Dorothy L Miller

HISTORY OF AIR FORCE PARTICIPATION IN THE BIOLOGICAL WARFARE PROGRAM 1951-1954

Historical Division
Office of Information Services
Air Materiel Command

Historical Study no 313

Wright-Patterson Air Force Base
January 1957

Declassified by
Auth C/S USAF
28 June 78
W Donnelly
HQ USAF/SAIB

SECRET

HISTORY OF
AIR FORCE PARTICIPATION IN THE
BIOLOGICAL WARFARE PROGRAM
1951-1954
(Unclassified

64EW-21061

CLASSIFICATION CANCELLED SECRET
(OR DOWNGRADED TO)
1st Ind, Hq USAF, (AFDRD-S) 17 Jul 64 (Uncl)
BY AUTHORITY OF [illegible] DATED [illegible] WRITTEN AUTHORITY
BY Henry M. Hey 28 Jul 64
(NAME & GRADE OF INDIVIDUAL MAKING CHANGE) (DATE)
HENRY M. HEY
2nd Lt, USAF
Top Secret
Control Officer

EXCLUDED FROM GENERAL
DECLASSIFICATION SCHEDULE
(DOD 5200.1-R, para 4-301a)

64EW-21061
SECRET
HISTORICAL STUDY NO. 313
USSR # 42-6
AFSHC TSC # 64-4
AFDRD Control No. 10-59

[redacted]

HISTORY OF AIR FORCE PARTICIPATION IN THE BIOLOGICAL WARFARE PROGRAM 1951-1954

(Unclassified)

Cancelled

EXCLUDED FROM GENERAL DECLASSIFICATION SCHEDULE (DOD 5200.1-R, para 4-501a)

CLASSIFICATION CANCELLED [redacted] (OR CHANGED TO ____)
Uncl 1st Ind HqUSAF(AFSDC-S)17Jul64
BY AUTHORITY OF (INDIVIDUAL OR WRITTEN AUTHORITY)
BY Henry M. Ivey 28Jul64
(NAME & GRADE OF INDIVIDUAL MAKING CHANGE) (DATE)
HENRY M. IVEY
2nd Lt, USAF
Top Secret
Control Officer

by Auth C/S 08 26 Jun W Dowe

This document is classified [redacted] because the major portion of the information contained herein was drawn from source documents bearing that classification. This history contains information on policy, plans, and programs relating to the USAF Biological Warfare Program, and technical data on specific agents and means of delivering them. It has not been possible to identify specific TS paragraphs because most of the source documents were not so marked.

Extracts will not be made without prior approval of the originator (MCKH).

SPECIAL HANDLING REQUIRED. NOT RELEASABLE TO FOREIGN NATIONALS. The information contained in this document will not be disclosed to foreign nationals or their representatives.

Prepared under provisions of AF Regulation No. 210-3 as a part of the USAF Historical Program.

This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18 U.S.C., Sections 793 and 794. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

64 [redacted] 06

EXCLUDED FROM GENERAL DECLASSIFICATION SCHEDULE (DOD 5200.1-R, para 4-501a

THIS DOCUMENT
COPY

[redacted]

HISTORY OF AIR FORCE PARTICIPATION IN THE BIOLOGICAL WARFARE PROGRAM 1951-1954 (Unclassified)

By

DOROTHY L. MILLER, A.B.
Historian

Monograph Prepared By
Historical Division
Office of Information Services
Air Materiel Command
Wright-Patterson Air Force Base
January 1957

Approved by:

Wilbur E. Clemmer
WILBUR E. CLEMMER, M.A.
Supervising Historian

Paul M. Davis
PAUL M. DAVIS, Ph.D.
Chief, Historical Division

Julian B. Cross
JULIAN B. CROSS, Colonel, USAF
Chief, Information Services

[redacted]

CONTENTS

[redacted]

PREFACE

This study is a supplement to "The History of Air Force Participation in Biological Warfare," completed by the Air Materiel Command Historical Office in September 1952. It examines the progress made subsequent to receipt of the Stevenson Committee Report of 30 June 1950, and is based on records available at USAF, ARDC, AMC, and WADC headquarters, supplemented by numerous personal interviews. However, the history makes no claim to being complete in all respects. Time limitations did not permit examination of all pertinent files; and since research was restricted to Air Force agencies, it presents essentially the Air Force point of view.

Even in this restricted area of research, it was not always possible to arrive at firm conclusions. The program, because of its complexity, did not permit wide generalization; not always could it be summed up in simple black or white terms. Moreover, there were wide differences of opinion. Some views reflected reasoned criticism of past errors. Others were more personal and partisan in their implications

and had their origin in judgments that were somewhat prejudiced. It was inevitable, therefore, that anything more than a surface analysis led into highly controversial areas. And by the same token it was to be expected that some conclusions represent a compromise of views.

Notwithstanding, on one point there was general accord; the substantial funds expended on biological warfare munitions had not brought commensurate returns. There had been no dramatic fruition of the bright hopes entertained for the biological warfare program in 1951. Examined at close range, the initial planning seems to have met with a tremendous lack of success--there was a definite gap between planning and performance. But in a longer perspective it seems clear that much was accomplished. In less than five years the program went from a small beginning to an unduly expanded effort and thence to the stabilized position which it needed so badly. Meanwhile, the military services had developed a capability in biological warfare, however limited; and they had sparked a consciousness of the need for developing new weapon systems to fit the pattern of a future war. Even if they learned what not to do, this was important.

If the Air Force had its "druthers" it might have acted differently. But in the last analysis, all policies must be considered in the light of the circumstances existing at the time. The Stevenson Committee had urged a strong biological warfare program. The Joint Chiefs of Staff had placed this program in a top priority category. All subsequent guidance indicated that considerable urgency existed to attain an operational readiness as soon as possible. This was an enormous responsibility, particularly in view of the fact that the work was comparatively new to the military services. Decisions often had to be made before all the facts were in and before future trends could be judged. Therefore, any policies formulated in that trying period command a respectful hearing; and any opinion as to the motives underlying those policies can be only personal opinions--nothing more.

There is, therefore, no need to defend the biological warfare program against the sterile defeatism of disenchanted perfectionists. Nor is there any wish to sit in judgment on the program's leadership. Like most reports by outside groups, this study reflects the writer's limited knowledge

and experience and is weakened further by the writer's personal philosophy. Rather, the attempt is made here to discuss, in a comprehensive and objective way, the action taken during the period being reviewed and to present some of the background and thinking that led to the decisions.

I. INTRODUCTION

Biological warfare is defined as the military utilization of bacteria, viruses, rickettsiae, fungi, toxins, and plant growth regulators to produce a lethal or incapacitating disease in man and animals or to destroy or injure crops. The term also includes defense aspects.[1]

For centuries the possible use of biological agents in warfare had intrigued the imagination of military planners. However, it was not until the 1940's that the United States initiated the development of disease producing organisms for possible military application. The need was plain, since intelligence sources had cited German and Japanese interest in this type of research. After World War II this field of endeavor took on added importance. By that time events had thoroughly gutted the concept of the forty-eight states as a snug fortress, with oceans for walls. The United States was faced with potential enemies having numerically superior manpower. Obviously its air force needed additional weapons in its arsenal, and the biological warfare weapon appeared to be a promising candidate.

The initial emphasis on a biological warfare program resulted from the major recommendations of the Stevenson Committee* submitted on 30 June 1950. With two exceptions, Secretary of Defense George C. Marshall approved those recommendations on 20 October and directed their implementation. In that same month General Nathan F. Twining, Vice Chief of Staff, outlined the air staff responsibilities for preparing the United States Air Force to use biological agents, if required. On 21 February of the following year the Joint Chiefs of Staff placed the biological warfare program in strategic category I and charged the Air Force with developing a world-wide combat and defensive capability. And on 20 June 1951 the Vice Chief of Staff made the Assistant Deputy Chief of Staff, Operations, responsible for carrying out the Joint Chiefs of Staff directive. That office directed its Assistant for Atomic Energy to monitor a USAF biological warfare program and to establish within its organizational framework a biological warfare--chemical

---

* Mr. Earl P. Stevenson was the chairman of the ad hoc committee invited by the Secretary of Defense to review the BW-CW program.

warfare division and also to set up the necessary supporting field agencies. All subsequent top-level guidance said, in substance, to get on with the job of getting a capability at the earliest possible time. The work proceeded on a high priority basis and was stimulated further by the onset of the Korean War and the uneasy peace which followed.

Between October 1950 and December 1951 the military services expanded their research and development program, carried out procurement projects, planned production facilities, and to some extent engaged in construction of such facilities. A few munition prototypes were undergoing tests. Studies had been initiated preliminary to developing doctrine and plans. But there were recognized deficiencies in the program. The services lacked reliable test data. The development of doctrine, operational plans, and logistic equipment and procedures had failed to keep pace with munition development. As a result, the USAF was not prepared in biological warfare, nor was the planning adequate to insure that preparedness in the near future. Much remained to be done to satisfy military requirements to get the capability desired.

On 15 January 1952 General Twining established a time phased program for attaining an early capability and set forth the respective responsibilities of the Air Force commands.* Although amended in July 1952 to establish more realistic goals,[4] the so-called Twining directive was to become one of the most controversial elements of the entire biological warfare program. Notwithstanding, it remained the major piece of guidance until its rescission in the latter part of 1953. Additional guidance included the USAF operating program for special weapons published in March 1952, which assigned a specific capability to Air Force units. This document represented the first indication of an actual Air Force capability in biological warfare. Another major piece of guidance was the "USAF Biological Warfare--Chemical Warfare Objectives Program" published in the latter part of 1953.[5] This document consolidated Air Staff objectives.

. . . By 1953 the Air Force, working on a crash basis with the Army Chemical Corps, had achieved a limited capability

---

* General Twining did not change the assignment of responsibilities as set forth in the October 1950 memorandum. The project initiated by his directive was designated "Project Respondent" (Confidential).

in the use of anti-personnel and anti-crop biological agents. Only one anti-personnel munition had been standardized. This was the M33, filled with Brucella suis (standardized by the Chemical Corps as [redacted]). The anti-crop capability was represented by the M115 (formerly the E73) filled with wheat and rye rust [redacted]. In addition, the Air Force had developed an anti-crop spray system (the MC-1) for use in disseminating chemical growth inhibitors. These munitions were stockpiled and ready for operational use if directed by higher authority.

