energy, but it does appear technically feasible to obtain about 4 trillion kilowatt-hours in electrical energy from Death Valley alone . . . what we have said so far has been known for a long time. The more important question is, can we recover this power at reasonable cost?

Their answer is "Yes," in a paper entitled "Solar Energy and Public Power," dated April 1971.

Solar energy systems must provide ways to store the energy for nights and dark days. Because one way is to use the sun's energy to produce gaseous, pollution-free fuels which can then be shipped and stored, I would like to add the Ford/Kane statement that about 2 percent of our major deserts are capable of producing enough hydrogen gas to produce all the electrical power we now use. Hy-

drogen gas is perfect for fuel-cell conversion to electricity.

Mr. President, in view of the connection between some solar energy propositions and fuel cells, I ask unanimous consent to have two articles about fuel-cell development printed as part of supplement 2 at the end of my remarks.

Another way to store solar energy for nights and dark days has been proposed by Dr. and Mrs. Aden Meinel, of the Optical Sciences Center at the University of Arizona in Tucson. Their proposal is simplicity itself: Thermal storage of solar energy in tanks of salt or metals which have large heats-of-fusion.

The Meinels have thought through an entire solar energy system which requires no technical breakthroughs in either solar cells or fuel cells. If adopted, we might see a 100-megawatt solar plant in operation by 1976, and the first 1,000-megawatt plant in operation by 1980—which is President Nixon's accelerated target date for operation of the first 300- or 500-megawatt nuclear breeder plant.

Mr. President, I ask unanimous consent to have printed at the end of my remarks as a part of supplement No. 2 an article from Science magazine, May 14, 1971, about the Meinel proposal, and a paper by the Meinel's, April 27, 1971.

The Meinel's propose heat accumulation and generation of electricity via the familiar steam turbine system. Drs. Kane and Ford propose conversion of water to hydrogen and the distribution of nonpolluting energy via our familiar gas pipeline system. There is a third kind of solar energy proposal which would employ silicon solar cells adapted from the space program.

Silicon cells convert sunlight directly to electricity without moving parts or by-products. Their present efficiency is about 10 percent in commercial versions, 14 percent in laboratory versions, and 20 percent expected soon.

Mr. President, I ask unanimous consent to have a paper by Dr. Peter E. Glaser, head of engineering sciences at Arthur D. Little, Inc., printed as part of supplement No. 2 at the end of these remarks.

The cost of silicon cells, which are now wildly expensive, is high because of present manufacturing processes, not because of the material. Silicon is an abundant element. readily refined from sand. The cost of silicon cells could readily be reduced fourfold just using presently known techniques, and might well be reduced an estimated 700-fold with the application of a little industrial engineering.

Mr. President, I ask unanimous consent to have a paper on this subject by Dr. E. L. Ralph of Heliotek-Textron, Inc. printed as part of supplement No. 2 at the end of my remarks.

Though we know for sure that silicon works, it may not necessarily be the most efficient substance for solar cells. Organic semiconductors, for instance, would present no inherent upper limit to the cell's efficiency, and might reduce the cost of solar electricity even below silicon's lower limit. Dr. Elliot Berman has a research team working on the problem under the auspices of the Esso Research and Engineering Co.

Mr. President, I ask unanimous consent to print the Esso news release, November 24, 1970, as part of supplement No. 2 at the end of these remarks.

That solar energy is technically a sure thing seems understood by President Nixon. In his energy message, he said:

> The sun offers an almost unlimited supply of energy if we can learn to use it economically . . . and we expect to give greater attention to solar energy in the future.

But he gave the dollars to the breeder.

I emphatically disagree that "economics" should be the determining factor when the fate of the planet is at stake. Nevertheless, let us look at the "economics" of the breeder a moment.

The estimated capital costs of the breeder rose 50 percent between 1968 and March 1971, according to the AEC. By 1980, the Government investment in the breeder will be way over $2.5 billion, and the business investment even higher. That makes $5 billion without counting the $2 billion additional tax dollars invested in developing the present generation of civilian nuclear power plants.

All in all, by 1980, this country will have at least $5 to $7 billion invested in developing a 500-megawatt plutonium breeder, depending on how you count.

Therefore, when someone tries dismissing solar energy as "uneconomical" compared to nuclear energy, he overlooks the fact that large-scale solar energy might well look competitive already if the Government were subsidizing its development to the tune of $3 to $5 billion.

Strangely, some people say:

> If solar energy is so great, why isn't business interested?

Apparently it does not occur to these people to ask the same question about nuclear fission. Business would certainly not have grown devoted to nuclear fission if it had not been for the $3 billion Government development subsidy, the controlled fuel prices, and the Price-Anderson Act which removed normal public liability.

Remarkable, I think, is the growing business interest in solar electricity in spite of zero support from the Government. It is notable that several of the articles I have requested to be printed in supplement No. 2 are business-sponsored studies.

If Congress decides to treat solar energy to some of the lavish encouragement given nuclear fission, I predict we will see immense employment and solar business opportunities open up overnight. If we diverted $4 billion from the breeder to solar electricity, we would have economic solar energy. The least we should do, I believe, is to match our fission and solar investments dollar-for-dollar.

Therefore, I am considering a solar energy development bill for introduction this session and I would welcome cosponsorship of it.

There being no objection, the items were ordered to be printed in the RECORD, as follows:

THE PLUTONIUM ECONOMY

Fissioning of nuclear fuel (uranium or plutonium) produces radoactive fission products in direct proportion to the amount of nuclear which is fissioned. It matters not whether the fissioning is done as an instantaneous explosion, or slowly as it happens in a nuclear power plant operating properly. The amount of nuclear fuel required to produce bombs of a certain size measured in kilotons, and to produce electrical power measured in megawatts, is known. Therefore, it is possible to compare the radioactive fission products produced in a nuclear reactor with the radioactive fission products produced by exploding an atom bomb.

NUCLEAR WEAPONS AND FALLOUT

The following are approximations encompassing three assumptions about nuclear weapons and fallout:

1. The Hiroshima bomb had a yield of about 20 kilotons (20,000 tons of TNT equivalent).

2. About 200 megatons (200,000 kilotons) of fission explosives were detonated in nuclear bomb-tests (US, USSR, UK) before the 1963 Test Ban Treaty.

3. Since most of the bomb-test fallout fell in the Northern Hemisphere, and since the continental United States comprises about 3% of the surface area of the Northern Hemisphere, approximately 3% of the 200 megatons, or about 6 megatons of long-lived radioactive fission-products will have fallen on the USA when all of the bomb-fallout has fallen.

NUCLEAR POWER PLANTS

The following are three assumptions about the fission-products created by nuclear power plants:

1. A 1000-megawatt (electrical) nuclear power plant—LMFBR breeder-design or present models—produces about as much long-lived radioactivity each year of operation as is produced by the explosion of about 1,000 Hiroshima bombs (equivalent to 20,000 kilotons, or 20 megatons of fission-bombs).

2. By the year 2000, the AEC hopes to license 500 breeders in the USA, each at least 1000 megawatts (electrical). In addition, the AEC expects to have licensed 500 water-moderated nuclear power plants by the year 2000, and expects to see another 1,000 nuclear power plants in operation in other countries.

3. 500 breeders, each producing long-lived fission-products equivalent to a 20-megaton bomb per year, will combined produce each year the equivalent of 10,000 megatons of fission-explosion.

500 water-reactors in operation will produce another 10,000 megaton equivalent per year.

1,000 water and breeder reactors in other countries will produce an additional 20,000 megatons of fission-products per year.

Every year, a single 1000-megawatt nuclear power plant (water model) produces enough radioactive plutonium alone to give 500,000,000,000 people the maximum permissible "body burden". This is in addition to the radioactive fission-products discussed above. The physical half-life of plutonium-239 is 24,000 years.

COMPARISON

1. If Americans manage to achieve 99.9% success containing the annual production of fission-products from 500 breeders, still the equivalent of 10 megatons of fission poisons would be escaping into this country's biosphere eventually. Thus, even a success-rate as high as 99.9% (which is unlikely in human efforts) would eventually release 300 megatons of long-lived radioactivity in this country from just 30 years of breeder activity. That is 50 times more radioactive contamination than we received from the bomb-test fallout, and excludes contamination from the water-reactors and foreign reactors.

2. In fact, 30 years is too short a period to assign to the production of radioactive waste from the breeder program. The AEC has stated its expectation that breeders should be developed and deployed because they are "essential to assure to our Nation, for centuries to come, an adequate supply of energy" (Milton Shaw to JCAE, Fiscal 1972

Authorization Hearings, page 27 in typewritten submission).

Therefore, the breeder program clearly poses the possibility of totally and permanently poisoning the planet, even if man could achieve a phenomenal 99.9% success-record in confining its radioactive by-products in perpetuity.

THE FISSION-PRODUCT EQUIVALENCE BETWEEN NUCLEAR REACTORS AND NUCLEAR WEAPONS

(By Dr. John W. Gofman)

What is desired here is a determination of the comparison of production of long-lived fission products (for example, Strontium 90 or cesium-137) in nuclear power reactors with such production in nuclear weapons. In particular we shall determine what megatonnage of atomic *fission* bombs is required to produce an inventory of long-lived fission products equivalent to that within a 1000 Megawatt (electrical) nuclear generating station that has operated for one year.

Listed below are certain physical conversion factors and parameters of relevance, together with the source of such information.

Energy Units: 1 Kilowatt-hour equals 8.6 times 10^5 gram-calories.

Reference: Handbook of Chemistry and Physics, 44th Edition, 1962–3, Chemical Rubber Publishing Co., Cleveland, Ohio. page 3305 (Units and Conversion Factors)

Equivalents of 1 Kiloton of TNT: 1 Kiloton TNT equals 10^{12} gram-calories. 1 Kiloton TNT equal 1.15 times 10^6 kilowatt-hours.

Reference: "The Effects of Nuclear Weapons", Samuel Glasstone, Editor, Published by the U.S. Atomic Energy Commission, Revised Edition, February, 1964 (U.S. Government Printing Office, Washington, D.C.) page 14, Chapter I, Table 1.41.

Yield of Hiroshima Bomb: 1 Hiroshima Bomb is roughly 20 Kilotons TNT.

Reference: Ibid., page 6, Chapter I.

CALCULATIONS

1. In one year of operation of a nuclear reactor, long-lived fission products that have been manufactured will not have decayed significantly. Hence the inventory at the end of one year will be almost precisely equivalent to the total quantity of such fission products that has been produced.

2. The nuclear generating station will be taken as 33% efficient in the conversion of thermal to electrical energy. Thus 3000 Megawatts (thermal) yields 1000 Megawatts (electrical). Obviously, the calculation can be correspondingly modified for any other efficiency value chosen.

3. The nuclear generating station will be presumed to operate at full power throughout the year. Clearly, the calculation can readily be modified for any deviation from 100% operation over the full year.

Now, 1 year of operation represents 24 times 365, or *8760* hours of operation.

If 1 Kilowatt-hour equals 8.6 times 10^5 gram-calories, then 1 Megawatt-hour equals 8.6 times 10^5 times 10^3 equals 8.6 times 10^8 gram-calories.

Therefore 1 Megawatt-year (or 8760 megawatt-hours) equals (8.76 times 10^3) (8.6 times 10^8) equals 7.53 times 10^{12} gram calories.

But 1 Kiloton TNT equals 10^{12} gram-calories.

Therefore a reactor at 3000 Megawatts (thermal) for one year is equivalent to 2.26 times 10^{16} equals 2.26 times 10^4 Kilotons of TNT, divided by 1 times 10^{12}.

1 Megaton equals 1000 Kilotons.

So 2.26 times 10^4 Kilotons represents 2.26 times 10^4 divided by 10^3 equals 22.6 Megatons.

So, we can say 3000 Megawatts (thermal) for one year is equivalent to 22.6 Megatons of fission bomb.

Now, taking 1 Hiroshima bomb as 20 Kilotons, we can say 3000 Megawatts (thermal) for 1 year equals 2.26 times 10^4 divided by 20 equals 1130 Hiroshima bombs equivalent.

(Note: The energy of the reactor and of the bomb are totally from nuclear fission. Hence, if we have compared equal *energy* production, we have automatically compared equal fission product production. And since, for long-lived fission products we neglect the decay, we can say the inventory of fission products (*long-lived*) in a 3000 Megawatt (thermal) reactor is equal to that from 1130 Hiroshima bombs.)

We can check this calculation by an alternative one. We listed above that 1 Kiloton TNT equals 1.15 times 10^6 kilowatt-hours.

Also 3000 Megawatts (thermal) for 1 year equals 3000 times 8760 equals 2.628 times 10^7 megawatt-hours.

2.628 times 10^7 megawatt-hours equals 2.628 times 10^{10} kilowatt-hours.

Therefore, 3000 Megawatts (thermal) for 1 year represents 2.628 times 10^{10} divided by 1.15 times 10^6 equals 2.29 times 10^4 Kilotons.

(Note: Calculating above via calories, we got 2.26×10^4 kilotons. Within rounding off errors, this result is identical, approached via kilowatt-hours or calories, which is, of course, expected.)

Converting to Hiroshima bombs equivalent, we have 2.29 times 10^4 divided by 20 equals 1,145 Hiroshima bombs. (Via calories, we obtained 1,130 Hiroshima bombs, again in agreement, within rounding errors.)

SOME POSSIBLE MODIFICATIONS

(1) It is claimed that, in the future, nuclear reactors may operate at 40% efficiency (thermal to electrical) instead of the 33% efficiency employed in these calculations.

In such a case, the Hiroshima bomb equivalent would be 1,130 times 33 divided by 40 equals 932 Hiroshima bombs for 1,000 megawatts (electrical) (2,500 megawatts (thermal)).

(2) One might, for any calculation, consider that the reactor will not operate at 100% power throughout the year. Estimates like 75% have been suggested.

If a 1000 Megawatt electrical plant, with 33% efficiency, operates 75% of the year.

The Hiroshima Bomb equivalent = (0.75) (1130) = 848 bombs.

If a 1000 Megawatt electrical plant, with 40% efficiency, operates 75% of the year,

The Hiroshima Bomb equivalent = (0.75) (932) = 699 bombs

Therefore, looking toward the future, and using 40% efficiency and 75% operation, it appears that 699 Hiroshima bombs equivalent is the lowest figure.

(3) The Hiroshima Kilotonnage was taken as "roughly" 20 Kilotons. York, in "Race to Oblivion," suggests the Hiroshima bomb may have been 14 Kilotons.

Above we calculated for 3000 Megawatts (thermal) for one year we have the equivalent of 2.26 x 10^4 Kilotons TNT

If one Hiroshima Bomb is 14 KT,

then 3000 Megawatts (thermal) for 1 year equals 2.26 x 10^4 divided by 14 equals 1614 Hiroshima Bombs, instead of the 1130 bombs calculated above.

[From the Wall Street Journal, May 19, 1971]

"LITTLE BLACK BOX" FUEL CELL, LONG SEEN AS ELECTRICITY SOURCE, MOVES AHEAD IN TESTS—COSTS REMAIN UNECONOMICAL BUT ARE STEADILY FALLING; COMMERCIAL SERVICE BY 1975?—GAS VERSUS ELECTRIC UTILITIES

(By Roger W. Benedict)

FARMINGTON, CONN.—A "little black box" that many major corporations have relegated to the back shelves of their research laboratories is undergoing a renaissance that could have broad economic and ecological significance.

The gadget is nothing mysterious. It's the long-heralded, but still unperfected, "fuel cell," a silent, essentially pollution-free device with no moving parts that produces electricity through a chemical reaction of hydrogen and oxygen. The hydrogen can come from many common fuels—such as natural gas—and the oxygen from the air.

The first field test of a new lower-cost version of the device is under way in a plush display home in this Hartford suburb, and 59 other units will be tested over the next year and a half in such diverse locations as a Los Angeles drugstore, a Chicago hamburger stand and a Brooklyn apartment. By the end of next year, its backers, the Pratt & Whitney division of United Aircraft Corp. and 32 gas and electric utilities, will decide whether they will proceed to commercial fuel cell service by 1975.

A MAJOR BENEFIT?

If the venture succeeds, its advocates say, it could prove of major benefit in closing the nation's growing energy gap and in tackling some of the most pressing environmental problems. In the process, they believe, the fuel cell could change the whole concept of the electric-utility business by introducing substantial competition into a field now largely the preserve of regulated monopolies.

But the fuel cell's ability to compete with conventional power remains to be proved, and many observers are skeptical. And in each state, lawmakers, regulators and courts will have to decide who can offer fuel-cell service and on what basis.

Invented 132 years ago, the fuel cell still has few practical uses, although it supplies electricity on Apollo moon flights. It also has found limited commercial use at oil pipeline pumping stations and in operating switches on European railroads. Thus far, fuel cells have proved too costly to make and operate to challenge conventional power sources in most applications.

Fuel cells would probably become "of real interest" when the cost of producing electricity drops to about $150 per kilowatt, says W. Donham Crawford, president of the Edison Electric Institute. The institute is a trade group of investor-owned electric utilities, which potentially could face stiff opposition from fuel cells powered by natural gas. Mr. Crawford says he understands the cost has been cut sharply to about $400 per kilowatt from $1,200 a few years ago, when fuel-cell electricity cost nearly 10 times as much as that bought from a local power company. At present, power-generating costs vary widely throughout the industry but generally range from $100 to $200 per kilowatt at plants using gas, coal or oil.

William H. Podolny, who heads the fuel-cell program at Pratt & Whitney, declines to estimate the specific cost per kilowatt achieved to date. But he does say, "We have made substantial progress in reducing the cost."

Robert Suttle, president of the group formed by the project's backers and also managing director of the Southern Gas Association, says, "We don't want to give anyone the impression he can go down to his corner gas-company office and sign up for fuel-cell service in the next few years. We are at about the midpoint of an estimated nine-year development program. We still have a long way to go to get a competitive cost."

EXPERIMENTAL DEVICE UNVEILED

Yesterday Pratt & Whitney and gas-industry officials unveiled an experimental 12.5-kilowatt gas-powered device occupying less space than a modern furnace. Already the device is quietly generating power in the basement of a futuristic $109,000 condominium here that Connecticut Natural Gas is using to demonstrate the fuel cell to the public. At a news conference, they also disclosed a production-line model only one-fourth the size and weight of the test unit, or no bigger than a TV set.

The gas utilities hope to have such units coming off the Pratt & Whitney production line in time to offer fuel-cell service by 1975. This, they say would provide industrial, commercial and residential customers with an

option of buying their electric power from a gas utility or an electric utility.

"Even in my wildest dreams, I can't see gas fuel cells eliminating the electric utility." says Robert H. Willis, president of Connecticut Natural Gas. "But we believe fuel cells will get a lot of the electricity market. They will certainly bring about growing competition between gas and electric utilities, and that competition could even become strong enough to eliminate the need for utility regulation."

Mr. Willis estimates that the fuel cells could initially gain as much as an additional $100 million to $200 million of new revenue annually for gas utilities and that within seven to 10 years after its first commercial introduction, it could be producing as much as $1 billion of new business.

Up to now the nation's electric systems have become increasingly centralized, using ever-larger power plants tied together by increasingly wider integrated networks of power lines. Such moves have achieved the "economies of scale" that have reduced power costs by more than one-third since World War II. But this approach is being confronted with growing problems of air and water pollution, rising controversies over plant sites and power-line rights-of-way, increasing construction costs and delays, and the danger of massive "cascading blackouts" over vast sections of the country.

Some electric-industry executives see the fuel cell as a possible answer to such problems, permitting them to add decentralized fuel cells at neighborhood substations as local power needs rise. These cells would reduce the need to build new central stations and long-distance power lines. To test this concept five of the Pratt & Whitney fuel cells will be used at electric substations by two members of the supporting group, Public Service Electric & Gas Co. and Northeast Utilities.

"A lot of our friends in the electric industry think we're crazy for helping the gas industry develop the fuel cell," says Raymond A. Huse, general manager of research and development at Public Service, New Jersey's largest electric utility. "But we think the gas industry is doing us a favor."

Northeast Utilities, New England's biggest power company, is already urging Pratt & Whitney to develop larger fuel cells for use in integrated power systems and would like such units to be able to run on either gas or liquid fuels interchangeably, reports Sidney H. Law, the utility's director of research and system studies. He says that tying fuel cells into existing electric systems would maintain the advantages of "diversity of load" (many customers sharing the same power source) and emergency backup power. And he adds that electric utilities would need fewer kilowatts of fuel-cell-power to do the same job than would gas utilities putting units into individual homes, where each must meet that family's peak power needs.

But Peter J. McTague, a utility consultant with Gilbert Associates Inc. of Reading, Pa., believes most electric utilities have been slow to recognize both the threat and the potential of fuel cells. He talks of "the approaching apocalypse" that could prove to be a "period of turmoil, conflict and agony for the utility industry." And he says, "Gas utilities are a little unrealistic if they expect to maintain their own monopoly position (supplying gas to electric utility fuel cells as well as their own) while destroying the monopoly position of the electric utilities."

Many observers are already predicting there will also be nonutility suppliers of fuel-cell service to the public. Considered to be prime candidates are fuel-oil dealers and their oil-company suppliers, which already compete against gas and electric utilities in the home-heating field.

One major oil company, Atlantic Richfield Co., through a joint venture with Bolt, Beranek & Newman Inc., a Cambridge, Mass., research firm, has developed a fuel cell that can run on gasoline, kerosene or propane (bottled gas) as well as natural gas. The two companies are seeking to license the cell for manufacture.

LIGHT AT THE TUNNEL'S END

"We're all a little disappointed at how slowly the fuel cell has been developing," says Frank Long, product director in the commercial development department of Atlantic Richfield's Arco Chemical, "but now there seems to be some light at the end of the tunnel." He says he expects success of the gas-utility fuel cells to attract attention to the Bolt-Beranek fuel cell, which he considers to be a more advanced device.

Late in 1970 Standard Oil Co. (New Jersey) agreed with a unit of France's Compagnie Generale d'Electricite on a $10 million, five-year fuel-cell development program. And both British Petroleum Co. and the Royal Dutch-Shell Group have turned out experimental fuel cells.

Pioneer Systems Inc. of Manchester, Conn., has been selling fuel cells commercially for more than a year, powered by hydrazine, a chemical used in rocket fuel. David N. Abrams, president, says, "They're not a completely satisfactory substitute for conventional power at this point, but they are entirely satisfactory for specialized power uses." He adds that he is "not bullish on the possibility of every home having a fuel cell" but sees growing industry uses for them.

The success of the Pratt & Whitney devices could revive the interest of some of the many companies that have sidetracked their fuel-cell programs. Much of this work was done under federal contracts, and the companies decided there wasn't sufficient commercial potential to pursue the research with their own funds when the contracts expired. Much of it, too, dealt with the fuel cell as a possible replacement for the internal-combustion engine in vehicles, and scientists generally believe this possibility is a long way off.

THE SMITHSONIAN GETS A TRACTOR

Allis Chalmers Manufacturing Co., which developed the first fuel-cell vehicle in 1959, says the vehicle, a farm tractor, is in the Smithsonian Institution and the company's fuel-cell research is in mothballs. Others no longer actively pursuing fuel cells include Monsanto Co., which developed a fuel-cell truck; Union Carbide Co., which had a fuel-cell motorcycle; Texas Instruments Inc., which made fuel cells to run radar and communications equipment, and General Electric Co., which was active in the space fuel-cell program.

With so many others dropping by the wayside, however, Pratt & Whitney has stuck doggedly to its belief that the cost problems of the fuel cell can be solved. Mr. Podolny, who heads the fuel-cell program, persuaded the National Aeronautics and Space Administration to adopt fuel cells for the Apollo program and is given much of the credit for getting the fuel cell out of the laboratory and into practical application. With nearly 1,000 fuel-cell researchers, Pratt & Whitney's total effort in the field is estimated by competitive researchers as exceeding that of all other companies combined.

The Team to Advance Research for Gas Energy Transformation (TARGET) was formed in 1967 by 27 gas utilities—five more utilities have since joined—to work with Pratt & Whitney in a concerted push for a commercial fuel cell powered by natural gas. Over the past two years, the concerns have poured $20 million into the program and have committed another $30 million through the end of next year. This is one of the largest research ventures ever undertaken entirely with private capital. But the companies are quick to give credit to the space program for providing substantial fallout benefit to their current research effort.

