"THE DOMESTIC CONTROL OF
THE UNITED STATES ATOMIC ENERGY PROGRAM"

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PREFACE

Many people consider atomic energy to be the most significant development of science during the last century. The implications for both military and peaceful concerns have been tremendous and sometimes frightening in their import. It was recognized quite early that because of the awesome consequences of the atomic program, the question of both domestic and international nuclear control would be as important as any that the country had faced during its history. To quote the preface to the Atomic Energy Act of 1946,

> The effect of the use of atomic energy for civilian purposes upon social, economic, and political structures of today cannot now be determined. It is reasonable to anticipate, however, that tapping this new source of energy will cause profound changes in our present way of life.[1]

It will be the purpose of this paper to describe and analyze the development of the policies of domestic control and leadership of the American atomic energy program. Although this will be done primarily from an historical point of view, the final objective will be to examine the conclusions reached during the historical analysis with particular emphasis directed towards their relevance to the immediate future of the Atomic Energy Commission and contemporary issues of domestic nuclear control. The paper will be divided into three sections--each corresponding to a term of the seminar. The first two sections will deal with the history of domestic nuclear control from the inception of the wartime project to the present. The third and final section will be more analytical in content and will attempt to discuss current thoughts and policies concerning the subject of domestic control as well as to make limited future projections.

As is so often the case, the attempt to analyze any particular subject by isolating it from the flow of history is a rather artificial procedure. Certainly the relationship between the development of international and domestic control of nuclear weapons is very strong and interdependent. Yet only a brief mention will be made in this paper concerning the formation of international policy which ran parallel to and hinged to a very large degree upon domestic atomic legislation. Then too, the mood of the American people after World War II most surely affected the issues, and yet this mood could only be clearly shown and understood through the introduction of additional historical events.

Despite these shortcomings, I feel that there is still much to be gained in an historical analysis of this type. Indeed, it seems as if most history is made out of context, without considering the interrelated historical nature of particular decisions at the time that they are made. Evidence the apparent insensitivity of Congress with regard to the international nuclear control problem as they debated and admended the McMahon proposal. Thus recognizing some of the pitfalls in this method of approach, and yet also anticipating some of its benefits, I will seek to present and analyze the short history of domestic control of atomic energy in the United States.

I. THE EARLY YEARS: 1940/1947

INTRODUCTION

This first section of the paper will concern itself with roughly the period from the inception of the war project to the Congressional confirmation of the first Atomic Energy Commission appointments in 1947. It is necessary that we "begin at the beginning" and tell much of the story of the atomic energy program during the initial stages of its development so that we may better understand the background of later decisions and policy formation.

FIRST EFFORTS

It seems ironic and rather frightening that the initial stumble into the world of nuclear fission should occur in Nazi Germany, but late in 1938 Otto Hahn and Fritz Strassman noticed thefirst results of a fission reaction while performing experiments on nuclear interactions. Danish physicist Niels Bohr recognized immediately the consequences of the discovery and brought this realization with him to the United States. Small groups of scientists within the country immediately began experiments to confirm the discovery. Even at this early state the United States was a leader in experimental physics and thus relatively well-prepared for nuclear research. Several of our own scientists were only weeks behind the Germans in the discovery of fission.

Physicists Enrico Fermi and Leo Szilard saw in the fission process the potential of a self-sustaining chain reaction leading to a tremendous source of power. Szilard saw a more frightening concept in applying the fission reaction in a weapon capable of such incredible destruction that he felt an all-out effort towards nuclear weapon development seemed advisable even in the face of strong doubts as to its feasibility. Together

with other scientists, Szilard drafted a letter signed by Albert Einstein which was delivered to President Roosevelt on October 11, 1939. Alerted to the potential of the atom, Roosevelt appointed an Advisory Committee on Uranium to keep track of the country's atomic research.

This committee fell under the auspices of the National Defense Research Committee under the direction of Vannevar Bush. The main attack was directed towards confirming the possibility of the chain reaction. Although the early pace was slow, the significance of the U-235 isotope was recognized early and preliminary research into the separation of this isotope from natural uranium began. Research indicated that an artificial element, plutonium, might also prove capable of sustaining a fission reaction.

On June 28, 1941 a reorganization and expansion of the committee occurred under the newly formed Office of Scientific Research and Development. S-1, as the reorganized section was now coded, now lay under the protective wing of the executive branch, and during July, 1941 the program rapidly accelerated. After discussing the state of atomic research once more with Bush and noting the optimism of British scientists and also that of a report prepared by a National Academy of Sciences committee under Arthur Compton, the President approved the full scale effort towards finding a method of separating U-235 and making plutonium on October 9, 1941. Thus by the time the United States was catapulted into the war by Pearl Harbor, the commitment had already been made towards the development of the weapon. It was recognized early however that the separation process would be quite difficult and expensive, and Bush felt that after the preliminary research and design work had been accomplished by S-1, the Army should take over full-scale construction and operation of production

facilities. A Planning Board under Eger V. Murphree, after exploring electromagnetic, gaseous diffusion and centrifuge separation methods during early 1942, was unable to decide on any one superior process. The committee finally decided that the safest procedure would be to begin work on all three types of separation installations to produce U-235, as well as an installation to produce plutonium.

THE MANHATTAN ENGINEERING DISTRICT

Bush had approached the Army concerning takeover of the program as early as March, 1942. Both he and Roosevelt had been particularly interested in Army supervision for several reasons. Besides the fact that research under military direction had been quite successful during WW I, the mere magnitude of the atomic program would necessitate a body capable of controlling immense operations. Because of the security demands, it was necessary to limit the program to one service. Since Roosevelt had been at odds with the Navy for some time, the Army seemed from the beginning the logical choice for a wartime manager.[2]

Although the Army was somewhat reluctant to begin on all four methods of production of fissionable materials, they agreed on June 10, 1942 to follow initially the OSRD program. During the early construction period, the Army and the OSRD were to work together in direction of the program. The Army decided to put the project under their Corps of Engineers and selected Col. James C. Marshall as a director. They would receive some 60% of federal appropriations for the program, and planned to contract construction out to private firms. The Army would take over development, engineering design, procurement of materials, and site selection. The OSRD would continue with research.

Flaws in the arrangement appeared immediately. It soon became obvious that the research and engineering functions could not be separated quite so easily as had been anticipated. Within the Army the project had little prestige, and the OSRD's influence on military decisions was negligible. There was no higher authority to which the Army and OSRD could go to resolve differences. As with most programs under separate but parallel management, the project suffered from an alarming lack of coordination.

The Army was facing problems of its own however. Slowness in the establishment of the Oak Ridge, Tenn. site and an inability to secure a top priority on wartime materials complicated the plans for construction. Marshall attempted to direct the project from his headquarters in New York (thus the title Manhattan Engineering District), and communications with Washington suffered. To resolve the material and appropriation problems, it was finally decided to place the project under the Services of Supply, and Colonel Leslie Groves was appointed direction of the entire program on September 17, 1942.

Groves had been following the development of the MED for some time prior to his appointment. Within 48 hours he had resolved the site difficulty and secured a top priority for the program. He brought added vigor and direction to the Manhattan District, as well as the absolute command which the wartime pace demanded. He was assisted in his decisions by a Military Policy Committee suggested by Bush and containing representatives from the Army, Navy, and OSRD.

During the remainder of 1942 the MED program jelled into firm commitment to the development of the weapon. Scientific achievements came rapidly. Fermi achieved the first sustained fission reaction under old Stagg Stadium as the University of Chicago on December 2. Ernest O.

Lawrence continued his development of the calutron which was to electromagnetically separate the uranium isotopes. A decision was reached to abandon the struggling centrifuge separation program. On December 28, 1942 presidental approval marked the transition from research to the all-out production effort[3]. The S-1 committee had completed its task and was eventually dissolved in March. James Conant of the NDRC and Richard Tolman of C.I.T. replaced it as direct scientific advisors to Groves. The formal civilian direction of the program had come to a necessary close, and the military assumed the mantle of control. From reliance upon the scientific ability of the country, the program now shifted to reliance upon the American industrial and engineering might. The United States was well along the road that would eventually lead to Hiroshima.

The MED directed itself towards two objectives: the production of fissionable materials and the design and fabrication of the weapon itself. To provide fissionable material for the weapon, the nation would have to undertake its most ambitious technical project in its history under the binding restrictions of wartime security. The production facilities themselves gave evidence of the tremendous scope and complexity faced by the MED.

In Oak Ridge the isotope separation plants were under construction to separate U-235 from natural uranium. Most hope rested with Lawrence's electromagnetic process. This used a series of mass spectrometers (the calutrons) to separate the isotopes as a result of their differences in atomic mass. The plant itself, coded Y-12, was a huge complex of intricate electronic equipment which relied upon continual engineering adjustments and refinements for its sustained operation.

In another area of the Tennessee site, the gaseous diffusion plant (K-25) was being erected. This relied upon the fact that gaseous U-235 and U-238 would diffuse at different rates through a suitable barrier. Although the barrier material had yet to be perfected, the huge building which would contain the hundreds of barriers in series was under construction quite early. It was eventually realized that even suitable barriers would not bring the initial production of U-234 to desired concentration levels, so it was decided to use a thermal diffusion process to act as a feeder to the K-25 plant.

The third path to the weapon was that of producing the element plutonium artificially in a nuclear reactor, such as the one Fermi had built in Chicago. Initial work was begun on the Clinton laboratories and the X-10 complex at Oak Ridge to determine the design of the production reactors. Construction of the production facility near Hanford, Washington progressed. Besides the production reactors, the Hanford site also contained vast chemical equipment for separating the plutonium from the slugs of uranium irradiated within the reactors. The first of the production reactors achieved criticality on September 27, 1944.

Although these three operations suffered many disappointments and frustrations, there was little doubt that some fissionable material could be produced eventually (although there was concern until late 1944 as to whether enough material for a weapon could be processed before the end of the war). To insure that a weapon design would be ready, the MED established a top secret laboratory high in the mountains of northern New Mexico in early 1943. Robert Oppenheimer, the first director of the laboratory, began the difficult task of recruiting scientists to work at Los Alamos, as the area was called. During the laboratory's initial construction there was some concern over whether its operation was to be civilian or military. It was eventually decided

to have a civilian staff with military support. There was occasionally friction over this, as there was trouble over the scientists' refusal to follow the policy of compartmentalization established by Gen. Groves. However the laboratory overcame these difficulties to proceed with the design of the weapon itself.

Throughout 1944 the atomic weapon program gained momentum although barrier problems continued to plague K-25 while Y-12 was unable to achieve sustained production. The production reactors at Hanford suffered from xenon poisoning, and thus the early production of plutonium was also limited. Meanwhile At Los Alamos two weapon designs were being considered. The plutonium weapon would use conventional explosives to implode the fissionable material into supercritical shape, while the uranium weapon would use a gun to blast one projectile of U-235 into another U-235 mass used as a target. Both methods looked feasible, and the development of an operational weapon before the end of the war looked more and more probable.

With the successful test of an implosion device near Alamogordo, N.M. on July 16, 1945, the tremendous program begun four years earlier (had) achieved its goal. The destructive power of the weapon was much greater than anyone had anticipated. The world of nuclear war had arrived. But even before the Trinity Test, people were looking forward, past the war to the years of peace. Questions were being raised concerning the use of the weapon--in fact whether it might not be better to avoid using it at all.

POSTWAR ALTERNATIVES

The implications of the atomic weapon program were apparent to Bush and Conant quite early. No one could foresee what the consequences of nuclear power would be to the postwar world. For this reason Bush had resisted all policies which might influence the future of the atomic program as the results of wartime decisions alone. Not only the weapon, but the entire program would require extraordinary measures of control during the ensuing years. Other The

scientists joined Bush and Conant in their concern for the control of the program after the war. The Jeffries and Tolman reports[4] authorized by the Military Policy Committee strengthened this concern. There were the international questions of security, collaboration with the rest of the world, and eventual world control of the weapon to be considered. Yet the scientific community became more and more frustrated as they felt that "statesmen who did not realize the atom had changed the world were laying futile plans for peace while scientists who knew the facts stood helplessly by".[5]

Secretary of War Stimson alerted the president to the growing concern over the postwar control issue. An Interim Committee was authorized on May 4, 1944 to explore the issues and begin postwar planning. Although it was immediately apparent that international control would be a serious problem, both foreign and domestic atomic energy programs were proposed and investigated.

First proposals stressed the scientists' concern for freedom of research, the possibility of a combine of democratic power for control of the weapon, and most importantly, an understanding with the Soviet Union. The committee appointed Deputy Chairman George L. Harrison to work on the domestic proposals. At the same time Arthur Compton and the scientists continued working on their own ideas. A Scientific Panel expressed some of these views to the Interim Committee. Oppenheimer saw the primary need for an extremely broad program so as to blanket any future developments in the field. An extension of the MED seemed advisable for a time, although Compton felt it was necessary to begin preparations to replace it.

The concern over the use of the weapon brought out other ideas which related to the philosophies of postwar control. Many felt that since the

future of the world would rest on international control of the weapon, any attempt to use the weapon directly against Japan could only jeopardize post-war cooperation. They felt that military tacticians alone should not be responsible for the decision to use the weapon, and that even from the isolated viewpoint of winning the war itself, bombing Japan was undesirable. However these questions were weighed against the military questions involved, and the decision to use the weapon directly against the enemy was made. Szilard made one last try to alter this decision with a petition from the scientists, but to no avail.[6] The 509th Composite Wing was ordered to attack Japan with the weapon on the earliest possible date.

On August 6, 1945 the weapon destroyed Hiroshima and shortly after Nagasaki. The Japanese surrender followed three days later. Other than brief comments by the President and Secretary Stimson, the first public release of information concerning the MED appeared in the Smyth report, a semi-scientific account of much of the previous four years prepared by Henry Smyth at the request of the president. One of the keys to the issue of postwar control was stated in the preface of the report: "the ultimate responsibility rests with the citizens of the United States. The people of the country must be informed if they are to discharge their responsibilities wisely."[7] They alone had to decide on the future of the weapon and on the role it would play in the postwar world.