These achievements were commendable, but they fell far short of expectations. As a result, the Air Force found itself saddled with procurement programs for munitions of questionable military value. For example, the M33 munition had critical deficiencies. Area coverage was small. Its logistic and operational limitations were many and difficult to remove. Although its operational use generated only moderate personnel and specialized training requirements, the need for equipment exceeded the bounds of reason. Particularly serious was the fact that the Air Force had been unable to come up with lucrative targets for biological

54 EW/

munitions. And little was known of the psychological and economic effect the use of such weapons would have upon an enemy people.

The ambitious efforts launched by the Twining directive had failed to produce satisfactory results. Research and development had failed to support planning estimates, and the near future held out small hope for substantial improvement. Obviously, the situation called for a more critical look at the program and a redefinition of policy and objectives.

In October 1953 the Assistant Vice Chief of Staff rescinded the Twining directive, and on 5 March 1954 the Secretary of Defense gave official status to a re-oriented biological warfare program which was to provide the much needed change in direction. The Air Force committed itself to the policy of delaying procurement of a biological munition until reasonably sure of its effectiveness. Emphasis was to be on a long range research and development program which would result in superior weapons--not merely incremental improvements to existing munitions. That is, instead of continuing to polish "gadgets" that showed little promise, the services were to get munitions

that would be worthy of the money and time expended in their development.[6]

The redirected program placed the emphasis upon the development of a lethal, rather than an incapacitating, weapon. The wisdom of this decision did not go unchallenged. In the nuclear weapon the Air Force already had a devastating lethal weapon, and many favored exploiting the unique possibilities offered by the biological munition as an incapacitating weapon. But there was general agreement that the Air Force could not afford to continue on a course that so far had led to doubtful end items. Everyone considered the realigned program a more realistic approach to proving, or disproving, the military worth of a biological weapon system.

By the end of 1954 the military services had completed the major part of the development and testing of the E61 biological bomb filled with Bacillus anthracis, together with the required logistic support. The superiority of this lethal anti-personnel munition-agent combination over the M33 was by no means a foregone conclusion. However, its development was highly significant to the over-all biological warfare program because the work was pursued with an objectivity of purpose that was almost entirely lacking in

the M33 project. Attention was being given to logistic and training considerations concurrently with development and testing. As a result, in the end item the Air Force would have a weapon that conformed more nearly to the Air Force concept of a weapon system. Moreover, this project engendered a spirit of partnership between the developing and the using military services, thus going a long way toward solving previous difficult relationships between the Army Chemical Corps and the United States Air Force.

Nevertheless, the future of the biological warfare program lay very much in doubt. Decisions in the past had been based largely on assumptions, not on valid test data. And it was dangerous to pursue any course of action without continually re-examining and re-evaluating the potential of biological warfare munitions. Therefore, the year 1955 was to be a date of major importance in the over-all program. Before its close the Joint Chiefs of Staff were to have the results of a survey to be made by the Weapons Systems Evaluation Group* and were then

* The Weapons Systems Evaluation Group was set up by Secretary of Defense James V. Forrestal at the time of the B-36-supercarrier controversy. Originally placed under the Joint Chiefs of Staff, it was later placed under the Assistant Defense Secretary (Research and Development).

to reassign the biological warfare program to its appropriate place in military planning.

Proponents of biological munitions did not ask for special consideration; they asked only that the potential of such munitions not be judged by previous inferior results. Many areas remained to be explored. For example, biological warfare held tremendous psychological implications, which so far had received only word play. They considered it a fallacy to regard the biological weapon as a competitive weapon. In their opinion, to judge the worth of a biological munition by comparing it to the nuclear weapon was like judging sheep and goats in the same ring at a fair. Each had its own special capabilities and limitations. They felt that under certain circumstances, biological munitions might surpass all other weapon types in effectiveness. In the final analysis, however, only the progress made in developing efficient munition-agent combinations, together with their supporting logistics systems, could determine the stature the biological warfare program would attain in future Air Force planning.

To summarize, the original planning had failed to produce truly effective munitions. Management had been

a critical area, but the most formidable barrier to the successful military application of the biological warfare potential had proved to be the serious gaps in technical knowledge. The reoriented program, based upon more conservative policies, was designed to remove that barrier. In developing the [redacted] munition, the services had corrected many of their earlier mistakes. And it was hoped that the evaluation of this munition by the Weapons Systems Evaluation Group would be favorable to the over-all biological warfare program.[7]

[redacted] SECRET

II. M33 BIOLOGICAL CLUSTER BOMB

The devotion of an entire chapter to the M33 biological bomb in no way attests to the importance this munition occupied in war plans. The M33 was not efficient and everybody knew it. But it was the only standardized anti-personnel biological weapon, and it had served a useful purpose. In a sense it had served as a valuable training vehicle.

Description

The M33 consisted of 103 of the M114 four-pound biological bombs contained in the M26 cluster adapter. The munition used the nose ejection principle to free component bombs from the cluster. The component bombs in turn used an explosive charge to break the munitions container and to spread the agent fill over the target area. The M114 could disseminate concentrated Brucella suis and Brucella melitensis.

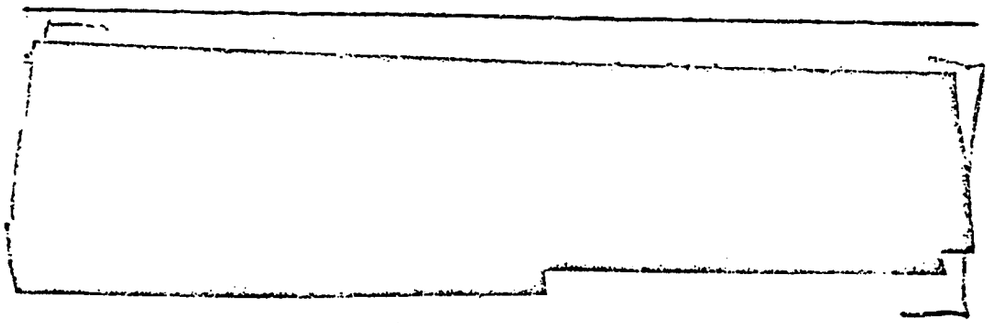
Brucella suis (undulant fever) was the most infectious species of Brucella and had been standardized as [redacted]. The agent was disseminated through an aerosol and had to be taken individually into the respiratory system. The

64

[redacted]

usual symptoms were fever, malaise, weakness, aches and pains, anorexia, and night sweats, sometimes accompanied by mental depression. Since these symptoms were characteristic of other diseases, undulant fever caused by a biological warfare attack would be difficult to diagnose. Adequate therapy did not exist, and it was difficult to prevent disease by immunization procedures.[1]

The M33 was primarily a strategic weapon for use at high altitude. It was designed as an "area weapon"; that is, it did not pinpoint targets. This 500-pound munition fulfilled USAF requirements for a biological weapon to incapacitate enemy personnel in the event of war. However, it was essentially an interim munition and was to be replaced by the E133 in order to meet USAF requirements for the 750-pound new series cluster.[2]



64EW-2-38

Deficiencies

The M33 was standardized in 1951. Subsequently the munition was stockpiled, operational plans were written, logistic equipment was developed, personnel were trained, and techniques were developed and incorporated in procedural documents. The Air Force had a continuing emergency capability with this munition, but it well knew that the M33 was no match for nuclear weapons. Because of its weight the M114 had to be carried in small numbers and so the area coverage was small. The agent was disseminated from the bomb by the explosion of a central burster, and only a small percentage of bacteria carried in the bomb was distributed in the viable aerosol and in the particle size (1-5 microns) which was best for infection via the lungs. This meant that a lot of munitions were required to achieve effective coverage. In addition, the M33 was not compatible with the aerodynamic shapes and speeds of new type aircraft. Original USAF guidance had specified internal carriage in bombardment type aircraft. Later it was expanded to specify delivery by fighter-bomber type aircraft also, but this capability would not exist until external carriage was possible. What

64 FB21061

[redacted]

.dded up to was that the Chemical Corps had developed
nition suitable for carriage by World War II type air-
ft, and by the time the M33 was ready for possible
erational use, such aircraft were obsolete and were being
based out of the Air Force inventory.

Logistic support of the munition was a nightmare.
Since the potency of the agent fill was reduced by temperature
extremes, the using service had to have specialized equip-
ment and handling procedures for shipping and storing the
munition. Moreover, the design of the M33 had been gov-
erned by a centralized control concept. Empty bombs were
to be stored at the production plant and, when needed, were
to be filled and airlifted from the plant into the combat zone.
This concept made heavy demands upon aircraft, increased
transportation difficulties, invited sabotage, and limited
operations. Until biological munitions could be designed
to permit decentralization of control, large scale operations
could not be conducted from overseas areas.

Development and Procurement

Work on this anti-personnel munition began in 1942
but was discontinued at the end of World War II and not re-
established until 1947 when the USAF indicated formal

61

requirements for a biological anti-personnel munition. At that time the improved prototype bomb was designated the E48. Modifications were made, and in 1951 the E48R2 model was standardized as the M114 biological bomb. This bomb was the component bomb for the biological cluster which the Chemical Corps standardized as the M33. Standardization action was taken at the request of Headquarters USAF. It was approved on 11 January 1951 by the Chemical Corps Technical Committee and subsequently approved by USAF headquarters. The Air Force waived service tests prior to standardization.[5]

The selection of [redacted] agent fill proved to be unfortunate. [redacted] was a delicate vegetative organism, and the M33 had been designed for anthrax, which was a rugged spore forming organism. [redacted] had been standardized in 1949 before many logistics problems had been worked out. Standardization action had brought research on this agent-fill virtually to an end, leaving unsolved many technical problems relating to logistics.[6]

The early standardization of the [redacted] munition-agent combination had serious consequences. It was not until

later that the military services recognized the necessity for completing operational suitability testing prior to taking standardization action. Perhaps the Air Force should have recognized the implications, but Air Force people were essentially operators, not scientists, and so may have been justified in leaving it up to the more experienced judgment of the Chemical Corps to satisfy the criteria for standardization.[7] On the other hand, the Chemical Corps was under pressure. In response to the Stevenson Committee recommendations, the USAF wanted to stockpile biological munitions, and, upon the strong recommendation of the Chief Chemical Officer, had in October 1950 initiated procurement action for 5,000 [redacted] clusters (later standardized as the [redacted])[8] Standardization did not mean that the Air Force was completely satisfied with this munition. Nor did it indicate necessarily that the developing agency acted arbitrarily, without concerning itself with whether or not the munition was acceptable to the service for which it was developed. The USAF stated urgent requirements for a biological warfare munition, and the [redacted]

[redacted] was simply the best available at the time. It is sometimes necessary to have a capability to respond to possible enemy action without waiting for the most desirable research objective.