"We don't know at this point whether we have a viable, marketable fuel cell," says E. L. O'Rourke, manager of market planning for Pacific Lighting Corp.'s Southern California Gas Co. and head of TARGET's marketing committee. "But we hope we'll have the answers by the end of next year, and if it proves to be a commercial product, we've got an exciting concept. There's nothing to preclude anyone from selling fuel cells, but we believe the gas utility will have an advantage in this field."

PUSHING THE TECHNOLOGICAL LEAD

The gas companies are counting on both their technological lead over cells using other fuels and on the fact that gas can be transported at about one-fifth the cost of electricity and sells for less than most competitive fuels.

Edwin S. Larson, vice president of Brooklyn Union Gas Co., even notes, "we're not unhappy about the probability that electric utilities will be using fuel cells—because they'll most likely run on gas they buy from us."

With the nation facing a growing shortage of natural gas, how do the gas utilities justify entry into a potentially broad new market?

"Fuel cells can make a substantial contribution to conserving energy resources by saving 30% or more of the fuel that would be needed to generate the same power in central stations," says John W. Partridge, president of Columbia Gas System Inc., the nation's largest gas utility. "And we're working very hard on the gas-supply problems, and we believe they'll be solved by the time there is significant market penetration by fuel cells." By such time, he says, he expects gas supply to be increased by an Alaskan pipeline, coal gasification (that is, making pipeline-quality gas from coal), imports of liquefied natural gas and stimulation of conventional drilling by higher gas prices.

N. P. Chestnutt, vice president and operations manager of Southern Union Gas Co. of Dallas, says that over the long term he expects gas utilities to lose much of their present industrial gas load, which produces a low profit return. "We hope to replace this with a higher-return fuel-cell service," he adds.

RESEARCH BY WESTINGHOUSE

The potentially greater efficiency of fuel cells has caused Westinghouse Electric Corp., a major builder of conventional power plants, to research the possibility of building large-scale fuel-cell plants running on gasified coal.

"We hope to be able to build a fuel-cell power plant for no more than the cost of a conventional plant, but with a 50% to 60% greater efficiency," reports Daniel Berg, director of energy systems. "We can do it on paper," says Jack Brown, manager of energy storage. Westinghouse is pursuing the project with its own funds but is seeking federal money from the Office of Coal Research to build a 100-kilowatt experimental plant.

"But we want to emphasize that fuel cells are just one arrow in our quiver," says Mr. Berg. "We're working on a lot of other ways to reduce the cost of power, and in the long run some of these may prove to be more important than the fuel cell."

But Edison Electric's Mr. Crawford has undergone a substantial change of opinion on fuel cells over the last year. "It might well be that these units could play a significant role in electric-utility operations of the future," he says now. Only a year ago, he said, "We just don't believe the little black box will become a viable option for central-station power."

[Excerpts from Chemical and Engineering News, April 5, 1971]

CHEMICAL THERMODYNAMICS IN THE REAL WORLD

(By Frederick D. Rossini)

(NOTE.—Dr. Frederick D. Rossini delivered his Priestley Medal address March 29 at the national ACS meeting in Los Angeles, Calif.

The Priestley Medal was established in 1922 by ACS to recognize distinguished services to chemistry. The award consists of a gold medal designed to commemorate the work of Joseph Priestley and a bronze replica of the medal. It is awarded to members and nonmembers of ACS; medalists are selected by the Board of Directors.)

Fuel cells.—Fuel cells are another example of the importance of thermodynamics in man's control of energy. In 1967, we published a report on the thermodynamics of fossil fuel cells. During the past 50 years, the total quantity of energy consumed in the U.S. per year has about tripled. Today, all fossil fuels—natural gas, petroleum, and coal—account for about 95% of the energy produced in the U.S. The natural supply of petroleum and natural gas may last another 50 to 100 years. The natural supply of coal may last another 500 to 1000 years.

The conventional combustion of fossil fuels for power may take place in a steam-turbine-generator system to produce useful energy for electricity or in an automotive engine to produce useful energy for transportation. In both of these cases, the conversion of the heat energy into useful energy is severely limited by the second law of thermodynamics, through the Carnot factor. On the average, only about 35%, or less, of the heat energy is actually converted into useful energy.

The conventional combustion of a fossil fuel is a thermodynamically irreversible process. However, it is possible, by means of a device called the fuel cell, to carry out the process of combustion in a thermodynamically reversible manner. In this case, theoretically, 100% of the energy is convertible into useful energy. Even allowing for a 30% loss, we could thus obtain with the fuel cell twice as much energy from the same amount of fuel as with the conventional process.

The schematic, below, gives a diagram of an ideal hydrocarbon fuel cell, using propane. In this ideal picture, the fuel enters at the upper left, the oxygen enters at the upper right, the produced carbon dioxide is discharged at the lower left, and the produced water is discharged at the lower right. At the anode, propane reacts with water to form carbon dioxide plus hydrogen ions and electrons. The hydrogen ions produced pass from the anode through the electrolyte to the cathode. The electrons pass from the anode into the external circuit through the work machine and return to the system at the cathode. At the cathode, the oxygen molecules combine with hydrogen ions and electrons to form water molecules. The sum of the electrode reactions is simply the combustion of propane in oxygen to form water and carbon dioxide.

The fossil fuel cell power plant has many attractive possibilities. As previously mentioned, a given amount of fuel in it should produce about twice as much energy as in a conventional power plant. Other possible advantages of the fossil fuel cell power plant are summarized as follows: No noise; no vibration or moving parts; no mechanical generating problem; no heat transfer problem; no starting problem; minimal maintenance; no dirt or other local pollution; no atmospheric pollution; completely self-contained; and can be coupled directly to a direct current motor.

Fossil fuel cell power plants could be used in many different places, such as trucks and passenger vehicles for city driving; industrial plant trucks; locomotives; marine installations; standby power generators; portable power plants; a central generating plant for isolated areas; and small power installations in isolated areas. When the fossil fuel cell power plant is part of a mobile vehicle, the fuel is carried in a suitable container aboard the vehicle. When the fossil fuel cell power plant is stationary, the fossil fuel can be fed into it as a gas, liquid, or pulverized solid, through a pipeline from a nearby or a remote source.

The possible advantages and uses of the fossil fuel cell power plant appear so attractive as to warrant the considerable amount of research and development work still required before a fully operational and practical everyday device becomes available. We hope that this may come in the not too distant future.

[From the Science magazine, May 14, 1971]

SOLAR ENERGY: A FEASIBLE SOURCE OF POWER?

(By Allen L. Hammond)

Hopes for utilizing solar energy on a large scale have never materialized in the past. Recent discussions of how to meet growing national energy needs have focused on fission breeder reactors and fusion reactors as the best long-range replacements for fossil fuels and have usually dismissed solar energy altogether.[1] However, a new proposal for a solar energy system has been attracting considerable attention among Washington officials. The proposed system would capture the sun's energy extremely efficiently by means of specially coated collecting surfaces, which would be heated by the resulting super "greenhouse" effect to temperatures as high as 540° C; the heat energy would be collected and stored in a thermal reservoir, to which conventional steam boilers, turbines, and electrical generating equipment would be attached. Although several key questions remain to be answered, preliminary calculations indicate that such a system may well be technically and economically feasible.

The proposed new solar energy system was designed by two astronomers, Aden B. Meinel, director of the Optical Sciences Center of the University of Arizona at Tucson, and his wife, Marjorie. Their system, which would operate at much higher temperatures than those of earlier solar energy schemes, would attain a 25 to 30 percent overall efficiency of conversion of incident sunlight to electricity.

In the relatively cloudless deserts of the southwestern United States, the solar energy flux reaching the earth's surface averages about 0.8 kilowatt per square meter for the middle 6 to 8 hours of day during most of the year. An ordinary black surface absorbs most of this energy, but much is reemitted as thermal radiation. It is the spectral differences between the incident and reemitted radiation that makes efficient use of solar energy possible. The incident energy flux has a maximum at a wavelength of about 0.5 micrometer, near the center of the visible region—0.4 to 0.7 micrometer—but the flux decreases rapidly toward the red end of the spectrum. The thermal reemission is mostly in the infrared with a peak near 5 micrometers at the temperatures envisioned for the collecting system. Hence highly selective coatings that are black in the visible and are poor emitters in the infrared are able to absorb essentially all of the incident sunlight but give off almost nothing.

There appear to be many ways of making suitable coatings from layers of thin films deposited on a steel collecting surface by evaporation techniques. One type of coating developed recently by Bernard Seraphin at the University of Arizona depends on the intrinsic properties of materials. An example of this type of coating consists of a semiconductor material that is opaque to visible light but transparent to infrared; underneath the semiconductor layer would be another layer of a material, such as gold, which has a very low emissivity in the infrared. Because of the transparency of the semiconductor to infrared radiation, the composite coating would act like a mirror—a desirable property because high reflectivity corresponds to low emissivity—in the infrared.

Other more sophisticated coatings involve interference phenomena. Layers of a metal and of a completely transparent material, such as quartz, can be alternated with thicknesses adjusted to the wavelength of the reflected light, so that the coating absorbs visible light well but is a good mirror in the infrared or ultraviolet.

The collecting surfaces in the proposed system would be enclosed in a vacuum to eliminate convective cooling. Liquid sodium would be pumped through channels in the steel to transport the heat to a tank containing a eutectic mixture of molten salts, which, like a giant water-ice system, can maintain a constant temperature over a wide range of energy storage. The molten salt system would provide a reservoir from which energy could be drawn by the steam turbine as required, so that operation overnight and for short periods of cloudy weather would be possible. According to the Meinels' estimates, about 8 square kilometers of collecting surface and a 50-million-liter thermal storage tank would be required for the equivalent of a 1000-megawatt generating plant—a size comparable to nuclear power plants being built today. The largest question as to the technical feasibility of the proposed system appears to concern the durability of the thin film coatings.

Solar energy systems have no fuel costs, but they require higher initial investments in equipment than do other energy systems. In addition, the cost of manufacturing thin film coatings on a large scale has always been prohibitive in the past, because of the high vacuum and large currents required. Recently, however, large continuous evaporators have become available and are now used to coat such products as architectural glass. If a commitment were made to utilize solar energy on a sufficient scale, so that a large manufacturing plant could be built to produce the collecting surface, then, Meinel estimates, the unit costs should decrease to the point that electricity from solar energy would be economically attractive—in the range from 5 to 10 mils per kilowatt-hour, exclusive of distribution costs. Comparable figures for fossil fuels range from 1.5 to 5 or more mils per kilowatt-hour at present. Although in this country solar energy plants would be restricted to the southwestern deserts, developments in cryogenic or superconducting power transmission lines could make the power available to a larger region.

Solar energy systems are environmentally attractive, because they do not contribute to air pollution, and because they avoid the radioactivity hazards of nuclear power systems. However, solar energy systems would still require cooling water for the steam turbines, so that thermal pollution would potentially still be present. Meinel envisions dual-purpose plants that could use the waste heat for industrial or agricultural purposes, or for running evaporators to produce fresh water by desalinization.

It is still too early to make accurate assessments of the economic feasibility of solar energy, but the prospects appear to be encouraging enough to warrant further research. Similar economic questions remain to be resolved about breeder reactors, and fusion power systems have yet to be proved scientifically feasible, so that solar energy must be considered a significant, if still uncertain, alternative for future power needs.

A PROPOSAL FOR A JOINT INDUSTRY-UNIVERSITY-UTILITY TASK GROUP ON THERMAL CONVERSION OF SOLAR ENERGY FOR ELECTRICAL POWER PRODUCTION

(For Presentation to the Arizona Power Authority, Phoenix, Ariz., April 27, 1971, by Dr. A. B. Meinel, Director, Optical Sciences Center, University of Arizona, Tucson, Ariz.)

(NOTE.—Figures referred to are not printed in the RECORD.)

SUMMARY

This document outlines a proposal for the eventual establishment of a National Solar

[1] See, for example, a speech by Glenn T. Seaborg, U.S. Atomic Energy Commission, at a forum on Energy, Economic Growth and the Environment, Washington, D.C., 21 April 1971.

Power Facility along the Colorado River desert strip with a total capacity of 1,000,000 megawatts of electricity. Using waste heat from the turbines, it will be possible to desalinate 50 billion gallons of water per day, enough for 120,000,000 people.

The basic technology proposed for thermal conversion of solar power has been verified, and a proposal to proceed toward a program culminating in 1976 with a 100-megawatt generator has been formulated for consideration by the National Science Foundation.

A brief technical description of how the proposed system functions and interfaces with present steam turbine power generation is given here, and several points for possible action are listed.

INTRODUCTION

Dr. A. B. Meinel and Marjorie P. Meinel of the Optical Sciences Center of the University of Arizona, Tucson, have recently shown that new technology is available that casts new light on the feasibility and economics of converting solar energy into electrical power. Laboratory experiments by Optical Sciences Center scientists Drs. D. B. McKenney and Bernhard O. Seraphin confirm the computations by the Meinels, and we feel that it is time to seek the support necessary to see this task explored as a potential answer to the critical need of the United States for pollution-free electrical power. It appears that Federal financial support can be obtained for this project, and we propose that a Task Group be formed to provide a practical overview of the effort and sponsorship of action items when such become appropriate.

The interests of the governments of both Mexico and the United States are involved in this project because the water byproduct of the proposed National Solar Power Facility requires access to ocean water for fresh water production. This aspect is not a minor one since a 1,000,000-megawatt power facility has the capability of also producing 50 billion gallons of water per day, enough for 120,000,000 people. The potential for early and amicable relations with interested offices in both Sonora and Mexico City should have the attention of the Task Group.

WHAT IS THE PROJECT?

The project is for the thermal conversion of solar energy into power. By thermal conversion we mean use of the heat of sunlight as contrasted to direct conversion by means of silicon solar cells as used on spacecraft. We propose a system for gathering and storing solar energy as heat at 1000°F, which can be readily interfaced with the standard 1200-psi–1000°F steam turbine generating technology, as is used by the power utilities in the United States. The project initially is to verify the projected technology and develop a demonstration generating station of approximately 100 megawatts, to be located in the Yuma-Wellton area, by 1976. The ultimate goal of the project is the development of 1,000,000 megawatts of generating capacity in the Colorado River desert corridor, using about 10% of the uninhabited desert stretching from the Gran Desierto region of Sonora to Las Vegas, Nevada. This amount of electrical energy can supply the major fraction of the needs of the United States and northern Mexico by the year 2076. A map of the prime areas is shown in Figure 1.

HOW CAN THE PROJECT BE STARTED?

It is clear that the magnitude of the task and the probable length of time from initiation to development of a commercial product is too large for it to be economically feasible for implementation by private industry or public utilities. Utilities are already economically stressed to meet today's demand for power, and they *must* use interim methods—fossil and nuclear—regardless of the ecological problems involved. The importance to the people of the United States of a pollution-free source of electrical power and one that will not be depleted makes it appropriate that this project be initiated by funding from the Federal Government.

The University of Arizona has initiated action in Washington through the Arizona Congressional delegation and other interested offices in the Executive branch. A favorable reception has been forthcoming, and a proposal for a grant of $64,000 has been made to the National Science Foundation (NSF) for an 8-month study. A further proposal for a Phase I study costing $10,900,000 over three years has also been discussed with the NSF and the Office of Science and Technology (OST).

Although the study can be done with the staff and facilities available at the Optical Sciences Center and the Department of Electrical Engineering of the University of Arizona, it is clear that the magnitude of the Phase I task (see below) is more than is appropriate for a university. We propose that the major part of the Phase I and II work will be done in close cooperation by industry, the University of Arizona, and an appropriate utility group. The industry entity would be an association of interested companies, probably a new corporation, Helio Associates. The probable division of funds during these two phases would be 70% to industry, 10% to the university, and 20% to the utilities. All three would join in making the required proposals to the Federal Government.

PROGRAM OUTLINE

The research and development relating to solar power systems can be divided into several phases.

A. Studies: Concept Development and Program Definition; 8 months

B. Phase I: Basic Technology Development; 36 months

C. Phase II: Power Research Installation (1 MW); 36 months

D. Phase III: Demonstration Power Facility (100 MW); 60 months

E. Phase IV: Commercial Power Facility (>200 MW); 72 months

F. Phase V: Byproduct Development (water, etc.)

The time estimates are not sequential in that, upon passage of key milestones, the following phase can be initiated before the preceding one is fully completed. The proposal covering Studies is for 8 months of work.

A. Studies:

The work to be done under Studies covers the following tasks:

1. Rounding out the concept
2. Analysis of the mutually interacting parts of the concept
3. Definition of the magnitude of the effort and time scale to be required in each of the phases
4. Definition of critical milestones
5. Collection of relevant technology documents
6. Consultation with utilities and industry on technical goals and cost estimates
7. Consultation with branches of the Federal Government as may be necessary
8. Laboratory materials study to verify the key technology points
9. Experiments with selective films and measurement of operating parameters
10. A feasibility report on the power project including impact on questions of National needs

HOW DOES THE SYSTEM WORK?

In spite of the considerable effort that has been expended for solar energy research over the past 25 years, applications of solar energy for production of low-cost electrical power have not been successful. The reasons for failure can be summarized in one basic fact: failure to be economically competitive with fossil or nuclear power systems. Contributing to this basic fact are

(1) high initial capital facilities cost
(2) maintenance of the energy collectors
(3) low conversion efficiency (<2%) owing to low operating temperatures
(4) heat losses within the system
(5) degradation of mirrors and Fresnel lenses with dirt and time
(6) energy storage problems for night and cloudy periods

A preliminary re-examination of technology available in 1971 shows that there are new factors that can affect these six points sufficiently to make a system that will be economically competitive with other possible future power systems. Like the D–D fusion reaction, solar power offers an energy source unlimited in time and very large in possible amounts. Unlike the D-D reaction, solar power conversion can very likely be achieved sooner with lower developmental expenditures. This proposal is directed to the examination of the questions of feasibility and the milestones that must be passed in progressing from the conceptual phase to verification of the technology and demonstration of a working system.

Energy losses and carnot principle

Thermal conversion of solar energy encounters a basic conflict between the Carnot principle and energy loss mechanisms. The Carnot principle states that maximizing the yield of work out of a given quantity of heat depends upon maximizing the working temperature. On the other hand, all heat loss mechanisms are also maximized at the maximum working temperature. As a consequence, to maximize the net efficiency for conversion of solar energy into work, we must simultaneously maximize temperatures and minimize heat losses. It is easy to lower conduction and convection losses by minimizing the cross section of supporting structures and evacuating the air from the vicinity of the absorbing surface. Radiation losses are harder to control since one needs an absorbing surface that can both absorb sunlight and inhibit reradiation, i.e., a "selective" surface.

Selective surfaces

The reason one can achieve such a selective surface is shown in Fig. 2. Solar radiation peaks near 0.5 μm and has dropped to a low value at 1.5 μm. Thermal emission from a blackbody (or gray body) peaks in the infrared and at 700 K is about 4.5 μm. As the temperature of the emitting surface is raised, to 900 K for example, the peak shifts toward shorter wavelengths. It is therefore clear that if one can make a surface of the characteristics shown in Fig. 3, one could absorb sunlight (high emittance) and inhibit infrared re-emission (low emittance).

The basic technical capability that is key to the proposed solution is the ability to make highly selective absorbing coatings. These coatings have high absorbance (black) for sunlight and low emittance (high reflectance) in the infrared. As a consequence these surfaces become hot even in the absence of mirror or lens sunlight concentrators. We have already made laboratory samples that can reach the operating temperatures needed to operate conventional high-pressure steam turbine power generators. To reach such temperatures one needs to vacuum encapsulate the absorbing surfaces to reduce convective and conductive losses to minimal values.

One can quickly predict the performance of a selective surface. If we plot the solar absorbance a and the infrared emittance e we obtain the graphs shown in Figs. 4 and 5. Note that solar flux on such a planar surface can yield high temperatures and a maximum extractable energy suitably high to be attractive for system applications.

We find that these highly selective surfaces can be made in at least two basic ways:

1. Intrinsic solid-state films, such as silicon over gold, suitably isolated for diffusion

by a dielectric layer; the surfaces are deposited by evaporation, sputtering, or reactive chemical deposition.

2. Interference thin films where ordinary metals and dielectrics are combined to produce highly selective optical properties by means of proper selection of film thicknesses, the layer being deposited by evaporation, sputtering, or reactive chemical deposition.

At this point we do not know which of the several methods that are available will yield the optimum cost for the final system.

The use of evacuated selective film absorbers changes points (3) and (4) above [page 5] and offers the possibility of yielding total conversion efficiencies in a steam turbine system on the order of 30% of the solar energy incident on the surface of the earth. Operating temperatures of 1000° F (540° C), currently used by power utilities, seem obtainable.

The achievement of a practical power *system* requires some way of storing all the received energy and allowing use of this energy at the actual demand rate imposed upon the utility.

Direct conversion of solar power, or of energy once it is converted into electricity, can be done only by use of batteries (expensive, relatively short cycle lifetime) or hydrostorage (huge volumes of water per megawatt-hour storage). In the case of thermal conversion, we have the option of storing the energy as heat. At the high operating temperatures that we propose we can use the high *heat of fusion* of common materials to store energy at a constant temperature.

SYSTEM DESCRIPTION

The proposed system is shown in Fig. 6. The upper portion is the energy supply subsystem. The lower portion is the energy conversion subsystem. The central portion interfacing these two subsystems is the storage and transfer subsystem.

Supply Subsystem I. The field of solar collectors is provided with a circulating system of liquid metal (Na or NaK) to extract heat from the collectors and transfer it to the storage subsystem. The liquid metal (LM) would enter the collector field at a low temperature, as determined by the condenser temperatures of the steam turbine. It would exit at a high temperature (1000+°F), close to that of the input temperature of the steam turbine. Much of the basic AEC technology for handling LM would be applicable and have fewer complications since the LM would not be radioactive. Different modes of operating the LM loop will be used depending on whether the system is gathering energy or is in a standby mode.

Thermal Storage Subsystem II. The thermal storage subsystem is a large tank, probably sunk into the ground, containing a material whose melting point is approximately equal to the turbine operating temperature. A number of salts and metals having large heats of fusion are available. The exact choice depends both on the exact temperature desired and its cost and physical handling properties. The LM loop from subsystem I passes through the storage medium and transforms a portion of it to the liquid phase.

The shape of the tank is optional since adequate thermal insulation can be provided at low cost to make the thermal relaxation time several weeks or months long; hence the shape can be determined for engineering convenience either as a cylinder with the hottest zone in the center or a rectangle with the hot zone at either end or in the central region. The top of the tank should be free-floating since the melting material will in general change volume upon phase change. The top of the tank, for example, could be a floating raft of firebrick of density lower than that of the liquidus phase.

Our study will examine the tradeoffs of various thermal storage media, geometrical configurations, and heat exchanger loops.

Conversion Subsystem III. The conversion subsystem consists of the high-pressure steam loop, turbine and generator, reject heat exchanger and condenser, and pumps. The pressurized working fluid (water) is injected into the boiler stage of the subsystem II where it is vaporized. The steam is superheated in the superheater stage of the subsystem II and carried to the turbine. The turbines can be of a wide variety of types depending on the reject temperature desired. If maximum energy is extracted by an ultra-low-pressure turbine stage, the condenser temperature need be only 20°F above ambient. If one wishes to use the reject heat for auxiliary uses, such as desalination or chemical processing, then the low-pressure stage of the turbine may be eliminated.

The steam loop of subsystem III enters the thermal storage subsystem at a low temperature and exits at close to the temperature of the incoming LM loop from subsystem I.

System Details. Subsystem II can store a large amount of energy at constant temperature. The system temperature T_s is achieved when the output end reaches melting temperature at energy input Q_1. The system temperature remains "constant" up to energy input Q_2 when all of the storage material is melted. If additional energy is pumped in and if the LM temperature is above T_s, then the storage system temperature will rise. The total mass of the storage medium is then determined by how much energy ($Q_2 - Q_1$) is to be stored. The minimum amount is clearly the amount needed to supply power during the nongathering period of 24 hours. Additional material is needed to provide reserve energy for successive cloudy days, rare for the Yuma area of California and Arizona. The order of size of the thermal storage for a 1000-MW generator will be 300,000 barrels, a large-sized oil storage tank.