DOMESTIC LEGISLATION

The pressure had been on the Interrim Committee to study postwar domestic control long before Japan had surrendered. Bush and Conant had suggested that a 12-man commission composed of scientists and military officers be established[8]. The need for comprehensive federal control was

stressed since even relatively small-scale nuclear experiments were extremely dangerous. They urged the Interim Committee to continue the study of international control since any attempt to formulate domestic policies had to be compatible with international plans.

Harrison had been hard at work however. He had appointed Kenneth C. Royall and William L. Marbury, lawyers with the War Department, to draw up a preliminary draft for a 9-man part-time commission to be assisted in its work by various advisory committees. It would be granted sweeping powers Bush, Conant, and Oppenheimer had considered so vital, and most activities outside of the commission's control had been prohibited. The commission would also receive the benefits of political isolation. However members of the Interim Committee noticed faults with the plan. There was a worry about restriction and over-control of research. The plan bore many similarities to a wartime operation--an extension of the Military Policy Committee itself[9]. Before the Interim Committee could agree on revisions however, the weapon was dropped on Hiroshima and the wartime program became a public issue.

Royall and Marbury were quick to get the State Department to agree to help sponsor the proposals. But as the War Department worked to get their bill presented, forces were beginning to swell within the MED itself to counter the effort. Scientists had become more and more irritated at the failure of the Army to consult them on their own ideas. The continued security regulations after V-J day only served to compound this frustration. Groves asked the scientists to confine their discussion to private circles in order not to jeopardize the War Department's proposals. The scientists felt no inclination to comply however, since they didn't even know what these proposals were[10]. The first of the movements towards organizations

(to express) scientific opinion began with the foundation of the Atomic Scientists of Chicago in September, 1945.

The Marbury-Royall proposal gained momentum within the War Department as Robert Patterson took over from Secretary Stimson. An initial statement by Herbert Marks of the State Department suggested that the administration was backing the Stimson international control proposal and the Royall-Marbury domestic plan. Sen. Edwin Johnson and Rep. Andrew May agreed to introduce the domestic bill in their respective houses, hoping to get the measure referred to the Military Affairs Committees. Although May succeeded, Johnson's attempt in the Senate was blocked by Sen. Vandenberg on October 4 and was eventually referred to a special committee under Sen. Brien McMahon of Connecticut. Later the House committee got bogged down over the proposal when several members objected to the proposed commission's exemption from congressional influence. Thus Patterson's hope for quick action had been dimmed before the measure had gotten off the ground. The bill was hopelessly ensnarled in congressional committee.

The scientists were alarmed by the May-Johnson bill and kept a steady stream of public opposition directed towards it. The Army was charged with attempting to ram the bill through Congress. Patterson, on the other hand, blamed the scientists for thwarting the bill's passage, but the real barriers lay much deeper within the changing American attitude towards the military after the war. Years of rationing and regulation had created a suspicion of the intentions of the armed services which would have blocked any proposal for atomic legislation initiated within the War Department.[11]

With the May-Johnson bill entangled in Congress, forces within the administration went to work. James R. Newman of the Office of War Mobilization and Recovery realized that the struggle in Congress represented the first attempt to incorporate an incredibly dangerous and mysterious force into

the life of the nation.[12] The May-Johnson bill had overemphasized the military aspects of atomic power. The peacetime uses of the atom deserved much more consideration than they had received. They would require that the commission be composed of men with varied backgrounds. It was also desirable to have a full-time commission appointed by the President, thus putting atomic control under the executive branch of the government. The President as well as other sources within the administration felt as Newman did, and on October 23, 1945 Truman officially withdrew his support from the May-Johnson bill.[13]

In the meantime the May committee had adjourned with only a majority report. The Senate Special Committee on Atomic Energy, proposed and chairmaned by Sen. McMahon, seemed like the ideal place to introduce the administration's ideas. Newman, was part of the OWMR, began work with Byron S. Miller on a new draft while McMahon began the critical task of educating his committee in the matter over which they were considering legislation.

The draft prepared by Newman and Miller proposed a commission of nine appointed by the president with a full range of powers.[14] The commission would have the responsibility and power to encourage and support atomic research, but not to control it. To limit control over research and yet insure adequate power over production, the commission was given control over all production and use of "fissional materials". This also limited its powers to impose and enforce security regulations which had worried scientists. Contracts and licensing became the methods of controlling private activities within the security area.

Attacks were organized against the May-Johnson bill concentrating on the vaguely defined powers and congressional independence of its proposed commission. The scientists continued to develop national lobbies[15] and put

their power behind Newman and McMahon. The showdown was quick in coming.

McMahon requested that his committee have access to classified information. Groves refused. Although Truman eventually backed Groves in his decision, McMahon became infuriated. Newman now shifted to demanding complete military exclusion from the commission. In its testimony before the McMahon committee, the military countered with an attack upon the qualifications of full-time commissioners, the advisibility of excluding the military in the light of national security, and the absolute monopoly on fissionable materials recommended by the McMahon proposal. However public sentiment was against the military as evidenced by reaction to an incident where captured Japanese cyclotrons were destroyed.[16] McMahon and Newman continued to work on their proposal, and on December 20 McMahon introduced their result as S.1717. This was similar in content to the earlier Newman-Miller drafts and proposed that a commission of five be appointed by the president with advisory committees in the areas of research, production, materials, and military application.[17] The scientists were quite pleased with this bill, particularly since it seemed compatible with their proposals for international control.

The battle lines over S.1717 seemed quite clear--at least on the surface. The newspapers exploited the civilian vs. military issue warning of the danger of military control. Much of the bitterness voiced by the scientists was directed personally against Groves who seemed to embody all of the restrictions that had annoyed them so much during the war years. Supporters of the McMahon bill saw opportunities to use the issue to direct public sentiment behind their measure.[18] They stressed civilian supremacy as a first principle of American government. With the administration falling in behind the measure and Henry Wallace joining in the fire directed at the military, McMahon seemed to have attained the desired public support for his bill.

Yet the same theatrics concerning the civilian-military controversy that had attracted public support on the outside, tended to turn the conservative members of McMahon's committee against him. The idea of complete military exclusion seemed ridiculous. There was additional concern over the approach to patents and security. Although the committee proved receptive to the ideas of such a monopoly of fissionable materials in a free enterprise system because they anticipated the spectacular innovations atomic energy could bring, they were stubborn on the civilian-military issue.[19]

Patterson presented the War Department's criticisms of S.1717 in a report to Truman. Although this was suppressed within the administration, Patterson skillfully used Truman's own interpretations of the proposal to swing the tide against McMahon during his testimony on February 14, 1946. The Army position gained back public sentiment with the Ottawa spy affair.[20] People even began to see an argument for retaining Groves' security system, and eventually the general was invited to speak before McMahon's committee. Although McMahon badgered Groves, he only succeeded in turning more of the committee against himself. Military exclusion was doomed. National security demanded military participation, and all of the pressure McMahon and the scientists brought against the committee was in vain.

Vandenberg introduced an amendment establishing a military liason board to review commission activities and with a right of appeal to the president.[21] McMahon tried to defeat this, but after heavy failure decided to seek a compromise. The Vandenberg Amendment was passed, although the military board was limited to review of military matters and appeal only to the Secretaries of War and State. Although the scientists continued to protest, many thought that the military issue had just served as a scapegoat.[22] The amended bill was introduced and passed unanimously in the Senate on June 1, 1946.

The bill ran into difficulty in the House, as many on the Military

Affairs Committee were against any governmental control. Some amendments proposed suggested complete military control. Men like Rep. Thomas caused a great deal of sensationalism,[23] but it turned out that the military-civilian issue was only a minor theme. Although the House proceeded to cripple the Senate's bill with amendments[24], it was eventually passed and referred back to a special inter-house committee.

In committee both Houses agreed to compromise. An amendment on international exchange of information was tempered to allow industrial information exchange while the Senate version of the patent policy (using an "exclusion" clause on restricted discoveries) was accepted. The Vandenberg Amendment was also agreed upon with the final commission being civilian with the military liason board acting as advisors. The bill was finally sent to the president and signed into law on August 1, 1946.

With the enactment of the McMahon bill and the appointment of the first commissioners, a new era in the domestic control of the atomic energy program had dawned. But before actual transfer from the MED to the Atomic Energy Commission could occur, many preparations and decisions were necessary. The MED was instructed to continue its supervision of the program in the meantime until such a transfer could be effected. Yet since the end of the war, Groves had been struggling to keep the wartime machinery intact during the struggle over domestic legislation.

Production had settled into a routine with more and more material being prepared at Oak Ridge and Hanford. However trouble had developed at the strategic research centers in Chicago and Los Alamos. The scientists were leaving for better positions now that they felt their duty had been completed. The production and design of weapons had slowed to almost a standstill. Groves realized that definite plans had to be made quickly to save the program even though these might result in commitments severely restricting the future commission.[25] Although the production complex retained top priority, improvements

were sorely needed at Los Alamos. Groves appointed a new director of the laboratory and authorized work on "super", the thermonuclear weapon. Both housing and research facilities were also improved on a much more permanent basis.[26] Groves made commitments to the expansion of research with new laboratories at Brookhaven, L.I., Argonne, and a proposed laboratory in nothern California. By October, 1946 although the MED had suffered, it was apparent that Groves had done remarkably well in preserving the wartime machinery.

TRANSFER

We have seen the sweeping powers that were granted to the directors of the atomic energy program both during and after the war. It is evident that the personalities and philosophies of these men would have their reflection in the policies pursued in the program. Perhaps one of the most appropriate methods of analyzing the transition between military and civilian control would be a comparison of the ideas and outlooks of the men that directed the atomic program during these crucial times. In Gen. Leslie Groves and David Lilienthal we have embodied most of the contrast and most of the change that took place in the months of transition from the Manhattan Engineering District to the Atomic Energy Commission.

The success of the wartime program bespeaks the effectiveness of Groves' leadership. His form of rigid military discipline had worked well during the war years. He himself attributed the success and efficiency of the MED to compartmentalization, the clear-cut direction of authority, and the benefit of a clearly defined specific objective and a specific task.[27] The MED had become an extremely powerful and efficient machine by mid 1945. Yet we have seen the problems Groves ran into following the war while Congress battled over domestic atomic legislation. Groves' attitude concerning the question of legislation hinged on his feelings that any bill would be an interim measure at best because of the nature of the subject. He felt it was necessary

to have a bill passed as soon as possible, and the May-Johnson proposal embodied most of what he saw as immediately necessary.[28] The situation in which Groves found himself and the MED in 1945-1946 prompted his support of the War Department measure.

It was particularly fortunate that the first civilian chairman of the AEC had strength and purpose similar in intensity to that of Gen. Groves. David Lilienthal had been well-versed in the control of mammoth federal enterprises during his years as director of the TVA. His service as chairman of the Acheson advisory panel on atomic energy had equipped him with much of the necessary knowledge and insight into the program. Probably no other person in the country was more aptly prepared to take over the reins from Groves and effect the transition from military to civilian control.

And yet perhaps because of his indirect relationship to the problems faced by Groves, Lilienthal developed a broader perspective of the future role of the commission. One can see his TVA heritage in his early thoughts on control: "Industry will try to get control and at first will be successful. But as it goes on, it will be clear that no such control over the destinies of us all can be left in the hands of private corporations."[29] He also saw that the Army's bill was definitely not the answer. Since the first time that he had heard the incredible story of the MED, he had realized that the director of the atomic energy program was probably to be one of the most powerful men in the world. He recognized the extremely important consequences of the peaceful uses of atomic power, the silver lining in the nuclear cloud. Perhaps most important, however, was his belief that "Atomic energy development is more important as a stimulus to the imagination, an awakening force, than are any of its foreseeable applications."[30]

Both Groves and Lilienthal were extremely dedicated and dynamic men. Yet many of their ideas on methods of domestic control were incompatible. It was only natural that conflict would develop during the transition period between the MED and the AEC.

With nothing but press support and an excellent array of commissioners, the AEC began the preparations for transfer late in 1946. At the first meeting of the commission on October 29, Lilienthal expressed his feelings, "The last words of the oath of office which each of us has taken are these, 'So help me God'. These words were never more appropriately used. So help us God. We will need that help."[31] After a brief period of initial orientation, the commission began planning for transfer from the MED. Both Lilienthall and President Truman realized that it was very important to get the whole business in civilian hands quickly to quiet the fears stirred up during the congressional battle over legislation. Lilienthal felt that the "only way to learn to swim is to get wet", and thus the commission set transfer for December 31, 1946 and requested Groves to prepare an accounting of the MED's holdings.[32] Groves indicated that such an accounting would be impossible. He became more and more irritated at the idea of holding responsibility while carrying out the decisions of the commission, feeling like a caretaker with no authority to make decisions of his own. On the other hand, Lilienthal was convinced that Groves was still trying to run things.

Conflict between the MED and the AEC came to a climax when Groves raised the issue of weapon custody. The Army wished to retain its weapon stockpile and assembly facilities. After initial discussion, the AEC finally demanded complete transfer, subject to presidental order. Other disagreements occurred over the issues of personnel security and information control. The AEC desired a complete break with the MED and worked vigorously to this end.[33]

Yet on the night of December 31, 1946 transfer occurred smoothly and on schedule. The AEC had inherited "a carefully conceived, well-organized system". The new era in domestic control had dawned without event.

But even with transfer completed, the battle over domestic control was far from over. The AEC had created many enemies during her formation, and these enemies were to continue to harass her and block her actions in every possible way. By early February Lilienthal was discouraged and weary, fearing that the military would continue to cut the ground from the commission while continually criticizing and condemning them. With the mood of the American people approaching that which had existed shortly after World War I, the danger of a "Red Scare" concerning the AEC became even more menacing.

