SCIENCE AND THE AIR FORCE

A HISTORY OF THE AIR FORCE OFFICE OF SCIENTIFIC RESEARCH

OFFICE of AEROSPACE RESEARCH ★ U.S. AIR FORCE

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SCIENCE AND THE AIR FORCE

A History of the Air Force Office of Scientific Research

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PREFACE

No one can deny that, since World War II, the U.S. Air Force, like the rest of the military services and the federal government generally, has become hopelessly dependent on science. And at no time has this dependence been more pronounced than now. By the same token, at no time has the Air Force's involvement in science been greater than it is today. In 1947, when the Air Force became a separate service, only one of its laboratories had anything resembling a basic research program--and that program was limited to one narrow area. Indeed, basic research activities were so circumscribed that the Air Force did not even feel the necessity of formally accounting for them in its budget. Today, basic research not only occupies a separate line in the Air Force budget, but represents, like the rest of the Air Force's activities, an endeavor global in character.

Not all Air Force basic research is done in Air Force laboratories. Indeed, in 1951, when the Air Force decided to pursue fundamental scientific studies on a wide scale, its thought was to support such studies only by contract at colleges and universities. Today, however, the Air Force Office of Scientific Research (AFOSR), the organization formed to support the Air Force's extramural research activities, is but one of several basic research organizations in the Air Force, most of which do research internally. Nonetheless, AFOSR remains the only Air Force agency engaging solely in extramural research; and, as such, it is the door through which the Air Force makes daily contact with the scientific community and the frontiers of science. The aim of this study is to trace the development of this organization from its origin to the present.

A basic research program, like any other human undertaking, does not exist in a vacuum; and this is particularly true of a military research program, which is subjected to more extraneous pressures than a civilian program run by, say, the National Science Foundation. In addition, there are such things as budgets, organizational practices, research management philosophies, and a host of other things that impinge upon and give shape to a research program. It is my

intention in this study to look at this aspect, the human and political aspect, of AFOSR's history, which is, I believe, the key to AFOSR's development. In doing this I concern myself only incidently with the organization's technical program. Nor do I give much attention to day-to-day contracting and contract monitoring, which do not readily lend themselves to historical treatment. On the other hand, I touch upon a great many subjects outside of the organization, but only when I feel they have a direct bearing on the organization's development. Conversely, I ignore a great many things about research in the Air Force. This is not a history of research in the Air Force; it is a history of one Air Force research organization.

Many people helped me in a number of ways with the preparation of this study. Dr. Oliver G. Haywood, President of the Huyck Corporation, and Dr. William O. Davis, Physical Sciences Administrator, the U.S. Department of Commerce, not only read and criticized the manuscript in full, but also provided me with a great deal of information. Major General Daniel E. Hooks, USAF (Ret.), and Brig. General Hollingsworth F. Gregory, USAF (Ret.), either corresponded or talked to me about the history. Lt. Colonel Ernest J. Davis, Jr., R&D Director, Headquarters Office of Aerospace Research (OAR), put documents at my disposal. Dr. David Bushnell, Associate Professor of History, University of Florida, Dr. A. Pharo Gagge, of the John B. Pierce Foundation Laboratory, Dr. Amos G. Horney, Director of Chemical Sciences, AFOSR, Dr. Knox T. Millsaps, Research Professor of Aerospace Engineering, University of Florida, Lt. General Donald L. Putt, USAF (Ret.), Vice President, United Aircraft Corporation, Dr. D. G. Samaras, Propulsion Division, AFOSR, Major General John W. Sessums, USAF (Ret.), Assistant to the President, Lockheed Propulsion Company, Dr. Lloyd Wood, Director of Physical Sciences, AFOSR, and Dr. Harold Wooster, Director of Information Sciences, AFOSR, read all or parts of the manuscript and provided me with the benefit of their knowledge either by correspondence or through interviews or both. Needless to say, the responsibility for any errors of fact or interpretation rests not with any of the people mentioned above, but with me alone.

All manuscripts cited in the footnotes, unless otherwise indicated, are to be found in the OAR Historical Division. Much of the cited correspondence is composed of signed originals; I did not believe it necessary, however, to distinguish in the footnotes between originals and reproductions since the authenticity of the latter is not to be doubted.

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Chapter I

ORGANIZING FOR RESEARCH

In October 1951, what is now the Air Force Office of Scientific Research was established as a small staff section in the Headquarters of the Air Research and Development Command. The Office was entrusted with sponsoring a select program in basic research at the nation's institutions of higher learning.

The event was of no small significance. It marked the formal recognition by the Air Force that a viable military technology had roots sunk deep in fundamental science. The Air Force was becoming increasingly aware that an intimate association, a kind of benign symbiosis, existed between science and technology. Neither science nor technology could exist without the other, and the Air Force, perforce, had to live with both.

The event was significant in another way. The Air Force had now come to realize that the task of mobilizing science to the service of military technology could no longer be left entirely to others. The Air Force itself would foster science at the most fundamental level of inquiry.

II

In a sense, the Air Force had been preparing for this moment for seven years. It was in the fall of 1944, while the Second World War still raged, that the Army Air Forces, in the person of General H. H. Arnold, began to give serious thought to the future relationship between science and airpower. Convinced that "the first essential of Air Power is pre-eminence in research," Arnold was determined to put the Air Forces' R&D programs on "a sound and continuing basis."[1]

[1] Memo, Gen. H. H. Arnold, Subj: "AAF Long Range Development Program," to Dr. Theodore von Kármán, 7 November 1944; ltr., Lt. Gen. Ira C. Eaker, Deputy Cmdr., AAF, to Gen. George D. Kenney, CG, Far Eastern Air Forces, 6 September 1945; *History of the Air Research and Development Command*, 1 July-31 December 1956 (ARDC Historical Division), I 217, hereinafter cited as *History of ARDC*.

A bluff, unceremonious man, who had learned to fly as a member of an air force that had "more spirit than gasoline and more guts than horsepower," Arnold stood in striking contrast to the people in the scientific community. Yet, differences in makeup aside, he had formed a great deal of respect for scientists as such ("the long-haired boys," he called them) and had developed a close personal relationship with many of them.[2]

Before too long, Arnold induced, with the assistance of an old friend, Dr. Robert Millikan, the President of the California Institute of Technology, an impressive array of scientists into his Pentagon offices. First and foremost was a graying, Hungarian-born aerodynamicist named Theodore von Kármán, who, for the rest of the decade and into the fifties, would cast a long, benign shadow over the Air Force's research and development activities. Following von Kármán into the fold were, among others, Hugh L. Dryden, Lee A. DuBridge, George E. Valley, George Gamow, W. H. Pickering, and Frank L. Wattendorf. In November 1944, Arnold formally constituted these men as the Army Air Forces Scientific Advisory Group, over which von Kármán was named chairman. Arnold assigned these men a broad mission. He asked them to divorce themselves from the present war and, in the light of recent scientific and technological developments, plan what he termed "a Buck Rogers program for the next twenty years."[3]

Even with the forces he commanded engaged around the world, Arnold could permit himself this slight indulgence. Little that remained in this war could tax the energies of the AAF. The AAF's mastery of the air was nigh on absolute. It had recently reduced the once dreaded *Luftwaffe* to impotency. It had long since swept the Japanese from the skies. And it was now poised for a final, death-dealing blow at the enemy.[4]

The AAF's supremacy was impressive, but it had been bought at a considerable cost to new aeronautical developments.

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[2] Samuel Milner, "The Air Force Research Division: The Historical Background," unpublished MS, pp. 22-23; Ernest G. Schwiebert, *A History of the U.S. Air Force Ballistic Missiles* (New York, 1965), pp. 42-43.

[3] H. H. Arnold, *Global Mission* (New York, 1949), pp. 532-33, 580; memo, Arnold to von Kármán, 7 November 1944; ltr., Arnold to Maj. Gen. Muir S. Fairchild, 3 January 1946; ltr., Eaker to Kenney, 6 September 1945.

[4] Arnold, *Global Mission*, p. 531; William R. Emerson, *Operation Pointblank, A Tale of Bombers and Fighters* (United States Air Force Academy, 1962), p. 35.

The war had worked a strange twist. At no other time in history had science and technology been mobilized on so grand a scale for employment in war. Nonetheless, the war had been largely fought with, and largely decided by, conventional weapons. Arnold himself had issued the orders, in June 1940, that gave priority to "the continuous production of current types of airplanes."[5]

The Army needed airplanes at once; there was no time to nurse along something that was not even on the drawing board. Hence, at the twilight of the Second World War, the AAF's front-line arsenal was based on aeronautical concepts that had been known, and successfully applied, before the outbreak of hostilities. America's air supremacy was due to its ability to wring out the last engineering refinement from conventional aircraft; upon this and its ability to mass-produce such aircraft at a rate far beyond the fondest hopes of the enemy.[6]

But while the exigencies of war had not permitted the United States to develop and employ new aeronautical principles, the war experience itself had demonstrated that the AAF could now ignore the frontiers of aeronautics, and the frontiers of science in general, only at the risk of certain obsolescence. There was already a hint of what lay ahead. The Germans had developed and successfully employed both jet-powered aircraft and rockets. But never was the ability of science to work great change in the instruments of war more vividly demonstrated than by the development of the atom bomb. In six, short, furious years, science had taken the results of an experiment in nuclear physics and devised a devastating instrument of war, revolutionizing, in the process, the art of warfare itself. Henceforth, no military organization worth its name could afford to ignore the work of science.[7]

III

That Arnold intended to break with the old technology was clear. It was by no means so clear how he would effect such a break. Throughout the war, the research and development

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[5] Alfred Goldberg, "Equipment and Services," pt. II of Wesley Frank Craven and James Lea Cate (eds.), *Men and Planes* (Chicago, 1955), p. 229.

[6] *Ibid.*, p. 193.

[7] W. W. Rostow, *The United States in the World Arena* (New York, 1960), p. 58, James Phinney Baxter, *Scientists Against Time* (Boston, 1946), p. 420.

chores of the military services had been severely circumscribed; the services' main concern was at the extreme right of the R&D spectrum, with advanced engineering and production. The bulk of military research was shouldered by the Office of Scientific Research and Development, a civilian agency that came under the direct control of the White House.[8] Whether military research and development would be entrusted during peacetime to a similar organization, or a facsimile thereof, or whether it would be entrusted to the military services was a question still to be resolved.

Vannevar Bush, the Director of the Office of Scientific Research and Development, was first to speak on the question. In November 1944, a few days after Arnold had formally constituted the Scientific Advisory Group, President Franklin Delano Roosevelt asked Dr. Bush to recommend to him a federal science policy for peacetime.

Bush's report, *Science, the Endless Frontier*, appeared in July 1945, three months after Roosevelt's death. While its main focus was on the peaceful uses of science, the report was not silent on military research. Bush's wartime experience was vividly before him, and he turned to that experience in shaping his recommendations. He proposed that military research be under civilian control. The military services themselves would engage only in "research on the improvement of existing weapons." He further recommended that civilian-controlled military research be made one of the responsibilities of a "National Research Foundation," an agency proposed by Bush to promote the national interest in science.[9]

Arnold appears to have received Bush's recommendations with equanimity, although the purport of these recommendations clearly obviated his plans for a scientific research program under AAF control. Von Kármán displayed no comparable equanimity. He went directly to Arnold, ripped into the report, and offered the opinion that Bush was, in effect, telling the AAF that research was none of its business. To assuage von Kármán, and perhaps to relieve his own doubts, Arnold sent Brigadier General Lauris Norstad, who was serving on his staff, to see Bush. Bush assured Norstad that his report had

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[8] Irving Stewart *Organizing Scientific Research for War* (Boston, 1948), pp. 35-51.

[9] Vannevar Bush, *Science, the Endless Frontier* (Washington, D.C., 1960), pp. 33-34.

been misunderstood. The AAF would be permitted to conduct research under his plan. But he was not specific either as to the extent such research would be permitted or the areas it would be conducted in. And his assurances to Norstad notwithstanding, Bush was never able to dispel the feeling in the AAF that he meant to place all military research under civilian control.[10]

The issue was publically joined with the appearance of von Kármán's report, *Toward New Horizons*. Issued in two installments, "Where We Stand," in August 1945, and "Science, the Key to Air Supremacy," in December 1945, the report was the product of an eight-month long investigation by the Scientific Advisory Group.

A national program in basic research, von Kármán wrote, was a "necessary adjunct" to the maintenance of a strong military posture. "Every scientific development," he said, "eventually finds its way into the field of military applications." It was essential, therefore, that government sponsor basic research. But this sponsorship should not be concentrated in one controlling organization; several competing federal agencies should foster research, including an agency of the AAF. "If free enterprise and initiative are essential for maintaining a sound economy within a nation," he wrote, "certainly they are more necessary in scientific life."

The AAF should not delegate its responsibility to pursue scientific knowledge to any other federal agency. The Air Forces should be free to call on any institution or individual for scientific assistance. It was imperative that the AAF be permitted to expand its direct relations, both spiritual and contractual, with the scientific community. No one should act as "the only source of information" between science and the AAF.[11]

Von Kármán concluded with a final admonition. Reminding his readers of the atom bomb and the ability of science to work

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10 Frank L. Wattendorf, transcript of personal interview with Mr Samuel Milner, 11 February 1961; Theodore von Kármán, transcript of personal interview with Mr. Samuel Milner, 23 July 1960; memo for the record, Brig. Gen. D. L. Putt, Military Director, SAB, Subj: "Civilian Control of Military Research," 28 February 1949.

11 Theodore von Kármán. "Where We Stand," *passim* and "Science, the Key to Air Supremacy," *passim*. See also, ltr., Theodore von Kármán to General H. H. Arnold, 15 December 1945.

rapid change in weapons technology, he warned the men in charge of the future Air Forces that

> . . . problems never have final or universal solutions, and only a constant and inquisitive attitude toward science and a ceaseless and swift adoption to new developments can maintain the security of this nation through world air supremacy.[12]

IV

What influence the report had on the Air Staff and others is difficult to gauge. Arnold himself was impressed. He hailed the report as a document that would serve "for some time to come as a guide . . . for scientific research and development in the Air Forces" and directed that it be read by the principal members of his staff.[13] But his enthusiasm for the report was not translated into effective action. What the report did do was establish a point of reference. *Toward New Horizons*, along with Bush's *Science, the Endless Frontier*, accurately anticipated the coming dialogue between the advocates of military controlled and civilian controlled military-related basic research. And in a more tangible realm, it led directly to the eventual establishment, on the level of the Chief of Staff, of the Air Force Scientific Advisory Board, with von Kármán at its head. The report did little else--at least for the present.

To begin with, Arnold soon left the scene.[14] Suffering from a chronic heart ailment, he retired at his own request, in March 1946, and his successors did not bring with them the same sense of urgency for scientific matters. Moreover, there was formidable resistance within the Air Staff to tampering with the old way of doing things. More than one member of the Air Staff favored leaving fundamental science to civilians. And there were distractions--demobilization, declining budgets, the threat of inflation. Presently, the problem of military unification would consume the Air Staff's energies. And on the heels of unification and the establishment of the Air Force as a separate service came the problem of creating an Air Force

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12 Ltr., von Kármán to Arnold, 15 December 1945.
13 Ltr., Arnold to Fairchild, 3 January 1946.
14 Arnold, *Global Mission*, pp. 603, 609.

in-being. These were some of the barriers before the formation of an Air Force science policy.[15]

But things by no means remained the same. The war over, the Office of Scientific Research and Development went out of existence. Some of its functions fell to the military services and to the newly-created Atomic Energy Commission; but nothing really took the place of OSRD.[16] It was the hope that the proposed National Science Foundation would eventually fill the gap. And when President Harry S. Truman proposed the creation of such an agency to Congress, he recommended that the Foundation be responsible, among other things, for military research. Congress was a long time in acting. The debate over the Foundation droned on for five years. The question of military research was caught up in the Congressional treadmill, and, in the process, civilian control over military research began to dissolve.[17]

The Navy was alert to discern the void left by the passing of OSRD. In 1946, it persuaded the Congress to create the Office of Naval Research with a broad charter to conduct research. It was now clear that no matter what decision was made concerning military research, the Navy would control and conduct its own research program.[18]

At least some of the questions posed by the dissolution of OSRD appeared to be answered, in July 1947, when the National Security Act, which created the Department of Defense, passed its last legislative hurdle. Established at the Department of Defense level, in September 1947, was the Research and Development Board (RDB). The authority to preside over questions affecting military R&D, which had once resided in the immediate vicinity of the White House and had passed virtually into limbo with the demise of OSRD, now appeared to reside at the upper echelons of the Department of Defense. And, with Vannevar Bush at the helm of the Research and Development Board, it also appeared that one could guess how these questions would be answered. So much for appearance. The RDB was, in reality,

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15 See for example, Ethel M. DeHaven, *History of the Separation of Research and Development from the Air Materiel Command* (AMC Historical Study, 1952), pp. 35-39.

16 J. Stefan Dupre and Sanford A. Lakoff, *Science and the Nation* (Englewood Cliffs, N.J., 1962), p. 65.

17 *Ibid.*; J. L. Penick, Jr., *et al.* (eds.), *The Politics of American Science: 1939 to the Present* (Chicago, 1965), pp. 65-66.

18 R/Adm. Julius A. Furer, *Administration of the Navy Department in World War II* (Washington, 1959), p. 706; Penick, *et al.* (eds.), *op. cit.*, pp. 132-37.

a far cry from OSRD. It had no money, no facilities, and little power. It would function for most of its existence as a high level coordinating committee. The void created by the passing of OSRD was still very much in evidence.[19]

Meanwhile, the Executive Branch was giving serious thought to aviation, both military and civilian. One of the more important pronouncements on the subject came from Thomas K. Finletter. Finletter, a future Secretary of the Air Force, was asked by President Truman, in July 1947, to study the problems facing American aviation and recommend to him an "integrated national aviation policy."

Finletter's report, *Survival in the Air Age*, appeared in December 1947; among its recommendations was a call for a vigorous research program in aeronautics. The report assigned the main responsibility for aeronautical research to the National Advisory Committee for Aeronautics ("The NACA should take the leading role in sponsoring supplementary aeronautical research in educational and scientific institutions"). But the NACA's responsibility would by no means be all-inclusive. All agencies engaged in aeronautics were encouraged to sponsor a limited program in aeronautical research with university and industrial laboratories. "The benefit to be derived from direct association of military and civil government personnel with scientists," Finletter wrote, "has been clearly demonstrated by the wartime and postwar contract research programs of the Office of Naval Research and by the work already done in the universities by the NACA."

The Air Force should, therefore, according to Finletter, have an active basic research program of its own. But it would not be a program that stretched across the board; it would be strictly confined to the aeronautical sciences. The allied basic sciences would be outside of the Air Force's research realm, although it was recognized that the Air Force's research efforts would have to be closely correlated with scientific events outside of aeronautical research. The job of correlation and coordination should fall to the Research and Development Board and should be further facilitated and broadened once the National Science Foundation was established.[20]

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[19] Dupré and Lakoff, *Science and the Nation*, pp. 36-37, Don K. Price, *Government and Science* (New York, 1954), p. 147; First Report of the Secretary of Defense, 1948, para. 131.

[20] Thomas K. Finletter, *Survival in the Air Age: A Report by the President's Air Policy Commission* (Washington, 1948), pp. 73-96.

Thus, while Finletter was more generous with the services than Bush, his report was, nevertheless, restrictive. Presumably, the Air Force could engage in basic research in aerodynamics, but not in, say, solid state physics. In view of the growing importance of all the physical sciences to modern weapons, it was unlikely that the Air Force would find such restrictions acceptable. And then there was the example of the Navy. Why, the Air Force could ask, should the Navy, through the Office of Naval Research, be engaged in all manner of things, while the Air Force was narrowly circumscribed in its research activities? It was a question no one outside the Air Force appeared to ask, much less answer.

V

The question had, to say the least, occurred to Theodore von Kármán. But von Kármán, while he persided over the influencial Scientific Advisory Board, was scarcely in a position to carry the day alone. There was, indeed, considerable opposition throughout the Air Force, including the Air Staff and higher, to the Air Force entering the rarified atmosphere of fundamental science.[21] But von Kármán and other advocates of an Air Force basic research program had an important advantage working for them--there was no federal research agency, civilian or otherwise, that could satisfy the Air Force's basic research needs.

Stuart Symington, the Secretary of the Air Force, makes an instructive example. He was convinced that what the Air Force's R&D program needed most was a heavier concentration on development.[22] The Air Force would foster a basic research program, but the objective of this program would be merely "to seek answers to problems posed by the development program." To von Kármán and others a basic research program so subservient to development was no basic research program at all. Symington was prepared to accept this and even to accept the proposition that basic research conducted with no immediate practical objective in mind could be of value to the Air Force. But he could not accept the idea that an agency of the Air Force, with a strictly military outlook, was the proper place to conduct such research. "It is more fitting," he wrote to

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21 Wattendorf, transcript of personal interview with Milner, 11 February 1961.
22 Ltr., W. Stuart Symington to Theodore von Kármán, 28 November 1949.

Secretary of Defense James Forrestal, "that an agency such as the proposed National Foundation look after basic research of a long-term nature . . . ." At this moment, however, Symington could not make this argument convincingly, for there was no National Science Foundation to turn to. Symington was thus forced to conclude that, as an interim measure, "the military establishment must . . . pursue basic research on a broad scale."[23]

Others had succumbed, or were succumbing, to the same kind of reasoning. General Carl Spaatz, the Air Force Chief of Staff, had begun to tinker with the idea of a basic research program as early as November 1946. Indeed, Spaatz saw a potential danger in the armed services laboring under the assumption that a national research agency would soon be created. The services would thus pour all their research funds into applied research, the result being, Spaatz concluded, that the nation's basic research resources would be syphoned off into applied efforts. The armed services, he warned, had "a responsibility to see that [their funds were] wisely distributed."[24] Such thinking was taking hold in the R&D establishment. By early 1948, the people in the Directorate of Research and Development, Headquarters USAF, had come to the conclusion that the Air Force must "undertake such basic research not now being carried on by other [federal] agencies . . . ."[25]

With this kind of atmosphere developing, von Kármán began to strike out on a course of action. He recommended to the Air Staff, in the summer of 1947, that a research organization similar to the Office of Naval Research be established in Washington, D.C. He wanted the organization under the control of the Air Staff, and he envisioned it conducting both a contract program with colleges and universities and a program in its own laboratories.[26]

The Air Staff was receptive to the idea of a research office, but there was strong opposition to many of the details of von Kármán's proposal. Lt. General Benjamin W. Chidlaw, the

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[23] Memo, W. Stuart Symington to Secretary of Defense James Forrestal, Subj: "Air Force Concept of Basic Research," 2 March 1948.

[24] Ltr., Gen. Carl Spaatz, Commanding General, AAF, to Theodore von Kármán, 29 November 1946.

[25] Ltr., Maj. Gen. L. C. Craigie, Director of R & D, Office of DCS/M, Hq USAF, to Commanding General, AMC, 4 March 1948.

[26] Von Kármán, transcript of personal interview with Milner, 23 July 1960; Wattendorf, transcript of personal interview with Milner, 11 February 1961; but see also, ltr., von Kármán to Stuart Symington, 15 January 1949.

Commander of the Air Materiel Command (AMC), the organization entrusted with the bulk of the Air Force's R&D, provided the most vigorous opposition. If such an office had to be established, Chidlaw contended, it should be established at Wright Field, which, at the time, was the hub of R&D activities in the Air Force; indeed, the office should fall under the Engineering Division of AMC, where it could serve, and be controlled by, the Air Materiel Command.[27]

Chidlaw carried the day, and the office was established, in February 1948, within AMC's Engineering Division. After undergoing a couple of changes in its name, the organization was finally named, in February 1949, the Office of Air Research and, simultaneously, moved from under the Engineering Division into an organizational slot parallel to it. Colonel Leighton I. Davis served as the organization's first chief.[28]

VI

The Air Force, then, had made the decision to engage in basic research. It was one thing, however, to make such a decision and quite another to give the decision force. The Air Force, in simple fact, was not prepared to aggressively support a basic research program.

The threat of failure hung over the new office from the first. People were scarce, equipment was hard to come by, money was never forthcoming. After being in operation for one year, the office was limping along with 33 people, many of them administrators. What equipment Colonel Davis did get, he had to beg, borrow, or steal. To further compound his difficulties, his budgets were disapproved virtually out of hand. Thus, while Davis was there, the office was unable to get even the semblence of a program in operation. This, in turn, deterred everything else. As Davis put it, "The lack of substantial approved programs and adequate laboratory facilities was a millstone around the neck of the whole operation." In August 1949, Davis was selected for the Air War College, and as he came away from his command, he did so "with a feeling that a miracle would

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[27] Von Kármán, transcript of personal interview with Milner, 23 July 1960.

[28] Ltr., Maj. Gen. Leighton I. Davis to Mr. Samuel Milner, 26 October 1960; Col. Frank J. Seiler, transcript of personal interview with Mr. Samuel Milner, 9 December 1959.

be necessary in order to put research in the Air Force on a sound basis."[29]

Meanwhile, as if internal difficulties were not enough, trouble began to lurk from without. In early 1948, the argument was gaining ascendency in some quarters of the Defense Department that the sponsorship of separate basic research programs by each of the military services would constitute wasteful duplication. The Navy attempted to take advantage of this kind of thinking by suggesting that the Office of Naval Research be given the responsibility for conducting all basic research in the physical sciences within the Department of Defense. The suggestion was beaten back only after a vigorous protest by von Kármán and members of the Air Staff.[30]

Almost concurrently, in February 1948, the Research and Development Board, now headed by Dr. Karl T. Compton, came forward with a proposal that a new civilian research agency, constructed along the lines of the wartime OSRD, be established at the Defense Department level and given control of all research. Once again von Kármán was instrumental in turning back the proposal.[31]

To Brigadier General Donald L. Putt, the Military Director of the Scientific Advisory Board, events appeared darkly foreboding. He surmised the RDB proposal was grounded on the assumption that the military departments had done nothing, and apparently could do nothing, to improve the effectiveness of military R&D. "I believe that there are grave implications in any movement which will place military research under civilian control," Putt wrote. Attempts to deprive the Air Force of its research function had to be vigorously countered. And this could best be done, he concluded, by strengthening the Air Force's ability to conduct research and development.[32]

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[29] Ltr., Davis to Milner, 26 October 1960; memo, Dr. Louis Ridenour to Maj. Gen. David M. Schlatter, 12 October 1950, but see also for research in general, *History of ARDC*, 1 January-30 June 1951, I, 386.

[30] Air Force Scientific Advisory Board, "Research and Development in the Air Force," 21 September 1949, p. 81, hereinafter cited as Ridenour Report. See also "Comments of Dr. von Kármán on the Concepts of the Departments of Navy and Air Force on Research Policy," 14 April 1948.

[31] Memo for the record, Brig. Gen. D. L. Putt, 28 February 1949; ltr., Theodore von Kármán to Dr. Karl T. Compton, 28 February 1949; DeHaven, *Air Materiel Command*, p. 2.

[32] Memo for the record, Brig. Gen. Putt, 28 February 1949.

VII

That the Air Force, if it seriously intended to foster a basic research program, had to do something about the way that program was run was self-evident. That something was done in the end, however, was due less to the inner appeal of basic research than to circumstances. Basic research found a niche for itself in the Air Force during a general organizational upheaval of the Air Force's R&D activities--an upheaval brought on by the woeful ineptitude of the Air Force's technological arm. The thrust to reform Air Force technology possessed enough momentum to carry basic research with it.

Much of what was wrong with Air Force R&D stemmed from a weakness in organization. An independent research and development command did not exist. What did exist was the Air Materiel Command, a vast, sprawling, heterogenous structure with such diverse responsibilities as supply, procurement, production, testing, advanced engineering, exploratory development, research, and what have you. Activities on the extreme right of the R&D spectrum and beyond, the improvement of a product and its procurement, weighed most heavily on the Command; it was here that the day-to-day pressures were greatest.[33] As Major General F. O. Carroll, AMC's Director for Research and Development, noted, "We, at the AMC, in Research and Development are continually faced with the responsibility of figuring out a way to get this or that fixed."[34]

AMC's *modus operandi*, then, was channelled into the quick-payoff, prototype end of the spectrum, giving priority to short-term projects, short shrift to long-term projects. But this was only part of the story. In the final analysis, all research and development, whether long or short term, got short shrift. The qualitative functions of research and development were

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[33] Ltr., Hugh L. Dryden to Theodore von Kármán, 10 January 1949; ltr., von Kármán to W. Stuart Symington, 15 January 1949; ltr., Col. W. M. Canterbury to Brig. Gen. Ralph P. Swofford, Jr., 5 January 1951; Air University, "Research and Development in the United States Air Force," 18 November 1949, Tab A, p. 2ff, hereinafter cited as Air University Report.

[34] Presentation by Maj. Gen. F. O. Carroll, Director for R&D, AMC, 18 January 1949.

being overwhelmed in an environment dominated by such quantitative functions as procurement, maintenance, and supply.[35]

There were other failings, principally, a dispersed, unintegrated program, lacking, and not amenable to, central direction. As AMC was organized, each R&D center was virtually an entity unto itself. Each center, moreover, was charged with a multiplicity of functions, reflecting, in microscopic form, the variety and incompatibility of function throughout the Command as a whole. The man charged with managing such a center was faced with a massive job. He had to bring into play a host of management attitudes and techniques, each of which was so dissimilar from the other that, no matter how great his abilities, it was unlikely that he would possess the necessary flexibility of approach and character to direct such multifarious activities.[36]

Logistics encroached on R&D in other ways. Financial encroachments were among the more serious. Research and development did not have a separate budget; and without a budget of its own, R&D was never in a position to argue its case before the Air Staff or defend itself against the budgetary policies of more powerful interests within the Air Materiel Command. R&D usually got what money logistics felt it could give it. This made for an R&D program that was inconstant of purpose and unyielding in results.[37]

Contributing to the general disorder was a personnel policy that reeked of gross discrimination. A career in R&D was normally a one-way street to oblivion. Naturally, the more promising young officers preferred duty with operational or combat units, for it was with such units that the greatest promotion opportunities lay. Officers of less competence tended to gravitate to service agencies like AMC, where competition was less keen. And it was with officers such as these that the R&D centers were often staffed.[38]

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[35] Ltr., von Kármán to Symington, 15 January 1949; memo, Dr. James H. Doolittle to Gen. Hoyt S. Vandenberg, 20 April 1951; ltr., Dryden to von Kármán, 10 January 1949.

[36] Colonel Frank J. Seiler, transcript of personal interview with Mr. Samuel Milner, 20 March 1960.

[37] Ltr., Theodore von Kármán to Gen. Hoyt S. Vandenberg, 15 January 1949; Air University Report, Tab A, p. 4.

[38] Transcript of meeting of the Air Staff, 3 January 1950; memo, James H. Doolittle to Gen. Hoyt S. Vandenberg, 20 April 1951; Air University Report, Tab B, pp. 1-4.

Of course, even if the right people got the right job, there were never enough qualified technical personnel in uniform to go around. And the Air Force, like the other services, had turned to civilians. But neither were these people of the caliber or number required. The end of the war had brought with it an exodus of scientists and engineers from Wright Field. What was left, in effect, was an administrative staff, with only a skeleton crew of bench scientists. What with low salaries, a lack of opportunity to do challenging work, and the general unsettled state of affairs, the same expertise that prevailed at Wright Field during the war was not attained throughout the rest of the 1940's. A scientist could not be lured from the congenial atmosphere of a university campus or the affluence of an industrial laboratory to a military installation, where his problems were often misunderstood and his status often unsettled.[39]

That development could exist in the midst of logistics only under the most trying circumstances, and at its peril, was clear enough. That this fact would be made clear to the Air Staff now became the primary objective of von Kármán and the Scientific Advisory Board. By the turn of 1949, von Kármán became more aggressive in making his ideas felt. He urged on Stuart Symington the separation of R&D from logistics and the creation of a separate R&D budget.[40] To General Hoyt S. Vandenberg, the Chief of Staff of the Air Force, he recommended the establishment of a Deputy Chief of Staff for Research and Development on the same level as the Deputies for Personnel, Operations, and Materiel, so that R&D might have that all-important entree into the Air Staff.[41]

At the same time, von Kármán had picked up some important friends. Allied with him, and possessing the sympathy of General Muir Fairchild, the Vice Chief of Staff, was a coterie of strategically placed individuals, Brigadier General Donald L. Putt, the Military Director of the Scientific Advisory Board, Dr. James H. Doolittle (Lt. Gen., USAF Res.), a member of that board, and Major General Gordon Saville, the Director of Requirements, Headquarters USAF.[42]

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39 Transcript of meeting of the Air Staff, 3 January 1950; Col. Leslie B. Williams, transcript of personal interview with Mr. Samuel Milner, 8 June 1960. See also, First Report of the Secretary of Defense, 1948.

40 Ltr., von Kármán to Symington, 15 January 1949.

41 Ltr., von Kármán to Vandenberg, 15 January 1949.

42 Lt. Col. Peter J. Schenk, transcript of personal interview with Mr. Samuel Milner, 16 October 1959.

These individuals, while they were, with the exception of Fairchild, junior members of the Air Staff, were able, nevertheless, to persuade their superiors that an investigation of the Air Force's R&D activities should be undertaken by a committee of civilian experts. It was shrewdly concluded, however, that such a group would not impress all members of the Air Staff, especially those hidebound by tradition. An additional study group, made up entirely of men in uniform, but with the same predispositions as the civilian group, was needed to conduct a concurrent investigation. With the blessings of General Vandenberg, von Kármán, Putt, and company, set to work, picked the committees, and hoped for the best.[43]

The civilian committee, headed by Dr. Louis Ridenour, physicist, Dean of the Graduate School of the University of Illinois, and soon to be the first Chief Scientist of the Air Force, finished its work by September 1949. To emphasize the importance he ascribed to the committee's findings, Ridenour, in the company of General Doolittle, who served on the committee, delivered the report in person to the Air Staff. Ridenour was brutally frank, and Doolittle, when it came for him to speak, was no less so: The Air Staff could either implement the committee's recommendation or face a future frought with disaster. Two months later came the report of the military committee, based on the findings of the Air University Staff. Its recommendations were virtually identical to those of the civilian committee.[44]

In contrast to von Kármán's *Toward New Horizons*, which was mainly interested in identifying technological goals, the Ridenour Report, as the civilian study came to be known, was mainly interested in suggesting the means for accomplishing these goals. The main thrust of the report was that the Air Force was not properly organized for R&D. The Air Force had to make a change in emphasis; after concentrating in the past on the needs of the present, it was now time to devote more to the needs of the future. And for this job, the Air Materiel Command, as constituted, was inadequate. It was a familiar argument, reminiscent of von Kármán, as were the report's principal recommendations--full representation of R&D on the Air Staff,

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43 Dr. Oliver G. Haywood, transcript of personal interview with Mr. Samuel Milner, 12 November 1959

44 Memo, Gen. Muir S. Fairchild to Eugene M. Zuckert, Subj: "Establishment of a Deputy Chief of Staff for Development and a Research and Development Command," 1 February 1950.

the creation of an independent R&D command with a separate budget, the elimination of discriminatory personnel policies. But this time the argument went home.[45]

Confronted with the double-barrelled attack of the Ridenour and Air University reports, opposition to revamping the R&D structure crumbled.[46] And, in late January 1950, the Air Research and Development Command, devoted entirely to problems of research and development, was established. Major General David M. Schlatter, the former Assistant for Atomic Energy in the Office of the Deputy Chief of Staff for Operations, was chosen as the organization's first commander. Created along with ARDC was the Office of the Deputy Chief of Staff for Development, Headquarters USAF. Major General Gordon Saville, who had been a bulwark at the side of von Kármán and Putt, was chosen to fill this position.[47] The coming months would be devoted largely to study and planning designed to put the new organization on a sound footing.

VIII

While the Ridenour Report was primarily interested in the way the Air Force was organized for technology, it by no means ignored fundamental science. Indeed, it laid great stress on the need to strike a better balance between basic research and the more practical sciences. The Air Force, the report contended, could never hope to maintain an R&D program at the highest level of competence without a close association with the frontiers of science at the nation's colleges and universities.

The report recommended three steps by which such an association could be struck: (1) supporting a broad program in basic research by contract, (2) establishing an Air Force science fellowship program, (3) transforming the Air Institute of Technology into a first-rate graduate school of engineering. The Office of Air Research would play the key role in this

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45 Ridenour Report, *passim.*

46 Haywood, transcript of personal interview with Milner, 12 November 1959; transcript of meeting of the Air Staff, 3 January 1950.

47 Transcript of meeting of the Air Staff, 3 January 1950; Dept. of the Air Force General Order No. 9, 23 January 1950; Dept. of the Air Force Special Order No. 19, 24 January 1950; ltr., DDF to Commanding General, R&D Command, 23 January 1950. The organization was originally named the Research and Development Command (RDC) and was redesignated, on 16 September 1950, the Air Research and Development Command (ARDC). *Office of Aerospace Research Chronology*, OAR 62-8 (OAR Historical Division, 1962), p. 7.

three-pronged attack. Besides being charged with running the contract program and the fellowship program, the Office would serve as the link between research in the Air Force and teaching in the Air Institute of Technology.

The committee left little doubt as to the kind of research program it proposed the Air Force adopt. While the research would be of potential interest to the Air Force, it would be in broad general fields and would not be directed toward definite goals or applications. The research contract itself should not even specify what was to be investigated, "Except in terms proposed by the investigator." Moreover, contracts should be awarded "less with regard to the description of the project than with regard to the ability and promise of the principal investigator." And it would be at universities, "the great centers of fundamental research," where most of the investigators would be found. Clearly, then, the Ridenour Report proposed that the Air Force embark upon the systematic pursuit of fundamental science.[48]

IX

Early in 1950, General Schlatter and a small staff (one brigadier general and a handful of colonels) settled into a few rooms in the Moses Building, at 11th and F Streets, in downtown Washington, D.C. This, for the moment, was all that constituted the new R&D command.[49] Its job was to extract those R&D activities enmeshed in the Air Materiel Command and transfer them to the new organization. Since it was not always easy to distinguish between what belonged to R&D and what belonged to testing and support engineering and since AMC was by no means willing to stand idly by while others carved it up, the process of extraction proved painful, protracted, and prolonged. It took fifteen months, until April 1951, before the new command became operational.[50]

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[48] Ridenour Report, pp. 36-37, 80-83.

[49] Ltr., Maj. Gen. David M. Schlatter to Chief of Staff, USAF, 9 August 1950; ltr., Maj. Gen. Schlatter to Chief of Staff, USAF, 30 June 1950.

[50] Text of Briefing for General Schlatter, 3 January 1952, p. 2; memo, W. Stuart Symington to Gen. Hoyt S. Vandenberg, 28 January 1950; memo, James H. Doolittle to Gen. Hoyt S. Vandenberg, 20 April 1951; talk by Maj. Gen. D. L. Putt to WADC Laboratory Chiefs, Subj: "Organizational Philosophy of the Air Force," 2 April 1952, Williams, transcript of personal interview with Milner, 8 June 1960. Secretary Symington foresaw great difficulty in establishing the new command. "My apprehension is increased," he wrote to

Little of the resistance and animosity that accompanied the transfer of many of AMC's development activities marked the transfer of research, whether basic or applied. Research was easily distinguished, and everyone agreed it belonged in ARDC. There were, however, other questions about research, particularly about how research was to be organized, that had to be resolved. And these questions fully occupied ARDC for the next fifteen months.[51]

In the spring of 1950, General Schlatter handed the task of planning and organizing ARDC's research efforts to a former AMC officer, Brigadier General Donald J. Keirn. A tall, soft-spoken engineering officer, Keirn had extensive R&D experience, having served both with the Air Force's Propulsion Laboratory and the Atomic Energy Commission, and had thus been in a position to observe at close range the way research was managed. Armed more or less unofficially with the title of Deputy Chief of Staff for Research and in possession of General Schlatter's confidence, Keirn went about his work with imagination, if not with a necessary regard for the climate of opinion in the Air Force hierarchy.[52]

In the fall of 1950, in order to facilitate the transfer of facilities, General Vandenberg moved the main contingent of Headquarters ARDC to Wright Field.[53] It was here that Keirn began unfolding his plans for research. He found the Office of Air Research in what he considered an unhealthy state. The organization housed ten officers and forty-two civilians in a building of approximately 15 thousand square feet, only a third of which was devoted to research. (Set aside, however, was a

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(Footnote 50 Continued)

Gen. Vandenberg, in January 1950, "because . . . we are now going to take on those who don't want the Air Force to advance in the broad field of research and development." Two years later, General Donald L. Putt confirmed Symington's apprehensions. "[ARDC] had some very severe birth pains." he told a group of Air Force scientists. "There were a lot of people who were trying to insure that it was not born."

51 AMC Headquarters Staff, "Interim Study of the Division of Resources and Functions Between Air Materiel Command and Research and Development Command," 17 August 1950.

52 Maj. Gen. Donald J. Keirn (USAF, Ret.), transcript of personal interview with Mr. Samuel Milner, 15 December 1959. Keirn was a Colonel at the time of his appointment as Deputy Chief of Staff for Research, but was promoted to brigadier general shortly thereafter.