On 20 August 1952 the USAF started action to buy 18,900 additional [redacted] clusters.[9] This completed procurement action on this anti-personnel biological munition. By that time, 23,900 clusters had been funded for by issue of military inter-departmental purchase requests to the Chemical Corps and were definite obligated funds so far as the USAF was concerned.

Testing

In the summer of 1950, limited field trials were made at the Dugway Proving Ground using the [redacted] cluster and M114 bombs filled with Brucella and simulants. They were air dropped and fired singly, statically, and in groups. During calendar year 1951, [redacted] clusters were dropped from B-29 type aircraft at Dugway. Two clusters were

[redacted]

filled with [redacted] and one was filled with concentrated Brucella suis. It was estimated that 8 to 16 clusters would be required to provide 18 to 25 per cent infectivity over a one-square mile area.[10] These tests were satisfactory as far as they went. They indicated that the biological weapon had to be reckoned with as a potentially effective munition. However, it was evident that large scale field tests would have to be run before the Air Force could determine the operational feasibility of this agent-munition combination. At a conference on 13 March 1952, attended by representatives of the USAF and Army Chemical Corps, it was decided to conduct additional testing of the [redacted] cluster using clusters filled with live agent in mass drops.

Final operational suitability testing of the [redacted] was performed by the Air Proving Ground and began on 2 June 1952. The test was a joint effort of the USAF and Chemical Corps. All phases were monitored and evaluated by ARDC technical consultants.* The logistic phase was

* These consultants were participants in the [redacted]). Their work in connection with [redacted] testing operation was nicknamed [redacted]

accomplished at Eglin Air Force Base. Actual bombing was performed at Dugway Proving Ground. The objectives were (1) to determine the user suitability of [redacted] agent-filled M33 clusters when released from medium bombers; (2) to determine the necessary protective measures for handling and storing; and (3) to provide operational experience from which the Air Force could develop tactics and techniques and could evaluate the organizational and logistical requirements and the psychological implications involved.

The test consisted of five trials. Camp Detrick (the Chemical Corps research and pilot plant facility) filled the bomblets with [redacted] then sent them to the Edgewood Arsenal for clustering. The arsenal furnished the Air Proving Ground with 10 M33 clusters filled with Brucella suis, plus one control cluster in an unarmed condition which was filled with representative samplings of the production lots of the agent. The Air Proving Ground Command transported each shipment by B-50 aircraft to Eglin Air Force Base, flying at the proper altitude to maintain the viability of the agent fill. At Eglin the munitions were unloaded and placed in a refrigerator van. Temperature recordings were taken

61

at least once every hour throughout the entire storage period. Samples of the agent were withdrawn from the control cluster in order to get the viability count of the agent after arrival of the munitions at Eglin. A second sampling was taken just prior to each strike mission.

B-50 aircraft flew the munitions from Eglin to Dugway. After each mission the aircraft landed at Dugway (or at Hill Air Force Base) and turned over to the Chemical Corps the representative samples of the control cluster for further laboratory processing. To insure safety, technical escort was flown in C-124 aircraft. Upon completion of each bombing mission, test personnel and air and weather crews were questioned and a transcript made of their observations.

The target area was located on level terrain 13 miles from the nearest inhabited dwelling. The 11,000 guinea pigs used as test animals were placed in trenches and in the prefabricated houses constructed especially for the purpose. The animals were boxed, with only their heads exposed. Two hours after bombing they were taken to the animal storage area in the biological laboratory. After a 30-day waiting period for incubation, autopsies and laboratory analyses were made.

On 19 March 1953 the Air Proving Ground Command issued its final report on the user suitability tests run on the M33 munition. The report covered force requirements, munition effectiveness,* and logistic support requirements. In brief, it concluded that the M33 cluster provided an additional item in the USAF arsenal of weapons since it could infect hostile troops and civilians with a debilitating illness. However, the report pointed out that the M33 would not be suitable operationally until certain logistic and operational limitations had been overcome. Also, personnel would have to have specialized training in handling the munition.

This report made a worthwhile contribution to the M33 project. It made suggestions for improvement in design and in field testing. But the test data were too limited to give much weight to the conclusions reached. Also, the 1952 tests, as did the tests run in 1951, showed a lack of coor-

* The report stated that the M33 bomb cluster with Brucella suis compared with the atomic bomb would produce only 1/3 to 1/2 as many casualties in an attack on a typical target city, but would require 7 times as many bombers. It stated that the average loss of labor force during the first year after an attack would be 44 per cent for the atomic bomb, but only 7 per cent for a biological munition.

coordination in the planning phases, leading to delays. It was evident that more thought would have to be given to organization and management of future testing programs.

Production

Quantity production of biological agents did not impose insuperable difficulties. The essential raw materials were available on the open market, and equipment and techniques were similar to those used in production of antibiotics. The main problem was in safeguarding the workers. Inter-tank contamination had to be reduced to the minimum, and any leakage or explosion had to be localized as much as possible.

Biological agents were being produced at the pilot plant facility at Camp Detrick and at the Vigo plant, which was built during World War II at Terre Haute, Indiana, and later leased to industry. However, the amount being turned out was not sufficient for needs in the event of war. Since agents died off rapidly they could not be stockpiled. Therefore, production facilities had to be available when needed, and this was the responsibility of the Chemical Corps. The Air Force merely submitted an estimate of its requirements in terms of complete items.

The Chemical Corps' first production plant for vegetative type bacterial agents (not spores and virus types) was the X-201 plant* constructed at Pine Bluff, Arkansas. Authority to begin construction was a memorandum dated 31 October 1950 from Secretary of Defense Marshall to Secretary of the Army Pace. But prior to that time, process design studies for the plant had been carried on by the Blaw-Knox Construction Company, as authorized by a Chemical Corps contract issued 23 May 1950. This study contract was converted to a letter contract on 6 October 1950 by the Chief of Engineers, with the approval of the Assistant Chief of Staff, G-4. The letter contract permitted the company to proceed with site investigation and with the study of architectural and structural features not included in the first contract. On 18 December of that year the letter contract was converted to a formal contract and full scale engineering effort started at once.

At first the construction company considered underground as well as surface construction, but decided in

---

* Redesignated Production Development Laboratories in March 1954.

favor of an above-ground plant to be located at Pine Bluff. As construction progressed, the scope of the project changed because of requirements for additional equipment, personnel, maintenance, and floor space. The final cost, including allowances and fees, was about $64,000,000. All work was essentially completed by 1 December 1953. The facility was turned over to the Chemical Corps on 13 November 1953, and it was ready for operation in mid-June of the following year. The results of the hot run test completed in December indicated that the plant would operate well beyond design capacity and that safety precautions were adequate.[12]

Thereafter, quantities [redacted] were always on hand at the arsenal. The agent was held in tanks for from 14 to 21 days. If none was required it was pasteurized and disposed of. Prior to disposal new batches were made, approved, and placed in storage. Weekly inventory records were maintained. Enough agent fill was being maintained to permit filling 360 bombs in 24 hours after 72-hour notice and to continue filling at the rate of 2,000 per month. Stockpiled items could not be increased except to replace quantities that had deteriorated

or had been released for testing purposes upon the express
- 13 -
authorization of Headquarters USAF.

As stated, the X-201 plant was built at a final cost of $84,000,000. The arsenal had several thousand employees. It was preparing biological agents which might never be used in war operations. Moreover, the plant was operating at only about 10 per cent of its capacity. It was inevitable, therefore, that its construction could not escape criticism. But it must be noted that the decision to create the big establishment was made in the interests of strengthening the nation's preparedness. Operational plans called for maintaining an adequate quantity of fill on hand at all times. Since clustered munitions would have to be filled and loaded on short notice, the Chemical Corps had no alternative but to maintain the plant on a ready standby basis.

Strategic and Operational Concept

In 1951 the Air Materiel Command asked for data on tactical and strategic planning, since such plans would

---

* Eventually USAF headquarters authorized the AMC to release items without such authorization, but AMC was to notify headquarters in the event of requests for unusual quantities.

influence the design of logistical supporting organizations and procedures. Guidance subsequently furnished by the Joint Chiefs of Staff was based on the assumption that the national policy governing the operational use of chemical agents would be applicable also to the operational use of biological agents. This policy specified that such agents could be used operationally only to retaliate against an aggressor. Stocks were to be maintained in the Zone of the Interior and could be released only by direction of Headquarters USAF, following authority issued by the President of the United States.* Biological munitions were to be used simultaneously with other type bombing operations, and attacks were to be directed primarily against strategic targets.[15]

The concept that the biological weapon was primarily a strategic weapon was generally accepted because most biological agents were slow to act and their use was impractical in close contact fighting or in situations of rapidly changing positions. Also, their use in tactical

---

* This restriction set the biological weapon in a separate category from the so-called conventional weapons.

[redacted]

operations entailed difficult logistic problems. However, the biological weapon did have some potential for tactical operations, particularly if a quick acting lethal type agent were used. In any case, an attack in a tactical situation would have to be timed well in advance of assault type operations so that the agents would be most effective just prior to or during the assault and so that the using forces could protect their own troops.[16]

To plan for the logistic support of a biological weapon, the AMC had to have an approved operational concept. But the Air Force ran into a snag on this point. The M33, for example, had been standardized before a firm logistic concept had been formulated. As a result, the AMC could not recommend any one system of logistic support. The best it could do was to present several possible variations of a basic system from which the USAF could determine the one most compatible with its current planning. The lack of a firm operational concept also handicapped the ARDC in providing the necessary support equipment.[17]

As stated previously, original USAF guidance called for a central control type of operation. Empty bombs were to be stored in the Zone of the Interior, filled when needed,

and airlifted into the combat area. That guidance had determined the ultimate design of the M33 cluster and had influenced the Chemical Corps in its standardization action. But this guidance had been based on the hypothesis that only a few munitions would be required per target, and by 1951 that concept was no longer valid. It was then apparent that airlift requirements would be excessive. Since 17,000 M33's would be needed to cover 30 target areas consisting of 30 square miles each, 1,221 C-54 aircraft equivalents would be required. It was evident that some means of assembling components in strategic areas was necessary.