The flames of this unrest were fanned by Lilienthal's personal enemies in the Senate as the committee concerned with the confirmation of the commissioners' appointments was beginning its hearings. The attack was led by Lilienthal's old enemy, Sen. McKeller, who began a personal vendetta against him. There was a great worry that the attack would cause national hysteria, concentrating as it did on "Red" hunting. Truman realized the difficult and outrageous situation developing in the Senate, but hoped for an early agreement. Finally after many torturous meetings, the more responsible members in the Senate took charge and pushed the confirmations through. As Sen. Vandenberg put it, he had no wish to be part of a "lynching bee".[34]

This victory was not in any sense final however. The essence of the struggle was to continue through the first years of the commission. Problems came from other quarters as well. The difficulties of recruiting qualified personnel for the commission's operation was extreme because of the pay and working conditions. Many of the AEC's activities as prescribed by law were incompatible with hopes for international control. Lilienthal saw the irony

in this situation when he wrote "It was our purpose to maintain and increase the lead of the United States, whereas the international agency, if established, would take over all aspects of national agencies' activities in this field that related to weapons."[35]

But the outstanding problem faced by the fledgling commission was that of the temper of the country itself. Lilienthal recognized the vital importance of public awareness. The image presented by the AEC to the people of the country would determine much of its success in the future. As Henry Smyth had noted in his report, the public had to be informed if it were to act wisely in future issues of atomic control. And fears could only be quieted by knowledge.

CONCLUSION

The early development of the United States atomic energy program can be divided into several stages. After the groping and relatively uncoordinated efforts of early experimenters, the erratic growth of the program was guided by the efforts of the S-1 committee and the OSRD. A new stage of development appeared as the program mushroomed into the monolithic wartime machinery of the Manhattan Engineering District. Following the war there was a period of confusion during congressional legislation, and finally the transition in control from the MED to the fledgling Atomic Energy Commission. It is most appropriate, therefore, to concern final comments with each of these stages in turn.

The development of the program during the early years of exploratory research and eventually its growth under the S-1 committee was haphazard at times. Considering the doubts looming over most of the program however, even this progress was remarkable. We must conclude that although the early pace was slow, no other approach to early development would have been reasonable under the circumstances.

The program matured under the direction of the military during the war years. To make any critical evaluation of these years, it is imperative that we consider the situation. America was involved in a wartime struggle for her life. The most expedient path to the weapon was sought, and to achieve the goal, military control seemed, and proved later, to be the best route.

The preponderance of this military control rested with one man. It has been said that if a man is effective in his chosen task, then he must have a sense of the major problems of his time. This would apply to Gen. Leslie Groves. His leadership, authority, and understanding of the situation, along with the goal of the weapon itself, led to the success of the wartime program. In light of these considerations, one must evaluate the years of the Manhattan District as a tribute to the technical and industrial might of the United States and to the leadership of Leslie Groves.

Yet it was obvious that the same policy of control that had worked so magnificantly during the war years would be dangerous and undesirable in the years that followed. The nation had now to insure that the future control of the program would remain with the people. The early Interim Committee recognized this, as did many of those involved in the legislative battle that raged over the issues of postwar control. Yet it almost would seem that we would have to raise the question posed by Rep. Jerry Voorhis on the final day of House debate over the McMahon proposal when he suggested that "one year after the first atomic explosion Congress did not understand the general issues well enough to legislate".[36] There was a lack of apprehension concerning the gravity of the issues. There was also very definitely a lack of the facts--though many times inspite of efforts of congressmen to become informed. The American process of legislation seems to contain much that is irrevelant to the matter at hand, and appears to skirt the issues under consideration at times. Yet one cannot deny its effectiveness. The final piece of legislation

although very much a compromised proposal, was realistic in light of the times, and proved to be more successful that its early critics would have ever anticipated.

The new body of control, the Atomic Energy Commission, was the first attempt at a new type of civilian control bordering on totalitarianism. It was only natural that it would experience many failures. The problems it faced were tremendous in scope, ranging from the internal problems of recruiting qualified personnel to combating the suspicions of the American people themselves. Although the AEC had the advantage of competent leaders, its future was still very much a questionmark in 1947.

Perhaps if there is any one thread that can pull the history of domestic atomic control together, it would be suggested in an idea of David Lilienthal's. To Lilienthal the entire issue of domestic control of science had the earmarks of earlier struggles over economic and social control such as the Populist and Progressive movements. However "perhaps even the question of who shall 'control' science is no longer greatly relevant as the center of a struggle, for the control before was a matter of possession. But technology can only be controlled by those who know, rather than by those who possess."[37] Henry Smyth had agreed that the key to civilian control was knowledge. Yet it was paradoxical that the nature of the early program itself prevented the public from attaining the state of knowledge necessary to "discharge their responsibilities wisely".[38]

FOOTNOTES

1. Richard G. Hewlett and Oscar E. Anderson, Jr., The New World, 1939/1946 (University Park, Penn.: The Pennsylvania State University Press, 1962) p. 714

2. Ibid., p. 71

3. Ibid., p. 115

4. Ibid., pp. 324-325

5. Ibid., p. 342

6. Ibid., pp. 399-400

7. Henry Smyth, A General Account of the Development of Methods of Using Atomic Energy for Military Purposes under the Auspices of the United States Government, 1940-45 (Washington, 1945) p. 165

8. Hewlett, op. cit., p. 409

9. Ibid., p. 414

10. Ibid., p. 422

11. Ibid., p. 435

12. Ibid., pp. 435-436

13. Harry S. Truman, Memoirs (Garden City, N.J.: Doubleday & Co., Inc., 1956) Vol. II, p. 594

14. Hewlett, op. cit., p. 441

15. Such as the Federation of American Scientists, the Federation of Atomic Scientists, and the National Committee on Atomic Information

16. This was an incident where American troops in occupied Japan destroyed several cyclotrons confiscated from Japanese universities. Although the order to destroy the instruments originated with Groves, he afterwards maintained that his instructions had been misunderstood. He remarked at this time that a "commander must always make his intentions clear to his subordinates". Leslie R. Groves, Now It Can Be Told: The Story of the Manhattan Project (New York, 1962)

17. Hewlett, op. cit., p. 483

18. Ibid., p. 487

19. The Private Papers of Senator Vandenberg, edited by Arthur H. Vandenberg, Jr. (Boston; Houghton Mifflin Co., 1952) p. 252

20. Hewlett, op. cit., p. 501

21. Vandenberg, op. cit., p. 254

22. Hewlett, op. cit., p. 525

23. Ibid., p. 522

24. Such as the Harness amendment curtailing the exchange of information between nations which almost destroyed the scientists' hopes for international agreement over control issues.

25. Hewlett, op. cit., p. 628

26. The First Twenty Years at Los Alamos, (Los Alamos, N.M.: LASL Office of Public Relations, 1963) p. 32

27. Groves, op. cit., p. 414

28. Ibid., p. 391

29. The Journals of David E. Lilienthal, Vol. II "The Atomic Energy Years, 1945-50" (New York: Harper and Row, 1964) p. 2

30. Ibid., p. 160

31. Ibid., p. 105

32. Ibid., p. 116

33. Ibid., p. 122

34. Ibid., p. 166

35. Ibid., p. 210

36. Hewlett, op. cit., p. 528

37. Lilienthal, op. cit., p. 67

38. Smyth, op. cit., p. 165

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The most comprehensive presentation of the early history of the atomic energy program is found in Hewlett and Anderson's The New World. This volume was sponsored by the Atomic Energy Commission in an effort to provide an integrated record of its historical development. For this reason much of my historical information has been derived from this work, as attested to by the number of my footnotes referring to it. Since history is made by men however, I realized the necessity of exploring the personal side of many of the historical events concerning the development of domestic control policies. For this reason I attempted to draw from various works by men who were directly involved with the development of the program (Groves, Lilienthal, Truman, etc.). These and other sources are listed below.

Groves, Leslie R., Now It Can Be Told: The Story of the Manhattan Project (New York, 1962)

Hewlett, Richard G., and Oscar E. Anderson, Jr., The New World, 1939/1946 (University Park, Penn.: The Pennsylvania University Press, 1962)

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occurred in 1948 over the renewal of the terms of the first commissioners. In May, 1949 Sen. Hickenlooper accused the AEC of "incredible mismanagement" and stirred up the many house members that continued to favor military control. These repeated attacks provoked Lilienthal to comment that the AEC had a wealth of advisors and watchdogs--but what they really needed were able men.[28]

Yet Congressional influence was very definitely limited. "It is difficult for a legislative body to compel an independent commission to push through vigorously a program which the commission does not like" noted Commissioner Thomas Murray.[29] And nonpolitical policy decisions could only be insured by an independent commission.

One of the principal duties of the AEC was to direct the United States' nuclear weapons program. A close relationship with the military was necessary, yet we have seen the antagonism between these two groups on matters of weapon custody and policy. In the early days of the Commission, the principal link between them, the MLC, served only as a watchful eye over AEC activities. The only channel of communication was unilateral and indirect. The Joint Chiefs would submit their requests to the President who would then forward them to the Commission. The AEC was in a position of tacitly accepting the requirements presented to it and was unable to question the assumptions behind these requirements since it frequently didn't even know them.[30] The problem concerning the relationship between the AEC and the military--indeed between the civilian sector in general and the military--lay in the lack of an effective channel of communication with the Joint Chiefs which could inject the civilian point of view before any of their decisions on military policy had crystallized. The "main problem.....is the lack of real cooperation--under the present system--between the military and civilian authorities of the government in national

defense policy".[31] This situation was modified in 1949. President Truman, under advice from the National Security Council, initiated a new measure of civilian participation with the decision to include executive staff work involving the Secretary of State, the Bureau of the Budget, and the AEC on any future proposals concerning atomic demands from the Joint Chiefs before these were sent on to the Commission for execution. The decision to expand AEC production facilities in August of 1949 felt the influence of this new cooperation. Later in 1953 the Eisenhower administration adopted a policy enabling the AEC chairman to inject opinion through the NSC during atomic weapon policy discussions. These steps were indicative of the growing recognition that cooperation between civilian and military agencies was vital to national security in the postwar years.

The General Advisory Committee provided a necessary link between scientists and the Commission. Composed of many of the nation's top scientists, the GAC was responsible for advising on both technical matters and policies within the field of atomic energy. Its influence over policy decisions was clearly illustrated in the discussion preceding the thermonuclear program. Many felt that it was only proper that the scientists who had given the atom to man should retain some influence over decisions concerning its use.

The scientific community used other methods to influence the Commission. Organizations such as the Federation of Atomic Scientists and the National Committee on Atomic Information were strong forces in motivating public and congressional opinion. The participation of scientists in policy formulation had originated during the war years, and as technology and scientific development continued to play a dominant role

after the war, so too did the nation's scientists continue to become involved in the formation of policies affecting national security. The growing number of advisory panels and committees was evidence of this trend. And the GAC was one of the strongest and most important of these groups during the late 1940's and 1950's.

The relationship between the AEC and the public was of major importance to an effective system of democratic control of the atom. It is unfortunate that this link has always remained the weakest and most indirect. As Chairman Dean remarked, "The participation of every citizen in policy-making has always been important in our democracy, in a world that contains the unleased atom it is vital."[32]

The shroud of secrecy surrounding the American atomic energy program tended to leave the public uninformed on the very matters of policy on which their opinion was so necessary. There were numerous instances during which the people responsible for decisions were denied access to information influencing these decisions. From the early days of 1946 when Congressmen struggled to enact legislation concerning a subject to which only a handful of them had been exposed, to situations in the late 1950's when much information was available but unpublicized, the inadequacy of the knowledge upon which to base public opinion has been apparent. It has only been during the past few years that we have begun to accomplish the true institution of the atomic program into our democratic process.

CONCLUSION

The history of the Commission from its birth in 1947 to the 1960's was the story of change--both in the mechanisms used by the AEC to control the nuclear program and in the philosophy and extent of this control. As the shock of Hiroshima began to fade, the motivation behind demands for

stringent and absolute government control became less fervent. Steps such as the Atomic Energy Act of 1954 began to allow gradual private entrance into the field. Similarly the strong feelings about the civilian vs. military control issue began to subside, although flaring up on occasions during the late 1940's. An atmosphere conducive to cooperation between the AEC and the military came into being during the early 1950's--partly necessitated by the evolution of nuclear weapons and partly by the realization that this cooperation was vital to our national security.

Thus the American atomic program had spread out to encompass much of our society by 1960. The AEC had been successful in fulfilling most of its military and peaceful objectives. Yet many questions remained which were to challenge the American approach to atomic control during the 1960's.

FOOTNOTES

1. Gordon Dean, Report on the Atom (New York: Alfred A. Knopf, 1957) p. 24

2. The Journals of David E. Lilienthal, Vol. II "The Atomic Energy Years, 1945-50" (New York: Harper and Row, 1964) p. 297

3. Ibid., p. 252

4. Dean, op. cit., p. 137

5. Lilienthal, op. cit., p. 509

6. Ibid., p. 510

7. Ibid., p. 377

8. Ibid., p. 391

9. Dean, op. cit., p. 12

10. Lilienthal, op. cit., p. 505

11. James R. Shepley and Clay Blair, Jr., The Hydrogen Bomb (New York: David McKay Co., Inc., 1954) p. 48

12. Ibid., p. 74

13. It was discovered that Klaus Fuchs, a member of the British scientific team at Los Alamos during the war years, had been passing atomic secrets to the Russians.