53 Ltr., Lt. Gen. K. B. Wolfe, DCS/M, Hq USAF, to Commanding General, ARDC, 13 July 1950; ltr., Maj. Gen. Gordon P. Saville to Commanding General, RDC, 13 July 1950; ARDC General Order No. 5, 8 November 1950; memo, General Hoyt S. Vandenberg to the Vice Chief of Staff, USAF, 12 October 1950.

sum of $1.25 million for a new laboratory to house the organization--an indication, at least, that AMC was not entirely indifferent to the fate of research.) The organization's main efforts, thus, were concentrated in running an extramural program, with its key scientific personnel devoting approximately 85 percent of their time to monitoring research contracts with industrial and educational institutions.[54]

Keirn proposed to change all this. For one thing, he felt that the Office had failed to create an academic atmosphere conducive to scientific thought; moreover, he failed to see how such an atmosphere could ever be created at Wright Field. Like von Kármán, Keirn wanted the Office of Air Research out of Wright Field--preferably in the Washington, D.C., area, which loomed at the moment as the most likely site for Headquarters ARDC.[55]

In a great many other details, Keirn's concept of what the Office of Air Research should be coincided with von Kármán's. He, too, envisioned the Office patterned after ONR. There would be both contract and in-house programs. The program would be run by a Directorate of Research, attached to Headquarters ARDC, under which would serve a staff of scientists. These scientists would, as it were, wear three hats. They would monitor a contract program, do in-house research, and perform staff supervisory duties. The capstone of Keirn's system was a large, modern, in-house laboratory. This was to be the Air Force's principal center of scientific activity, the source from which Air Force scientists would draw their inspiration and ideas.[56]

From all appearances, General Schlatter was sympathetic to Keirn's scheme, and Keirn began setting some of the groundwork. After conferring with Dr. Detlev Bronk, the President of Johns Hopkins, Keirn approached Harry Clifton Byrd, the President of the University of Maryland, on the idea of building an

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54 Office of the Deputy for Research, RDC, "The Role of the Office of Air Research," n.d., July 1950; Keirn, transcript of personal interview with Milner, 15 December 1959.

55 Memo, Col. D. J. Keirn to Brig. Gen. A. R. Maxwell, Subj: "Office of Air Research," 24 October 1950; Keirn, transcript of personal interview with Milner, 15 December 1959.

56 Brig. Gen. D. J. Keirn, "Directorate of Research -- Organization and Functions," 5 January 1951; Dr. Amos G. Horney, personal interview with author, 17 October 1961; Keirn, transcript of personal interview with Milner, 15 December 1959; Col. L. B. Williams, personal interview with Samuel Milner, 27 May 1960; Col. Edward H. Wynn, transcript of interview with Dr. Ernest Schwiebert, 30 November 1951.

Air Force laboratory on the university campus. Byrd was agreeable to the idea and even offered Keirn temporary quarters until the laboratory was constructed. Schlatter once again gave his blessing.[57]

At about this point, Keirn ran into some opposition. One of the first components of AMC to be transferred to ARDC was the Directorate of Research and Development, which included the Engineering Division and the Office of Air Research. Under ARDC it was renamed the Wright Air Development Center (WADC) and handed over to Major General Frederick R. Dent, an officer with an extensive experience in AMC. Dent had his own ideas about the Office of Air Research, mainly that it should be kept within his own command. While Dent was relentless in his determination to keep the Office at Wright Field, Keirn felt secure in the knowledge that General Schlatter was behind him. Moreover, as Keirn began to unfold his plans on an elaborate scale, the Office of Air Research began to take on less and less significance. As long as he was permitted to build a new basic research laboratory in the Washington area, the Office of Air Research could presumably remain at Wright Field as an applied research laboratory. And, in April 1951, this was, in effect, what was decided. Keirn was given the Office's contract activities. What remained of the Office was renamed the Flight Research Laboratory, given an applied research mission, and handed over to Dent.[58]

In June 1951, the transfer of AMC's R&D activities behind it, Headquarters ARDC moved to its permanent home in Baltimore, Maryland. (The hoped-for Washington location had to be abandoned because of the crowded conditions in that area.) Keirn's research group, attached to the Headquarters, now began to take shape. A Directorate of Research was established according to Keirn's specifications. Two divisions fell under the Directorate, the Systems Research Division and the Physical Sciences Division. Keirn, as the Director of Research, had control not only of basic research, but also of applied research and the early stages of development. As a start, the Directorate

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57 Keirn, transcript of personal interview with Milner, 15 December 1959; Williams, transcript of personal interview with Milner, 27 May 1960; Wynn, transcript of personal interview with Dr. Schwiebert, 30 November 1951; Haywood, transcript of personal interview with Milner, 12 November 1959.

58 Keirn, transcript of personal interview with Milner, 15 December 1959; AMC Notice No. 77, 3 April 1951; ltr., Brig. Gen. Ralph P. Swofford, Jr., to Commanding General, Air Development Force [WADC], 11 April 1951.

got in the neighborhood of 250 research projects that formerly belonged to the Office of Air Research, along with the projects' fiscal year 1952 budget. Also coming with the projects were sixteen people, some of whom Keirn had hired while at Wright Field. Altogether, a research staff of over two hundred was expected to run the Directorate.[59]

The Directorate never got off the ground. Keirn's difficulties appear to have begun, in May 1951, when, in a surprise move, the Air Staff replaced General Schlatter with Lt. General Earle E. Partridge, who had just completed a tour as the Fifth Air Force Commander in Japan. Partridge, while he tended in the beginning to look upon Keirn's program with the same favor as Schlatter, had little or no direct experience in R&D and was inclined to rely more on the advice of others than did Schlatter. Partridge looked particularly in the direction of Louis Ridenour for help.[60]

Ridenour, who had recently become the Air Force's first Chief Scientist, had been following Keirn's activities with some annoyance. Keirn's proposed research laboratory, which Ridenour labeled a "private scientific playhouse," was a special target of Ridenour's disapproval.[61] His opinions were molded while touring Air Force installations during the investigations of the Ridenour Committee. He found at that time ramshackle laboratories, manned by second-rate scientists, strangled in a maze of red tape; he had come to the conclusion that Air Force laboratories could never hope to attain the productivity of university laboratories. Ridenour can be--and was--accused of passing premature judgment on the Air Force's ability to engage in research; but he and others of his persuasion, notably General Doolittle, had other reasons, too, for opposing the construction of the laboratory. To staff such a laboratory and other federal laboratories, their argument went, with scientists of the required competence would mean draining the nation's universities of much of their top talent. Scientists should remain in universities, where they do their best work and contribute most to the nation. Moreover, Ridenour argued, there was little

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59 ARDC General Order No. 13, 13 June 1951; ltr., Brig. Gen. Floyd B. Wood, Chief of Staff, WADC, to Commanding General, ARDC, 31 July 1951; Harry S. Baer, Jr., "History of the Office of Scientific Research," July-December 1951, pp. 1-2.

60 *Dayton Journal Herald*, 24 May 1951; ARDC General Order No. 16, 24 June 1951.

61 Memo, Louis N. Ridenour to General Schlatter, Subj: "Office of Air Research," 12 October 1950.

reason for the Air Force to build facilities that already existed at universities and were readily available to it.[62]

In the summer of 1951, General Partridge asked Dr. Ridenour to study the Air Force's current planning for research and recommend to him the course such planning should take. Ridenour toured the Air Force's research facilities and talked to the administrators in charge during a brief swing through Dayton and Cambridge, Massachusetts, the site of the Cambridge Research Laboratory. In a memorandum dated 20 July 1951, Ridenour conveyed his recommendations to Partridge. He forcefully counselled against Keirn's plans for a new laboratory (". . . even a good government laboratory," he wrote, "is usually inferior to its civilian counterpart"). Besides, the Air Force's research interests were now so vast that "the Air Force can never hope to perform in its own establishment more than a tiny fraction of the work in which it will be interested." The answer, as he saw it, was to establish a contract program, mainly with the universities of the country. The program could be managed by a small scientific staff attached to Partridge's headquarters. As for the research facilities that did exist, they could be used for research that could not be bought or not be performed as well at educational institutions--research which only the Air Force had the facilities for, research which required extensive flight testing, and research which was highly classified.[63]

Keirn was taken aback by Ridenour's recommendations. It was not so much the nature of the recommendations that was surprising--he had expected views contrary to his own--as was the source from which they came. All along he had been laboring under the assumption that his ideas on how research should be established were shared by the Air Force's principal scientific advisers. And Keirn's attitudes about research, particularly those concerning in-house research, were indeed closely akin to von Kármán's. But von Kármán's attitudes were not so firmly established in the Air Force as Keirn may have believed. Seven years at the head of the Scientific Advisory Board had been wearing on von Kármán; he yearned for more time to think and sought what was for him the more congenial pursuits of applied mathematics. He was thus, of late, spending

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62 *Ibid.*; Williams, transcript of personal interview with Milner, 27 May 1960; Dr. Lloyd A. Wood, personal interview with author, 16 November 1961; memo, James H. Doolittle to General Hoyt S. Vandenberg, 20 April 1951.

63 Memo, Louis N. Ridenour to General Partridge, 20 July 1951.

less time in Washington and correspondingly more at his home in Pasadena. He was not in the thick of things, and it was relatively easy for Ridenour, from his Chief Scientist's perch, to step into the breach and make his own, and quite different, ideas felt.[64]

Soon after Ridenour's July memorandum, it was evident that Keirn's counsel had fallen out of favor. On 10 August, Partridge pulled the Physical Sciences Division from under the Directorate of Research, renamed it the Office of the Assistant for Research in the Basic Sciences, and restricted its mission to extramural basic research. In September came the denouement: the plan to establish a large internal laboratory was officially dropped. Keirn left for a new job on 15 September, missing by a week the total dismemberment of the Directorate of Research. On 29 October, the name Assistant for Research in the Basic Sciences was dropped in favor of the Office of Scientific Research. Finally, in one of his last acts before he left the Air Force for private industry, Ridenour recommended that Colonel Oliver G. Haywood, whose leanings were closely in line with Ridenour's, be given the job of heading the new research agency--a recommendation that Partridge readily acceded to.[65]

Louis Ridenour, then, had fashioned research in the Air Force to his own satisfaction, if not to the satisfaction of everyone. When von Kármán heard of Ridenour's impending departure, he reportedly quipped, "Louis is performing his greatest service to the Air Force--he is resigning."[66] Von Kármán, and others, had reason enough to be chagrined. The Air Force, by choosing the course it did, by adopting the contract as the sole mechanism for acquiring fundamental knowledge, was admitting that it could not itself maintain adequate basic research laboratories. Von Kármán refused to make such an admission; indeed, while he accepted the proposition that a contract program was necessary, he insisted that an in-house program was equally so. But, whatever the merits of the chosen course, a course had been chosen, and the Air Force, after seven years of planning and debating, was now poised to embark in earnest upon a program in basic research.

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64 Williams, transcript of personal interview with Milner, 27 May 1960.

65 *History of ARDC*, 1 July-31 December 1952, I, p. 94; Baer, "History of OSR," p. 3; memo, Col. O. G. Haywood to Gen. Partridge, 6 August 1952; Wynn, transcript of personal interview with Dr. Schwiebert, 30 November 1951.

66 Williams, transcript of personal interview with Milner, 6 June 1960.

Chapter II

THE HAYWOOD YEARS

Oliver Haywood arrived at Headquarters ARDC, in September 1951, when the research office was still going under the name of Assistant for Research in the Basic Sciences. The office was not yet a going concern. A scientific staff scarcely existed. What there was of a program had been inherited from the Office of Air Research and was, in Haywood's opinion largely uninspired. Even the name of the office appeared unsuitable to Haywood, and he changed it, the following month, to Office of Scientific Research (OSR), this having the exact connotation he desired. Haywood himself assumed the title of Chief of Scientific Research.[1]

A forty-year-old West Pointer who had finished first in his graduating class, Haywood soon made his presence felt in other ways. General Partridge gave him a free hand in establishing and running the research office, and Haywood was not reluctant to exercise this authority. He set to hiring and firing personnel, constructing an organic structure for the office, and formulating an operating philosophy. With considerable experience in R&D matters (notably with the Atomic Energy Commission), with the academic credentials (M.S., Harvard; D.Sc., M.I.T.), if not the scientific achievements, to match those of the men he would be in daily contact with, Haywood felt both secure and at home in a scientific milieu. Moreover, he was thoroughly familiar with the problems facing Air Force research. In 1949, he traveled with the Ridenour Committee on its tour of R&D installations and helped write its report. The frame of reference he brought with him was largely constructed while he served with this committee. And he harked back to it in fashioning OSR. The original form that OSR took was largely that which Haywood gave it.[2]

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[1] Ltr., Col. Oliver G. Haywood to Mr. Samuel Milner, 9 February 1960; O. G. Haywood, draft of speech at I&AE Meeting, 31 March 1952; ARDC General Order No. 2, 5 January 1952.

[2] Ltr., Haywood to Milner, 9 February 1960.

II

The kind of program that OSR would ultimately support was not merely dependent on the Air Force's needs; in the final analysis, the particular view that Haywood and his staff took of basic research was as important as any other factor shaping the program. And this factor, in turn, largely determined the organization's mode of operations.

The point from which Haywood's thinking on research began was that a basic research program was not readily amenable to very deliberate planning. One could not sit down and logically construct a program and then go out and requisition the research he wanted done. In point of fact, this was the way the Air Force had been accustomed to doing things. Requirements were established; if it was found, as each requirement was broken into bits and pieces, that existing materials and techniques were inadequate to the task at hand, the laboratories were simply instructed to come up with the necessary materials and techniques. This approach had its place, but it also had its limitations. The trouble was that when it yielded a solution it was only to the assigned problem. A well-conceived basic research program, in Haywood's view, would lend itself to a broad range of applications. But to do so it could not be slavishly subservient to requirements. And herein lay another difficulty with the traditional approach. Basic research was an attempt to grapple with the unknown. What its results might be was virtually unpredictable. How, then, could requirements be established for unknown elements? If anything, the reverse was more logical: the Air Force's future requirements might very well be suggested by discoveries in fundamental science.[3]

Haywood saw another difficulty to the traditional approach. Basic research, unlike applied research and technology, was not utilitarian in its inspiration. Scientists sought new knowledge not so much as a result of external pressures but from an inner need. Since the quest for knowledge sprang from within, it followed that the scientist, the man doing the research, was

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[3] Col. Oliver G. Haywood, Jr., "The Air Research and Development Program," *Journal of Engineering Education*, XLIII (March 1953), 375; memo for the record, Dr. Walter Leighton, 3 June 1953; Col. Oliver G. Haywood, "1953 Budget Presentation -- Research," 2 November 1951; Nick A. Komons, *A Decade of Chemical Research*, OAR 62-7 (OAR Historical Division, 1962), pp. 9-10.

the best man to decide what research should be done. And Haywood proposed to allow him to do just that.[4]

OSR, then, would function somewhat like a modern, privately endowed foundation. It would receive unsolicited research proposals from interested members of the scientific community, judge each of them on its merits, and support those that appeared most promising. (Of course, whether a proposal was promising or unpromising often depended on from where it came. As one OSR research administrator put it, "We support the scientist rather than the project.") But unlike a private foundation, OSR applied, in addition to scientific merit, one more criterion to each proposal: relevancy to the Air Force's needs.[5] The way OSR functioned was perhaps expressed most succinctly by another OSR administrator:

> I don't have to manage the scientist. As soon as I determine that he is working in an area of interest to the Air Force . . . I need only assure myself that he is one of the best men in this field. Then it is simply a matter of letting him work on what he wants to work on--what he'd work on anyway, if he had the money. I don't have to go out to make him work, don't have to check on him every month to be sure he's doing what he doesn't want to. I need only visit him once in a while to get his input.[6]

The question of receiving a scientist's "input," however, was not entirely answered by monitoring. A monitor might be a storehouse of information, but to how many others could he convey it? The solution, of course, was simple, and Haywood struck it when, in paraphrasing Faraday, he said: ". . . there are three stages of research: to begin it, to complete it, and to publish it." And by this Haywood did not mean the submission of periodic reports; he meant publication in the learned journals. Reports prepared solely to satisfy contractual requirements had all too frequently left Haywood with the impression of slipshod work. But when a contractor wrote for publication in a professional journal, he knew he was facing the

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4 Ltr., Haywood to Milner, 9 February 1960; Dr. Merle M. Andrew, personal interview with author, 21 November 1961.

5 Brochure, "Office of Scientific Research, Air Research and Development Command," March 1952; ltr., Haywood to Milner, 9 February 1960; Dr. Lloyd A. Wood, personal interview with author, 16 November 1961; Haywood, "1953 Budget Presentation -- Research," 2 November 1951.

6 Col. William O. Davis, transcript of personal interview with Dr. Ernest Schwiebert, 8 November 1956.

scrutiny of his peers and usually put his best foot forward. Haywood had another, and equally important, consideration. Even if the two were equal in quality, the journal was still a more effective means of communication than the government report, which could not reach the wide audience of the journal without a considerable and costly effort in distribution. Thus, Haywood encouraged OSR's contractors to fulfill their reporting requirements by submitting, in lieu of a formal report, the text of a published paper.[7]

III

As OSR took shape, its organic structure began to reflect the scientific disciplines that it supported. Five functional divisions were organized--Chemistry, Mathematics, Physics, Solid State Sciences, and Fluid Mechanics. Haywood intended to bring in civilian scientists to head the divisions. But, with such men in short supply and with restrictive hiring practices in force at the time, he resorted initially in many cases to military officers with scientific backgrounds.[8]

One position that he did fill with a civilian was that of Chief of the Chemistry Division, which went to Dr. Amos G. Horney, a chemist and former Dean of Liberal Arts at the Associated Colleges of New York, who had been a holdover from General Keirn's regime.[9] Major Seymour Schiller headed the Physics Division for approximately two years and finally gave way to a civilian physicist, William J. Otting. The Mathematics Division went initially to Major Dalton Wright. When Wright departed at the end of 1952, Haywood arranged for a Washington University of St. Louis professor, Dr. Walter Leighton, to take the post while, at the same time, retaining his job at the university. The arrangement was to be temporary, until such time as Leighton could leave his teaching post. Ultimately, in the fall of 1954, Leighton decided not to make the move to Baltimore, and Dr. Merle Andrew, formerly of the National Bureau of Standards, who had been with ARDC since 1952, took over the direction of the division.

Haywood's original plans provided for a metallurgy division. While such a division never took shape, Major Michael Zubon

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7 Haywood, "The Air Research and Development Program," p. 376; Haywood, personal interview with author, 18 November 1965.

8 OSR Organizational Chart, 28 April 1952; brochure, "Office of Scientific Research, Air Research and Development Command," March 1952.

9 Komons, *op. cit.*, p. 7.

was given responsibility for that area in the fall of 1951. Early the following year, however, Zubon was moved over to head the newly formed Fluid Mechanics Division, and what was to be the metallurgy division took organic form as the Solid State Sciences Division. Charles F. Yost, another former member of the Bureau of Standards, was put at the head of this division.[10]

A sixth division, differing from the others in that it had no research program of its own, was established in Pasadena, California, in October 1951. Named the Western Regional Office, and renamed the Western Division a year later, the office was entrusted with providing "liaison between ARDC and the scientific talent and research facilities in the western area of the United States." The division's origins, largely revolving around the presence of one man, Dr. Morton Alperin, bear recounting. Alperin had been one of Theodore von Kármán's students at Cal Tech and, after securing his Ph.D., followed von Kármán to Washington, where his old mentor put him to work as one of his assistants on the Scientific Advisory Board. Then, in the late forties, when von Kármán slackened his pace and began spending most of his time in Pasadena, the Air Force, wishing to keep its access to von Kármán open, decided to provide him with a small staff in California. Alperin was chosen to head the staff. By the time AFOSR was established, however, von Kármán began leading a more active life (he would soon go to Paris to become Chairman of NATO's Advisory Group for Aeronautical Research and Development), and the need for Alperin diminished. But both von Kármán and Haywood wanted to keep Alperin in the Air Force and judged that he could still be used to advantage on the West Coast. Haywood thereupon hired him and established the Western Regional Office specifically for the purpose of taking advantage of Alperin's special talents. While the office's function was at first somewhat nebulous and while the other division chiefs often felt that Alperin was impinging on their domain, the western office ultimately evolved, as will be shown, into a unique and useful instrument with a program all its own.[11]

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[10] Dr. Merle M. Andrew, telecon with author, 6 August 1965; Dr. Amos G. Horney, telecon with author, 6 August 1965.

[11] ARDC General Order No. 49, 11 October 1951; ARDC Regulation No. 21-1, 12 October 1951; memo, Col. Oliver G. Haywood to Lt. Gen. E. E. Partridge, 6 August 1952; memo, Haywood to Partridge, 25 February 1953; ltr., Haywood to Milner, 9 February 1960; ltr., Dr. William O. Davis to Nick A. Komons, 4 November 1965.

In addition to the program in the physical sciences, Haywood felt that OSR should support a program in the life sciences. But lacking a qualified staff in that area and unwilling to take on more people, he hesitated in establishing a life sciences division. Existing in ARDC Headquarters at the time was a Directorate of Human Factors (its duties were strictly supervisory) with a staff that could serve OSR's purposes. Haywood struck an agreement with Colonel Don Flickinger, the Director of Human Factors, whereby Flickinger's directorate would act as a division of OSR in the life sciences. This arrangement, as Haywood expressed it, gave OSR "a method for handling contracts for basic work in the life sciences out of Baltimore without any increase of staff in either [Colonel Flickinger's] office or mine."[12]

On one more occasion Haywood's improvising served OSR well. Under the Air Force's procurement directives, an organization such as OSR could not possess procurement authority; that authority belonged to the Directorate of Procurement, ARDC, and to ARDC centers to which that authority was delegated. Haywood felt, however, that it was of vital importance that the individuals responsible for handling OSR's contracts be in direct, day-to-day contact with OSR research administrators.[13]

The Armed Services Procurement Regulations, and the contract, the principal instrument for procurement, were originally designed fo the purchase of hardware. Gradually, the contract itself, a cumbersome thing at best, was revised to better fit the research situation. This improvised instrument, while never wholly satisfactory for procuring research, was capable of being lived with if administered by a procurement staff that thoroughly understood the special requirements of research.[14] And Haywood, who had seen the work of ARDC's predecessor, the Engineering Division of AMC, hampered by an ineffective procurement office, resolved that the same thing would not happen to OSR.

Haywood's problem fell on the understanding ears of Colonel John R. Martin, the Director of Procurement, ARDC. While,

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12 Dr. David Bushnell, "Origins of the AFOSR Life Sciences Program," unfinished manuscript, ca. 1961; memo, Haywood to Partridge, 6 August 1952; ltr., Haywood to Milner, 9 February 1960.

13 Ltr., Haywood to Milner, 9 February 1960.

14 Nick A. Komons, *Development of the Air Force Research Grant Program*, OAR 63-11 (OAR Historical Division, 1963), pp. 3, 5.

as mentioned, OSR could not possess procurement authority as long as it remained a part of Headquarters ARDC, there was nothing in the regulations to prohibit the individuals charged with handling OSR's contracts from being directly under Haywood's aegis. Accordingly, in September 1952, Martin worked out a plan whereby a sub-office of the Directorate of Procurement, whose sole task was to procure basic research, was established in the physical vicinity of OSR. The Contracts Section, as it was called, soon established a fine working relationship with OSR's technical staff, and Haywood's procurement problems were solved as well as circumstances permitted.[15]

Besides filling the divisions with competent people, Haywood had to think of bringing in a senior scientific assistant and adviser, namely a chief scientist. When Haywood first arrived, the senior individual in the organization was Dr. Selby Skinner, a Keirn holdover who was in fact functioning as Chief Scientist. Skinner's credentials as a scientist were unimpeachable, but Haywood found him wanting in administrative ability and persuaded him to return to academic life. He offered Skinner's position to Dr. Francis H. Clauser, a Johns Hopkins aerodynamicist who was also a member of the Air Force Scientific Advisory Board. Clauser could not see his way clear in leaving the University at the time, even on a year's sabbatical, but he consented to serve as a part-time scientific adviser. Haywood never did hire a full-time chief scientist, probably preferring to be his own chief scientist. For general guidance, however, he did rely on the Air Force Chief Scientist and on the Panel on the Physical Sciences of the Air Force Scientific Advisory Board, headed by Dr. George Kistiakowsky.[16]

IV

OSR had been established as a purely domestic organization; its job was to tap the scientific resources within the borders of the United States. But the scientific community was, after all, a worldwide community, to which the American contingent was a late, though brilliant, addition. Under the circumstances,

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[15] Memo, Haywood to Partridge, 25 February 1953; ltr., Haywood to Milner, 9 February 1960; memo. Haywood to Partridge, 25 February 1952.

[16] ARDC General Order No. 37, 23 August 1951, ltr., Oliver G. Haywood to Samuel Milner 18 April 1960, memo. Haywood to Partridge, 6 August 1952.

the thought that its research program should perhaps look beyond national frontiers did not escape the Air Force for long. Indeed, in January 1952, the Air Staff threw the question of whether the Air Force should expand its research operations into Western Europe squarely into the lap of ARDC.[17]

Haywood opposed expansion, especially in the form of a European office of ARDC. He told General Partridge that the Air Force was only beginning to tap the potential of American science; a European office should, if anything, be deferred until the American operations had matured. He also cautioned Partridge that whoever was sent to Europe to explore the possibility "would be enamoured of the place and want to establish an office," whereupon Partridge decided that Haywood was just the man to send to Europe to report on the question.[18]

In March 1952, Haywood, accompanied by a team of military and civilian experts, embarked for Europe. The group visited several European cities and conferred with both military and diplomatic officials, including General Lauris Norstad, the Commanding General of the U.S. Air Force in Europe, and Theodore von Kármán, who was lecturing at the Sorbonne at the time and who counselled in favor of the office not only because it would be of direct benefit to the Air Force, but also because it would help "revive the research and development activities of the NATO countries."[19] Whether enamoured of Europe or not, Haywood changed his mind. He recommended that a European office be established in Brussels, Belgium--a recommendation that was fully implemented on 14 August 1952.[20]

The European Office, Air Research and Development Command (EOARDC), was essentially a procurement and monitoring office. It had neither a research program nor research funds. All European research proposals passed through its hands, its staff giving them a preliminary screening. Those proposals that survived this screening were sent to OSR, and its staff, in turn, kept those that fitted in the basic research program and sent the remainder to the appropriate ARDC laboratory or center. Those proposals that were ultimately accepted were

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17 *History of the Air Research and Development Command*, 1 July-31 December 1956 (ARDC Historical Division), I, 210, hereinafter cited as *History of ARDC*.

18 Ltr., Haywood to Milner, 9 February 1960.

19 *History of ARDC*, 1 July-31 December 1956, I, 213-16, 218.

20 Ltr., Haywood to Milner, 9 February 1960; ARDC General Order No. 48, 14 August 1952; ltr., Davis to Komons, 4 November 1965.

financed by the agency in the United States that accepted them. The European Office, however, had the responsibility of monitoring all active European contracts.[21]

EOARDC's position within ARDC Headquarters was not altogether clear during this period. Haywood did not feel that the office belonged in OSR, believing that its main business would be in applied research and end items, and recommended to Partridge that it be made responsible to the Deputy for Development, ARDC. But Partridge was unpersuaded, directing that the European Office remain under OSR for one year, at which time transfer to the Deputy for Development would be reconsidered.[22]

V

It was in the nature of the OSR scientific program, touching as it did so many aspects of modern science, that it could not be managed entirely by a permanent staff of insiders. The division chiefs and their associates, many of whom were competent scientists in their own specialities, could not be expected to pass judgment on every proposal that crossed their desks; modern science was too complex for that. One man could no longer become expert in even a single traditional discipline. OSR needed a bevy of experts for each discipline. Such experts, however, were not required on anything approximating a full-time basis (and they could not have been had on such a basis even if they were). The job of a given group of advisers might not be more consuming than judging the relative merits of a handful of research proposals. OSR needed scientific advice periodically and from a wide variety of sources, not unceasingly from a single source. This was, in general, characteristic of the scientific needs of the federal government.

Of course, the Air Force was not without scientific advisers. The Scientific Advisory Board had been in existence since 1944, was broadly based, and was available to OSR; however, it could not possibly undertake the kind of detailed, contract-by-contract appraisal that OSR required. The SAB was not equipped to go

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[21] ARDC General Order No. 48, 14 August 1952, memo, Haywood to Partridge, 25 February 1953, Haywood, personal interview with author, 18 November 1965

[22] *History of ARDC*, 1 July-31 December 1957, II, 274.

beyond its traditional role of appraising the broader scientific problems of the Air Force.[23]

The Army and the Navy had satisfied their need for scientific advice in different ways. The Office of Naval Research established an advisory group for each scientific discipline, but it also had a large internal staff that screened most of the Office's research proposals itself. The Office of Ordnance Research, lacking the large scientific staff of the Navy, relied exclusively on the National Research Council to screen its proposals. Haywood wanted to steer a course somewhere between the Army and the Navy. OSR, like the Office of Ordnance Research, did not have a large scientific staff. CNR's approach was, therefore, closed to it. On the other hand, Haywood was unwilling to follow the course of the Army, feeling that this would lead to OSR losing control over its program.[24]

Meanwhile, the Chemistry Division, under the direction of Dr. Amos Horney, had attacked the problem its own way. Largely anticipating the need for consultants, Horney arranged for Cornell University to provide the Chemistry Division with an advisory group even before OSR had been officially established.[25] Haywood might well have followed Horney's example and extended similar contracts to other universities for the remaining divisions; but, while allowing Chemistry to follow its own path, he feared that the practice of getting advice in a particular discipline from a single university might, if it became general, leave OSR open to charges of bias from other universities.[26] What was good physics at Berkley might not be equally good physics at Cambridge. So went his reasoning.

There were other paths open, each with its own set of disadvantages. Haywood could have hired advisers as part-time employees; but this would have required in the neighborhood of thirty manpower slots which OSR did not have and, presumably, if it had, would have been unwilling to use for such a purpose. Then, too, each adviser could have been contracted for individually. Manpower slots would not have been involved; however, under the procedures of that day, each such contract required the personal approval of the Secretary of the Air Force. This made it much too cumbersome a procedure.

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[23] Colonel O. G. Haywood, draft of speech to the I&AE Meeting, 31 March 1952.

[24] Ltr., Haywood to Milner, 9 February 1960.

[25] Komons, *op. cit.*, pp. 13-14

[26] Ltr., Haywood to Milner, 9 February 1960.

Haywood gave some thought to having a group of scientists form a corporation. OSR could then contract the group to furnish advisory services. The procedure appeared to be well within legal bounds, but it had never been done before, and ARDC's legal staff was reluctant to give it sanction.[27]

Haywood finally approached the National Research Council with a plan. OSR would contract the Council to review its proposals in much the same way the Army had done, but with these exceptions: OSR would participate in the selection of the advisory committees; the views of the individual advisers would be made known to OSR; OSR would pay the advisers for their services. The first two points were reconciled easily enough; the last, however, proved irreconcilable.[28] Dr. Detlev W. Bronk, the President of the National Academy of Sciences, of which the National Research Council was a part, insisted that the advisers should not be paid. Indeed, he felt very strongly that scientists should contribute their services to their government free of charge. He himself had served the federal government without compensation during the Second World War. Bronk's views on the matter may have appeared somewhat bizarre to some members of the scientific community, especially those who lacked Bronk's personal means, but Bronk was not guided by his prejudices alone. With something like two thousand scientists freely contributing their services to the National Research Council, it was understandable why Bronk was determined to hold to the letter of the National Academy's charter. A break in this policy and the National Academy's hitherto ample supply of free scientific talent might dry up over night.[29]

Haywood had equally good reasons, however, in wanting the Air Force to pay its way. He felt that the advisory committees would function best if they possessed a measure of stability and continuity. That such would not be the case if the committee members went unpaid was certain. Since a man could not be expected to serve without pay for a prolonged period, Haywood reasoned that committee members would probably be terminating their services just as they were beginning to fully understand the nature of the OSR program.[30]

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[27] *Ibid.*

[28] *Ibid.*; ltr., Col. Oliver G. Haywood to DCS/D USAF, 6 July 1953.

[29] Memo, Col. Oliver G. Haywood to Gen. Earle E. Partridge, 16 January 1953.

[30] Ltr., Haywood to Milner, 9 February 1960.

An impasse was avoided during the early stages of the negotiations when Haywood suggested that the National Research Council undertake a formal study to determine the kind of advisory group system that would be suitable for OSR's purposes. Haywood was disposed to believe that any objective study of the problem would support the conclusions he had already reached. And his suggestion appeared to carry with it an implicit willingness on his part to accept the recommendations of the study. In all likelihood, Bronk accepted this suggestion with such an understanding.[31]

In due course, the question of advisory groups was entangled with another question that had been giving Haywood some pause--the impact of the Air Force's research efforts on the nation's colleges and universities. By the widest stretch of the imagination, the two questions had only the vaguest intrinsic connection. But because they were being considered at the same time, and because the National Academy of Sciences became involved with both of them, they were eventually enmeshed with each other.

That Haywood should be concerned with the health of American universities was natural enough; the Air Force was, after all, greatly dependent upon them. General Partridge, in expressing this dependence to Dr. Bronk, wrote, "The universities of the Nation have become as essential to the Air Force research and development programs as Air Force operated laboratories."[32] There was, however, a degree of danger in this dependence, not so much to the Air Force as to the universities. It was conceivable that a federal agency, with millions to spend on research, could upset a university's delicate balance between research and teaching. It was also conceivable that the allure of government funds could subject universities to severe competition, not only for these funds but also for the scientific talent that could attract them. These were some of the dangers that could accompany a university contract program.[33]

Of course, they were not the kind of problems that were amenable to unilateral attack by the government, and even if they were, OSR could scarcely have solved them alone. But

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[31] Ltr., Col. O. G. Haywood to Dr. Detlev W. Bronk, 23 May 1952, Haywood, personal interview with author, 18 November 1965.

[32] Ltr., Lt. Gen. E. E. Partridge to Dr. Detlev W. Bronk, 11 June 1952.

[33] Ltr., Senator John C. Stennis to Deputy Secretary of Defense William C. Foster, 11 June 1952, ltr., Dr. Marston Morse to Dr. Walter Leighton, ca. August 1953, Haywood, "The Air Research and Development Program" 377.

both Partridge and Haywood felt this fact did not absolve OSR of responsibility. They wanted, therefore, a study conducted to bring these problems into sharp focus. OSR could then design its policies so as to give balanced consideration to "the proper role of universities as educational and research institutions, the needs of the Air Force, and the overall good of the Nation." After Haywood sounded out Dr. David T. Griggs, the Air Force's Chief Scientist, and Dr. George B. Kistiakowsky on the study and got their approval and support, General Partridge asked Dr. Bronk to have the National Academy of Sciences undertake the study.[34]

No sooner had Partridge written to Bronk than signs of a deep-seated opposition to OSR sponsoring such a study began to appear. Dr. W. W. Rubey, the Chairman of the National Research Council, had sensed the opposition, particularly on the Research and Development Board, and gave Haywood fair warning. Haywood, who was out of the Washington-Baltimore area almost continuously from late June to early August, let the matter go unattended.[35] It thus came almost as a total surprise when, on 18 July, Lt. General L. C. Craigie, the Deputy Chief of Staff for Development, Headquarters USAF, severely criticized the proposed study. Craigie also directed some severe criticism at the advisory group study.

The nub of Craigie's criticism was that the Air Force had no role in the support of university research; this was the job of the National Science Foundation. The Air Force did not support university research, according to Craigie, it bought university research. Hence, the Air Force had no direct concern with the impact of federal research support on universities. But, in any event, Craigie continued, the question was receiving "widespread attention" in the Department of Defense. He asked that General Partridge withdraw his proposal to the National Academy.[36]

Craigie was equally outspoken on the advisory group study, although he did not go so far as to recommend that it be cancelled. And while he did not become entrapped in fine semantic distinctions this time, his opposition, nevertheless, was rooted

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[34] Ltr., Haywood to Milner, 9 February 1960, memo, Colonel Haywood to General Partridge, 16 January 1953, ltr., General Partridge to Dr. Bronk, 11 June 1952.

[35] Memo for the record, Colonel O. G. Haywood, 12 August 1952.

[36] Ltr., Lt. Gen. L. C. Craigie to the Commanding General, ARDC, 18 July 1952.

in semantics. The trouble could be traced to some imprecise language used by Haywood, on 23 May, in a letter to Bronk. In the letter, Haywood spoke of the National Research Council assisting in establishing an advisory group system for the "Air Force," whereas he actually meant OSR. Craigie pounced on this, lecturing Partridge that the Scientific Advisory Board already had the responsibility of providing scientific advice to the Air Force. Of course, Partridge was free to establish a group that was advisory to his command only. He recommended that this be made clear to Dr. Bronk.[37]

Haywood returned to Baltimore in August believing that most of the difficulties were due to semantics. Brigadier General James McCormack, Jr., the ARDC Deputy Commander, was more inclined to look at Craigie's opposition as part of a continuing pattern of poor relations between ARDC and DCS/Development. (He sent Craigie's letter to General Putt with the comment, "Here is the result of our efforts in one area of the problem of relationships with DCS/D on Basic Research.")[38] On 6 August, Haywood finally took Rubey's suggestion and went to the Research and Development Board. He found the opposition to the study on federally supported research particularly strong. The Army and Navy members of the RDB were somewhat chagrined because the Air Force had not taken the trouble to consult them before acting. Haywood also found that there was some misunderstanding among the RDB as to the intent and scope of the study. When Haywood showed Partridge's letter of 11 June to some of the members, they were surprised by the innocuousness of the proposal.[39]

Everyone on the RDB, however, was not convinced that the Air Force should properly be in the business of sponsoring such a study. One member, Dr. William H. Fitzpatrick, felt that the Air Force was being overly paternalistic. He told Haywood that universities were mature enough to take care of themselves, and even if some were not, they probably felt that they were. Another member of the Board, Dr. Charles C. Price, repeated the same semantic distinction that Craigie had made in his letter to Partridge--the Department of Defense did not support research, but bought it. Haywood felt that this

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37 *Ibid.*

38 Ltr., Lt. Gen. E. E. Partridge to Lt. Gen. L. C. Craigie, 11 August 1952, memo, Brig. Gen. James McCormack, Jr., to Lt. Gen. D. L. Putt, 29 August 1952.

39 Memo for the record, Haywood, 12 August 1952.

argument was to some extent a fiction, and he believed that both Price and Fitzpatrick felt that it was, too. But, in any event, it was clear enough to Haywood that, whatever the reasons, both Price and Fitzpatrick would welcome the Air Force withdrawing its proposal.[40]

Meanwhile, with this kind of opposition building up in the Department of Defense, the NRC decided to stop all work on the study. At the same time, however, the study began picking up support from other quarters. The Atomic Energy Commission saw a great deal of merit in the study (Commissioner T. Keith Glennan, when told of the study was reported to have shouted, "Three cheers for the Air Force"), submitted a proposal to the NRC for a similar study, and loaned the NRC one of its people to assist in the research. The National Science Foundation began talking of a similar study, as did several private foundations.[41]

The effect federally supported research might have on universities had obviously been in the back of many people' minds. No one, however, was doing anything about it. The Partridge letter was the first concrete act in this direction and it had a kind of a catalytic effect, prodding those who saw some cause for concern into action. Bronk in particular was determined to go ahead with the study, with or without the Air Force's participation. And, indeed, by the second week in August, Partridge decided that, considering Craigie's opposition, it would be best for all concerned if he withdrew his proposal. He informed both Bronk and Craigie of his intention, telling the latter, however, that "the ARDC has implemented and must continue to implement research policies and procedures based, in part, on their probable impact on the universities concerned." And Bronk, while smarting from the withdrawal, made good his intention to go ahead with the study on his own, but with the emphasis slanted toward federal research in general, rather than toward the Air Force.[42]

Meanwhile, the advisory group study was being conducted as planned, although Bronk was still bristling over Craigie's letter. Even as late as January 1953, six months after the event, Bronk could not think of the letter with any show of calm (he described

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40 *Ibid.*

41 *Ibid.*

42 Ltr., Lt. Gen. E. E. Partridge to Dr. Detlev W. Bronk, 11 August 1952, ltr., Gen. Partridge to Gen. Craigie, 11 August 1952.

it to Haywood during a casual encounter as "The worst example of bureaucratic fostering of socialism in this democracy that I have ever encountered"). Bronk had in all likelihood managed to see a copy of the letter; what disturbed him most was Craigie's position on advisory groups. He interpreted Craigie's position to be that ARDC could not seek scientific advice from the National Academy or any other outside agency, but had to go to either the SAB or advisers approved by Headquarters USAF. In addition, Bronk was sorely piqued by the fact that Craigie had not sent him a copy of his letter, which he felt he should have gotten and which he now proceeded to demand. He told Haywood that he would not stop short of an official investigation to get one.[43]

Haywood saw that something had to be done to placate Bronk and he told Partridge so. Partridge, in turn, wrote Craigie, cautioned him that "any misunderstanding with Dr. Bronk could have serious repercussions on the Air Force research and development," and suggested a meeting between Bronk and Craigie. In this way, a potentially serious situation was headed off. Nevertheless, the affair had not exactly promoted Haywood's chances of getting the kind of advisory group system he wanted. Indeed, Bronk was even more determined now to make his views prevail, especially those on compensation. Thus, even before the NRC had completed its study, Haywood began looking elsewhere for an advisory group system.[44]

In early 1953, Haywood approached the Research Corporation of New York City with essentially the same proposal that he had originally made to the NRC. Not only was the Research Corporation interested, but after a few meetings with Haywood all the details had been ironed out except for the formality of clearing the contract with the corporation's board. Then, in May, the Research Corporation did a complete aboutface. It refused to undertake the venture under any conditions. Once again, opposition to the arrangement in the Department of Defense had contributed to the outcome. Dr. Joseph W. Barker, the President of the Research Corporation, while meeting with Deputy Secretary of Defense Roger M. Kyes on another matter, casually brought up the subject of OSR's advisory group. This was the first time Kyes had heard of the proposed contract, for Haywood,

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[43] Memo, Haywood to Gen. Partridge, 11 January 1953.