Therefore, the Air Force proposed that agents be developed that could be packed in separate disposable containers, sent overseas, and stored. Empty bombs could be assembled overseas as required. This would simplify and reduce transportation needs, allow for constant resupply of viable agents, and reduce the chance of the Air Force being caught without biological munitions at the onset of war. This concept had been presented by the ARDC in 1951. Four years later the command was still awaiting a final USAF headquarters determination. As a result, the ARDC had been placed in the difficult

position of having to outguess the operational and logistic people in developing equipment for them.[18]

The overseas assembly of biological munitions was not a simple matter. First of all, agents would have to be developed that had a longer shelf life than did [redacted] for example; otherwise, the Chemical Corps would probably prefer to ship as needed. Also, the consent of foreign governments to stockpile munitions overseas would have to be obtained.

[redacted]

* This document, drawn up by the League of Nations at Geneva, Switzerland, in September 1924, embodied a plan to insure peace and to facilitate the limitation of armaments. The United States did not ratify the document.

[redacted]

By this time, completion was well along of another munition-agent combination (the [redacted] filled with Bacillus anthracis) that would permit overseas filling.

Operational Plans

The Twining directive made the Air Force responsible for developing operational plans and their supporting logistics for the biological warfare munition. Headquarters USAF delegated this responsibility to the Air Materiel Command. That command then prepared an operational plan for the use of the M33, to be effective 1 July 1953. Designated AMC Operational Plan 13-53, it was to undergo revision each succeeding year.

Operational Plan 13-53 related to the movement of M33 clusters filled with Brucella sui[redacted] to an overseas theater. The plan called for surface movement concurrent with air movement. It was to work this way.

If the President of the United States authorized the combat use of biological weapons (and he would do so only in retaliation) USAF headquarters would notify AMC to initiate action. The AMC then would notify the Chemical Corps to deliver complete rounds to the aerial port designated. The Chemical Corps would fill the munition on a crash basis at its production plant, load 12 temperature control trailers with 30 M33 clusters each, and move them over the highway to the aerial port. Each shipment would be accompanied by Chemical Corps technicians, qualified to perform decontamination in the event of leakage of agent from the containers. At the aerial port the trailers would be loaded on C-124 aircraft furnished by the Military Air Transport Service, complete with crews. Military escort would go aboard. At the overseas destination (USAFE areas only) the cargo would be turned over to the air depot wing designated by the Strategic Air Command to receive it. The depot wing would then deliver the munitions to the combat unit and be responsible up to the time of actual loading on strike aircraft. If additional strike missions were planned, the trailers would be reloaded on the aircraft and flown back

to the Zone of the Interior. Otherwise, the airplanes would be released for other use and the trailers would be returned by Marinex within 48 hours after being emptied. When the initial airlift requirement had been met, the filling plant in the Zone of the Interior was to start shipment by surface carrier in order to sustain the overseas theater requirements of 2,000 munitions a month. Therefore, transport ships, as well as aircraft, would have to be equipped to accommodate temperature control trailers which would protect the viability of the agent fill.

The Chemical Corps was responsible for storing and issuing biological munitions and agents within the continental limits of the United States. The Air Force assumed that responsibility at the ports and overseas. Logistic support was to be integrated into the normal ammunition support system, not divorced as was the case with the atomic bomb. Overseas air depots were to requisition, receive, store, maintain, and issue defense equipment as prescribed by

---

* Each military service had custody of its own weapons. Both weapons and the necessary specialized equipment were handled in normal supply channels, and technical training was handled in established training courses in each service.

the area air commander. Resupply of technical handling equipment was to be on a requisitioning basis. The AMC was to arrange for procurement (by the Chemical Corps) of the munitions and for receipt, storage, maintenance, and issue of biological munitions, plus the necessary ancillary equipment (such as the refrigerator van and mobile surveillance laboratory) and the required defense equipment for all USAF units as directed by Headquarters USAF.

In summary, munitions could be released only by authority from the President. No prestocking meant air movement on a demand basis. Also, special types of aircraft were needed. Specially trained personnel and specialized equipment had to be provided. Provisions had to be made for handling munitions in case of accident. The

---

* Support equipment was committed before it was available actually. Delivery of the refrigerated vans did not begin until August, and the mobile surveillance laboratory was still undergoing fabrication. However, the operational plan could have been used if necessary. Normally "availability" means that the equipment has been standardized, catalogued, stocknumbered, and given to a prime air materiel area. This support equipment was not available in that sense.

plan involved the use of other major command bases and ports. It required special allocations of airlift, and it called for Chemical Corps personnel to act as escort and as standby emergency decontamination teams.

The revised plan for the year 1954 was essentially the same. The Tactical Air Command was to provide the necessary base support, designate the loading area, arrange for security measures, and provide its people with protective equipment. Alexandria Air Force Base was designated the aerial port of embarkation; Brookley Air Force Base, the alternate port.

20

Under the circumstances, AMC operational planning was satisfactory. However, the planners were not happy. Since stocks were kept in the Zone of the Interior, the AMC had to prepare plans that could be put into effect at any time, and in any theater, as directed by USAF headquarters. (By that time the requirement for an operational capability had been extended to include TAC and FEAF.) As a result some AMC people felt that in trying to prepare for almost every eventuality they were preparing poorly for any one. Actually, at the end of 1954 the European

continent and North America were the only areas where the Air Force could logistically support the M33 munition. The use of plans in other areas, such as the Far East, would be restricted by the limited amount of equipment available.

Moreover, the AMC people monitoring the program had not been permitted personal contact with overseas commanders, and they felt they were merely sitting at AMC headquarters trying to "outguess" the commanders in operational theaters. This sense of frustration was aggravated by their opinion that the biological warfare program had not received the necessary support within the AMC special weapons office. In their opinion, even at top Air Force levels the essential guidance had not always been forthcoming. In that connection, however, it must be recognized that USAF headquarters did not always have all the answers. Biological warfare was a new field. Planning documents could not anticipate all the questions that might arise. Not until some precedent had been established could USAF headquarters come up with certain information necessary for AMC planners to have.

[redacted]

Some dissatisfaction also was expressed with the amount of cooperation AMC had received from operational commanders. Plans had been prepared on a crash basis; they needed refinements. The AMC needed a statement of use concept, but had received only a general statement with respect to how the Strategic Air Command, for example, proposed to use the biological munition. This was not surprising. That command had looked at the M33 and did not like it. One airplane and one atomic bomb could do a tremendous job, but the effective use of the M33 took a lot of aircraft and a lot of bombs. General LeMay had to haul the weapon that would give the biggest return per payload. He could not afford to reduce his atomic capability by carrying an inferior biological weapon.[21]

Nevertheless, the Strategic Air Command could not arbitrarily reject biological munitions. National policy called for a retaliatory capability, and so operational commands had to plan for their possible use. However, the policy did not require them to use such munitions unless they would prove advantageous. That is, their use would be determined by the nature of the selected target, the effects desired, and the effectiveness of a

weapon types available. In no case could commanders use them unless specifically authorized to do so.[22]

Logistic Support

With respect to logistics planning, one major error stands out above all others. This was the failure to realize that logistics planning should coincide with the development and testing of a biological munition. Until May 1953 only five per cent of the effort expended on the biological warfare program had been devoted to logistics. The AMC did not collaborate in testing the M33. Little of the data collected was collected specifically for application to handling, storage, and surveillance procedures. Logistics information was fragmentary, leading to tentative conclusions. As a result, a capability was declared with the M33 before it could be supported logistically. What in the beginning had seemed to be of minor importance--the development of an adequate support system--turned out to be of major importance; for unless a munition can be supported, it can be of small interest to the prospective user. Eventually this basic principle was to receive due recognition. But in the case of the M33, the Air Force

had bought a munition that required excessive logistics equipment and for which logistic procedures and techniques were inadequate.[23]

Transport Equipment

At one time the USAF was studying five possible systems for support of the M33. The two basic systems proposed the use of temperature controlled trailers to transport either filled M33 clusters or the M114 component bombs from the Chemical Corps plant at Pine Bluff to the ports of embarkation. A special purpose vehicle of this nature was needed because transportation from the production site to the target was a most crucial test for a biological munition. As time goes on, the viability of the agent decreases and the munition becomes a biological dud. Therefore, agent life had to be protected against temperature extremes, and handling and storage had to be meticulously controlled. The use of a refrigerated trailer, or van, seemed to be the best solution to this problem.

Early in 1953, Headquarters USAF authorized procurement of a refrigerated van and allocated approximately $640,000 to the project. Although a standard commercial article, the van required certain changes to meet military

specifications. The Wright Air Development Center assisted in its development, and by August 1953 delivery was being made of the 67 refrigerated vans on procurement.[24]

For storage purposes these trailers offered many advantages over the permanent type igloos. They could be moved easily from one theater to another, and they eliminated rehandling in storage and required less equipment. On the other hand, they required more security guards, were more vulnerable to enemy air attacks, and incurred higher operating costs because of the number of units needed. Moreover, the limited number on procurement obviously could not meet total requirements. They would have to be kept shuttling back and forth between the Zone of the Interior and overseas. Even if the AMC wanted to use them for storage (which was not likely) there were not enough for this purpose. Still another major restriction to the use of these trailer bodies as shipping containers was their weight. They weighed 5,800 pounds, and only C-124 aircraft could carry them.

As a result, favorable consideration was given to the concept of having the depots preheat agents prior to delivering clusters to the Strategic Air Command. The

[redacted]

method was technically feasible, and it would eliminate the need for the trailer mounted refrigerators. Preheating the agent would make it possible for any type aircraft, with the possible exception of B-36's, to fly the munition to its destination.[25]

Surveillance Equipment

To make sure that only effective clusters were used in actual operations the agent fill had to be assessed for viability count and freedom from contamination. Therefore, the surveillance (or maintenance) of a biological munition was one of the most vital elements in the logistics system. Notwithstanding, until 1953 only slight attention had been given to this phase of logistics support. Assessment had been handicapped by the lack of suitable sampling devices and sampling techniques. Since specialized hazards were involved in assessing biological agent fills, much of the equipment and many of the techniques used for surveillance of chemical and high explosive munitions were not applicable directly to biological warfare items. In addition, agencies were unwilling (perhaps were unable) to agree in advance on what constituted adequate criteria for assessment.