14. Annual Report to Congress of the Atomic Energy Commission for 1960 (Washington: U.S. Government Printing Office, 1961) pp. xiii-xiv

14. Dean, op. cit., p. 11

15. Ibid., p. 111

16. Lilienthal, op. cit., p. 207

17. Ibid,, p. 241

18. Lewis L. Strauss, Men and Decisions (Garden City, N.J.: Doubleday and Co., Inc., 1962)

19. Dean, op. cit., p. 237

20. Atoms for Power: United States Policy in Atomic Energy Development (New York: The American Assembly, Columbia University, 1957) p. 46

21. Ibid., p. 61

23. Lilienthal, op. cit., p. 208

24. Ibid., p. 360

25. Richard G. Hewlett and Oscar E. Anderson, Jr., The New World, 1939/1946 (University Park, Penn.: The Pennsylvania State University Press, 1962) p. 715

26. Dean, op. cit., p. 321

27. Lilienthal, op. cit., p. 225

28. Ibid., p. 354

29. Thomas E. Murray, Nuclear Policy for War and Peace (New York: The World Publishing Co, 1960) p. 201

30. Strauss, op. cit., p. 407

31. Dean, op. cit.

32. Ibid., p. 321

33. John E. Hodgetts, Adminstering the Atomfor Peace (New York: Atherton Press, 1964) p. 31

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"THE DOMESTIC CONTROL OF THE UNITED STATES ATOMIC ENERGY PROGRAM"

Part II: 1947-1960

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INTRODUCTION

In the years following World War II America faced the complicated task of converting her wartime atomic weapons program into comprehensive peacetime activities directed toward general atomic energy development. This development was to be concentrated in three areas: weapons, power, and scientific tools. The Atomic Energy Act of 1946 created the Atomic Energy Commission to design and administer the peacetime program. This act not only bestowed enormous powers upon the Commission, but in addition directed the AEC to use these powers to continue the wartime monopoly of fissionable materials and production facilities. And although the Act had created ties between the AEC and Congress through the Joint Committee on Atomic Energy (JCAE), the military through the Military Liason Committee (MLC), and the executive branch through a system of presidential appointment of commissioners coupled with other specific powers, the civilian Commission operated in fact as a relatively autonomous entity in its formulation and direction of atomic policy matters within this country. Since "in essence, the [American] approach to the postwar atom was one of rigid government control administered by civilian officials"[1], one needs to concentrate primarily upon the development of the Commission itself to follow the postwar development of domestic administration and control of atomic energy.

The problems of transition to a peacetime program were particularly complicated by the dual role which atomic energy had to play in the American society. Men had long recognized the importance of developing the peaceful side of the atom even though such development was closely related to weapon technology. But because of the continuing threat of war after 1946, there were many questions concerning the relative importance

of the benign applications of atomic energy. Chairman David Lilienthal had stated that "every new knowledge raises a question of its net worth; in the case of atomic energy we have such a huge addition to knowledge of our environment, such an increase in our control over it, and chief of all, such a stimulus to more understanding, that the balance of the useful or beneficial will almost certainly outweigh the nonbeneficial or destructive."[2] But in those early years after the war he was forced to admit that the most important single aspect would have to remain the military program. The dominating role of weapon development in our atomic energy program has never changed. The threat of nuclear war has never vanished--and the peaceful uses of the atom have never become the "paramount objective" of our domestic atomic energy program.

Secondary though it was however, the program to develop the peaceful aspects of the atom grew to a position of considerable importance affecting our national development and security. In tracing the development of control over the American atomic energy program, it is necessary to include a study of peace-oriented atomic developments.

In the discussion that follows,these two major phases of the work of the AEC, weapon production and peaceful atomic energy development, will be traced from 1947 to 1960. Since this paper is not intended to be an historical documentation, more care will be taken to illustrate the developing aspects of policy formulation and control over the program by reference to specific events than to provide a detailed historical account. The remainder of the paper will then treat the development of the administrative structure of the Commission as well as its relationship with other sectors of the government and American society in general.

WEAPON DEVELOPMENT

The prime responsibility of the AEC during its early years was to maintain and improve the vast weapon development facilities inherited from the Manhattan Engineering District. Of central importance to the success of the AEC in this venture was its relationship with the military. The nature of this relationship was the subject of much controversy during the late 1940's and early 1950's. To better understand the role played today by the Commission in our national security, it is important that we examine the questions that arose during these years.

The civilian vs. military control issue had received much attention during the Congressional struggle over the McMahon bill. Yet it soon became apparent that most of this debate was not concerned with who should run the program--it was generally felt that civilian control was desirable--but rather the extent of military participation in the formulation of nuclear policy and weapon development. The Vandenberg Amendment had established the Military Liason Committee to provide for communication between the military and the AEC. The intent was that the Joint Chiefs of Staff would determine their military needs, communicate these to the President, and then he in turn would issue a directive to the Commission specifying the number and types of weapons desired. All details concerned with the actual development, production, and custody of nuclear weapons were to remain under the jurisdiction of the AEC, subject to special Presidential order.

There were several factors working against such an arrangement however. Many Americans realized that because of the volatile nature of world politics following the war, we would never again be able to retreat into the isolationism of the 1920's and 1930's. The necessity of a military establish-

ment capable of rapid mobilization became apparent. Thus the military came to achieve a position of prominence it had never before held in (the) peacetime American society. Its increased participation in all matters of national policy was unlike any ever before experienced by an American government in times of peace. Thus it is easy to see why the military came to question its role of responsibility without authority in its relationship with the AEC. The military had directed the atomic program in the years of the Manhattan District, and yet in the late 1940's they had been forced to relinquish most of their control over atomic development and policy decisions.

Men such as General Leslie Groves did little to ease the situation. On several occasions the commissioners found themselves at odds with the former director of the MED. Groves retained his influence with the atomic energy program through positions on the MLC and the Armed Forces Special Weapons Project. He frequently opposed the decisions made by the AEC and seemed to be of the honest opinion that the Commission was "no damn good".[3] The antagonism between the General and the Commission was symptomatic of the tension between the military and the AEC in 1947 and 1948.

The military seemed unable to remain within the limits of its authority as prescribed by the Atomic Energy Act of 1946. "Too frequently the military was suggesting not simply WHAT the AEC should do, but also HOW it should be done."[4] This was resisted vigorously by the Commission since it had become clear that the AEC could best conduct its production duties without military interference. Lilienthal had long felt that the military conception of the bomb was also at fault. To them it seemed like just another weapon. Secretary of Defense Louis Johnson and others seemed to regard the Commission

as simply "munition makers".[5]

When the issue of weapon custody flared up again in 1948, many of the issues and problems surrounding the AEC-military relationship were revealed. The military had been pressing for custody of the weapon since the end of the war. This wasn't an easy question to resolve. Many felt the important issue of civilian control was involved. Indeed it seemed as if perhaps the more general issue of civilian participation in any military policy had been involved by statements from Secretary Johnson such as "A unanimous military judgment of the Joint Chiefs is something the President HAS to follow."[6] Thus even the nature of the President's role in military decisions was in need of clarification. A statement by President Truman in July, 1948 upheld the intention of the McMahon Act: "As long as I am in the White House I will be opposed to taking atomic weapons away from the hands they are now in [AEC], and they will be delivered to the military by particular order of the President issued at the time when they are needed."[7]

The debate continued however, and eventually reached a climax at a meeting between the military, the AEC, and the President on July 21, 1948. The most interesting (and amusing) account of this meeting is given by Lilienthal himself. During the discussion he had emphasized the risk involved in any change in the current system of custody. President Truman remarked "You have to understand that the bomb isn't a military weapon." It was a weapon to be directed against civilian personnel, not troops. However Secretary of the Air Force Symington appealed, "Our fellas need to get used to handling it.....Yea, our fellas, they let them take out bombs without the hot stuff; afraid of a real bomb I guess." Secretary

of the Army Royall topped off the argument for military custody with "We have been spending 98% of all money for atomic energy on weapons. Now if we aren't going to use them, that doesn't make any sense".[8]

President Truman later issued a public statement: "Since a free society places the civilian authority above the military power, the control of atomic energy properly belongs in civilian hands".

However in 1950 the Department of Defense and the AEC agreed to assign prominent roles in the design of non-nuclear weapon components to the military. As the size and character of the weapon stockpile continued to change, it became necessary to re-evaluate the custody issue again in 1952. As weapon development branched out to include tactical weapons, it became desirable to locate stockpiles closer to utilization points to facilitate military readiness capability. Although the AEC still opposed outright military custody, it did agree to transfer weapons to storage sites abroad or to advanced delivery bases under AEC custody and responsibility.

With the increasing development of tactical weapons and more advanced delivery systems, it eventually became necessary to disperse weapons to an extent resulting in effective military custody. Yet ultimate control over these weapons still rested with the Commission, and decisions concerning their use could only come from the President. Control of the weapons thus continued to remain in civilian hands during the late 1950's, although the weapons themselves were gradually integrated into the military arsenals.

The basic goal of the United States postwar nuclear weapons program was intended to be the retention of the American monopoly of atomic

weapons until an international control system had been established.[9] However in 1949 this goal and our national security were severely jeopardized by Soviet advances in nuclear weapon development. It was an extremely fortunate set of circumstances that enabled the nation to awaken to the severe nature of the Soviet threat.

Most accepted sources had placed the USSR from 10 to 20 years behind the United States in nuclear weapon technology. However AEC Commissioner Lewis Strauss had been able to persuade the Commission to institute a nuclear explosion detection system involving atmospheric sampling shortly after the war. In August, 1949 one of these samples showed traces of "Joe One", the first Soviet atomic explosion. This was reported immediately to Sec. Johnson. However the new Secretary was readying an effort to reduce military expenditures and being a strong proponent of the more pessimistic views of Russian technology, at first chose to disbelieve the report. The detection was quickly confirmed by the AEC however, and the President was informed and subsequently the Soviet test was announced to the public.

"Joe One" had drastic effects on our military policy. Before the Russian device we had regarded our monopoly of nuclear weapons as a counter to Soviet troop buildups in Europe. Now the possibility of a Russian stockpile of strategic weapons endangered our military position. This prompted Strauss to renew the issue of thermonuclear weapon development, the "super", and reach the conclusion that development should be initiated immediately. Yet this topic had been a much debated issue in earlier years, and thus when Strauss presented his recommendation in 1949, the AEC voted against it. As Chairman Lilienthal said, "I am one who hates force and has no faith in military power as a <u>solution</u> to anything."[10]

The principal opposition to "super" came from the quarters of the atomic scientists themselves. Robert Oppenheimer voiced the feelings of many when he said "In some crude sense, which no vulgarity, no humor, no overstatement can quite extinguish, the physicists have known sin and this is a knowledge which they cannot lose."[11] He and others suspected that the weapon was possible, but as the General Advisory Committee of the AEC reported on November 29, 1949, "We all hope that by one means or another, the development of these weapons can be avoided. We are all reluctant to see the United States take the initiative in precipitating this development. We are all agreed that it would be wrong at the present moment to commit ourselves to all-out efforts toward its development."[12]

Backing Strauss however, were scientists such as Edward Teller and E.O. Lawrence. Strauss turned to the DOD and Johnson to mobilize opinion, while Sen. McMahon, another advocate of the "super" program, convinced the JCAE. When Truman learned of the conflicting views of the AEC on one hand and the DOD and JCAE on the other, he asked the special committee of the National Security Council to study the question further.

As fate would have it, the Fuchs spy incident[13] occurred on January 27, 1950 while this study was in progress. The special committee decided 2 to 1 against Lilienthal to advise the President to direct commencement of the thermonuclear program. Truman agreed, and on January 31, 1950 made a public announcement to that effect. The battle was far from over however. Sentiment at Los Alamos was strongly opposed to the weapon. Teller recognized that many technical problems had to be overcome before the weapon could be built, and these problems could be surmounted only by a concerted effort on the part of the atomic scientists. Primary among these technical problems was that of determining the design of a "dry" weapon, one that wouldn't require

massive refrigeration components to keep the deuterium-tritium (D-T) trigger of the thermonuclear reaction in liquid form.

However development proceeded with the immediate goal as Operation Greenhouse, the Pacific test of the D-T trigger itself. Many felt that if this test failed, the entire program would be abandoned. This feeling arose from claims that the "super" program was interfering with the effort to develop tactical weapons at Los Alamos. Even before Greenhouse took place however, Teller hit upon the idea that eliminated the technical barriers to dry weapons. The super program received another boost when the Greenhouse test was a complete success in May, 1951.

Concern about the growing friction at Los Alamos had prompted Teller to press for a new laboratory in which to continue the work. After three refusals from the GAC and AEC, pressure behind Teller overcame objections and the Livermore division of the Lawrence Radiation Laboratory was set up. Its main function was regarded by many as merely spurring Los Alamos on through competition, since the latter laboratory eventually completed most of the development work on the hydrogen bomb.

On November 1, 1952 the "Mike" shot was detonated at Eniwetok. This was the first true thermonuclear device and was of 3 megaton (MT) magnitude. It was still not a "dry" weapon however. Soon afterwards on August 12, 1953 the United States detected a Soviet blast of thermonuclear nature. Analysis later showed the Soviet weapon to be of the "dry" variety. For the first time the United States faced the prospect that she might possibly be behind in the weapons race. The United States tested her first dry weapon in Operation Castle in March, 1954. The magnitude was miscalculated, and the device resulted in an explosion of 15 MT. However never

again could the United States assume a technical advantage in weapon development. Many considered as fortunate indeed the set of circumstances that enabled us to develop our thermonuclear weapon before the Soviets had gained an actual weapons advantage.

The development of the thermonuclear weapon was a "milestone" of sorts in our nuclear weapons program. Perhaps an even more significant development began during 1951 and has continued throughout most of our weapon development to date. This was the "third generation" of nuclear weapons, the tactical or antipersonnel weapon. Scientists had broken through the size limitations on weapons. During the 1950's they began developing "fractional crit" bombs in the low kiloton range. Although this paper is not directly concerned with military strategy, the strategic implications of the tactical weapon are obvious. Prior to their development we had balanced our stockpile of strategic weapons against the Soviet troop buildup. With the Soviet nuclear weapon stockpile, the stalemate disappeared since our conventional military forces had been reduced to a fraction of their wartime strength. The tactical weapon brought us into a position of balance once more since it could be used (or so we hoped) in a "limited" war.

Weapon development was important in fields other than military strategy however. With the billions of dollars spent and thousands of men employed within the atomic weapons program, changes in weapon production had powerful effects on the non-military sectors of the American society. The expansion of production facilities played an important role in the early 1950's. It was decided in 1950 to expand production facilities with new plants in Savannah River,S.C., Paducah, Ken., and enlargement of Oak Ridge

with three billion dollars in expenditures. Then in 1952 another plant was built in Portsmouth, Ohio and further modifications in existing facilities took place requiring four billion dollars. The motives behind these expansions were two-fold: the thermonuclear program and the desire for a more diverse family of tactical weapons. These programs, coupled with the desire to disperse weapon stockpiles--both for physical security and to have the weapons nearer points of use--greatly increased the demand for fissionable materials. These expansions were jointly requested by the DOD and the AEC with final approval coming from the NSC, thus illustrating the developing cooperation between the military and the Commission in the early 1950's.