[44] *Ibid.*; ltr., Lt. Gen. E. E. Partridge to Lt. Gen. L. C. Craigie, 19 January 1953.

certain of ARDC's right to consumate such an agreement, had neither briefed the Defense Department on the matter nor sought its approval. Nevertheless, while totally in the dark as to OSR's needs and the details of the contract, Kyes did not hesitate to inform Barker that the Defense Department would look with disfavor on such an arrangement. Caught in the middle of things, Barker backed out. "In my two years as Chief of OSR," Haywood wrote some time later, "I ended up unable to work out a comprehensive contract to cover all our advisory groups."[45]

Haywood thus turned from the idea of one comprehensive contract with a single institution to a number of contracts with several institutions. Life Sciences, following on Chemistry's heels, had already made arrangements for Johns Hopkins to provide advice in the biological sciences. And, ultimately, the remaining divisions made similar arrangements with other institutions to satisfy their needs.

VI

The Ridenour Report, it will be recalled, had recommended that the Air Force, in mobilizing science to the service of military technology, should, besides supporting basic research at institutions of higher learning, establish a fellowship program and transform the Air Institute of Technology into a first-rate graduate school of engineering.[46] The launching of a contract program by OSR had met one of these recommendations, and Haywood, at spare moments, gave some thought and attention to the report's two additional recommendations. But, for a variety of reasons, his efforts in this direction were unavailing.[47]

The proposed fellowship program had failed to strike an enthusiastic response in Haywood. He judged that it would prove an administrative headache; it appeared to be politically controversial; and, more to the point, he felt the program would be of little value to the Air Force. If there was a shortage of scientists, that shortage, in Haywood's opinion, was not due to a paucity of qualified students, but to the limited physical and

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[45] Ltr., Haywood to Milner, 9 February 1960, ltr., Colonel O. G. Haywood to DCS/D, USAF, 6 July 1953; Extract from Minutes of Research Corporation Staff Meeting, 6 May 1953; Haywood, personal interview with author, 18 November 1965.

[46] See *supra*, p. 17.

[47] Haywood, personal interview with author, 18 November 1965.

financial resources of universities. An Air Force fellowship program, therefore, while it might train someone who would otherwise have gone untrained, might, given the fact that university facilities were at a premium, displace a student who would otherwise have been trained. Thus, in the end, according to Haywood's reasoning, such a program would not add appreciably to the store of scientific talent. Moreover, as Haywood saw it, the Air Force already had a fellowship program--but under another name. More than one graduate student was working on OSR sponsored research (and thus being trained in fields of direct interest to the Air Force); indeed, more students were doing so than could be supported by any reasonable fellowship program. And these students were being selected without any administrative effort by the Air Force.[48]

Despite these reservations, Haywood, urged on mainly by David Griggs, the Air Force Chief Scientist, began laying plans for an OSR fellowship program. Haywood persuaded Dr. Alan Waterman to have the NSF undertake the screening and selection of applicants. This solved the principal political and administrative problems. Now it was merely a question of getting the program approved by the Air Force, and it was precisely here that Haywood ran into trouble. After Haywood and Jim Kelly, OSR's legal adviser, had successfully carried the program upward through General Partridge to the Air Staff, they were stopped by the Air Force General Counsel. The General Counsel, having decided that the program was not in consonance with Air Force policy, ruled it illegal and dismissed Haywood and Kelly's objections with the remark that, at his level in the Air Force, "there is no difference between law and policy." That ended that.[49]

Equally futile were Haywood's efforts to vitalize the Air Institute of Technology. The answer here, as Haywood saw it, was to transform the AIT faculty into a research, as well as a teaching, faculty. Haywood's solution, as proposed to Brigadier General Ralph Swofford, the AIT commander, was simple. OSR would accept proposals from AIT as it did from any other institution, although, to get the AIT research program going, OSR would initially relax its standards. For those proposals that were accepted, OSR would defray the cost of necessary equipment and materials. Swofford liked the plan, but he also

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48 *Ibid.*

49 *Ibid.*, ltr., Haywood to Milner, 9 February 1960.

felt that AIT needed more people to put it into effect. Swofford's manpower spaces were never forthcoming, and AIT's research program, to Haywood's disappointment, did not advance beyond the planning stage.[50]

VII

General Partridge and Colonel Haywood decided from the outset that OSR would be both an operating and a staff agency, i.e., besides running a contract program, the organization would have staff supervision over basic research. And for the organization to perform these dual functions, it was necessary that it be a part of ARDC Headquarters. Thus, OSR's mission virtually determined its location in the Command.[51]

Almost from the beginning, there had been talk in the Headquarters that OSR, since it was involved in operational activities, should be a separate center. But, even if it remained in the Headquarters, the feeling was among these same people that it should at least be stripped of its supervisory powers. The mixing of staff and operational functions was considered to be contrary to established management principles, which, indeed, it was.[52]

Haywood insisted that such unorthodoxy was essential to the success of the organization. He believed that, in the long run, OSR's main function would not be to support basic research, although this activity would always be a necessary part of it; it would be, rather, "to use the results of this research to assist in the formulation of the entire development program of ARDC." To perform this kind of job, OSR needed a close working relationship with both the Headquarters staff and ARDC's centers. Thus, to make OSR a center or to strip it of its supervisory powers for the sake of conformity would, he felt, "militate against this close working relationship."[53]

Haywood had other reasons, which he believed were equally compelling, for keeping the organization in the Headquarters.

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[50] Haywood, personal interview with author, 18 November 1965.

[51] "Office of Scientific Research," enclosure to memo, Colonel O. G. Haywood to General E. E. Partridge, 29 October 1951; brochure, "Office of Scientific Research, Air Research and Development Command," March 1952, ltr., Haywood to Milner, 9 February 1960.

[52] Col. Leslie B. Williams, transcript of personal interview with Mr. Samuel Milner, 6 January 1960, ltr., Haywood to Milner, 9 February 1960, Dr. Merle M. Andrew, personal interview with author, 17 November 1961.

[53] Ltr., Haywood to Milner, 9 February 1960.

Scarcely anyone in the Air Force, he felt, understood what OSR was about. The general feeling, he wrote sometime later, was that basic research "was something that was way off with respect to any pay-out to the Air Force . . . . It might be good for the nation but what did it do for the Air Force?" Ridenour had sensed this same feeling and proposed to General Partridge that OSR report directly to the ARDC Commander. Both Partridge and Haywood liked the idea. In this way, with no intervening echelon between it and the ARDC Commander, OSR would not only be assured of continued support from the top, but also the ARDC Commander would be guaranteed of having sound scientific opinion at his fingertips.[54]

As long as Haywood remained on the scene, OSR continued, in theory at least, as both an operating and staff agency, and, in consequence, it was looked upon by some members of the ARDC staff with understandable resentment as an elite, but overly privileged, corps of scientific experts. But, while this resentment was real, OSR was in practice almost wholly an operating agency. To be sure, the organization ventured into supervisory work on occasion, but, on the whole, it was too preoccupied with establishing its own research program, with setting up the European Office, and with sundry other operational matters to give serious attention to its supervisory duties. "Nothing ever came from ARDC Headquarters about research in the centers," recalled one in-house laboratory chief. "This was part of Haywood's mission . . . but . . . he never really got around to it . . . ."[55]

VIII

On the surface, at least, there was something anomalous and strangely incongruous about OSR's mission that transcended the specific argument that the mixing of staff and operating functions was contrary to established management principles. If only vaguely hinted at officially, it was nevertheless understood that OSR's operational mission was exclusive: To OSR alone belonged the responsibility of providing the Air Force with fundamental knowledge.[56] Yet, as pointed out, OSR had the additional responsibility of providing general staff supervision for basic research in the centers. OSR thus appeared in

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54 *Ibid.*

55 Williams, transcript of personal interview with Milner, 6 January 1960.

56 See, for example, memo, Haywood to General Partridge, 25 February 1953.

the implausible position of being the sole begetter of fundamental knowledge while at the same time supervising others seeking the same knowledge. But, if there was something incongruous about all this, the incongruity was more apparent than real. It came to the surface, in part, because of the ambivalence with which OSR was often approached and, in part, because research and the management of research was a new undertaking for the Air Force. That a fledgling organization with a unique mission appeared at times to go off in opposite directions was understandable enough; that it did so when things were in a fluid state, when in some cases practice had not caught up with policy or policy with practice, was even more understandable.

To begin with, OSR's supervisory powers over in-house research were neither so fixed or extensive as they seemed. When General Keirn was running things, control over research in the centers was unquestionably in his hands. But, with his departure and the establishment of OSR, staff responsibility for research in the centers went to the Deputy Chief of Staff for Development, Major General Floyd Wood. The arrangement, however, took a somewhat complicated turn. General Wood organized his staff according to technical (armament, electronics, etc.) and operational (strategic, tactical, etc.) areas, with no staff section for research. To compensate for this omission, Wood, Haywood, and Partridge hit upon an arrangement whereby OSR, upon General Wood's request, would furnish advice on the "scientific merit of [basic] research" in the in-house laboratories. Thus, OSR had staff supervision over research in the centers, but could exercise it only at General Wood's behest.[57]

As for OSR's operating mission, it, too, took some complicated twists; and while it was unique up to a point, its exclusiveness rested, in part, upon some hair-splitting definitions of basic research. OSR may never even have been, as Haywood characterized it, "the focal point of Air Force basic research"--although, if such a point ever existed in the Air Force of the early fifties, OSR came closer to being it than any other agency.[58] Louis Ridenour had certainly intended that one agency in ARDC be exclusively responsible for basic research,

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[57] *Ibid.*; Haywood, personal interview with author, 18 November 1965; memo, Haywood to Partridge, 25 February 1953.

[58] Brochure, "Office of Scientific Research," dated March 1952.

and General Partridge appears to have accepted this view when the official mission statement of the Assistant for Basic Sciences, OSR's immediate predecessor, was released. "The Assistant for Basic Sciences," read the statement, "is that agency of the ARDC through which the mission of the Command with respect to Basic Scientific Research is discharged . . . ."[59] OSR's mission statement carried with it no comparable exclusivity, although the belief persisted, both in OSR and the centers, that it did.

Haywood proceeded on the proposition that OSR's mission was exclusive; but the key here was how Haywood defined research. To him OSR was the only agency in the Air Force in the business of supporting basic research that was unrelated to specific Air Force problems--with the emphasis on "unrelated."[60] To this extent, OSR's mission was exclusive. And Haywood meant to keep it so, for he had little regard for the capacity of the in-house laboratories of that period, especially FRL, to engage in basic research. The beauty of a contract program, in Haywood's eyes, was that it could command both the best available talent and resources in the country while at the same time leaving scientists "in the academic environment of universities pursuing the unfettered basic investigations required for the long range advancement of science."[61]

On the other hand, this by no means meant that such laboratories as the Geophysics Research Division (GRD) of the Air Force Cambridge Research Center (AFCRC) and the Flight Research Laboratory could not engage in what could properly be defined as basic research. Problems daily arose in development which could only be solved with more fundamental knowledge. Such laboratories as FRL and GRD, if they did basic research, would be invaluable to the development laboratories. Besides, GRD, which had a well-conceived and well-integrated mission, had traditionally ranged across the entire geophysics spectrum. Haywood saw no conflict between OSR's mission and GRD and FRL engaging in such research. The in-house laboratories would be largely engaged in quick fixes; such research, even if it sought new knowledge, had an application in mind and,

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[59] Assistant for Basic Sciences, Function and Organization, 6 September 1951.

[60] Memo, Haywood to Partridge, 25 February 1953, Haywood, personal interview with author, 18 November 1965

[61] Haywood, draft of speech at I&AE Meeting, 31 March 1952.

in Haywood's view, was distinct from the studies in the universities. Haywood even went so far as to offer to transfer any established OSR program to an in-house center if the center could show that the program was related to its development efforts.[62]

The distinction made by Haywood was one of motivation. The in-house laboratories, whether they performed basic or applied research, were motivated toward solving existing problems; OSR was motivated toward supporting work "that would strengthen the foundations of knowledge in scientific areas of paramount interest to the Air Force even though there was no known need for the research results." No other Air Force agency was similarly motivated.[63]

IX

But, while Haywood was willing to see the centers engage in what he termed "related" basic research, he was opposed to in-house laboratories running an extensive contract program. This was OSR's job. It was not so much that he felt OSR's perquisites threatened; he would have gladly suffered a contract program in the in-house laboratories if, in his estimation, this was in the best interests of the Air Force. It all came down to a question of management philosophy. Haywood felt that a research organization, with minor exceptions, should be engaged either in in-house work or contract work. The two would not mix, for the natural biases of the scientists would come into play and debilitate the program. Give a man already deeply engaged in research authority to contract for research and the inevitable result would be that this man would perpetuate his own ideas. This was not, in Haywood's opinion, the way to build "a strong and enlightened program of basic research."[64]

The in-house laboratories, on the other hand, contended that a contract program was a necessary part of their operations.

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[62] Ltr., Haywood to Milner, 9 February 1960, Haywood, interview with author 18 November 1965.

[63] Haywood, interview with author, 18 November 1965.

[64] Ltr., Haywood to Milner, 9 February 1960; Haywood, draft of speech at I&AE Meeting, 31 March 1952. Haywood was by no means alone in opposing contract research at the laboratories. In November 1952, for example, OSR's Chemistry Advisory Committee went on record as being "firmly opposed to the prevailing policy which allows research groups in Research Centers to arrange for and administer contracts in basic research." "This function," the committee continued, "should be centralized immediately in a single branch such as the OSR." Memo, Chemistry Advisory Committee, Subj: "Recommendations of the Chemistry Advisory Committee, OSR," 24 November 1962.

No laboratory could generate on its own all the fundamental knowledge that it needed. Besides, a contract program was not necessarily a program unto itself; properly administered it was an extension of, and a complement to, the in-house program.

Haywood was not oblivious to this argument. He granted that some contracts could tend to complement an in-house program. He had seen the NACA, for example, bolster a research effort that was preponderantly in-house through the judicious use of contracts. But the NACA was judged on the effectiveness of its in-house programs, and Haywood felt the Air Force's in-house laboratories should be judged the same way. But where the old Office of Air Research was concerned, and, in some measure, where FRL was concerned, the contract dominated the in-house effort. And the result, in Haywood's estimation, left much to be desired. In some cases, scientists who had been hired to do in-house work were spending half or even more of their time monitoring contracts. The accusations leveled at the in-house laboratories, particularly during the Ridenour Committee investigation, were not the kind that Haywood could easily overlook: in-house people supported only "pet" projects; they did not support investigators whose theories might disprove their own; they stole ideas from contract proposals to set up in-house programs; they passed off the results of contract research as their own. These were the kind of practices that Haywood wanted to bring to an end. And the best way to do this, Haywood believed, was to restrict the in-house laboratories to a small contract effort that was directly related and complementary to established in-house programs.[65]

Some laboratory chiefs, although a distinct minority, saw merit in what Haywood was saying. A few had even anticipated Haywood. For example, Dr. Knox Millsaps, the Chief of FRL's Applied Mathematics Branch, judging contracts were anathema to the productiveness of his group, put them under ban at an early date. But laboratory people with Millsaps' views were the exception rather than the rule.[66]

And for as long as Haywood was at OSR, the laboratories continued to argue the case for a contract program, doing so, mainly, by answering Haywood's arguments in kind. Not only were the in-house laboratories competent to run a contract

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65 Haywood, personal interview with author, 18 November 1965.

66 Dr. Knox T. Millsaps, personal interview with author, 25 & 27 October 1965; Dr. Lloyd Wood, personal interview with author, 8 November 1965.

program, they contended, but they could do it better than OSR. Who was better qualified, they asked, to perform technical monitoring, an administrator in Baltimore or a bench scientist actively engaged in the same general field as the contract he was monitoring? As for the bias of laboratory scientists, "there seems to be no a priori reason why they should be any more biased than any other group of scientists who might be appointed to select projects," noted one laboratory director.[67] The issue, of course, could not be approached purely on rational grounds and it was never resolved in Haywood's time or from his time to the present. It was the kind of issue that men could forever disagree on.

That, under these circumstances, there was an underlying current of animosity and distrust between FRL and OSR was scarcely surprising. How deep these feelings ran was illustrated, in the spring of 1952, when Colonel Haywood, at the request of General Wood and in the company of Dr. Francis H. Clauser, traveled to FRL to conduct a formal review of FRL's operations. The stated reason for Haywood's visit was to review FRL's research activities and, if need be, recommend to General Wood how these activities might be improved. But to some people at FRL, particularly Colonel Leslie B. Williams, FRL's Chief, Haywood's stated reason was merely a cloak for his true purpose--the dissolution of FRL.[68]

Haywood and Clauser spent the better part of a week at FRL. Haywood was unimpressed. In his view, the laboratory could justify its existence only as an arm of the Wright Air Development Center. This meant that the laboratory's work had to have a direct relationship to the responsibilities of WADC. Instead, Haywood found FRL supporting research that ran over a wide range of interests. Thus, in what was perhaps his most important recommendation, Haywood advised that FRL should confine itself to contributing "to the effectiveness of the [WADC]

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67 Williams, transcript of interview with Milner, 6 January 1960; ltr., Haywood to Milner, 9 February 1960; Dr. Lloyd A. Wood, "Memorandum Regarding Research Policy for Chemistry Research Group, FRL," 12 May 1952. It is interesting to note that nine years later, when the laboratory director who wrote the above memorandum became a member of OSR, his views on contract research changed. He now believed that "an in-house laboratory should have as little as possible to do with contracts." Wood, personal interview with author, 16 November 1961.

68 Haywood, personal interview with author, 18 November 1965; Williams, transcript of personal interview with Milner, 6 January 1960; Dr. Amos G. Horney, personal interview with author, 17 September 1965.

development laboratories in their assigned mission"--i.e., to applied research.

Haywood then went on to touch what was perhaps FRL's most sensitive chord, its contract program. He found it lacking on two counts. To begin with, the program was dominated "by the fixed beliefs of individuals engaged themselves in research operations." In addition, Haywood found basic research unrelated to WADC's mission very much in evidence in the program. His solution here was simple. "OSR is prepared to accept transfer from FRL," he wrote to General Putt, now the WADC Commander, "of any contracts which support basic research . . . ." Haywood made a few more sallies at the laboratory's management ("FRL has been organized, reorganized, and disorganized"), but these two points were the crux of his criticism.[69]

Haywood's recommendations were scarcely the sort that looked to the dissolution of FRL. Colonel Williams, nevertheless, remained dubious of Haywood's motives, reasoning that Haywood softened his blows when it became evident that General Putt would never have entertained the idea of dissolving FRL. ("I could have killed FRL anytime I chose, but I didn't want to," Haywood was to remark years later.) But, whether Haywood softened his blows or not, the blows were still much too harsh for Williams to accept with equanimity. Indeed, he made a sharp rebuttal to Haywood's charges. FRL was not disorganized. Its scientists were not biased. Its contract program was sound. "A 'quick and dirty' survey by personnel not familiar with WADC and the FRL," he charged, "can hardly be expected to elicit the necessary facts as a basis for judgment."[70]

Haywood's intrusion upon FRL's research activities had mixed results. Ultimately, and with a show of willingness, FRL turned over the administration of some contracts to OSR. In addition, in May 1953, the laboratory, in the process of changing its name to the Aeronautical Research Laboratory, adopted an applied research mission. But, like most things under a ban, basic research that was unrelated to the laboratory's mission did not disappear, it went underground. A research

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69 Ltr., Haywood to Milner, 9 February 1960; memo, Col. O. G. Haywood to Commanding General, WADC, 14 April 1952.

70 Haywood, personal interview with author, 18 November 1965; Lt. Col. L. B. Williams, "Report on Research Study," 2 May 1952; Lt. Col. L. B. Williams, "Comments on Report of Research Study by Colonel O. G. Haywood," 22 April 1952.

task may have carried a strong applied research orientation in the official project documentation, and the funds allotted to it may have been represented as in support of this or that development project, yet the task may have been as pure a basic research task as anything OSR sponsored. The laboratory, then, while it was now definitely oriented toward applied research, did not, nevertheless, abandon basic research altogether. It nursed along, more or less surreptitiously, a small program in basic research until such time as it was safe to bring it into the open.[71] Hence, OSR was never the Air Force's exclusive agent for the pursuit of fundamental knowledge for its own sake. Moreover, the laboratory did not, and never intended to, abandon its contract program.

The basis for a continuing conflict between OSR and the internal laboratories had thus been established. The question of the exclusiveness of OSR's mission and the associated question of contract research administration remained for the future to confront. They were not necessarily confronted on the premises established by Haywood, but confronted they were.

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[71] Nick A. Komons, *Cadmium Sulfide: A History of Semiconductor Research at the Aerospace Research Laboratories*, OAR 64-11 (OAR Historical Division, 1964), pp. 28, 43; memo, Haywood to General Partridge, 25 February 1953.

Chapter III

OSR AND THE FEDERAL SCIENCE SCENE

"Everyone is for research and development, just as everyone is against sin," General Doolittle observed. "However, very few people will sacrifice for it."[1] During the early 1950's, the Air Force sacrificed little for basic research, especially money. OSR's budgets, in relation to the total Air Force R&D effort, were mercilessly low. And there was little inclination to bolster them. People in high places even had doubts as to the propriety of the Air Force having a basic research budget. Thus, while Haywood had things fairly well under control within OSR's immediate environs, the organization, engaged as it was in a field widely believed to be of little direct military importance, was vulnerable to attack from the outside. OSR's vulnerability was amply illustrated during the preparation of the fiscal year 1954 budget and the drafting of a Presidential executive order on research in the summer of 1953.

II

Haywood had no illusions about the attraction basic research commanded among the keepers of the purse strings. He accepted the fact that OSR's growth would be slow and eschewed asking for large appropriations, knowing that the vagaries of the budget were such that a healthy increase one year could be followed by a healthy cut the next. He preferred to begin from a base that was low enough so as to be relatively immune to cuts in ensuing years. From there, he hoped, OSR could advance slowly to a level that was in keeping with the Air Force's needs. This was the price Haywood was willing to pay for budgetary stability, something which he felt was essential to the proper administration of a research program.[2]

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[1] Memo, Dr. James H. Doolittle to General Hoyt S. Vandenberg, 20 April 1951.

[2] Ltr., Oliver G. Haywood to Samuel Milner, 9 February 1960.

One more consideration dictated a go-slow policy. OSR did not have the people, and it was not likely that it would have them very soon, to administer a large program. If anything, the ratio of contracts to contract monitors was increasing rather than decreasing.[3] This fact, combined with Haywood's concern for stability and some notable parsimony at the top, were the main forces impinging on OSR's budget.

The fiscal year 1952 budget had already been put to rest by the time OSR was established, and the organization depended upon what ARDC would give it and upon funds transferred from Wright Field to see it through the year. All told, OSR got something in excess of a million dollars for research. With this it negotiated 39 contracts, scarcely enough to keep its staff busy.[4]

Haywood asked for $15.7 million for fiscal year 1953 and found that he had overshot the mark by a considerable margin. Congress gave the Air Force $7.6 million for basic research, all of which was allotted to OSR. For fiscal year 1954, Haywood lowered his sights and asked for $8.6 million. Headquarters USAF responded by lopping off $2 million from the request. Then, in January 1953, the Bureau of the Budget lopped off an additional $2 million. At the same time, the Bureau took a second look at OSR's 1953 budget and reduced it by $1.4 million.[5]

Considering the circumstances, OSR was fortunate to have emerged with what it did. What the Bureau of the Budget actually proposed when it made these reductions was that the military services get out of basic research entirely. Indeed, the Bureau decreed that since the National Science Foundation was perfectly capable of undertaking all such work, the services would receive no funds for the same purpose. The Navy, which had, in effect, a Congressional charter permitting it to perform whatever research it saw fit, was not in the least inclined to bow to the Bureau's wishes. It decided to challenge the Bureau. The inclination in the Air Force was to pretend to accept the inevitable. General Donald Yates, the Director of Research and

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3 *Ibid.*

4 *Ibid.*; memo, Colonel O. G. Haywood to General E. E. Partridge, 6 August 1952.

5 Colonel O. G. Haywood, "1953 Budget Presentation -- Research," 2 November 1951; *History of the Air Research and Development Command*, 1 January-31 December 1953 (ARDC Historical Division), I, 317, hereinafter cited as *History of ARDC*; memo, Col. O. G. Haywood to Gen. E. E. Partridge, 25 February 1953; memo, Col. Haywood to Gen. Donald L. Putt, 22 July 1953.

Development, Headquarters USAF, told OSR that budgetary line items for research in chemistry, physics, and other sciences were simply not defensible. But Yates, while he was unwilling to argue the Air Force's case with the Budget Bureau, was also unwilling to see the Air Force abandon basic research. Hence, OSR's fiscal year 1954 budget was moved under a line item for the B-58. And, for all the Budget Bureau knew, the $4.7 million it approved was for research connected with the development of this aircraft, clearly within the realm of applied research. But, in reality, this money was handed over to OSR to use, as originally planned, for basic research. Later in the year, as a result of a small "windfall," ARDC was able to bring OSR's budget up to $6 million. In this way, by deftly juggling figures from one line of the ledger to another, OSR was able to remain afloat. Meanwhile, the Navy argued its case before the Budget Bureau and won, actually getting money clearly labelled for basic research.[6]

While OSR had emerged from this crisis with a budget, it by no means emerged unscathed. The 1953 reduction, besides being unexpected, came as a severe jolt. In January 1953, when the reduction was made, the fiscal year was already half over, and, not surprisingly, most of the budget had already been obligated. It was too late to reduce the research program, so the cut had to come from funds allocated to travel and to financing of advisory groups. The total effect of the fiscal year 1953 reduction was that, while leaving OSR with its research program virtually intact, it left OSR without sufficient means to administer it.[7]

There was an additional threat of a further reduction in OSR's 1954 budget when the Defense Department cut deeply into the Air Force's R&D budget. But with OSR's budget already substantially reduced, Headquarters ARDC decided that applied research and development would absorb the entire cut imposed by the Defense Department.[8]

For most of the Air Force--indeed, for most of the federal government--such budgetary gyrations were part of one's day-to-day existence. They had to be lived with, and were. But

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[6] Col. William O. Davis (USAFR), "Utilization of the Product of the Air Force Research Program," Air War College Thesis, Air University, 1964, p. 4, Lt. Col. Jack D. Warthman, transcript of personal interview with Mr. Samuel Milner, 7 November 1959; ltr., Haywood to Milner, 9 February 1960.

[7] *History of ARDC*, 1 January-31 December 1953.

[8] Memo, Haywood to General Putt, 22 July 1953.

Haywood questioned whether OSR could live under such uncertainty. A research program required fiscal stability. Unlike operational commands, which could acquire a number of new aircraft one year and only half that number the next and still get along, OSR could not begin a project one year and drop it the next for lack of money. General Partridge saw the point and, in April 1952, he set down the policy that once OSR's budget had been approved by Headquarters USAF, that level of effort would be frozen unless the total R&D effort changed drastically.[9] But, as evidenced, this policy, while of some help, was not very effective when the Bureau of the Budget set its sights on a particular chunk of money.

There remained another safeguard that would have proved more valuable--the instituting of long-term funding. Haywood was all in favor, but such a policy required Congressional approval. Fortunately, the Department of Defense supported the idea, and, in 1952, a bill was introduced in the House of Representatives that permitted the granting of research contracts for up to five years. But Headquarters USAF appeared lukewarm toward the measure, and, by late 1952, it was not certain that, if and when the measure cleared the Congress, OSR would be permitted to take advantage of it.[10]

When all was said and done, it was not the existence of legislation--or the lack of it--or the austerity program of the Eisenhower Administration that was at the root of OSR's financial difficulties. The trouble lay in official misgivings--in the Air Force, the Congress, the Bureau of the Budget, the federal government generally--over the Air Force engaging in basic research, a pursuit that many viewed as purely academic.

III

The idea that Vannevar Bush planted in 1945, that all the basic research activities of the federal government should be the responsibility of a civilian research organization, preferably the National Science Foundation, was not one that died easily. Congress rejected the idea--or perhaps merely avoided it--when it finally established the National Science Foundation in 1950, making no specific provision for military research in the organization's charter. Be that as it may, the Foundation

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[9] Memo, Haywood to General Partridge, 6 August 1952.

[10] Memo, James J. Kelly, Jr., Assistant for Management, OSR, to Colonel O. G. Haywood, 31 October 1952.

was now in existence, and being the government's principal scientific arm, it could play as large or as small a role in research of interest to the military as the Executive Branch chose to give it.

Under the law that established it, the Foundation had the responsibility of evaluating the scientific programs of other agencies, including the military services, and correlating the entire federal effort in basic research. The Foundation, however, under the direction of Dr. Alan T. Waterman, was reluctant to exercise its statutory authority, at least, in the absence of a directive from the Executive Branch. The result was that there was more than a little confusion in the early 1950's as to the precise role the Foundation would play in supporting the scientific programs of other agencies. The Defense Department, for example, assumed that the Foundation would exercise its statutory authority, and, in June 1952, it even went a step further in its assumption when, in a policy directive on basic research, it authorized the military services to transfer funds to the Foundation to carry out research projects that could be better managed by the Foundation than by the services themselves.[11] Authorized or not, the Air Force never undertook to do any such thing.[12] But the policy directive of June 1952 was significant in that it illustrated the lingering doubts in many minds of the propriety of the military services engaging directly in basic research.

In the summer of 1953, an attempt was finally made, in the form of two proposed executive orders, to define the National Science Foundation's relationship to other federal research agencies. The executive orders were drafted by the Bureau of the Budget, and like most policies that emanate from that bureau, they were motivated by fiscal considerations. It appeared to the Bureau that with a multiplicity of federal agencies engaged in basic research there was a great deal of undesirable and wasteful duplication in the federal research program. While the Bureau did not attempt this time, as it had earlier in the year, to concentrate all basic research in the National Science Foundation, it pronounced the Foundation the "primary agency" for the support of basic research and limited the other agencies to "such additional basic research as may be directly related

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[11] DOD Directive No. 3210.1, "Policy on Basic Research," 19 June 1952.

[12] During this period, however, OSR did refer proposals to the National Science Foundation to be financed by the Foundation's own funds.

to the solution of problems for which they have statutory responsibility."[13] But the Foundation was given the job of evaluating the research programs of other agencies; these agencies, in turn, were instructed to "consult with the Director of the National Science Foundation with respect to the desirable emphasis on basic research."[14]

Haywood saw the drafts of the orders when they were circulated to the various agencies for comment and could not have been more opposed to their intent. "It is the old clerical approach to the administration of research," he told Lt. Colonel William O. Davis, OSR's Vice Chief for Research.[15] His feelings were shared by the heads of other agencies. Hugh Dryden of NACA remarked that an executive order instructing the Attorney General to coordinate all the legal activities of federal agencies would make as much sense as the proposed orders.[16] But it was not so much coordination *per se* that OSR opposed; there had been a degree of coordination all along. It was, rather, with that part of the orders that directed each agency to "consult with the Director of the National Science Foundation with respect to the desirable emphasis on basic research," that OSR objected to most. As far as Haywood was concerned, if this section were adopted, "all government support of basic research outside the NSF would exist at the sufferance of NSF."[17] Davis was like-minded, feeling that this section "effectively removes from the service commander responsible for R&D the authority to implement his mission . . . ."[18]

If the orders meant what Haywood feared they meant, if, henceforth, all research outside of the NSF would exist "at the sufferance of NSF," a situation potentially dangerous to science was in the offing. "It is extremely important to the scientific progress of the country that proposals of scientists may have several independent hearings," wrote Walter Leighton. "One agency may err in its decisions. It is unlikely that all will." Another thing bothered OSR--the implication in the orders

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13 Davis, "Utilization of the Product," p. 3; Draft of Executive Order on the National Science Foundation, 10 August 1953.

14 Draft of Executive Order on Coordination of R&D. 10 August 1953.

15 Memo, Col. O. G. Haywood to Lt. Col. W. O. Davis, 18 August 1953.

16 Memo for the record, Haywood, Subj: "Coordination of R&D," 24 August 1953.

17 *Ibid.*

18 Lt. Col. W. O. Davis, "Comment on Executive Order on Coordination of R&D," enclosure to ltr., Brig. Gen. James McCormack, Jr., Vice Commander, ARDC, to DCS/D, USAF, 10 September 1953.

that all duplication was bad. Of course, science attached no merit to the exact duplication of the work of others. But in many cases duplication was both necessary and desirable; it was essential, for example, that scientists took different approaches to the same problem.[19]

On 18 August, Dr. Waterman met with representatives of the agencies that would be most affected by the orders--Haywood, Dryden, Dr. Emanuel R. Piori of the Office of Naval Research, Dr. Thomas J. Killian of the Office of Ordnance Research, and Dr. Thomas Johnson of the Atomic Energy Commission. It soon became clear that everyone opposed the orders except Waterman, and even he was in favor of revising them. All agreed, again with the exception of Waterman, that the effect of the orders would be to decrease the federal level of support of basic research. They advised Waterman that the orders be dropped.[20]

Waterman, who had collaborated with the Bureau of the Budget in drawing up the orders and had participated in toning down the original drafts, was convinced that an executive order, in some form or another, would be issued and counselled the others to make the best of it. The task at hand, as Waterman saw it, was to try to agree on an order that was satisfactory to all concerned. Waterman then proceeded, in so many words, to leave the impression that since he, Waterman, would have the job of administering the orders and since, coming as he did from the Office of Naval Research, he had a sympathetic understanding of research outside the NSF, there should be no cause for concern, even if the orders in their final form appeared to invest the NSF with undue control over the research activities of other agencies.[21]

Despite Waterman's assurances, Headquarters USAF decided to oppose the orders. Dr. Albert E. Lombard, Jr., the chief assistant to General Yates, was instructed "to try to kill [the orders] altogether; if not, make them as ineffective as possible."[22] Colonel Davis, in the meantime, conveyed OSR's formal objections, contending that "a serious limitation on the

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[19] Ltr., Walter Leighton to Lt. Col. W. O. Davis, 24 August 1953.

[20] Memo for the record, Haywood, 24 August 1953.

[21] *Ibid.*

[22] Ltr., General McCormack to DCS/D, USAF, 10 September 1953; memo, Haywood to Davis, 18 August 1953.

authority of the Commander, ARDC would result from the publication of these orders in their present form . . . ."[23]

The total effect of these protests was that, on 17 March 1954, when Executive Order 10521 ("Administration of Scientific Research by Agencies of the Federal Government") was issued, it was potentially less restrictive than the orders originally proposed. But, while many of the objectionable sections had been removed, the order still restricted agencies other than the NSF to "basic research in areas which are closely related to their missions."[24] To OSR, particularly to Colonel Davis, this restriction meant one thing: the organization would henceforth be required to defend its program, and its budget, on the basis of relevance to existing Air Force requirements, the difficulty inherent in intelligently relating basic research with existing requirements notwithstanding. Equally clear to Davis was that OSR's program, if it were to continue to be of maximum usefulness to the Air Force, would have to go on as before. The problem, as Davis stated it later, was that "by virtue of the Executive Order [basic research] could no longer be labeled basic research" if the Air Force were to retain a measure of control over it. In the end, OSR solved the problem by a skillful exercise in semantics.[25] And, as will be shown, executive order or no, in the face of increasing opposition to basic research by the Bureau of the Budget, OSR would have had to resort to some such tactic sooner or later.

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[23] ARDC Staff Summary Sheet, Subj: "Executive Orders dated 10 August 1953," 8 September 1953.

[24] Executive Order No. 10521, Subj: "Administration of Scientific Research by Agencies of the Federal Government," 17 March 1954.

[25] Davis, "Utilization of the Product," pp. 1-5.

Chapter IV

CENTER STATUS

In comparison to the uncertain position it held on the federal science scene, OSR appeared well entrenched within the confines of ARDC. OSR could do things its own way. Its staff, in most cases, was free to shape the organization as it saw fit. Given all this, OSR's status was deceptive, for it rested almost entirely upon the excellent relationship Haywood enjoyed with General Partridge. That OSR's position within the Command hung on a few tenuous threads was made abundantly clear, in June 1953, when General Partridge left ARDC, to be replaced by Lt. General Donald L. Putt.[1] The organization was now vulnerable not because General Putt was no friend to basic research--research in the Air Force probably had no truer friend--but because it did not necessarily follow that Putt, or any other succeeding ARDC Commander, would accept all the assumptions underlying Haywood's concept of OSR. And, in the ensuing months, OSR was subjected to what it believed were a succession of hammer-like blows. As a result, by the fall of 1955, the organization that Haywood shaped had, for better or for worse, been radically altered in form.

II

The first blow, dealt in September 1953, was unintentional and came in the form of Haywood's resignation from the Air Force.[2] Haywood's mantle fell on Colonel Davis, a young, exuberant, keenly intellectual physicist-turned-airman, who was promptly confronted with the prospect of OSR's dissolution. The plan, which originated in the Headquarters ARDC staff, was to do away with OSR, establish in Headquarters ARDC a Directorate of Research, which was to have strictly supervisory powers, and invest the ARDC centers with responsibility for all basic research, both in-house and contractual. It was only

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1 *History of the Air Research and Development Command*, 1 January-30 June 1954 (ARDC Historical Division), I, 39, hereinafter cited as *History of ARDC*.

2 Harry S. Baer, Jr., "The Military: Second Class Citizen," excerpt from *American Aviation*, 17 August 1953; memo, Lt. Col. W. O. Davis to Lt. Gen. D. O. Putt, 11 February 1954.

through the intervention of Major General James McCormack, Jr., now ARDC's Vice Commander, that the plan was stillborn.[3]

No sooner was this crisis over than OSR was confronted with yet another, one which it was less able to cope with. General Putt disliked the way the Headquarters was organized. Partridge's experience had mostly been as a line officer, and he had organized the Headquarters in the traditional manner. Putt, who had spent a career in R&D staff work, wanted the Headquarters organization to more accurately reflect the Command's responsibilities and functions. In February 1954, after a study of the problem (conducted by a committee headed by Colonel B. A. Lawhon), Putt put into effect a sweeping reorganization of the Headquarters. The result was that OSR was stripped of its supervisory powers and its direct line to the ARDC Commander was broken. Those who had been looking askance at the mixing of operational and supervisory functions had found in the impending reorganization the opportunity to make their ideas felt.[4]

Under the reorganization, the traditional structure of a chief of staff with a bevy of deputy chiefs was abandoned. In its place arose two large staff sections, a Deputy Commander for Technical Operations and a Deputy Commander for Support Operations. Falling under the Deputy Commander for Technical Operations was, among other things, a Directorate of Research, to which was assigned staff supervision over all the research activities in the Command. Directly under the Directorate of Research fell OSR. Thus, whereas OSR was previously a direct offshoot of the ARDC Commander's office, it was now just another staff section, with two organizational layers between it and the ARDC Commander.[5]

The reorganization was announced with a fanfare that belied any trace of dissatisfaction within ARDC (the reorganization, according to ARDC's official news release, was designed "to clarify responsibility and authority, fix accountability, and obtain more rapid, efficient, and economical management . . ."), but OSR was clearly, and unalterably, dissatisfied.[6] Colonel Davis, much grieved by the turn of events, could not suppress

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3 Dr. William O. Davis, transcript of personal interview with Mr. Samuel Milner, 19 November 1959.

4 *History of ARDC*, 1 January-30 June 1954, I, 39-42.

5 *Ibid.*, pp. 42, 59.

6 ARDC News Release, ca. February 1954.

his disapproval.[7] He let it be known to all concerned, as he did on the following occasion, that science in the Air Force had been dealt a severe blow:

> . . . the Office of Scientific Research has lost prestige and some of its ability to maintain effective contact with the leaders of the scientific community as a result of the recent reorganization . . . . This is in no small measure due to the many levels of responsibility above the Office at the present time. [P]roper coordination requires frequent contact with other agencies at a level and in a manner not compatible with the rank and organizational position of the Chief of Scientific Research. Therefore, to assure stability, to improve the prestige of the Air Force with the scientific community, to permit effective management . . . it is regarded as essential that the Office of Scientific Research be established as a separate statutory organization . . . .[8]

Davis was saying, in effect, that OSR required more than people and money to do its job properly; it also required the prestige that a higher status in the Air Force's R&D structure would give it. Haywood had departed, but his elevated view of OSR had remained.

For the moment at least, things were not so dark as they first appeared. The reorganization affected OSR's ability to conduct its affairs its own way not at all. Davis worked reasonably well with Colonel Don Flickinger, the Director of Research, and Flickinger, it appears, was even prepared to acknowledge the correctness of Davis' point of view. Be that as it may, Flickinger, who was in any event busy with other matters, was willing enough to adopt a laissez-faire attitude toward OSR. The supervision of OSR that was to ensue upon the creation of the Directorate of Research never came. As one observer put it, Davis continued to do "pretty well what he pleased." And he ultimately took heart, coming to believe that with time OSR would regain its seat beside the ARDC commander.[9] What Davis could not know was that the reorganization of February 1954 was mere prelude.