Two additional semi-trailer type vans of special design were procured and equipped for surveillance purposes.* They were modified to incorporate safety features and suitable equipment for assessing biological agents. Only two trailers were bought for this purpose because at that time only two overseas areas were contemplated for possible biological warfare operations. The laboratories were to be given to the overseas theater depot ammunition squadron when directed by USAF headquarters.

The entire operation (developing and testing of a mobile laboratory trailer for surveillance of the M33 munition filled wit[redacted]n overseas areas) was identified by the nickname [redacted] It was a Headquarters USAF-directed project, requiring a special one-time installation. It was under the supervision and control of the Wright Air Development Center, which designed the layout, installed the equipment, and tested it. The center got the munition from Pine Bluff arsenal, exposed it in a test chamber in an isolated part of Wright-Patterson Air Force Base, and made tests

---

* Nomenclature was "Laboratory, Field Surveillance, Portable, Type MA-1," Contract AF-33(600)24443, Brown Trailers, Inc.

84 EWP

under simulated transport conditions, using quality control techniques and analyses. The results were to provide written laboratory procedures for assessing [redacted] agent in filled munitions and an evaluation of the adequacy of the surveillance laboratory.

Operation [redacted] used two sampling methods. One involved the removal of bomblets from a sample cluster for examination. The other involved the use of a small metal container that would give the same heat transfer characteristics of the cluster. The second system was simpler and required less time and manpower. The AMC considered the first to be logistically impractical. This had been demonstrated by the sampling done at Eglin in a test exercise.* Although the clusters were modified to facilitate bomblet removal, it took 1 1/2 manhours to remove one bomblet from a cluster after the tie-downs were removed. However, Headquarters USAF was opposed to the large scale development of a representative sample container for the M33. The M33 was an interim item, and it seemed inadvisable to increase the

---

* See pages 45-48.

amount of equipment to support it. Air Force headquarters believed that the best solution was to increase the accessibility of the bomblets within the cluster and to take the test sample directly from the bomblet removed from a cluster. Its replacement by a dummy bomblet, it was thought, would not seriously lower the effectiveness of the cluster.

The [redacted] operation was completed in October 1954. Although the laboratories proved satisfactory, no more were to be manufactured because a more efficient assessment method was being developed by the Chemical Corps. This was the dye reduction test method. However, the two [redacted] laboratories would not go begging. The Surgeon General could make use of them in studying the epidemicity of biological agents, and the WADC could use them in support of its field tests. These laboratories were later modified to support the surveillance phase of the E61/N munition development.

26

In October 1954 the Directorate of Supply and Services at USAF headquarters directed the AMC commander to continue to develop an integrated logistic system for the M33 within the limits of the support equipment available.

64

Although this munition did not fulfill USAF long range objec-
27
tives, an adequate logistic system had to be ready.

At that time the following elements constituted the major portion of the logistic support system for the M33 munition. AMC Operational Plan 13-54, dated 5 May 1954 (as amended) had been distributed and the Army said it could support the plan. The production plant could turn out 2,000 M33 clusters a month if required. Hardware for 23,900 clusters was on hand. Technical orders had been distributed or were being revised. These included one which outlined defense and decontamination procedures and included instructions for calculating the amount of preheating required for a planned mission. Another specified individual protective and detection equipment. Another, for assaying [redacted] agent, was being prepared. Since some technical orders had been written originally for support of ground troops, they had to be revised to make them applicable to an air base operation and also to incorporate findings of vulnerability studies. Refrigerated vans, trailers, dollies, slings, and such were available in storage. Loading and maintenance instructions

64

were being distributed. Bombing tables were available on requisition from the Shelby Air Force Depot. On 7 June 1954 the AMC had instructed the prime and zonal depots on how to compute requirements for defense equipment.

The AMC was not too well satisfied with its technical instructions. If its crash procedures had to be put into effect, the command would be in for trouble. But testing information was too meager and too unreliable to permit writing realistic technical instructions. Under the circumstances, the command was doing a fine job.

Test Exercises

To test operational plans and to evaluate support equipment and training techniques, a test exercise was conducted in November 1953. This exercise had been in the talking stage since December 1952, but the publication of AMC

---

* Headquarters USAF established the basis of issue, qualitative requirements, priorities, format and content, and determined the initial publication of bombing tables. ARDC produced the tables and entered them into the Air Force publication distribution system. AMC was responsible for establishing quantitative requirements and for distribution, storage, and maintenance of stock levels. ARDC handled research and development aspects. Interim, provisional, partial, and experimental tables received special handling as determined by USAF headquarters.

Operational Plan 30-53 on 10 April 1953 was the first official action. Certain factors, however, forced a postponement. The Strategic Air Command could not participate; the Military Air Transport Service could not furnish aircraft; and AMC Operational Plan 13-53 (which Operational Plan 30-53 was to parallel) was not yet effective. When that plan became effective, the plan for the test exercise was revised and sent to USAF headquarters for approval. Headquarters approved the plan in principle, and at a conference at the AMC on 20 October 1953 all were in complete agreement on details. The formulation of a final draft of the exercise followed, and on 30 October 1953, USAF headquarters authorized the exercise. The WADC conducted a two-day course of instruction on loading procedures. The exercise was conducted on 17-18 November 1953.

[redacted]

* Participants in the exercise included Army Chemical Corps, AMC, ARDC, APGC, SAC, TAC, and MATS.

Instead, Eglin Air Force Base was utilized as a forward base, representing an overseas tactical Air Force. The M33 clusters were filled with a simulant agent (Serratia Marcescens) at the Pine Bluff Arsenal, loaded into two temperature controlled vans (30 clusters per van) and moved over the highway under Chemical Corps technical escort to Barksdale Air Force Base (Louisiana), the aerial port. There the loaded refrigerated vans were removed from the semitrailer chassis, mounted on loading dollies, loaded into C-124 aircraft, and flown to Eglin Air Force Base. At Eglin, the munitions were off-loaded by Air Proving Ground Command personnel, and sample munitions were reloaded on C-124 airplanes, flown back to Barksdale Air Force Base, and returned by surface movement to Pine Bluff Arsenal for further assessment of the agent fill. The Air Force assumed responsibility for the cargo at the aerial port; the Chemical Corps reassumed responsibility for the return trip to the arsenal.

The results of the test exercise demonstrated conclusively that the USAF had a workable logistic support system for airlifting anti-personnel biological munitions to an

overseas operational base, if directed. As in any normal operation, deficiencies existed. The teletype communication system was too slow. Loading procedures were not efficient. In some cases briefings were inadequate and the proper precautions were not taken; had the agent been a pathogen instead of a simulant, casualties might have been experienced. Also, the reject rate was high. It had been a recurring complaint that specifications (prepared by WADC) were too restrictive, leading to a high reject rate which resulted in excessive consumption of stockpiled components. (Later, WADC was to make some recommendations with respect to relaxing specifications.) Of major seriousness-sampling procedures were unrealistic and laboratory facilities were inadequate. In fact, the only justification for referring to the working area as a "laboratory" was the presence of glassware, bench space, and laboratory personnel. Under these trying circumstances, the workers performed remarkably well. But the exercise pointed to the urgent need for a suitable surveillance laboratory and improved techniques. And the exercise showed clearly that the necessary logistic support was excessive when considering the limited number of munitions carried.

One recommendation coming out of this test exercise [redacted] was that a second practice exercise should be conducted. The proposal contemplated the delivery of the M33 filled with [redacted] agent from the production site to a forward operating Air Force base using surface movement as well as airlift. There were several stumbling blocks to carrying out this plan. The proposed use of B-36 type aircraft did not comply with the programming of medium bombardment type aircraft for such a mission. The USAF had no authority to direct movement of live agent beyond the continental limits of the United States. The movement of the agent through civilian ports might compromise security. And no decision had been made on who was to be responsible for decontamination and disposal action. Also, it seemed inadvisable to have the Strategic Air Command conduct the exercise, since the [redacted] Therefore, it seemed best to have the Air Proving Ground Command

perform the test and to use a simulant agent instead of a hot agent. The AMC revised the plan accordingly.

This practice exercis[redacted] was to have been conducted in October 1954, but it was suspended in September. Responsibilities for decontamination had not yet been determined. No one could predict accurately the results of a possible accident. If the exercise became known to the general public and to potential enemies, the psychological and political impact might have adversely affected the over-all biological warfare program. Moreover, the use of a simulant agent had already been tested successfully, and in the opinion of the Deputy Chief of Staff, Operations, the AMC had not furnished sufficient justification for using live agents.

By that time the Pine Bluff arsenal had completed about 50 per cent of its part in the project. This work did not go down the drain, since the experience gained could be applied to other work. However, an unfortunate aspect was that the monitoring people at AMC headquarters remained in the dark as to the thinking that motivated the cancellation. They wondered if the action indicated a lack of faith in the command's ability to support the exercise.

Actually, USAF headquarters was satisfied with the logistic planning. The door was left open for a second try at some future date under more propitious circumstances. No one quarrelled with the necessity for establishing the military worth of a biological munition. And everyone agreed that such maneuvers were a good way to do it.

30

In summation, the M33 had been standardized and the Air Force had accepted it for operational use. Subsequently, it had undergone operational suitability tests with a fair degree of success. A plant existed for production of the agent fill and for filling the required number of clusters when directed.

Nevertheless, the munition was extremely disappointing to the military user. The agent itself had inherent limitations. Aircraft design had outrun munition design; the M33 was not satisfactory for external carriage by high performance aircraft. The munition required an excessive amount of logistic support. Realistic operational planning was impossible because of insufficient testing data. Munition expenditure rates could not be calculated except for a narrow range of target conditions, and intelligence people had been unable to determine potential target areas. Almost nothing was known of the effects an attack would have upon a nation's economy. Psychological aspects had not been exploited. Moreover, coordination between the developing, logistics, and using agencies left much to be desired. It was evident that the available test data did not justify the emphasis that had been given to procuring biological warfare munitions. As a result, acute disillusionment was experienced by many former enthusiasts, and the prestige of the entire biological warfare program suffered a damaging blow. Everyone familiar with the facts knew that the program was not accomplishing as much as it should. They wanted to know why. What was wrong? And how could it be corrected?