The work on tactical weapons continued though the 1950's. The growing ICBM program prompted additional work aimed at reducing weight to yield ratios for warheads. With growing interest in test ban negotiations, the Vela programs were instituted to study nuclear test detection methods. The nuclear weapon development program was then slowed down appreciably by the self-imposed moratorium on nuclear testing adopted by the United States in 1958. By 1960 the Commission and other agencies had become quite concerned about this policy. They felt that weapon development was on the verge of significant advances, yet these could only be achieved through testing. To adopt a unilateral ban on testing was to severely jeopardize our military position.[14]

Many people today conjure up a picture of the mushroom cloud over Hiroshima when responding to the phrase "atomic energy". It is unfortunate that secrecy requirements and inadequate publicity have tended to isolate the subject from the layman. It was in the area of policy issues that the public's lack of information was most disturbing however. "Instead of man controlling the atom, the atom had threatened to control man".[14] Were the demands for secrecy so great as to jeopardize public opinion and control in atomic energy matters?

Unfortunately in the post-war years they were. It was many times impossible to give information to the public without also giving it to those who could use it against us. "The objective is to give out certain basic information upon which reasonable and responsible people can reach valid conclusions and withhold information that would help out possible enemies more that it would help us" said Commissioner Gordon Dean.[15] But in tying the hands of the enemy, we sometimes tied our own. The "need to know" principle many times excluded information from people in positions of responsibility in the atomic energy program itself, thus creating perplexing problems and mistakes. Examples were numerous. Lilienthal frequently described situations where numbers were so secret that they were communicated by word of mouth alone and never written down. Even General MacArthur had very vague knowledge of our atomic capabilities during his Korean campaign.

There was much disagreement and debate over the value of such secrecy. During hearings before the JCAE Lilienthal remarked that any effort to suppress or to conceal information that was not concerned with weapons would lead the nation in a very dangerous direction. "The chance of keeping the important core of secrecy inviolate depends upon not discrediting and making foolish

the whole system of secrecy."[16] He called the notion that atomic energy was too "technical" or secret for public information and discussion "plain nonsense and dangerous nonsense".[17] Yet until the public knew more, they could not understand why secrecy was at times such an illusion and hobble. Misinformation and sensationalism ruled. The public was being scared more by the press that they ever were by the Russians. Secrecy had still other adverse effects. Since the McMahon Act all information exchange between the US and her wartime allies had been forbidden, causing tension between the US and the United Kingdom. Yet because of laxness in the British security system, we felt that there was a definite risk in exchanging information with them.

Many like Lewis Strauss saw these problems, but continued to remain in favor of secrecy. "When security is found to be excessive, it can always be relaxed." But the converse was not always so true.[18] However others argued that secrecy was becoming a matter of illusion. Both the US and the USSR were approaching similar levels of nuclear technology in the early 1950's. Spectacular lapses in personnel security such as the Fuchs and Pontecorvo incidents had damaged confidence in the system. Ambiguity in the portions of the 1946 Act concerned with personnel security hindered an effective security system. Mountains of wartime classified documents threatened to engulf the AEC staff workers. Over one-half million people were investigated in the first seven years of the Commission. In the early 1950's, general manager Marion Boyer and others undertook a reorganization of data classification while new steps were taken to standardize personnel security procedures and reform the secrecy situation.

The temper of the early 1950's did not help the reorganization of the

security system however. McCarthy and others had created a national mood which hindered responsible action. The peak of the controversy over personnel security was focused in 1954 on the cancellation of Robert Oppenheimer's clearance for classified data. Since the years of dispute over the thermonuclear weapon program, Oppenheimer and other influential scientists who had opposed "super" had born the brunt of the attack from the program's supporters. Many feel today that the Oppenheimer hearing was an attempt to focus the "blame" for the delay in the United States program on one man. However there were other considerations involving Oppenheimer's personal affiliations which influenced the final decision against him. As Arthur Scheslinger wrote, "There is no easy answer to the conflict of principles between civil liberties and national security in the field of government employment."[19] Let it be said, however, that this hearing seemed to cast genuine doubts about the effectiveness of the personnel security system in the early 1950's.

ATOMIC POWER DEVELOPMENT

Since the early years of the atomic energy program, people had anticipated the beneficial potential of the atom. The responsibility for developing this potential was assigned to the AEC by the McMahon Act. The primary goal was that of atomic power, yet the difficulties that lay between this objective in 1946 and the first operation of a civilian power reactor some ten years later were very real and complex. The whole field of knowledge upon which reactor technology was based was strongly interrelated with our weapons program. There were many questions of reactor safety and regulation to be answered. Since the 1946 Act had given the Commission absolute monopoly over atomic materials, all of the early develop-

ment work had to be conducted within the government program. Yet it was not until April, 1949 that the Commission was finally able to convince the Appropriations Committee that power development was a program of such importance that it had to be coupled with and coequal to weapon development. Thus early progress toward Einstein's "almost certain" goal of atomic power was erratic at best.

We have seen the basis of nuclear technology laid during the war years. From Fermi's first pile in Chicago, the MED progressed to the massive Hanford plutonium production reactors, and then on to more sophisticated designs for research. "By the end of the war era, there had been built, operated or studied by people within the United States nearly every kind of a reactor that anyone has ever thought of then or now."[20] In 1946 the MED launched the first atomic power program with decisions to proceed with an early power design, the Daniels Pile, as well as establishing naval and air force military reactors projects. However this program was reviewed by the AEC after its takeover in 1947 and eventually was halted because of growing pessimism concerning the possibility of achieving economically competitive atomic power. A decision was made to concentrate all reactor work at the Argonne Laboratories thus uprooting existing facilities at Oak Ridge (and according to Teller, setting the power program back several years). It was not until 1948 that a new program was formulated. This involved work on a materials testing reactor, a land-based submarine reactor, an experimental breeder reactor, and design work on a full scale land-based power plant. These programs were all quite successful, although in several cases they duplicated the earlier MED work, as did an expansion in the program in 1950 which renewed work on the air force and naval reactor studies.

technical progress in this field to provide a necessary basis for such development....."[21]

A further important step was taken with the 1954 Atomic Energy Act. This Act, which will be described in more detail in a later section, allowed private ownership of nuclear materials and reactors and revised the patent laws to create higher personal incentives towards development. Although this Act placed added emphasis on peaceful atomic development, the Eisenhower administration failed to follow it up with the necessary action--and in many respects simply slackened government efforts thus slowing down progress toward a civilian atomic power industry.

During the 1953-58 period the AEC made several new attempts to engage private industry in atomic power. Known as the Five-Year Program, this effort consisted largely of small experimental reactors aimed to provide a basis for further technology, although it also included the authorization of a land-based civilian reactor at Shippingport, Pa. which later became our first full scale power reactor in 1957. A Power Demonstration Reactor Program was launched in 1955, and several completely privately financed proposals were entertained and approved. As final testimony to the willingness of the AEC to allow private development, Chairman Strauss discouraged legislation in 1956 aimed at authorizing the AEC to build and operate power plants.

In 1959 the Dresden power plant went critical while two other large power facilities (Indian Point, N.Y. and Rowe, Mass.) were finished in 1960. The Commission continued its policy of developing prototypes while encouraging private industry to handle the major installations. Thus by the end of the 1950's the American atomic power program was broadened to include increased participation from private industry and appeared to

have a sound technical foundation. Many said that we had been slow to develop the program because of our tendency to gear its pace to our own domestic power requirements. However it was apparent that economically competitive nuclear power would be available by the late 1960's.

The peaceful activities of the AEC were not confined to atomic power alone however. One of the first benefits of the atomic energy program was the development of radioisotope applications in a number of different fields. Isotopes produced by the Commission's Oak Ridge reactors found uses in medical research and treatment of cancer during the late 1940's. Their value as "tracers" quickly established them as a valuable tool in scientific research.

One of the most fascinating programs initiated during the late 1950's was Project Plowshare. This involved the projected use of nuclear explosives in excavation work. Although the moratorium limited actual test work, preparations were made for the Sedan and Nome projects which were to follow in the 1960's.

Reactors themselves found important uses in the space program. The SNAP (Space Nuclear Auxiliary Power) program aimed at providing small reactors for powering satellites and space vehicles. The Rover program to develop a nuclear rocket became a dominant part of the work at Los Alamos and Livermore, and the first runs of the Kiwi reactor were unqualified successes in 1960.

However the most significant program initiated by the Commission was that which sprang out of the thermonuclear weapon development work. Project Sherwood began in 1954 and was aimed at the goal of controlled thermonuclear power. Scientists were quick to realize the importance of Sherwood. Even

assuming that fission power was economically feasible, the world reserves of fossil and fissile materials would only fulfill man's projected consumption rates for several hundred years at most. Controlled fusion would give man an unlimited source of power since it would use the hydrogen from the oceans as its fuel. But the difficulties in the fusion program were immense since the "reactors" would involve hot gases (plasmas) with temperatures upwards of 100,000,000 degrees. Work proceeded on the project at various AEC laboratories across the country in the late 1950's.

THE ATOMIC ENERGY COMMISSION

The first term's paper traced the legislative battle that eventually culminated in the Atomic Energy Act of 1946. This act placed the American atomic energy program under the direction of an "independent" civilian commission possessing enormous powers to monopolize and regulate the new field. The AEC was expected to carry out a highly complex managerial and technical undertaking on which the world's future might well depend. "And yet the worst imaginable way to get a complex job done at the present time is to have it done by the federal government, at a time when the conditions of government service have dropped to the lowest level within living memory." noted the first Chairman, David Lilienthal.[23] However as we have seen, the greatest asset of the young Commission was the competence of the men chosen as the first Commissioners. Lilienthal characterized the essential ingredient in the early Commission as a kind "of desperate courage....,a willingness to stand up against fear and fear begotten emotions that have swept the country."[24]

Many were pessimistic about the ability of five men to work together in managing the vast complex inherited by the Commission, yet in the first 500 decisions made by the Commission over a period of seven years, there were only 12 dissents. There were times when Lilienthal himself worried about a rift

in the Commission, but harmony prevailed. It was soon apparent that a far more serious problem concerned the immense managerial duties which threatened to overcome the Commissioners with day-to-day routine. It became necessary to broadly delegate authority, yet ultimate responsibility always rested with the Commissioners themselves. The Chairman's office soon became the nerve center of the complex operation. These considerations prompted Lilienthal and others to suggest in the 1950's the adoption of executive powers for the Chairman with the rest of the Commissioners serving on parttime bases. However the majority of opinion was against this idea, and the only step taken in this direction was the designation of the Chairman as the "principal spokesman" for the Commission in the Atomic Energy Act of 1954.

The Commission was not alone in formulating nuclear policy. The McMahon Act had placed the AEC within a specific framework (Figure 1) which tied the Commission to the President, Congress, the military, the scientific community, and the public. The nature of the relationship between the AEC and each of these groups was quite varied and changed occasionally during the ensuing years. It is necessary to examine each of these relationships separately to trace the development of control through the years following World War II.

Final authority over the AEC rested with the President. He was authorized by the 1946 Act to appoint the five Commissioners and to designate their chairman. He was assigned special powers and duties with respect to the Commission such as issuing production directives, and was the final authority in any disagreement between the AEC and the DOD. The executive branch had further control since the Bureau of the Budget processed all requests for Commission appropriations.

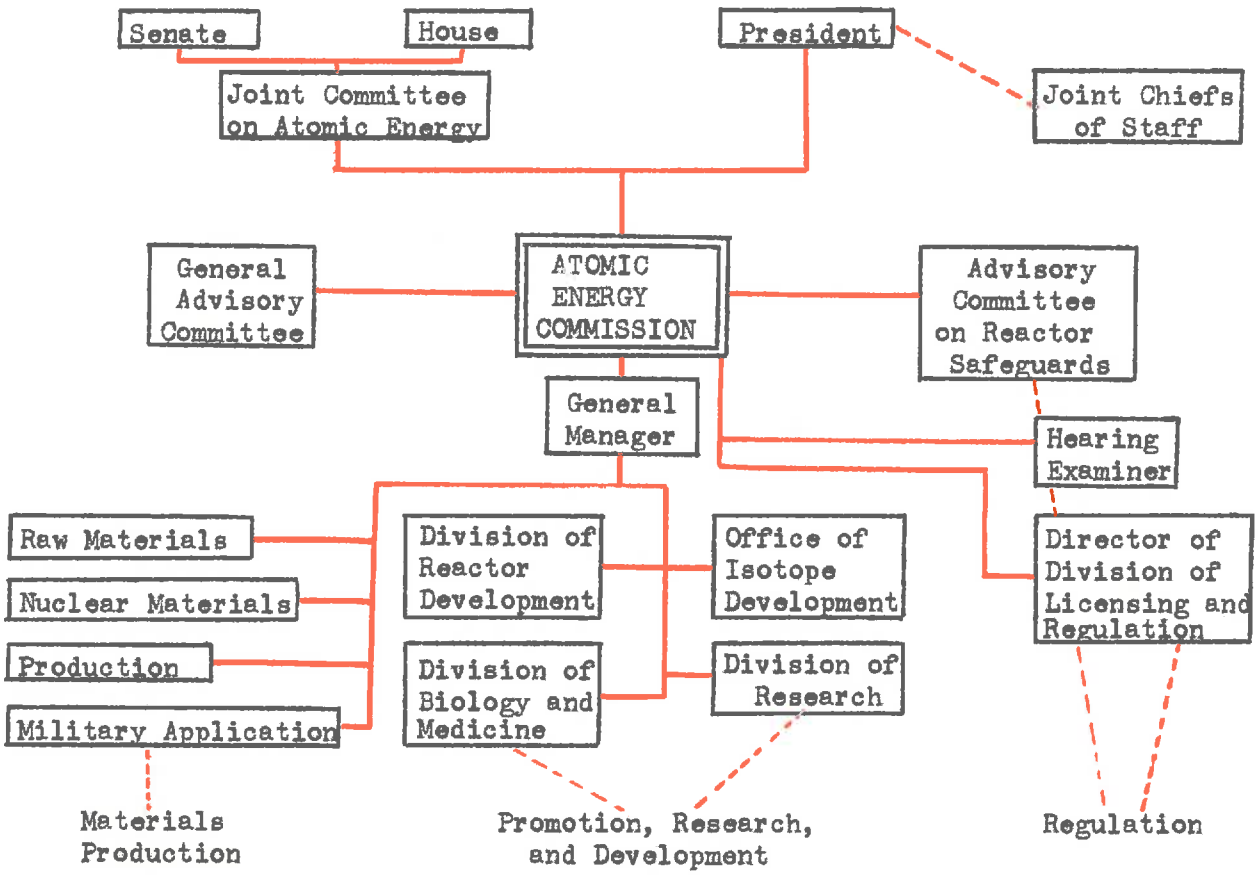

Figure 1: Administrative Structure of the Atomic Energy Commission [53]