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[7] Colonel Leslie B. Williams, transcript of personal interview with Mr. Samuel Milner, 6 June 1960.

[8] Ltr., W. O. Davis to Colonel D. W. Roberts, Subj: "The ARDC Scientific Research Program," 4 October 1954.

[9] Williams, transcript of personal interview with Milner, 6 June 1960.

III

A few months had scarcely passed than ARDC changed commanders again. In April 1954, General Putt went back to staff duties at the Pentagon, and Lt. General Thomas S. Power took command of ARDC.[10] The coming of Power presaged yet another reorganization. Since commanders generally tend to organize their immediate staff to suit themselves, such a prospect would not have been altogether surprising no matter who succeeded Putt. But with General Power, who was an independent and remarkably self-reliant individual, the surprise would have been had he not reorganized. As it was, the reorganization came eighteen months after his arrival.

Besides being dissatisfied with the makeup of the Deputy Commander for Technical Operations (he felt it was too large and too preoccupied with weapons systems development), Power was less than enthusiastic about how research was organized. He knew of OSR's recent disenchantment and wanted to settle that problem at once. (For a man who had made a career of strategic bombing, Power displayed an unexpected regard for OSR and research in general.) He also resolved to put an end to the treatment OSR had been receiving in financial matters. Whatever else might be done to OSR, Power was determined to bolster its operations with a generous infusion of people and money.[11]

Power disliked the idea of an operational unit functioning within the Headquarters. An operational unit attached to the Headquarters was an indication to Power that some people had special privileges. Such a practice, he concluded, could not but lower the morale of units in the field. One more thing about OSR bothered Power. The organization appeared to be staking out its own course without supervision from the responsible staff section. A reconstituted Directorate of Research, with teeth in its mission, would have to be established to guide the Command's research activities.[12]

The decision that was finally reached at staff level was to make OSR a separate ARDC center, the designation at the time for ARDC's principal operating units. Taking such a step had, in Power's eyes, a double advantage. For one thing, it removed

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[10] *History of ARDC*, 1 January-30 June 1954, I, 72.

[11] *Ibid.*, 1 January-30 June 1955, I, 29-39.

[12] Colonel W. S. Rader and Colonel H. J. Crumly, transcript of personal interview with Dr. Ernest Schwiebert, 11 October 1955.

OSR from the Headquarters. For another, since it put OSR on a footing with other ARDC centers, making it an equal among equals, the step would tend to enhance OSR's prestige and thus, hopefully, allay those feelings that had been so badly jarred the previous winter.[13]

OSR went along with the proposal from the first, although, since OSR's opposition could scarcely have weighed the balance in another direction, this was not necessarily an indication of the true feelings within the organization, which, at best, could be described as reluctantly favorable to the proposal. Certain advantages would accrue to the organization. Power promised increased support in both people and money. He also promised a general officer for AFOSR's command, something which Colonel Davis had been advocating for some time; and this would elevate its prestige both within the command and among the scientific community.

There was another benefit that center status could ultimately bring: it might work to bring about the physical separation of OSR from Headquarters ARDC. This was one more illustration of the ambivalence with which OSR viewed the change. On the one hand, the organization wanted to remain on the upper rung of ARDC's organizational ladder, where it would have an unobstructed path to the ARDC Commander, and, by way of him, to the Pentagon. Yet, failing this, it preferred to be physically separated from the Headquarters staff, which was, perhaps, a reminder of its recent descent. In addition, there were other, more valid, reasons which dictated that OSR leave Baltimore for Washington, D.C., the hub of federal research activity.[14]

But given all this, center status was not all that ARDC's staff made it appear. Being an equal among equals was fine, but it did not resort OSR to a perch beside the ARDC Commander. Equality had its disadvantages. And then there would be the reconstituted Directorate of Research. Would it indeed attempt to exercise supervision over research or would it stand idly by, allowing OSR to speak as the preeminent voice in the Air Force on scientific matters?[15]

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13 Ltr., Lt. Gen. Thomas S. Power to Director of Manpower and Organization, Headquarters USAF, 6 June 1955.

14 Ltr., Lt. Gen. Thomas S. Power to AC/S Installations, Headquarters USAF, 10 June 1955. Williams, personal interview with Milner, 6 June 1960.

15 William O. Davis, draft of speech, ca. fall 1955, but see also *infra*, Chapter VI.

These were some of the doubts in the minds of OSR's staff when, on 11 August 1955, the organization was formally detached from Headquarters, renamed the Air Force Office of Scientific Research (AFOSR), and made a separate ARDC center.[16] As promised, a general officer, Brigadier General Flickinger, the former Director of Research, who had been recently promoted, was given the command. General Power himself personally requested the Director of Manpower and Organization, Headquarters USAF, to give AFOSR sixty-one additional manpower spaces; in addition, he set a figure of $20 million as his ultimate goal for AFOSR's annual budget.[17]

For all practical purposes, the organization's mission remained the same, "to plan, formulate, initiate and manage [a basic] research program . . . ."[18] There was, moreover, little or no change in the top managerial positions. Of course, with Flickinger's designation as commander, Colonel Davis stepped down to occupy the position of Deputy Commander for Operations, where he remained, nevertheless, the moving spirit in all matters of great moment to the organization. Influencial only to a slightly lesser degree would be Colonel A. Pharo Gagge, the Deputy Commander for Resources, a former Yale University physicist who entered the military service during World War II and decided to make it a career.[19]

The organization's organic structure did change somewhat. To begin with, the organization could no longer rely on Headquarters ARDC for a variety of housekeeping chores. Thus, staff offices for Comptroller, Information, Administrative Services, and Procurement were opened directly under the Deputy Commander for Resources. On the operational side, an additional administrative layer was superimposed upon the technical divisions. What emerged were five directorates, Advanced Studies (the former Western Division), Bio-Sciences (inherited from the Directorate of Human Factors), Material Sciences (Chemistry Division and Solid State Sciences Division), Aerospace Sciences (Mathematics Division, Mechanics Division, and Combustion Dynamics Division), and Physical Sciences (General

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16 ARDC General Order No. 46, 26 July 1955; *Aviation Week*, LXV (6 August 1956), 116.

17 Department of the Air Force Special Order No. 151, 4 August 1955; AFOSR General Order No. 1, 8 August 1955, ltr., General Power to Director of Manpower and Organization, Headquarters USAF, 6 June 1955.

18 ARDC Regulation No. 22-30, 15 September 1955.

19 AFOSR General Order No. 5, 1 September 1955.

Physics Division and Nuclear Physics Division), all of which fell under the general direction of the Deputy Commander for Operations.[20]

Where the European Office would go was an open question even after the reorganization. After the February 1954 reorganization, the Office was in a somewhat undetermined state. The Office was technically under the control of the Directorate of Research, while in practice it functioned as part of OSR. In April 1955, however, the Office was suddenly shifted, on paper at least, from under OSR to the Directorate of Research. The European Office, it now appeared, had become collateral with OSR; but, in reality, it still continued to function as before, and Flickinger, Davis, and Gagge still looked upon it as part of their domain. Indeed, an October 1955 organization chart had the European Office jutting out from the AFOSR Commander's box. But the ink on this chart had scarcely dried than General Power decided to make the European Office a separate detachment of Headquarters ARDC and thus, as Gagge put it, "severed the 'moral bond' that had existed between the European Office and AFOSR."[21]

Along with the decision to make the European Office a separate detachment, Power decided to give General Flickinger the European command, and, on the recommendation of his deputy commander, Major General J. W. Sessums, to give the AFOSR command to Brigadier General Hollingsworth Franklin Gregory, a man with a wide-ranging experience in Air Force R&D who was presently rounding out a four-year term as Air Attache to the U.S. Embassy in Paris. Flickinger left for Europe in late December, but since Gregory was not due to take command until March, Colonel Gagge, the senior officer in AFOSR, filled in as commander in the interim.[22]

IV

Thus, two years after the departure of Haywood, AFOSR had been transformed from a small staff section in Headquarters ARDC into a full-fledged ARDC center with a general officer

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[20] AFOSR Organization Chart, October 1955.

[21] Col. William O. Davis and Col. A. P. Gagge, transcript of personal interview with Dr. Ernest Schwiebert, 8 November 1956.

[22] Department of the Air Force Special Order No. 186, 23 September 1955; Williams, transcript of personal interview with Milner, 6 June 1960; *OAR Chronology*, p. 23.

at its head. And, with more people and more money on the way, the organization appeared on the threshold of its greatest period of growth. But a healthy infusion of people and money was only one element shaping AFOSR's view of the future. More than one thing, in the summer and fall of 1955, gave AFOSR's staff cause for some apprehension. AFOSR's position on the federal science scene was far from established. Its new commander was an unknown quantity. The Directorate of Research had yet to make its intentions known. And, most importantly, there was the question of what center status would really mean to the organization in the long run. Haywood's belief, that AFOSR had a unique mission which could be properly performed only if the organization was uniquely placed in the Air Force's R&D hierarchy, was still the common belief among AFOSR's staff. Whether the status of an ARDC center was AFOSR's place in the scheme of things remained to be seen.

Chapter V

THE CONUNDRUM OF FUNDING

"The primary preoccupation of a manager of research and development in the Department of Defense," noted William O. Davis, "is inevitably the defense of his budget."[1] There were, to be sure, other concerns that at times weighed more heavily, but, year-in-year-out, the budget was the most persistent problem facing AFOSR's staff. Budgetary matters came to a head for AFOSR immediately following the issuance of the Executive Order of March 1954. At this time, Colonel Davis concluded that AFOSR's budget could no longer be defended on its merits. To do so, Davis felt, would make it appear as if AFOSR were competing with the National Science Foundation for funds--something which the Bureau of the Budget would not countenance.[2]

During the preparation of the fiscal year 1955 budget, General James McCormack, Jr., who had recently left ARDC to become Director of Research and Development, Headquarters USAF, sat down with General Flickinger and Colonel Davis to map out that year's budget strategy. McCormack made it clear that AFOSR could not hope to get any money unless it accepted a certain amount of semantic perversion in its programming. Hence, Davis began revising the programming categories and coining fresh designations. Basic research and applied research were dropped from the programming idiom, replaced in turn by exploratory research and supporting research.[3]

Supporting research was virtually self-defining. Designed to solve problems in development, it was in support of advanced

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[1] Colonel William O. Davis (USAFR), "Utilization of the Product of the Air Force Research Program," Air War College Thesis, Air University, 1964, p. 1.

[2] *Ibid.*, pp. 3-4; *History of the Air Research and Development Command*, 1 January - 30 June 1954 (ARDC Historical Division), I, 155, hereinafter cited as *History of ARDC*.

[3] William O. Davis, transcript of personal interview with Mr. Samuel Milner, 19 November 1959; Lt. Col. Jack D. Wartlman, transcript of personal interview with Mr. Samuel Milner, 7 November 1959; memo, William O. Davis to Lt. Gen. D. L. Putt, 11 February 1954.

projects. It was the kind of research conducted by the in-house laboratories and it sprang largely from requirements.[4]

Exploratory research, which now became the sole business of AFOSR, was little more than basic research under a new guise (although it would shortly take on a unique meaning). It did not spring from requirements. It did not look to the improvement of this or that system. It looked, rather, according to the official definition, to the "exploration of the furthest portions of knowledge in areas which may prove fruitful for military application." On the results it bore, according to Davis, would be based "tomorrow's equivalent of the hydrogen bomb and jet aircraft."[5]

Now, of course, when Davis conjured up images of hydrogen bombs and their equivalents, he could not at the same time ask for money for research in topology or cryogenics and be very convincing that such research would educe the desired effect. Call it exploratory research or basic research or anything else, if its line items in the budget appeared under chemistry and physics and mathematics, it was still fundamental science and it was still in competition with the National Science Foundation's program. Thus, any and all line items that smacked of ivy and ivory towers were blotted out. In their place arose such categories as electronics, materials, propulsion, and what have you. The more practical a category sounded, the better. Indeed, AFOSR virtually lifted the applied research programming structure and adopted it as its own.[6]

This was by no means the full extent of the relabeling. The documentation that was used to describe and to justify the research effort no longer carried justifications for basic research. Instead, a few large research areas, all of whose titles had the ring of practicality, were devised and under them was inserted AFOSR's program--everything crisply phrased in the language of tomorrow's engineer.

Davis and the rest of AFOSR's staff did not stop with the written word. In briefings, conferences, and other points of personal contact, they began speaking the language of applied

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[4] William O. Davis, "Concept of Operation of the Office of Scientific Research," 12 January 1955.

[5] *Ibid.*; see also, Brig. Gen. Don D. Flickinger, "Message to All AFOSR Personnel," 21 December 1955.

[6] Davis, "Utilization of the Product," pp. 4-5; Davis, transcript of personal interview with Milner, 19 November 1959; Warthman, transcript of personal interview with Milner, 7 November 1959.

[7] Warthman, 'ranscrip' of personal interview with Milner, 7 November 1959; memo, Davis to Putt, 11 February 1954.

research. The effort worked. AFOSR talked of applications, and the Bureau of the Budget loosened the purse strings. ("We sold them the sizzle," cracked one AFOSR administrator, "not the steak.")[8] Davis, in short, had built a semantic bridge between what was implied in AFOSR's mission and what AFOSR was actually doing.[9]

The budget exercise of fiscal year 1955 was the first of a recurring series of exercises designed to alter the semantic content of AFOSR's program, leaving, at the same time, its scientific content untouched. This was AFOSR's way of meeting budgetary problems brought on by changing conditions. How long a particular rendering of AFOSR's program would suffice was dependent on how AFOSR gauged the prevailing climate of opinion. Thus, while the general scientific character of AFOSR's program remained constant, the façade that AFOSR held before the Congress, the Bureau of the Budget, and the rest of the federal fiscal apparatus was constant only in the regularity of its changing character. AFOSR saw to it that it was always in vogue.

The practical consequences of changing the descriptive content of AFOSR's program to meet changing fiscal conditions went beyond the mere solution of budgetary problems. For one thing, it permanently introduced an element of confusion in AFOSR's mission, and, indeed, in the missions of other ARDC centers. It was an exceptional individual who could now pick his way through this formidable semantic maze. Thus, what was to serve as an effective smoke screen between AFOSR and the Bureau of the Budget also served to confuse AFOSR's friends. And, as a corollary to this, it scarcely served to educate anyone to the overriding benefits of basic research to military technology. On the other hand, with Davis providing most of the philosophical ammunition, the term "exploratory research" evolved into a formidable management tool which, for as long as Gregory and Davis remained with AFOSR, conveyed what AFOSR was doing.[10] As Davis developed the concept, he began to put it to use, partially altering in the process AFOSR's mode of operation. What was once cant became gospel.

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[8] Warthman, transcript of personal interview with Milner, 7 November 1959.
[9] Davis, transcript of personal interview with Milner, 19 November 1959.
[10] Davis, "Utilization of the Product," pp. 5-6.

II

The period between Haywood's departure and the arrival of General Gregory was both bleak and fitful for AFOSR. The abortive attempt to dissolve the fledgling organization, the reorganizations of 1954 and 1955, accompanied as they were by the descent from the top, and the budgetary crises of fiscal years 1954 and 1955--all combined to disrupt the relative tranquility enjoyed during the Haywood years. The fitfulness continued even after 1955. And many a member of AFOSR's staff was prone to see a bleakness over the horizon in the years that followed. Nonetheless, the years that followed the granting of center status were prosperous ones for AFOSR. It was the irony of the period that, during a time when basic research was under pressure in the military services, when the Air Force was forced to conceal its basic research program behind an elaborate apparatus of words, AFOSR experienced its greatest period of growth.

The early period of Gregory's reign also saw AFOSR move, in July 1956, to a much cherished Washington location. Moving to Washington was one of the things uppermost in Colonel Davis' mind, as it was in the minds of other members of the staff. Washington was, after all, the center of scientific policy making. All federal research agencies of any importance were located there. More private scientific research organizations had their headquarters there than in any other city. Men of science gravitated there, either for brief visits or for permanent employment. AFOSR was now unquestionably more in the stream of things. And it was General Gregory who brought things to a head, in the summer of 1956, and moved the organization after Davis and Flickinger before him had failed.[11]

No ARDC commander ever had any illusions about what the Air Force expected of his command: ARDC had the task of translating technical knowledge into usable military hardware. Under the circumstances, as long as the hardware kept rolling, neither Partridge, nor Putt, nor Power had to worry about how basic research fared. "I would never be criticized for what I didn't do in [basic] research," General Power said, in 1956,

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[11] Ltr., General Power to AC/S Installations, Headquarters USAF, 10 June 1955, ARDC Staff Summary Sheet, 3 June 1955; *History of ARDC*, 1 July-31 December 1958, II, 181-88; Williams, transcript of personal interview with Milner, 6 June 1960; ARDC General Order No. 25, 28 June 1956.

"and this is just where I should catch hell."[12] General Putt no doubt felt the same way, for, fitted as he was by background to understand such things, he knew, perhaps better than any other ARDC commander, of the intimate connection between new knowledge and technological progress. But Putt, in the short time he headed ARDC, was not overly successful in acquiring research funds. Power, on the other hand, if he was anything, was an aggressive, and successful, fund-raiser;[13] and while his belief in the efficacy of basic research was purely intuitive, Power was one to act on intuition. One thing that was obvious to him, after he took his first hard look at ARDC, was that the Command was heavily weighted on the side of weapon systems, model improvements, and quick fixes generally. He decided to get AFOSR more money.[14]

As early as August 1954, Colonel Davis got a hint of Power's intentions. Power attended a briefing Davis was giving on an AFOSR propulsion project. During the course of the briefing, Power was struck by the small amount of money that was going into the project. He interrupted the proceedings to tell Davis to put into the project whatever money was required and was struck again when Davis replied that there was no basic research money left, all of it having been tabbed for continuing projects.[15]

Impressed by Power's concern for research, Davis took the opportunity to suggest that AFOSR's budget be doubled. Power was prepared to go even further, suggesting that a $20 million budget in the near future would not be excessive. The upshot of this exchange was that Power instructed Davis to approach both Trevor Gardner, the Assistant Secretary of the Air Force for R&D, and General Putt, who was now the Deputy Chief of Staff for Development, Headquarters USAF, on the question of increasing AFOSR's budget.[16]

Davis met with Gardner and Putt early that fall. Both agreed that a $20 million annual budget was desirable and that they would do what they could to see that basic research was eventually

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[12] *Aviation Week*, LXV (6 August 1956), 117.

[13] Col. Leslie B. Williams, transcript of personal interview with Mr. Samuel Milner, 6 June 1960; ltr., Maj. Gen. J. W. Sessums (USAF Ret.), to Mr. Samuel Milner, 16 February 1962.

[14] *History of ARDC*, 1 July - 31 December 1954, p. 91.

[15] *Ibid.*, pp. 94-95.

[16] *Ibid.*; ltr., Col. William O. Davis to Col. D. W. Roberts, 4 October 1954.

funded on that level. But they also made it clear to Davis to expect no miracles.[17]

General Flickinger, who was Director of Research at this time, decided to act while Headquarters USAF appeared to favor a funding increase. He therefore suggested to Davis that he ask for an additional $3.5 million for fiscal year 1955. He also suggested that Davis ask for an additional 15 civilian positions, which would be required to handle the organization's growing program.[18]

The question of additional people was intimately connected to any substantial increase in the organization's budget. In the fall of 1954, the organization had twenty-seven people, each of whom handled approximately $4'0 thousand in contracts. At an average value of $25 thousand a contract, each administrator was saddled with the responsibility of monitoring about 18 contracts--too heavy a load to do a thorough job. In contrast, the average administrator with the Office of Naval Research carried approximately half this load. A meaningful increase in AFOSR's budget appeared to be out of the question if unaccompanied by a comparable increase in the organization's technical staff.[19]

In November, with Davis already having laid the groundwork, General Power officially proposed to General Putt that AFOSR's budget be increased to $20 million. Power recognized that this level was an ultimate goal and, in the interest of orderly growth, would be reached gradually. As a start, he took Flickinger's suggestion and asked Putt to add $3.5 million to AFOSR's fiscal year 1955 budget. He also asked for fifteen civilian spaces. Finally, he asked Putt to do what he could to modify "current Department of Defense policies limiting scientific research activities by the military services."[20]

The upshot of this request was that, for fiscal year 1955, AFOSR got its budget boosted from the originally approved figure of $5.6 million to $9.4 million.[21] As for the longer term expansion, in January 1955, AFOSR presented its case before the Coordinating Committee on the General Sciences of the Office

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[17] Ltr., Davis to Roberts, 4 October 1954; ltr., Lt. Gen. Thomas S. Power to Lt. Gen. D. L. Putt, 23 November 1954; ltr., Lt. Gen. D. L. Putt to Lt. Gen. Thomas S. Power, 10 December 1954.

[18] *History of ARDC*, 1 July - 31 December 1954, pp. 94-95.

[19] Ltr., Davis to Roberts, 4 October 1954.

[20] Ltr., Power to Putt, 23 November 1954.

[21] Ltr., Davis to Roberts, 4 October 1954; ARDC Form 185B, "AFOSR Budgets," 27 July 1961.

of the Assistant Secretary of Defense for R&D. The Committee was impressed, and by the summer of 1955, C.C. Furnas and the rest of the chairmen of the Technical Advisory Panels of the Defense Department were recommending to the Assistant Secretary of Defense for R&D that the Defense Department double its efforts in basic research. But the proposal received a chilly reception from J. B. Macauley, the Deputy Assistant Secretary, who in turn reminded Furnas of the existence of the National Science Foundation.[22] Thus, the desirability of expanding AFOSR's program did not at any time receive the official sanction of the higher echelons of the Defense Department. But it was in the nature of things, especially with AFOSR's program concealed behind a morass of technical verbage, that this did not hinder AFOSR's growth.

There was a corollary (that was both significant and interesting) to AFOSR's efforts to expand its budget. When Putt answered Power, informing him that he approved of an expanded program for AFOSR, he dropped the hint that "great emphasis is now being placed on the obligation of funds already appropriated to the Air Force." AFOSR's request for additional funds, Putt continued, would be "strengthened by early completion of the obligation of the funds already available [to it]."[23] Putt may not have meant for Power to interpret this advice broadly, but, with all of ARDC being unduly slow in obligating funds, Power was more than happy to do so.

For ARDC, large year-end balances of unobligated funds, which had to be carried over to the next fiscal year, were a recurring problem that served to obscure the necessity of the Command's annual appeals for more money. Part of the problem lay in overly deliberate procurement practices and part in the leisure with which the technical people rounded out their programs, but by no means was this the whole story. Much of the problem went back to the piecemeal funding policies of Headquarters USAF.[24]

A budget was never put to rest, for it came not in a lump sum, but in driblets. The original budget for a given year, after being hammered together over a period of six months or longer,

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[22] Ltr., Maj. Gen. James McCormack, Jr., Director of R&D, DCS/D, Hq USAF, to Lt. Gen. Thomas S. Power, 14 December 1954; memo, C. C. Furnas, *et al.*, to Assistant Secretary of Defense for R&D, 24 August 1955; memo, J. B. Macauley to chairmen, Technical Advisory Panels, DOD, 1 October 1955.

[23] Ltr., Putt to Power, 10 December 1954.

[24] *History of ARDC*, 1 January - 30 June 1954, p. 101.

schedule, the technical people had to have their programs in an advanced stage of planning. Thus, what may have appeared on the surface as a stepped-up accounting procedure was actually an implement for prodding the technical people into rounding out their programs well in advance of procurement. It was Power's way of speeding up the procurement cycle so as to avoid the piling up of unobligated funds at the end of a fiscal year.

Power did not stop merely with the swift obligation of funds that were actually available. During fiscal year 1957, Power directed his center commanders to obligate funds on the basis of their approved requirements rather than their budget authorizations.[29] An obligation is far enough along the procurement cycle so that a purchase request will have been issued and a contract signed; all that remains is for the disbursing officer to hand a check over to the contractor. Arriving at this stage of the procurement cycle presupposes that the ability to disburse is not in doubt. Thus, while it was possible for the Command to find itself overextended if its projected budget took an unexpected turn, Power appeared little intimidated by such a prospect. "[If] we can demonstrate a high rate of obligations . . . ," he observed, "we will be in a much better position to justify the need for additional funds . . . ."[30]

Finally, so as to cover all exigencies, centers were urged to have on hand an abundance of potential areas of expenditure (or, in the budgetary vernacular, to be "overprogrammed" in good ideas), so that whenever an unexpected windfall came their way it could be promptly obligated. And, to ensure that all center commanders spent with equal dispatch, Power let it be known that funds left unspent by one center would be shifted and spent by another.[31]

The initial response of the centers was not so enthusiastic as Power had hoped. What dampened enthusiasm--and, in turn, the rate of initiation and commitment--was the fear among center commanders that, in the end, they would be unable to obligate. Thus, in the beginning, most of the centers played it safe, initiating and committing only those funds which could be

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[29] *Ibid.*, 1 January - 30 June 1957, p. 41.

[30] Ltr., Lt. Gen. T. S. Power to Commanding General, AFFTC, 13 August 1956, quoted in *ibid.*, p. 41.

[31] Trip report, Col. A. P. Gagge, 14 November 1955.

was inevitably too small to keep the Command going and was never accepted with any kind of finality. In consequence, the plea for funds throughout the year was unceasing, and Headquarters USAF would respond by releasing additional money at appropriately spaced intervals. It was Headquarters USAF's way of keeping a tight rein on the R&D program.[25]

The impact of such piecemeal funding (or incremental funding, as it was officially known) on the Command was considerable. In terms of money alone there was usually an appreciable effect on the organization, with the final budget, as in fiscal year 1954, totaling as much as 25 percent more than the original. But the nature of incremental funding was such that there was always a disturbing note of uncertainty within the Command. Programs could never be planned with the assurance that they would be funded. And, since a windfall could come close to the end of the fiscal year, neither was there any assurance that all funds would be obligated before the fiscal year was over.[26]

It was somewhat ironic that Putt should urge Power to speed up the obligation of funds when Headquarters USAF policy was in great measure responsible for the lag. Be that as it may, if the ability to spend was to Headquarters USAF the primary criterion for need, if money not spent was money not needed, then Power was prepared to spend, and to spend feverishly.

By September 1955, Power had informed Flickinger that, where money was concerned, AFOSR was its own worst enemy. Henceforth, Power emphasized, AFOSR must go "intelligently broke."[27] In November, Power officially outlined his "Accelerated Obligations Program" in a letter addressed to all ARDC center commanders. He set down a strict schedule for the initiation (1 January 1956), commitment (1 March), and obligation (1 April) of funds and directed the various commanders to comply with it.[28]

The initiation of funds was purely a bookkeeping device which could normally be rescinded at anytime without an undue amount of difficulty. But for such an entry to be made on a prescribed

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[25] *Ibid.*, p. 102; U.S. Congress, *Hearings Before the Subcommittee on the Air Force of the Committee on Armed Services*, U.S. Senate, 84th Congress, 2nd Sess. (Washington: Government Printing Office, 1956), 1107.

[26] For increment funding see *History of ARDC*, 1 January - 30 June 1954, Chapter VII.

[27] Minutes of AFOSR's Directors Meeting, 21 December 1955.

[28] *History of ARDC*, 1 July - 31 December 1955, Chapter IV.

obligated with certainty. But, as Power continued to urge them on, the centers began to drop their cautious attitude.[32]

AFOSR, particularly after General Gregory took command, responded well. "We can only play the game by the rules . . . ," Gregory admonished his staff, "I am not going to stand by and lose money." And, during fiscal years 1956 and 1957, AFOSR proceeded to go "intelligently broke."[33]

This policy, when combined with AFOSR's verbal espousal of applied research and Power's determination to fulfill his promises, paid handsome dividends. In fiscal year 1955, AFOSR's budget rose 40 percent to $9.4 million, in fiscal year 1956, 48 percent to $13.9 million, and in fiscal year 1957, another 18 percent to $16.3 million.[34] This was at a time when basic research was at its nadir in popularity in the Department of Defense. Whatever else may be said of Power's "Go Broke" policy--and its effects were not salutary throughout the Command--for AFOSR it was a good money-getter.

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[32] Minutes of AFOSR's Directors Meeting, 21 December 1955. But see the following sections in the semiannual *History of ARDC:* 1 July - 31 December 1955, Chapter IV; 1 January - 30 June 1956, Chapter IV; 1 January - 30 June 1957, Chapter III.

[33] Minutes of AFOSR Staff Meeting, 10 July 1956.

[34] ARDC Form 185B, "AFOSR Budgets," 27 July 1961.

Chapter VI

CRISIS IN RESEARCH MANAGEMENT: AFOSR AND THE RPO'S

No one supposed that the circumstances which led to the founding of AFOSR as the Air Force's sole agency for the support of basic research would abide forever. The people responsible for the 1951 decision, Ridenour, Partridge, Haywood, and others, were now gone; and the conditions on which that decision was based had altered. The in-house laboratories continued to exist, albeit primarily as applied research laboratories, but with a stake in basic research. And under the wings of ARDC, these laboratories were better supported, equipped, and staffed than under AMC. The existence of these laboratories was an inducement to those who believed in the efficacy of in-house research to attempt to dislodge the Air Force from the grips of the Ridenour thesis. That such an attempt would constitute a direct attack on AFOSR was not to be doubted. Neither was it to be doubted that AFOSR would recoil at the prospect.

II

Ever since the reorganization of February 1954, the possibility that a Directorate of Research with staff supervisory powers might be established at Headquarters ARDC had been a matter of concern to AFOSR. The question of establishing such a directorate or something like it arose naturally enough during the planning that went into making AFOSR a center: someone would have to do the staff work for basic research at the Headquarters. Davis and Flickinger suggested that a single AFOSR liaison officer in Headquarters ARDC could adequately perform these duties. Major General Floyd B. Wood, the Deputy Commander for R&D, was of a different mind. He felt the job required a full staff office at the Headquarters; and, with General Power in agreement, Wood prevailed. Thus, concurrent with the establishment of AFOSR as a center, a Directorate of Research was established under the Deputy Commander for R&D with the job

of exercising "broad surveillance over the conduct of Command basic and exploratory research programs . . . ." In August 1955, General Wood brought in his own personal choice to head the directorate, Colonel Leslie B. Williams.[1]

In giving Williams his instructions, General Power expressed his concern over the seeming confusion in the Command's research efforts. There appeared to be an unnecessary proliferation of research categories. Integration between AFOSR's activities and the activities of the in-house laboratories was totally lacking. The Command had failed to make research appear meaningful. Power told Williams to integrate the Command's research activities in such a way that Headquarters ARDC "would not only know what was going on, but could control it." Williams could not have asked for an assignment closer to his heart.[2]

III

From the vantage point Williams had been occupying for the last three years, Chief of the Aeronautical Research Laboratory, he tended to see things from a different perspective than Flickinger or Davis or anyone else in AFOSR. While at ARL, Williams missed the supervision and support that normally came from a responsible staff office in higher headquarters. The rest of WADC's laboratories had a parent staff at Headquarters ARDC, but ARL felt cast aside because neither Haywood nor Flickinger after him found time to exercise their staff functions (nebulous as they were). The consequences of this neglect, Williams believed, were serious: the Air Force was losing control of its research program. With the emphasis on extramural research, the Air Force was relying more than ever on outsiders; and for as long as it continued to do so, Williams lectured, "we shall always be at the mercy of our consultants and advisers . . . and never be able to make our own decisions." His prescription was simple. The Air Force needed a vigorous in-house research program in order to maintain "a strong,

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[1] Lt. Col. Jack D. Wartinman, transcript of personal interview with Mr. Samuel Milner, 7 November 1959; ARDC Disposition Form, Brig. Gen. M.C. Demler to RDSO, Subj: "Request for Organization and Manning Action." 15 August 1955; ARDC General Order No. 69, 15 November 1955.

[2] Col. Leslie B. Williams, transcript of personal interview with Mr. Samuel Milner, 6 June 1960; ARDC Disposition Form, Demler to RDSO, 15 August 1955; memo, Brig. Gen. M. C. Demler to Lt. Gen. Thomas S. Power, 30 January 1956.

settled group of resident scientists" who would free it from its near-total dependence on outsiders for scientific advice.[3]

Of course, AFOSR's staff was indigenous to the Air Force, but, in Williams' estimation, it did not qualify as "a strong, settled group of resident scientists." For one thing, Williams believed AFOSR had an insufficient number of first-rate people; and what first-rate people it did have were overburdened administering AFOSR's contract program. AFOSR was not what it appeared to be. Its staff, particularly Colonel Davis, had oversold AFOSR's talents; they had, to quote Williams, sold the Air Force "a pig in a poke."[4] Neither was Williams overly enthused with AFOSR's program. He was decidedly opposed to what he believed were AFOSR's objectives. The organization, he felt, mistakenly believed it had an obligation to further the advancement of science and was willing, as a result, to support any good scientist who had a good idea, whether or not the idea had any direct relationship to the Air Force's mission. There had to be a relationship, Williams maintained, between ARDC's research program and the rest of what ARDC was doing.[5]

Fortunately, in Williams' eyes, basic research that had a relationship to ARDC's mission had not been altogether abandoned. When Williams headed the Aeronautical Research Laboratory, he fostered a small basic research program. He had never labeled it basic research, for he knew that the policy that AFOSR alone would do basic research was too well entrenched.[6] But whatever it was called, the program did survive; and it was here, at the in-house laboratories, Williams felt, that research of special significance to the Air Force could be performed. Moreover, such a program, if adequately supported, would afford the Air Force the kind of internal scientific staff that would emancipate it from outside counsel.

Throughout the early fifties, the internal basic research program was financed in a haphazard, catch-as-catch-can manner. Nevertheless, since ARL's funds came from the Wright Air Development Center, rather than Headquarters USAF, Williams had

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[3] Williams, transcript of interview with Milner, 6 June 1960; memo, Col. Leslie B. Williams, Subj: "Major Points of Difference--RDTR - AFOSR," 11 January 1956; ltr., Col. Leslie B. Williams to Col. J. E. Condron, Office of the DCS/D, Headquarters USAF, 3 May 1956.

[4] Williams, transcript of personal interview with Milner, 6 June 1960.

[5] *Ibid.*; Col. Leslie B. Williams, speech delivered before the Air Force Scientific Advisory Board, 21 May 1957.

[6] See *supra*, pp 47-51, see also, Williams, speech delivered before the Air Force Scientific Advisory Board, 21 May 1957.

less difficulty financing his program than Haywood had financing his. By the time Williams became Director of Research, the situation was reversed. Development costs rose, and money at the center tightened. WADC was less willing, and less able, to support research. At the same time, AFOSR had entered a period of steady growth. It was obvious to Williams that if basic research at the in-house centers was to be saved something had to be done about how this research was financed. Research at the centers could no longer be left to the whims of development.[7]

Others in ARDC Headquarters, particularly those who believed such a move would strike a blow for orderliness, wished to put an end to the haphazard manner in-house research was financed. Since the two centers with in-house basic research programs received no money earmarked for basic research as such--their official business being applied research and development--it was nigh on impossible for the Air Force, or even ARDC, to know how much money went into basic research. Only AFOSR's budget was clearly earmarked for "exploratory" research. It was a case of one hand not letting the other know what it was doing. And it was clearly to the advantage of Headquarters ARDC to know what the rest of the organization was up to.[8]

But those who were in favor of more orderly financing practices could also see some danger in reform. According to the best educated guesses of the time, GRD and ARL combined did almost as much basic research as the whole of AFOSR. Thus, half of the command's basic research money was being funneled out of the development program. If this practice were stopped and all basic research money were clearly labeled, would Headquarters USAF allocate as much money to basic research under a single budget as was presently being allotted under a number of budgets? General Sessums, the Vice Commander, felt at one point that ARDC might as well make a clean break and put all basic research under AFOSR. But he also believed, as others did, that AFOSR alone was unable to command a budget equal to

[7] Williams, transcript of personal interview with Milner, 6 June 1960; Williams, speech delivered before the Air Force Scientific Advisory Board, 21 May 1957; Directorate of Research Staff Study, Subj: "Management Procedures for ARDC Research," enclosure to ltr., Col. L. B. Williams to Maj. Gen. Floyd B. Wood, 15 November 1955.

[8] Williams, speech delivered before the Air Force Scientific Advisory Board, 21 May 1957; Directorate of Research Staff Study, "Management Procedures for ARDC Research," enclosure to ltr., Williams to Wood, 15 November 1955.

that going into basic research at the time. This was a telling argument, and with ARL and AFCRC recoiling at the prospect of losing control over their research programs the idea was dropped.[9] Williams was now free to seek what was for him a more satisfactory solution.

IV

That solution, as Williams saw it, was to devise appropriate "Research Planning Objectives" (RPO's) for basic research. With such objectives devised and properly enshrined in the official regulations, all research would henceforth be planned and programmed against these objectives. Such a plan had, from Williams' point of view, several distinct advantages, not the least of which was that it gave the Directorate of Research nominal control over ARDC's research program.[10]

Once the plan was in operation, those centers in pursuit of basic research were to gear their programs so as to fulfill the goals established in the official RPO's, which, as proposed by Williams, would be in such areas as propulsion, materials, electronics, geophysics, life sciences, and aeromechanics. These, according to Williams, were "major problem areas" in which the Air Force "unquestionably has an interest and a need to conduct basic research." Thus, whereas AFOSR now asked for money for chemistry, physics, and other scientific disciplines, under Williams' plan, AFOSR and the in-house laboratories would ask for money for any and all of the established research planning areas. And whereas AFOSR's budget now constituted the Air Force's basic research budget, under the plan, the Air Force's basic research budget would be the combined budgets of AFOSR and the in-house laboratories. Of course, AFOSR would go on as before contracting for work in the academic disciplines. But this work, in theory at least, could no longer be justified on its own merits. On the official research plans, which AFOSR and the in-house laboratories would be required to submit to the Director of Research along with their annual budget requests, current and proposed contracts and in-house efforts would be cited merely as the means by which a center proposed to attack

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[9] Ltr., Maj. Gen. J. W. Sessums USAF (Ret.), to Samuel Milner, 16 February 1962.

[10] Williams, personal interview with Milner, 6 June 1960, Directorate of search Staff Study, "Management Procedures for ARDC Research," enclo- to ltr., Williams to Wood, 15 Novem er 1955.

a particular objective in propulsion, materials, or what have you. And it would be the job of the Director of Research to judge each research plan and distribute money accordingly--rejecting this plan, adopting that, allotting so much to AFOSR for research in this, so much to ARL for research in that. Theoretically, then, the plan gave the Director of Research control over the research program.[11]

Moreover, since the in-house laboratories would no longer look to the development centers for their support, the plan theoretically pulled together all of ARDC's research efforts and made the entire program readily identifiable. And since this would be so, Williams no longer had to be concerned with the Air Force's dependence on outside counsel, for he would now be in a position to feed and keep alive an extensive in-house effort, which would in turn maintain a permanent staff of qualified scientists within the Air Force. Furthermore, Williams believed the RPO system would give the research program some badly needed "objectivity"; it would tie the program to tangible Air Force objectives. And, purely as a money-getting proposition, the system needed no defense. One could readily get money for research on new propulsion systems; it was more difficult to get money for research in, say, the isotopic-exchange reactions of the boron hydrides.[12]

V

In seeking a solution, Williams by no means ignored AFOSR--in the beginning, at least. He took care to keep Davis, Flickinger, and, later, Gregory informed of his most recent approaches to the problem. With the completion of a staff study on the question in November 1955, Williams invited Davis, Gagge, and other AFOSR staff members to a number of conferences so that whatever solution was reached would be a mutually agreed upon solution. It soon became evident, if it were not evident before, that there could be little agreement on matters large or small between AFOSR and the Directorate of Research.[13]

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[11] Williams, speech delivered before the Air Force Scientific Advisory Board, 21 May 1957, ltr., Col. Leslie B. Williams to Brig. Gen. H. F. Gregory, 9 October 1956.

[12] Ltr., Williams to Gregory, 9 October 1956; ltr., Maj. Gen. Floyd E. Wood to Maj. Gen. Ralph P. Swofford, Director of R&D, Headquarters USAF, 26 January 1956.

[13] Memo for the record, Brig. Gen. Don R. Flickinger, Subj: "Scientific Research in the Air Force," 22 November 1955.

Williams himself was the source, if not the conscious source, of some of the difficulty. His record as Chief of the Aeronautical Research Laboratory was known to most, but admired by few, of AFOSR's staff. His antipathy to AFOSR, or, at least, to the way AFOSR operated, was public knowledge; and AFOSR's staff returned this antipathy with dividends, although, in the beginning, apparently without malice. The prevailing view of Williams in AFOSR was that he was a sincere, well-meaning man who did not quite understand what basic research was about. If this was damning Williams with faint praise, as time went on, AFOSR dispensed with such subtleties. But, be that as it may, at bottom, it was not so much Williams himself who was unacceptable to AFOSR as the ideas he espoused and the authority he represented.[14]

AFOSR's staff took early and vigorous exception to Williams' plan for unifying and controlling research. "To put it very simply," General Flickinger wrote after a week of meeting with Williams, "the OSR group disagree completely with the [Directorate of Research] in what actually comprises a true basic research program in the Air Force. This has reached the point where the OSR group cannot accept any of the concepts of the [Directorate of Research] in regards the goal, the organization, the philosophy, and mechanics of research."[15]

More specifically, AFOSR maintained that research goals could not be set down for basic research. A true scientific research program would itself "produce [the] objectives upon which development and systems are based." Moreover, AFOSR rejected the philosophy which it believed underlay the Directorate's plan: that basic research can be managed in much the same way as other programs in ARDC. The stewardship and management of basic research could not be discharged in the same manner as that of a hardware program.[16]

Specifics aside, AFOSR would have probably resisted any plan that the Directorate of Research may have proposed.