The solar collectors must be evacuated, and the mass of glass required represents a major portion of the costs of the proposed systems. Studies will be made to optimize the size/area relationships, and our preliminary estimate is that the optimum size will be a 6-in. to 8-in. diameter glass pipe.

The absorbing surfaces can be arranged as shown in Fig. 7a. A planar surface of width equal to the pipe diameter is conceptually simple and has the advantage that the collector will function well on bright cloudy days, whereas "lens" collectors function only when a direct image of the sun is available. Planar surfaces, however, require higher values of a/e to reach a given operating temperature.

A simple form of optical flux concentrator is showing in Fig. 7b, where the lower half of the pipe is used as a mirror. This portion of the pipe in any case is high-reflectance-coated to minimize radiation back-losses, so use of it seems attractive if higher operating temperatures are desired for a given a/e rate. The mechanical structure having the selective coating in this case can be a simple pipe or triangular structure to minimize mass of the pipe and total surface coated. Choice of one or the other depends upon optimization studies.

One idea of what a solar power station might look like is shown in Fig. 8. The actual collecting panels will probably be of the tubular type rather than the flat panels shown in this figure.

In the next three pages are quantitative descriptions of the efficiencies, cost, and needed areas for the solar power systems.

SYSTEM EFFICIENCIES

Sunlight (average, desert, sea level)	0.800 kw/m².
Absorbance × Losses	0.75.
Q input	0.600 kw/m²
Carnot efficiency	0.55.
Turbine	0.75.
Energy utilized	0.250 kw/m².
Efficiency	31%.

ALTERNATE DERIVATION

BTU input	2700/m²·hr.
Clear days/year (Yuma)	330 days.
Average day	8 hrs.
Hours/year	2650 hrs.
Absorbance × Losses	0.75.
BTU output	5.4×10^6 BTU/m²·yr.
"Therms"/m²·year (At "standard" utility conversion rates per therm of energy)	5.4.
Energy output	660 kw hr/m²·year.

WHAT IS THE COST OF THIS ENERGY?

[Solar power faces the economic problem that energy is purchased via a capital outlay rather than an operating expense]

SYSTEM COST

	K.g./m²	Amount
Absorber	15.6	$13.8
Envelope	34.3	7.9
Coatings		2.1
Plumbing	15.0	13.9
Support	25.0	11.2
Heat collection	17.1	6.8
Thermal storage	19.9	2.2
Site		2.2
Labor		20.0
Cost per meter [2]		77.9
Amortization 10 years (5 percent).		
Cost of energy (0 to 10 years)		18.0 mills/kilowatt hour.
Mean life to failure		40 years.
Cost of energy (10 to 40 years)		0.6 mills/kilowatt hour
Average energy cost		5.0 mills/kilowatt hour

AREA NEEDED

250 MW AP: [1]	
(850 MW PP[2] input):	
Collecting Area	3.4×10^6 m²
Land area	9.0×10^6 m²
Dimensions	3 km square.
1000 MW AP:	
Collecting area	14×10^6 m²
Land area	36×10^6 m²
Dimensions	6 km square.
National Solar Power Facility 1,000,000 MW AP:	
Land area	36×10^9 m²
Dimensions	188 km square or 117 mi square.
Area	13,700 mi²
Desert areas of the United States	100,000+ mi²
We need 13.7 percent of the "Desert"	

[1] AP=24-hour average power.
[2] PP=10 AM peak power.

WHAT ACTION IS APPROPRIATE NOW?

We would like the utilities of Arizona to recommend how the utility industry should be represented in the project. Initially the Western states will all benefit from the project. We cannot ignore the critical needs of the Eastern Seaboard, and their needs and the need to solve the matter of long-distance power transmission become inescapable parts of this project. Would West Associates be an appropriate representative, or should some of the Eastern utilities groups or Edison Electric Institute be invited to participate?

What action can the State of Arizona take to facilitate such things as land availability and siting approvals for the demonstration units? Could an area of several square miles be set aside as a "Solar Energy Reserve"?

What action can our Congressional delegation take to establish the project? One area of concern is that the charter of the NSF states that it can give grants or contracts to industry only with the approval of the President. For this reason, the NSF has dealt entirely with universities and nonprofit groups. It now appears that the NSF through its new RANN program (Research Applied

to National Needs) will have a charter to catalyze solutions to the energy problem. The energy problem is so large that industry must be a primary participant; therefore, it seems appropriate that an effort be made to facilitate Presidential approval (through the OST) for this project.

THE ENVIRONMENTAL CRISIS IN POWER GENERATION AND POSSIBLE FUTURE DIRECTIONS

(By Peter E. Glaser, Phd., Head Engineering Sciences Section, of Arthur D. Little, Inc., Cambridge, Mass.; presented at: 39th National Meeting of the Operations Research Society of America, Dallas, Texas, May 7, 1971)

THE GENESIS OF THE CRISIS

We can no longer doubt that the Earth's resources are finite. We have to accept the reality of "spaceship" Earth. This realization has brought about the awareness that we cannot continue the mindless exploitation of nature for much longer. Yet, we have to tap the world's energy resources to maintain our industrial potential and to meet our consumer needs. We are not sure whether we can satisfy our projected energy demands without imposing unacceptable burdens on the environment. Our major urban centers have already experienced the miseries of electric power shortage, a new phenomenon in our formerly energy-rich society. We expect that these problems will be with us for a long time and will not be solved easily.[1] We are not certain whether the technology of energy production which is being developed to meet our projected electric power demands will spawn a whole host of hydra-like problems.

Increases in the level of energy consumption in the United States can be directly related to increases in the GNP.[2] Our consumption of energy has increased from about 3% a year between 1947 and 1965 to about 5% a year since 1965. Our appetite for energy has become so voracious that each year we are burning up 500 million tons of coal, 20 trillion cubic feet of natural gas, and 5 billion barrels of oil.[3] And, there is no sign of a slowdown. Between now and the year 2000, if we are to meet our burgeoning demand, we will have to increase our power-generating capacity to six times its present level—from 330 million kilowatts to nearly 2 billion. In that time, electric utilities will have to invest about $600 billion in capital expenditures.[4]

The problem we face in trying to avert the crisis is two-pronged. First, the world does not have limitless supplies of coal, oil, or gas, or even of fissionable elements.[5] Second, even if the supply of these energy sources were infinite, we could not continue to use them as we have without placing an intolerable burden on the environment. In fact, our still new concern for the environment has already made our limited supply of fuels even more limited. Witness, for example, the prices utilities and cities have had to pay for low-sulfur residual oil. For example, a barrel of oil cost Boston Edison $1.75 three years ago and now costs $4.25. We need options, but our options are sharply restricted by the limitations on our fuel supplies and our need to protect the environment. And one option that we may not have is the alternative of putting artificial ceilings on the demands for energy; energy itself is a prerequisite for many of our social and ecological goals.[6] Therefore, the challenge to us is to use our present resources more efficiently while we develop options for the future.

WHAT'S GOING ON TODAY

Our present efforts to avoid a power crisis are moving along three paths: increase the efficiency of fossil fuel power plants, develop advanced nuclear power plants, and control the fusion reaction.

Footnotes at end of article.

Approximately two-thirds of the total energy converted in present-day power plants is rejected as waste heat at relatively low temperatures. Thus, efforts to improve efficiency are directed at putting this heat to use or minimizing the amount of waste heat generated. In the past, for example, economics dictated that waste heat be rejected to nearby bodies of water if possible. With the advent of water quality standards, however, limitations are being set on the amount of heat that can be rejected to a cooling water source. Consequently, users are turning to cooling towers, recirculating the water, and exploring ways of putting the waste heat to good use.[7]

Magnetohydrodynamics (MHD) represents an attempt to reduce the amount of waste heat. MHD has the potential to increase the cycle efficiency of steam power plant to about 50 or 60% and thus reduce their waste heat to 40–50%. An experimental power plant using MHD has been constructed in Russia. However, there is no assurance as yet that the inclusion of MHD in the steam power plant cycle will prove to be economically viable.

Nuclear power, although still very promising, has run into a number of roadblocks. Some of these are purely technical and have led to increased costs. Some deal with the inherent problem of waste-heat rejection and safety. Some concern adequate supplies of uranium unless advanced breeder-type reactors can be developed.

The thermal efficiencies of breeder power plants could approach those of modern fossil-fueled power plants and thereby reduce the waste heat rejection problem. However, very substantial sums of money will have to be invested before 1500-megawatt breeder power plants can be purchased by utilities on a competitive bid basis with effective performance warranted. Furthermore, even if power plants based on breeder reactors are successfully developed two major problems will have to be overcome: the difficulty of assuring completely safe operations and the disposal of low-and high-level radioactive wastes.[8] These problems will have to be resolved fairly soon if we are to raise our nuclear electric power capacity to the hoped-for goal of 740,000 megawatts by the year 2000. With only 86,000 megawatts of nuclear power capacity in operation, being constructed, or committed for construction, we already face the task of bringing onstream more than twenty 1000-megawatt nuclear power plants a year for the next 30 years to reach this goal.

There is additional political concern with the widespread production of plutonium threatening a nuclear black market when our dependence on plutonium will rise from about 15% in 1980 to 70% in 2000 as the energy source for electrical power.[9] By then plutonium reserves will total $18 billion in value and 720,000 kilograms in quantity. Only 5 kilograms are required to produce a bomb of the size which destroyed Nagasaki in August 1945.

Controlled nuclear fusion holds substantial promise—a virtually infinite energy source with the possibility that 90% of the fusion energy may be converted to electrical energy. Controlled fusion probably will be demonstrated in the laboratory within the next decade. But commercial viability is something else again. A fusion reactor probably won't be operational before the end of the century. In short, our present efforts to avert an energy crisis are being directed at means which are at best stop-gap measures because of supply limitations, potential threat to the environment, or both. Furthermore, even these efforts are being hindered because we have not established any coherent, comprehensive national energy policy to guide them.

Decisions regarding specific energy sources have been based on the conventional techniques of cost analysis and on the interplay of technical, economic, and social factors in changing political situations. Conflicting reports and recommendations concerning energy vie for public attention as diverse groups argue the merits of their particular energy production methods. There is no technical perspective, let alone a broader social perspective even though such is vital to the achievement of our national goals—goals that will certainly be furthered by the availability of abundant energy with minimal side effects.

One consequence of this dilution of effort is that we are not yet in a position to state what bets should be placed on each of several advanced energy technologies. However, this position may be a blessing in disguise for we have not yet decided that any one energy source is best. Thus we still have the opportunity to systematically evaluate all energy sources—putting each into perspective in terms of costs, benefits, and degree of maturity.

WHAT OF THE FUTURE?

In any evaluations of energy sources, we simply cannot ignore our primary energy source—the sun—which has sustained life and led to the complex interrelationships of the Earth's ecology. We have always depended on the sun but only for its natural function of providing the Earth with a hospitable biosphere through the processes of atmospheric, hydrologic, and oceanic circulations and through photosynthesis. Yet, the sun continuously provides 178 trillion kilowatts to the Earth—about half a million times greater than the present U.S. electrical power generating capacity, five thousand times greater than the world's geothermal capacity, and 60 thousand times greater than the total tidal energy. We have not, however, tapped more than a minute fraction of this colossal reservoir of energy—even though solar energy is available everywhere, is free of pollution, and costs nothing to supply or distribute. This is not to say that man has not tried to take advantage of the sun's energy.[10] He has, perhaps as far back as the early days of Rome.[11] Man has tried to convert solar energy directly to useful power—one example being the photovoltaic cell. He has tried the indirect approach—for example, utilizing temperature differences at various depths in ocean waters.[12] But solar energy was dismissed as being a less feasible means of generating power than conventional methods.

This conclusion is understandable in light of the technology available for the conversion of solar energy before the 1960's. Recent advances in technology, however, have markedly increased the potential for large-scale conversion of solar energy to heat or to electric power.

1. Conversion to heat

The sun's radiation is readily convertible to heat; one need only provide a surface on which the solar energy can be absorbed. If a fluid such as air or water is then brought in contact with the heated surface, the energy can be transferred into the fluid and subsequently utilized for some practical purpose.

An example of the successful application of this principle is the several million domestic hot-water heaters in use in a dozen countries including Australia, Israel, and Japan. A solar hot-water heater usually consists of a blackened sheet of metal or plastic in a shallow glass or plastic-covered box occupying 10–50 square feet of roof area. Water circulates through tubing fastened to the surface of the blackened sheet, and the warmed water is stored in an insulating tank. (The tank can be supplied, if desired, with auxiliary heat.)

The principle employed in solar hot-water heaters can be applied to heating homes—all that is required are more or larger solar-

heating panels. Enough heat can be absorbed in the circulating water or air to provide most of the heating requirements of houses in reasonably sunny climates. Of course, the storage tank must be large enough to provide carry-over capacity during short periods of cloudy weather—perhaps one or two days. Conventional energy sources can be used to supplement the solar heater. If air is used as the heat-transfer medium, it is delivered by fan/duct system either directly throughout the house or to a storage tank filled with water or crushed stone. In the latter case, the heat from the air is transferred to the water or stone.

In the past 25 years a number of houses and laboratory buildings have been heated at least partially with solar energy on an experimental basis in the U.S., Australia, and Japan. Most of these installations have been technically successful and extensive performance data have been obtained on various modifications of the air or water heating systems.

In most U.S. locations residential heating with solar energy would be somewhat more costly than present conventional means because of the relatively high cost of equipment still under development. If produced on a large scale, however, solar house-heating systems could be competitive with fossil fuels, particularly when all of the hidden environmental costs are accounted for.

An extensive economic study of residential solar house-heating indicates that, for the cities considered, the least-cost system size would provide substantially less than the total heat supply.[13] If the solar heating system were designed to supply a more substantial percentage of total heat, average costs would be quite high because the cost of solar heating is almost all in fixed capital investment. Because 100% solar heating is not a rational objective an optimal mix of solar and conventional heat has to be employed.

The least-cost, house-heating system will be applicable to the Southwest and Far West. Higher-cost systems will be useful at more northerly latitudes, e.g., New York, and in more humid climates. The Southeast, e.g., Florida, is a poor site for solar house heating because the heating requirements are too low to justify such equipment. Supplementary heat will be required when solar energy is not available. The optimum combination of solar and electric heat will be that which is equivalent in cost to the cost of electrical power over a 20-year period.

Energy consumption for comfort control can be further reduced with such simple expedients as proper site selection, lay-out, overhangs, insulation, and so forth.

Residential cooling systems that rely on absorption-refrigeration cycles which use the solar-heated water or air from a roof-mounted collector will require more technical development. However, the solar collector would be the same unit used to heat residences and the cooling unit would be a somewhat more expensive version of the conventional heat-operated air conditioner. The inherent advantage of solar cooling is that the maximum requirement coincides roughly with the time when the maximum amount of energy is available to operate the system. In addition, the solar collector, which is the most expensive portion of the system, can be employed nearly year-round if cooling is combined with solar heating.

The technical development of the devices required to cool and heat houses with solar energy has reached the stage where these devices should be available in about 10 years. Their potential impact is evident from two bits of data. First, a 10% reduction in electrical usage normally translates into a 30% reduction in the energy requirements at a power plant. Second, in the year 2000, our power plants will need to generate 120,000 megawatts to heat or cool residences.

2. Conversion to power

The primary advantage of producing power from solar energy is the inherent absence of virtually all of the undesirable environmental conditions ascribed to present and anticipated means of power generation with fossil or nuclear fuels. The interest in producing power with solar energy goes back at least a century.[14] [15] Mouchot's solar-powered steam engine was a central attraction at the Paris Exposition of 1878. More recently, several imaginative concepts have been proposed for the large-scale untilization of solar energy on Earth,[16] in the atmosphere,[17] and in space.[18] Which of these approaches will be the most feasible alternative to present power-generation methods remains to be established. The fact is that most of them are based on existing technology and well-known physical principles.

Space exploration has provided a unique opportunity to develop new materials and methods to invent better technical devices, to improve manufacturing procedures, to lengthen the life of instruments, and to discover new frontiers. This technology and man's capability to successfully undertake major development projects should provide the opportunities and lend credibility for the concepts advanced for the large-scale production of power with solar energy. Two major approaches can be distinguished:

Terrestrial Solar-Energy Conversion

The possibility of direct energy conversion to electricity on the surface of the Earth is intriguing. For example, a 10% solar-energy-conversion efficiency would produce 180,000 kilowatts per square mile while the sun is shining. Thus, it is not surprising that solar-energy conversion, particularly based on photovoltaics, is of interest. The state of the art of solar cells, especially that which is based on single-crystal silicon, is well understood and conversion efficiencies of about 10% can be reached routinely. The major drawback is that present solar cells are prohibitively expensive because they have been developed to meet the stringent requirements imposed by their application in spacecraft missions. New designs for solar cells and the supporting arrays would have to be developed to permit the cells to be mass-produced and to obtain the consequent savings. Cost reduction by more than two orders of magnitude would be required so that a price of $1.00 per watt could be approached. Designs based on partial concentration of solar radiation could be evolved to minimize the number of solar cells. Approaches following these lines might decrease the cost to about $150 per kilowatt.[19]

The location of a solar power station would be crucial. Even in Arizona January normally has 15 days of 0.3 cloud cover or less, 7 days of cloud cover between 0.3 and 0.8, and 9 days of cloud cover of 0.8 or greater. This amount of cloud cover would greatly reduce the solar-energy conversion capability. Thus, energy storage for night periods and overcast days would be required. Whether this would be pumped-water storage, pneumatic storage, or hydrogen and oxygen produced by electrolysis for use in fuel cells would have to be carefully evaluated. Land costs, power substations, and transmission lines will substantially affect the economics of operation. For example, to supply Arizona in the year 1990 would require about 190 square miles of solar-energy-conversion surface if the various inefficiencies of the system are taken into account.[20] The economic attractiveness of this approach could be greatly enhanced by increasing the efficiency of solar cells from the present 10% to 20%, which appears to be a distinct possibility.[21]

Solar Energy Conversion in Space

The successful missions of unmanned spacecraft in Earth orbit and to other planets have demonstrated the feasibility of direct conversion of solar energy in space to produce power and telemeter signals. Based on this experience and the further advances in space technology which can be projected, the concept of a system of satellite solar power stations has been proposed.[22] Suggestions to use satellite collectors to concentrate solar energy and beam it to Earth are not new,[23] [24] but the technology now available to us makes such suggestions practical.

Such satellites, when placed in synchronous orbit around the Earth's equator, will be exposed to solar energy for 24 hours a day except for short periods near the equinoxes. Lightweight solar cells deployed over a substantial area of a solar collector can produce electricity which can be transmitted to microwave generators.[25] Microwaves of a selected wavelength can be beamed by an antenna to a receiving station on Earth with no significant ionospheric or atmospheric absorption.[26] The receiving station on Earth, consisting of a microwave rectifying antenna, converts the microwave to DC electricity.[27] A system consisting of a network of such satellite solar-power stations could generate enough power to meet foreseeable future energy production requirements.

The primary advantage of this approach is that the inefficiencies of the conversion process can be tolerated in outer space. On the Earth microwaves could be converted to electrical power with efficiencies of about 90%.[27] This efficiency cannot be equaled with any known thermodynamic process. The microwave beam power density would range from one-tenth of the solar energy received on Earth (at the fringes of the receiving array) to an amount equal to the solar radiation density (in the middle of the array). Since the microwave beam position with respect to the receiving array can be carefully controlled, the beam *should not represent a significant health hazard.* Beyond the confines of the receiving arrays the beam density would drop to immeasurably low values.

A satellite solar power station capable of producing 10,000 megawatts, for example, to meet the demands of a city such as New York in the year 2000, would require an Earth-orbit transportation system with a reusable booster and a space shuttle.[28] The development over the next decade of such a transportation system coupled with the experience which will be gained in placing large, manned space stations in orbit indicates that many common technical problems will have to be addressed.

Detailed design concepts have not yet evolved to the point that cost and weight trade-offs among components can be made. However, on the basis of likely developments, capital costs of $500 to $1,000 per kilowatt appear to be feasible.[29]

To develop a system of major proportions will require the type of systems engineering and management techniques which have already been proven in such massive engineering undertakings as the manned lunar landing program. Although the task appears to be immense so are the opportunities if we can succeed.

IN SUMMARY

We appear to be at the threshold of a new era of energy production. Before we commit ourselves to pursue any one direction, solar energy, and its potential large-scale application relative to other technically feasible energy production methods capable of meeting national needs, should be evaluated. This evaluation should involve the definition of standards, criteria, and procedures for analysis on technologic, economic, social, and political grounds. With such an evaluation, the steps we take over the coming decades will be consistent with national goals and broader national purposes.

We can envisage the possibility of forming a global partnership to develop solar-energy applications to benefit all peoples. Such a partnership might very well mean the reali-

Footnotes at end of article.

zation of the goal: "to curb the arms race, to improve the human environment, to defuse the population explosion, and to supply the required momentum to development efforts before the problems facing the world today will have reached such staggering proportions that they will be beyond our capacity to control." [30]

ACKNOWLEDGEMENT

I owe a debt of gratitude to many persons who have supported and encouraged my endeavors to advance the utilization of solar energy. These include colleagues at Arthur D. Little, Inc., and many valued friends in the International Solar Energy Society. I wish to acknowledge valuable discussions with Mr. W. Brown, Raytheon, Mr. W. Cherry, NASA/Goddard, Dr. G. Löf, Denver, and Mr. E. Ralph, Heliotek; they have been most helpful in providing valuable inputs in terrestrial and atmospheric applications of solar energy and microwave transmission.

FOOTNOTES

[1] Stern, M.: Con Edison's Prospects of Meeting City Demands in 10 Years Held Bleak, *The New York Times*, March 17, 1971, p. 30.

[2] Dole, H. M.: America's Energy Needs and Resources. Dept. of Interior. Presented at Stanford University, Palo Alto, California, January 12, 1971.

[3] Committee on Public Works, United States Senate. Some Environmental Implications of National Fuels Policies. December 1970.

[4] Crawford, W. D.: Electric Power in the 21st Century, *Prof. Engineer*, Vol. 41, 2, 1971, p. 20.

[5] Hubbert, M. K.: Energy Resources for Power Production. Prepared for Symposium on Environmental Aspects of Nuclear Power Stations. International Atomic Energy Agency, Paper IAEA–SM–146/1. United Nations, New York, August 10–14, 1970.

[6] The Energy Policy Staff, Office of Science and Technology. Electric Power and the Environment. Washington, D.C., August 1970, p. 2.

[7] The Energy Policy Staff, Office of Science and Technology. Considerations Affecting Steam Power Plant Site Selection. Washington, D.C., December 1968, p. 14.

[8] Gravel, M.: U.S. Senator, Alaska. Reason to be Worried—The Need for a Moratorium on Construction of Nuclear Power Plants. Statement to the Oregon State Legislature, March 3, 1971.

[9] Shapley, D.: Plutonium: Reactor Proliferation Threatens a Nuclear Black Market, *Science*, Vol. 172, 9 April, 1971, p. 143.

[10] Daniels, F.: Direct Use of the Sun's Energy. Yale Univ. Press, New Haven, Conn., 1964.

[11] Rau, H.: Solar Energy, Macmillan Co., New York, 1964, p. 43.

[12] Claude, G.: Power from the Tropical Seas. *Mech. Eng.*, Vol. 52, No. 12, December 1930, p. 1039.

[13] Tybout, R.A. and Lof, G.O.G.: Solar House Heating. *Natural Resource Journal*, Vol. 10, No. 2, April 1970.

[14] Ericsson, J.: The Sun Motor and the Sun's Temperature. *Nature*, Vol. 29, January 1884, p. 217.

[15] Mouchot, A.: L'Energie Solaire et Ses Application Industrielles. Gauther-Villars, Paris, 1869.

[16] Meinel, A. B. and M. P.: A National Solar Power Facility—2076 AD. To be presented at International Solar Energy Society Conference, NASA-Goddard Space Flight Center, Greenbelt, Maryland, May 10, 1971.