PROJECTS IN TECHNICAL DEVELOPMENTS AREA
Development Funds (Contract Costs)
March 1954

	Prior $M	FY 1954 $M	FY 1955 $M	FY 1956 $M
R&D in BW Munitions & Munitions Distribution	5722	1350	775	1000
BW and CW Spray Tanks	200	125	250	125
Anti-Personnel BW Munitions	2653	2100 (95)*	1614 (472)*	1110
BW Logistics Support Equipment	63 (63)*	31 (31)*	145 (145)*	25 (25)*
Anti-Crop BW Munitions	612	350	264	200
R&D on Guided Missiles BW and CW Warheads & Fuzes	-0-	400 (300)*	200 (200)*	500 (400)*
Airborne Dispersing Equipment for BW and CW Munitions	-0-	-0-	200 (200)*	50 (50)*

* Indicates funds for USAF contracts direct to industry.

III. REORIENTATION OF THE BIOLOGICAL WARFARE PROGRAM

Funds

In accounting for deficiencies in any military program the tendency is first to examine funds for their adequacy. Although no one really knows just how much is enough, there was general agreement that funds had been adequate for the amount of emphasis that had been placed on the biological warfare program. Sometimes Air Force funds were late in coming and the Chemical Corps temporarily had to put up its own money for projects having Air Force implications. But on the whole, the Air Force had given the Chemical Corps more money than it could spend.* As of 1 June 1954, unobligated funds at Camp Detrick amounted

---

* Budgeting for items and support equipment was based upon specific operational requirements developed by the Directorate, Plans; Directorate, Operations; and Directorate, Supply and Services. ARDC and WADC bought research and development items and paid for testing. AMC originated military interdepartmental purchase requests for Chemical Corps munitions, buying items for stockpile and some test items. That command had been charged with submitting the fiscal year 1954 budget estimate for biological munitions, but at that time lacked the necessary planning factors and USAF headquarters did the work.

to $2,003,743 of fiscal year 1954 money and $1,304,348 of fiscal 1955 money. In the case of the M33 the major criticism was that the Air Force had gone into procurement some three years before the munition had gone through user suitability testing. In effect, the service had gambled, and it was lucky to get as much as it did for the money.

Personnel and Training

A major problem in 1951 was the lack of technically qualified officers for air staff positions. To provide a nucleus of qualified officers, the Air Force established the so-called 100-man program. The files of more than 1,000 officers were screened, and 100 officers were selected to receive one year of on-the-job training at Chemical Corps installations. Twenty-six medical officers were scheduled for this training. Subsequently these officers were to be reassigned throughout the Air Force, as requisitioned. These people were "the cream of the crop"; many had masters or doctorate degrees in the biochemistry field.

Originally the training program was to continue for three years; however, it was discontinued after the second

64

year. The results were somewhat disappointing. The program was certainly better than nothing, but its limited scope was a serious deficiency. Had there been an organized effort to insure more extensive training, the results would have been better. As it was, officers learned but a small segment of the over-all biological warfare field. Some knowledge was gained of other projects through attendance at seminars held once a week at the Air Force field office at Camp Detrick; but in general, this program did not produce officers really qualified in biological warfare. Trainees were uncertain as to what assignments they could expect; morale was low. To many, the 100-man program seemed ill conceived--

2

without a clearly defined purpose.

Additional training included crash programs, either at Chemical Corps installations or at USAF headquarters. The Air University offered some training in its special weapons course. Also, for a short time the Air Force participated in a very high-level indoctrination project. A joint Army-Navy-Air Force Orientation Team was organized by the Chemical Corps to brief senior commanders of flag and general officer rank and key staff personnel on

64 [illegible]

the capabilities and limitations and on the operational concepts of biological warfare and chemical warfare weapons systems. This traveling team began its work in September 1952, but the Air Force soon withdrew its membership on the grounds that not enough information was available to make the briefings worthwhile. For example, the film that was produced on the strategic use of biological weapons showed a potential capability based on the 1952 technical estimates that were proved by subsequent tests to be far too optimistic. The Air Force recognized the need for an indoctrination program. At the same time it was unwilling to participate in additional briefings without data of more value and reliability.[3]

To summarize, the on-the-job training provided by the 100-man program had proved inadequate; also the Air Force could not justify membership on the tri-service orientation team. However, training was being advanced in other ways. The Biological Warfare--Chemical Warfare Division at Headquarters USAF provided an excellent source for training officers to assume air staff posts.

"Retaliation Only" Policy

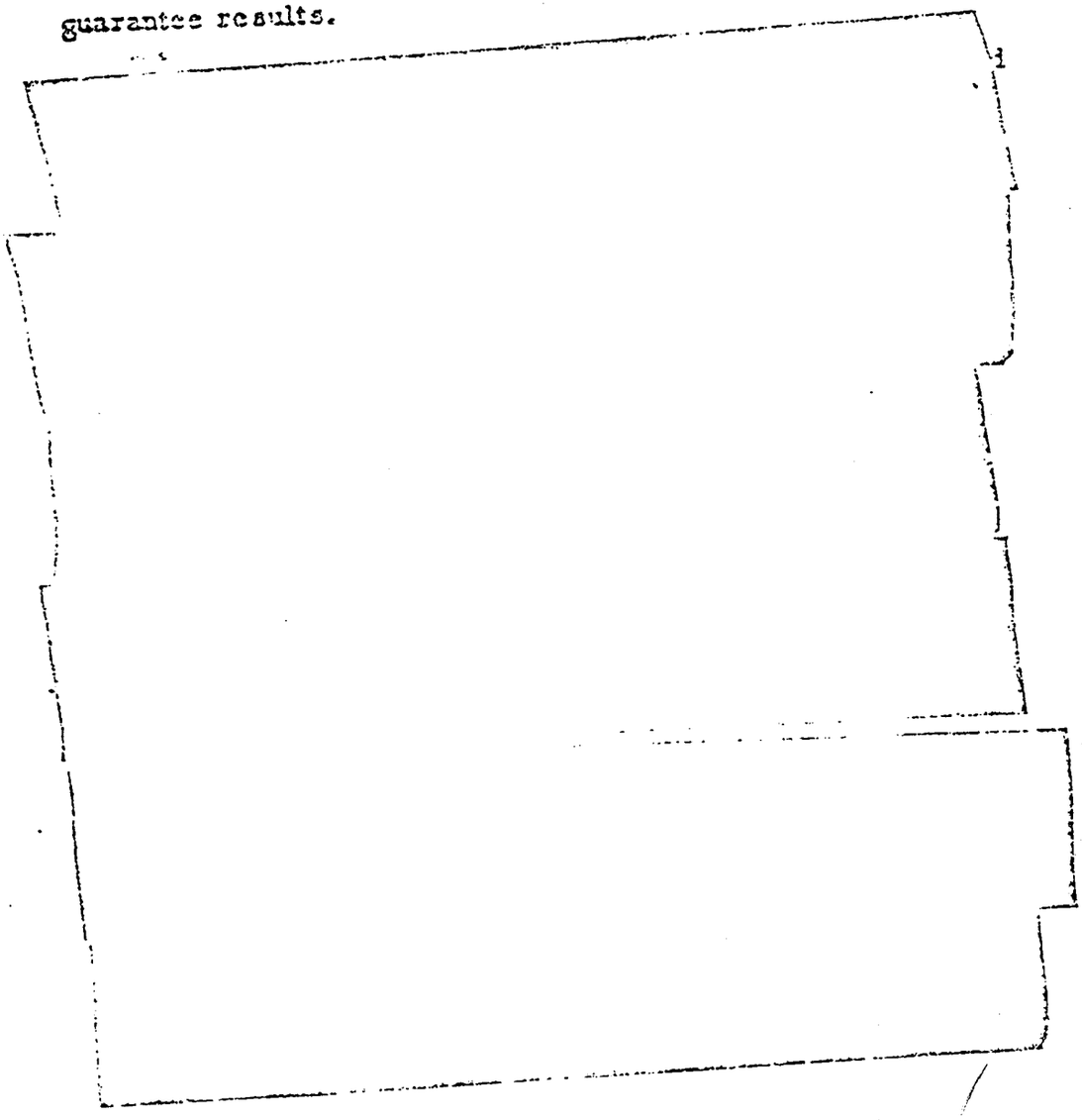
There was no stated national policy with respect to biological warfare. However, biological warfare was

associated so closely with chemical warfare that the policy for both was assumed to be the same. Under this implied policy, the biological weapon could be used only if authorized by the President of the United States, and even then only on a retaliatory basis. This policy did not mean "retaliation always." Such weapons were to be used only if determined to be expedient militarily. It was questionable, therefore, that they would be used even to retaliate in kind if other weapons would do the job better.

It was an argument of long standing whether or not this policy had deterred progress. Some charged it with complicating operational planning and with discouraging competent personnel from entering the program. The Army, for example, stated as late as October 1954 that a major obstacle to progress was the reluctance of the military to invest time and resources in a weapons system that might never be used.

But others did not agree entirely with this viewpoint. They recognized the sense of insecurity which existed, but they attributed it chiefly to the fact that since World War II the biological warfare program had been either a "feast or famine" enterprise. Moreover, they were

convinced that the policy had served a useful purpose. The biological weapon had not been proved a competitive weapon, and were it not for the requirement to have a retaliatory capability, the entire program might have been dropped. As it was, the national policy meant that the Air Force had to have a program, but did not have to guarantee results.[5]



revision at some future date.[6] Subsequently, the policy was to de-emphasize talk about the offensive use of bacteriological agents and even to withhold a positive official endorsement of the retaliatory concept. It seemed advisable to preserve a certain flexibility on this vital matter. Officials recognized the danger of being trapped into a rigid policy commitment.[7]

In 1952 the Biological Warfare--Chemical Warfare Division at USAF headquarters asked that the national policy on toxic chemical warfare be revised. The Joint Chiefs of Staff (urged by General Vandenberg) approved a detailed study on biological warfare, which concluded that a clear statement of national policy was essential and that the biological warfare program should be exempt from the interim retaliatory policy. However, no change in policy was achieved.[8]

In the fall of 1954 the Army requested the Joint Chiefs to remove the retaliatory restriction. It recognized the danger of pursuing such a course, for such action would remove the legal and moral restrictions to the use of such weapons by the Soviets. Also, it might be extremely disadvantageous to the United States, for it would declare the

nation's intention to use the biological weapon when actually it did not have the capability to justify the risk. Nevertheless, the Chemical Corps pointed out that removing this restriction would restore to the United States the initiative in the use of biological weapons--a prerogative which it had surrendered under the existing national policy.