Yet much authority had been left with the Commission. The 1946 Act insured the independent status of the Commissioners by specifying five year terms and removal only for "inefficiency, neglect of duty, or malfeasance in office".[25] Most of the comprehensive directives concerning the actual atomic program originated within the Commission. But the importance of executive control was most emphasized by the position of the President as elected representative of the public. It was his duty to "uphold the principle of civilian supremacy, not only through his role as Commander-in-Chief, but also as the leading catalyst of an informed, rational judgment by the American people on issues which touch them vitally as atomic energy does."[26]

It was only natural that Congress should insure a means of communication between itself and the AEC. The McMahon Act established the Joint Committee on Atomic Energy, consisting of nine members from each house, to make continuing studies on the activities of the AEC and problems relating to the development, use, and control of atomic energy. It was responsible for all legislation concerning the atomic energy program. Although many saw its purpose as more sinister (Congressman Cannon tabbed it the "Watch Lilienthal Committee"),[27] it provided the necessary link between the Commission and the legislative body.

The JCAE became an extremely active partner of the Commission even in the exercise of purely executive functions. Through the process of Congressional hearings and legislation, it exercised powerful influence over the formulation of national nuclear policy. At times a state of harmony existed between the AEC and the JCAE, but at other times friction erupted. Investigations during the late 1940's into the efficiency of the Commission were brutal and resulted in a "political mauling of the atom". A heated debate

"THE DOMESTIC CONTROL OF THE UNITED STATES ATOMIC ENERGY PROGRAM"

Part III: Present and Future

Jim Duderstadt

History 125 c

May 26, 1965

ATOMIC ENERGY ACTIVITIES, 1960 to 1965

Public attention during the early 1960's was still preoccupied with the so-called "missile gap" and focused upon delivery system aspects of the United States defense effort. Nuclear weapons development had gradually lost the notoriety it had attracted during the early stages of the thermonuclear program. Indeed there were many of the opinion that nuclear weapons had reached a point of technical stagnation and further developments would have relatively small military consequences. It was true that the self-imposed test moratorium had slowed down the weapons program, but the AEC's weapons laboratories at Los Alamos, Livermore, and Sandia continued work developing and modifying various weapons designs.

The new requirements of the Polaris and Minuteman programs created demands for small 0.5 MT warheads. These programs, coupled with demands for 5 MT devices for the Atlas and Titan systems, and other tactical and strategic needs kept the AEC production facilities occupied until early 1964. (At this time substantial reductions in Pu^{239} and U^{235} production rates were announced.) Actual weapons tests were begun again in April, 1962 with the Dominic Pacific test series shortly after the Russians resumed testing. This test series, consisting primarily of effects- and proof-tests (of complete weapons systems), was particularly significant since it proved the feasibility of weapon design extrapolation. Weapons that had been designed using the maximum extrapolation possible from the data provided by the 1958 Hardtack test series were proof-tested and shown to be entirely satisfactory. This ability to extrapolate nuclear weapons design was to have particular significance after the limited test ban agreement in 1963. The Dominic series provided considerable data on the

various "blackout" effects of nuclear radiation upon electronic systems. The tests approached a level of sophistication far beyond any previous series of either the United States or the USSR and were indicative of the American progress in weapons technology.

Thus when Secretary of Defense Robert McNamara testified before the Senate Foreign Relations Committee during the Test Ban Treaty hearings in 1963, he was able to state that "The net of the relevant factors is that the United States' nuclear forces is manifestly superior to the Soviet Union's." [1] Warhead stockpiles had been increased 100% since 1960. And although the USSR appeared to have a slight edge in very high yield weapon technology, the United States was clearly superior in the weapons range below a few megatons. And even the slight Soviet lead in high yield weapons was not alarming since it had resulted from an AEC-DOD decision in the late 1950's to forego the development of high yield weapons because of their questionable military advantages over smaller nuclear weapons. The U.S. had performed many more tests and had developed a superior weapons capability in a spectrum extending from tens of MT down to sub-KT ranges.

Yet much work remained in the field of weapons development. The continued effort towards increasing specific yield occupied much of the program. Work continued towards the development of "clean" weapons (devices creating negligible fallout) for tactical use. Effort was begun on the development of the anti-ballistic missile (ABM) warhead. And there was much discussion, at least among the press, concerning the feasibility of a fission-free fusion weapon, the "neutron bomb". [2]

Progress was made for the first time in the international control of nuclear weapons development with the Limited Test Ban Treaty of 1963. This agreement prohibiting nuclear explosions in the atmosphere, outer space, and

underwater was signed in Moscow on August 5, 1963[3]. The treaty was to have profound effects upon the development program of the AEC, and the congressional hearings concerning its ratification greatly illuminated the U.S. program in nuclear weapons development.

The advantages of the treaty were clear. Sec. McNamara testified that the test ban would retard the spread of nuclear weapons. He stressed that even undetected clandestine testing by the USSR would not alter the present military balance, and that by limiting the Soviets to underground testing, we would prolong the duration of our own technological superiority.

The test ban did pose several problems however. McNamara himself recognized the risk of euphoria such as that which had occurred during the 1958 to 1960 period when the nation had relaxed its atmospheric test capability. Many critics of the treaty raised technical questions concerning the development of high yield weapons, an ABM warhead, the continued strength of our weapons laboratories, and ill effects on peaceful programs like Plowshare. McNamara and others testified that the ABM warheads could be developed through underground testing, while the military position on high yield weapons was still against their development (although he indicated that we already had the technology to develop a 60 MT weapon). It would be necessary to maintain strong programs in the laboratories as well as a capability for rapid resumption of atmospheric testing should the treaty be violated. Programs such as Plowshare would contribute to the laboratories' vitality when coupled with a vigorous program in underground weapons testing.

There were other worries however. Dr. John S. Foster, director of the Livermore laboratory, testified that "Without atmospheric testing, I doubt that we can develop and maintain the requisite skill in the important

area of effects of nuclear weapons."[4] Dr. Edward Teller suggested that the treaty would prevent ABM development, raise barriers between the U.S. and her allies, and inhibit the development of peaceful uses of atomic energy.[5] But these criticisms of the treaty were outweighed by considerations such as those contained in a letter from America's Nobel Laureates, "We believe that this treaty marks a significant if minimal first step in reducing the tensions of a continued nuclear arms race, thereby enhancing the security of the United States."[6] The majority of those concerned were led to the same conclusions as Dr. Norris Bradbury, director of Los Alamos, "I am of the opinion and belief that the proposed treaty banning nuclear tests in the atmosphere, space, and underwater may be ratified by the Senate with only mild risks to our national defense posture, but with the possibility of taking the first real, even if small, step in the direction of the prevention of a nuclear war."[7]

Atomic power development continued to play a secondary role to weapons development during the early1960's. Although the 1954 Atomic Energy Act had been designed to accelerate civilian power development, the nation appeared no closer to competitive nuclear power than it had been in the early 1950's. In 1958 the AEC had adopted a new 10 year program of reactor development aimed at 1.) the reduction of nuclear power costs to competitive levels in high cost areas, 2.) assistance to friendly nations with high power costs, 3.) support of long range development programs, 4.) developing breeder reactors, and 5.) maintaining the U.S. lead in reactor technology.[8] This guideline was followed into the 1960's, but by this time it had become apparent that a re-evaluation of the entire program was needed.

In 1962 the AEC reviewed the status of the program and reached several important conclusions. "Contrary to earlier optimism, the economic require-

ments [of nuclear power] have led to many problems--combining low capital costs with long life and assured reliability; lower costs by improved efficiency; developing long-lived and therefore economic fuels".[9] Yet the Commission still retained the belief that the United States would exhaust its readily available low-cost fossil fuels in a century or less and its presently visualized total supplies in about another century. Thus it concluded that "nuclear energy can and should make an important and ultimately, a vital contribution toward meeting our long-term energy requirements", and in particular, that "The development and exploitation of nuclear electric power is clearly in the near and long-term national interest and should be vigorously pursued."[10] The Commission redefined the proper role of government in the future program; this role was to take the lead in developing and demonstrating the technology until such time that economic factors would promote industrial applications in the public interest and lead to a self-sustaining and growing nuclear power industry. "In our opinion, economic nuclear power is so near at hand that only a modest additional effort is required to initiate its appreciable early use by the utilities." However "We do not believe that a major step-up in the whole program is appropriate."[11]

This report contained only a faint glimmer of the optimism of the early 1950's. The directors of the program were beginning to face the demanding realities of an unfulfilled technology, the problems of economic boundaries and public acceptability. Since the Atomic Energy Act of 1954 "the national effort to develop the peaceful atom has progressed in eight years from excessive hopes at the outset, to disillusioned skepticism somewhat later, and now to chastened resignation".[12]

Progress was more favorable in other areas of peaceful development. Although the cancellation of the Air Force's Aircraft Nuclear Propulsion

program in March, 1961 and the decision to dispense with a flight test of the Tory II C ramjet in the Pluto program in 1964 dealt severe blows to the development of nuclear aircraft, the Rover program continued to gain momentum and by late 1964 had successfully finished the development of the Kiwi rocket reactor and was far along on the development of NERVA, the vehicle itself. The SNAP program achieved several successes, the most notable being the successful launching of a nuclear reactor, SNAP 10A, into orbit on April 4, 1965 and later the test operation of an ion propulsion system designed for deep space operations.

The Plowshare program was quite active during the early 1960's with further advances in the application of nuclear explosives to excavation, industrial engineering, and scientific research. Although the partial test ban slightly curtailed the development work, the program gained added importance with the announcement of the trans-isthmian canal plan in 1965.

Thus by the middle of the decade, atomic energy, although still far short of the potential envisioned by the designers of the McMahon Act in 1946, was firmly established as a vital tool in American industrial, scientific, and military technology.

THE NEED FOR SPECIAL CONTROL OF ATOMIC ENERGY

In 1946 the United States met the challenge of the atomic age with a unique precedent in government agencies, the Atomic Energy Commission. In the first term's paper the wartime development of the atomic program and legislative battle prior to the Atomic Energy Act of 1946 were traced. The second term's paper examined the role played by the AEC in the development and control of the atom during the years since World War II. Now the time has arrived for us to critically examine this role and the effectiveness of the American effort to control the atom in modern society.

Why is a special type of control even needed? This can best be summarized in one word, ambivalence. The atom plays significant roles in both war and peace. To separate these roles is sometimes hazardous and artificial at best. "This combination of purposes in a single agency is perhaps the most striking administrative feature of the atomic energy program and helps explain the need for a separate, specialized agency".[13] Thus when the United States established a special agency in 1946 to administer the atomic program, it was responding to three sources of motivation[14], each revolving around the ambivalent nature of atomic energy: First, the awesome destructive capacity of the atom gave rise to many worries--chief among these the worry that the military would dominate atomic energy. But then it was also felt desirable to retain the American nuclear monopoly of the war years, at least until international control could be achieved. Secondly, the nature of atomic development had been a tightly guarded secret during the war years. It was felt necessary to continue to safeguard these secrets with a government monopoly over all technical development of atomic energy. And finally, the future of the atomic program was uncertain and capable of revolutionary changes in peacetime technology. A special new agency was thought needed to prepare and plan for these dynamic changes. These unique qualities of atomic energy induced the nation to establish the civilian AEC in 1946. And instead of placing the agency under the existing executive and legislative controls of the government, it was placed in a unique and independent position between both branches. Today the AEC bears the imprint of these original concerns for the wartime potential of the atom and the expectation of peaceful atomic developments.

But what is the validity of these three premises in the light of

present day developments? It is true that the primary role of the AEC continues to be the development, production, and testing of nuclear weapons. The hope for international nuclear weapons control has diminished (despite with the exception of) such minor steps as the Partial Test Ban Treaty. However we have also seen that while the civilian-military weapons custody and development issue was still relevant in the late 1940's, the evolution of the American defense arsenal has led toeffective military custody (as evidenced by the complete transfer of weapons storage facilities to the DOD in 1961) coupled with growing cooperation in the weapons development effort. Nuclear weapons themselves are only a part of the complexities of a modern weapons system such as an ICBM, and although assuredly a most important part, are no reason to give the Commission any independentjudgment in systems design and policy. "Realistically, the AEC essentially is not too different from any major technical contractor to the Defense Department in the area of missiles, say, or some other weapons system."[15] Thus as the sharp separation between civilian and military roles has faded, so too has (faded) the importance and advantages of a civilian government agency in nuclear weapons development.

Ambiguous

The previous two papers have pointed to the rather incongrouous nature of the technical secrecy issue. As the Russian nuclear arsenal has grown, the value of such secrecy has diminished. There is still aneed for technical secrecy in much of the weapons program, primarily to avoid international proliferation of weapons technology for as long a time as possible. However with increased efficiency in classification techniques, the AEC has successfully removed the blanket secrecy of the late 1940's and today restricts only material which is directly pertinent to weapons design. Similarly the personnel security system has evolved into a more realistic program. The atmosphere of the early 1950's tended to make secrecy a national obsession.