[17] Cherry, W. R.: Concept for Generating Commercial Electrical Power from Sunlight. Presented at Eighth Photovoltaic Specialist Conf., Seattle, Washington, August 1970.

[18] Glaser, P. E.: Power from the Sun: Its Future. *Science*, Vol. 162, November 22, 1968, pp. 857–861.

[19] Ralph, E. L.: A Plan to Utilize Solar Energy as an Electric Power Source. Presented at Eighth Photovoltaic Specialist Conf., Seattle Washington, August 1970.

[20] Rink, J. E. and Hewitt, J.: Concepts for Larger-Scale Solar Energy Conversion on the Earth's Surface. To be presented at Intersociety Energy Conversion Engineering Conference, Boston, Mass., August 7, 1971.

[21] National Academy of Sciences. Report on the study of the increased efficiency of solar cells. To be published.

[22] Glaser, P. E.: Power Without Pollution. *The Journal of Microwave Power*, Vol. 5, No. 4, December 1970.

[23] Oberth, Hermann: Die Rakete zu den Planetenräumen. Oldenbourgh Press, Munich/Berlin, 1923.

[24] Gaucher, L.: Energy Sources of the Future of the United States. *J. Solar Energy Soc.*, Vol. 9, 1965, p. 119.

[25] Brown, W.: High-Power Microwave Generators of the Crossed-Field Type. *The Journal of Microwave Power*, Vol. 5, No. 4, December 1970.

[26] Falcone, V.: Atmospheric Attenuation of Microwave Power. *The Journal of Microwave Power*, Vol. 5, No. 4, December 1970.

[27] Brown, W.: The Receiving Antenna and Microwave Power Rectification. *The Journal of Microwave Power*, Vol. 5, No. 4, December 1970.

[28] Tischler, A. O.: Space Shuttle—Defining a Giant Step in Space Transportation. *Astronautics & Aeronautics*, Vol. 9, No. 2, 1971, p. 22.

[29] Glaser, P. E.: Space Resources to Benefit the Earth. Presented at Third Conference on Planetology and Space Mission Planning, The New York Academy of Sciences, October 29, 1970.

[30] U Thant: Quoted by J. Reston, *The New York Times*, October 23, 1970:39M.

Large Scale Solar Electric Power Generation

(By E. L. Ralph, Heliotek, Division of Textron, Inc., Sylmar, Calif.; presented at Solar Energy Society Conference, Greenbelt, Md., May 10, 1971

(Note.—Figures referred to are not printed in the Record.)

ABSTRACT

The need for a new source of energy for generating electric power has been well established. This new energy source must be able to meet the many demands of our society in respect to resource depletion, increased electrical power requirements, peak demands, site location, low costs and the elimination of pollution. The one energy source that provides a solution to these problems is solar energy. Although no significant effort or funds are being spent on solar energy research, there are indications that this energy could be tapped with present day technology. This paper describes some features of a large scale solar cell electric power generating system that could be built to show the feasibility of utilizing solar energy. The basic system components are described and an engineering analysis made of the electrical, optical, mechanical, and thermal characteristics of the system.

INTRODUCTION

One important question facing the world today is whether solar energy will become an important source of power for the future. Power has become very important in modern man's life. Everyone is aware of the vast amount of energy being used to supply this thirst for power. Also, almost everyone is aware that a precarious balance exists between the discovery of natural resources that supply this energy and the rate that it is used. It is known that the fossil fuel resources being used are not replaceable and will eventually be depleted. Probably the only reason there is no crisis declared is that for the immediate time and short term future, fuel is plentiful and cheap. As long as this is the case the Earth will be looted and stripped of these resources because everyone is enjoying the power.

Even though the vast majority of the people on Earth would not want to change this situation today, it is the responsibility of the leaders in government and science to have a plan to conserve resources and provide power for generations to come. This responsibility extends beyond the area of fuel resources into an understanding of all resources of the Earth and the limits these resources place on man's usage.

To better understand the significance of the earth's power situation an epoch of fuel exploitation and potential has been shown in Figure 1. (1) A period of time has been selected to which one can relate, in respect to the civilization that has preceeded us over 2000 years and a time in the future half as long. Total world power has been plotted on a log scale to provide accuracy in data and at the same time provide a scale covering a wide range of power. Of primary concern are the fossil fuel curves for crude oil and coal. These are shown as solid curves (as is the U235 nuclear burner source) since these are actual production levels and projections based on studies of the source reserves.

The short dashed curves represent potential power sources which have a finite amount of energy so they too must eventually be depleted. The long dashed lines represent power sources that are perpetual. The line represents the maximum level of power if the resource were fully developed. It can be seen that geothermal and tidal power potential are quite low. Surprisingly, water power usage is presently quite low in respect to what is could be if it were developed fully. Nuclear breeder reactors could provide a high level of power for 1000 years if the development problems can be solved in time so that the natural radioactive fuel (needed to breed new fuel) are not depleted first. The lithium-deuterium fusion reaction could provide about the same power level. The limit on time is based on the depletion of lithium.

All the above energy sources could provide power levels at or near the world consumption rate (the 1950 rate is shown for reference). None of these sources, however, can provide perpetual power. Only coal can be relied upon for the near future, unless some technological breakthrough occurs in breeder and fusion reactor research. The two obvious giants in respect to energy sources are deuterium-deutrium fusion and solar energy. D–D fusion could provide 10^{17} kwh/yr for 6000 years before it would deplete the ocean of deuterium. The solar energy intercepted by the earth converted at 10 percent efficiency could provide this same power level perpetually. A look at the amount of energy available from the D–D fusion reaction makes it clear why research is being sponsored. Since solar energy has this same potential it appears to have equal justification for research support.

SOLAR POWER STATION PLANNING

A proposed plan that has been discussed (2) would follow a step-by-step development of solar power systems starting from small modular arrays and going up to large scale solar power stations as shown in Figure 2. The research and development on new materials, new devices, manufacturing methods, regulation and storage systems, and power transmission would be done during Phase I and II. Prototype power stations would also be built during Phase II. By 1985 large scale power stations on the Earth could be constructed to prove feasibility and stimulate production. In the 1990's full scale solar power stations would be built. These could be ground based, airborne, or space stations depending on the results of the development program. The direction to be followed in developing large scale solar power stations depends on factors other than strictly technical requirements.

There will be strong economic factors to

be considered. The system must be competitive with the prevailing costs of power stations. This will not be able to be proven unless the proper research and development funds are made available to work out the system design and prove feasibility. As inexpensive fuels are depleted and cost of making pollution free power stations go up, the economic justification for alternative power sources increases.

Social factors will become more important than they have in the past with the development of other power sources. The waste products of massive power generating stations and transportation power are becoming a curse to society. There is a great social need for the development of a clean power source.

Another factor to consider is the impact of a new field of business emerging. How will it affect the business of long established energy interests? The transition must be made at a pace that causes the least hardship and stress for a business that provides employment for large numbers of people.

Then there is a factor of public opinion and acceptance. New ideas and different physical features will need to be accepted. A power station may be a farm having crops consisting of many acres of solar cells producing electrical power. Power may be generated during the sunlight hours and stored in the form of a fuel (such as hydrogen or aluminum) for use in a fuel cell as the power is required. Power may be beamed from one point to another instead of traveling on wires.

Political factors will also play a part. The advantage of huge quantities of perpetual power and a pollution free power source might be a strong platform to win constituent approval: Countries that conserve their fossil fuel resources for use in products and use solar energy as a power source, will be the powers of the world when others have burned their resources.

SOLAR POWER STATION DESIGN

Today's silicon solar cell technology can be taken and applied to the design of a large scale solar power station. Silicon solar cells could simply be connected together in a weather protected array of any size and power level. This array would produce electric power from solar energy on the Earth's surface at an efficiency greater than 10 percent. The design problem one faces is how to build the array economically. In order to solve this design problem we need to determine the basic components required and the cost levels of these components. Let's consider a specific power station design with characteristics shown in Figure 3.

The solar power station will be a terrestrial design. It will be one square mile in area which corresponds to a peak electrical generating capacity of 0.259×10^6 kw at a solar intensity of 100 mW/cm² and a conversion efficiency of 10 percent. It will be located in the Phoenix, Arizona area which has a mean daily solar radiation value of 540 langleys per day on a horizontal surface. (3) The one square mile station will therefore receive 16.1×10^6 kwh per day and produce at 10 percent efficiency 1.6×10^6 kwh per day. The raw DC electrical power generated would be fed directly to a central switching station by conventional DC transmission lines. The central station would convert the DC to AC, transform the voltage to standard levels and switch it onto the existing distribution systems. All the solar electric power generated would be utilized, while power from conventional turbine generators would be switched into the system as needed to supply the demand just as it is with conventional electric power distribution stations.

Energy converter design

Silicon solar cells will be used as the solar energy converter. The design of this device cannot be fixed at this time because the system cost will be primarily dependent on the converter design. A conventional single crystal silicon solar cell as built today would provide a very good technical design, but a poor economical design. New devices or low cost concentration techniques must be developed before the device design can be fixed. However, a test has been made of the feasibility of using silicon as the building block for large scale solar power stations and the results are shown in Figure 4.

The amount of silicon required to cover one square mile at a thickness of 0.010 inches is 1.5×10^8 kg. Assuming 50% waste the total amount of single crystal silicon required would be 3.0×10^8 kg which corresponds to a cost of \$920 x 10^6 at the current rate of \$0.30 per gram. Consequently, this cost represents a investment of \$3550 per kilowatt of generating capacity just for the silicon used in the converters, so it is apparent that this approach is not competitive with conventional fossil fueled plants that cost as low as \$125 per kilowatt generating capacity.

A look at the costs for various forms of silicon reveals that the raw material is not the basic limitation, but instead it is the particular process used that determines these costs. For instance, single crystal silicon can be formed by depositing directly from the vapor phase instead of going through an intermediate step of melting and growing single crystals. In this case single crystal silicon rod, which costs \$0.07 per gram, for the one square mile array would cost \$215 x 10^6 which corresponds to \$830 per kilowatt generating capacity. Already this is a good cost reduction and no new technology is required.

If we assume silicon technology and production techniques can be improved, then it might be reasonable to assume that costs would be close to the cost of the purified raw material (trichlorosilane cost is about \$0.01 per gram) used to produce the silicon. (4) In this case the silicon for the one square mile array would cost \$30 x 10^6 or \$115 per kilowatt of generating capacity. This would be about \$1 per square foot and brings the silicon costs into a competitive range so that an array design with no concentration techniques need be considered.

Another cost reduction step might be feasible if one could use metallurgical grade silicon which is 96 to 99% pure, plentiful, and costs \$0.0004 per gram. (5) This material would cost \$1.2 x 10^6 for a one square mile array or \$4.6 per kilowatt generating capacity. Raw material silicon costs as obviously not a limiting factor.

Silicon production capacity was also considered. The yearly production of high purity silicon in the U.S. is estimated to be 0.5×10^8 kilograms. The one square mile power station requirement of 3.0×10^6 kilograms would have a significant impact on the high purity silicon production facilities since it is a requirement about six times the present capacity. On the other hand it represents only five percent of the metallurgical grade silicon production which is 66×10^6 kilograms per year.

Thermal control design

The power output for a given solar cell is dependent upon the incident illumination spectrum, the cell response function, and the cell temperature. Any significant utilization of solar cells for terrestrial power generation will require ultra high cell array outputs. Due to the relatively premium cost of solar cells, terrestrial solar cell power systems must include some economical means of providing high solar cell power output. This is commonly achieved by using low cost reflective collectors to increase the illumination intensity on the cell which in turn will reduce the cell quantities required for given power needs. These collectors, nominally consisting of reflective aluminum surfaces have a drawback in that large quantities of solar radiation which fall outside the solar cell's response region are equally intensified on the cell. This radiation, and also the radiation within the cell response region not converted into electrical current, is ultimately transformed into heat. This causes the cell temperature to increase, until equilibrium is attained with the surrounding environment. This increase in temperature reduces the cell output.

Consequently it is desirable to eliminate incident radiation which falls outside the cell's response region, and also radiation which is not efficiently utilized as that most of it is converted to heat. Techniques for achieving this consist of the use of cold mirror concentractors, which do not reflect inefficient wavelengths upon the cell, and multilayer interference filters located between the cell surface and reflector which transmit only "efficient" portions of the collected beam.

A theoretrical analysis of cell output under idealized conditions of incident radiation wavelength discrimination was conducted to determine the magnitude of cell power improvement that could possibly be attained through the use of large reflector collection values. The solar illumination spectrum and intensity upon the cold mirror was taken as air mass two. A typical panel was envisioned as solar cells bonded to a thin aluminum plate which was placed upon a 45° inclined hill consisting of finely divided and compacted sand. The reflector was envisioned as a number of cold mirrors located at some distance from the solar panel which concentrated light upon the panel.

An ideal cold mirror was assumed consisting of 95 percent reflection between 0.61 microns and 0.96 microns and 0% reflection outside those limits. A simple heat transfer relation was utilized for determination of the cell's equilibrium temperatures under varying concentrator ratios, i.e.:

$$\alpha G = (0.29)\left(\frac{\Delta T_1}{L}\right)^{1/4} \Delta T_1 A + 0.71\left(\frac{\Delta T_2}{\Delta X}\right) A \quad \text{(Eq. 1)}$$

= heat convected to atmosphere + heat conducted to ground

where α = solar cell absorptivity = 0.82
G = incident radiation intensity in BTU/hr
$\Delta T_i = T - T_i \quad i = 1, 2$
T = cell temperature
T_1 = air temperature ~90° F
T_2 = ground temperature ~60° F
$\Delta T_2/\Delta X$ = temperature gradient of earth beneath panel
A = panel area = 1 ft²
L = panel side = 1 ft.

This relationship can be solved to find T for a particular value of G only when the Earth temperature gradient is determined.

In the given equation all terms, with exception to the Earth temperature gradient are sufficiently listed in reference material (6) (7) that values of T can be calculated. The temperature gradient could be determined empirically; however, for this analysis, another approach was utilized. Sample collector and cell systems, consisting only of aluminum reflective surfaces, (no cold mirror surface) were examined to determine the relative cell output versus panel temperature. Since these systems did not reject the inefficient energy which the cold mirror would, it was assumed that for a given relative output the operating temperature of the ideal system would be lower (or at worst, the same) than the aluminum collector. For this analysis it was conservatively assumed the aluminum and ideal collector systems would have the same temperature for given relative cell outputs. Through trial and error the heat transfer equation was solved to satisfy the above requirements and a value for the temperature gradient was obtained. This, in turn, was solved to yield a value for Δ x which was then used for all concentrator levels.

Typically cell output was then determined by assuming some collector ratio; hence determining the illumination intensity. This spectrum was then multiplied by the cell response curve to yield the cell output current for a 28° C temperature. This value was then compared to the output of the same

cell under unfiltered AM2 conditions 28° C. Following this the cell's operating temperature was calculated from the heat transfer relation and based upon cell I–V characteristic vs. cell temperature data, (8) the cell's power was adjusted to correspond to the new operating temperature. This procedure was repeated for a wide range of collection ratios, varying from 1 to 35. The curve in Figure 5 labeled "ideal mirror" shows the calculated cell output relative to the same cell at AM2, 28° C conditions.

The data presented in Figure 5 shows three curves: the linear relation expresses relative cell output versus concentration ratio for a fixed temperature system. In practice this could be achieved only through the use of perfectly designed cooling fixtures. Next to this is shown the data points for simple aluminized collector systems that have been experimentally tested. The dotted line extrapolates this type system to higher concentrator ratios. The third curve plots the calculated output for the ideal cold mirror system. Figures adjacent to the data points are the temperature values for the illuminated cell.

The aluminum and cold mirror collector curves exhibit similar behavior showing a cell output increase with concentration ratio, a peak power output, and a falling off in power for further concentration due to increasing temperature. The cold mirror collector, although initially yielding inferior power output in comparison to the plain collector eventually obtains higher outputs than can be achieved by the plain collector. Such a family of curves for various concentrator-filter configurations would be useful in designing terrestrial power systems. Where low cost, low power systems would be required or where limited room was available the plain aluminum collector would provide the best solution. Conversely for high power requirements and high concentration ratios a filtered collector would be expected to provide an advantage. Of course, the cost of the collector needs to be thoroughly examined and for some power requirements might prove to outweigh cell costs. In such a situation the power system designer might more economically utilize large cell quantities or forced cooling systems. It is evident that the use of collector configurations and passive cooling will provide a limited practical solution to the economic power generation problems. By utilizing inexpensive collector systems (either reflective or cold mirror) a solar cell system capable of providing moderate power levels over extensive periods of time under minimum maintenance circumstances should prove to be economical and "ecological." For larger power requirements and high concentration ratios some means of forced cooling would be needed in addition to the passive cooling system in order to gain the advantage of increased power per solar cell.

SUMMARY

It is quite clear that solar energy could be used to produce vast amounts of electrical power by using solar cells. To make this practical, efforts must be directed toward a substantial reduction in the cost of solar cell arrays. Considering the low cost and plentiful supply of metallurgical grade silicon, it appears that it would be desirable to try and develop a purification process that would produce solar cell grade silicon at a small fraction of the cost paid today.

Although silicon cost reductions alone appear quite promising, it has been estimated that work directed toward a reduction of solar cell processing costs and array fabrication costs would also provide another substantial cost reduction. (2) Also concentration techniques can be utilized if necessary to reduce the number of solar cells required. Assuming these cost reduction development efforts are successful and solar power stations such as that described above become operational a schedule should be made for phasing in this new power source.

Figure 6 shows the level of electrical power generation in the United States for the past fifty years. This curve has been extrapolated about 70 years based on forecasts made to the year 2000. (9) The slope of this curve indicates that electrical generation in the U.S. is increasing at a rate of a factor of two every decade. Assuming a start of the use of solar power stations about 1990 the total U.S. requirement could be provided within sixty years if the solar power generating capacity was increased by a factor of ten every decade. By the year 2000 there would be ten one square mile power stations. By the year 2020 there would be 1000 square miles of solar arrays which would produce a level of power generation almost equal to that produced in 1960. This substantial capability would require an area 10 miles wide by 100 miles long, a size that could easily be accommodated in many locations in the U.S. By the time all electrical power could be generated from solar power (year 2040) 100,000 square miles would be needed. Probably some of the arrays would be located on the oceans so that the 100 mile by 1000 mile area would not need to use up too much land area. Although the rate of increase of solar power stations could be much slower if other new power sources are developed, this arbitrary rate was selected so that all electrical power will be generated from solar energy at a time when both crude oil and conventional nuclear (burner) reactors are being phased out because the fuels are depleted.

REFERENCES

(1) "Resources and Man," N. H. Freeman Co., San Francisco, California, 1969

(2) E. L. Ralph, "A Plan to Utilize Solar Energy as an Electric Power Source," IEEE Eighth Photovoltaic Specialists Conference Record No. 70C32ED August 1970

(3) "Handbook of Geophysics," Macmillan Company, New York, pp. 16-28 to 16-29, 1961

(4) Private Communication

(5) Bureau of Mines Minerals Yearbook, U.S. Department of the Interior, Vol. I–II, 1969.

(6) "Heat Transfer," Alan Chapman, Macmillan Co., 1967.

(7) "Heat Transmission," Sidney Kirkpatrick, McGraw-Hill, 1954

(8) E. L. Ralph, "Performance of Very Thin Silicon Solar Cells," IEEE Sixth Photovoltaic Specialists Conference Proceedings, March 1967

(9) A Review and Comparison of Selected United States Energy Forecasts, Battelle Memorial Institute, Prepared for OST Des. 1969.

ESSO RESEARCH AND ENGINEERING COMPANY

(Media Relations, P.O. Box 172, Linden, N.J. 07036, Harlan F. Stone, (201) 474–2701 (Office), for release November 24, 1970)

LINDEN, N.J.—A Corporate Research Energy Conversion Unit has been formed by Esso Research and Engineering Company to develop the science and technology needed for low-cost commercial solar cells. Dr. Elliot Berman, who has extensive experience in photochemistry, photochemical phenomena, and the photographic industry, will lead the new project.

Dr. Berman is employed by Jersey Enterprises, an affiliate, and is on special assignment to Esso Research and Engineering. He will report directly to Donald L. Baeder, vice president for corporate and government research. Esso Research and Engineering is the chief technical affiliate of the worldwide Standard Oil Company (New Jersey).

Present solar cell technology results in a cost of about $100 per watt to convert solar energy from the sun into electrical energy, Dr. Berman said. The conversion takes place within a cut and polished silicon crystal, which absorbs the solar energy. The high cost of solar cells has limited their utility. Solar cells have powered monitoring instruments that the astronauts left on the moon and are used as power sources for satellites.

"There is a potential use for commercial solar cells wherever electricity is used now," Dr. Berman said. "Initially they will best meet electrical needs where relatively small amounts are required, such as in movie cameras, wrist watches, and radios. If they can be made low enough in cost, they can eventually move into markets such as water pumping in desert areas, residential electricity in remote geographical areas, and other uses where it is not now possible to tie into existing electrical distribution systems."

To discover materials for low-cost, light-to-electric power conversion, Dr. Berman will form an inter-disciplinary task force. He expects the group to contain scientists with training in solid state physics, electrical engineering, organic chemistry, and biophysics.

"Our initial program of investigation will include such areas as electronic conduction in organic and inorganic materials, effects of light on these materials, organic synthesis, dye sensitization, and energy storage and conversion," Dr. Berman said.

Dr. Berman holds 23 U.S. patents on photochemical systems and novel image-forming processes. He has been director of the Lexington Research Laboratories and of the Photosensitive Materials Group of Itek Corporation, the photographic equipment manufacturer, where he has worked for the past ten years. Before Itek he worked at National Cash Register Company, where he was head of the Organic Section of the Fundamental Research Department. He received his bachelor's degree in chemistry from Brown University and his doctorate in chemistry from Boston University.

CONCLUSION OF MORNING BUSINESS

Mr. BYRD of West Virginia. Mr. President, is there further morning business?

The PRESIDING OFFICER. Is there further morning business? If not, morning business is closed.

ORDER OF BUSINESS

The PRESIDING OFFICER. Under the previous order the Chair recognizes the Senator from Virginia.

APPLICATION OF THE FIRST AMENDMENT TO PUBLICATION OF SECRET VIETNAM DOCUMENTS

Mr. BYRD of Virginia. Mr. President, the month of June 1971 will figure prominently in American history.

It was on Sunday, June 13, that the New York Times began publishing a series of articles from a secret study, made in the Defense Department, of American participation in the Vietnam war.

The documents were labeled "Top Secret," although the material covers a period that ended in 1968—and thus, in a sense, is a history of the early years of the war.

The Justice Department asked the New York Times to refrain from publication on the grounds that it would cause "irreparable injury to the defense interest of the United States."

The Times refused to withhold publi-

cation. Meanwhile, the Washington Post began publication of the "Top Secret" documents.

The Justice Department sought and obtained a court order temporarily restraining publication of the documents.

Meanwhile, various other newspapers began publication of the controversial documents, which had been stolen from the Government and made available to the press.

The temporary restraining order against the Times and the Post was appealed to the Supreme Court. On June 30, the Supreme Court ruled:

> Any system of prior restraints of expression comes to this Court bearing a heavy presumption against its Constitutional validity . . . the government thus carried a heavy burden of showing justification of the enforcement of such a restraint . . . we agree . . . that the government has not met that burden.

The decision was six to three—with each of the nine Justices setting forth his own separate view, a unique procedure.

The historic nature of the case can best be understood when it is realized that never before has the U.S. Government sought to enjoin a newspaper from publishing information in its possession. The first amendment to the Constitution, guaranteeing freedom of speech, press, and religion, long has stood as a bar to the imposition of judicial restraints prior to publication.

But is the first amendment an absolute? A reading and rereading of the nine separate opinions does not give a clear answer as to the view of the present court.

At least two Justices—Mr. Justice Black and Mr. Justice Douglas—believe that the first amendment is an absolute guarantee to the press, while at least one, Chief Justice Burger, rejects the view that the first amendment is absolute in all circumstances.