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[14] Williams, transcript of personal interview with Milner, 6 June 1960; Dr. Amos G. Horney, personal interview with author, 2 August 1965; Dr. Harold Wooster, transcript of personal interview with Mr. Samuel Milner, 4 December 1959; memo, Milton Rogers and Carl Kaplan to Col. A. P. Gagge, 2 November 1956.

[15] Memo for the record, Flickinger, 22 November 1955.

[16] *Ibid.*, ltr., Col. W. O. Davis to Col. L. B. Williams, 16 December 1955; ltr., Col. W. O. Davis to Lt. Col. J. F. Mazy, 30 April 1957; Amos G. Horney, "Comments on Manpower Survey," 5 December 1958.

Anything that smacked of AFOSR's subservience to a staff section in Headquarters ARDC was unacceptable to AFOSR.

There was something about AFOSR's ambition to be highly placed in the Air Force R&D hierarchy that made it feed on adversity. After each setback, after each painful step down to center status, AFOSR's estimate of its proper place in the scheme of things rose another notch until, by the turn of 1956, Davis and Gagge, but Davis in particular, were openly suggesting that AFOSR be attached to the Air Staff.[17]

Ever since the days of Haywood, AFOSR's staff looked upon AFOSR as the Air Force's true counterpart to the Navy's Office of Naval Research. But AFOSR and ONR, while they were comparable, were scarcely equal. Besides having a considerably larger budget, ONR was highly placed in the Department of the Navy, with the Chief of Naval Research reporting directly to the Under Secretary of the Navy. The Chief of Naval Research, therefore, was the recognized spokesman for research for his department, as were the chiefs of the other federal research agencies for their departments. They represented their agencies on the various coordinating committees of the Department of Defense, the National Research Council, and what have you. And they had a large voice in establishing policy.[18]

The Commander of AFOSR had no similar status, being several organizational layers removed from the policy making echelon in Headquarters USAF. This put AFOSR's staff at a great disadvantage in relation to its counterparts in other agencies. AFOSR could not deal with other research agencies as an equal among equals--or, at least, so its staff believed.

AFOSR's case was not exactly bereft of merit. Dr. Albert E. Lombard, for example, who was the principal adviser to the Director of Research, Headquarters USAF, complained in private about the Air Force's propensity to organize research along traditional military lines. Lombard himself had to reach down through seven staff levels before he could find, as he expressed it, "a live working Indian."[19]

If this was frustrating to Lombard, it was even more frustrating to someone in an in-house laboratory or in AFOSR since, if he wished an idea of his to be adopted, that idea had to receive

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[17] Williams, personal interview with Milner, 6 June 1960; ltr., W. O. Davis to author, 4 November 1965.

[18] Ltr., Davis to author, 4 November 1965.

[19] Memo for the record Col. A. P. Gagge, 21 March 1956.

concurrence on all staff levels. The system not only precluded a quick reaction to any given situation, but it also worked to snuff out much of the thought that emanated from the working level. Accordingly, AFOSR tended to look upon the Directorate of Research, ARDC, as one more superfluous staff level in an organizational arrangement that was already unworkable because of a proliferation of staff levels.[20]

With AFOSR and the Directorate of Research unable to resolve their differences over the proposed research objectives, the question went to General Power. At a meeting on 19 December, at which Power, Flickinger, Demler, Williams, and Davis were present, AFOSR's representatives went right to the point and attempted to upend the Directorate of Research. Flickinger, who carried the burden of AFOSR's argument, began by proposing to Power that the AFOSR Commander act as the ARDC staff adviser on research. Flickinger further suggested that the AFOSR Commander, or his designated representative, be ARDC's sole representative for basic research at the Air Staff and Defense Department levels. He proposed, in addition, that the Chief Scientist, AFOSR, also be the Chief Scientist, ARDC.[21]

Power dismissed Flickinger's suggestions. He did not believe in anyone carrying two portfolios. AFOSR, like any other center, he pointed out, would take its general direction from ARDC's staff. AFOSR could not, he said, "have its cake and eat it too"; it could not be both a staff and an operating agency. As to the research objectives, Power made it clear he favored the concept and left it up to the centers and the Directorate of Research to work out the details.[22]

Two days later, Flickinger held a staff meeting, reminded the members of his staff to "appreciate our very considerable stature as a separate ARDC center," and asked them "to detach yourselves completely from staff activities . . . ." Williams had clearly won the first round.[23]

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[20] Ltr., Davis to author, 4 November 1965. Among the more difficult problems facing AFOSR, A. P. Gagge pointed out, in November 1956, was mastering "all the middlemen between us and General Power." A. P. Gagge, transcript of personal interview with Dr. Ernest Schwiebert, 8 November 1956.

[21] Memo for the record, Col. Leslie B. Williams, Subj: "Summary of Meeting with General Power," 19 December 1955.

[22] *Ibid.*; memo, Demler to Power, 30 January 1956.

[23] Ltr., Brig. Gen. Don D. Flickinger to All AFOSR Personnel, 21 December 1955.

VI

Meanwhile, a jurisdictional dispute of modest proportions, but substantial significance, broke out between GRD and AFOSR which served to shed a great deal of light on the research management policies Williams was attempting to adopt. In the summer of 1955, Dr. John W. Evans, the Director of GRD's Sacramento Peak Observatory, Sunspot, New Mexico, tried to hire a young solar physicist named R. N. Bracewell. Government salaries being what they were, Evans could not meet Bracewell's terms, and Bracewell took a more lucrative position at Stanford University. He then proceeded to propose to Evans a contract for the development of a microwave spectroheliograph. Evans liked the proposal, but GRD could ill-afford the $150 thousand price tag. Accordingly, Bracewell submitted the same proposal to AFOSR. AFOSR accepted.[24]

When this news reached Cambridge, Lt. Colonel Robert F. Long, the Chief of GRD, lodged a vigorous protest at ARDC Headquarters. AFOSR's entrance into one of GRD's established fields, Long maintained, would disrupt "the cohesiveness of a going research program." So that the unity of GRD's solar research program might be preserved, Long suggested that AFOSR transfer $150 thousand to GRD so that GRD could support the Bracewell contract. "It appears to be an unprincipled practice," he continued, "to take advantage of the gross unbalance in budgets among organizations in ARDC having research responsibilities . . . to establish an internally competitive research program."[25] A week later, Major General R. C. Maude, the Commander of the Air Force Cambridge Research Center, appealed directly to General Power. The Bracewell case, Maude argued, "violates an important principle which has prevailed in ARDC regarding the Command's geophyics mission, namely, that it is a complete mission covering the whole spectrum of geophysical research and development."[26]

Sooner or later, it was inevitable that AFOSR's rising budgets would become a subject of concern among the in-house laboratories. But what was at stake here was more than just money. Long had raised the question of how encompassing

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[24] Memo, Lt. Col. Robert F. Long, Chief, Geophysics Division, ARDC, to Col. John R. V. Dickson, Director of Development, ARDC, 12 January 1956.

[25] *Ibid.*

[26] Ltr., Maj. Gen. R. C. Maude, Commanding General, AFCRC to Lt. Gen. Thomas S. Power. 20 January 1956.

AFOSR's mission in basic research should be. If it were now found that its mission did not include the field of geophysics, it might be found later that it did not include some other field over which an in-house laboratory felt it had preemptory rights.

In its reply to GRD, AFOSR asserted that it regarded itself privileged "to enter any technical area it chose whether or not there were already established programs elsewhere in ARDC . . . ." (As a matter of fact, AFOSR was at work in programs that had been established in the in-house centers long before AFOSR was created.) In addition, AFOSR categorically refused to transfer any of its funds to another agency of ARDC.[27]

The dispute had its ironic aspects. Colonel Williams' RPO system, which would have promoted competition between AFOSR and the in-house laboratories, was designed to bolster research at the in-house centers. Yet, GRD recoiled even at what little competition there now existed, and AFOSR, while appearing to benefit from this competition, feared what an increased dose, brought on by the RPO system, might do. So much for irony. The affair illustrated that the system, once in operation, might take some unexpected turns.

Williams, in the meantime, if he were serious about implementing the system (and he was), had to remain faithful to it. And under the system it was the specific Air Force objective that mattered, not the scientific disciplines employed to reach it. He had no choice, therefore, but to align himself solidly behind AFOSR. "[No] scientific or engineering discipline should 'belong' to one and only one given Center as a basic prerogative," he wrote to General Demler: "Rather, any and all disciplines may be needed by all Centers to reach their stated objectives."[28] Demler, and ultimately Power, agreed with Williams' position, and nothing else was ever officially heard of the matter.[29]

VII

AFOSR's staff could feel duly grateful for Williams' efforts; and, at least on this occasion, they would have had to admit that

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[27] Quoted in memo, Long to Dickson, 12 January 1956.

[28] Memo, Col. Leslie B. Williams to Brig. Gen. M. C. Demler, 19 January 1956. See also Williams, speech delivered before the Air Force Scientific Advisory Board, 21 May 1957.

[29] Ltr., Lt. Gen. Thomas S. Power to Maj. Gen. R. C. Maude, 29 February 1956.

Williams was right. But, had they read Williams' detailed position on the matter, they would have probably added that Williams was right for the wrong reasons. Now that Power had categorically rejected AFOSR's overtures for higher status, AFOSR was forced to meet Williams on his own grounds. And Williams' proposed research objectives, which had swung the tide to AFOSR in its dispute with GRD, increasingly appeared as the most likely terrain on which the two would meet.

Following the meeting with Power, Williams' earlier inclination to work closely with AFOSR was no longer evident. When Williams and his staff undertook the task of outlining and incorporating the RPO system into ARDC Manual 80-4, which governed all R&D activities, they did so without seeking either the advice or consent of the centers.[30] And as the months passed little or no effort was made by either party to resolve their differences. A report of the ARDC Inspector General, submitted to General Power, in March 1956, pictured the two in disagreement over the management of research, the role of the in-house laboratories, and even the definition of research.[31] Nonetheless, General Gregory took exception to the Inspector General's report and assured General Power that "all conflicts have been resolved and that OSR is presently implementing its mission as directed by the Commander, ARDC."[32]

In July 1956, Colonel Davis saw a "bootleg" copy of the revised programming note to the ARDC research manual. To him, this was "the biggest axe swung at AFOSR up to that time."[33] General Gregory reacted with a long letter to General Power. The adoption of the RPO system and the subsequent compartmentalization of research into research goals, he wrote, "can only lead to the desiccation and complete atrophy of exploratory research in ARDC." He continued:

> The principal danger in the proposed change . . . is not whether ten goals or twenty goals are specified, but lies in the fundamental belief, exemplified in this change, that research must be guided and directed toward specific goals--that there is no place in the Air Force for research

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[30] See below, pp. 90, 92.

[31] Memo, Col. John W. Carpenter III, Inspector General, ARDC, to Lt. Gen. Thomas S. Power, 13 March 1956.

[32] Ltr., Brig. Gen. H. F. Gregory to Lt. Gen. Thomas S. Power, 1 March 1956.

[33] Memo, W. O. Davis to Brig. Gen. H. F. Gregory, 13 August 1956; Wooster, transcript of personal interview with Milner, 4 December 1959.

> without an obvious application for the solution of known Air Force problems. This is extremely dangerous, especially if the choice of specific goals is left to a few people with remote working knowledge of the respective scientific area in which research is contemplated.[34]

Gregory further complained that the manual had been revised without AFOSR's participation and asked that publication of the manual he held up until AFOSR was given an opportunity to review it.[35]

Before Power had an opportunity to compose a formal reply to Gregory, Gregory shot off another letter. This time he suggested that Power adopt a formal policy statement, giving to AFOSR the exclusive right to conduct exploratory research by contract.[36]

In mid-August, Power composed a carefully worded reply to Gregory's first letter in which he assured Gregory that AFOSR would have an opportunity to review the manual before publication, but otherwise yielded nothing of substance.[37] A week later, on 24 August, apparently prompted by Gregory's second letter, Power paid AFOSR a visit. He pointed out that AFOSR was a relatively new organization and Gregory himself a new commander; he then advised Gregory to "play the management situation cozy." Gregory should not "take off in all directions but go along slowly and surely . . . ." Then, in what was an obvious reference to Gregory's proposed policy statement, Power said he felt as if he had stated AFOSR's position within the command ten thousand times and he would state it ten thousand more times, if need be; but he would not put it on paper, preferring, as he put it, "to talk it out, talk it over and rub the rough edges together to make them smooth."[38]

Gregory wheeled out for the occasion his soon-to-be-familiar "Rainbow Grap -a bright, multicolored chart that graphically depicted the spectral range of ARDC's R&D activities. Making appropriate references to the chart, Gregory delivered a lecture on what exploratory research was and why it should be managed the way AFOSR wanted to manage it--a lecture wnich he would

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[34] Ltr., Brig. Gen. H. F. Gregory to Lt. Gen. Thomas S. Power, 11 July 1956.
[35] *Ibid.*
[36] Ltr., Brig. Gen. H. F. Gregory to Lt. Gen. Thomas S. Power 6 August 1956.
[37] Ltr., Lt. Gen. Thomas S. Power to Brig. Gen. H. F. Gregory, 16 August 1956.
[38] Memo for the record, Williams, Subj: "Summary of Visit by General Power to AFOSR," 27 August 1956.

deliver on many another occasion to audiences of widely varying degrees of scientific discernment.[39] Davis followed Gregory with a presentation of his own, in which he discussed three research projects that AFOSR wished to sponsor as soon as possible--a gatling gun shock tube, a unique cosmic ray experiment, and research in magnetohydrodynamic propulsion.

Davis' presentation gave Power an opportunity to make a point. "You can't tell and sell the public and the world on these things in such a way that they believe that this is just sky blue thinking," he said. AFOSR had to be "truthfully deceitful" about its program so as to "coat" it with a look of practicality.[40] The meeting broke up on this note.

Davis had foreseen the necessity of being "truthfully deceitful" long before Power. The fact of the matter was, both Gregory and Davis were convinced that the RPO system was far too elaborate for merely moving balky officials in the Bureau of the Budget. To them the heart of the system was aimed at AFOSR.

Gregory's suspicions that this was so were reinforced by a memorandum sent to the in-house laboratories over the signature of Brig. General Marvin C. Demler, who had become Deputy Commander for R&D when General Wood was killed in an air accident in the spring of 1956. The memorandum, largely the work of Williams, urged the in-house centers to direct their programs away from time-phased hardware and into research. It was an invitation to the laboratories to compete with AFOSR for the research dollar.[41] But this did not mean (and this was a crucial point) that Williams was putting the entire research budget up for grabs. The promise that Power had made to bring AFOSR's budget up to an annual level of $20 to $25 million in the next few years still held. The minimum AFOSR would receive each year would be determined by other processes. This meant that a large part of the budget would never be competed for; it would go automatically to AFOSR. The rest would be competed for by everyone, including AFOSR.[42] Thus, while there would be some competition for the research dollar, AFOSR appeared to hold most of the trumps. As events would tell, however, the organization did not look at it quite this way.

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[39] *Ibid.*

[40] *Ibid.*

[41] Memo, Col. Leslie B. Williams to Brig. Gen. M. C. Demler, 15 August 1956; memo, Rogers and Kaplan to Gagge, 2 November 1956; memo for the record, Col. A. P. Gagge, 20 November 1956.

[42] Memo, Williams to Demler, 15 August 1956; memo, Assistant Deputy Commander R&D, ARDC, to Gen. Demler, 17 August 1956.

VIII

In August 1956, with Lt. Colonel Jack D. Warthman, AFOSR's Director of Plans, representing AFOSR, representatives from the centers met with Williams to compose their differences over ARDC Manual 80-4. Williams accepted a few changes in wording, but no substantive changes in the system. Warthman left the meeting as dissatisfied as when he came.[43]

In September, the revised version, labeled by the Directorate of Research as a final draft, was distributed to the centers. Early the following month, Williams wrote Gregory, mentioned the finality of the latest version of the manual, and requested that Dr. Carl Kaplan, AFOSR's Chief Scientist, take part in writing the RPO on dynamics.[44] Gregory responded with another letter to Power. The manual, he insisted, had never been coordinated with AFOSR. "Coordination implies concurrence, which has never been obtained from this organization," he wrote, reaching for a veto over the system. He then went on to make substantive objections--mainly, that the research goals established by the system were far too confining and thus "incompatible with the mission and concept of operation" of AFOSR. The objectives should be broadened and should represent merely a "self-contained technical expression of Air Force interests . . . ." In no way, Gregory urged, should the RPO's bear a "formal relationship to 80-4 programming and reporting procedures."[45]

Receiving no satisfactory response from General Power, Gregory composed yet another letter for the ARDC Commander, this one written in sharper tones. Demler and Williams, according to Gregory, had been engaged in "a concentrated effort to diminish the responsibility of AFOSR in exploratory research." ARDC Manual 80-4 was revised under pretense. Its aim was not to coordinate research; "the real reason was to allow the centers to set up a contract program and to control research at Headquarters ARDC." Gregory had finally touched the point really troubling AFOSR; but he relented, decided not to send

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[43] Memo, Lt. Col. Jack D. Warthman to Brig. Gen. H. F. Gregory, 19 September 1956; ltr., John L. Greene, *et al.*, to Commanding General, ARDC, Attn: RDGP, 15 August 1956; ltr., Maj. Walter W. Sanders, D/R, ARDC, to Commanding General, AFOSR, 10 September 1956.

[44] Ltr., Lt. Col. Leslie B. Williams to Brig. Gen. H. F. Gregory, 9 October 1956.

[45] Ltr., Brig. Gen. H. F. Gregory to Lt. Gen. Thomas S. Power, 17 October 1956.

the letter, and launched instead a campaign to undermine the RPO system in the centers.[46]

A version of Manual 80-4 that AFOSR could support, one which did not require the RPO's to correspond to budgetary line items, was drawn up by Colonel Warthman and sent to the commanders of AFCRC, WADC, and the Rome Air Development Center, along with a plea by Gregory that Warthman's version be accepted in favor of that drafted in Headquarters ARDC.[47] Only Major General Stuart P. Wright, whose operation at Rome was far removed from Gregory's concern, came close to sympathizing with Gregory. No one agreed that the RPO's should be independent of budgetary line items, and Brig. General Thomas L. Bryan, the WADC Commander, doubted that the situation was as serious as Gregory represented it. All expressed a willingness, however, to renew discussions with Headquarters ARDC.[48] In this way, Gregory forced another round of discussions, a round which, given the fact that the centers were due to reap the rewards of the new system, was destined to get nowhere.[49] Try what he might, Gregory was unable to prevent the incorporation of the RPO's into the programming structure.

IX

Adoption of the system by no means rang down the curtain on the debate. AFOSR's protests continued as before.[50] And while the debate touched many points, and while it was fed in part by personal antagonisms, there was only one significant point at issue: whether AFOSR should continue as before being the Air Force's sole basic research agency.

In consequence, it was of little consolation to AFOSR that it had the largest claim on the basic research budget. After all, before the new programming note, AFOSR's budget was the total Air Force basic research budget. But what had once been a total claim was now only partial. To AFOSR's staff, the RPO

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[46] Draft of ltr., Brig. Gen. H. F. Gregory to Lt. Gen. Thomas S. Power, ca. November 1956.

[47] Ltr., Brig. Gen. H. F. Gregory to Brig. Gen. Thomas L. Bryan, 4 December 1956.

[48] Ltr., Brig. Gen. Thomas L. Bryan to Brig. Gen. H. F. Gregory, 8 January 1957; ltr., Maj. Gen. W. M. Morgan to Gregory, 20 December 1956; ltr., Maj. Gen. Stuart P. Wright to Gregory, 14 December 1956.

[49] Memo, Lt. Col. Jack D. Warthman to Brig. Gen. H. F. Gregory, 23 August 1957.

[50] See below, footnotes 60 and 61.

system appeared to be a means by which the Directorate of Research could give AFOSR's money to the in-house laboratories.[51]

The whole affair, in the eyes of Pharo Gagge, was a "studied effort" by the Directorate of Research "to dilute AFOSR's responsibilities."[52] Jack Warthman echoed Gagge's charge: "We see this as a proposal to dilute research funds without serving any useful purpose."[53] Others, such as Major John B. Shipp, Jr., the Assistant Director of Material Sciences, took an even gloomier outlook. "Since personnel [in the Directorate of Research] administering funds normally understand the language of supporting research," Shipp wrote, "the possibility exists that current AFOSR philosophy and operation may have to change to compete." In the meantime, Shipp concluded, AFOSR would remain "in an unfavorable position regarding competition for research funds."[54]

Williams' answer to this was that the in-house laboratories were not alone in acquiring more research money under the new system; AFOSR was doing well, too. How could AFOSR claim to be losing money to the centers when its budget was rising according to the rate of progression set down by General Power? The element that AFOSR overlooked, according to Williams and his proponents, was the dynamics of the RPO system. The RPO's, because they tied research to tangible objectives, were raising more money for everyone, including AFOSR.[55]

This kind of argument was difficult to meet head-on, so AFOSR attacked it obliquely. AFOSR's staff had no quarrel with using research program areas as an information dissemination structure or as a means of acquiring funds--AFOSR had done the same thing in the past. What it did object to was the use of the research program areas by the Directorate of Research as a means to control funds.[56] To put the control of funds in the hands of Williams and the rest of the Directorate of Research

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[51] See below, p. 95

[52] Memo for the record, A. P. Gagge, Subj: "Relations between AFOSR and Headquarters ARDC and Other Centers," 19 November 1956

[53] Memo, Warthman to Gregory, 19 September 1956.

[54] Memo for the record, Major John B. Shipp, Jr , 14 September 1956.

[55] Williams, transcript of personal interview with Milner, 6 June 1960.

[56] Memo, Warthman to Gregory, 23 August 1957; Dr. Morton Alperin, transcript of personal interview with Mr. Samuel Milner, 23 July 1960, Dr. Amos G. Horney, personal interview with author, 19 December 1961.

was to put them in incompetent hands.[57] This objection was elaborated on by two members of AFOSR's staff:

> Col. Williams . . . admitted [the Directorate of Research] is at present in no position to evaluate ARDC-wide proposed exploratory research. Moreover, he had no intention of increasing his staff in order to acquire this capability. On what basis would he render decisions with regard to exploratory research proposals emanating from the Centers was not made clear, but render decisions he will. We feel that Col. Williams' position in this matter is inherently weak and presents OSR an opportunity to offer its services in coordinating, evaluating, and funding all exploratory research within ARDC . . . . Obviously, Col. Williams will not accept an offer which amounts to full control by OSR of the exploratory research programs . . . but it may lead him into arguing on a point where he is weak and ineffective and therefore lose the battle to OSR by default.[58]

There was an important corollary to this: since Williams and his staff could not judge what was good or bad research, then there was no guarantee that the money going to the in-house laboratories was going for good research. More than one AFOSR staff member maintained that much of the money going to the laboratories was not being spent for basic research at all, but for the support of development.[59]

Say what it might, AFOSR's staff was less concerned than it appeared about how the laboratories spent their money internally. And, if the laboratories had spent their money exclusively on internal efforts, AFOSR's hue and cry would have been less anguished. But the laboratories supported extramural efforts, too. Thus, as AFOSR saw things, it had now became vulnerable on two fronts. The laboratories were now competing for research funds which AFOSR considered rightfully its own and, to make matters worse, were using some of these funds to engage in contract research, an activity which AFOSR believed was its exclusive preserve.[60]

Hence the debate continued. At conferences, in correspondence, at briefings and informal gatherings, Gregory, Davis, and

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[57] See *supra*, p. 84

[58] Memo, Rogers and Kaplan to Gagge, 2 November 1956.

[59] Memo, Warthman to Meyers, 29 January 1958.

[60] Ltr. Dr. Amos G Horney to Brig Gen. B. G. Holzman, 22 September 1959, Dr. Merle Andrew, personal interview with author, 17 November 1961.

other members of AFOSR's staff, never lost an opportunity to attack the RPO system. And Williams, put on the defensive, felt obliged to regularly hold forth on the merits of his handiwork. From here it was but a short step to stating the issue in personal terms. The recriminations and counter-recriminations that followed need not be detailed here; suffice it to say that the controversy between Davis and Williams became so acute that, in the fall of 1957, General Sessums felt obliged to reassign the two men to outlying units. But, while the departure of Davis and Williams tended to ease relations between AFOSR and Headquarters ARDC, it changed little in the long run. The RPO system remained the Air Force's programming structure for research as well as the chief thorn at AFOSR's side.[61] Thus, interpreting the dispute in personal terms reveals little. The key to the dispute was the RPO system itself, which represented the inevitable swing of the pendulum away from the monistic approach to research management advocated by Louis Ridenour to the pluralistic approach of Theodore von Kármán. The Air Force had determined that it would no longer depend on extramural research alone for acquiring fundamental knowledge, and AFOSR felt threatened.

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[61] Ltr., Davis to Mazy, 30 April 1957, ltr., Dr. Amos G. Horney to Capt. Patrick W. Caulfield, 5 October 1956; memo for the record, Gen. M. C. Demler, 3 June 1957; ltr., Gen. M. C. Demler to Gen. Thomas S. Power, 12 June 1957; ltr., Maj. Gen. J. W. Sessums, Jr., to Brig. Gen. H. F. Gregory, 14 June 1957; Williams, transcript of personal interview with Milner, 6 June 1960, ltr., Maj. Gen. J. W. Sessums, USAF (Ret.), to author, 28 December 1965.

Chapter VII

AN EXERCISE IN AUSTERITY: THE FISCAL YEAR 1958 BUDGET

The summer of 1957 found AFOSR (not to mention the Air Force as a whole) deep in crisis--a crisis precipitated by a government-wide austerity drive. The Eisenhower Administration, finding that projected expenditures threatened the existing federal debt ceiling and determined not to breach that ceiling, ordered a reduction in fiscal year 1958 spending. Accordingly, AFOSR sustained a five percent cut in its budget. A ceiling was slapped on its monthly expenditures. And its 1958 funds were virtually frozen pending further review by higher headquarters. For an organization that had been following an accelerated obligations policy (and had, indeed, obligated all its 1957 funds), the new cost-cutting policies came as the severest kind of blow. AFOSR could either drastically curtail and dislocate its operations or else shut them down altogether.

II

Whatever its difficulties in other areas, by the fall of 1956, AFOSR had little reason to expect anything but smooth sailing in budgetary matters. General Power had thus far delivered on his promises, and Gregory, confident that Power would continue to deliver ("General Power is behind AFOSR 100 percent," Gregory told AFOSR's staff in July 1956), began laying plans for a $25 million budget for fiscal year 1958.[1]

As early as May 1956, Gregory told Power he was confident AFOSR's staff could obligate a sum in the neighborhood of $25 million.[2] Then, in November, in an effort to expand AFOSR's technical staff, he weakened his argument by claiming that a critical shortage of manpower existed in AFOSR. Colonel

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[1] Minutes of AFOSR Staff Meeting, 17 July 1956; ltr., Brig. Gen. H. F. Gregory to Lt. Gen. Thomas S. Power, 4 June 1956.

[2] Memo, Brig. Gen. H. F. Gregory to Lt. Gen. Thomas S. Power, 4 May 1956.

Williams had been saying this all along, and he now began to question AFOSR's ability to handle with effectiveness a budget in excess of $15 million--the most, in Williams' estimation, AFOSR could spend and still maintain a reasonable ratio of contracts to contract monitors.[3] Nonetheless, AFOSR got $16.3 million in fiscal year 1957, and Gregory pressed for another boost the following year.

By December, Gregory's chances of getting $25 million were somewhat dim. Major General Ralph P. Swofford, McCormack's successor as Director of Research and Development, Headquarters USAF, told Demler and Williams that a $25 million budget for AFOSR could not be supported at this time and advised them to lower their sights by about five million. Later that month, Demler's office gave a budget presentation before General Putt and Secretary of the Air Force Donald A. Quarles. At this meeting, Demler was told that Headquarters USAF would not entertain a figure in excess of $16 million for AFOSR. Demler and Williams informed Gregory of these developments, but they still held out the hope that they might be able to go as high as $20 million.[4]

By February, however, it was evident that $20 million was out of the question, and AFOSR began giving serious consideration to dropping plans for constructing and supporting a much wanted nuclear accelerator facility at the California Institute of Technology.[5] In March, the Directorate of Research submitted to Headquarters USAF a financial plan which called for $16.3 million for AFOSR--the same figure the organization had received the previous year. And, by the end of April, even the usually optimistic Gregory seemed reconciled to a temporary leveling off in the organization's growth. "Next year's budget will be the same as this year," he wrote to Amos Horney.[6]

The first sign that the tightening of the reins around AFOSR's budget might be part of a broader austerity program came on 26 April, when Headquarters USAF directed ARDC to terminate its accelerated obligations policy. At the same time, it directed

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[3] Memo, Col. Leslie B. Williams to Brig. Gen. M. C. Demler, 22 May 1956; Col. Leslie B. Williams, "Staff Study--FY 1957 Budget for the AFOSR," 22 May 1956; ltr., Maj. Gen. John W. Sessums to Brig. Gen. H. F. Gregory, 14 June 1957.

[4] Memo, Col. Leslie B. Williams to Gen. M. C. Demler, 13 August 1957.

[5] Memo, Col. Leslie B. Williams to Executive Secretary, Coordinating Committee on Sciences, DOD, 20 February 1957.

[6] Memo, Williams to Demler, 13 August 1957; memo, Brig. Gen. H. F. Gregory to Amos G. Horney, *et al.*, 30 April 1957.

ARDC to carry over all unobligated funds into fiscal year 1958. As far as AFOSR was concerned, this order was purely academic, for, thanks to Gregory and a well run procurement office, AFOSR was already fully obligated.[7]

Meanwhile, AFOSR's staff began to review what a $16.3 million budget would mean to the organization. Since most of AFOSR's growth had taken place during the past two years, AFOSR's program was relatively new, the average age of its most promising contracts being less than two years old. Thus, the bulk of the budget ($14.7 million) had to be set aside for renewals. The proposed accelerator at Cal Tech required an additional $1.1 million, leaving only $500 thousand for supporting new work. By Gregory's reckoning, AFOSR had at hand $6 million worth of new proposals worthy of support.[8]

In late May, with these facts before him, Gregory decided to plead for more money. "The retention of the 1957 ceiling. . . ," he wrote General Power, "will force us to discontinue further consideration of any future proposals. . . . Under these circumstances it would be only a short time before the interest of the scientific public in our research efforts. . . would vanish. . . ." Gregory recognized, of course, that the austerity drive was not ARDC's doing, but he also felt that ARDC had helped contribute to AFOSR's plight. "[Under] present austere conditions [it] is untimely. . .to establish new contract programs in other centers," he continued, putting the blame squarely on the doorstep of the Directorate of Research. Thus, if AFOSR were to remain reasonably receptive to new work and new ideas, Gregory proposed that $2 million of the $9.2 million allotted for research in the in-house laboratories be turned over to AFOSR. Otherwise, he warned, "AFOSR will be forced into an increasingly obsolete and mediocre program. . . ."[9]

Power could understand Gregory's predicament, although he did not necessarily agree with Gregory's solution. He summoned both Demler and Williams into his office and told them to work out a satisfactory solution.[10] The two ultimately decided to try to finance such costly items as the Cal Tech accelerator with

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[7] Lt. Col. Jack D. Warthman, "Study of the Impact of Expenditure Limitations of FY 1958," 20 November 1957.

[8] Ltr., Brig. Gen. H. F. Gregory to Lt. Gen. Thomas S. Power, 23 May 1957.

[9] *Ibid.*

[10] Memo, M. C. Demler to Col. Leslie B. Williams, 29 May 1957.

other than research money. This would leave AFOSR with a sum close to $2 million for supporting new work. Concurrent with this effort, Williams, who truly believed that AFOSR needed more people to undertake any new contracts, undertook, with the blessings of Power and Demler, to acquire more manpower spaces for the organization.[11]

While this was going on, rumors began to circulate that the Air Force's R&D program was in for a sizable cut, perhaps as large as 25 percent.[12] And perhaps by way of forewarning Gregory that it was by no means a certainty that AFOSR would receive more money, General Sessums wrote him, reminding him of the already high ratio of contracts to contract monitors in AFOSR and telling him of the burden a budget in excess of the present ceiling would impose on AFOSR's technical staff. But he assured Gregory that Headquarters ARDC was doing what it could to get AFOSR more manpower authorizations.[13] Then Sessums turned to the proposed Cal Tech accelerator:

> I do not question the scientific worth of the proposed effort at the California Institute of Technology. However, this effort may not achieve a sufficiently high Command precedence so that it can be funded . . . . In this event, you must weigh the advantages of funding this effort with R&D contract funds against the value to the Air Force of the many smaller research contracts which the $1.1 million would support.[14]

The scientific community, disturbed by the all-pervading dominance of one federal agency, the Atomic Energy Commission, in the fields of high energy and nuclear structure physics and in an effort to diversify the sources of nuclear physics support, had been urging the Defense Department to take increased interest in these fields. The Cal Tech accelerator, which would represent the Air Force's entry into the construction of nuclear facilities, was now threatened. More would shortly be threatened.[15]

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[11] Memo, Col. Leslie B. Williams to Major Sanders, 11 June 1957; memo, Col. Leslie B. Williams to M. C. Demler, 12 June 1957.

[12] Minutes of AFOSR Staff Meeting, 5 June 1957.

[13] Ltr., Maj. Gen. John W. Sessums to Brig. Gen. H. F. Gregory, 14 June 1957.

[14] *Ibid.*

[15] Nick A. Komons, *The Air Force and Nuclear Physics*, OAR 63-4 (OAR Historical Division, 1963), pp. 12-22.

On the eve of the new fiscal year, AFOSR's budget (16.3 million) had been through the chain of approval in Headquarters USAF; the Congress, however, had yet to act on military appropriations, and the Secretary of Defense had released no funds. On the last working day of the old fiscal year, 28 June 1957, came what everyone had feared would come. On that day, Secretary Wilson himself announced that austerity would prevail throughout the fiscal year. No new programs would be begun and no old programs would be expanded without Department of Defense approval. Moreover, fiscal year 1958 funds would be held up until the fiscal year 1958 program had been reviewed by the Office of the Secretary of Defense. On the same day, the Bureau of the Budget released a letter to all federal agencies asserting the determination of the Eisenhower Administration to hold the rate of expenditures for fiscal year 1958 at or below the previous year's level.[16]

On 29 June, Headquarters ARDC, acting on Headquarters USAF instructions, informed its centers by teletyped message that each new or renewed contract would have to be individually justified to the satisfaction of Headquarters USAF on the basis of technical urgency before it could be funded.[17] If the events of the previous day had been expected by AFOSR, the TWX of 29 June came as a distinct shock. Austerity was one thing; undertaking as prodigious a task as this was another. Gregory decided that, given his limited staff resources and the pressure on his staff created by six months of proposals for new work that could not be funded, the job could not be done. So AFOSR submitted a blank justification for approximately 50 contracts with universities and not-for-profit institutions. In the process, AFOSR reminded Headquarters ARDC that the institutions concerned fully expected these contracts to become effective on 1 July and had made arrangements, including the hiring of graduate assistants, to begin work on that date.[18]

This was only the beginning. On 19 July, Headquarters USAF directed that all "effort-type" contracts would be cut by five percent. Since all of AFOSR's contracts were for services rather than goods, AFOSR's entire fiscal year 1958 program was subject to a five-percent cut on an individual contract

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[16] *History of the Air Research and Development Command*, 1 July - 31 December 1957 (ARDC Historical Division), pp 25-26.

[17] ARDC TWX RDCB-7-264-E, 29 June 1957.

[18] Warthman, "Study of FY 1958," 20 November 1957.

basis.[19] ARDC immediately went to work to get relief. In five days, after prolonged conferences at the Pentagon, it succeeded in having the directive of 19 July revised--but as events proved, only temporarily. In lieu of the original five-percent reduction on an individual contract basis, ARDC could now apply as it chose a $15-million reduction against its "effect-type" contracts. Of this, $2 million would come out of the research budget. How much would be applied against AFOSR was still to be decided.[20]

It was in such an atmosphere of uncertainty that, on 1 August, AFOSR was informed that its blanket justification would not do. Contracts would have to be justified on an individual basis. A schedule for the submission of justifications was set up. The first batch of justifications, for contracts falling due during August, was due in two days. Despite the tight deadline, AFOSR's staff, working overtime, managed to meet it. Gregory, however, continued to look askance at the whole, madcap procedure.[21]

In the meantime, Secretary Wilson revealed the depth of the austerity drive. The Defense Department, he explained, had been spending, since January, at a rate in excess of $40 billion a year, while the allotted rate was $38 billion. Thus, during the coming year, in order to avert a penetration through the national debt limit, defense outlays would be trimmed not only so as to match the cuts made in the original budgetary planning, but also so as to make up for the last several months of excessive spending. In short, he estimated that there would be a $2.2 billion cut in the original defense budget.[22] Simultaneously, James H. Douglas, only recently appointed Secretary of the Air Force, announced that the Air Force would sustain a one-billion-dollar cut in spending for the fiscal year--by far the largest cut among the three services. In order to achieve the savings, Douglas remarked, it "will demand brains, guts and patience from headquarters down to base level. . . and throughout our defense industries."[23]

At the lower levels, patience was one thing many people were running out of. Gregory had become especially impatient with the dreary, time-consuming task of justifying contracts

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[19] USAF TWX 30[illegible]98, 19 July 1957.

[20] Memo for the record, Lt. Col. Carl Arnold, P&P, ARDC, 25 July 1957.

[21] Warthman, "Study of FY 1958," 20 November 1957; ltr., Lt. Col. Jack D. Warthman to Commanding General, ARDC, ATTN: RDGPP, 9 August 1957.

[22] *Baltimore Sun*, 2 August 1957.

[23] *Washington Post*, 4 August 1957; *Aviation Week*, Vol. 66 (5 August 1957); *St. Louis Post Dispatch*, 6 August 1957.

that had long since gone through channels and had been amply justified before. He was particularly piqued when he learned that the Air Force was the only service that had adopted such a procedure for research. On 9 August, with AFOSR in a mood of utter exasperation, Gregory sent off a letter to Headquarters ARDC and requested exemption for research from the policy of individual contract approval. Besides protesting that AFOSR did not have the manpower to continue such an undertaking, he questioned both the necessity and soundness of the policy for research. Technical urgency, he pointed out, was an extremely poor basis on which to judge the value of a long-range program in basic research. He then asked ARDC to consider the comparatively small amount of money that was involved in the basic research program. Whatever savings were ultimately extracted from it would be scant; but they would be extracted at the cost of a good many years of accumulated good will among colleges and universities. This to him was false economy. The immediate effect of Gregory's protest was to get AFOSR a slight dispensation; AFOSR would now have to justify only its more costly contracts. It appeared to do little else.[24]

By 12 August, Headquarters ARDC, collaborating closely with Headquarters USAF, had worked out the spending rates for the centers. AFOSR was given an expenditure ceiling of $12 million (a sum which included the contracting AFOSR did for other agencies) for each six months of fiscal year 1958; in other words, the organization could spend $2 million per month. In addition, Lieutenant General Samuel E. Anderson, who had taken over command of ARDC from General Power on the eve of the fiscal crisis, made it clear that Headquarters USAF would entertain no reclama to the existing ceilings. The next day, Headquarters USAF once again slapped on a five-percent reduction per contract, leaving the expenditure rate the same, however.[25]

The fiscal outlook was critical, to say the least, but AFOSR reckoned that it could probably live with it until November--and by that time, relief might come. The organization had spent $2.5 million in July and more than $2 million in August.

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[24] Warthman, "Study of FY 1958," 20 November 1957; ltr., Chief of Naval Research to Comptroller of the Navy, 18 July 1957; ltr., Comptroller of the Navy to Chief of Naval Research, 26 July 1957; ltr., Warthman to Commanding General, ARDC, 9 August 1957.

[25] Minutes of AFOSR Staff Meeting, 13 August 1957; Warthman, "Study of FY 1958," 20 November 1957; USAF TWX 36359, 12 August 1957.

This left a little over $7 million for the rest of the calendar year. But by reluctantly cancelling such expensive projects as the Cal Tech accelerator, it could get through the calendar year.[26]

Finally, some good news came. On 27 August, Headquarters ARDC, with Headquarters USAF approval, rescinded the requirement for individual contract justification. Liberated from this time-consuming task, AFOSR's staff now concentrated on achieving a five-percent reduction in the cost of each contract. The approach chosen was to write directly to each contractor affected, explain the situation, and ask him to effect a reduction himself by cutting from such items as overhead, travel, and equipment. This was probably the least painful method of effecting the cuts; but the instructions to the contractors were clear that if the cuts could not be achieved in this manner, they would have to come out of the direct labor charges.[27]

As this was going on, General Anderson was responding to the arguments contained in Gregory's letter of 9 August. On 29 August, he asked General Putt to exempt research from the five-percent reduction per contract and to apply instead a five-percent reduction to the total research effort. "This would allow the Command some flexibility in applying the reduction to the least sensitive areas of the Research Program," he wrote, "and help to minimize the serious and far-reaching effects of reduction by individual contract."[28] On 3 September, Anderson was writing again, this time to the Chief of Staff, USAF, General Thomas S. White. "The small total cost of the Air Force Research Program, plus the large number of low-cost contracts it includes, make it seriously questionable whether the small net saving to be realized by applying a 5% reduction to each individual research contract justifies or pays for the administrative effort required to implement this action," Anderson wrote, adopting Gregory's argument. Anderson made no direct plea for relief, but it was clear that that was what he was after.[29]

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[26] Minutes of AFOSR Staff Meeting, 20 August 1957.