It almost seemed more important to conceal technical developments than to improve them. And thus the early personnel security program was based on the suspicion, not the loyalty, of the individual.[16] As the red scare subsided, the system gradually became based on a more positive and confident attitude toward the individual, and the AEC clearance program developed into one of the more effective security systems in the government today. Yet even with such improvements, it becomes apparent that the issue of technical secrecy is no longer sufficient reason in itself for an independent civilian agency such as the Atomic Energy Commission.

The third premise behind the need for a special civilian agency has similarly faded in importance. Atomic energy has failed to develop into the revolutionary panacea of the peacetime world. The atomic power industry has had a struggle from the beginning, and as we shall later see, even if a breakthrough could make atomic power immediately competitive with conventional power sources, it would have no major economic effects since it would merely provide a new source of heat for generating electricity and not a radically different form of power in itself.

Consequently the three prime factors behind the establishment of the AEC are no longer entirely valid considerations. But this in itself is not enough to decide against the special government agency as a method to control the national atomic energy program. It was recognized in the early years that the gargantuan size of the atomic program would not only limit private participation but also severely distort any existing government department attempting to assume its control. The very dimensions of the program speak for the importance of specialized agencies concerned with its administration.

Then too, the "almost explosive development of nuclear energy programs for both war and peace accompanied by problems of regulating and con-

trolling, the security and health hazards implicit in exploiting the atom has fostered the creation of highly specialized agencies to administer these programs."[17]

Although judging by the three major considerations of 1946 we would be forced to conclude with David Lilienthal that "The reality is that the Atom has not justified the separate and unique status which Congress understandably assigned to it in 1946";[18] we must look to different areas such as those mentioned above before we decide against the present American form of control, the Atomic Energy Commission.

Some of these considerations will become apparent as we retrace briefly the developing and changing roles and activities of the Commission during its brief history and then proceed to point out changes in the structure of the AEC itself during this period.

THE ATOMIC ENERGY COMMISSION--FUNCTION AND FORM

The initial function of the AEC was to produce fissionable material for weapons use, to develop and manufacture these weapons for the military, and to explore peaceful atomic development while maintaining the government monopoly in atomic energy. This almost exclusively operational role was the AEC's sole duty until the 1954 Atomic Energy Act. At this time the AEC acquired new responsibility for promoting and encouraging private enterprise investment in atomic activities as well as for regulating and licensing the fledgling nuclear power industry. The 1954 Act compelled the AEC to act at the same time as "partner, employer, promoter, rival, and policeman..."[19] The operational, promotional, and regulatory functions of the Commission will now be examined as the first step in analyzing its effectiveness.

Of the some $2.5 billion in funds appropriated to the AEC each year, almost 3/4 is devoted to the operational duties of fissionable materials

production and weapons fabrication.[20] Thus the military function which was essentially the exclusive responsibility of the Commission from 1946 until 1954 has continued to be its primary activity. Since the United States program was aimed at developing civilian as well as military atomic energy, the attempt to exploit the peaceful side of the atom became inseparably linked to the international demands upon national security. This union, as we have seen, greatly retarded peaceful developments in this country. Research facilities and personnel which might have been utilized in peaceful pursuits were expended in the military nuclear weapons program. Secrecy and red tape surrounded much of the information vital to civilian power development. Thus the operational duties of the AEC complicated and conflicted with its promotional responsibilities.

It has been contended by many that the operational duties have suffered from the commission form of administration, and that the atomic power program has been allowed to drift. However there is no public indication that the national atomic energy program, either military or civilian, has been delayed or has suffered appreciably under the Commission.[21] Since 1950, the AEC appears to have carried out its operational responsibilities with vigor and efficiency.

Because of the enormous complexity and expense of atomic power development, the federal government has had to assume a much more active role than has been characteristic in exploiting other forms of energy. Both research and development work have had to be executed simultaneously without the usual time lag between pure research, its experimental application in prototypes, and its ultimate commercial applications. The government found it necessary to play a major role in the promotion of the civilian atomic power industry. But two questions immediately arose and have continued to

plague these activities: How much government assistance should be given, and what form should this assistance take? We will address ourselves to these very important questions in a later section.

The promotional role of the AEC in the civilian atomic power industry has been a major activity since the Atomic Energy Act of 1954. Through contract and grant the Commission encouraged research in universities and industry. The prototype and power reactor demonstration programs were phases of promotional activities. By 1962 the Commission had invested $1.275 billion in the civilian power program as compared to some $0.5 billion on the part of private industry.[22] Gradually the AEC began the transfer of operational activities to private concerns. By loosening regulations the Commission encouraged private participation. Understandably the duty of promotion was to conflict with the final responsibility of the AEC, regulation. The activities which reinforced promotion created regulatory problems of severe complexity.

Atomic energy is unique in requiring maximum regulation of its every aspect. There are features of the substances used, the processes involved, and the end products themselves which impose a regulatory role on the AEC. Regulation demands arise from 1.) the military uses of fissionable material, 2.) the hazardous nature of nuclear materials, and 3.) the war-engendered atmosphere of secrecy.[23] Yet one questions whether it is necessary for the Commission to assume exclusive responsibility for regulation of atomic energy.

It may be that the psychological impact of the awesome destructive power of the atom has induced an exaggerated need for strict regulation to calm the anxieties of the public. This fact is aggravated by the widespread public ignorance of the nuclear science and technology concerning the nature and extent of necessary regulation. To insure maximum public protection, the regulating agency must have ready access to the most up-to-date technical information, and at the present time this information is only available within

the AEC.

The early forms of regulation were quite simple--the Commission merely owned all nuclear materials and their production and use facilities. However it was apparent that such an absolute monopoly was incompatible with the hopes for a civilian power industry. Consequently the 1954 Act sought to loosen this monopoly with increased civilian participation. Even then, however, Congress insisted "It is essential to the common defense and security that title to all special nuclear material be in the United States while such material is in the United States".[24] Thus the monopolistic position of the government was not merely a by-product of efforts to insure supplies for the military effort, but also to enable it, for safety and security reasons, to know who had the material or where and to whom it was being transferred.[25] Private owners and operators of nuclear reactors could only lease nuclear materials from the Commission (until 1964). Today the AEC also maintains a reactor safety program as well as supervising the control of isotopes and other radioactive materials.

The trend for the past decade has been towards greater and greater private participation in atomic energy development. Yet to the extent that the government manages to divest itself of direct operating responsibilities in the field of research and development, the problems of regulation become more complex.[26] Increasing private participation magnifies the regulatory responsibilities. To this extent promotional activities tend to complicate regulatory duties.

The conflict between the promotional and regulatory duties of the Commission is much broader however. Many fear that these two responsibilities are incompatible within the same agency. There is always the danger that regulations may be drafted and executed with too firm an eye on the

operating necessities of the Commission.[26] Perhaps the crucial point is not so much the propriety of blending two separate and superficially incompatible functions however, but rather the determination of how and by whom the regulations themselves should be framed. This matter has been complicated, as we have noted, by the requirement that the regulating agency have access to the best technical information. The situation is further complicated by the fact that the AEC has deemed it necessary to assume operating responsibilities as a means of regulating several facets of the atomic program (although it seems questionable that the government should monopolize mining, refining, processing, and fabrication in order to achieve complete surveillance over fissionable materials.)[27] Perhaps the only alternative is to separate the regulation drafting process from the Commission while leaving it a voice in these decisions (although not necessarily a preeminent voice). Then the regulatory responsibility would not be so directly incompatible with promotional duties since it would be more operational in nature.

A final difficulty with the present regulatory activities of the AEC stems from the fact that the AEC is surrounded by agencies with long-established claims to jurisdiction over at least some elements of the regulation of atomic energy. Further complications arise since much of the health and safety regulation is assigned to the state and local government. There is an acute need to coordinate the regulatory activities of the Commission with the policing powers of other agencies. This is being accomplished to some extent through an amendment in 1959 allowing state regulation of some phases of atomic activity. The process is a gradual one however, and conflicts and duplication will continue to exist for some time to come. Despite these problems, the excellent safety record of the AEC testifies to its

conservative and successful approach to regulation.

As the nature of the Commission's responsibilities changed, we would expect the administrational structure of the AEC similarly to conform. A necessary factor of any special agency is flexibility. In 1946 the atom was an unknown quantity. The atomic energy program had brought together the largest single assemblage of scientists and technicians with which the government had been forced to contend. The financial commitment had been immense. To safely control the program, the United States chose the civilian commission form of administration since it would "diffuse responsibility" and "slow down the decision making process".[28] Although the commission form of organization might not have been ideal from the standpoint of operating functions, it was the usual and accepted format for regulatory agencies. And although the AEC was an operating agency during the early years, it was natural to expect the form of the agency to evolve as the activities of the atomic energy program became more predictable. For this reason and because the Commission assumed responsibility for a combination of wholly unrelated functions, eventual adjustments were expected to be necessary.

Some of the problems which arose have been mentioned above. The conflicting nature of promotional and regulatory functions demanded change, as did the conflict-of-interest situations posed by operational and promotional activities. The Commission represented a shift of power within the government from the democratically responsible authorities to the technical experts who were not subject to democratic control. And the role of the Commission itself came to be questioned as many began to suggest that a single administrator should assume control. But for all these and other considerations, the structure of the AEC has changed relatively little since the time of its formation.

The initial structure of the Commission provided for involved the position of a general manager serving at the pleasure of the commission to act as "the chief executive officer of the commission" and"to discharge such of the administrative and executive functions of the commission as the commission may direct".[29] Thus for most of the AEC's history, the direct supervision of operational, promotional, and regulatory activities rested with one man. Much of the conflict between promotional and operation duties was resolved by specific policies designed to contract out many Commission functions, to rely upon consultants, and where possible to select new firms to receive contracts thus preventing the dominance of the atomic energy field by several large contractors. The promotional and regulatory conflict was not so easy to resolve. In 1957 the Commission set up separate departments, the Division of Licensing and Regulation and the Office of Industrial Development. Then in 1961 a Director of Regulation was authorized to direct the Division of Licensing and Regulation, Compliance, and Radiation Protection Standards.[30] This new director was responsible directly to the Commission, thus relieving the general manager of regulation duties. These internal organization changes, while stressing the need to effect a sharper separation of regulatory and operative functions, also confirmed the original decision to leave both functions in the same agency since both were still combined at the level of the Commission.[31]

It was announced in 1962 that by unanimous vote the Commission had recommended that it be abolished and replaced with a single administrator, creating a new agency presumably along the lines of NASA.[32] Although nothing has come of this suggestion as yet, this does indicate the recognition that the prime responsibility of the AEC is operational rather than regulatory. Although the commission form of agency functioned adequately in the area of weapons development, it had become apparent even during the late 1940's that

the general manager merely acted as a go-between for the management of the program. The peaceful atomic program has created more problems with its accompanying responsibility of regulation. To meet these challenges, the Commission apparently now feels it is necessary to separately completely the regulatory and operational activities and switch over to the most effective organizational structure to handle the latter, the single administrator.

PROBLEMS WITH THE UNITED STATES' APPROACH TO DOMESTIC CONTROL

The status of the AEC is rather anamalous. Although the Commission's primary functions are of the type usually subject to Presidential control, we have seen that the AEC actually occupies an undefined constitutional limbo between the President and Congress. Although the tie to Congress through the Joint Committee on Atomic Energy is rather strong, all powers of appointment rest with the President. Yet the absence of strong Presidential interest has tended to isolate the Commission. Consequently the AEC, "without a supporting constituency, and with few relationships with Congress, came to rely upon the JCAE for sympathy and support".[33] The JCAE has moved into this power vacuum and must be recognized as a major policymaking force in the United States' atomic energy program. It has become probably the most powerful congressional committee in history[34]--and certainly the only permanent congressional joint committee.

Last term's paper traced the growth of the JCAE's influence. Although the Committee played a rather passive role during the late 1940's, it began to expand its powers during the 1950's as it gained experience in the formulation of nuclear policy. The 1954 Act increased the Committee's influence by strengthening the requirement that the AEC keep it "fully informed" on all nuclear matters. It gained control over the authorization of plant construction and property acquisition, and later authority over other AEC appropriations in 1957. It assumed not only a legislative policy role but

part of the executive responsibility as well. It is essential that we examine a very important question, "Does the JCAE in its present role as policy-maker provide a leadership capable of handling the American atomic program wisely and judiciously?"

It is true that many of the members of the Committee studied hard and conscientiously to attain sufficient background in nuclear matters to enable themselves to execute their responsibilities competently. During the 1950's the JCAE was perhaps the prime mover behind the civilian power program and spurred the AEC much further along these lines that it would normally have gone on its own. As one Committeeman stated, "The JCAE is doing work the Commission should be doing."[35]

Yet this does not appear to justify the present status of the Committee. It has influence extending into areas of security, diplomacy, and international trade policy that have traditionally been primary legislative responsibility of the Committees on Foreign Relations and the Armed Services. It has retained power based upon the assumptions of 1946. "The largely out-dated but still potent aura of secrecy about the atom sustains the JCAE's position of exclusiveness and expertness in relation to other committees and other individual members of Congress."[36]

The JCAE was originally intended to be a check on Commission activities. It has tended to become a formulator and defender of the program instead of a probing critic. "The shakiness of this advocate or promoter-judge role is compounded when the JCAE's eagerness to press a nation-wide atomic power plant program is added to the balance of considerations."[37]

Yet recognizing a problem is far short of providing a solution. It would be difficult to adjust the power balance since congressional committees are usually quite hesitant about giving up power. The substitution of a single administrator would strengthen Presidential control and sap some

strength from the JCAE[38], but to pursue adjustments of this type through the JCAE might prove quite difficult.