If I can interpret the individual opinions of the nine justices accurately, the prevailing view—and to my mind the most logical view—is best enunciated by Mr. Justice Stewart and Mr. Justice White. In ruling in favor of the newspapers, they drew a distinction between prior censorship and subsequent criminal prosecution for actual publication of vital Government secrets.

Mr. Justice Brennan put it this way:

> The entire thrust of the Government's claim throughout these cases has been that publication of the material sought to be enjoined "could," or "might" or "may" prejudice the national interest in various ways. But the First Amendment tolerates absolutely no prior judicial restraints of the press predicated upon surmise or conjecture that untoward consequences may result.

In the case at issue, the Government simply failed to convince the Court that publication of the Vietnam documents would cause "irreparable injury to the defense interest of the United States."

For this the Defense Department itself must bear a substantial part of the blame. Clearly the documents are overclassified.

While I have not read all of the Pentagon papers, I have read 1,000 or more pages and have seen nothing that could reasonably be construed as jeopardizing the security of the United States.

Mr. Justice Stewart hit straight to the point, it seems to me:

> Without an informed and free press there cannot be an enlightened people.
>
> Yet it is elementary that the successful conduct of international diplomacy and the maintenance of an effective national defense require both confidentiality and secrecy.
>
> I think there can be but one answer to this dilemma, if dilemma it be. The responsibility must be where the power is. If the Constitution gives the Executive a large degree of unshared power in the conduct of foreign affairs and the maintenance of our national defense, then under the Constitution the Executive must have the largely unshared duty to determine and preserve the degree of internal security necessary to exercise that power successfully . . .
>
> I should suppose that a very first principle of that wisdom would be an insistence upon avoiding secrecy for its own sake.
>
> For when everything is classified then nothing is classified, and the system becomes one to be disregarded by the cynical or the careless, and to be manipulated by those intent on self-protection or self-promotion. I should suppose, in short, that the hallmark of a truly effective internal security system would be the maximum possible disclosure, recognizing that secrecy can best be preserved only when credibility is truly maintained.

Mr. Justice Stewart has struck at a point which needs emphasizing; namely, the overclassification of Government documents.

To quote Mr. Justice Stewart again:

> For when everything is classified then nothing is classified.

The tendency in Government is to slap a secrecy label on almost every document that comes along.

Why?

I put this question last week to the Assistant Secretary of Defense for Administration when he came before the Senate Armed Services Committee for confirmation to the post of Secretary of the Army. He replied that most persons in Government feel that they will not be condemned for overclassifying, but could be condemned for not classifying.

Why should Government officials not be condemned for overclassifying?

The overclassification of Government documents is not only denying to the American people information they should have, but it is tending, as Mr. Justice Stewart notes, to destroy the entire security system of the Government.

Most certainly unwarranted secrecy and the failure to inform the public and the Congress has seriously weakened the credibility of the U.S. Government.

The Congress needs to come to grips with the question of classification of Government documents. The Congress has sat silent too long.

The Nation as a whole, as well as the executive branch of Government, would benefit, I feel, if there were to be established an independent group to review the classification of Government documents.

Senator ROTH, of Delaware, has introduced legislation to accomplish this, and I have joined with him as a cosponsor.

Until this is done, however, Executive leadership should make clear that overclassification of documents will not be tolerated.

The Government needs less "Top Secret" documents which in fact do not justify such a label—and a tighter security system for safeguarding those relative few documents which, in order to prevent irreparable injury to the defense interest of the United States, should logically be tightly safeguarded.

If a document such as the Vietnam papers, which the Defense Department regards as top secret, can be stolen and disseminated, how do we know what other top secret documents affecting our national security are being taken from the vaults?

Indeed, it is important that the person or persons who stole the documents be prosecuted to the full extent of the law.

I associate myself at this point with the distinguished and able Senator from West Virginia (Mr. BYRD), who earlier in the day called for full prosecution of those who stole from the Government the top secret documents.

While the court sided with the newspapers in its decision of June 30, a close reading of the nine decisions suggests that the communications media cannot escape from the fact that their freedom from censorship entails responsibilities to the Nation. The press, I should hope, will view the decision as something more than a cause for celebration.

The Washington Evening Star put it well, I think, in an editorial on July 1:

> It should be noted, too, that the concept of press responsibility is no more abstract than that of press freedom.

If the favorable court decision will have the effect of sharpening the communication media's sense of responsibility—and if the unfavorable decision, from the Government's point of view, should bring about a reappraisal of its reclassification policy—then the Nation as a whole will benefit greatly from the events of June 1971.

What the people of the Nation need are more facts.

The Government and the press, by accepting and carrying out their respective responsibilities, can make the facts available to the people, without jeopardizing the security of the Nation.

TRANSACTION OF ROUTINE MORNING BUSINESS

The PRESIDING OFFICER (Mr. STEVENSON). Under the previous order, the Senate will proceed to the consideration of routine morning business, with statements therein limited to 3 minutes.

QUORUM CALL

Mr. BYRD of Virginia. Mr. President, I suggest the absence of a quorum.

The PRESIDING OFFICER. The clerk will call the roll.

The second assistant legislative clerk proceeded to call the roll.

Mr. BYRD of Virginia. Mr. President, I ask unanimous consent that the order for the quorum call be rescinded.

The PRESIDING OFFICER. Without objection, it is so ordered.

THE ROLE OF THE JUDICIARY IN PRESERVING AMERICA

Mr. BYRD of Virginia. Mr. President, on June 25, 1971, the distinguished junior

Senator from West Virginia, Mr. ROBERT BYRD, addressed the 41st Fourth Circuit Judicial Conference. This Fourth Circuit Judicial Conference was held at Hot Springs, Va., and was attended by outstanding lawyers and jurists from throughout the area of the Fourth Judicial Circuit.

Since that date of June 25, about 3 weeks ago, I have received many communications from those who were present commenting on how excellent was the address made by Senator BYRD of West Virginia. These communications have come from outstanding lawyers in Virginia and from judges in Virginia, all of whom were tremendously impressed by the logic of the remarks of the distinguished Senator from West Virginia.

So, after receiving so many communications in regard to the speech, I sought the permission of my distinguished colleague from West Virginia to insert in the RECORD the text of his speech. All of us in the Senate know Senator BYRD of West Virginia to be a man of unusual ability, and one who is learned in the law. Speaking personally, I cherish my close association with him as a Member of the Senate, and I commend him and compliment the people of his State for the magnificent job that he is doing in representing not only the people of West Virginia, but all of the people of the United States, in the U.S. Senate.

I ask unanimous consent that the outstanding address delivered by ROBERT C. BYRD, U.S. Senator from West Virginia, on June 25, 1971, before the 41st Fourth Circuit Judicial Conference, be printed in the RECORD at this point.

There being no objection, the address was ordered to be printed in the RECORD, as follows:

ADDRESS BY ROBERT C. BYRD, U.S. SENATOR FROM WEST VIRGINIA

Chief Judge Haynsworth, Judge Maxwell, Judges of the Fourth Judicial Circuit, Members of the Conference, Ladies and Gentlemen:

I feel privileged, and I value this opportunity, to address the 41st Fourth Circuit Judicial Conference.

The role of the Judiciary in preserving America for our children cannot be underestimated.

All of us have noted the recent breakdown in order in this country. We have noted a trend, now quite pronounced, to reject authority of any sort, to decide for oneself whether a particular law or rule is to be observed. It is a matter of great concern to the people and considerable moment to the courts, since the power which courts have is pretty much dependent on the willingness of the parties and the public to obey rulings even when they disagree with them.

It is only necessary to refer to a remark frequently ascribed to President Jackson that Chief Justice Marshall had made his decision, now let him enforce it; or to Alexander Hamilton's overworked phrase about the Court having neither purse nor sword; in order to appreciate that it is the authority of the courts which inevitably suffers first and greatest from a disposition not to be bound by rule or authority—which disposition unfortunately has gained wide currency in our society.

Since this is true, it is more than passing strange, then, that many persons believe that some of the federal courts, and in particular the United States Supreme Court, have done more than any other branch of government—local, state, or federal—to foster such a feeling and mood and disposition in our society—more indeed than any other institution with the possible exception of the American educational establishment.

I realize the obligation all lawyers necessarily feel to accord the greatest amount of respect to the U.S. Supreme Court. I feel that obligation; my feeling of respect is considerable; I honor the Court as an institution. But I need not quote the remarks of distinguished judges, lawyers, and scholars that respect does not require loss of critical faculty.

Thus, despite my trepidation, despite my respect, and despite the fact that I address a body of men whose professional lives are inextricably involved in parsing and closely examining the reasoning of the Supreme Court and other appellate courts and the District Courts, I sincerely trust that you will not think it presumptuous of me to believe it possible to contribute to the discussion by sharing with you not only my own thoughts but also the conclusions and thoughts which I hear expressed frequently in the Congress and in the conversations and letters from constituents about the Supreme Court and what are considered its errors of recent years.

There are, of course, many areas in which the Court's rulings carry out the Constitution and the laws and promulgate standards for sound governance of society. But while we welcome and support those rulings, our objections run to the fact that the Court has in many areas appeared not to follow the Constitution—or has followed strained interpretations of it or has ignored Congressional direction in matters subject to statutory regulation.

Thus, while we welcomed the Allen decision last year was welcomed authorizing trial judges to take the necessary steps to deal with obstreperous defendants by setting them outside the courtroom or binding and gagging them or citing them immediately for contempt of court—and while it is to be hoped the same standards will be applied to riotous defense counsel—one cannot ignore the evidence that the Court itself has contributed to the problem by applying Court-created constitutional limitations on the inherent powers of trial judges to deal with contempt committed in their presence or outside their presence. The unprecedented application of jury trial requirements to contempts when the sentence may exceed a certain limit, the rulings in *Mayberry* this Term, and the Mississippi case within the last month limiting the authority of judges to deal with contempts directed at them—these and other rulings appear to be expressing a feeling that trial judges, sworn to uphold and defend the Constitution, are not to be trusted to be fair and just.

In other words, one can perceive this series of cases only as carrying over to the trial judges the Court's well-known aversion to trusting Congress and the legislatures to uphold the Constitution. When a body of men forming the court of last resort in this country becomes seized of such a fear—a fear of their lower court brethren and of legislators and for all we know of the President as well—then there is a substantial danger that rigid rules will be laid down to circumscribe the discretion of everyone.

And unless my reading is wrong, I see a danger that this mistrust so recently applied to the trial courts is soon to be transferred back to the legislatures. The Court recently granted review of an appellate court decision sustaining the power of the Wisconsin legislature to imprison summarily Father Groppi for leading a raid on the floor of the legislature while it was in session to protest a legislative decision. It would not surprise me at all to find the *Powell* and *Bond* decisions, and the decisions curbing the power of Congress and the legislatures to investigate, expanded and applied to infringe on the inherent power of legislatures—and of Congress—to punish for contempt without invoking the aid of the courts. We simply cannot afford to submit to further chipping away at the powers and prerogatives of legislators and trial judges.

Thus, even when the Court, as in the *Allen* case, reaches an eminently correct result, it may be that the problem was either created or compounded by earlier Court decisions or still remains a problem because the Court persists in error.

I would not contend that the Justices have been actuated by anything but high motives or pure ideals. The problem, instead, has been that they have made bad law and rendered wrong decisions in pursuit of those high motives and pure ideals rather than admit that however socially desirable something might be in abstract principle it should not be attained except within the context of applicable constitutional, principles.

Let me illustrate what I mean by noting the recent decision involving the closing of a number of swimming pools in Jackson, Mississippi, after their desegregated operation was decreed by a local federal district court. In a five-to-four decision, the Court held—and, I think, rightly—that the Constitution did not compel the City of Jackson to reopen those pools.

Some of the Justices may have felt that the Jackson officials closed the pools because of an impure motive, a refusal to operate them so as to permit white children and adults and Negro children and adults to swim together.

But that was not the question which faced the Court. The question was whether the United States Constitution compelled the City to reopen and to operate those pools. It was a question of constitutionality, and I think that Chief Justice Burger's concurring opinion capsuled the matter in a way that cannot be bettered. "All that is good is not commanded by the Constitution and all that is bad is not forbidden by it."

In the spirit of judging the issue by what the Constitution commands or forbids, then, the majority noted that insofar as the equal protection clause was concerned everyone in Jackson was deprived of public swimming pools. The City was not attempting surreptitiously to preserve racial separation by seeing that the pools were kept in operation in collusion with private groups. The pools were closed. Thus, said the majority, whatever the motivation of public officials, their acts were not forbidden by the Constitution nor did the Constitution require them to operate what is in essence a luxury.

The minority did not look at the matter that way. It was enough for them that Jackson officials had been actuated by bad motives: because their thoughts were impure their actions were constitutionally tainted and the Court ought not let them "get away with it."

It should be said that some Justices resist the impulse to sit in judgment on the innermost thoughts and motivations of others and, instead, judge their actions by the standards of constitutional commands and prohibitions. But others, unfortunately, appear to psychoanalyze motives and approve or condemn actions on the basis of what such an exercise in psychology reveals.

It is this proclivity which comes through clearly if we look at the "sit-in" cases of the early 1960's, which illustrate how a majority of the Court has often confused good intentions with lawful actions, starting the nation on a path leading to disorder and contempt for law.

The essence of the philosophy of the "sit-in" movement was the conviction that if law protected the prejudice of an owner of pri-

vate property in being selective regarding his choice of customers, then the law would be disobeyed. It would be violated by persons placing their bodies in forbidden areas and inviting arrest. I should say that if all these people wanted was to bear witness to their objection to racial discrimination by inviting arrest and submitting to conviction for violating clearly neutral and constitutional laws, thereby petitioning for legislative change outlawing private discrimination, that would be one thing. The actions might be disruptive but the viability of law to preserve order would not be called into question.

But neither the demonstrators nor the Supreme Court was willing to leave the matter at that. The demonstrators did not submit to conviction as a method of bearing witness; they appealed, seeking to void their convictions by obtaining a ruling that the Fourteenth Amendment either outlawed all private discrimination or else prohibited the enforcement of trespass and other laws by which the States and localities lent some assistance to store owners and other owners of private property. Such a ruling, of course, would have had enormous consequences for American constitutional jurisprudence, all of it bad. Some Justices, notably Mr. Justice Douglas and Mr. Justice Goldberg, were willing to go that far. A majority of the Justices did not feel so inclined. But that did not mean that the demonstrators were out of luck. The Court simply used every device which could be thought of to reverse all convictions without ever reaching the ultimate decision.

The result was that not any conviction which was appealed to the Supreme Court was sustained. No doubt the majority was impressed with what they considered to be the general "good" motivation of the demonstrators. No doubt the majority thought that some means, almost any means, were justified in order to let the "pure in heart" off. The radiations from these decisions show what a monumental mistake this sentimental conclusion from the heart instead of from the head was in fact.

Can anyone doubt that the waves of campus demonstrators, arrogantly presuming themselves qualified to dictate educational decisions, were undertaken with the the demonstrators in the "sit-in" cases had succeeded. No doubt the fact that the earlier demonstrators had not had to pay to bear witness with jail sentences inspired the cry for amnesty which accompanied every demonstration, every trashing, every invasion of a dean's office, which the students undertook. Or it may be that the amnesty cry simply reflected the puerile character of the affluent college student as contrasted with the serious purpose underlying the Negro demonstrators' actions.

Whichever is the case is really irrelevant. The earlier Court decisions which affirmed that a degree of "purity" of motive could excuse lawbreaking bore fruit, not only in the college demonstrations, but also in the riots when apparently respectable people went to looting to secure what they wanted and in the "rock" festivals where young people flaunted their distaste for all values by engaging in open nudity, open public copulation, open marijuana smoking, and open pervasive destruction of property.

Bitter fruit, indeed, but the lesson is unlearned where the learning of it would be most valuable. Evidence? On June 7 of this year, there was a five-to-four decision of the Supreme Court which reversed the California conviction of disturbing the public peace by offensive conduct of a youth who appeared in the crowded corridors of a court house in the presence of women and children with the four letter word "F—the draft" printed on his jacket. The Court's opinion was written, incredibly, by Mr. Justice Harlan, and at one point he solemnly assures us that it is "often true that one man's vulgarity is another's lyric." In the same paragraph, he says: "Surely the State has no right to cleanse public debate to the point where it is grammatically palatable to the most squeamish among us."

So, objection to the profusion of four-letter words and the most open profanity is appalling only to the "squeamish" among us! The power of government to prevent children and objecting adults from being subjected to the most objectionable and callous obscenities means nothing more to the Justices than making "public debate . . . grammatically palatable." It is nothing short of astounding! It would help the Justices in the majority to take a walk around a few blocks of their Court building and just observe and listen to the nauseating language and the sickening abuse of verbal sexual assault which any woman, no matter how old or how young she may be, is subjected to. The streets are unfit for decent people now and it is tragic to notice how young children so casually utter the most obscene, barnyard language which they have picked up by simply listening.

More evidence? On June 1, the Court struck down as being in violation of the right of assembly a Cincinnati ordinance which punished persons who congregated on the public streets and engaged in annoying conduct. The majority was not even concerned with the conduct the particular defendants had engaged in. Mr. Justice Stewart simply pronounced that no government could "make criminal the exercise of the right of assembly simply because its exercise may be 'annoying' to some people." Furthermore, he said, government could not proceed against persons who annoy others because of "their ideas, their lifestyle or their physical appearance."

With all due respect, I submit that this is ridiculous! Of course, merely assembling to express ideas or protest may not be prohibited if it should annoy some persons. But what about a crowd of rowdies who harass passers-by, who throw trash around them, who congregate outside a church and throw a drunken revel. Is there any doubt in your minds that such annoying conduct should be punishable? The Court should have restricted the City's application of the ordinance; it is not difficult to distinguish between protected and unprotected conduct. But the Court blithely struck the whole ordinance down.

And what is wrong with applying such an ordinance to the sort of grimy loafers who are familiar to us all if their "lifestyle" involves public nudity and public copulation or simply who gather in unsightly conglomerations which affront every decent person.

Thus, the trend which began with the "sit-in" cases continues unabated. A majority of the Court seems content to preserve the right of everyone, in the current vernacular, "to do his thing" no matter how nauseating it may be to his fellow citizens. But we have come so far from the "sit-in" cases that we do not have as an excuse the argument of purity of motives. Some of the "sit-in-ers" may have had good motivations; many of these people now are simply bums, addicted to drugs and immorality and avoidance of work. But somehow they have a constitutional right to their own "lifestyle".

I am very much afraid that what has happened to the Justices is the sort of thing which afflicts people who think in concepts and abstractions instead of thinking in "things," as I believe Justice Holmes once recommended. Abstractly, it may be a good thing that each person should have a large degree of control over his person in the sense that his choice of "lifestyle," of language and dress and leisure and the like is pretty much unfettered by the legal system. But the actuality of the matter is that society then is at the mercy of the lowest common denominator of "lifestyle" and behavior.

Society has an interest in having clean, safe streets. And if a subclass of people persist in attempting to turn those streets (or parks or whatever) into pestilential mudholes in which unsightly individuals using nauseating language indulge in obnoxious behavior, then society is obligated to sweep them off the streets. It does us little good to speak of the uplifting qualities of individual freedom if our children and our women, indeed any decent human being offended by such things (and there is no reason men may not be so offended), are subjected to spectacle after spectacle of degrading public activities.

And yet, the Court gives no sign of recognizing the fact that freedom for all cannot exist without the exercise of responsibility for all and the fact that if there are persons in the society incapable of balancing their exercise of freedom with the exercise of responsibility, then society must rein them in. Instead, the Court has just granted review of two vagrancy cases and we may except that in the coming Term the ability of police, of society, to deal with petty criminals, professional bums, and obnoxious characters will be further curbed.

This is not idle prophecy. We need only look at other cases to notice how concentration on abstractions has created a gulf between the Justices and the reality which the rest of the people must live with.

A good example is in the area of forced integration in the public schools. The desegregation decision of 1954 was right and proper, in my judgment. I believe that decision is supported by a majority of the American people. I believe further that a majority of white Americans want black Americans to have the opportunity for education and economic advancement which they rightfully should have. But those desirable goals, in my judgment, will not be reached by some of the means that have been resorted to to effectuate forced integration.

I shall not dwell on that matter here except to say that the almost fanatical efforts to force an artificial racial mix in the schools only serve to push the suburbs ever outward and inevitably hasten the decay of the inner cities, together with their public school systems. Forced integration has not yet produced better education for black or white, and I do not believe that it will. Indeed it may have done just the contrary. The numbers game being played with respect to forced integration is doomed to failure, and the American people in general, in my opinion—black as well as white—would like to see an end to this folly which threatens to convert the primary purpose of the public school system from that of education to that of integration.

Under the equal protection clause of the 14th Amendment, no child may be discriminated against on the basis of race in the assignment to a public school. This, in essence, was the meaning of the 1954 school decision. And it was the right decision, based on the Constitution as amended.

In the years that have since intervened, not one "jot or tittle" has been changed in the verbiage of that amendment. Yet, children today—by virtue largely of Federal Court decisions—are being assigned to public schools throughout the South, specifically and wholly on the basis of their race, and that alone.

How long will the people tolerate the seeming obsession of the courts in this profitless pursuit of abstract social goals rather than pursuit of reality?

Another example of concentration on abstractions is in connection with the rash of instances of flag burnings and other acts of desecration we have witnessed in the last few years. It would no doubt have astonished the drafters and enacters of the First Amendment had it been suggested that they might be immunizing a shoddy practice of protesting something through the desecration of the flag: "symbolic speech" as a concept and a fact would undoubtedly have merited only contemptuous rejection from Madison

and the members of the First Congress. It is simply absurd to permit the flag to be so treated simply because someone wants to make a splashy show of protesting a grievance—a grievance often feigned rather than real.

The tragedy is that at a time when patriotism is at a low ebb and devotion to country is something too many people snicker at, the Court is lending support to further erosion not out of any sympathy for such a sorry trend but because the attention of the Justices is focused on an abstraction, on a concept of speech as an absolute.

It is this same single-minded focus, I believe, which forms the basis for the Court's incredible performance with regard to obscenity. From *Roth* to the cases this Term, the Court—Justices Black and Douglas dissenting—have pronounced obscenity to be outside the area of protection of the First Amendment. So much for official doctrine. The result, as the Court has proceeded through the cases, is that less and less is held to be legally obscene, from the printed page of the grubby paperbacks produced solely to titillate, to the peep shows, to the feature movies which throw in a little something "socially significant" to justify the 98% raw sex.

The Court seems to be so tied up in single-minded concentration on free speech in the abstract that its rules and standards for defining what is obscene and for suppressing what is obscene have so hemmed in the police and the lower courts that they are incapable of protecting the vast majority of the public from constant exposure to all this sordidness. As a result, free speech is not advanced any, but a lot of *fast-buck, seedy operators* are making a lot of money off a clientele of pathetic people who are being made even more pathetic by the exploitation to which they are subjected.

The entire area of First Amendment jurisprudence is infected with the Court's beguilement by an abstraction. The infection can also be seen in the *Times* v. *Sullivan* case and the cases following it in which the Court is immunizing more and more libel and slander from legal accountability. Certainly, it is one of the prime functions of the First Amendment to protect public disclosure on public issues. Free press and free speech are absolutely necessary to the functioning of a free government. But freedom, I assert again, without responsibility is detrimental and destructive of the values of a free society.

Now the Court tells us the defense of truth is inadequate to protect the freedom of the media. The First Amendment protects lying too, unless a libeled person can psychoanalyze the offender and show the jury that malice lay at the base of the lying. So far, the burden of such a rule has been on public officials and candidates for public office who have always been considered fair game anyway, but in the recent *Rosenbloom* case, the Court extended the rule to libels and defamations of private individuals connected in some way with an event the media finds "newsworthy."

I think that it is fortunate when we turn from the area of First Amendment jurisprudence to the area of criminal law and criminal procedure that we see reflected in recent Supreme Court cases a dissatisfaction with abstraction and a dedication to realism which the criminal cases of Chief Justice Warren's tenure wholly lacked.

With the possible exception of search and seizure which still remains a morass of contradictory rules and arbitrary limitations, the Court is moving away from a hyperactive concern with the rights of criminal defendants in the abstract and deciding cases on the basis of the effect of constitutional rules in real cases.