The Air Force and Navy did not concur in the Army recommendation. Although the Air Force had on two occasions favored the change, it then felt that circumstances dictated a reversal in its former position. By that time, officials had developed a better appreciation of the difficulties involved.

As a result of the differences of opinion, the Bronze Team* referred the matter to the Joint Strategic Survey

---

* The Bronze Team was composed of one member each from the Army, Navy, and Air Force. Members of the Bronze Team of the Joint Strategic Plans Group prepared reports and studies for the Joint Chiefs of Staff pertaining to joint and combined education and training; military assistance and training for non-NATO allies; and chemical, biological and radiological warfare and the review of annexes thereon in joint war plans. Members presented oral briefings to individuals at the highest level in the Department of Defense, including the Chairman of the Joint Chiefs of Staff. The Air Force member was Colonel Roy A. Davidson, who served as Chief of Materiel and Services until transferred to the Joint Chiefs of Staff on 1 July 1953.

Committee for consideration. This committee corroborated Air Force-Navy findings and recommended no change. The matter then went to the Secretary of Defense and was to go before the National Security Council for review and decision; thus the matter was still pending. The assumption was that the policy would remain the same. That is, in the event of war, biological munitions might be used only to retaliate against an attacking enemy, and only then upon the express authorization of the Commander-in-Chief of the Armed Forces.[10]

Disapproval of the proposed change in policy constituted the official Air Force position. It did not necessarily reflect the personal opinions held by some Air Force people. Significantly, Secretary of Defense Wilson recognized the implications of this policy in his directive of 5 March 1954. In that document he warned that the "retaliatory only" policy was not to deter the military services in their efforts to achieve a truly effective capability in biological warfare.[11]

Management

It was no secret that the Air Force was dissatisfied with the results of Chemical Corps research in biological warfare. The Secretary of the Air Force, concerned at

the slow progress being made, wondered if management problems were responsible. And on 15 January 1953 Secretary Thomas Finletter asked General J. H. Doolittle to head a civilian committee to examine the potential of the biological warfare program, with particular reference to organization and management aspects. Essentially the objective was to see if the program met Air Force requirements, and if not, what could be done about it. The proposal met with considerable opposition from the Research and Development Board and the Army. General Doolittle was asked to delay action, pending the completion of studies which the Board* and the Army were to make. The proposed Doolittle Committee did not materialize.[12]

Another proposal to improve management had contemplated withdrawing the program from the services and placing it under an agency similar to the organizational structure of the Atomic Energy Commission. The argument was that such action would minimize dominance by a single service,

---

* The study prepared by the Research and Development Board was known as the Whitman Report, or the Cairns Report Mr. Whitman was chairman of the Board, and Dr. [redacted] conducted the study.

eliminate interservice competition, and consolidate objectives and policy. However, the Secretary of Defense removed his original recommendation and it did not appear in the final Joint Chiefs of Staff paper. No one quarrelled with the outcome. Establishing a joint agency at top level did not promise to simplify or improve matters. Moreover, all three services could be expected to resist giving over-all management direction to a joint agency.[13]

Fundamentally, many management problems had their origin in the fact that so many agencies were involved in the program. This indicated the necessity for exercising considerable restraint in the natural desire of each group to advance its own interests. The so-called unification of the services in 1947 had not always produced a singleness of purpose, and the biological warfare program was no exception. Service considerations seemed to have influenced some decisions and evaluations. Still, the friction between the developing and the using agencies undoubtedly was caused in large part by the lack of appreciation of the other's problems. For example, the Air Force complained that the Chemical Corps did not live up to its commitments--that the results did not bear

out the Corps' predictions and that the developing agency was continually unable to meet deadlines. The records support this position. But also to be considered was the possibility that staff groups had placed unreasonable demands upon the Chemical Corps. The changing of military requirements imposed an additional burden on the developing agency. Moreover, biological warfare was a relatively new art and it was difficult to make accurate predictions. It was to be expected that some of the data developed would be too nebulous or too technical to be immediately applicable to Air Force problems. Had more people familiar with the required sciences been assigned to staff positions, the impatience felt with the inability of the technical people to come up with the right answers might have been mitigated to a large extent. 14

Actually, no person connected with the biological warfare program passed through its toils without scars. Nor could anyone disclaim at least a small part of the responsibility for results. As one officer expressed it, "Nobody comes out of the biological warfare program smelling like a rose," since all action was thoroughly

coordinated* and guidance by the Joint Chiefs of Staff represented the thinking of all the services.** Therefore, the position must be accepted that in the beginning all the military services got off on the wrong track. It was not until they gained a better appreciation of their mutual problems that inter-service relationships improved.[15]

Technical Knowledge

It was evident that better direction and a more sympathetic working relationship between the military services would go a long way toward improving the status of the work. However, the Joint Chiefs of Staff concluded that insufficient technical knowledge, not management, was the chief stumbling block to getting satisfactory end items.[16]

The development of biological weapons presented unique technical complexities in the sciences. The developing agency was handicapped by a critical shortage of engineers

---

* The Twining directive was coordinated by 92 persons. Not all were agreed, but the paper did get signed. Unfortunately it was not coordinated with G-4, Army, thus relieving the Chemical Corps of official responsibility.

** USAF thinking was always incorporated in [illegible] Team paper, which was prepared [illegible] Staff. The Bronze Team was [illegible] each from the three

familiar with airborne ordnance equipment. The Air Force was handicapped by its meager technical knowledge and limited experience. All were more or less "playing by ear." To complicate matters further, a munition-agent combination might be convincing to the research scientist but inadequate to the military user. Conversely, it might meet military requirements, but still not exploit fully the potentialities of the agent fill.[87] The entire task was magnified by the ramifications of any decision. The consideration of one factor might lead to one position, but that position was often invalidated by the consideration of still another factor.

The services had made progress in developing, testing, and evaluating biological munitions, but there were apparent gaps when the program was considered from the operational viewpoint. Particularly critical was the problem of translating experimental data to prediction of human infection and the subsequent target effect. Extrapolation had been a major weakness in the over-all program. Although animals had been used extensively in studies of infectivity, the resultant data did not necessarily provide meaningful information on the virulence of a biological

agent to man. That is, the Air Force could be fairly accurate in predicting what a biological warfare attack would do to a city full of monkeys, but what an attack would do to a city full of human beings remained the "sixty-four dollar question."

What had plagued the biological warfare program from the beginning was the lack of guidance on what effects the Air Force wanted to produce with a biological munition. As a result, the Air Force and the Chemical Corps had been at a sort of impasse on this point. The Air Force asked the Chemical Corps what it could produce; the Chemical Corps in turn asked the Air Force what it wanted a munition to do. And since too little was known of weapons effects, the Air Force had not been able to determine suitable targets. The Directorate of Intelligence was responsible for making target studies, but had found the going rather rough. For one thing, intelligence people had been unable to agree on weapons effects data. It was evident that somewhere along the line, a compromise would have to be made so that they could get on with the work.

18

64 Exh

[redacted]

Twining Directive

The Deputy Chief of Staff, Development, had said repeatedly that planning was being based on over-optimism, both with respect to the date of availability of biological munitions and their effectiveness.[19] That over-optimism had produced the Twining directive, which established a crash program to attain an operational readiness. By setting definite time-phased goals for achieving this capability, the directive may have produced more tangible results than would have been realized otherwise. On the other hand, many people were convinced that the directive had done the biological warfare program almost irreparable damage.

Issued on 15 January 1952 the Twining directive was the first official statement of the establishment of a USAF biological warfare effort. [redacted] This project to get an early capability was designed [redacted]. By 31 December 1952 one wing of SAC medium bombers was to be capable of using specific anti-personnel, anti-crop, and anti-animal biological agents. By 31 December 1953, this capability was to be expanded to three wings of

medium bombers, and additional biological agents were specified. By 31 December 1954 all Strategic Air Command units were to be ready for conducting biological warfare operations. This directed capability later was extended to include all TAC and FEAF units. In addition, all installations were to be able to defend against overt or covert attacks. The directive noted that revisions would be required as the program progressed. It did not change the assignment of responsibilities outlined in the 20 October 1950 memorandum.[20]

The Twining directive was based largely on technical estimates submitted by the Research and Development Board, which were based on Chemical Corps predictions of what it could produce. Actually, the Air Force could not use the completion dates specified because it did not know if the items would be acceptable. The estimates were based on extrapolations from laboratory data--not from field tests--and therefore were not reliable. As a result, the Acting Vice Chief of Staff issued an amendment on 3 July 1952,

specifying agents by types instead of by name. This accorded some latitude to research people in accelerating the program, but it was a long way from establishing realistic goals for the program.[21]

A report issued by RAND in July 1952 trod on some important toes. It questioned the philosophy behind the Twining directive. RAND was of the opinion that the directive would produce a fictitious capability--that a crash program would disrupt the normal steps of research and development, testing, and formulation of doctrine, and therefore would result in inferior munitions. In other words, RAND did not believe that the directive established a sensible biological warfare program.[22]

Eventually there was to be general agreement that the Twining directive was ill timed. It had been conceived in an emotional atmosphere that did not engender a calm

---

* The agent Pasteurella pestis originally specified was not available. This amendment specified that by 1 January 1955 all SAC heavy and medium bomber wings, all TAC medium, light, and fighter bomber wings, and all USAFE and FEAF light and fighter bomber wings were to be able to use all suitable biological agents in offensive operations. All Air Force echelons were to be able to defend against covert or overt attack.