A second unresolved issue arises from the need to preserve traditional lay controls over both the operational and regulatory aspects of the nuclear energy program. Several factors contribute to this problem. Lack of popular participation has been caused by the technological complexity of the issues involved, their far-removed nature from the life experiences of the American public, and the still apparent concern for technical secrecy. The complex and hazardous nature of the substances and processes involved in nuclear work have forced dependence upon the judgment of the scientist, both as administrator and policy-maker.[39]

Traditionally controls over such technical experts have been exercised by the executive through the power to make regulations and budget control. The recent rise to power of the JCAE has contributed to this control. But even they must rely upon technical advice. The only true safeguard against pre-emption of power by politically irresponsible experts is the existence of countervailing sources of influences. "No expert should be placed in a position where he alone has access to the highest political authority."[40] And an informed public is necessary to interpret such technical advice.

Thus the problem of democratic control becomes two-fold: "first in setting up specialized atomic energy authorities outside the conventional system of departments, how to maintain the normal controlling functions of the executive and the legislature; second, the more subtle problem, how to preserve the traditional authority of politically responsible laymen over the scientist-administrator."[41]

The relationship between the AEC and private industry has always been an important issue. With the growing civilian atomic power program, this relationship becomes particularly significant. The initially monopolistic

position of the Commission had been thought necessary for national security. As these considerations became of lesser importance, the realization that private participation was necessary for a successful atomic power program motivated some loosening of the monopoly in the 1954 Act. Yet when the Kennedy administration assumed executive power in 1960, three dominant issues remained: 1.) the amount and kind of public assistance to be given to private enterprise, 2.) how best to circumvent the public vs. private power issue and proceed with reactor development, and 3.) the respective government and industry responsibilities for prototype construction.[42] There was also the question of private ownership of nuclear fuels to be reckoned with. Yet the true and great barrier to full private operation of the atomic energy industry remained, and still remains, the huge production facilities of the Commission.

These problems continue to face the nation today. The desire of industry is to see the AEC get out and leave the atomic energy field to private enterprise. The AEC similarly feels that the time has come for industry to begin playing a larger role. Yet the Commission is not so sure that the manufacturers of equipment and the utility industry will supply the nation's future needs without federal intervention. "The AEC worries that an impending fuel shortage may be upon us while industries are still having their economists calculate expected break-even points."[42'] That the main cause of the interest of private utilities in power reactor projects has been their fear of public power rather than concern for future power needs seems apparent. The time has not yet arrived for complete federal withdrawal from the civilian atomic power field.

Other steps should be taken however. As the Atomic Industrial Forum recommended in 1962[43], "the government should not undertake new manufacturing of service activities or new facilities which can be provided by industry, and should review all of its present manufacturing and service

activities with a view to having these carried out by industry whenever no continuing major penalty to the taxpayer is involved." The government should rely on greater indirect financial assistance as an alternative to AEC construction and subsidy. And the federal government should insure that the precident it has set in shepherding the new atomic power technology through to competitive commercial feasibility--at times without assuming full administrative responsibility--is not repeated. Future developments in fields such as thermonuclear power should be developed as much as possible in the private sector.[44]

A major step was taken in this direction in 1964. Since March, 1963 the Commission had been pressing for private ownership of nuclear fuels. The Private Ownership of Special Nuclear Materials Act signed on August 26, 1964 provided for eventual private ownership of fuels. To prevent a slowdown of nuclear power growth from excessive fuel costs, a transition period was provided leading eventually to mandatory private ownership of reactor fuels in 1973. The immediate effect of this act will be small, and until 1970 most reactor fuels will probably remain on lease. But this act, combined with the decision to provide enrichment services for domestic and foreign customers in 1969, is strong indication that the AEC is making every effort to move out of the civilian atomic power field as quickly as it thinks is advisable.[45]

A final problem facing the American effort in atomic energy is that of coordination. To fit such an immense and complex program into an existing government framework without hazardous distortions of traditional lines of responsibility is difficult if not impossible. The overlapping of jurisdictional responsibilities between other government departments and a special atomic energy agency has been inevitable. These conflicts can be smoothed and avoided to some extent through the frequent use of interagency coordinating committees. Yet in the final analysis, the only feasible manner in which

this coordination can be achieved is through the President himself.

FUTURE DEVELOPMENTS

To analyze the future role of the AEC in its administration of the atom, we must speculate about the future of the atomic energy programs themselves. These future developments will occur in three general areas: weapon development, civilian atomic development, and the future role of the atom in foreign policy. We can touch only briefly upon each of these areas.

Nuclear weapons will continue to play an important role in the United States defense strategy for some time to come (barring the unlikely occurrance of an international agreement on nuclear arms). As Secretary of State Rusk put it, "I believe that the United States must maintain in its own security interests a very large overall nuclear superiority with respect to the Soviet Union. This involves primarily the capacity to demonstrate that regardless of who strikes first, the United States will be in a position effectively to destroy an aggressor."[46] This viewpoint coupled with the new McNamara strategy of "multiple options"[46'] rather than reliance upon a purely strategic strike force will create a continued demand for new and more effective strategic and tactical nuclear weapons. The AEC is in a position to effectively develop these weapons through underground testing.

The immediate future will see work directed to increasing hardness and penetration of missile warheads and modifying the safety features of these weapons. The pledge between the US, UK, and USSR in October, 1963 to abstain from orbiting nuclear weapons in space should hopefully curtail this path of development. The fission free weapon or neutron bomb, important both as a technical symptom of advancing technology and as a political symbol of destruction, continues to remain a future possibility.[47]

Lately there has been considerable concern about the United States'

"overkill" capacity, i.e. our possession of many times more weapons than we actually need to deter the Soviet Union. It seems probable that our weapon stockpiles will continue to grow as newer weapons are added and older weapons are modified. As Sec. McNamara stated[48], "the future--technologically, strategically, and politically--remains too uncertain for the country to hand the initiative in this field to the Soviet Union."

Nevertheless President Johnson in his State of the Union message in 1964[49] announced production cutbacks in Pu^{239} and U^{235} stemming from an AEC-DOD study of long-range weapons requirements. This involved the shutdown of four production reactors and the K-25, K-27 diffusion plants at Oak Ridge while a stretchout program in ore purchasing was adopted. Thus it appears that our ability to produce nuclear weapons has finally exceeded our projected need for these devices.

The growing disillusion with the civilian nuclear power industry has been apparent. The program itself has suffered from numerous faults. To begin with, the problems of securing safe and competitively economic power have greatly exceeded most expectations. Coupled to this is the diminishing cost of conventional fuels as more reserves and better mining techniques become available. The worries about fossil fuel reserves, while to some extent of substantial validity, have been greatly exaggerated, as has the role that nuclear power could play in underdeveloped areas. Today no one expects or even predicts that some magic can be found from the atom such that it will "cause profound changes in our present way of life"[50], at least in a peaceful sense.

In attempting to develop nuclear power wisely, the nation and conflicting groups of interest have been contending with difficult questions of political economy. The AEC and JCAE have not yet succeeded in formulating a

long-range program in which the AEC is made responsible for taking the initiative in power reactor development.[51] Advanced reactor experiments have been too conservative and too few in numbers, particularly in the area of breeder reactors. Primary activity has been directed to the development of hardware in support of demonstrations of current technology. And owing to the uncertainty of results and the number of reactor concepts, the AEC has assumed the most effective way to competitive nuclear power is to follow multiple development routes. Not only do excessive costs limit this concept, but spreading financial and technical resources among eight or more reactor designs has resulted in insufficient attention to long term designs. Diversity of approaches has not provided systematic coverage of the major possibilities.

Although depletion of conventional fuel resources represents a false justification of accelerated government-sponsored nuclear energy development at the present time, there are many important reasons why we should continue the present level of the effort toward economic nuclear power. Nuclear development has and will continue to help constrain price increases of conventional fuels induced by faulty United States' energy policies[52](i.e., the protection of domestic oil producers because of exaggerated national security considerations). Yet fossil fuel reserves are definitely limited, and their chemical value in synthetics production will provide increasing motivation for nuclear power.

By the 1960's an extraordinary economic situation had arisen: "the vastly expanded nuclear resource base--in uranium output, fissionable material production, chemical processing facilities, and nuclear energy laboratories--had become so great and the demands of civilian applications had proved to be so small that as military stockpiles grew, a huge surplus of nuclear capacity

appeared probably until 1970 at least."[53] Thus the nation's capacity to produce material for military and civilian needs is so great that enormous economic waste is in prospect if these resources cannot be employed productively for peaceful purposes. A final added incentive is the unequaled opportunity for the US to provide effective world leadership in both the control and promotion of nuclear power development.

What do these considerations portend for the future of atomic power development? As we have seen, there is no economic justification for large, costly accelerated nuclear power development programs. The Atomic Industrial Forum recommended "the continuation of a vigorous nuclear power development program, both public and private, at a level of effort which approximates that of the past few years".[54] Thus in their 1962 report to Congress, the AEC stated, "We do not believe a major stepup in the whole Commission program is appropriate". The trend toward increasing private participation will be continued towards the eventual goal of a self-sustaining private industry.

Consequently the nation can look forward to a large, sustained "public-private" program--although at substantial cost to be sure--as a necessity in achieving the long-term economic benefits of nuclear energy. And although atomic power will not cause profound economic effects until it proves very much cheaper than conventional sources, the A.I.F. study mentioned earlier indicated the inception of competitive nuclear power will probably occur in the next five years, and by 1980 from 12 to 24% of all new electrical capacity will be nuclear.[55] Thus the atomic power program, although experiencing difficulties, is quite close to competitive power in America.

It has been difficult if not altogether impossible to separate the American atomic energy effort from the international scene. A particularly awkward problem has been that of reconciling the technical and economic reali-

ties of lagging power reactor development at home with our commitments to industrializing countries under the long standing Atoms-for-Peace program.[56] President Eisenhower's ill-fated program was important for providing new hope for improved international relations in the cold war, but it failed in its aim to divert substantial quantities of fissionable material from military use and it failed to greatly aid under-developed nations. There was a basic conflict as voiced by Commissioner Henry Smyth[57] "We cannot simultaneously make 'atoms for peace' a major part of our foreign policy and atoms for private industry a controlling part of our domestic policy. However desirable it may be to get the government out of the nuclear power business, it is more important to back our announced foreign policy with a vigorous and fast-moving program of reactor development and construction."

The basic aims of the program, the slow step-by-step creation of moderately ambitious atomic-assistance mechanisms to serve as stepping stones toward a measure of control and the use of nuclear science in the welfare of other nations, suffered also from price undercutting by conventional fuels. In light of lower conventional power costs, nations abroad began reappraising the scale and direction of their atomic programs resulting in cancellation and stretching out. "In August, 1960 the United States gave evidence of its recognition that the Atoms-for-Peace program could not accomplish the objectives of disarmament and safeguards and turned back to the idea of deposit of materials in international custody as well as through use in peaceful atomic power plants".[58] This decision was significant of the realization that the peaceful atom could only play a technical role internationally and not a political role. The only way to prevent diversion of fissionable materials to military uses was through specific international agreement.

The future relationship of the atomic energy program to science in

America is of vital importance. The postwar activities in weapons development and its effect upon basic scientific research has put a premium on huge "programmatic" technical enterprises rather than true research. Many are worried because scientists seem to spend more time dreaming up mammoth research projects than conducting actual research. The requirements program for the government--need must precede development--has turned many potentially beneficial scientific programs into engineering studies. The tendency of the AEC to use universities as directors of its research activities has tended to involve educational institutions in non-educational functions by appealing to their patriotism. Far too much of our technical and scientific manpower has become involved in the atomic energy program. These influences on the scientific community are quite dangerous.

The future of the Commission's own research facilities is also an important issue. The mammoth laboratories such as those at Los Alamos, Oak Ridge, Argonne, and Livermore represent enormous investments, both in facilities and manpower. Yet they were designed for specific weapons programs. As Dr. A. M. Weinberg, director of Oak Ridge, has observed[59], "It is therefore unlikely that the problems big enough to challenge big laboratories will continue to be in the areas of technology for which the laboratories were originally organized.....the institutions must inevitably be prepared to move into areas outside their original interests if they are to retain immortality". Solutions to this problem have been suggested. One involves putting the NSF in charge of the research laboratories such as Argonne and Brookhaven, while transferring the weapons groups at Livermore, Los Alamos, and Sandia to the DOD.[60] This would limit the AEC to production and regulation alone, thus limiting its influence on scientific research.

We have now followed the history of the American atomic energy pro-

gram and its administration from the days of the Manhattan District up to the present. Perhaps as David Lilienthal observed some 20 years after the creation of the MED, the present status of the atom in our society is based on a myth, a myth composed of the worries and fears of 1946. These obsessions led us to assign to the atom a separate and unique status in the world. In those days the development of the Bomb seemed to be the ultimate breakthrough in scientific achievement, in the control of physical matter; and thus it even seemed possible that we could make similarly radical departures in dealing with those problems in human affairs which the Bomb so greatly intensified.[61] This has proved, in retrospect, to be false. Today the atom has not justified the special treatment accorded it in 1946. "The Atom has NOT been the single necessary weapon. It has NOT revolutionized industrial society. It has NOT produced revolutionary advances in medicine or industry. The peaceful atom has NOT ushered in a new world, but has rather become a part, and quite a minor part, of the old one."[62]

Perhaps the present program in peaceful atomic development is as much a product of a compulsion on the part of the nation to find <u>some</u> peaceful use for so terrible a weapon as it is a response to actual needs for atomic power. Perhaps the time has come for a more hardheaded reappraisal of the relations between costs and expected returns in dollars and in human well-being from the atomic program.

As Lilienthal correctly remarked, "Atomic energy achievements represent a very high degree of imagination and creativity, but also a high point in the fragmentation of knowledge and responsibility for knowledge."[63] In attempting to control and administer the atom, people have tended to look at fragments. One cannot treat problems in weapons development, civilian atomic power, or international development of the atom separately. But then the only manner in which such a wide variety of considerations can be inte-

grally dealt with is through the American democratic process of government--not by special agency or commission. It seems reasonable to conclude that the main effort in controlling the atomic energy program could best be handled by removing it from special authorities and placing it instead into the normal processes which govern the rest of American society.

FOOTNOTES

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