I will not dwell on the cases which bear out these statements, for you are more familiar with them than I. Nor will I dwell further on my point about the Court's abstraction with theory versus reality as evidenced in the *Bruton* case in 1968, the *Harrison* case in the 1967 Term of the Court, or in *Miranda, Escobedo, Wade* and the like, except to say the importance of cases like *Miranda* is not so much the damage that is actually done in keeping out valid confessions or authentic reliable evidence. The damage lies in the fact that every crook is thereby encouraged to think that a hypertechnical Court is turning their confederates loose. An increase in confidence that, if caught they can "beat the rap", has without doubt contributed to the increase in crime.

It is in that sense I think that we have to acknowledge the influence of court decisions on crime. Criminals, normally, do not read Supreme Court decisions or lower court decisions. But once a court begins to lean hard on the police and issues a few rulings that are publicized which make it more difficult to convict, criminals are encouraged simply because the impression is about that their chances are better.

Severity of sentence in my opinion is a deterrent to crime. Equally effective is the belief generally abroad that the chances of getting caught and being convicted and serving time are substantial. The principal fault of the courts in recent years is that they have made possible a contrary opinion.

But not only criminals are subject to such prevailing influences. I have no doubt that trial courts also now, state and federal, have for years been afflicted with the fear of reversal by the higher courts so that they have grown more and more lenient on sentences, given defendants more and more of the doubt in ruling on suppression motions, and generally have made the jobs of prosecutors more difficult. I have no doubt that, for example, a study of the district courts in the District of Columbia would show that the supersensitive-to-defendants attitude of the Court of Appeals has made trial judges lean over backward in favor of defendants.

There would appear to be little doubt then that a change in the Supreme Court on criminal law should correct this attitude. It will be none too soon in my opinion. If we are to call a halt to the spiraling increase in crime we must speed up trials which means cutting out a lot of the waste and the coddling which goes on. Stiff sentences have to be handed out upon conviction. Habeas corpus must be returned to traditional limits so that once a defendant has exhausted his appeal rights he cannot simply, over and over again, clog up the courts with frivolous petitions.

I have no doubt at all that if the exclusionary rule at one end of the process and habeas corpus at the other end were returned to their traditional orientation the clutter in the courts could be cleaned up faster, trials could be more expeditious, sentences would be more meaningful, and justice would be done, society as well as the criminal.

Regrettably, I must except from my generally complimentary remarks about the Court's very recent criminal law trends its search and seizure doctrines. As the *Coolidge* decision handed down only this week demonstrates, the Court is still mired in confusion of its own earlier making with respect to the Fourth Amendment, and, through its unwise extension of the unwise exclusionary rule to the States, the confusion afflicts all fifty States. *Coolidge* is particularly illustrative since there the majority held that police who had come lawfully onto the defendant's property to arrest him lawfully were held forbidden to seize and impound his car which was parked in plain view in his driveway and which police knew had been used in the commission of a brutal murder of a 14-year old girl.

Worse still, on the same day in the *Bivens* case a six-Justice majority held that any crook who claimed that federal agents had committed an unlawful search and seizure could sue for damages in the federal courts. No act of Congress gives them this right; the Fourth Amendment says nothing about it. But the Court implied the remedy from the "spirit" of the Amendment.

The harm to law enforcement is obvious. *Coolidge* demonstrates that the Justices cannot agree on what constitutes illegal searches, but if law enforcement officers in the field guess wrong they are subject to suit under a judicially-created tort theory.

No more can society live in a state of fear of crime than it can suffer the degradation of many of its members by abuse of the right of speech and press. We were once in a state where these excesses did not exist and no one can argue we were less free. Then, a man could take his family out without fear of robbery or rape or subjecting his children to the brutalization of language and immorality and fear which now exists. That man and his family were free. We can have that state of existence again but it takes discipline and rejection of what passes for intellectual counsel these days. It takes perseverance and dedication to first principles. And we can do it.

Let me repeat, in closing, that I have respect for the Supreme Court as an institution. But I shall continue to be disturbed by what my colleague in the Senate, Sam J. Ervin of North Carolina—a distinguished jurist in his own right—has called the "misty idealism" of many of the Court's decisions in recent years.

Woodrow Wilson once said: Constitute them how you will, governments are always governments of men, and no part of any government is better than the men to whom that part is entrusted. . . . The courts do not escape that rule. So far as the individual is concerned, a constitutional government is as good as its courts; no better, no worse.

The Federal Judiciary, of which you who are here today are so important a part, bears a heavy responsibility in the years ahead for a return to order and tranquility in our society, a restoration of respect for law and the courts, and the preservation of constitutional government.

INTERNATIONAL WHEAT AGREEMENT

Mr. BYRD of West Virginia. Mr. President, I ask unanimous consent that it be in order to order the yeas and nays on the International Wheat Agreement.

The PRESIDING OFFICER. Is there objection? The Chair hears none, and it is so ordered.

Mr. BYRD of West Virginia. I ask for the yeas and nays.

The yeas and nays were ordered.

MESSAGE FROM THE HOUSE

A message from the House of Representatives by Mr. Berry, one of its reading clerks, announced that the House had agreed to the amendment of the Senate to the concurrent resolution (H. Con. Res. 206) to reprint the brochure entitled "How Our Laws Are Made".

The message also announced that the House had passed the following bills, in which it requested the concurrence of the Senate:

H.R. 6483. An act to amend section 5232 of title 10, United States Code, to provide authority for appointment to the grade of general of Marine Corps officers designated under that section for appropriate higher commands or for performance of duties of great importance and responsibility; and

H.R. 8805. An act to amend title 39, United States Code, to exclude from the mails as a

special category of nonmailable matter certain material offered for sale to minors, to improve the protection of the right of privacy by defining obscene mail matter, and for other purposes.

HOUSE BILLS REFERRED

The following bills were each read twice by their titles and referred, as indicated:

H.R. 6483. An act to amend section 5232 of title 10, United States Code, to provide authority for appointment to the grade of general of Marine Corps officers designated under that section for appropriate higher commands or for performance of duties of great importance and responsibility; to the Committee on Armed Services.

H.R. 8805. An act to amend title 39, United States Code, to exclude from the mails as a special category of nonmailable matter certain material offered for sale to minors, to improve the protection of the right of privacy by defining obscene mail matter, and for other purposes; to the Committee on Post Office and Civil Service.

QUORUM CALL

Mr. BYRD of Virginia. Mr. President, I suggest the absence of a quorum.

The PRESIDING OFFICER. The clerk will call the roll.

The second assistant legislative clerk proceeded to call the roll.

Mr. SYMINGTON. Mr. President, I ask unanimous consent that the order for the quorum call be rescinded.

The PRESIDING OFFICER (Mr. SPONG). Without objection, it is so ordered.

LAOS—APPROPRIATING "IN THE BLIND"

Mr. SYMINGTON. Mr. President, in the course of the June 7 closed session of the Senate at which various U.S. activities in Laos were discussed, I stated that I would propose an amendment to the defense authorization bill, S. 939, limiting obligations or expenditures for economic aid, military assistance, and all other U.S. activities in Laos to $200 million in the fiscal year 1972. The sole exception was combat air operations by U.S. forces over the Ho Chi Minh Trail area in southern Laos.

On June 15, I made a statement on the floor of the Senate at the end of which the amendment, amendment No. 160, was printed.

As stated on both June 7 and 15, my reason for proposing such an amendment was because in many cases we have been authorizing and appropriating money for our activities abroad "in the blind"; that is, we do not know how much we were and are really spending, or how said funds were being spent.

In the course of consideration of the defense authorization bill in the Armed Services Committee, the Department of Defense was asked for its views on this, my amendment.

Their memorandum in reply states that—

DOD strongly opposes the amendment.

This memorandum contained one confidential paragraph and one paragraph classified "secret." The remainder of the memorandum was not classified, however, and I ask unanimous consent that the text of the memorandum, less the two classified paragraphs, be printed in the RECORD at this point.

There being no objection, the memorandum was ordered to be printed in the RECORD, as follows:

DOD POSITION ON THE SYMINGTON AMENDMENT

(Adding Sec. 502 to the bill S. 939 which authorizes appropriations in FY 72 for procurement, etc. for the Armed Forces.)

EFFECT OF THE AMENDMENT

The proposed amendment would limit obligations or expenditures to $200 million for economic and military assistance and for support of all military operations in, to, for, or on behalf of Laos during FY 72 except for the expenditure of funds to carry out combat air operations by US forces over the Ho Chi Minh Trail area in southern Laos and "areas immediately adjacent to such trails." In addition, the amendment would prohibit any funds from being obligated or expended for operations in Laos outside the Ho Chi Minh Trail beginning with FY 73, unless specific new authorizing legislation is enacted. Finally, the amendment requires a quarterly report by the President to Congress of all expenditures "in, for, or on behalf of Laos" during the preceding quarter.

DOD POSITION

DOD strongly opposes the amendment.

1. It would substantially impair our ongoing operations in Laos, operations which have been undertaken at the request of the Government of Laos to assist it in resisting military takeover by North Vietnam.

The strategic location of Laos, bordering the other states of Indochina plus Thailand and Burma, makes it especially important that a belligerent state not control Laos. The opportunity for regional stability is being kept open by the continued independence and neutrality of Laos. The following comment by President Nixon on 7 October 1970 is relevant: "The war in Indochina has been proved to be of one piece; it cannot be cured by treating only one of its areas of outbreak."

This Administration has continued American support for the efforts of Prime Minister Souvanna Phouma to reconstitute the 1962 Geneva Agreements guaranteeing his country's neutrality, independence and territorial integrity. Limitations imposed by Congress on our ability to achieve that objective would raise doubts not only about our determination to adhere to our stated objectives, but to our more formal commitments as well.

Such a limitation would severely limit our ability to effectively implement that part of the Nixon Doctrine that calls for sufficient military assistance to allow such governments to resist Communist aggression. In implementing his policy, the President should have sufficient flexibility to meet with an adequate response, changes in the local military situation. As he indicated about Indochina in his 25 February 1971 foreign policy report: "A negotiated settlement for all Indochina remains our highest priority. But if the other side leaves us no choice, we will follow the alternative route to peace—phasing out our involvement while giving the region's friendly countries the time and the means to defend themselves."

The overall limitation of $2.5 billion annually for expenditures in military assistance to friendly and local forces in Southeast Asia already applies to DOD budgeted support of Laos.

II. The proposed amendment would intrude into matters properly within the constitutional authority of the President, as Commander-in-Chief, to direct military operations in Southeast Asia. A special limitation on the amount of funds which may be used in one of the operational areas of conflict would be a back door attack on the President's authority.

III. As drafted, the amendment cannot be administered by the Executive branch. With the knowledge and express concurrence of the cognizant congressional committees since FY 67, the records of the Department of Defense for military assistance service funded (MASF) for Southeast Asia have been maintained only on an estimate basis because of the necessary integration of the supply and fiscal procedures of MASF with our own operations to meet a combat situation. Further, while DOD has been able to maintain records by country on an estimate basis with respect to *obligations*, it has not been able to maintain records on a country-by-country basis—as distinguished from Southeast Asia as a whole—with respect to *expenditures*.

IV. Assuming, however, that it were possible to establish and maintain current records both as to expenditures and obligations, to impose a fiscal year ceiling on both expenditures and obligations would be to cut the actual level of operations in a current fiscal year substantially below the amount specified in the Amendment as the ceiling on obligations—inasmuch as expenditures in any fiscal year necessarily involve obligations incurred in prior fiscal years as well as those which relate to obligations of the current year.

V. Finally, it should be observed that subsection (C) of the Amendment is ineffective, as drafted, to carry out the Sponsor's intent to provide an exception for combat air operations over the Ho Chi Minh Trail area. Whereas the operative subsections which impose constraints are written in terms of obligations *and* expenditures, the exception provided for in subsection (C) with respect to combat air operations over the sanctuary areas in Southern Laos only excludes expenditures and not obligations.

Mr. SYMINGTON. Mr. President, I would now make the following three comments on the memorandum of the Defense Department:

First. The Department of Defense memorandum states that a limitation of $200 million "would substantially impair our on-going operations in Laos, operations which have been undertaken at the request of the Government of Laos to assist it in resisting military takeover by North Vietnam."

I would say, in reply: How much does the Department of Defense want for United States operations in Laos for the coming fiscal year?

Surely, we in the Senate should not continue the present practice, which gives us no real indication whatever of what we are actually spending in Laos.

Surely, the American people have a right to know something about how their tax dollars are being spent in Laos; and in any case the Department of Defense should state to the Congress how much it considers necessary for the United States to spend to assist the Government of Laos in this fiscal year.

In its memorandum the Department of Defense takes the position that my amendment "would intrude into matters properly within the Constitutional authority of the President, as Commander in Chief, to direct military operations in Southeast Asia."

It adds that the kind of limitation my amendment would apply "would be a back door attack on the President's authority."

This is an intriguing comment. The Department of Defense would appear to be saying that the responsibilities the Congress has under the Constitution to

raise and support armies, does not mean what it says. The President, as Commander-in-Chief, has the constitutional authority to direct military operations; but under our system of checks and balances, he can do so only with the funds authorized by the Congress.

As the Defense Department memorandum states, the Congress has limited to $2.5 billion, the amount that can be spent for military assistance in Southeast Asia. If that limitation is constitutional, why is a sublimitation delineating the amount that can be spent in Laos itself any less constitutional; or a back door attack on the President's authority.

Second. Equally disturbing is the statement in the Department of Defense memorandum that such an amendment "cannot be administered by the Executive Branch."

The memorandum goes on to point out that the records "for military assistance service funded for Southeast Asia have been maintained only on an estimate basis."

As two members of the staff of the Subcommittee on United States Agreements and Commitments Abroad discovered on a recent trip to Laos, however, those estimates bear little relation to the actual amounts both obligated and spent. In this fiscal year, for example, the estimated amount is only half the amount which U.S. authorities in Laos expect to spend.

Also disturbing, is the admission in the Department of Defense memorandum that it has not been able—

to maintain records on a country-by-country basis—as distinguished from Southeast Asia as a whole—with respect to expenditures.

How can the executive branch be certain that expenditures do not exceed obligations in each country? Indeed, how can it be certain that the limitation of $2.5 billion for expenditures in military assistance in Southeast Asia is being adhered to if it does not know how much is being spent in each country?

Far from being an argument against my amendment, this admission strikes me as a strong argument for its adoption. It could well force the executive branch to institute procedures which will provide an accurate accounting of what we are spending in Laos, in Thailand, and in Vietnam.

This would be an accounting which the Congress most certainly should consider in judging the various authorization and appropriation bills which relate to these countries on which, under the Constitution, it must act.

Third. Finally, I note that the last paragraph of the Department of Defense memorandum states that subsection (c) of my amendment is ineffective as drafted because it excludes only expenditures for combat air operations over the Ho Chi Minh Trail area and not obligations and expenditures.

The Office of the Senate Legislative Counsel does not agree; but in any case we plan to change the language of the subsection so as to exclude both the obligation and the expenditure of funds to carry out combat air operations in southern Laos. In that way there can be no misunderstanding and the Congress will be in a better position to perform its constitutional functions when it comes to authorizing and appropriating funds.

Mr. President, on the ticker this afternoon the following is stated with respect to what is going on in Laos today:

VIENTIANE, LAOS.—The defense ministry declared today the new special forces drive in the Plain of Jars was the responsibility of the U.S. Embassy, not the Laotian Government.

Gen. Thongphanh Knoksy, defense ministry spokesman, conceded tribal special forces are on the plain but declined to discuss details, telling newsmen: "You should ask the American embassy. This is their affair." Andrew P. Guzowski, an embassy spokesman declined comment.

It is no secret that the Central Intelligence Agency pays, equips and advises the special forces and the Meo tribal army under Gen. Vang Pao, who is in command in the Plain of Jars region.

The Meo tribesmen, and the general is a member, are militants and U.S. sources say they are the best fighting force in Laos.

Asked if Vang Pao had informed the Laotian Government of his activities, Thongphanh replied: "No, the government is not responsible for this operation."

Mr. President, if this information is correct, it proves what many of us have been saying for some time; namely, that for years the Government of the United States has been operating a war in secret in Laos not only without the approval of the Congress, but also without its knowledge.

CONCLUSION OF ADDITIONAL MORNING BUSINESS

The PRESIDING OFFICER (Mr. SPONG). The time for the transaction of routine morning business has expired.

QUORUM CALL

Mr. SYMINGTON. Mr. President, I suggest the absence of a quorum.

The PRESIDING OFFICER. The clerk will call the roll.

The legislative clerk proceeded to call the roll.

Mr. SYMINGTON. Mr. President, I ask unanimous consent that the order for the quorum call be rescinded.

The PRESIDING OFFICER. Without objection, it is so ordered.

PERIOD FOR THE TRANSACTION OF ADDITIONAL ROUTINE MORNING BUSINESS

Mr. BYRD of West Virginia. Mr. President, I ask unanimous consent that there now be a resumption of the period for the transaction of routine morning business, with statements therein limited to 3 minutes.

The PRESIDING OFFICER. Without objection, it so ordered.

RELATION OF PROPOSED DRUG AND CANCER AGENCIES TO THE PRESIDENT'S REORGANIZATION PROGRAM

Mr. PERCY. Mr. President, in proposing the creation of a Special Action Office for Drug Abuse Prevention, reporting directly to the President, President Nixon has recognized the overwhelmingly critical need to establish a vitally strong, coordinating unit for most Federal drug-related programs. The President has similarly recognized the special importance of the need to coordinate Federal programs leading to a cure for cancer, and has proposed that Federal Government programs for this purpose be coordinated by an office reporting to the White House.

One of the questions raised by these two new units is their relationship to the President's executive reorganization program. At least superficially, these two new agencies created specifically to report to the President run counter to one of the major purposes of the executive reorganization program, which is to reduce the number of units reporting directly to the President. In this way, the level of conflict resolution and decision-making can be reduced to the departmental level, freeing the President and his staff for policy consideration, planning, and evaluation.

In light of this question about possible conflict. I have requested and received from the Office of Management and Budget an explanation of the relationship of the new special White House drug abuse and cancer units to the executive reorganization proposals. As this brief paper makes clear, the special drug and cancer programs are seen as emergency efforts requiring initial strong Presidential leadership. According to OMB:

The proposed new (drug) Office would be temporary in character, on the assumption that when the Office operating out of the Executive Office succeeds in welding together an integrated program it will then be possible to place direction of the overall program or its separate elements into one or more of the existing agencies for continuing operation.

With regard to the cancer office it states:

The proposed organization for cancer research represents an effort by the President to provide direction to an area of priority medical and social concern. The Director would have authority over the cancer programs of HEW and be responsible for advising the President on the utilization of the Federal resources engaged in cancer research. Such an arrangement may be temporary but is needed at this point in time to assure that cancer activities are united in a truly national effort.

Secretary of Health, Education, and Welfare Elliot Richardson confirmed this concept at the Government Operations Committee's opening hearings on the creation of the Special Action Office (S. 2097) on July 7. He said that the special drug office was not to be seen as a permanent unit, and, after its statutory tenure, could be redirected to report to an existing agency. This is envisaged in S. 2097 itself, which in section 14(b) provides the Special Action Office with a life of 3 years, extendable up to 2 more years by the President, but expiring not later than June 30, 1976. To extend it beyond this date would require a new act of Congress.

I think it noteworthy that the Special Action Office reporting to the President was in good part necessitated by the existing fragmented Government structure that the executive reorganization proposals are intended to change. Were there, for example, a Department of Human Resources such as would be created

by S. 1432, a more comprehensive and logical framework would now exist for coordinating many of the programs to be managed by the Special Action Office.

Another factor is that the executive reorganization proposals were not intended to exclude the possibility of creating new units in the White House to respond to specific and special needs. There was no intention by the President's Advisory Council on Executive Organization, the "Ash Council," to block the creation of such new units; in fact, the Council specifically recognized that they might be necessary. In providing that the drug office be temporary, the President has indicated his intention to adhere to the managerial and organizational principles on which his executive reorganization program is based.

If there was any question in the mind of anyone as to the need for a special crash program or a Special-Action Office on Drug Abuse, reporting directly to the President, that doubt would have been resolved by anyone who could have heard the testimony taken this morning by the Committee on Government Operations, under the chairmanship of the Senator from Connecticut (Mr. RIBICOFF), who is the chairman of the Subcommittee on Executive Reorganization.

We had before us three former drug addicts, two of them 15-year-olds from New York City, the other a 25-year-old returned veteran. Drug usage has reached epidemic proportions in the ghetto areas of our major cities, and it has reached epidemic proportions in Vietnam. Certainly any feeling we might have had that this is a smaller problem as revealed by the only 2 percent showing in the urinalysis tests conducted in recent days in Vietnam was refuted by one of the witnesses who testified as to the extensive use of heroin and hard drugs, not this year, not last year, but 3 years ago.

Mr. President, I ask unanimous consent to have printed in the RECORD the statement of the Office of Management and Budget on the "Relation of Proposed Drug and Cancer Agencies to the President's Departmental Reorganization Program."

There being no objection, the statement was ordered to be printed in the RECORD, as follows:

RELATION OF PROPOSED DRUG AND CANCER AGENCIES TO THE PRESIDENT'S DEPARTMENTAL REORGANIZATION PROGRAM

A question has been raised as to whether the creation of the proposed agencies for prevention of drug abuse and for cancer research runs counter to the principle of organization by major purposes.

The President's Departmental Reorganization Program (PDRP) was never intended to foreclose the creation of specialized agencies when conditions warrant, even if the new departments were in existence. For example, the proposed Special Action Office for Drug Abuse Prevention reflects the President's determination to launch a broad ranging and concerted program to deal with a deepening crisis. The Director of the Office through his control of funds and organizational position in the Executive Office can be the "man in charge," answerable only to the President. The proposed new Office would be temporary in character, on the assumption that when the Office operating out of the Executive Office succeeds in welding together an integrated program it will then be possible to place direction of the overall program or its separate elements into one or more of the existing agencies for continuing operation.

The full range of drug programs contemplated for the proposed agency would in no event be encompassed by the Department of Human Resources. For example, the Veterans Administration and the Department of Justice, which support drug programs, would not be affected by the PDRP.

One of the primary objectives of the President's Departmental Reorganization plan is to enable the day-to-day coordination of established programs to occur at the departmental level so as to enable the President to give attention to those urgent problems of high national priority. The intent is to have the Cancer-Cure Program administered in an agency (NIH) which is to be transferred, under PDRP, to the new Department of Human Resources. Because of the critical impact of cancer programs on this nation's well-being, however, the President will appoint the Director and provide him with the necessary guidance and resources needed.

As in the case of drug abuse, the proposed organization for cancer research represents an effort by the President to provide direction to an area of priority medical and social concern. The Director would have authority over the cancer programs of HEW and be responsible for advising the President on the utilization of the Federal resources engaged in cancer research. Such an arrangement may be temporary but is needed at this point in time to assure that cancer activities are united in a truly national effort.

In summary, the organization proposals for both drug abuse and cancer research demonstrate that (a) emerging social needs and opportunities may require new organizations tailored to the specific area, (b) the President can selectively use his authority to direct programs cutting across agency lines, and (c) the PDRP would not always obviate the need for specialized agencies some of which would be temporary in charcter. This last point reflects the fact that a number of agencies not included within the PDRP will play important roles in special efforts such as the curtailment of drug abuse. When new specialized agencies have achieved their integrative purpose, every effort should be made to place them within the appropriate major purpose department. For example, the Department of Human Resources with its medical, education, and manpower components would offer much more promise as a location for drug rehabilitation responsibilities than would either the present HEW or Labor.

QUORUM CALL

The PRESIDING OFFICER. Is there further morning business?

Mr. BYRD of West Virginia. Mr. President, I suggest what I assume to be the final quorum call of the day.

The PRESIDING OFFICER. The clerk will call the roll.

The legislative clerk proceeded to call the roll.

Mr. BYRD of West Virginia. Mr. President, I ask unanimous consent that the order for the quorum call be rescinded.

The PRESIDING OFFICER. Without objection, it is so ordered.