[27] Warthman, "Study of FY 1958," 20 November 1957; form ltr., Brig. Gen. H. F. Gregory to AFOSR Contractors, 22 August 1957; ARDC TWX 8-17-M, 22 August 1957; ltr., Brig. Gen. H. F. Gregory to Commanding General, ARDC, 27 August 1957.

[28] Ltr., Lt. Gen. S. E. Anderson to Lt. Gen. Donald L. Putt, 29 August 1957.

[29] Ltr., Lt. Gen. S. E. Anderson to Gen. Thomas D. White, 3 September 1957.

Three days later, on 6 September, came the most devastating blow of all. AFOSR's expenditure ceiling was reduced from $12 million to $11 million.[30] It did not require a skilled accountant to deduce that this further reduction was catastrophic. If the reduction stood, AFOSR was out of business.

With this ceiling, it would have been difficult enough for AFOSR to meet merely its own obligations, but, since it acted as a research procurement agent for the RAND Corporation, Headquarters USAF, and the Defense Department, there was no way it could meet every voucher coming in for payment, even at the reduced rate of five percent. During fiscal year 1957, AFOSR had obligated, both for itself and others, $28.1 million. Of this amount, $15 million fell due between 1 July and 31 December 1957. In addition, $3.23 million had to be expended for obligations incurred during fiscal year 1958. Figuring in the five percent reduction, $17.32 million fell due during the first half of the fiscal year. If the accelerated obligation policy had not been in effect during fiscal year 1957, the organization may have been able to sustain the cut, or, at the very least, it would not have been in such narrow straits. But, as matters now stood, even with the $12 million ceiling, AFOSR would have run out of money around the beginning of November. With the $11 million ceiling, it could not meet vouchers awaiting payment in September. Technically, the organization was bankrupt.[31]

The organization could now do one of three things. It could cancel its contracts and close up shop, which, at this point, was not so unthinkable to many of AFOSR's staff. It could try to live with the reduction by dropping some of its more costly contracts, cutting drastically the direct labor costs in others, and scaling down other costs which were already down to the bone. Finally, it could make another plea for relief. Such was the state of confusion that at no time was a firm decision made as to what course of action to follow. Instead, the organization flailed about in all directions, made preparations for drastic cutbacks, pleaded for more money, and, in moments of greatest despondency, came perilously close to shutting down.

The staff's first thought was to cancel about half of its 600 or so active contracts. Cutting individual contract costs further

[30] ARDC TWX RDGPP 9-1-E, 6 September 1957, in Warthman, "Study of FY 1958," 20 November 1957.

[31] AFOSR TWX to ARDC (Personal, Gregory to Anderson), 11 September 1957; Warthman, "Study of FY 1958," 20 November 1957.

was dismissed almost out of hand.[32] The original five-percent cut had met with enough resistance at universities without attempting to tack on an additional reduction. Indeed, university administrators were beginning to voice their protests both publicly and loudly.

"In September we get orders telling us what we can spend in September," related an Ohio State spokesman. "We also are told we cannot spend by the end of September money already spent by the end of August. It is ridiculous on the face of it."[33] One thing university administrators could not understand was how the Army and the Navy had managed to go through the ordeal with a minimum of confusion while AFOSR stood on the verge of collapse. "I have never seen a panic of this kind in research," observed a university administrator. "[The Air Force] has been panicked by a bunch of bookkeepers," said another. "If there ever was a state of confusion," said an MIT spokesman, "the Air Force is now it." But one thing university administrators did understand was that irrespective of whether AFOSR could or could not survive the $11-million ceiling, universities would be hit hard. "Being a nonprofit organization," explained a University of Michigan administrator, "we can't accrue funds to hold personnel and continue the work. We can't wait until the government's pleasure to restart. When contracts are cancelled, we have to either find work for personnel on other projects or let them go."[34] The consequences of cancelling 600 research contracts were far-reaching not only in terms of science, but also in human terms.

If AFOSR had been panic-stricken when the new ceiling was ordered, a week later the organization was in an extreme state of despondency. Such was the depth of this feeling that Gregory, seeing no other way out, ordered the preparation of 600 telegrams notifying contractors that their work had been cancelled.[35] "The entire structure of Air Force advanced research program is in danger of collapse," reported *Aviation Week* in mid-September.[36]

It was at this point that Colonel Davis decided on a bold move. One day before the 600 telegrams were scheduled to go

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[32] *Aviation Week*, Vol. 66 (16 September 1957).
[33] *Aviation Week*, Vol. 66 (23 September 1957).
[34] *Ibid.*; *Baltimore Sun*, 17 September 1957; *New York Times*, 22 September and 9 October 1957.
[35] William O. Davis, personal interview with author, ca. 3-14 January 1966.
[36] *Aviation Week*, Vol. 66 (16 September 1957).

out, he saw to it that Jerome B. Wiesner, I. I. Rabi, and Lee A. DuBridge, three of the most influential men in science, were fully apprised of the depth of the crisis facing AFOSR. Rabi took the matter directly to the White House, where it was received with sympathy, and the crisis began to take on some fluidity.[37]

The next day, 16 September, two important meetings took place. One was a regularly scheduled meeting of the DOD's Coordinating Committee on the General Sciences, at which the financial plight of basic research dominated the discussion. The committee drew up a strongly worded recommendation for the Assistant Secretary of Defense for Research and Engineering, asking that long-term funding be instituted for basic research. The Assistant Secretary himself, Dr. Paul D. Foote, who was present at the meeting, undertook to persuade Secretary Wilson to exempt basic research from the existing budgetary restrictions.[38]

The other meeting was between the Air Staff and Secretary Douglas, who now knew of the warm reception Rabi's appeal received at the White House.[39] But Douglas apparently made no promises to the Air Staff, for, after the meeting, Putt wrote Anderson that the limitations were still firm and that Anderson should expect no relief. But he gave Anderson some badly needed flexibility. If Anderson wished to rescue AFOSR of his own accord, he was free to do so. "If you desire to fund the research program at the expense of other [ARDC] programs . . . ," Putt wrote, "you may do so . . . ."[40] Since the rest of ARDC was as hard-hit as AFOSR, it was anybody's guess where Anderson would find the money; but he nonetheless wired Gregory not to take any steps which would "constitute a complete closing of your operations."[41] The telegrams were held back.

Two days later the crisis was over. On the morning of the 18th, Major General Jacob E. Smart, the Assistant Vice Chief of Staff, called General Anderson to say it was all a mistake.

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[37] Davis, personal interview with author, ca. 3-14 January 1966.

[38] Memo for the record, Frank Voltaggio, Jr., Asst. Chief, P&P Division, Directorate of Research, Subj: "Summary of First Meeting of Coordinating Committee on Sciences," 24 September 1957.

[39] ARDC TWX RDTRP 9-3-E, 17 September 1957.

[40] Ltr., Lt. Gen. Donald L. Putt to Lt. Gen. S. E. Anderson, 16 September 1957.

[41] ARDC TWX RDGP 9-8-E, September 1957.

The Secretary of the Air Force had not meant to be all-inclusive in his original instructions. The five-percent reduction was not intended to include contracts with universities.[42] Richard E. Horner, the Assistant Secretary of the Air Force for Research and Development, gave the same explanation to the press: it was all a mistake.[43]

III

It was in this atmosphere of budgetary confusion and self-imposed austerity that the news of Russia's successful launching of the first earth satellite, on 4 October, hit the front pages. Sputnik was a severe blow to American prestige; but, if it had a substantive meaning, it meant merely that the USSR had a lead over the United States in one special R&D area, space technology--an area in which the United States had the basic, but not the technological, knowledge to compete with the Russians. But, because of the way the incident was exploited, especially by the scientific community in the United States, basic research was given a badly needed boost both in public and official esteem. And AFOSR became a direct beneficiary of this new-found esteem.

From the $11-million expenditure rate imposed in early September, AFOSR's expenditure rate for the first six months of the fiscal year climbed to $19 million.[44] Its fiscal year 1958 budget, pegged at $16.3 million in June and reduced by five percent in July, ended up at a level of $22.5 million--a thirty-eight percent increase over fiscal year 1957.[45]

Meanwhile, Neil H. McElroy, the new Secretary of Defense, was assuring everyone that the Defense Department would pay its bills when they came due--even if it meant piercing the $38-billion Defense ceiling.[46] In the end, defense spending penetrated through the ceiling, and the Eisenhower Administration, hoping for a budget surplus on the eve of Russia's first

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42 Memo for the record, Col. John R. V. Dickson, Asst. Deputy Commander, R&D, 18 September 1957; *New York Times*, 22 September 1957, USAF TWX 45470, 18 September 1957, Warthman, "Study of FY 1958," 20 November 1957.

43 *New York Times*, 22 September 1957

44 ARDC TWX RDGPP 9-23-E, 20 September 1957, in Warthman, "Study of FY 1958," 20 November 1957.

45 ARDC Form 185B, "AFOSR Budgets by Division," 27 July 1961.

46 *Alamogordo Daily News*, 22 October 1957, *The* [Washington] *Evening Star*, 30 October 1957.

dramatic exploit in space, and in the face of mounting unemployment and a deepening slump in durable goods, ended up the year with a $2.1 billion deficit.

Gregory was heartened. ". . . the Sputnik influence along with the announced national policy of more emphasis in research," he wrote General Sessums, "has been extremely stimulating to the scientific community."[47] It had also worked as a stimulus on Gregory. He started an accelerated procurement policy of his own, setting deadlines for the initiation and pre-initiation of contracts. At the same time, he waged a relentless campaign for more money; and while he never received quite what he asked for, AFOSR did get $27 million in fiscal year 1959--double the budget Gregory had inherited from his predecessor.[48]

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[47] Ltr., Brig. Gen. H. F. Gregory to Maj. Gen. John W. Sessums, 13 January 1958.

[48] Memo, Brig. Gen. H. F. Gregory to All AFOSR Directors, 10 January 1958; ltr., Brig. Gen. H. F. Gregory to Lt. Gen. S. E. Anderson, 22 November 1957; ltr., Brig. Gen. H. F. Gregory to Maj. Gen. John W. Sessums, 15 January 1958; ltr., Gregory to Sessums, 13 January 1958; ARDC Form 185B, "AFOSR Budgets by Divisions," 27 July 1961.

Chapter VIII

PROJECT FAR SIDE

There was no denying that, for basic research in general and AFOSR in particular, Sputnik was a blessing in disguise. Coming at a time when military R&D was under severe financial pressure, the Soviet exploits in space tended to point up the fact that support for research in the United States was not what it should be. And, after the inevitable agonizing that followed this event, there came for basic research help in the form of money and men and an enlightened outlook. Nevertheless, not all the events that followed Sputnik were fortuitous ones for AFOSR. The Soviet exploit, combined with a particular set of circumstances, worked to wreck AFOSR's budding space program and to claim the life of one of its directorates, the California-based Directorate of Advanced Studies.

II

It will be recalled that, in 1955, the old Western Division, by now possessing a technical program of its own, was renamed the Directorate of Advanced Studies, conforming with a general reorganization which made the directorate, rather than the division, the principal organizational unit within AFOSR.[1] Instituting the directorate system, which, in effect, superimposed an additional administrative layer atop of the existing technical divisions, was part of an over-all scheme by William O. Davis to take better advantage of the practical potentialities inherent in AFOSR's research.

What AFOSR might do in disseminating scientific information and stimulating new work at Air Force development laboratories, other than encourage its contractors to publish, was not something easily answered. Nonetheless, Oliver Haywood believed from the first that this would eventually be the area of AFOSR's

[1] See *supra*, p. 65.

principal responsibility. And Davis, after Haywood left, began to give increased attention to the problem. One of his approaches was to dignify the area of information with the status of a legitimate scientific pursuit. In 1956, he brought Dr. Harold Wooster, Jr., to head a newly established Directorate of Research Communication. The directorate was charged with a broad range of information functions--sponsoring research in the information sciences, gathering and disseminating technical information and military intelligence, and running the technical library and the public information program. Adopting a coded card system for indexing AFOSR's contracts, so that information and its user could be easily matched by machine, was one of the more notable achievements of the directorate.[2] When all was said and done, however, the directorate only solved the related problems of information gathering and dissemination. And this, to Davis, was not enough. Even if the most efficient mechanized means imaginable were devised to disseminate information, even if this information were conveyed in such a way that it could be understood by people in many disciplines, including engineers, Davis still felt it was not enough.[3] Davis believed that new ideas could not easily take hold within the framework of the Air Force's existing R&D structure. Development laboratories were busy pursuing their own ideas and were not easily deflected by the flow of new scientific information into new areas of development. Davis' solution was to establish within AFOSR a directorate capable of responding quickly to the challenges posed by the flow of new scientific information. Hence, the Directorate of Advanced Studies (DAS) came into being. It was Davis' way of "utilizing the product" of AFOSR's research.[4]

From this idea, Davis proceeded to tie everything into a neat philosophical package. AFOSR's principal function was the support of "exploratory research" (a term, it will be recalled, invented to meet a budgetary crisis). Exploratory research, according to Davis' definition, could be either basic or applied, just as the work at in-house laboratories could fall under both of these categories. But all similarities between AFOSR's work and the work at the laboratories stopped here. The laboratories did

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[2] Col. William O. Davis (USAFR), "Utilization of the Product of the Air Force Research Program," Air War College Thesis, Air University, 1964, pp. 15-16, 24.

[3] *Ibid.*, p. 24.

[4] *Ibid.*, pp. 24-25, memo, William O. Davis to Brig. Gen. H. F. Gregory, 4 October 1956.

research--whether basic or applied--that was in support of already existing development programs. AFOSR's work, however, was, in Davis' words, "oriented towards the discovery of new capabilities and the recognition of their implications so that entirely new development programs can be created in the future"--and this was so whether AFOSR was involved in the search for a new elementary particle or the development of a space suit.[5]

Davis assigned a key role to the directorates. The technical divisions--Chemistry, Nuclear Physics, Mathematics, and the rest--were for the most part concerned with the day-to-day activities of administering a research program--that is, they were confined to the business of discovering new fundamental knowledge about nature. The directorates, or let us say the directors themselves, who hovered over the divisions organizationally, concerned themselves only casually with the performance of this role. Their main job was to serve as "the essential links between undirected research and its application to practically useful devices and systems." In the words of General Gregory, the directors, while keeping themselves in intimate contact with the results of research sponsored by the divisions under them, looked "outward at the possible application areas" that this research suggested. The directors looked in two directions. They looked, first of all, to the ARDC development engineer, providing him with fundamental knowledge bearing on his problems, and to the Directorate of Advanced Studies, providing it with fundamental knowledge that could lead to the development of "revolutionary" weapon concepts.[6]

To say the least, the directorate concept was a neat approach to a complicated problem--almost too neat for some people to take seriously. For one thing, the concept was put in operation after the fact, the directorates having been established before any such functions had been assigned to them. Indeed, General

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[5] *Ibid* p. 5; "Logically," Davis wrote to General Gregory, "exploratory research and exploratory development go together--one is a natural outgrowth of the other, and the type of enlightened management AFOSR has developed for exploratory research is the same type required for exploratory development." Memo, Davis to Gregory, 4 October 1956.

[6] Ltr., Brig. Gen. H. F. Gregory to Commanding General, ARDC, 22 September 1958; Dr. Morton Alperin, transcript of personal interview with Mr. Samuel Milner, 23 July 1960; Morton Alperin, "Concept of Operation of the Office for Advanced Studies," enclosure to ltr., Alperin to William O. Davis, 19 December 1955.

Flickinger, who commanded AFOSR at the time, saw the directorate structure as a more or less arbitrary grouping of technical divisions. Some people even took the cynical view that the directorates were established merely as a means of justifying higher salaries for a few key administrators. As for the DAS itself, some people felt it was duplicating existing applied research and development laboratories and thus saw no need for its existence. Others took the other side of the coin: since the directorate did not support existing requirements, it served no useful purpose. And more than a few deprecated the directorate for pursuing what they believed were "crackpot" ideas.[7] Strictly from the standpoint of public relations, the DAS was not a smashing success.

This kind of sniping notwithstanding, the DAS, with the strong backing of Gregory and Davis, had forged together, by 1957, what Alperin considered a well-rounded program of "a very advanced type."[8] The program was frankly and overwhelmingly space oriented, designed to put the Air Force in the forefront of space research at a time when other federal agencies were showing little or no interest in the area. Alperin's interest, held jointly by Gregory and Davis, stemmed from the belief that space was "essentially a military environment and that the national security required we be able to operate in space and, if necessary, on the moon to defend ourselves."[9]

The program, as it evolved, looked to the solution of three distinct, but nevertheless related, problems--the development of propulsion systems for future space vehicles; the simulation of outerspace in a laboratory; the probing of outerspace for scientific information essential to any space venture. The directorate was one of the first organizations to seriously explore the possibilities of developing ion and plasma propulsion systems. Its contract with Litton Industries in space simulation resulted in the development of the first American high-vacuum laboratory, inside which a man, outfitted in a space suit, could work in simulated space conditions. And rounding out the program were studies in the environmental conditions in the upper atmosphere

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[7] Col. A. P. Gagge, transcript of personal interview with Dr. Ernest G. Schwiebert, 8 November 1956; ltr., Morton Alperin to Brig. Gen. Benjamin G. Holzman, 14 November 1958, Davis, "Utilization of the Product," p. 25.

[8] Alperin, transcript of personal interview with Milner, 28 July 1960.

[9] *Ibid.*

and space, largely represented by the ill-fated Project Far Side.[10]

III

In August 1955, at a meeting of the International Astronautical Federation, in Copenhagen, Morton Alperin met a young, Vienna-born cosmic-ray physicist from the University of Maryland, Dr. S. Fred Singer. Singer, who had been making a name for himself in scientific circles by proposing novel experiments for the detection of cosmic rays, so intrigued Alperin with his ideas on upper atmospheric research that Alperin hired him as a consultant to the Directorate of Advanced Studies.[11] It was an association bred, in part, by mutual frustration.

In 1951, Singer made the first practical public proposal for the design, development, and use of a small artificial earth satellite for upper atmospheric research. Two years later, having worked out his proposed experiment in detail, Singer published it. While the suggestion by no means received widespread acceptance throughout the scientific community, it did catch the imagination of a few influential individuals, particularly Lloyd V. Berkner, President of the Associated Universities of New York, Sydney Chapman, Professor of Aeronautical Engineering at the University of Michigan, and Athelstan Spilhaus, Dean of the Institute of Technology at the University of Minnesota. And it was with the support of these men that Singer, in 1954, managed to have his proposal accepted as part of the program of the International Geophysical Year (which ran from July 1957 to December 1958). In 1955, the United States announced that the launching of a satellite would be part of its national IGY

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[10] AFOSR, "Directorate of Advanced Studies Research Program," 31 December 1957; *Business Week* (12 October 1957), pp. 192-96; memo for the record, Lt. Col. Robert J. Burger, Subj: "Directorate of Advanced Studies," 25 July 1958, Disposition Form, Morton Alperin to Lt. Col. Jack D. Warthman, 25 April 1955.

[11] Ltr., Dr. S. Fred Singer to Dr. Ernest G. Schwiebert, 24 November 1957; S. Fred Singer, transcript of personal interview with Dr. Ernest G. Schwiebert, 24 October 1957.

program. Russia made a similar announcement the following year.[12]

Meanwhile, Singer was trying, through the good offices of William O. Davis, to interest the Air Force in his satellite. Davis believed in the idea from the first, as did Alperin. It had promise as a scientific tool. But even more important to Davis were the non-scientific aspects of the idea: placing a satellite in orbit could be an important strategic act, an act which could exert great influence over the minds of men around the world. Davis launched his own private campaign to get the project accepted by the Air Force and even brought Singer in to brief Headquarters ARDC on the subject. The idea fell on deaf ears. ARDC was not interested, being especially reluctant to take on another major project while its ballistic missile program was still in a critical stage of development. Ultimately, the Navy got the satellite program (Project Vanguard). And, in so doing, the Navy crowded out not only the Air Force, but Fred Singer, too, who found himself playing no role in a project he had originally conceived. So Singer, by now a DAS consultant, contented himself with thinking of other ways to tap the upper atmosphere and outer space.[13]

Davis and Alperin had to content themselves with other things, too. To both these men the loss of the satellite program was a grievous blow to the Air Force. Something had to be done to rectify it. If nothing were done, if the Air Force forfeited its rights to a future mission in space, then, according to Davis, the nation's air arm "would be reduced to a transport corps." As time went on, another consideration occurred to both Alperin and Davis. If the reports filtering out of the intelligence community were to be believed, the Russians would have a satellite in orbit before the Navy's Project Vanguard--indeed, much before. Thus, it became even more imperative to Davis that the Air Force remain in the forefront of space research and

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[12] Singer, transcript of personal interview with Schwiebert, 24 October 1957; Eugene M. Emme, *Aeronautics and Astronautics* (Washington, 1961), pp. 72, 76, 79, ltr., Professor Sydney Chapman to Ernest G. Schwiebert, 4 November 1957; ltr., Dr. L. V. Berkner to Ernest G. Schwiebert, 31 October 1957; Professor Sydney Chapman, Text of Remarks at the Closing Plenary Session of the CSAFI Conference on Rockets and Satellites, 30 September - 5 October 1957; J. L. Penick, Jr., *et al.* (eds.), *The Politics of American Science: 1939 to the Present* (Chicago, 1965), p. 166.

[13] Ltr., Singer to Schwiebert, 24 November 1957; memo, William O. Davis to Brig. Gen. Don D. Flickinger, 30 July 1954; William O. Davis, transcript of personal interview with Dr. Ernest G. Schwiebert, 15 October 1957; Emme, *Aeronautics and Astronautics*, p. 79.

have some accomplishment ready to offset the psychological and political effects a Russian satellite launching might have.[14]

In February 1956, Singer wrote and distributed an informal paper entitled, "A Program for Space Exploration," the first phase of which proposed the launching of research rockets from high-altitude balloons. The rockets would be fired when the balloon reached an altitude of 80,000 feet or higher (eliminating the problem of frictional heating due to the earth's atmosphere) and would eventually attain a distance of 4,000 miles in space (a distance hitherto unattained by a man-made device), gathering and relaying back to earth information on cosmic radiation and the earth's magnetic field.[15]

Both Alperin and Davis believed the idea sound (actually similar experiments had been performed by others, but with considerably smaller balloons and rockets and at much lower altitudes). The proposal also commended itself from a financial standpoint. Compared to Project Vanguard, it was a cheap way, dirt cheap, in fact (although a bit high by AFOSR standards), of exploring the upper atmosphere. It also appeared to Davis that this might be just the thing to counteract the effects of a Soviet satellite launching. After some hesitation, they decided that AFOSR was the organization to support the effort. There now remained to get approval and money for the project.[16]

Approval was fairly easy. Alperin outlined the project to General Gregory, and Gregory was for it. Gregory got some money from ARDC, dipped into his commander's reserve for more, and gave Alperin permission to divert money from existing DAS programs to the project. Altogether, Gregory rounded up $719 thousand. This, it developed, was not enough, and Alperin began looking for a contractor who would be willing to undertake the project on a cost-sharing basis.[17]

The University of Maryland was interested in the project, but Singer preferred an industrial contractor with an experienced public relations staff so that he would not be burdened with any

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[14] Davis, transcript of personal interview with Schwiebert, 15 October 1957, ltr., Dr. Morton Alperin to Dr. Ernest G. Schwiebert, 3 December 1957; Alperin, transcript of personal interview with Milner, 23 July 1960.

[15] S. F. Singer, "A Program for Space Exploration," 24 February 1956, ltr., Singer to Schwiebert, 24 November 1957.

[16] Davis, transcript of personal interview with Schwiebert, 15 October 1957; ltr., Alperin to Schwiebert, 3 December 1957, Alperin, transcript of personal interview with Milner, 23 July 1960.

[17] Ltr. Alperin to Schwiebert, 3 December 1957, Alperin, transcript of personal interview with Milner, 23 July 1960.

political questions that might crop up. Alperin talked to representatives of Aerojet-General, North American Aviation, Giannini Research Corporation, and Aeronutronic Systems, Inc., a recently established subsidiary of the Ford Motor Company. All four companies had the technical skill to undertake the project, although Aeronutronic had considerably less experience than the others. Aerojet-General and North American, however, were not only unwilling to consider any cost-sharing scheme, but were fully committed for the present to other projects. It was a different story with Aeronutronic. A young, fledgling organization with a small backlog, it was eager both for experience and a reputation and, with the Ford millions behind it, was willing to pay for both. The project, moreover, appeared to be the kind of thing that could permit the young company to get a foot in the door of the nation's coming space effort. In a month's time, Aeronutronic drew up its plans for the project. Alperin accepted, and, in December 1956, Aeronutronic began working on a sheer risk basis, the contracts for the project not being signed until the following March.[18]

Meanwhile, as news of the project began to circulate throughout the ARDC, those people who already had reservations about the DAS and the kind of work it sponsored, began to question the appropriateness of AFOSR sponsoring a project such as this. These individuals, however, motivated as they were by events considerably antedating the project, accounted for only part of the questioning concerning the project. AFOSR, it appears, approached the project with what it considered necessary caution, fearing, no doubt, that someone from on high might decide to scuttle it. It thus kept coordination to a minimum ("If we had . . . tried to coordinate [Far Side]," wrote A. P. Gagge, "the project would have been dead long ago")[19] and closely guarded information concerning the project. (So closely did Davis and Alperin keep the project to themselves that Carl Kaplan, AFOSR's Chief Scientist, was heard to remark, "This is one project on which I am not Chief Scientist.")[20] The result was that many people

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[18] Ltr., Alperin to Schwiebert, 3 December 1957; Davis, transcript of personal interview with Schwiebert, 15 October 1957; ltr., Morton Alperin to Brig. Gen. H. F. Gregory, 20 September 1957, Aeronutronic Systems, Inc., "A Proposal for Conduct of Far Side Phase II Experiments" (ASI Publication No. C-100), 16 September 1957, pp. 33-43; Alperin, transcript of personal interview with Milner, 23 July 1960.

[19] Memo, Col. A. P. Gagge to Col. W. H. Bowers, 2 May 1957.

[20] Dr. Carl Kaplan, transcript of personal interview with Dr. Ernest G. Schwiebert, 18 October 1957.

who might otherwise have been favorably disposed to the project had to rely upon the "rumor mill" for their information. And the most talked about rumor concerning the project was that AFOSR was preparing to shoot for the moon. (The rumor was not so farfetched since Singer's original proposal included a rocket shot past the moon.)[21] This was the worst possible kind of objective in the eyes of the Department of Defense. Davis and Alperin were now under acute pressure to release information, if only to counteract damaging rumors.[22]

In January 1957, Carl Kaplan, by now showing concern over the possibility of "high-level repercussions," arranged for his brother, Dr. Joseph Kaplan, a professor of Physics at UCLA and Chairman of the Geophysics Research Panel of the Air Force Scientific Advisory Board, to talk to General Gregory about the project from the standpoint of policy.[23] Later the same day, Alperin and Davis briefed Joseph Kaplan on the technical aspects of the project. "Are you going to shoot for the moon?" Kaplan asked. Being assured that this was out of the question, Kaplan left apparently satisfied that the project was sound.[24]

Before long, General Power and Assistant Secretary Horner asked for a briefing. Power was briefed, in March, and only cautioned AFOSR to avoid references to space travel and shots to the moon.[25] But to AFOSR's chagrin, and to the great annoyance of the Defense Department, references to the project in the daily press as an attempt to "shoot for the moon" continued to appear with regularity, with the project's name easily lending itself to the conclusion that it referred to the far side of the moon. By July, virtually every paper in the country was carrying some news about the up and coming high altitude shot.[26]

Meanwhile, a bitter jurisdictional dispute broke out in ARDC. Although the question of jurisdiction remained essentially muted,

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21 Davis, transcript of personal interview with Schwiebert, 15 October 1957; memo for the record, A. P. Gagge, 20 November 1956; Singer, "A Program for Space," *passim.*

22 Major W. L. Jones, transcript of personal interview with Dr. Ernest G. Schwiebert, 21 October 1957; memo, Capt. George E. Yale, Jr., to All AFOSR Personnel, Subj: "Far Side Briefing," 8 January 1957.

23 Kaplan, transcript of personal interview with Schwiebert, 18 October 1957.

24 Davis, transcript of personal interview with Schwiebert, 15 October 1957.

25 *Ibid.*

26 *Washington Post*, 12 July 1957, *Los Angeles Examiner*, 12 July 1957; *Aviation Week*, Vol. 66 (22 July 1957), 29; ARDC TWX to AFOSR, 29 July 1957; ltr., Mel White to Lt. Col. C. R. Tosti, Chief, Office of Information Service, ARDC, 6 August 1957.

with AFCRC and other interested ARDC centers confining their criticism to the charge that AFOSR had failed to properly coordinate the project, it was nonetheless clear that this was not the real thrust of the charges: Some ARDC centers felt that they, rather than AFOSR, should have sponsored the project. In the end, the dispute came to nothing, but it did introduce one more disturbing element into the picture, giving Gregory and Davis a few more headaches.[27] The dispute illustrated, moreover, not only how badly the Command was divided over the project, but also how badly it was divided over AFOSR itself.

By the summer of 1957 the project began to take shape. General Mills was chosen as a subcontractor. The company would manufacture the six balloons required for the experiment and lend its long experience in ballooning to the project. (Singer, who would design the instrument package, ended up as a subcontractor, too.) Also chosen were the rockets for the experiment--Thiokol Chemical's *Recruit* and Grand Central Aircraft's *Wasp*, both solid-fuel rockets of proven performance. The four-stage rocket cluster was composed of a set of four *Recruits* (first stage), one *Recruit* (second stage), four *Wasps* (third stage), and one *Wasp* (fourth stage). Eniwetok Atoll in the Marshall Islands was chosen as the site for the launches, six in all.[28]

On 28 June, at a test site near New Brighton, Minnesota, General Mills launched a 1500-pound, helium-filled balloon measuring 200 feet in diameter and 300 feet from top to bottom and carrying a dummy instrument and rocket cluster weighing 2300 pounds. The giant pear-shaped affair, the largest experimental balloon launched up to that time, floated gracefully out of sight, ultimately soaring to an altitude of 104,000 feet.[29] The simulated experiment was successful in all respects; as events would soon

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[27] Ltr., Col. Leslie B. Williams to Commanding General, AFOSR, 13 February 1957, ltr., Maj. Gen. William M. Morgan to Brig. Gen. H. F. Gregory, 17 April 1957, Jones, transcript of personal interview with Schwiebert, 21 October 1957, Col. Robert F. Long, transcript of personal interview with Dr. Ernest G. Schwiebert, 24 October 1957, Alperin, transcript of personal interview with Milner, 23 July 1960.

[28] ASI, "A Proposal for Far Side," 16 September 1957, *passim*, Brig. Gen. H. F. Gregory, Speech Given at a Luncheon Meeting of Aircraft Manufacturers Representatives in Washington, D.C., 12 November 1957; Gregory, Briefing Given to General Anderson on Project Far Side, 1 November 1957, S. Fred Singer, "A Research Proposal for Development of Scientific Instrumentation for Project Far Side," February 1957.

[29] Management Report (ARDC Form 111), Project 47503, "Electronic Sciences," 10 July 1957, *Saturday Review*, 7 September 1957, p. 41.

prove, however, it was scarely a harbinger of things to come. The flight of 28 June, which tested the system as an aggregate, was the only test the Far Side vehicle would get. The project's tight budget prohibited the testing of individual components or subsystems.[30]

On 25 September, a thinly overcast day at Eniwetok, the first of the six projected balloon-rocket experiments was launched. It failed completely. The balloon rose to about 500 feet, then made a rapid descent and slammed against the reefs on nearby Fred Island. There it deposited its payload and relieved of its burden, soared to a height of 10,000 feet, counted time, and, losing helium rapidly, fell into the ocean five miles from shore. The balloon had sustained a puncture, probably while being transported from the United States to the Marshalls.[31]

Eight days later, on 3 October, a second attempt was made, with only slightly more success. The balloon ascended with no apparent complications to 89,000 feet, at which point the command to fire was given, but with no results. Four more commands to fire were given, and the first stage still refused to respond. Then something unexpected happened. The balloon dropped 20,000 feet, and the first stage ignited at that point. The second stage fired normally. But when the rocket reached a height 370 miles from earth, the ground station lost contact. No scientific data was collected.[32]

It was only a few hours after the second Far Side flight that the Soviets announced the launching of Sputnik I. The inevitable now happened. A good part of the public, the press, and Washington officialdom turned their attention to the activities on Eniwetok. Far Side, as the United Press noted, could serve "to restore a little of the prestige this country has lost to the Russians in the field of space science in the last few days." (One participant waxed eloquent on the theme: "[Nakedly] exposed in Sputnik's cometic light, FAR SIDE suddenly acquired an embarrassingly uncomfortable eminence in the eyes of the Free World.") For better or for worse, Far Side was no longer a purely scientific

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[30] Memo, Dr. William Bollay to Brig. Gen. H. F. Gregory, 24 October 1957, Alperin, transcript of personal interview with Milner, 23 July 1960.

[31] Management Report (ARDC Form 111), Project 47503, "Electronic Sciences," 10 October 1957; Gregory, Briefing to General Anderson, 1 November 1957.

[32] Management Report (ARDC Form 111), Project 47503, "Electronic Sciences." 10 October 1957; Gregory, Briefing To General Anderson, 1 November 1957.

venture; it had now been thrust into the political arena.[33] Both Alperin and Davis, the latter now ready to depart for another assignment, had correctly concluded that an undertaking such as Far Side could serve as a timely political act. But they had failed to reckon what the consequences might be if the project, once it was thrust into the political arena, fell short of its scientific objectives.

If luck had not been with the project before Sputnik, it was definitely against it now. During the third flight, launched on 6 October, as the balloon reached a height of 60,000 feet, the first stage ignited prematurely, and, after the second stage fired, the instrumentation shook loose and flew off into space.[34] The fourth flight, launched four days later, hit tropopause temperatures of minus 82°C at 56,000 feet up. The balloon's polyethylene skin crystalized and then shattered. The rockets were fired as a safety precaution.[35]

Things now became critical. Far Side was simply not materializing, as heralded by the press, as the American accomplishment in space that would offset the effects of Sputnik. After meeting with General Anderson, General Gregory, concerned lest the two remaining launches prove failures, called a temporary halt to the proceedings. He dispatched Dr. William Bollay, the President of Aerophysics Development Corporation, to Eniwetok to act as his personal representative on the scene. Colonel Eugene LaVier, Davis' successor at AFOSR, Mr. C. P. Merrell, a balloon expert from General Mills, and Dr. Lawrence L. Kavanau, an aeronautical engineer from Aeronutronic, followed. Also rushed to the scene was Lt. Colonel Robert C. Bundgaard, a weather expert from Japan, along with a team of rawinsonde operators and weather map plotters. While Bundgaard and his weather team set up operations, Bollay, LaVier, and Kavanau made their rounds, and the technicians from Aeronutronic, taking advantage of the lull, rechecked their equipment.[36]

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[33] *The* [Pasadena] *Independent*, 9 October 1957; *Los Angeles Times*, 13 October 1957; *Air Force Times*, 16 October 1957, [San Fernando] *Valley Times*, 24 October 1957, memo, Bollay to Gregory, 24 October 1957, Lt. Col. Robert C. Bundgaard, "A Report on the Meteorological Support to Project Far Side," p. 2.

[34] Management Report (ARDC Form 111), Project 47503, "Electronic Sciences," 10 October 1957.

[35] Gregory, Briefing to General Anderson, 1 November 1957.

[36] *Ibid.*; ltr., Brig. Gen. H. F. Gregory to Dr. William Bollay, 18 October 1957; Col. Eugene LaVier, Operations Log, 22 October 1957, memo, Bollay to Gregory, 24 October 1957, Bundgaard, "A Report on Far Side," *passim.*

What the weather team found was not good. The characteristic temperature ranges in the tropopause were such that they would allow but a few opportunities for a successful firing--and these opportunities could be taken advantage of only if other weather conditions, such as surface winds, were favorable.[37] Bollay and LaVier reviewed the alternatives. The project could be moved either to Holloman Air Force Base, the Navy's Point Mugu base, or Fort Churchill, Canada. But moving to any of these locations involved a delay of three months. Bollay decided, therefore, that, "in view of the strong desire of the Air Force to attempt a successful firing as early as possible to counter some of the Sputnik propaganda," the final two launches should be made on Eniwetok--provided careful attention were paid to meteorological conditions. Bollay recommended this course to Gregory, waited three days for favorable weather, and that not coming, returned to the United States.[38]

On 19 October, with weather conditions favorable, flight No. 5 was launched. At 96,500 feet, the first stage fired normally, but, plagued as usual by one thing or another, the vehicle ran into telemetering trouble. The instrumentation, probably damaged when the rocket ripped through the balloon, went dead. Two days later, on 21 October, the sixth--and last--flight was launched. The balloon floated to 96,500 feet. The first and second stages fired normally. The rocket was tracked for about eight minutes after the first stage fired, whereupon the signal was lost. Forty-five minutes later a signal was picked up, but there was no certainty that it came from the vehicle and not from, say, a star. If the second signal truly came from the vehicle, then the Far Side rocket probably reached a height of 4,000 miles. If not, it was likely, as General Gregory told General Anderson after most of the facts were in, that "an altitude of 2,500 miles was achieved"--clearly an altitude record for any space probe made up to that time. But, altitude record or no, the flight, like the others, yielded no scientific data. And, as Gregory told Anderson a short time after the flight, "It is only a remote possibility that subsequent analysis will provide such data."[39] Further analysis yielded nothing.

The project had more than its share of trouble--punctured balloons, unusually adverse weather conditions, and unexpected troubles with its instrumentation. Such difficulties, however, as

[37] Bundgaard, "A Report on Far Side," p. 8.
[38] Memo, Bollay to Gregory, 24 October 1967.
[39] Gregory, Briefing to General Anderson, 1 November 1957.

Dr. Bollay saw them, were "typical of the problems encountered in the early phases of any flight test program."[40] Perhaps more time and money would have helped. Money had been scarce from the beginning, and time, from Sputnik forward, became ever more pressing. As William O. Davis admitted after the fourth shot, "Because of the limited nature of our funds and the pressures created by 'Sputnik,' we had to take a very long gamble. . . ."[41] Even under less pressing circumstances, the technical problems in any program that was the first of its kind would have been difficult enough to overcome. And the failures, which would have been judged normal under normal circumstances, were now magnified by an order of magnitude.

As a scientific space probe, Project Far Side was clearly a failure. But as a political act, it was a disaster. The Air Force was made to look like a modern Don Quixote. This proved fatal--fatal to the project, fatal to Alperin and the DAS. Those who had always looked askance at the concept underlying the DAS could now be heard. Those who had questioned the propriety of AFOSR undertaking Far Side were also in a position to be heard.

Needless to say, Far Side was never renewed. And a year after the books were closed on that project, the DAS itself was dissolved, and Alperin left the Air Force for good. The official reason for disbanding the office was that, with the creation of NASA, the Air Force no longer had a clear mission in space. And it was true that NASA did largely preempt whatever space mission the Air Force may have had. It was also true that the DAS program (less Far Side, the Litton chamber, and a few secondary efforts) went to AFOSR's Propulsion Division, where it continued to receive support.[42] It was Far Side, and the efforts of Davis and Alperin to make of the DAS something special and unique, that contributed most to the directorate's downfall. And with the directorate went Davis' novel concept of "exploratory" research. Henceforth, AFOSR contented itself with sponsoring basic research, leaving to others the task of utilizing the product of that research.

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[40] Memo, Bollay to Gregory, 24 October 1957

[41] Davis, transcript of personal interview with Schwiebert, 15 October 1957.

[42] Ltr., Morton Alperin to Brig. Gen. Benjamin G. Holzman, 14 November 1958, Alperin to Holzman, 3 December 1958; AFOSR News Release, 19 December 1958; ltr., Brig. Gen. Benjamin G. Holzman to Leonard Meyerhoff, Eastern Research Group, 29 December 1958, ltr., Holzman to Lee A. DuBridge President, Cal Tech, 29 December 1958, ARDC General Order No. 2, 12 January 1959, memo, Col. A. P. Gagge to All Directors, 16 January 1959, memo, Mel White to All AFOSR Personnel, 3 February 1959.

Chapter IX

CREATION OF THE AIR RESEARCH DIVISION

There was more than one contradiction in the dialogue flowing out of the debate over the RPO programming system--the most obvious, perhaps, being AFOSR's concern over the control the Directorate of Research had over funds at a time when AFOSR was becoming increasingly prosperous. But the contradiction stands only if the dispute is seen as basically an argument over money, which, in fact, it was far from being. At the root of the dispute was the question of how the Air Force should order itself for the pursuit of basic research. It was this question that divided AFOSR and the Directorate of Research. The dispute brought the question into the open and illustrated the depth of the division. But, since the dispute was closely confined with ARDC's own family, it did not itself reveal that this question was on the minds of other people in the Air Force. One thing it did reveal was that the cleavage between AFOSR and the Directorate of Research went so deep that the question could not be allowed to go unanswered much longer.

II

General Anderson had the misfortune of taking over the reins of ARDC at the depth of the fiscal crisis of the summer and fall of 1957. If Anderson was keenly aware that he faced an assignment fraught with problems of great technical complexity, the whirlwind events of that summer and fall reinforced this feeling. Running ARDC was a tough job, and especially so for a general who had spent a lifetime in either staff work or tactical commands. He decided, therefore, in the midst of the fiscal crisis to ask the Air Staff "to take a look at this baby they had brought forth" and see if it had "gone the way they thought it should go."[1]

[1] Extract from Proceedings of USAF Weapon Systems Management Study Group Meeting, Langley AFB, Va., 25 February 1960.

Anderson was not alone in thinking that a review of ARDC by a committee of the Air Staff, perhaps by a reconstituted Ridenour Committee, would be timely. Indeed, the question had been broached on several occasions over the last two years at meetings of the Air Force's Scientific Advisory Board. Hence, Anderson's request received a favorable reception not only from General Thomas D. White, the Chief of Staff, and General Putt, but also General Doolittle, who was now Chairman of the Scientific Advisory Board.[2]

General Anderson wanted as many members as possible of the old Ridenour Committee to sit on the new panel. Indeed, he tried without success to induce Louis Ridenour to come back and chairman the reconstituted committee.[3] Ultimately, Dr. H. Guyford Stever, Associate Dean of Aeronautical Engineering at MIT and a former Air Force Chief Scientist (1956-1957), was chosen to head the nine-man committee, composed largely of university professors or former university professors.[4]

Constituted as a special panel of the Scientific Advisory Board, the committee gathered at the Pentagon, on 21 November, to receive its instructions. General White, in laying down the provisions of the panel's charter, asked it to conduct a "searching review" of ARDC's organization, functions, policies, and procedures and recommend to him "how we can do our job better in the future."[5] And Stever was soon writing to General Putt, pointing out that the committee was part of the SAB and thus a member of the Air Force family and urging him to "encourage your staff to indulge in frankness on all points,

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[2] *Ibid.*; Chester N. Hasert, Secretary to the Air Force Scientific Advisory Board, transcript of personal interview with Mr. Samuel Milner, 18 April 1961.

[3] Extract from Proceedings of USAF Weapon Systems Management Study Group Meeting, Langley AFB, Va., 25 February 1960.

[4] Anon., "A Resume of the History and Mission of the United States Air Force Scientific Advisory Board," 1 January 1963, p. 5, memo for the record, Col. George H. Duncan, Secretary to the SAB, 13 November 1957. Besides Stever, the committee included Dr. Ralph A. Sawyer, Dean of the School of Graduate Studies, University of Michigan, Raymond J. Woodrow, Director of Research Administration, Princeton University, Dr. Teddy Walcowiz, a former Secretary to the SAB, Dr. Courtland D. Perkins, Professor of Aeronautical Engineering, Princeton University, Dr. Clifford T. Morgan, Professor of Psychology, University of Michigan, Bennett Archambault, President of the Stewart-Warner Corporation, Perry W. Pratt, Vice President and Chief Scientist of United Aircraft Corporation, and the late Dr. Randolph Lovelace II.

[5] Memo, General Thomas D. White to Chairman of the Scientific Advisory Board, 21 November 1957, MSS, memo for the record, Duncan, 13 November 1957.

both good and bad." Putt took up the theme, and the instructions going to the centers urged them to include "self-analysis and criticism" in their presentations to the committee.[6]

The panel, now unofficially known as the Stever Committee, began its swing around Air Force installations on 17 December with a briefing at ARDC Headquarters in Baltimore. On the 19th, the panel was at the Pentagon, looking into the operations of the Deputy Chief of Staff for Development, Headquarters USAF. The next day it was across the river, at Temporary Building "T" in Washington--AFOSR's headquarters. In mid-January, after a short break for Christmas and New Year, the Committee flew to California, home of the Air Force Ballistic Missile Division and the Air Force Flight Test Center. From there it swung eastward via Alamogordo, Albuquerque, Tullahoma, and Dayton. By the middle of February it was at Cambridge and worked its way back to Washington after touching ARDC installations at Griffiss, Eglin, and Patrick. The Committee then settled down for the next four months to write its report.[7]

III

It is doubtful whether the majority of the Committee's members had more than a vague inkling of the differences between AFOSR and Headquarters ARDC before they were appointed to the panel. One member of the panel, however, Dr. Courtland D. Perkins, a professor of aeronautical engineering at Princeton who had that very year completed a stint as Air Force Chief Scientist (he had, in fact, succeeded Stever in that position), not only knew the nature of these differences in detail, but was in strong sympathy with AFOSR's position. In August 1957, in what was in effect his final report as Chief Scientist, Perkins wrote a staff study in which he recommended that a panel much like the Stever Committee be established. The purpose of the Committee, however, was not to conduct an ARDC-wide investigation, but only to take a hard look at the ARDC research program. ". . . I feel that the management of this program," Perkins wrote, "is quite inefficient . . . ." AFOSR, while it

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[6] Ltr., H. Guyford Stever to Lt. Gen. Donald L. Putt, 22 November 1957; ARDC TWX 11-60-E, 29 November 1957.

[7] Samuel Milner, "AFRD to OAR: An Organizational and Administrative History" (unpublished manuscript), pp. 17-18, memo, Col. George H. Duncan to Stever Committee, Subj: "Proposed Itinerary," 14 November 1957.

had done "an excellent job to date under the restrictions placed upon it," should, if it were to carry out its job effectively, "be given complete cognizance of the exploratory research program of the Air Force." Furthermore, Perkins wrote, the AFOSR Commander "should be the member of the Air Force in the best position to judge how [research] money should be spent both from the contract point of view and also in-house at the various centers." Perkins was proposing, in effect, that AFOSR take over the functions of the Directorate of Research. And he added that if these reforms cannot take place within ARDC, AFOSR "should be taken out from under the ARDC and made to report directly to the Chief of Staff."[8]

If the remaining members of the Stever Committee had heard Perkins' views on what plagued research in ARDC, they heard precisely the same thing again when they stepped into Tempo "T," but, no doubt, expressed with more vigor. General Gregory was a forceful speaker on any occasion, and for this briefing he was in exceptionally good form. Buttressing his remarks by recourse to his "Rainbow Chart" and speaking with his accustomed intensity, Gregory went over much of the same ground he had gone over on many occasions with Power and Williams.[9]

If much of what Gregory said was to be expected, the same was not true of what was said by the people at AFCRC. The formal AFCRC briefing, it is true, was innocuous enough; but what some laboratory chiefs had to say in private to the Committee members sounded like an echo of AFOSR's position. Headquarters ARDC was managing the research program in minute detail. The Directorate of Research should delegate more authority to the centers. Funding was chaotic. Research could not be structured along the lines of a traditional military organization and yield good results. So it went.[10]

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[8] Milner, "AFRD to OAR," pp. 38-41, Courtland D. Perkins, "Staff Study, 30 August 1957.

[9] Milner, "AFRD to OAR," p. 18; memo, Brig. Gen. H. R. Gregory to Col. E. E. LaVier, 15 November 1957.

[10] Lt. Col. Lillian T. Robinson, transcript of personal interview with Mr. Samuel Milner, 30 October 1961, Disposition Form, L. M. Hollingsworth to CRC, Subj. "Comments for Presentation to the Stever Committee," 21 January 1958, James E. Gallagher, "Notes for the Stever Committee Presentation," 24 January 1958, Disposition Form, Vernon S. Dempsey to CRO, Subj: "Visit by Stever Committee," 21 January 1958.

IV

On 20 June 1958, Dr. Stever submitted the Committee's report to General Doolittle.[11] While the Committee by no means ignored what it felt to be good in ARDC, the tone of its report was decidedly critical. The thrust of the criticism went in two directions--namely, that authority in ARDC was far too centralized and that the centers were improperly organized. The Committee found a failure on the part of the higher echelons "to trust lower echelons . . . and to discipline [themselves] to do [their] own job well and not to meddle with others."[12] The Committee continued:

> The maze of communications channels, the excess of paper work, the continual reviews and justifications, the diffusion of decision-making responsibility and authority, which are prevalent throughout the Air Force R&D program and which constitute a most formidable . . . barrier to its success, are manifestations of this lack of trust and discipline.[13]

To correct these and other failings, the Committee recommended that ARDC organize itself along "functional rather than, as at present, geographical lines." The Committee singled out research, technical development (applied research), weapon systems development, air defense systems, and testing as the Command's primary functional areas and recommended that a deputy commander, residing at Headquarters ARDC, be created for, and put in charge of, each distinct functional area. In addition, the existing centers, many of whose missions were a hodgepodge of research, development, and testing, should be broken up and realigned according to primary functional areas. Thus, what the Committee was proposing essentially was that ARDC be broken down into five separate operating divisions, each division being responsible to a deputy commander who had cognizance over that function.[14]

Turning to the basic research program, the Committee found it scattered, compromised, and confused and lacking in both

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11 Ltr. of transmittal, H. Guyford Stever To Dr. James H. Doolittle, 20 June 1957; ltr., Maj. Gen. Roscoe C. Wilson, Assistant to the DCS/D, Headquarters USAF, to Lt. Gen. S. E. Anderson, 24 June 1958.

12 Scientific Advisory Board, "Report of the Ad Hoc Committee on Research and Development," June 1958, pp. 5-6.

13 *Ibid.*

14 *Ibid.*, pp. 8-11.

purpose and over-all direction. It also found it interwoven, to its detriment, with applied research and weapon systems development. The answer, according to the Committee, was to bring the entire basic research program, both that supported by AFOSR and that conducted by the centers, under a Deputy Chief of Staff for Research, who, under the scheme of things recommended by the Committee, would also be the AFOSR Commander. The AFOSR Commander, in other words, would be responsible for all basic research in the Air Force, no matter where it existed. Besides AFOSR, he would have under his jurisdiction, according to the Committee's recommendations, the Aeronautical Research Laboratory, the Geophysics Research Directorate and the Electronics Research Directorate of the Cambridge Research Center, the European Office of ARDC, the Aeromedical Field Laboratory, and the non-clinical research laboratories of the School of Aviation Medicine. In addition to offering this prescription, the Committee cautioned the Air Force against concentrating too much research internally. But not only should in-house research be strictly limited, confined to "cases where an AF laboratory constitutes the only feasible resource for carrying forward exploratory research," it should also never be combined with extramural research. The task of conducting in-house research and that of supporting research by contract should be entrusted to different groups.[15]

When General Demler read the Report he could not escape the conclusion that the Stever Committee had "bought the Gregory presentation lock, stock and barrel."[16] It was probably asking too much of the Committee, dominated as it was by university scientists, to expect it to be unsympathetic to AFOSR's point of view. But however much this natural sympathy for AFOSR may have helped shape the Committee's recommendations, it was unlikely that it told the whole story. If the Committee needed a point of reference, it was not necessary to turn to Gregory's briefing. The Ridenour Report was a more obvious one, for it represented, after all, the one great turning point in recent times in Air Force R&D. And if the Committee's prescription for research embraced a particular point of view, it was, with a few embellishments and a few exceptions, the

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15 *Ibid*, pp. 12-14

16 Maj. Gen. Marvin C. Demler, transcript of personal interview with Mr. Samuel Milner, 6 June 1961.

Ridenour thesis. But, mainly because it did embellish and did take exception, the Stever Report was not the herald of reaction. It did not try to hold back the pendulum altogether (indeed, the report was written in the spirit of reform). It tried, rather, through reform, to strike an accommodation between the pluralistic and monistic approaches to research management, while at the same time preserving (and enhancing) AFOSR's primacy in Air Force research. There were those, however, who felt that the Committee strove harder to preserve AFOSR's primacy than to strike an accommodation.

V

"Sam," General Doolittle said to General Anderson, "if you adopt this organization, you've got to have closed circuit television with every one of your commanders."[17] Anderson judged that Doolittle did not think too much of the handiwork of the Committee he had helped foster. As a matter of fact, Anderson did not think too much of it, either. The Committee, Anderson felt, had not even looked at what it was asked to look at. Anderson wanted enlightenment on the technical aspects of the command, and he got unwanted advice on its management.[18] But the report could not be shrugged off. Anderson himself had asked for the investigation. He had committed the Chief of Staff to it. He had involved the highest scientific advisory body in the Air Force in it. And he had himself approved the selection of every single member of the Committee. The Committee could not be repudiated. Nor could its recommendations be accepted. Anderson had a delicate job to perform.

The job became even more delicate when it developed that Headquarters USAF found very little to quarrel with in the report. "We are in general agreement with the philosophies and principles set forth in the [Stever] Committee Report," Major General Roscoe C. Wilson, the Assistant to the Deputy Chief of Staff for Development, Headquarters USAF, wrote to General Anderson. "It would appear that many of the recommendations . . . can and should be implemented at an early

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17 Extract from Proceedings of USAF Weapon Systems Management Study Group Meeting, Langley AFB, Va., 25 February 1960.

18 *Ibid.* But, for a contrary view, see *History of the Air Research and Development Command*, 1 July - 21 December 1959 (ARDC Historical Division), p. 118, hereinafter cited as *History of ARDC*.

date."[19] And Anderson's task was made no easier when the report was released to the press and the aviation trade journals, which promptly began reporting ARDC's alleged shortcomings with critical candor.[20]

But Headquarters ARDC raised not a finger in response. It sat on the Report and refused to make any public statements concerning it. (The Headquarters even prevented the report from being distributed within ARDC, keeping hundreds of printed copies under lock and key.)[21] Instead, the Headquarters turned its efforts to preparing a staff study, which, while laudatory of the Stever Committee, was designed to show why the Committee's recommendations should not be implemented.

Colonel Benjamin G. Holzman, Colonel Williams' successor as Director of Research, was given the task of preparing a separate staff study on research. Holzman was asked to examine the merits of two alternative plans for research: (1) establishing a Deputy Chief of Staff for Research as a kind of enlarged Directorate of Research, or (2) moving AFOSR back into Headquarters ARDC with both staff and operational duties.[22]

Holzman had been much taken by the Stever Committee's proposal that research in ARDC be organized along functional lines and would have recommended that ARDC follow such a course had the frame of reference within which he was required to do his study permitted. As it was, Holzman had to content himself with choosing between what were for him two less satisfactory alternatives. He was opposed to elevating AFOSR to staff status. For one thing, he felt the organization did not have the necessary number of people available to undertake staff duties. For another, he believed such a shift would interfere with AFOSR's mission as "a unique operating unit dealing with basic research contracts within the academic environment." He was left, therefore, with the other alternative, which, while it tended to vitiate the Stever recommendations, gave an impression, nevertheless, that ARDC was dignifying the basic

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[19] Ltr., Maj. Gen. Wilson to Gen. Anderson, 24 June 1958.

[20] *New York Times*, 13 July 1958, *Christian Science Monitor*, 22 and 23 July 1958, *Aviation Week* Vol. 69 (14 July 1958), 29-31 and (21 July 1958), 23-25.

[21] Milner, "AFRD to OAR," p. 45.

[22] Col. B. G. Holzman, Staff Study, Subj: "Establishment of a Deputy Commander/Research," 21 July 1958.

research effort and was taking "a logical first step in implementing the Stever recommendation . . . ."[23]

Holzman's recommendation was not only accepted and worked into the ARDC staff study, but it was also promptly implemented. In September, the Directorate of Research was abolished and a Deputy Commander for Research was established in its place. Major General Leighton I. Davis, who a decade before had been the first Chief of the Office of Air Research, headed the new staff section. Colonel Holzman became the Assistant Deputy Commander for Basic Research. Thus, ARDC appeared as having complied with the Stever recommendations.[24] But it was evident that the compliance, if it could be called that, was merely a pro forma gesture.

The people at Headquarters USAF did not have to read the ARDC staff study to know that ARDC disliked the Stever Report; they knew by this time that General Anderson had no intention of implementing the report's principal recommendations. But, while Headquarters USAF was decidedly better disposed to the Stever recommendations than Headquarters ARDC, Headquarters USAF was little inclined to pursue the matter. For one thing, ARDC appeared to be making sense when it cautioned that a major reorganization at this time might tend to disrupt the now smooth-running ballistic missile program. For another thing, General Anderson was due for reassignment in a few months to the Air Materiel Command. Headquarters USAF could wait. ARDC's evaluation of the Stever Report was accepted.[25]

But only two months passed before Secretary Douglas himself, in October 1958, took a hand in the matter. On the 3rd of that month, Douglas asked General Anderson to brief him on the report and what ARDC intended to do about it. After the briefing, Douglas appeared satisfied, although he did suggest that it might be well if ARDC continued to keep the subject of reorganization under close scrutiny.[26]

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[23] *Ibid.*

[24] Headquarters ARDC, Staff Study on the Report of the SAB Ad Hoc Committee on Research and Development, 31 July 1958, Milner, "AFRD to OAR," p. 57, ltr., Lt. Gen. A. E. Anderson to Lt. Gen Donald L. Putt, 7 August 1958

[25] Headquarters USAF, Evaluation of the June 1958 SAB Report on R&D, 31 August 1958.

[26] Lt. Col. Lillian T. Robinson, transcript of personal interview with Mr. Samuel Milner, 6 July 1961; Milner, "AFRD to OAR," p. 66.

Whether Anderson had a change of heart, or whether Secretary Douglas had persuaded him there was a need for change, is not known; in any case, Anderson did a flip-flop. In November, he set up a special committee to study the subject of reorganization (but with no direct reference to the Stever Report).[27]

In the meantime, AFOSR had not been idle. In October, General Gregory retired and was succeeded by Benjamin Holzman, who shortly thereafter was promoted to brigadier general.[28] Still intrigued by the functional organization recommended by the Stever Committee, Holzman put his staff to work on the subject as soon as he took command of AFOSR. The upshot was that both staffs, since they were working on a common problem, got their heads together and reached an early agreement that a functional, centrally managed research organization, with freedom to govern its own affairs, was a necessity.

The two staffs also agreed that AFOSR, ARL, GRD, ERD, the European Office, and, possibly, some of the Command's aeromedical units should comprise the new organization. But when it came to deciding around what to build the new organization, the staffs could find no common ground. The ARDC staff believed that the staff of AFCRC, since it already comprised a headquarters in being, was the logical choice to take charge of the new organization. And AFOSR's staff believed that the organization should be built around AFOSR.[29]

On 25 February 1959, the eve of General Anderson's departure for AMC, the ARDC committee briefed the general on its findings. It recommended a reorganization of the headquarters and a realignment of the centers along functional lines. When it came down to specifics, however, it was clear that the committee had not decided on a functional centralized field organization for research. What it proposed for research was a center composed of the European Office and AFOSR which would be built around AFOSR and bear its name. The center would govern its own affairs, but it would be strictly an extramural research organization, such in-house laboratories as ARL, GRD, and ERD remaining with development centers.[30]

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27 Milner, "AFRD to OAR," p. 67.

28 AFOSR General Order No. 6, 1 November 1958.

29 AFOSR, Plan of Organization of an Integrated ARDC Research Program, 13 February 1959, Harry Roberts and Arthur G. Wimer, Jr., Presentation on ARDC Reorganization, 25 February 1959; ltr., Brig. Gen. Benjamin G. Holzman to Col. N. L. Krisberg, 3 March 1959.

30 Roberts and Wimer Presentation on ARDC Reorganization, 25 February 1959.

Anderson professed to be pleased with what he heard and told the committee that were he not leaving the Command, he would implement its recommendations. As it was, he felt it would be unfair to saddle the new commander with a reorganization not of his choosing.[31]

VI

In the final analysis, whether or not ARDC would be reorganized depended upon the attitude of Headquarters USAF. The Headquarters, after all, was free to choose a commander who would either be or not be inclined to reorganize the command. And there was little doubt where Headquarters USAF stood on the question when it selected Lt. General Bernard Schriever to succeed General Anderson. For the last five years, Schriever had been commander of the one functionally organized development unit in the entire ARDC, the West Coast-based Ballistic Missile Division, which had authority and control over all aspects of the Air Force's ballistic missile program. Schriever ran the division with a small headquarters staff, delegating maximum discretion in technical matters to people on the working level.[32] The program had been an undisputed success, due in large part to Schriever's organizational skills. And it was expected that Schriever would now apply the same kind of organizational principles as ARDC Commander.

Schriever took command of ARDC on 13 May.[33] Two days later, he handed a small task force headed by Colonel Jewell C. Maxwell the job of recommending needed changes in ARDC's organizational structure. On 31 July, a little over a year after the release of the Stever Report, the task force had done its work.[34]

Describing ARDC's deficiencies in a blunt, straightforward manner, the task force recommended a sweeping reorganization of ARDC. ARDC's effectiveness was being impaired, the task force held, by a lack of "clear, vertical, decision-making

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[31] Milner, "AFRD to OAR," pp. 74-75, *History of ARDC*, 1 July - 31 December 1959, pp. 133-34.

[32] Milner, "AFRD to OAR," p. 75.

[33] ARDC General Order No. 44, 13 May 1959.

[34] Col. J. C. Maxwell, *et al.*, Report of the Special Task Force on ARDC Reorganization, 31 July 1959.

channels" between the Headquarters and the field. The responsibility and authority residing at the operating levels was ill-defined. The Headquarters meddled in areas that should normally have been the province of the working level.[35] The task force continued:

> . . . the Headquarters staff and the major command elements of ARDC are directing too much effort to peripheral second and third order tasks rather than to the accomplishment of the ARDC central mission--the timely translation of technology into useful military systems. An inordinate amount of time is being devoted to short-range, day-to-day, brush-fire actions. As a consequence, long-range planning, which would objectively analyze our strengths and weaknesses, and which would define major milestones along the road ahead, in the main, has been neglected . . . .[36]

The task force recommended that the deputy commander type of organization be scrapped in favor of a chief of staff and six deputy chief of staff sections. The main business of the headquarters would be to provide "its major field commands with responsibility, authority and the attendant resources necessary to proceed with assigned programs." All elements in the Headquarters with a "capability for technical review and control of research and development projects" should be eliminated. This "capability" belonged to the working level.[37]

Turning to the operating elements, the task force recommended the realignment of the command structure into four functional field organizations--among them, an Air Force research division situated in Washington, D.C. The division would be composed of AFOSR, ARL, the European Office, and, AFCRC agreeing, ERD and GRD. The division would be in charge of the entire ARDC basic research program. This meant that it would have authority to plan, program, budget for, manage, and review its own program. The division, not ARDC Headquarters, would "be responsible for the proper emphasis and balance" of the total basic research effort.[38] The task force's recommendations so nearly paralleled the Stever recommendations that, in a sense, events had now come full cycle.

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[35] *Ibid*
[36] *Ibid*
[37] *Ibid.*
[38] *Ibid.*

Schriever approved the task force's handiwork, as everyone knew he would, and, on 15 January 1960, with the blessings of Headquarters USAF, the Air Force Research Division came into being. AFOSR and the European Office were assigned to the Division immediately. ARL came in on 1 April, and ERD and GRD, going under the name of Air Force Cambridge Research Laboratories, on 2 May. General Holzman was named AFRD Commander, and he brought with him most of AFOSR's non-technical staff to man the headquarters. Colonel Gagge became the new AFOSR Commander, while serving at the same time as AFRD Vice Commander.[39]

The creation of AFRD was a watershed in Air Force research management. All basic research was now grouped in one cohesive unit. The technical direction for the research program no longer came from a headquarters far removed from the business at hand, but from the field unit itself. The old organizational structure, distinguished by its fragmented authority and its stacks of echelons, had now been partially broken down. And it appeared that basic research, with a division of its own on an equal footing with three development divisions, had now come of age in the Air Force. To no less than General Schriever himself, the creation of AFRD meant that "research in the Air Force, for the first time in the relatively short history of ARDC, assumes equal status with development."[40]

But equality had always been something of a bane for AFOSR. Of course, many of the old battles now appeared over. The Directorate of Research was gone, and so was the organizational structure that gave rise to it. Basic research was now the business of one organization, which could be called what AFOSR had always sought to be called--*the* Air Force basic research agency. But the trouble was that AFOSR was not that agency. Thus, AFOSR appeared destined to be but one element, although a special one, in an Air Force research structure that pulled together many elements. What remained to be seen was whether

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39 Ltr., Lt. Gen. B. A. Schriever to Brig. Gen. Benjamin G. Holzman, 12 September 1959; TWX, Lt. Gen. B. A. Schriever to All ARDC Center Commanders, 5 October 1959, Dept. of the Air Force Special Order No. A-55, 8 January 1960; *Office of Aerospace Research Chronology*, OAR 62-8 (OAR Historical Division, 1962), p. 14, ARDC General Order No. 30, 28 March 1960; ARDC General Order No. 38, 26 April 1960, AFRD General Order No. 2, 15 January 1960.

40 Ltr., Lt. Gen. B. A. Schriever to Dr. J. E. Wallace Sterling, President, Stanford University, 8 January 1960.

AFOSR could endure in peace with this realization. This depended not alone on AFOSR, but also on the Air Force Research Division. What no longer remained to be seen, however, was the historical direction Air Force Research management would take. The Air Force would not depend on one mechanism alone in seeking fundamental knowledge. General Keirn and Theodore von Kármán had, with time, triumphed over Louis Ridenour.

Chapter X

FROM AFRD TO OAR

AFRD was as much the creation of General Gregory and Colonel Davis and the rest of the AFOSR staff, who had clung with dogged tenacity to ideas they felt were right-minded, as it was of the Stever Committee, the Maxwell task force, or General Schriever. Under the circumstances, one would have expected AFOSR to find much to recommend the new arrangement. As it was, the reverse was true. After living under AFRD for a few months, AFOSR sank into a state of acute distress. To AFOSR the reorganization was an abomination.[1]

A great deal of AFOSR's distress could be traced to a change in AFRD commanders. In early March 1960, General Schriever decided to replace General Holzman with Major General William M. Canterbury. Holzman remained at the Headquarters, dislodging Colonel Gagge from the vice commander's position. The shake-up became effective in mid-April.[2]

"[On] Friday [4 March] I lost my job as Commander of the Research Division," General Holzman wrote, breaking the news to Colonel Nathan L. Krisberg, the Commander of the European Office.[3] "My tenure at AFRD, in my mind, seems to be quite unstable," he wrote in a subsequent letter to Krisberg. "I am still not certain what the shift of Monty [Canterbury] to Research will really mean as far as AFRD is concerned," he added.[4] General Canterbury had been serving as Schriever's Deputy Chief of Staff for Operations, when he was incapacitated by illness for six months. As it was, Canterbury had not fully recovered when he was given the AFRD job, and his appearances for duty were both infrequent and short.[5] This, in effect, deprived the

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[1] See for example, Anon. [Samuel Milner], "Staff Briefing Item," 8 July 1960.

[2] AFRD General Orders No. 9 and 10, 15 April 1960.

[3] Ltr., Brig. Gen. Benjamin G. Holzman to Col. N. L. Krisberg, 7 March 1960.

[4] Ltr., Brig. Gen. Benjamin G. Holzman to Col. Nathan L. Krisberg, 17 March 1960.

[5] Brig. Gen. Benjamin G. Holzman, transcript of personal interview with Mr. Samuel Milner, 24 October 1961, enclosure to ltr., A. P. Gagge to N. A. Komons, 2 June 1966, ltr., Maj. Gen. Daniel E. Hooks to N. A. Komons, 5 May 1966.

fledgling Research Division of a commander at a time when direction from the top was most desperately needed to weld together the conglomerate research elements that made up AFRD. General Holzman, in theory, at least, ran things during Canterbury's absences, but his effectiveness was limited--and not only because he could not act with the same authority as a commander, but also because he had gnawing doubts about his own future in the Command.[6] Another disturbing element in the shake-up, this one limited to AFOSR, was the ushering out of Colonel Gagge from the Headquarters. Gagge as Vice Commander was AFOSR's assurance that it would have a large voice in the shaping of research policy; and presumably AFOSR believed that with the precedent set, each succeeding AFOSR commander would automatically serve as AFRD vice commander. It was evident this was not to be the case.[7]

As if morale were not bad enough when General Canterbury was absent, it went from bad to worse on the few occasions he reported for duty. AFOSR's staff was given to the opinion that General Canterbury had neither a feel nor a liking for his job. Whether the notion was valid or not, Canterbury did little to dispel it, keeping AFOSR's staff at arm's length even on official business. And not helping matters was the inability of Canterbury and Gagge to establish even a modicum of rapport with each other.[8]

Ultimately decisions began to go against AFOSR. First its budget was cut; then twelve spaces were taken from it over Gagge's protests.[9] General Holzman did what he could, as he put it to General Schriever, "to calm the waters," but to little avail, as a rash of civilian resignations in AFOSR amply demonstrated.[10]

Things got no better when Gagge's letter protesting the transfer of the twelve spaces fell into the hands of the press. *Aviation Week*, quoting from Gagge's reclama, surmised that

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[6] AFRD General Orders No. 15, 25 July 1960, ltr., Holzman to Krisberg, 17 March 1960, Holzman, transcript of personal interview with Milner, 24 October 1961.

[7] Cf. enclosure to ltr., Gagge to Komons, 2 June 1966.

[8] Holzman, transcript of personal interview with Milner, 24 October 1961, enclosure to ltr., Gagge to Komons, 2 May 1966.

[9] Ltr., Col. Raymond A. Gilbert to AFOSR (SRG), 3 June 1960, ltr., Col. A. P. Gagge to AFRD (RRG), 6 June 1960, *Aviation Week* Vol. 72 (13 June 1960), 33-34.

[10] Ltr., Brig. Gen. Benjamin G. Holzman to Lt. Gen. B. A. Schriever, 29 July 1960.

basic research in the Air Force "is again under seige."[11] Ever since the arrival of General Canterbury, Colonel Gagge had been laboring under the assumption that the dissolution of AFOSR was a near certainty. He tended, therefore, to look upon the loss of the spaces not as an isolated incident, but as part of a series of incidents calculated "to curtail AFOSR's responsibilities."[12]

Headquarters ARDC and Headquarters USAF were now becoming painfully aware that the new Research Division was in trouble. "The recent loss of key civilians at AFOSR is a matter of great concern to me," Major General Marcus F. Cooper, ARDC's Deputy Chief of Staff for Research and Engineering, wrote to General Holzman. "I am concerned that we are not doing all that can be done to retain valuable civilians in this period of great demand for scientific personnel." "I am also concerned," General Cooper continued, making an obvious reference to Colonel Gagge, "that some of our people feel it necessary to air their problems outside the ARDC family." "Are we sure," Cooper asked, "that we have not closed the door to people being able to talk to their superiors on their problems?"[13] Courtland Perkins, for one, who was now serving as the Air Force's Assistant Secretary for R&D, believed this was the case. He also believed that research in the Air Force needed a change in leadership--perhaps a change from military to civilian rule.

Perkins favored putting a civilian scientist at the head of AFRD and he had nominal support for such a move from perhaps as high as the Under Secretary of the Air Force, Joseph V. Charyk. But General Schriever would have none of it. His choice for the job of heading AFRD was Major General Daniel E. Hooks, the Commander of the Air Force Missile Development Center, a physicist by training who was noted for his ability as a conciliator. Schriever did go a long away, however, in satisfying Dr. Perkins' wishes to bring civilian leadership into AFRD. He appointed Dr. Knox T. Millsaps, an applied mathematician serving under General Hooks as AFMDC's Chief

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[11] Enclosure to ltr., Gagge to Komons, 2 June 1966; *Aviation Week*, Vol. 72 (13 June 1960), 33-34.

[12] Enclosure to ltr., Gagge to Komons, 2 June 1966, Brig. Gen. Benjamin G. Holzman, transcript of personal interview with Mr. Samuel Milner, 22 September 1960; ltr., Gagge to AFRD (RRG), 6 June 1960.

[13] Ltr., Maj. Gen. Marcus F. Cooper, DCS/Research & Engineering, ARDC, to Brig. Gen. Benjamin G. Holzman, 16 September 1960; see also, ltr., Col. Frank J. Seiler to AFRD (RRG), 4 August 1960.

Scientist, to the dual posts of Chief Scientist of AFRD and Executive Director of AFOSR. On 19 August, General Schriever announced the change, and, in October, Hooks and Millsaps were in Washington to take up their new duties.[14] "I don't know whether to offer congratulations or condolences on your assignment to take over command of the Research Division," Brig. General Ralph L. Wassell, the Director of Research and Technology, Headquarters USAF, wrote to General Hooks.[15] Wassell may have been writing with tongue-in-cheek, but, considering the events of the past eight months, he need not have been.

II

AFRD's existence was turbulent, but short. The division survived for fifteen months before it was taken from ARDC, put directly under Headquarters USAF as a separate operating agency, and renamed the Office of Aerospace Research. At the same time, ARDC itself was altered and renamed the Air Force Systems Command. For research, as well as systems development, the reorganization of 1 April 1961 was of the first importance.

As with the reorganization that originally established ARDC, research played a minor role in the events leading to the establishment of AFSC and OAR--events which began as early as January 1959 with a Headquarters USAF directive for a committee of general officers to study Air Force weapons systems management. What transpired from that date to the date AFSC and OAR were created is not within the scope of this narrative. Suffice to say that the Air Force, at the urging of the Department of Defense, decided that weapon systems management could be vastly improved if the entire acquisition phase of a weapon system (development, procurement, and production) were made the responsibility of a single command. The result was that the Air Materiel Command, which, in 1951, had been stripped of responsibility in R&D, was now stripped of responsibility in weapon systems procurement and production, which were joined to ARDC to form the Air Force Systems Command. Thus stripped, AMC now became the Air Force Logistics Command.

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[14] Holzman, transcript of personal interview with Milner, 24 October 1961, enclosure to ltr., Gagge to Komons, 2 June 1966, ltr., Hooks to Komons, 5 May 1966, Dr Knox T Millsaps, personal interview with author, 26 and 27 October 1965, *Alamogordo Daily News*, 19 August 1960, ARDC News Release No. 97-60, 22 August 1960, ltr., Maj. Gen. Daniel E. Hooks to Commander, ARDC, 6 October 1960.

[15] Ltr., Brig. Gen. R. L. Wassell to Maj. Gen. Daniel E. Hooks, 29 August 1960.

The decision to create AFSC made, there now remained the question of what to do with research. AFSC was such a vast organization and, as its name suggested, was so overwhelmingly geared to the development, procurement, and production of weapon systems that research would have been all but lost in it. To put research within AFSC would be asking it to suffer the fate it suffered in AMC prior to 1951. Thus AFRD, now bearing the name Office of Aerospace Research, was made a separate operating agency, given the status, if not the title, of a major command, and made to report directly to the Air Staff. For a time it even seemed possible that OAR would not only have all basic research under it, but also all "non-systems oriented" applied research--that is, applied research geared to the advancement of the state-of-the-art. But General Schriever demurred, and OAR ended up with only a few scattered applied research programs.[16]

Basic research had come a long way up the organizational ladder since the lowly days of 1954-1955, and AFOSR had gone along with it. In those days there were no less than five echelons separating AFOSR from the top; now there was but one. And with Dr. Millsaps functioning both as head of AFOSR and OAR Chief Scientist, the one remaining echelon scarcely presented any obstacles. With such status, basic research now appeared to be a respectable business in the Air Force. But it should be remembered that OAR was created under a special set of circumstances. There was never any forethought to create OAR and endow research with elevated status. The Air Force had decided to streamline weapon systems management; that done, there seemed nothing else to do with basic research but place it where it was eventually placed.[17]

III

Shortly after taking over the direction of AFOSR, Knox Millsaps set three tasks for himself which he believed required

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[16] Samuel Milner, "AFRD Becomes OAR" (unpublished manuscript), *passim*, Mr. Harry Davis, transcript of personal interview with Mr. Samuel Milner, 1 November 1961, Col. Chester J. Butcher, transcript of personal interview with Mr. Milner, 31 October 1961, Dr. Eugene Fubini, transcript of personal interview with Mr. Milner, 18 November 1961, Col. Ralph P. Gentry, transcript of personal interview with Mr. Milner, 8 October 1961, General Thomas D. White, transcript of personal interview with Mr. Milner, 2 May 1962, ARDC TWX to AFRD, 18 March 1961

[17] General Thomas D White, transcript of personal interview with Mr. Milner, 8 May 1962.

his immediate attention: (1) bolstering AFOSR's morale, (2) building its budget, (3) improving the technical content of its program. The first task, the matter of morale, was by his reckoning the most urgent. But it was an area where others could, and did, contribute much. The presence of General Hooks, for example, worked like a tonic on AFOSR's flagging spirits. And the creation of OAR a few months hence, with all it meant for basic research, had a similar effect.[18]

And Millsaps was doing his part. One thing that struck him when he first came to Washington was the generally run-down conditions of AFOSR's physical plant; he wondered how the directors, even under the best of circumstances, managed to keep their spirits up after daily exposure to Tempo T. When AFOSR moved to Tempo D, which was in a slightly less advanced stage of decay, Millsaps had the place tidied up, ordered, what he termed, "elegant" furniture for the directors, put rugs on the floors, panelled the walls, and improved the general aesthetic tone of the place. In all, Millsaps spent something on the order of $100 thousand on his beautification program.[19]

Another Millsaps program which was primarily designed as a morale builder was the securing of PL-313 positions for all AFOSR directors. In most cases the general service grades held by the directors yielded salaries not much below the average PL-313 position. But the PL-313 had a certain aura about it that was missing in the ordinary high level general service grade and was much sought after by government scientists and scientific administrators. In all, Millsaps secured four PL-313 positions for AFOSR to go along with the one he held and the two held by Carl Kaplan and Amos Horney. As a result, every AFOSR director was in a PL-313 slot.[20]

The coming of Millsaps also brought with it some slight organizational changes. For one thing, it brought a new directorate into AFOSR. While serving as AFMDC's Chief Scientist, Millsaps performed not only the traditional advisory duties inherent in such an office, but also managed a small in-house laboratory, called the Office of the Chief Scientist, which, for the most part, did analysis and consultative work for ARDC and

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[18] Millsaps, personal interview with author, 26 and 27 October 1965.

[19] *Ibid.*

[20] *Ibid.*, DCS Personnel, OAR, "Semi-Annual Historical Report," 1 January - 30 June 1961 and 1 January - 30 June 1962, ltr., Maj. Gen. Daniel E. Hooks to Brig. Gen. Benjamin G. Holzman, 13 November 1961, memo, Knox Millsaps to Maj. Gen. Daniel E. Hooks, 15 November 1961, enclosure to ltr., Maj. Gen. Daniel E. Hooks to Gen. F. H. Smith, Jr., 29 August 1961.

Headquarters USAF. It was a small group, virtually handpicked by Millsaps; and Millsaps, who had a strong paternalistic interest in the laboratory and its mission, feared that, were it left in AFMDC, it might fall prey to people who little understood its special mission. With both Hooks and Schriever consenting, Millsaps brought the laboratory into AFOSR as the Directorate of Research Analyses. And, thus, for the first time since its establishment, AFOSR was involved in in-house work.[21]

There was some reshuffling among the original directorates, too. General Holzman took the first step in 1959. He broke up the Directorate of Material Sciences into two directorates, Chemical Sciences and Solid State Sciences. In addition, Holzman took the Mathematics Division from out of Aerospace Sciences and raised it to directorate status. At the same time, he demoted the Directorate of Research Communication to division level and placed it under the new Directorate of Mathematical Sciences. When Millsaps arrived both the Directorate of Physical Sciences and the Directorate of Solid State Sciences were without directors, Dr. Otting and Charles Yost having recently resigned. While looking around for replacements, Millsaps decided that solid state did not rate directorate status, but belonged as a separate division in the Directorate of Physical Sciences. He also decided that a new division of geophysics should be created to handle the substantial contracting AFOSR was doing for the Advanced Research Projects Agency. He put this division under Physical Sciences, too, giving that directorate four divisions--Geophysics, General Physics, Nuclear Physics, and Solid State Sciences. On the other hand, he felt that the information sciences were important enough and sufficiently distinctive to be in a directorate by themselves. Thus, he established the Directorate of Information Sciences, with AFOSR's technical library falling under its aegis.[22] Meanwhile, Dr. Millsaps began turning his attention to the Directorate of Aerospace Sciences, under which were the Mechanics Division and the Propulsion Division. Millsaps did not care for the name, Aerospace Sciences, which he felt was general enough to encompass all of AFOSR's programs and not specific enough to accurately pinpoint the directorate's program. He therefore had its name changed to

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21 David Bushnell and Nick A. Komons, *History of the Office of Research Analyses*, OAR 63-12 (OAR Historical Division, 1963), pp. 18-20

22 AFOSR Organization Charts, 19 January 1959 and 1 June 1961, memo, Lt. Col. James H. Ritter to Knox Millsaps, 12 October 1960, Millsaps, personal interview with author, 26 and 27 October 1965.