ORDER FOR RECOGNITION OF SENATOR BYRD OF VIRGINIA ON MONDAY

Mr. BYRD of West Virginia. Mr. President, I ask unanimous consent that on Monday, immediately following the recognition of the two leaders under the standing order, the distinguished senior Senator from Virginia (Mr. BYRD) be recognized for not to exceed 15 minutes.

The PRESIDING OFFICER. Without objection, it is so ordered.

QUORUM CALL

Mr. BYRD of West Virginia. Mr. President, I suggest the absence of a quorum.

The PRESIDING OFFICER. The clerk will call the roll.

The legislative clerk proceeded to call the roll.

Mr. NELSON. Mr. President, I ask unanimous consent that the order for the quorum call be rescinded.

The PRESIDING OFFICER. Without objection, it is so ordered.

THE ANT WAR

Mr. NELSON. Mr. President, recently the House of Representatives passed House Resolution 9270, the appropriations bill for the Department of Agriculture. Included in that bill were funds for the continuation of the imported fire ant control program through massive application of the chlorinated hydrocarbon mirex.

The efforts of the USDA to wipe out this insect date back to 1957, when they began unleashing huge quantities of pesticides into the environment. Since that time over 80 million acres have been treated with various poisons.

In recent years several studies have been published which contain substantial and persuasive evidence that the present fire ant control program is a dramatic overaction to the threat posed by this insect either as an agricultural pest or a human health hazard and that continuation of the program could well have serious adverse effects on nontarget organisms.

In response to this criticism from the scientific community, the USDA has toned down the program, describing it now as a fire ant control program—with spraying restricted to heavily infested areas and the implementation of environmental controls.

However, in spite of the severe criticism of the program and the cancellation of the registration of the pesticide mirex under the Federal Insecticide, Rodenticide, and Fungicide Act, the USDA has never addressed itself to the basic question of the need to continue the present program at all.

This has prompted me to write to Senator MCGEE, the chairman of the Senate Agriculture-Environmental and Consumer Protection Appropriations Subcommittee, to request that the funds for this program be deleted from the USDA budget, and that the subcommittee order an indepth study of the imported fire ant by qualified experts to determine what hazard, if any, exists, and the most environmentally sound and economically feasible means of dealing with it.

I ask unanimous consent to insert in the CONGRESSIONAL RECORD a copy of an article which appeared in a recent issue of Environment magazine, entitled "The Ant War," which reviews the USDA efforts to eradicate this insect and cites the various studies which have appeared

in recent years regarding the characteristics of the imported fire ant and the adverse effects of the pesticides used in the program.

There being no objection, the article was ordered to be printed in the RECORD, as follows:

THE ANT WAR

(By Donald W. Coon and Robert R. Fleet)

An insect called the imported fire ant has a bad name in the Southeast. Whether the reputation is valid is open to serious question. The question is important, since considerable money and large volumes of pesticides have been earmarked for a massive eradication campaign which some experts believe will do more environmental harm than good.

The imported fire ant (IFA) was introduced to the U.S. accidentally from South America early this century, but has become widespread only in the past two decades. As it spread, state and federal agricultural officials issued alarming warnings about the ant's capacity to injure crops, wildlife, and people. Local eradication programs began in 1937 and intensified with more recent widespread use of long-lasting insecticides. Such activities culminated in an organizational meeting on September 8, 1969 in Montgomery, Alabama. Members of IFA eradication committees and other interested persons from thirteen southern states unanimously approved a twelve-year eradication program developed jointly by the Southern Plant Board and the U.S. Department of Agriculture (USDA). The program calls for the Agricultural Research Service of the USDA and cooperating state agencies to treat 120 million acres in nine southeastern states three times with 1.25 pounds of Mirex (a chlorinated hydrocarbon insecticide) per acre per treatment.[1] The new program would cost about $200 million.

The exact date, manner, and source of the importation of the fire ant, which has the scientific name *Solenopsis saevissima richteri*, is not known. The first official recognition of the fire ant was made by H. P. Loding in an observation dated July 15, 1919 in *USDA Insect Pest Survey Bulletin 9*.[2] Loding indicated that this species had appeared in Mobile, Alabama in 1918. Mr. Loding reported his findings to Dr. William S. Creighton of Harvard University, who included the species in a work on the genus in 1930. This delay in recognition of the IFA was probably due to its similarity to native fire ants. (The IFA is blackish with a dull orange band at the base of its abdomen.)

It seems reasonable to assume that the IFA was inadvertently introduced to the U.S. via ship from South America, where it is native to Argentina and Uruguay. For about ten years it lived within or near the city limits of Mobile.[3] Then, about 1930, another form of the same species, smaller and pale red in color, appeared in the Mobile area. This variety is common in Brazil and Paraguay, and the evidence indicated a new importation rather than a mutant form. (The new, pale phase has mostly replaced the dark form,[4] which has had a very slow rate of spread, generally an outward expansion of one mile per year or less.)

In 1932, the pale variety's rate of expansion increased from one to three miles per year and after 1950 tended to become exponential. By 1963 the imported fire ant occupied roughly 31 million acres in nine southeastern states. Its present range encompasses 120 million acres within an area from eastern Texas and Arkansas eastward into North Carolina with the exception of Tennessee, from which it apparently has been eliminated.[5]

The first significant effort at eradication-control of the IFA was carried out in Baldwin County, Alabama in 1937 by the Alabama Department of Agriculture and Industries and the U.S. Public Works Administration. The campaign was soon abandoned, and the effects were short-lived. In the spring of 1948 the Mississippi state legislature appropriated $15,000 for the control of the IFA in that state. This project, like its predecessor in Alabama, was soon abandoned. Quantities of chlordane insecticide were furnished free by Alabama in 1949, and at cost by Louisiana in 1952, to provide local control.[6]

Then, in 1957, the USDA launched a campaign against the IFA, utilizing press releases, newspaper articles, and motion pictures.[7] Later that year the USDA requested congressional funding for eradication of the IFA. Congress responded with a $2.4 million annual allocation approved with the stipulation that local matching funds be made available.[8]

Spraying with two pounds of dieldrin per acre began in November 1957. Heptachlor at 1.00 to 1.25 pounds per acre was substituted in 1958, and this dosage was later reduced to two applications of $0.25 pound spaced three or four months apart. Not until the spraying program was under way were wildlife and health authorities notified about the use of these powerful, chlorinated hydrocarbon insecticides.[9] Immediate and widespread objections to the program by biologists were largely ignored by the USDA. Massive die-offs of fish, wildlife, and domestic animals occurred.[10]

In 1959, the Food and Drug Administration set a zero level of tolerance for heptachlor and its epoxide derivative in food. This action, coupled with continuing outcries by such distinguished biologists as Rachel Carson and Dr. Clarence Cottam and the obvious fact that the IFA was not being controlled, let alone eradicated, moved the Alabama legislature to withdraw matching funds in 1959. The Florida legislature followed suit in 1960.[11]

In 1961, Mirex (also a chlorinated hydrocarbon, but supposedly without the decided disadvantages of earlier pesticides) was developed by the Allied Chemical Company for control of several ant species. The federal program from 1961 until 1969 used Mirex and was aimed at containment rather than eradication.

EVALUATION AS A PEST

A sampling of statements in agricultural and mass media publications reveals how the fire ant has acquired a bad name, particularly in the past fifteen years.

A formidble army of South American fire ants has invaded the United States . . . Already the destructive insects have captured much of the South's best farmland and are eating their way northward and westward. Their onslaught, if unchecked, may not stop short of California and Canada.[12]

When their mound is disturbed, these ants attack by sinking powerful jaws into the skin, then repeatedly thrust their poisonous stingers into the flesh. Fire ants may attack and kill newborn pigs, calves, sheep, and other animals; newly hatched chicks; and the young of ground-nesting birds.[13]

Imported fire ants are destructive, costly and a nuisance. This ant can damage many kinds of young plants by gnawing holes in roots, tubers, stalks and buds.[14]

If you've never had a bout with stinging ants, consider yourself lucky. When the insect involved is the imported fire ant, the bout generally becomes a rout—and in short order! Imported fire ants are vicious stingers and attack without provocation.[15]

This ant damages vegetable crops by sucking juices from the stems of plants and by gnawing holes in roots, stalks, buds, ears, and pods. It injures pasture grasses, cereal and forage crops, nursery stock, and fruit trees.[16]

There is testimony aplenty that in areas where the imported fire ant has gained a stronghold, it inflicts losses on this game bird [bobwhite quail] so popular to Florida hunters. Although some reports on wildlife and livestock losses to the fire ant may have been exaggerated, extreme young of animals and birds certainly have been killed by this pest.[17]

Almost all of these statements are misleading in that they are half-truths.

It has been stated by many authors that the IFA is a menace to quail, particularly to the young birds as they emerge from the shell.[18] Statements such as "The ants enter the quail egg as soon as it is pipped and consume the entire chick before it can escape from the shell" and "quail chicks and their parents have been eaten while confined in brooder pens" are common in the literature.

A study conducted at Auburn University by the Alabama Cooperative Wildlife Research Unit, however, produced different conclusions about the IFA and its damage to quail:

1. Imported fire ants rarely attack and kill normally hatching quail chicks. Most incidents of attack are confined to chicks that are not normal and healthy.

2. Death of chicks in many cases may be attributed to predation by ants when the actual cause of death was some other factor, the ants being attracted to the nests after the chicks had died.

3. Drought may prevent some chicks from escaping the shell after pipping. Ants may then be attracted to the nests, covering the living chicks trapped within the shells as well as those that have already died.

4. Adult birds can keep limited numbers of ants out of the nest. Deserted nests in which the chicks have survived to pip the shell, may become covered with ants, and the chicks may be killed in the shells.

5. The limited destruction of hatching chicks by IFA has no significant effect on overall quail populations.[19]

Several investigators [20] have stated that the IFA does not have any effect on the overall populations of birds and mammals in an infested area. "There are no published papers on imported fire ants as destroyers of birds and animals, but Travis . . . has discussed the destruction of quail by the less populous native fire ants." [21]

Fire ants native to the Southeast have behavioral patterns similar to those of the IFA. They build small mounds, are insectivorous, and, when annoyed, sting with the same ferocity as the IFA. Bernard Travis [22] suggested that the IFA was responsible for the decline (reported by R. W. Williams in 1904 [23]) in the number of ground doves in Leon County, Florida. However, this would have been impossible since the reduction of the dove population occurred 14 years prior to the ant's introduction into the U.S. and 46 years before its range encompassed Leon County, Florida. We were unable to find any documented reports of significant destruction of quail or other ground-nesting birds by the IFA.

Statements such as "These insatiable pests can kill newborn calves and pigs," and "They chase brooding hens from the nest and eat their chicks; they prey on the eggs and young of quail and other ground-nesting birds" [24] are without basis and serve as scarce tactics to arouse public opinion.

PREFERENCE FOR INSECTS

That the IFA feeds mostly on agricultural crops has been presented as a well-publicized fact. E. O. Wilson stated, "In Alabama and Mississippi sections of fields of newly sprouted corn, beans, and other principal crops have been cut down by the marauding worker ants; one picks up crumpled plants only to find their stems and roots riddled by feeding ants." [25] J. Wheeler said about the IFA: "Its appetite for seeds, plants, and trees makes it destructive to many agricultural crops." [26] A. Rankin stated, "The fire ant is one of the most conspicuous nuisances ever to threaten U.S. farmers and the citizenry at large. It damages practically all edible plants by sucking the juice from their roots, stems,

Footnotes at end of article.

seeds, and tender shoots. With the fiery sting that gives it its name, its legions rout field hands trying to gather row crops like potatoes, strawberries, cotton." [27]

These and other reports of damage of varying degrees to major agricultural crops, young livestock, newborn wildlife, and to pasture grasses were based on hearsay, not on analytical studies.

Let us examine the research studies which have been completed on the biology of the IFA. In 1959 S. B. and K. L. Hays wrote:

Experiments were conducted in 1957 to determine food habits of the imported fire ant (*Solenopsis saevissima richteri*), by field observations and laboratory experiments. Ant mounds were dissected in the field to determine food storage, and ants were observed at work to determine the materials collected by the ant foraging parties.[28]

Stored food material included insects and other invertebrates such as termites, weevils, and beetles, cutworms, snails, and fire ants, indicating some degree of cannibalism. At all openings along the tunnels radiating from the mound, workers were observed bringing various insect parts to the mound entrances where the parts were devoured. Aphids, small spiders, various larvae, and some beetles were included. Fly larvae seemed to be a favorite food. Thus, the principal dietary items were insects, not plant material.

Laboratory studies by the same investigators [29] revealed that of seventeen kinds of dry seeds placed on the mounds, only peanuts were eaten. The ants neither damaged nor removed seeds of the other plants. Germinating seeds of the plants were also available to the ants, but only peanuts, okra, and corn were eaten. A thorough examination of roots and above-ground parts of eighteen species of seedling plants transplanted into mounds and allowed to grow for six weeks revealed no damage. Eighteen species of plants were produced from seeds planted in the mound; there was no damage to the seeds, and, of the plants, only okra was eaten. Where food was not available, cannibalism occurred.

In a later study by H. B. Green,[30] visual examination of the ants returning from foraging trips to an eighteen-inch mound revealed that about 25 percent of them were carrying burdens in their mandibles; all of these burdens were parts of insects. The remains of pill bugs or other crustacea have often been found in the "kitchen middens" of the IFA. At some times of the year, small terrestrial snails seem to form part of the fire ant diet. The IFA has also been observed tending aphids, scale insects, and mealybugs, and feeding on the honeydew discharged by these insects.[31]

K. L. Hays in 1958 reported on an inspection trip he made to Argentina, the home of the IFA, with two USDA officials. He noted,

The food of the imported fire ant in Argentina is composed largely of insects. Argentine specialists have not noted injury to vegetation except in building of mounds. Occasionally, ants have been observed to feed on germinating seeds, particularly those of high oil content. Most specialists consider these ants beneficial because of this insectivorous habit. Many reported seeing ants stinging, killing, and carrying numerous harmful species of insects into their mounds. One specialist estimated he had seen more than 100 different species of insects stored in the mounds of these ants.[32]

Hays continued,

The specialists, agricultural workers, and farmers of Argentina do not consider the imported fire ant an economic pest. Since little or no hay is harvested and since farmers do not clip or mow their pastures, no damage to farm machinery was reported. A large proportion of the agricultural produce of Argentina is harvested by hand. Persons working in citrus and apple orchards and cotton fields reported being stung only when they stood on a mound. In frequently cultivated areas, very few mounds of the IFA were seen. It appears that the ants cannot tolerate cultivation or frequent disturbances of their mound.[33]

These studies indicate that the IFA is primarily insectivorous and acts as a generalized predator on many species of insects, including some agricultural pests.

ALLERGIC TO STING

Some people are made ill by the sting of the IFA. The USDA reported: "The stings cause long-lasting sores that sometimes leave scars. People who are allergic to the stings may require medical care." [34] In 1958, Wheeler gave the following example of damage due to fire ant stings: a child in Jacksonville, Florida, in 1957, was found with a temperature of 106 degrees, and the attending physician reported that the illness was caused by fire ant stings. Fire ants are also thought to have been a contributing factor in the death of three people in Florida.[35] A USDA report described the fire ant sting as having a burning and itching sensation, followed by the formation of a white sore or pustule which may leave a permanent scar.[36]

Dr. Rodney Jung of the Tulane University School of Tropical Medicine found that the venom of the IFA is unlike that of other stinging ants, bees, and wasps. A person who is unusually sensitive to this venom may suffer chest pains, become nauseated, and even lapse into a coma from a single sting. Anyone who suffers severely from fire ant stings should be treated immediately for allergic reactions if stung.[37] G. H. Blake reported that the IFA is a vicious stinger and attacks without provocation.[38] Rankin stated that "ordinarily the fire-ant sting brings only searing momentary pain followed by small, pimple-like pustules that last three to ten days. People oversensitive to their venom may feel sharp chest pains and nausea, gasp for breath, turn blue in the face, and lapse into coma." [39] Rankin then goes on to calm the fears of the reader by saying: "The sting is rarely fatal, however, and entomologists remind us that stings of bees and wasps can have the same violent effects on persons allergic to them." [40] Wilson wrote in 1959: "Actually, the sting of the worker ant is much less severe than that of a bee or wasp but this is more than made up for by the size and ferocity of the colonies; the slightest disturbance of a nest brings out hundreds or even thousands of workers which attack any moving object within reach." [41] The same can be said for native fire ants with respect to stinging ability, however.

Some people, when stung, have general (systemic) allergic reactions such as headache and nausea, in addition to a local reaction (which varies from one individual to another). Allergic responses have occurred in individuals receiving one or two or as many as fifty to one hundred stings. However, in all documented cases, a previous history of stings has been recorded. People suffering allergic reactions probably have become sensitized to the venom by previous stings of these or other species of ants.[42] According to three investigators, *all* species of ants accounted for only *four* of the 460 fatalities reported from venomous animals in the United States from 1950 through 1959.[43]

We have not tried to eradicate the wasp, the yellow jacket, the bumblebee (with a much worse sting), the hornet (even worse yet), or the common honeybee. All of these pack a large amount of venom and kill a number of people each year. Bees were the cause of 124 deaths from 1950 through 1959; wasps accounted for 69, yellow jackets 22, and hornets 10 in the same period.[44] People who are allergic to venom must take extra precautions to insure that they do not get stung. It would appear that the IFA fits into the same category as the other types of venomous insects. According to entomologists working with the IFA, the foraging workers do not attack when approached. Instead, they communicate, presumably via chemical substances, and retreat to the nearest entrance of their mound.

ANTHILLS MINOR PROBLEM

Finally, mounds of the IFA are alleged to cause widespread damage to farm machinery with resultant economic loss to landowners. Several authors have suggested that blades of harvesting machinery may be damaged or broken when they strike the hard mounds.[45] It seems logical to assume that some working parts of harvesting machinery could become clogged with dirt from fire ant mounds and that rotary collection blades might be bent when striking the mounds. The idea that hard, steel cutting blades might be completely ruined seems highly doubtful. Information on the nature of the mounds of the IFA indicates that damage resulting from dirt clogigng and bending would be limited to a few specific conditions. For example, mounds of the requisite height and hardness to cause damage are found only in clay soils, and the mounds are not maintained to their maximum height during dry months—when most harvesting would take place.

CONTROL MEASURES ASSESSED

Before and after the initiation of the federal-state cooperative fire ant eradication program in 1957, many chemicals were used in the attempt to rid the country of this insect. S. W. Clark first reported on the use of calcium cyanide to control native species of fire ants in the Rio Grande Valley of Texas.[46] He also used poisoned baits that incorporated thallium sulphate as the active ingredient. Both of these treatments were successful in controlling the native fire ants under the conditions of his experiments. Apparently these methods were not suitable for the eradication programs planned by the USDA. New chemicals (super insecticides) were widely used instead. Among these were dieldrin, chlordane, and heptachlor—all chlorinated hydrocarbons, highly residual in nature, and requiring very small concentrations to be effective against non-target animals. Conservationists made their views known early in the campaign after several incidents of environmental damage were noted. Many reports appeared on the subject, all of them condemning large-scale use of "hard" pesticides.[47] Many instances of widespread damage to wildlife were reported. Maurice F. Baker said heptachlor or dieldrin applied by air at the rate of two pounds per acre resulted in a total kill of thirteen coveys of quail that ranged on the treated area. Two other coveys that ranged mostly off the treated land survived. A wide spectrum of other vertebrate animals was also killed.[48] Leslie L. Glasgow found a high rate of wildlife mortality following the application of two pounds of heptachlor per acre.[49] Redwing blackbirds and meadowlarks were reduced to zero in one study area, and earthworms, the chief food of the woodcock, contained heptachlor five months after treatment. In addition to the discovery that the control measures did more harm to wildlife than to the fire ant, incomplete control of the ant was noted in several of the studies. Reinfestation of treated areas was common, especially after one or two years.

The USDA, after consideration and study, discontinued large-scale use of these chemicals; however, chlordane is still used to treat specific areas.

More tests were conducted by the Plant Pest Control Division of the USDA on different compounds and baits (attractants and poisons) that would be more specific to the IFA and less dangerous to other animals.

Finally, as a result of these tests and other studies, a new chemical, the chlorinated relative of Kepone, Mirex, was studied exten-

Footnotes at end of article.

sively. It was determined that the main food item of the IFA is insects and that it feeds upon plant matter only as a last resort. It was further determined that the best baits for the IFA are those high in protein or fatty acids. Following up this lead, C. S. Lofgren, J. L. Thompson and USDA investigators [50] determined specifically that the best baits are cottonseed oil, soybean oil, peanut oil, fancy tallow, and lard. Soybean oil was chosen as the best single attractant and solvent for Mirex. A combination of Mirex at a concentration of between 0.05 and 0.45 percent dissolved in the soybean oil, then absorbed by ground corncob (grits) as a carrier, has proved to be the most effective insecticide for the IFA. Foraging workers bring food to the round, where it is fed to the nest queen first. Next in line are the larvae. The slow-acting insecticidal action of Mirex insures the death of the colony; since there is only a single queen (the only female with reproductive capabilities) per nest, and no replacements for lost workers, the colony expires.

Entomologists and ecologists examined the effects of Mirex applications on the wildlife of treated areas. J. B. DeWitt and his colleagues found that Mirex was less toxic to quail than was an equal dose of Kepone.[51] Research in 1964 showed that Mirex was less toxic to pheasants and mallards than was Kepone.[52] Baker studied the possible effects of Mirex bait on bobwhite quail and other birds. Although there were no deaths of quail or other birds attributable to Mirex when used in field tests, there was a reduction in fertility and hatchability of quail eggs in pen studies (where the birds are caged in the field). However, Baker stated that the pen tests were inconclusive and recommended only that further investigation be conducted. He concluded that it would be safe to use Mirex under the operational conditions of the eradication program.[53]

INTERFERENCE WITH REPRODUCTION

Baker [54] was the first scientist to check for and report on the long-term effects of Mirex on reproduction. Other researchers followed his lead. E. E. Good and his colleagues [55] demonstrated that Kepone, when fed at five parts per million (ppm) in the diet of the laboratory mouse, reduced litter frequency. Kepone apparently produced in the female test animals a hormonal imbalance which caused them to be in a continual state of sexual receptivity and prevented successful ovulation.[56]

Mirex, the more highly chlorinated relative of Kepone, has largely replaced Kepone for some uses, particularly IFA control in the South. It is much less toxic to quail,[57] pheasants, and mallards.[58] Little information is available regarding effects of Mirex on mammals. It has been reported that the amount required to kill 50 percent of a sample of male white rats was about three times that of Kepone.[59] However, preliminary tests with Mirex produced different results. George W. Ware and E. E. Good found that its toxicity was considerably greater than that of Kepone when fed continuously to one strain of laboratory mice. Dietary Mirex at 7 ppm produced greater mortality than 50 ppm of Kepone.[60]

In contrast to the findings with mice, Edward C. Naber and George W. Ware in 1965 found that much higher levels of Mirex than of Kepone (150 ppm Kepone as opposed to 660 ppm of Mirex) were required in the diets of laying hens to reduce hatchability of eggs.[61]

Another effect observed in experimental rats fed low dietary levels was the development of cataracts in the offspring. Litters from mothers that had not been fed Mirex were transferred at birth to foster mothers that had been fed Mirex at the rate of five ppm in their diets for 73 days. Not only was survival at weaning reduced (only 54 percent survived) but 37.5 percent of the infant rats from nine litters developed cataracts.[62]

Differences were found in the effects of Mirex, DDT, and Telodrin on two strains of laboratory mice. In one strain, the Mirex diet produced the smallest first litters, the smallest litters throughout the tests, and a significant increase in parent mortality. In the other strain, Mirex had no effect on parent mortality, but altered significantly the number of young per pair. In first litters, Mirex resulted in a significantly lower number of offspring produced per day than did DDT. "In all instances the Mirex diet resulted in reduced litter size and number of offspring produced per day." [63]

It is apparent, then, that Mirex is a poison that can, in certain concentrations, at least reduce reproductive success in certain mammals. Furthermore, a report on pesticides made to the Secretary of Health, Education, and Welfare by a special scientific commission lists Mirex as a carcinogen (cancer-producing agent) that induces tumors in mice.[64] The USDA believes, however, that in the small concentrations used in the eradication programs, the effects would be insignificant to species other than the several ant species for which Mirex is allegedly a specific toxicant.