Directorate of Engineering Sciences. Shortly thereafter he began reviewing AFOSR's electronics program, most of which could be found in the Directorate of Physical Sciences. He set up an ad hoc committee, under the chairmanship of Merle Andrew, to review the organization's electronics program and determine what portion of it could more appropriately be lodged in a new electronics division in the Directorate of Engineering Sciences. Ultimately, $3.3 million worth of contracts, including the Joint Service Electronics Program, were taken from under physics and put in the new Electronics Division.[23]

As for personnel, Dr. Lloyd Wood, a former administrator at the old Directorate of Research, Wright Air Development Center, was brought in from NASA to head the expanded Directorate of Physical Sciences. Harold Wooster assumed the status of Director once again with the elevation of the information sciences, and Carl Kaplan, who had headed the Directorate of Aerospace Sciences, remained in charge after the change to Engineering Sciences.

Kaplan, however, did step down as AFOSR Chief Scientist with the arrival of Millsaps. Indeed, the position was done away with altogether. It had been originally created to provide technical advice to a military commander; now, with a civilian scientist directing the organization, there appeared little need for such a position. Millsaps did toy with the idea, however, of permanently establishing some kind of technical group to oversee AFOSR's program. In November 1960, he took the step of establishing the AFOSR Technical Council, composed of the various directors and with Carl Kaplan as chairman, to do just that. With time, however, it became evident that the Council was little more than a coordinating committee, and, given the open channels of communication between the directorates, coordination was one thing there appeared to be an abundance of within AFOSR. The Council was abolished in April 1962.[24]

IV

AFOSR's budget, which had a spectacular rise during Gregory's reign, began to level off beginning with fiscal year

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[23] Minutes of the Electronics Committee Meeting, 26 March, 23 April, and 28 May 1962, ltr., Milton Slawsky, *et al.*, to Executive Director, AFOSR, 11 June 1962; ltr., Knox Millsaps to Merle Andrew, 13 June 1962, memo, Knox Millsaps to Lt. Col. Charles K. Reed, 13 June 1962.

[24] Ltr., Knox Millsaps to Directors and Division Chiefs, AFOSR, 25 November 1960, Minutes of the AFOSR Technical Council, 26 March 1962, ltr., Knox Millsaps to Directors and Division Chiefs, AFOSR, 10 April 1962.

1960. Indeed, in that year, it took a drop of $4.1 million, from $27 million to $22.9 million. The following year, the year Millsaps arrived, it rose to $25.8 million. This to Millsaps was clearly unsatisfactory. The budget was not even keeping pace with the so-called "Charyk Plan," a programming scheme suggested in 1959 by Joseph Charyk, which instituted a five-year plan for doubling the Air Force's extramural basic research budget. Moreover, all of this took no account of the rising costs of research. AFOSR's budget had definitely been set back during the Canterbury period, and Millsaps determined to make up for lost time.[25]

By November 1961, Millsaps and General Hooks had reached an understanding on how the extramural research budget should be divided. The guideline, which was popularly known in OAR as the "Hooks Formula," provided that AFOSR would receive 60 percent of all anticipated basic research funds (680 funds). Anything over the anticipated ceilings would go to AFOSR at a sliding scale rate of an additional two percent per each million. For example, if the increase were five million, AFOSR would receive 62 percent of the first million, 64 percent of the second million, etc. (The formula was 60% + (5x2%) or 70% of the increase.) However, no more than 80 percent of any increase was to go to AFOSR. And, under the formula, AFOSR's budget rose to $30.4 million in fiscal year 1962. But Millsaps was unable to lift it much beyond this level during the next two years. In fiscal year 1963 it went to $31.7 million and in fiscal year 1964 to $32.4 million. At the bottom of the trouble was that the Congress was beginning to question the size of the federal research budget; as a result, AFOSR's growth was not keeping pace with the Charyk Plan. But it did rise a healthy 45 percent from fiscal year 1960 through fiscal year 1964.[26]

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[25] ARDC Form 185B, "AFOSR Budgets by Divisions," 27 July 1961, Millsaps, personal interview with author, 26 and 27 October 1965, Minutes of the Meeting of the AFOSR Physical Sciences Advisory Committee, 2 December 1960. Additional budgetary data received from Office of the Assistant Executive Director, Research Operations, AFOSR.

[26] Memo, Maj. Gen. Daniel E. Hooks to Knox Millsaps, 5 June 1961, ltr., Maj. Gen. Daniel E. Hooks to Knox Millsaps, 17 November 1961, memo, Knox Millsaps to General Hooks, 10 May 1962, ltr., Col. Charles E. Carson to Executive Director, AFOSR, *et al.*, 21 September 1962, Minutes of Meeting of the AFOSR Physics Advisory Committee, 2 December 1960, 14 and 15 September 1961, ltr., Maj. Donald R. Courier to Executive Director, AFOSR, 19 March 1963, Knox Millsaps, "Suggested Improvements in the Management of the Office of Aerospace Research," 15 September 1962, p. 4.

Chapter XI

THE MILLSAPS YEARS

Millsaps was in many ways a purist, and, while he was the first to acknowledge that the business end of basic research in the Air Force "is the production of better aeronautical and astronautical weapon systems," he felt that this could best be done by keeping AFOSR simon pure.[1] This meant not only that the organization's program would be unadulterated by applied research or, as he was wont to say, gadgetry, but also that the organization would be run with only one principal objective in mind, the support of basic research.[2]

Under Millsaps, therefore, AFOSR paid little attention to such long-standing problems as the "utilization" of AFOSR's product. If AFOSR supported worthwhile efforts and if it were run properly, the organization was fulfilling its obligations. It was the job of the applied research and development laboratories to be aware of what AFOSR was doing and put AFOSR's product to use.[3] This raised the question, of course, of how AFOSR could best make its product available to these laboratories. Millsaps was opposed to any kind of formal mechanism being established, preferring the casual encounter, the seminar, and, above all, the published paper in the scientific and engineering journal as the best means of disseminating the results of AFOSR's research. In this respect he was much like Haywood; but where Haywood merely urged contractors to publish in the literature, Millsaps, except in rare cases, recognized no other form of publication as a legitimate product of a contractor's work. Besides believing that the scientific journal was the best means of conveying research results, he felt it was a valid test of a contractor's productiveness. What good was a formal

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1 Knox Millsaps, "Suggested Improvements in the Management of the Office of Aerospace Research," 15 September 1962, p. 1.

2 Knox Millsaps, personal interview with author, 26 and 27 October 1965.

3 *Ibid.*

technical report to AFOSR if the report's findings were unacceptable for publication in a learned journal?[4]

Anything else AFOSR might do, beyond using the normal channels of communication traditionally used by scientists and engineers, in getting its results to the applied research laboratories, was a comparative waste of time. Millsaps' reasoning went like this. While it was true that one criterion for selecting any given AFOSR project was relevance to Air Force interests, this did not mean that AFOSR supported, or could even begin to support, all science relevant to the Air Force. The whole world of science was relevant to the Air Force, and AFOSR's efforts were but a very small part of the total world-wide scientific effort. It made no sense, therefore, for AFOSR to take special care to get its work before Air Force laboratories in preference to work supported by others. And, it went without saying, that AFOSR could not even begin to channel this world-wide effort into the Air Force laboratories. In the final analysis, if the applied research laboratories were to do their jobs effectively, they had to be alert to scientific developments around the world, and these developments were to be found in the scientific literature.[5] But Millsaps enjoyed keeping tabs on AFOSR's contributions to that literature, and he lost few opportunities to inform General Hooks of any favorable statistical comparison between the contributions of AFOSR and other agencies.[6]

Interpreting AFOSR's role as he did, it was natural that he would be out of sympathy with the intent of the RPO system. It was, in his words, a "completely impossible" programming structure, and he found it wanting on many counts.[7] For one thing, the structure did not accurately convey what AFOSR was doing. ("At best, [the RPO's] connotate applied research goals for protective camouflage," he wrote, "and, at worst, they symbolize a petard of intellectual dishonesty on which sooner or later some ill-disposed official at higher levels will hoist the Air Force basic research program.")[8] For another thing,

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[4] Ltr., Harold Wooster to Knox Millsaps, 24 January 1962; ltr., Knox Millsaps to Dr. John W. Howard, 25 January 1962; ltr., S. Lefschetz to Knox Millsaps, 14 September 1962; ltr., Knox Millsaps to Dr. N. Rosenberg, 2 January 1963; ltr., Harold Wooster to Col. Jack Deets, 31 January 1963.

[5] Millsaps, personal interview with author, 26 and 27 October 1965.

[6] Memo Routing Slip, Knox Millsaps to General Hooks, 3 April 1962.

[7] Memo, Knox Millsaps to Maj. Gen. Daniel E. Hooks, 10 May 1962.

[8] Millsaps, "Suggested Improvements," p. 5.

while some of AFOSR's tasks could be fitted under RPO categories, a great many did not fit anywhere. Thus, AFOSR was supporting the Stanford Mark II linear accelerator under propulsion ("One might expect it to go into orbit at any moment," Millsaps cracked). He felt the only logical solution was to devise a programming structure along the lines of the traditional scientific disciplines. Unlike Davis and Williams, Millsaps felt no need to camouflage AFOSR's program; and, indeed, he believed that to do so would in the long run be harmful to AFOSR. AFOSR supported basic research; and if AFOSR had to sell its program, it should sell it for what it was.[9]

Ultimately, it was an effort on the part of the Defense Department to rationalize and unify programming methods throughout the Department that finally led to the scuttling of the RPO's. The new programming structure, the so-called "Hitch program," named for Charles J. Hitch, the Assistant Secretary (Comptroller) of the Defense Department, distributed basic research activities over five program elements: Physical Sciences, Engineering Sciences, Mathematical Sciences, Psychological and Social Sciences, and Biological and Medical Sciences. OAR adopted this program structure during the second half of 1962.[10]

II

AFOSR could also take heart in a number of other administrative reforms or programs adopted since 1958, the most important of which were the instituting of long-term funding, the enactment of the Grant Law of 1958, and the founding of a fellowship program.

Long-term funding was nothing new. It had been used by the National Science Foundation, the National Institutes of Health, and other federal research agencies for years. The Congress had permitted the practice since 1952. Headquarters USAF, however, refused to allow ARDC to make use of it.[11] The feeling at the time (and it was not just in Headquarters

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9 *Ibid.*; Minutes of Meeting of the AFOSR Physical Sciences Advisory Committee, 2 December 1960; Millsaps, personal interview with author, 26 and 27 October 1965.

10 *History of the Office of Aerospace Research*, July - December 1962 (OAR Historical Division, 1963), I, 4-6; ltr., Col. Charles E. Carson to AFOSR, *et al.*, 23 August 1962.

11 Draft of ltr., Maj. Voltaggio to RDTR-1, ca. 1958; see also *supra*, p. 70.

USAF, but in ARDC as well) was that, since research funds were essentially limited, committing a sizable portion to a few projects for a number of years would rob the research program of a great deal of its flexibility. "If we are not careful," wrote a highly placed ARDC staff official, "we are likely to eliminate the possibility of commencing high priority, new research because of frozen assets from prior year contractual actions." [12] But aside from this, as long as increment funding was the rule rather than the exception, long-term contracts for research were not very practical mechanisms. Yet, neither was short-term funding a very practical way of supporting research.

Basic research was a long-term proposition. Rarely, if ever, did a basic research investigation reach completion in a year or two. AFOSR had many a project on its books that had been in existence for as long as five years. Yet, none of these projects had been covered by a single contract, since Air Force Manual 172-1 limited all research contracts to eighteen months. Instead, the projects had been periodically renewed every twelve or eighteen months. Some, indeed, had gone through as many as ten renewals and supplements during the span of their existence.[13] In short, the eighteen-month limitation forced AFOSR to go through the procedure of renegotiating virtually all of its contracts at least once.

Aside from financial considerations, the chief deterrent to funding reform was a failure on the part of many people to recognize that the support of research was radically different from anything else the federal government had ever undertaken. Virtually everything the government did by contract could be funded on a short-term basis. In a kindred area such as development, for example, a contract is let for the development of an airplane, a missile, or some other weapons-system component. The object of the contract is the development of a tangible item. But the nature of technology is such that any weapons-system component, whether in an early or advanced stage of development, can be rendered obsolete at any time by something on the drawing boards. Moreover, such seemingly extraneous considerations as the state of international relations have a direct bearing on whether or not a particular weapons-system contract should be continued. For development, then,

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12 Ltr., Col. John W. Carpenter III to Dr. T. P. Wright, Vice President for Research, Cornell University, 18 June 1956.

13 Ltr., Maj. Gen. John W. Sessums to All Center Commanders, 21 April 1958.

short-term funding was a logical way of doing things, if only to protect the government's interests.

Basic research is another thing altogether. Here the specific problem an investigator is working on is never so important as the general area he is working in. AFOSR rarely, if ever, granted a contract merely because it liked the specific problem engaging an investigator; rather, it did so because it was interested in the general area of his endeavor and, above all, because it had faith in his capacity to do good work. And this faith, moreover, was never compromised if another investigator went on to solve the specific problem. In basic research, a discovery by one man is no reason for another to stop working. About the only valid reason AFOSR would have in cutting off a basic research project abruptly would be if it had misjudged its man originally. And this was such a remote possibility, given the open channels of communication within the scientific community, that it was impractical to guard against.

Purely from a narrow, administrative point of view, short-term funding of basic research was a nuisance, both for AFOSR and its contractors. But it was also something with a great deal more serious consequences. Project directors, who should have been thinking and planning on a long-range basis, were compelled to think in terms of what could be done in a year. ("It is obviously impossible to plan on basic research programs," complained Dr. Ernst Weber, the President of the Polytechnic Institute of Brooklyn, "if funding runs from year to year, with the uncertainty of renewal.")[14] Others, who had an eye out for the stability of their project, were prone to take their proposals to an agency that would sponsor research for a longer period. Short-term funding, moreover, was incompatible with the hiring practices and academic programs of universities. Graduate students, who needed from two to three years of research to comply with a university's graduate study requirements, were naturally reluctant to go into a project that ran for only a year when others that ran for as long as five years were available. And, while AFOSR usually gave verbal assurances to its contractors concerning renewals, there was no guarantee that AFOSR could live up to those assurances, as the budget crisis of the fall of 1958 demonstrated. On the other

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14 Ltr., Dr. Ernst Weber, President, Polytechnic Institute of Brooklyn, to Francis E. Dorn, 16 April 1958, quoted in *Congressional Record*, 85th Cong., 2nd Sess., 16 April 1958, Appendix, p. A3494.

hand, had AFOSR engaged in long-term funding from the beginning, the crisis of that fall would have scarcely touched it. Short-term funding bred instability. It was little wonder that among the complaints leveled against AFOSR by contractors, short-term funding ranked first in order of frequency.[15]

University complaints to the contrary, long-term funding stood little chance of being adopted by the Air Force until the budget crisis of 1957 came along to illustrate with a vengence what piecemeal funding could do to a research program during a period of general economic retrenchment. It was in the midst of this crisis, in September 1957, that the DOD's Coordinating Committee on the General Sciences recommended that all basic research be funded on a long-term basis.[16] The following month, at a Pentagon luncheon, at which General White, General Anderson, Dr. George E. Valley, Dr. James R. Killian, and Ernst Weber were present, the civilians in the group counselled Generals White and Anderson on the importance of long-range planning in research. They suggested that three years should be the minimum period for all contracts, with this period extended to five years sometime in the future.[17] In January 1958, once again at the Pentagon, Dr. Valley, General Putt, and General Demler met to decide on a course of action. They agreed that the Air Force should make longevity funds available for research, even if at first it would be on a limited scale. And they made a recommendation to this effect to the Air Staff. Two months later, ARDC's Directorate of Research formally requested Headquarters USAF to exempt basic research from the eighteen-month funding limitation.[18]

Headquarters USAF now proceeded to act. In August 1958, it made available to AFOSR $6 million in longevity funds, which could be used to support work at universities for a

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15 Ltr., Thomas W. Wilcox, Procurement Inspector, ARDC, to Inspector General, ARDC, 8 June 1956; ltr., Capt. Ronald W. Helmick, Chief, Procurement Inspection Branch, ARDC, to Inspector General, ARDC, 31 May 1956; ltr., Morton M. Pavane, Staff Engineer, ARDC Regional Office, to Col. Benjamin G. Holzman, 14 August 1958; ltr., Sessums to All ARDC Center Commanders, 21 April 1958; AFOSR Research Support Survey, 1 June 1958.

16 A. A. Albert, Office of the Assistant Secretary of Defense for R&D, "Effects of Recent Budget Augmentations on Programs in the Mathematical Sciences," 17 November 1958; see also *supra*, p. 146.

17 Ltr., Dr. Ernst Weber to General Samuel E. Anderson, 15 April 1958.

18 ARDC Staff Summary Sheet, Maj. Gen. M. C. Demler to RDG, 14 April 1958; ltr., Col. Benjamin G. Holzman to Commander, AFOSR, Attn: SRP, 24 March 1958.

period of up to three years.[19] This was a mere palliative, but a cure was on the way. In November 1959, basic research was exempted from the eighteen-month funding limitation in Air Force Manual 172-1. Research contracts could now be funded up to a period of five years.[20] Thus, seven years after the Congress had permitted such a practice, the Air Force had finally taken advantage of long-term funding. By the turn of the Sixties, long-term funding was the established way of doing things at AFOSR.

The Air Force took no comparable time to take advantage of the law permitting the use of grants for the support of basic research. Passed by the Congress, in September 1958, at the urging of the National Science Foundation and the scientific community, the law gave the military services and other federal agencies supporting research at institutions of higher learning an alternative to the contract, which was a cumbersome affair as an instrument for sponsoring basic research. Both the contract and the procurement regulations covering it were originally devised for industrial procurement; and while considerable effort had been spent in revising them to better fit the research situation, they still bore the earmarks of the purpose for which they were originally intended--that is, they retained many of the contractual elements that were germane to industrial procurement, but alien to research. And, as a result, both the contracting agency and the contractor were engulfed by a multiplicity of restrictive supply regulations, the so-called "boiler-plate" in the procurement idiom. The investigator in particular felt that he was needlessly encumbered with red tape and financial and other reporting requirements that imposed a cold, detail-watching attitude inappropriate to the research situation.[21]

Used by the National Institutes of Health since 1944 and the National Science Foundation since 1950, the grant was a somewhat different instrument. Simple in content, easy to manage, and free of all "boiler-plate," it avoided most of the rigmarole

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19 Ltr., Col. James T. Stewart, DCS/D, USAF, to ARDC, 22 August 1958; memo for record, Lt. Col. Robert J. Burger, Chief, P&P Division, Directorate of Research, ARDC 5 September 1958; memo, Lt. Col. Robert J. Burger to Maj. Gen. L. I. Davis, 26 November 1958; Albert, "Effects of Recent Budget Augmentations," 17 November 1958.

20 Air Force Manual 172-1, 4 November 1959, p. 2-149.

21 Nick A. Komons, *Development of the Air Force Research Grant Program*, OAR 63-11 (OAR Historical Division, 1963), pp. 3-5, 9.

of administrative red tape. While advanced payments under a contract required specific arrangements that were easy for some, but by no means all, colleges and universities to make, the grant readily allowed payment to be made in advance, thus putting fewer demands on a university's supply of working capital. Also with a grant, financial reporting was at a minimum. Public vouchers for each purchase were not required. Tedious audits, retroactive cost accounting, and complicated bookkeeping were eliminated. All this meant that the burden of administration for the grantor agency, the grantee, and the investigator was less for grants than contracts.[22]

Grants by no means had anything like a sweeping, instantaneous impact upon AFOSR's operations. For one thing, the contract still had to be used with industrial laboratories. And for another, some unexpected problems arose which set back an expeditious conversion to grants. Nonetheless, there was little doubt in AFOSR that the grant would have a significant effect on the way it did things. "When [the grant] program becomes fully implemented," wrote a highly placed AFOSR official, "it will have a far-reaching impact upon our operations."[23]

The expected impact was slow in coming, mainly because of a disinclination on the part of AFOSR's procurement directorate to pay a sum exceeding 20 percent of the direct costs of a grant for indirect or overhead costs. Since universities could get all their overhead costs paid under a contract, they chose that instrument instead. Consequently, the grant was sparingly used. In June 1961, however, General Hooks himself removed the limitation on grant overhead. Later that month, Dr. Millsaps formally laid down the policy that the grant would henceforth be the normal instrument for procuring basic research at colleges and universities.[24]

Things went smoothly for about a year; then, in the summer of 1962, the Congress attached a rider to the Defense Department appropriation for fiscal year 1963 that imposed a 20-percent limitation on grant overhead. At the same time, the indirect cost rate on contracts remained untouched, and a wholesale conversion from grants to contracts would have been in the making had Millsaps not held his ground. Believing he

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[22] *Ibid.*, p. 6.

[23] Ltr., Brig. Gen. Benjamin G. Holzman to Lt. Gen. Bernard Schriever, 4 June 1959.

[24] Komons, *Air Force Grant Program*, pp. 35-45.

could not do otherwise, he refused, despite the protests of university officials, to make the contract the preferred instrument for procuring research. But more than one university refused, in turn, to take a grant under these conditions, and, by the spring of 1963, it appeared that unless Congress lifted the limitation a change in AFOSR's policy would be inevitable.[25]

The AFOSR fellowship program, like long-term funding and grants, also had its roots in the late 1950's, although it will be recalled that Oliver Haywood, acting on a recommendation in the Ridenour Report, had tried without success to institute such a program as early as 1952.[26] When General Holzman arrived at AFOSR, the organization was already in the process of planning a fellowship program with the assistance of the National Academy of Sciences. Holzman was very enthusiastic about the program, gave it his support, and, by June 1959, AFOSR had established nine post-doctoral research associates in seven American universities. Holzman's enthusiasm for the program soon dampened, however, when the program was subjected to some severe criticism on Capitol Hill.[27] But the program survived, and by the time Millsaps came on the scene, AFOSR was spending in excess of $100 thousand for fellowships. In September 1962, the organization was supporting fifteen research fellows at a cost of $165 thousand annually.[28]

From contracts and grants to fellowships--all that remained was to endow chairs at universities, and Millsaps decided to do that, too. In April 1961, Millsaps, in the company of Lloyd Wood, was at the California Institute of Technology on other business when Dr. Frank Press, the Director of Cal Tech's Seismology Laboratory, suggested that AFOSR endow a chair in seismology. Millsaps told Press to submit a formal proposal; meanwhile AFOSR would give the subject close study.[29]

Nothing like this had ever been attempted independently by the Air Force, and this fact alone was a handicap. The Congress was not fond of the Defense Department undertaking precedent shattering programs in the area of scientific support. Another problem was that AFOSR, even were it found that a military agency could undertake such a program under

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25 *Ibid.*, pp. 61-69.

26 See *supra*, pp. 41-43.

27 Ltr., General Holzman to General Schriever, 4 June 1959.

28 Ltr., B. L. Kropp, Assistant Business Manager, National Academy of Sciences, to Knox T. Millsaps, 17 September 1962.

29 Ltr., Maj. Gen. Daniel E. Hooks to Lt. Gen. R. C. Wilson, 23 June 1961.

existing law, did not have the authority to act on its own. Since the endowment was to run for a period in excess of five years, it required the approval of the Secretary of the Air Force. In addition, the proposal smacked of federal aid to education, and with the administration's federal aid to education bill before the Congress at that time, an AFOSR endowment could easily be misinterpreted as a form of backdoor aid to education before the Congress had an opportunity to speak on the subject.[30]

While AFOSR was considering these problems, the *Washington Post's* science reporter, Howard Simons, managed to uncover the facts concerning the proposal, and, on 9 June, the story appeared in the *Washington Post*.[31] The Pentagon, which knew nothing of the proposal, was caught by surprise. Joseph V. Charyk, the Under Secretary of the Air Force, appeared particularly chagrined, perhaps in part by the fact that he first heard of the proposal when he read Simons' article. In a few days, Charyk was writing to General Hooks that it was "highly improbable that any scheme of this type would be acceptable." Charyk found it "highly undesirable to generate publicity along the lines indicated in the recent press release." The newspaper article, Charyk held, had already produced "a considerable reaction from all elements in Government," and he cautioned General Hooks not to explore arrangements of this kind without first consulting "with responsible officials in this Headquarters."[32]

Actually, the organization's hands were clean, for Hooks and Millsaps had intended to consult with higher headquarters; indeed, they could not avoid it since Secretary of the Air Force approval was required before they could endow the chair. But the appearance of the Simons' article, which Charyk believed was based on an OAR press release (when in fact OAR had released no information on the subject), made it appear as if AFOSR was acting on its own. The affair created enough of a stir to induce Cal Tech to withdraw its proposal.[33]

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30 Memo, Lt. Col. Ralph Slater to RRG, 20 June 1961; Fact Sheet, "Air Force Support of Geophysics Chair," enclosure to ltr., John Lay, Office of Information, OAR, to James Miller, Press Bureau, Cal Tech, 19 June 1962.

31 *Washington Post*, 9 June 1961.

32 Memo, Joseph V. Charyk to Maj. Gen. Daniel E. Hooks, 15 June 1961.

33 *Ibid.*; memo, Slater to RRG, 20 June 1961; ltr., General Hooks to General Wilson, 23 June 1961.

Hooks and Millsaps, however, were not disposed to give up and began to see what they could do to clear up the misunderstanding. They had one thing working in their favor: the relatively unadvanced stage of seismology was one of the chief stumbling blocks before a nuclear test ban treaty between the United States and the Soviet Union. And it was no doubt in great part due to the fact that the endowment was to go for a chair in seismology that Pentagon officials began taking a second look at the proposal.[34]

On 3 July, Lt. General R. C. Wilson, the Deputy Chief of Staff for Research and Technology, Headquarters USAF, told General Hooks that he liked the idea of an Air Force endowed chair, cited as precedent two professorships in English universities which the Air Force had helped endow, and urged Hooks to pursue the matter further. Before too long, Dr. Brockway McMillan, the Assistant Secretary of the Air Force for R&D, indicated that he was well-disposed toward the proposal, and Dr. Charyk, for his part, made no further objections. By September, Millsaps had sufficiently persuaded officials at Cal Tech that all political objections had now been removed to induce them to submit a proposal once again. In October, Press submitted a proposal calling for a lump sum grant of $95.1 thousand to finance a professorship for ten years.[35] In June 1962, the grant was made.[36]

III

As AFOSR's problems became less pressing with the passage of time, Millsaps began to look increasingly to the laboratories. To Millsaps, the job of AFOSR Executive Director was secondary to that of OAR Chief Scientist. AFOSR was, after all, a well-established organization which, in 1960, was suffering mainly from sagging morale. That problem brought largely under control, and its budget put back on an ascending curve, the organization required a minimal amount of executive

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34 See ltr., General Hooks to General Wilson, 23 June 1961.

35 Memo for the record, Maj. Gen. Daniel E. Hooks, 6 July 1961; Millsaps, personal interview with author, 26 and 27 October 1965; memo, Knox Millsaps to Maj. Gen. Daniel E. Hooks, 22 September 1961; ltr., Frank Press to Knox Millsaps, 3 October 1961; California Institute of Technology, "Proposal for Establishing an Air Force OSR Professorship in Geophysics," 2 October 1961; enclosure to ltr., I. F. Betts to Knox Millsaps, 16 October 1961.

36 AF-AFOSR Grant 62-421, 1 June 1962.

direction from the top. The laboratories, however, were another matter. They were, in Millsaps' estimation, OAR's great unfinished business.[37]

It was not merely as Chief Scientist that Millsaps took an interest in the laboratories; there was more than one in-house problem which Millsaps, as AFOSR Executive Director, had a vested interest in. As far as AFOSR was concerned, the big problem at the laboratories was the use (or misuse) of contract funds. The question was an old one and had occupied each and every head of AFOSR, from Haywood down to Millsaps. Millsaps, however, by virtue of his dual position, appeared to be the first head of AFOSR who was in a position to do something about the question.[38]

Millsaps' experience prior to AFOSR had been primarily as an in-house scientist and laboratory manager. Nevertheless, on the question of contract research at the laboratories, his position was virtually identical to AFOSR's traditional position--a contract program and an in-house program do not mix. ("Long and dear experience . . . has taught me that contract management and the creative production of basic research do not mix well if one wants and demands the most from both sources.")[39] For their part, the in-house laboratories answered that contract research was necessary to complement their own work. Millsaps countered this contention by saying that he knew of no Nobel Laureate or, for that matter, any first-rate scientist, who spent a great deal of his time monitoring other people's work. In other words, according to Millsaps, the management of a contract program took the in-house scientist away from his own laboratory pursuits. Moreover, Millsaps maintained, since in-house contract work was largely solicited by the laboratory, an in-house scientist was obliged to interest someone in the laboratory's work. But in Millsaps' view, a first-rate scientist would not be interested in having anyone tell him what research to do. So the in-house scientist would be forced to go to a second-rater or to someone who, for the money, would be

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37 Millsaps, personal interview with author, 26 and 27 October 1965; ltr., Hooks to Komons, 5 May 1966; memo, Col. Robert E. Fontana to Dr. Knox Millsaps, 25 April 1962.

38 Trip report, Erich E. Soehngen, Chief, Thermomechanics Research Branch, ARL, 15 May 1961; Memo Routing Slip, John Knox to Knox Millsaps, ca. May 1961; Minutes of Meeting of the AFOSR Physics Advisory Committee, 23 April 1961; memo for the record, E. K. Grimes, Technical Advisor, Directorate of Science & Technology, DCS/R&T, Hq. USAF, 26 November 1962.

39 Millsaps, "Suggested Improvements," p. 9.

willing to adopt other people's ideas. Such a man, Millsaps concluded, could not hope but do mediocre research.[40]

Millsaps' solution, which was also the solution of previous AFOSR heads, was to take the management of contracts out of the hands of the laboratories and put it in AFOSR.[41] Unlike other AFOSR heads, however, Millsaps had a measure of success in transferring contracts and contract funds out of the laboratories. In January 1961, Millsaps worked out an arrangement whereby ARL transferred ten contract administrators and their programs to AFOSR.[42] This was the first such transfer from a laboratory to AFOSR since the days of Haywood. Meanwhile, Millsaps was finding it increasingly difficult to be on record as opposed to contract research at the laboratories while allowing a directorate within AFOSR, the Directorate of Research Analyses, which was essentially an in-house laboratory, to have a contract program. Thus, in June 1962, over protests of Dr. Gerhard R. Eber, the Chief of DRA's Science and Engineering Analysis Division, Millsaps directed that all of DRA's fiscal year 1963 contract funds be transferred to AFOSR's Washington directorates.[43] In addition, the Hooks Formula, as already indicated, served to limit the percentage of contract funds going to the laboratories. Not only did it ensure that AFOSR would receive at least 60 percent of all basic research contract funds, but it also provided for AFOSR's share of these funds to increase to 80 percent over the next ten years.[44]

But, while the Hooks Formula was a limiting factor, it scarcely satisfied Millsaps. The largest in-house contracting activity, running between ten to twelve million dollars annually and growing steadily, was at AFCRL. Try what he might Millsaps was unable either to transfer this program or to halt its growth. But he did try mightily, to the consternation and chagrin of General Holzman, who was becoming increasingly piqued by

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40 Millsaps, personal interview with author, 26 and 27 October 1965; trip report, Soehngen, 15 May 1961.

41 Minutes of Meeting of the AFOSR Physics Advisory Committee, 23 April 1961.

42 AFRD News Release No. 1-61-1, 25 January 1961.

43 Ltr., Col. James H. Ritter to Dr. Knox Millsaps, 26 June 1962; ltr., Milton M. Slawsky to Dr. Knox Millsaps, 3 July 1962; David Bushnell and Nick A. Komons, *History of the Office of Research Analyses*, OAR 63-12 (OAR Historical Division, 1962), p. 30.

44 Ltr., Maj. Gen. Don R. Ostrander to Lt. Gen. James Ferguson, 11 October 1962.

Millsaps' attempt to upend the contract program of his laboratory.[45]

17

General Hooks had always been a force for stability within the organization and had a great deal of success in keeping dissenting factions within OAR on reasonably good terms with each other. But Hooks retired, in June 1962, and with his successor, Major General Don R. Ostrander, not expected to report for duty until the following fall,[46] there was no one present in OAR who was capable of keeping down the differences within the Command. Particularly disturbing during this period was the inability of Dr. Millsaps and General Holzman to resolve their differences over the management of AFCRL. And the two were soon embroiled in a disagreement that, to many, appeared irreconcilable.[47]

Meanwhile, in July 1962, Lt. General James Ferguson, the Deputy Chief of Staff for Research and Technology, Headquarters USAF, at the behest of Dr. Charyk, asked Dr. Millsaps for his thoughts on the future role of OAR in research and how that role might be improved.[48] Millsaps could have made as much or as little of this opportunity as he chose. But, as he put it, "with my well known Southern tendency for endless oratory, I yielded to the temptation of a sterling opportunity."[49] He chose to write a full-scale report detailing what he felt was wrong with OAR and how these wrongs could be corrected. Millsaps also chose to write the report in language which was bound to arouse the sensibilities of most of his readers. (". . . I shall not call the spade a sterling silver terra firma transferrer but rather a bloody shovel.") (Asked why he employed the language that he did, he replied, "It was expected of me.") The report, to which Millsaps gave the title, "Suggested Improvements in

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45 OAR Funding Summary, enclosure to ltr., Maj. Gen. Daniel E. Hooks to Dr. Knox T. Millsaps, 17 November 1961; Millsaps, personal interview with author, 26 and 27 October 1965.

46 Ltr., Col. Charles E. Carson to Brig. Gen. Benjamin G. Holzman, 7 June 1962.

47 Millsaps, personal interview with author, 26 and 27 October 1965; Millsaps, "Suggested Improvements." *passim.*

48 Ltr., Lt. Gen. James Ferguson to Knox Millsaps, 25 July 1962; Millsaps, personal interview with author, 26 and 27 October 1965; Dr. Lloyd Wood, personal interview with author, 6 July 1966.

49 Ltr., Knox Millsaps to Lt. Gen. James Ferguson, 14 September 1962.

the Management of the Office of Aerospace Research," was sent to General Ferguson on 14 September--one week to the day before General Ostrander was scheduled to report for duty.[50]

With respect to AFOSR, Millsaps proposed that it be organizationally and physically separated from OAR and given 35 spaces from Headquarters OAR to form its own support staff. (Millsaps dwelled more on the physical separation of AFOSR from the Headquarters than the organizational separation. Indeed, in one section of the report, where he sketched his proposed reorganization of OAR, AFOSR was an integral part of OAR.) In addition, he proposed that all contract funds be transferred to AFOSR and that AFOSR be hereafter the sole Air Force agency empowered to engage in extramural basic research. And in line with this recommendation, he proposed that the European Office and the Latin American Office, both of which dealt exclusively with extramural research, be converted from independent OAR detachments into outlying dependencies of AFOSR. And since Millsaps wanted to achieve a complete separation between extramural and in-house research, he further recommended that the Directorate of Research Analyses be taken out of AFOSR and made a detachment of OAR.[51]

The rest of the report--and this was most of it--was primarily concerned with the management of the in-house laboratories and the organization of OAR Headquarters--aspects which need not concern us here unduly. Suffice it to say that the greater use of civilians on higher management levels was a theme running throughout the report. Among the positions he felt should be filled by civilians were the Commander of ARL, the Commander of AFCRL, and the Commander of OAR. But if the Air Staff believed that the military liaison function was paramount in these positions, Millsaps suggested that a civilian scientific director, who would be completely responsible for the management of the scientific program, be put under each of these military commanders.[52]

On 21 September, General Ostrander arrived; one of his first tasks was to convey to General Ferguson his views on the Millsaps report. Ostrander acknowledged the merit of some of

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50 *Ibid.*; Millsaps, "Suggested Improvements," p. 2; *History of the Office of Aerospace Research, July - December 1962* (OAR Historical Division, 1963), I, 11.

51 Millsaps, "Suggested Improvements," *passim.*

52 *Ibid.*

Millsaps' recommendations and promised to study others, but rejected Millsaps' principal proposals--placing all extramural research under AFOSR and the "civilianization" of the command structure.[53] But the main problem confronting Ostrander was not so much that he was in disagreement with Millsaps on some major points of research management (presumably there was room within the organization for divergent views); the big problem was that Millsaps was both OAR Chief Scientist and AFOSR Executive Director. And it was particularly acute because of the increasingly poor relations between General Holzman and Dr. Millsaps. Having Dr. Millsaps continue in both these positions represented to Ostrander a conflict of interest. AFOSR appeared to be in a preferential position with respect to other elements of the Command. Thus, in what appeared to him as the most obvious solution to the problem, he proposed to eliminate the position of OAR Chief Scientist, while at the same time asking Dr. Millsaps to stay on as Executive Director of AFOSR. Millsaps decided not to stay, leaving AFOSR for the academic world in January 1963. To him the challenging work in OAR was in the laboratories, and this work was no longer open to him. AFOSR, offered no comparable challenges, for he considered it "the one and only organization in OAR that is doing an excellent job" in the management of research.[54] In September 1963, Dr. William J. Price, ARL's Chief Scientist, was appointed AFOSR's second civilian Executive Director.[55]

V

Millsaps headed AFOSR for roughly twenty-seven months, and it was as fateful a twenty-seven months as any the organization had ever experienced. Fateful not because events of great significance took place (although there were some exceptions, such as the creation of OAR), but because of the great change that the organization's subjective character underwent. It was during this period that, by some process, AFOSR

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53 Ltr., Lt. Gen. James Ferguson to Commander, OAR, 28 September 1962; ltr., Ostrander to Ferguson, 11 October 1962.

54 Ltr., Maj. Gen. Don R. Ostrander to Nick A. Komons, 26 July 1966; David Bushnell, "Notes on OAR Staff Meeting," 7 December 1962; ltr., Ostrander to Ferguson, 11 October 1962; Millsaps, personal interview with author, 26 and 27 October 1965; Millsaps, "Suggested Improvements," p. 13.

55 *The* [Bolling AFB] *Beam*, 30 August 1963.

finally reached maturity--finally reached that stage in its development where it was outwardly at peace with itself and its lot. No longer was AFOSR the fitful, aggressive, and turbulent stepchild of the Air Research and Development Command.

The creation of OAR had perhaps a great deal to do with the change. Putting OAR under the Air Staff went a long way to satisfy AFOSR's quest for high status. And, of course, the RPO's were dead. The status of the laboratories was essentially fixed. The elaborate system of supervisory echelon upon supervisory echelon was torn down. And AFOSR's budget appeared as secure as ever. The old problems were now ancient history, and while there was no end to new problems, they did not appear nearly so ominous as the old; they did not generate the same degree of intensity in the organization as the problems of the past. And while it was true that Knox Millsaps was rarely at peace, he was never really at war with AFOSR's fate, but with what he believed to be the fate of research in the in-house laboratories. Millsaps' major problems were not the kind of problems AFOSR could identify itself with intimately. This is not to say that Millsaps did not contribute to the change in AFOSR's character. No other head of AFOSR had subjected the organization to his will as much as Millsaps. He shifted programs, decided where money should and should not be spent, and generally decreed how the organization should be run. The important decisions were made by him, and they did not necessarily represent the collective wisdom of the directors.[56] Once bent in this fashion, the organization could never be so vibrant as before. But the way Millsaps ran things was not really so significant in reshaping AFOSR's character as the fact that AFOSR no longer lived under a constant state of pressure. AFOSR was no longer reacting to this or that, and, in consequence, it was no longer the same. In the 1950's, AFOSR had a special kind of spark, a youthful, vibrant quality, that made it appear as never being at rest. Much of this was now missing. In the 1950's, AFOSR was an organization on the make; by the early 1960's, the organization was made. And if it lost its spark and youth and vibrancy in the process, it was the price paid for maturity and well-being.

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[56] See for example, Lt. Col. William A. McClanahan, transcript of personal interview with Mr. Samuel Milner, 9 June 1961; memo, Knox Millsaps to Col. Charles E. Carson, 12 February 1962; Interservice Supply Agreement, Project 9751, Task 37510, 29 August 1961; David Bushnell, "Notes on AFOSR Management Conference," 1 June 1962.

GLOSSARY

AAF	Army Air Forces
AFCRC	Air Force Cambridge Research Center
AFCRL	Air Force Cambridge Research Laboratories
AFMDC	Air Force Missile Development Center
AFOSR	Air Force Office of Scientific Research
AFRD	Air Force Research Division
AFSC	Air Force Systems Command
AIT	Air Institute of Technology
AMC	Air Materiel Command
ARDC	Air Research and Development Command
ARL	Aeronautical Research Laboratory/Aerospace Research Laboratories
DAS	Directorate of Advanced Studies
DCS/D	Deputy Chief of Staff/Development
DCS/M	Deputy Chief of Staff/Materiel
DRA	Directorate of Research Analysis/Analyses
EOARDC	European Office, Air Research and Development Command
ERD	Electronic Research Directorate
FRL	Flight Research Laboratory
GRD	Geophysics Research Division/Directorate
Ibid.	In the same place
Infra	Below
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NRC	National Research Council
NSF	National Science Foundation
OAR	Office of Aerospace Research
ONR	Office of Naval Research
Op. cit.	In the work cited
OSR	Office of Scientific Research
OSRD	Office of Scientific Research and Development
Passim	Here and there
R&D	Research and Development
RDB	Research and Development Board
RDC	Research and Development Command
RPO	Research Planning Objective

SAB	Scientific Advisory Board
SAG	Scientific Advisory Group
Supra	Above
TWX	Teletypewriter exchange service
USAF	United States Air Force
WADC	Wright Air Development Center

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