The USDA policy differs with that of the Department of the Interior. The Secretary of the Interior recently announced a policy banning the use of 16 pesticides and sharply restricting the use of 32 others, including Mirex, on the 70 percent of all federal land holdings managed by the Interior Department.[65]

CONCENTRATED IN FOOD CHAIN

Generally ignored, however, is the question of food-chain buildup, that process by which environmentally persistent pesticides are concentrated within the ecosystem. Such buildups have occurred with other chlorinated hydrocarbons (such as DDT), which have turned up in high concentrations in the tissues of various vertebrates. Mirex, a chlorinated hydrocarbon, might also be expected to follow the route of biological concentration. Dr. L. D. Newsom, chairman, department of entomology, Louisiana State University at Baton Rouge, indicated in a personal communication to us on May 26, 1970 that this was indeed the case. The following is a statement by Dr. Newsom:

Data which have become available in the past few weeks have shown that Mirex has been accumulating in the wildlife of Louisiana. The potential importance of this new information is such that I am urging that the fire ant eradication program currently being undertaken by the USDA Plant Pest Control Division be halted immediately so that this program can be further studied.

In 1969 P. A. Butler studied pesticide residues in 5,000 samples of oysters and shellfish from estuaries on the Atlantic, Gulf, and Pacific coasts. He showed that over a three-year period Mirex was the fourth most frequently encountered pesticide residue. Mirex was exceeded only by DDT, endrin, and toxaphene.[66]

It has been noted that individual treatments of areas with Mirex have failed to control the IFA, much less eradicate it. L. D. Newsom stated that Mirex has been sprayed for several years in Louisiana and has failed to control the IFA for any extended period of time. This is true even after six applications of Mirex on some areas. F. Bellinger and his colleagues were even more blunt:

Based on data summarized in this report, the United States should free itself from any illusion that current airplane spray operations with Mirex [are] anything but a "control" operation, which will require reapplication more than once a year to the periphery of the infested area, even simply to prevent the spread of infestation.[67]

IN SUMMARY

Widespread danger to mankind from the IFA does not exist. Statements in the literature which indicate that the IFA kills livestock and wildlife, preys on the eggs of young quail, and is responsible for decreases in the numbers of ground-nesting birds have not been substantiated. Instead, such statements have been disputed with documented research.

The sting of the worker ant is less severe than that of a bee or wasp. Persons allergic to insect venom may suffer systemic reactions to the sting of other venomous insects. *All* species of ants accounted for only *four* of the 460 fatalities reported from venomous animals in the United States from 1950 through 1959.

Under certain circumstances, working parts of harvesting machinery *may* become clogged with dirt from fire ant mounds, and rotary collection blades may be bent when striking the mounds, but there is little to indicate such damage has been an extensive agricultural problem.

Field observations and laboratory experiments indicate that the diet of the IFA is composed primarily of insects and insect products, not plant materials, as some proponents of eradication have claimed. In its Argentine homeland, the fire ant is considered beneficial to agriculture due to its diet of harmful insects.

Mirex, a chlorinated hydrocarbon, has been used since 1962 to control the imported fire ant. This chemical was believed to be safer to wildlife than heptachlor, chlordane, and other pesticides which have been used by the USDA in previous attempts to eradicate the IFA. Recently it has been shown that Mirex is accumulating in the tissues of several species of wildlife in Louisiana and Mississippi. Mirex is highly resistant to breakdown into nontoxic form and is responsible for a decrease in the reproductive ability of certain test animals. Mirex has failed to control its target species, the IFA, as is evidenced by the continued expansion in range of the insect to an estimated 120 million acres.

The IFA is not the danger that is alleged. The Mirex program to eradicate the IFA, on the other hand, is dangerous. It will kill myriads of nontarget organisms, and will not eradicate the fire ant.

BACKGROUND

An article appearing on April 30, 1970 in the Bryan-College Station (Texas) local newspaper, The Daily Eagle, was the first indication that the imported fire ant had been found in Brazos County, Texas. The article discussed the "large, cement-like mounds on agriculture land . . . the extremely painful bite which . . . frequently causes the death of young livestock and wildlife," and "treatment with Mirex granules which does not affect common red ants, wildlife or humans."

A second article in the Daily Eagle of May 3, 1970 indicated that 5,200 acres, including parts of the city of Bryan, would receive an initial treatment against the imported fire ant beginning Monday, May 4, 1970. The area was to be treated with Mirex bait granules distributed by low-flying aircraft at the rate of one and one-fourth pounds per acre. The remainder of the article discussed Mirex bait and its supposedly low toxicity to other animal life.

The lack of documented information concerning both the imported fire ant and Mirex, along with incorrect information apparently provided to the newspaper, suggested to us that the proposed treatment should be temporarily halted until further studies could be made of its long-term environmental effects. Such studies may be requested by

Footnotes at end of article.

private citizens under Section 102 of the National Environmental Policy Act of 1969.

Thus, on the morning of May 5, 1970 we and Sidney E. Forsyth, all residents of College Station, Texas and students at Texas A&M University, attempted to obtain an interview with persons in charge of the imported fire ant control program in Brazos County. It was determined that the personnel connected with the project were employed by the U.S. Department of Agriculture (USDA). None of these people could be contacted prior to the spraying activities.

When the USDA district supervisor for the Plant Protection Division heard of our request for an interview, the single aircraft being used in this particular instance was recalled while we presented our case. We were informed by Mr. John Landrum, the USDA district supervisor, that in his opinion, the imported fire ant was a menace, Mirex was safe, and aerial distribution of Mirex was the most economical method of treatment. He further stated that the only person able to stop the Mirex application was the director of the Plant Protection Division of the USDA in Hyattsville, Maryland. The aerial distribution program was subsequently resumed and the initial treatment was completed by the evening of May 5, 1970.

This report is an attempt to assess both the role of the imported fire ant as an economic pest and the use of Mirex as a control measure.

FOOTNOTES

[1] Ferguson, D. E., "Fire Ant: Whose Pest?" *Science*, 169 (3946); 630, 1970.

[2] Cited in Green, H. B., "The Imported Fire Ant in Mississippi," *Bulletin of the Mississippi State University Agricultural Experiment Station*, 737: 1–23, 1967.

[3] Bellinger, F., R. E. Dyer, R. King and R. B. Platt, "A Review of the Problem of the Imported Fire Ant," *Bulletin of the Georgia Academy of Science*, 23(1):1–22, 1965.

[4] Bellinger et al., *loc. cit.* Green, *loc. cit.*

[5] Bellinger et al., *loc. cit.* Agricultural Research Service, *Observations on the Biology of the Imported Fire Ant*, United States Department of Agriculture, ARS–33–49:1–21, 1958.

[6] Allen, Ralph H., "History of the Imported Fire Ant in the Southeast," *Proceedings of the 12th Annual Conference, Southeastern Association of Game and Fish Commissioners*, 1958, pp. 227–233. Bellinger et al., *loc. cit.*

[7] Graham, F., Jr., *Since Silent Spring*, Houghton Mifflin Co., Boston, Massachusetts, 1970, 333 pp.

[8] Allen, *loc. cit.* Carson, Rachel, *Silent Spring*, Houghton Mifflin Co., Boston, Massachusetts, 1962, 368 pp. Rudd, R. L., *Pesticides and the Living Landscape*, University of Wisconsin Press, Madison, Wisconsin, 1964, 320 pp.

[9] Rudd, *ibid.*

[10] Carson, *loc. cit.*

[11] Rudd, *loc. cit.*

[12] Rankin, A., "The Great Fire-Ant Invasion," *Reader's Digest*, 71(425):74–77, 1957.

[13] Agricultural Research Service, *The Imported Fire Ant*, United States Department of Agriculture, PA–592, 1968, pp. 1–4.

[14] Thomas, J. G., *Fact Sheet: How to Control the Imported Fire Ant*, Texas A&M University, Agricultural Extension Service, 1–384, 1967, 4 pp.

[15] Blake, G. H., Jr., "Imported Fire Ant—On the March in Alabama," *Highlights of Agricultural Research*, Alabama Agricultural Experiment Station, 3(3):5, 1956.

[16] Agricultural Research Service, *The Fight Against the Imported Fire Ant*, United States Department of Agriculture, PA–368:1–4, 1958.

[17] Wheeler, Joe, "The Fire Ant," *Florida Wildlife*, March, 1958.

[18] Stoddard, Herbert L., *The Bobwhite Quail, Its Habits, Preservation, and Increase*, Charles Scribner's Sons, New York, 1936, 559 pp. Travis, Bernard V., "The Fire Ant (*Solenopsis sp.*) as a Pest of Quail," *Journal of Economic Entomology*, 31(6):649–652, 1938. Travis, Bernard V., "Fire Ant Problem in the Southeast with Special Reference to Quail," *Transactions of the North American Wildlife Conference*, 3:705–708, 1938. Emlen, John T., Jr., "Fire Ants Attacking California Quail Chicks," *Condor*, 40(2): 85–86, 1938. Rankin, *loc. cit.* Wheeler, *loc. cit.* Wilson, E. O., "Invader of the South," *Natural History*, 68(5): 276–281, 1959.

[19] Johnson, A. S., "Antagonistic Relationships Between Ants and Wildlife With Special Reference to Imported Fire Ants and Bobwhite Quail in the Southeast," *Proceedings of 15th Annual Conference of Southeastern Game and Fish Commissioners*, 1961, pp. 88–107.

[20] Murray, Robert W., "A Synecological Study of the Effects of the Fire Ant Eradication Program in Florida," *Proceedings of the 16th Annual Conference of Southeastern Game and Fish Commissioners*, 1962, pp. 145–153. Rhoades, W. C. and R. W. Murray, "A Synecological Study of the Imported Fire Ant Eradication Program," *Bulletin of the University of Florida Agricultural Experiment Station*, 720:1-42, 1967. Arant, F. S., Kirby L. Hays and Dan W. Speake, "Facts About the Imported Fire Ant," *Highlights of Agricultural Research*, Agricultural Experiment Station, Alabama Polytechnic Institute. Vol. 5, No. 4, 1958.

[21] Agricultural Research Service, *Observations . . . . loc. cit.*

[22] Travis, "Fire Ant Problem . . . ," *loc. cit.*

[23] Williams, R. W., Jr., "A Preliminary List of the Birds of Leon County, Florida," *Auk*, 21:449–462, 1904.

[24] Rankin, *loc. cit.*

[25] Wilson, *loc. cit.*

[26] Wheeler, *loc. cit.*

[27] Rankin, *loc. cit.*

[28] Hays, S. B. and K. L. Hays, "Food Habits of *Solenopsis saevissima richteri* Forel," *Journal of Economic Entomology*, 52 (3):455–457, 1959.

[29] *Ibid.*

[30] Green, *loc. cit.*

[31] *Ibid.* Agricultural Research Service, *Observations . . . , loc. cit.*

[32] Hays, Kirby L., "The Present Status of the Imported Fire Ant in Argentina," *Journal of Economic Entomology*, 51(1):111–112, 1958.

[33] *Ibid.*

[34] Agricultural Research Service, *The Imported Fire Ant, loc. cit.*

[35] Wheeler, *loc. cit.*

[36] Agricultural Research Service, *The Imported Fire Ant Program and Progress*, United States Department of Agriculture, ARS–81–9–1, 1963, 10 pp.

[37] *Ibid.*

[38] Blake, *loc. cit.*

[39] Rankin, *loc. cit.*

[40] *Ibid.*

[41] Wilson, *loc. cit.*

[42] Bellinger et al., *loc. cit.*

[43] Parrish, Henry M., "Analysis of 460 Fatalities from Venomous Animals in the United States," *American Journal of Medical Sciences*, 245(2):129–140, 1963. Pratt, Harry D. and John M. McDowell, "Current Status of Some of the Important Arthropod-borne Diseases in the United States," Report from Vector Control Services, Training Section, Training Branch, Department of Health, Education, and Welfare, Atlanta, Georgia, 1963.

[44] Pratt and McDowell, *ibid.*

[45] Arant et al., *loc. cit.* Thomas, *loc. cit.* Agricultural Research Service, *The Imported Fire Ant . . ., loc. cit.*

[46] Clark, S. W., "The Control of Fire Ants in the Lower Rio Grande Valley," *Bulletin of the Texas Agricultural Experiment Station*, 435:1–12, 1931.

[47] Baker, Maurice F., "Observations of Effects of an Application of Heptachlor or Dieldrin on Wildlife," *Proceedings of the 12th Annual Conference, Southeastern Association of Game and Fish Commissioners*, 1958, pp. 244–247. Curl, L. F. "Aerial Application in Eradication Programs," *Agricultural Chemistry*, 13(4) :42–44, 99, 1958. Cutler, M. Rupert, "Pesticides Versus Wildlife," *Virginia Wildlife*, 20:4–5, 1958. Glasgow, Leslie L., "Studies on the Effect of the Imported Fire Ant Control Program on Wildlife in Louisiana," *Proceedings of the 12th Annual Conference, Southeastern Association of Game and Fish Commissioners*, 1958, pp. 250–255. Kyle, George M., "These Died on 100 Acres of Fire Ant Treatment Area," Alabama State Department of Conservation, News Release, April 18, 1958, 4 pp. Lay, Daniel W., "Fire Ant Eradication and Wildlife," *Proceedings of the 12th Annual Conference, Southeastern Association of Game and Fish Commissioners*, 1958, pp. 248–250. Newsom, L. D., "A Preliminary Progress Report of Fire Ant Eradication Program," Concordia Parish, Louisiana, 1958. Rosene, Walter J., "Whistling-Cock Counts of Bobwhite Quail on Areas Treated with Insecticide and on Untreated Areas, Decatur County, Georgia," *Proceedings of the 12th Annual Conference, Southeastern Association of Game and Fish Commissioners*, 1958, pp. 240–244. Clawson, S. G. and M. F. Baker, "Immediate Effects of Dieldrin and Heptachlor on Bobwhites," *Journal of Wildlife Management*, 23(2) :215–219, 1959. Gaines, J. F. and H. E. Lowry, "The Controversial Fire Ant," *Southeastern Veterinarian*, 12(1) :122–124, 1960. Jenkins, J. H., "A Review of Five Years Research on the Effects of the Fire Ant Control Program on Selected Wildlife Population," *Bulletin of the Georgia Academy of Science*, 21(1/2) :3, 1963. Rusoff, L. L., R. S. Temple, R. G. Myers, L. D. Newsom, E. C. Burns, W. F. Barthel, Calvin Corley and Ava Allsman, "Residues in Fatty Tissues and Meat of Cattle Grazing on Pastures Treated with Granular Heptachlor," *Agriculture and Food Chemistry*, 11(4) :289–291, 1963.

[48] Baker, *loc. cit.*

[49] Glasgow, *loc. cit.*

[50] Agricultural Research Service, *The Imported Fire Ant Program . . ., loc. cit.* Lofgren, C. S., W. A. Banks and C. E. Stringer, *Toxicity of Various Insecticides to the Imported Fire Ant*, Agricultural Research Service, United States Department of Agriculture, 81–11:1–5, 1964. Thompson, J. L., "Baits and Natural Feeding Stimulants of the Imported Fire Ant," unpublished master's thesis, Department of Entomology, Mississippi State University, Starkville, Mississippi, 1967.

[51] DeWitt, J. B., W. H. Stickel and P. F. Springer, *Pesticide-Wildlife Studies, 1961–1962*, U.S. Fish and Wildlife Service, Circular 167, 1963, pp. 87–88.

[52] DeWitt, J. B., C. M. Menzie, J. W. Spann and C. Vance, *Pesticide-Wildlife Studies, 1963*, U.S. Fish and Wildlife Service, Circular 199, 1964, pp. 105–109.

[53] Baker, Maurice F., "Studies on Possible Effects of Mirex Bait on the Bobwhite Quail and Other Birds," *Proceedings of the 18th Annual Conference, Southeastern Association of Game and Fish Commissioners*, 1964, pp. 153–160.

[54] *Ibid.*

[55] Good, E. E., G. W. Ware and D. F. Miller, "Effects of Insecticides on Reproduction in the Laboratory Mouse: I. Kepone," *Journal of Economic Entomology*, 58:754–757, 1965.

[56] Huber, J. J., "Some Physiological Effects of the Insecticide Kepone in the Laboratory Mouse," *Toxicology and Applied Pharmacology*, 7:516–524, 1965.

[57] DeWitt, et al., *Pesticide-Wildlife Studies, 1961–1962, loc. cit.*

[58] DeWitt, et al., *Pesticide-Wildlife Studies, 1963, loc. cit.*

[59] Martin, H., *Guide to the Chemicals Used in Crop Protection*, Publication 1093, Fourth Edition, Queen's Printer, Ottawa, Canada, 1961, Spencer, E. Y., "Supplement to the Fourth Edition," *Guide to the Chemicals Used in Crop Protection*, Publication 1093, Queen's Printer, Ottawa, Canada, 1964.

[60] Ware, George W. and Ernest E. Good, "Effects of Insecticides on Reproduction in the Laboratory Mouse. II. Mirex, Telodrin, and DDT," *Toxicology and Applied Pharmacology*, 10:54–61, 1967.

[61] Naber, Edward C. and George W. Ware, "Effect of Kepone and Mirex on Reproductive Performance in the Laying Hen," *Poultry Science*, 44:875–880, 1965.

[62] Gaines, Thomas B. and Renate D. Kimbrough, "Oral Toxicity of Mirex in Adult and Suckling Rats," *Archives of Environmental Health*, 21:7–14, July 1970.

[63] Ware and Good, *loc. cit.*

[64] *Report of the Secretary's Commission on Pesticides and Their Relationship to Environmental Health*, U.S. Government Printing Office, Washington, D.C. 1969.

[65] "Forty-Eight Pesticides Harnessed," *Sport Fishing Institute Bulletin*, 216:5, 1970.

[66] Butler, P. A., "Monitoring Pesticide Pollution," *Bio-Science*, 19:889–891, 1969.

[67] Bellinger, et al., *loc. cit.*

ORDER FOR TRANSACTION OF ROUTINE MORNING BUSINESS ON MONDAY NEXT

Mr. BYRD of West Virginia. Mr. President, I ask unanimous consent that on Monday next, immediately following the order for the recognition of the distinguished senior Senator from Virginia (Mr. BYRD), there be a period for the transaction of routine morning business for not to exceed 30 minutes, with statements limited therein to 3 minutes.

The PRESIDING OFFICER. Without objection, it is so ordered.

ORDER TO LAY BEFORE THE SENATE THE UNFINISHED BUSINESS ON MONDAY NEXT

Mr. BYRD of West Virginia. Mr. President, I ask unanimous consent that on Monday, immediately on the close of the period for the transaction of routine morning business, the Chair lay before the Senate the unfinished business.

The PRESIDING OFFICER. Without objection, it is so ordered.

REQUEST FOR CONFERENCE CONCERNING PRICES OF WHEAT

Mr. BYRD of West Virginia. Mr. President, I ask unanimous consent that the Senate now proceed to the consideration of Senate Resolution 136.

The PRESIDING OFFICER. The resolution will be stated by title.

The legislative clerk read the resolution (S. Res. 136) by title, as follows: "A resolution requesting a negotiating conference in reference to the prices of wheat."

The PRESIDING OFFICER. Is there objection to the present consideration of the resolution?

There being no objection, the Senate proceeded to consider the resolution.

Mr. BYRD of West Virginia. Mr. President, there will be no action on this measure today. It has been made the pending business for the purpose of its being laid before the Senate on Monday next at the close of morning business as the unfinished business.

PROGRAM

Mr. BYRD of West Virginia. Mr. President, the program for Monday and the subsequent days of next week, as far as can be determined at the moment, is as follows:

On Monday the Senate will convene at 12 o'clock noon. Following the recognition of the two leaders under the standing order, the distinguished senior Senator from Virginia (Mr. BYRD) will be recognized for not to exceed 15 minutes. There will then be a period for the transaction of routine morning business, with statements therein limited to 3 minutes, the period not to exceed 30 minutes. The Chair will then lay before the Senate the unfinished business, Senate Resolution 136, the so-called McGee resolution.

Following action on Senate Resolution 136, the Senate will proceed, in executive session, to the consideration of the International Wheat Agreement, on which the yeas and nays have already been ordered. Therefore, there will be at least one yea-and-nay vote on Monday next and Senators are so apprised.

Also on Monday it is quite likely that the Senate will consider and dispose of the Federal boat safety bill, which is being reported today by the Commerce Committee.

I have been asked by the distinguished majority leader to announce that the vote to override the Presidential veto on the accelerated public works bill will be scheduled for Wednesday next. There will be a rollcall vote on the proposed veto override.

Two health manpower bills will be reported on Monday from the Committee on Labor and Public Welfare, and they may be taken up on Tuesday or Wednesday.

On Wednesday next, the Appropriations Committee will report a bill making appropriations for the Department of Agriculture. It is hoped that the Senate can proceed to the consideration of that appropriations bill on Thursday next.

On Thursday, the Appropriations Committee is expected to report the Department of the Interior appropriations bill, the Department of Housing and Urban Development appropriations bill, and the State-Justice-Commerce appropriations bill. So, three appropriations bills are expected to be reported from the committee on Thursday next, and it is the intent of the majority leader to attempt to schedule as many as possible of those bills for action on Friday next, with the hope that they may be disposed of on that day.

In view of the past practice, generally, of ordering the yeas and nays on the final passage of appropriations bills, therefore, Senators are on notice that undoubtedly there will be yea-and-nay votes on appropriations bills on Thursday and Friday of next week.

Other possible items for consideration late next week are the Atomic Energy Commission authorization bill, which has been reported today, as I understand, and on which action may be taken Thursday or Friday of next week, as well as reconsideration of the vote on the Veterans' Committee resolution, and it is my understanding that this may be taken up Thursday or Friday.

Senators will be aware, therefore, of the very busy week ahead of us, with a certain yea-and-nay vote on Monday, and with yea-and-nay votes to follow on days subsequent to Monday of next week.

ADJOURNMENT TO MONDAY

Mr. BYRD of West Virginia. Mr. President, if there be no further business to come before the Senate, I move, in accordance with the previous order, that the Senate stand in adjournment until 12 o'clock noon on Monday next.

The motion was agreed to; and (at 1 o'clock and 41 minutes p.m.) the Senate adjourned until Monday, July 12, 1971, at 12 noon.

NOMINATIONS

Executive nominations received by the Senate July 8, 1971:

DEPARTMENT OF DEFENSE

Charles L. Ill, of Maryland, to be an Assistant Secretary of the Navy.

U.S. DISTRICT COURTS

Malcolm M. Lucas, of California, to be a U.S. district judge for the central district of California, vice a new position created by Public Law 91–272, approved June 2, 1970.

Lawrence T. Lydick, of California, to be a U.S. district judge for the central district of California, vice Thurmond Clarke, deceased.

EXTENSIONS OF REMARKS

THE UTTER WRONGNESS OF OUR PAKISTAN POLICY

HON. FRANK CHURCH

OF IDAHO

IN THE SENATE OF THE UNITED STATES

Wednesday, July 7, 1971

Mr. CHURCH. Mr. President, the 4-month-old civil war afflicting the people of East Pakistan worsens, and no relief is in sight to heal the deep and festering wounds. Committing monstrous acts of inhumanity, the West Pakistan military regime, with an Army of 70,000 men, equipped, armed, and trained for the most part by the United States, still occupies the eastern wing of this bifurcated Asian country. Reports of atrocities continue to come in.

In turn, the Bengali sufferers, 75-million Muslims and Hindus, making up the majority of the country who won the majority of seats in the new National Assembly last December, continue to resist. Latest dispatches from Dacca, for instance, tell of the freedom fighters knocking out the electrical power systems of the biggest cities, Dacca and Comilla.

During this tragic period, the utter wrongness of American policy has become blatantly apparent. The United States supports the Government at Islamabad, the very creators of the widespread suffering in their own country. We keep shipping arms, ammunition, and spare parts and, although the U.S.