64 EW/

appraisal of the potential of biological warfare. It had tried to put biological munitions into the operating commands before their development was far enough along to assure reasonable success. Moreover, it was felt by many that the directive was arbitrary in its general tone and that the Biological Warfare--Chemical Warfare Division at USAF headquarters had been overly zealous in directing its implementation. The ARDC made clear from the first that it could not fulfill the requirements to the letter. As time went on, those working with the program came to feel that the directive had been rammed down their throats--and this was not palatable.[23]

BW-CW Division, USAF Headquarters

At the direction of the Vice Chief of Staff, a special division had been set up in the Office of Atomic Energy at Air Force headquarters to organize a biological warfare program, monitor it, and expedite special projects. The primary mission of this division was to encourage the development of an Air Staff capability; it was to cease to function for any staff agency when this goal was reached. To staff this office, most of the officers having knowledge of the program were withdrawn from the Air Staff and the

command [redacted]

The division accomplished its objective. It fulfilled its original mission and developed an Air Staff capability in the biological weapons field. It developed qualified people for a new item. Even its mistakes could not be written off as a loss, since those mistakes helped the program to find its proper place in military planning sooner than if the division had not existed.

But the newly activated division got off to a bad start. It was set up as a monitoring and coordinating agency; it was not in business to issue directives and to take actions independently of staff agencies. Notwithstanding, the division chief at times exceeded his authority. Moreover, the policies which he established produced some rather violent reactions. Many believed that those policies were based too much on personal conviction and too little on scientific facts. In their opinion, it should have been clear that the Chemical Corps was promising more than it could deliver. Actually it was not until 1953

that the Air Force had better control on what technical estimates* represented.

It may have been true that prior evaluation of the biological warfare potential had been flavored by predominantly partisan influences. The Chemical Corps had stated that it had produced a biological warfare munition, and the Air Force had eagerly sought to direct a capability based upon that assumption. Hindsight inevitably suggests that the Air Force placed too much confidence in Chemical Corps technical estimates and that strong personalities tried to drive the program through. But here, as in any development, there were extenuating circumstances. The pressure of world unrest called for positive action; the services could not indulge in watchful waiting for something to turn up. And even those who later were to criticize

---

* Earlier technical estimates had forecast end item progress in terms of "dates of availability." The 1953 Technical Estimates defined the term as receipt of a fully engineered prototype through development and procurement. The dates of availability normally occurred one to two years after completion of the final engineering tests. But the 1954 technical estimates forecast end item progress in terms of "completion of development" (completion of final tests by the development laboratories). This change was made to delineate development status items which had been tested and which met the specified military characteristics and could be produced in an emergency

the aggressive policies of the program's leadership would not have been entirely satisfied with policies that were largely negative.

Moreover, the over-optimism was not limited to any one individual or group of individuals. Bacteriological warfare had a strong emotional appeal. It was new. It seemed to offer fabulous possibilities. The Chemical Corps may have been too aggressive in selling the product of its labors; but in so doing, it had willing buyers.

In any event, subsequent developments were to show that service interests and personal conviction could not provide a stable basis on which to commit any part of the national effort. The Air Force learned the hard way that enthusiasm could not replace the need for cold calculation.

Realignment of Program

The capability achieved in the anti-crop field had been more encouraging than the results of the M33 anti-personnel development.* However, by early 1953 it was painfully clear that the entire biological warfare program needed an overhauling.

---

* Chapter V outlines the capability achieved in the anti-crop biological warfare field.

In a letter to Secretary of the Air Force Thomas Finletter on 9 January 1953 [redacted] who had succeeded Colonel [redacted] as head of the BW-CW Division at USAF headquarters) suggested that the biological warfare program was out of phase. He doubted the wisdom of continuing work on a crash basis.[25] The omission, or short cutting, of the established sequence of action (development, testing, acceptance, then procurement) had led to confusion and had delayed, not accelerated, real progress.

In April 1953, General Bunker* wrote to Lieutenant General T. D. White that the Air Force procurement money would buy more target effect per dollar if invested elsewhere. In an era of economy he considered the biological warfare program an unwarranted luxury. He recommended that all procurement then pending be canceled except for service test quantities, and that future procurement should be contingent upon the actual demonstration of the effectiveness of biological munitions. General Bunker was aware of

---

* Major General Howard G. Bunker, Assistant for Atomic Energy, Headquarters USAF.

64

the severe impact such action would have upon the Chemical Corps. He also conceded that restricting quantity procurement contained some element of risk. Still, he felt that the USAF no longer could proceed on a parallel front in all areas--its funds would have to be directed toward those weapons that promised the best results. 26

On 25 May 1953 a completely reoriented biological warfare program was presented to the Air Force Council, and by the end of the fiscal year it had been approved by the Secretary of the Air Force and the Vice Chief of Staff.

[redacted] In October 1953 the Assistant Vice Chief of Staff rescinded the Twining directive and

amendment thereto.* And on 5 March 1954, Secretary of Defense Wilson issued a directive canceling the Department of Defense directive of 21 December 1951. The new directive affirmed the necessity for a biological warfare program, but it reduced the pressure to build up an immediate capability. Instead, the emphasis was to be upon long range research and development, with an adequate field testing

---

* Operational planning was to be based on USAF Strategic Capabilities Mobilization Plan (WPC) which had broad guidance on Air Force capability to be attained, and the USAF Operating Program, Priorities and Programmed Units (OPU)--BW-CW Section, which set forth specific number of units, time phasing, capability to be obtained, and logistic support needed.

[redacted]

Prior to receipt of the formal directive, many actions had already been started. Three members of the team undertook studies and consulted with other agencies. The team initiated a draft which was submitted informally to other teams and other groups [redacted]

program. The military services realized that they had reached the point of diminishing returns on the development of existing end items.

In more detail, research and development was to be concentrated on a few high priority end items. Only research that was applicable to improved munitions was to be supported. Emphasis was to be placed on the development of a lethal anti-personnel biological munition for release from high speed aircraft and upon the development of munitions for delivery of anti-crop pathogens from high speed aircraft and by balloons. By 1 July 1955 the Joint Chiefs of Staff were to have the results of a critical reappraisal of the over-all program and were to recommend to the Secretary of Defense the level of effort to be placed on getting an offensive military capability. Meanwhile, the services were to maintain the existing limited capability in the operational use of biological agents. Further procurement, however, was to be held up; and no additional facilities, other than pilot plants, were to be built. The USAF was to continue to develop doctrine, tactics, and techniques as new munitions and defense equipment became available. Training

was to keep pace with development and logistics planning. [27] Defense aspects were to continue to receive a high priority.

It is interesting to note that the realigned research and development program was essentially the same as the proposed program set forth in ARDC and WADC letters between 20 August 1952 and 28 December 1953. One exception was that the highest priority was being placed on the development of the E61 bomb with anthrax instead of on a lethal agent which could be disseminated from an aerosol generator or in dry form, as specified in the letter from [28] ARDC to the Chief Chemical Officer on 8 October 1952.

The redirected program resulted in the reprogramming of $178,000,000 included in the fiscal year 1953 [* 29] budget for biological and chemical warfare munitions. It gave no guarantee of success. It was a candid admission that previous policies had failed to produce satisfactory results. And it recognized the principle that the search

---

* Items canceled from the program included 13,200 of the E108 750-pound biological cluster ($26,136,000); 6,000 of the 500-pound biological anti-crop cluster, the E86 ($9,000,000); and 5,250 of the biological anti-personnel aerosol generator cluster, the E99 ($28,875,000). Where possible, these funds were to be used to buy defense equipment.

for efficient biological munitions must necessarily be slow and painstaking. The services no longer could afford to settle for half answers to difficult technical problems.

target area.

The Air Force had supported and funded for anti-crop munitions since 1950. One agent, effective against wheat crops, had been standardized as The Air Force could disseminate this agent by manned aircraft or by balloons. In addition, the Air Force had developed a spray tank system* that could spread chemical agents to inhibit plant growth. Also receiving consideration was the possibility of spraying chemical agents that would defoliate plants.

The Secretary of Defense in March 1954 directed the military services to maintain an anti-crop capability, but by 1955 the Air Force was re-examining the anti-crop program and had to deal with many conflicting opinions. Two studies (one made by the Directorate of Intelligence and the

*

other by the Army Operations Research Office) were about 180 degrees apart in their conclusions.

Some felt that the program warranted more emphasis than had been accorded it in the past. [redacted]

[redacted]

On the other hand, anti-food operations required a lot of munitions. For example, the Air Force had bought agent-munition combinations believing that 8 tons of [redacted] agent would be sufficient for a specific area coverage but later found the requirements to be closer to 40 tons. Delivery of 150 functioning munitions would require the launching of 2,400 weapons. Because of possible unfavorable weather conditions, to launch 2,400 weapons during a single season would require distributing 4,000 weapons

among 5 launching sites. Moreover, to affect the enemy's war making potential, attacks would have to be launched near the beginning of hostilities to allow the agent time to act, and would have to be repeated at intervals. This posed the question: Would the war be over before the effect could be of any real military significance? And even if it were possible, would it be desirable to destroy the food crop of any nation? To do so might be politically unwise. The psychological implications were tremendous.

At the end of 1954 the problem remained to assess the probable effect of a biological attack [redacted] and to reckon the resultant impact on that country's war making potential. It was obvious that the enemy's air force and industrial capacity would be the primary targets, since it would take one year to destroy crops but only three to six months to destroy cities. However, anti-crop munitions would provide the USAF with the capability to negotiate for cessation of hostilities--provided, of course, that the war lasted that long. In any event, any decision on the military worth of anti-crop operations could be corroborated only by realistic target studies and continued emphasis on a realistic test program.

The M115 (E73R1)

he USAF first stated military requirements for an rop munition in a letter dated 26 September 1947 to hief Chemical Officer. On the basis of USAF require- ts the Chemical Corps developed the E73 500-pound ological bomb. In October 1950, when the Air Force ought 23,900 of the M33 biological clusters, it initiated procurement action for 4,800 biological clusters to attack cereal grain crops with wheat rust.[4]

The E73 was a modification of the old M16A1 propaganda leaflet bomb. It was filled with four packages of feathers contaminated with [redacted] the agent causing stem rust of wheat. Other agents could be used also. The cluster opened when released from an airplane, and the feathers were released when the packages were split.[5] Area coverage was extremely large. [redacted] by the Chemical Corps Technical Committee on 25 May 1951. The destructiveness of these pathogens, or plant parasites, was well known. The disease had struck wheat crops in the Upper Mississippi Valley on numerous

[The agent fill had been standardized as [redacted]

occasions. It was epidemic in nature. It was readily disseminated by the wind, and germination was immediate. The summer, or red, stage was the only stage in the life cycle of stem rust that had any military significance. The spores of stem rust of wheat that were consigned for military use were grown and harvested under carefully controlled conditions. Since the agent lost its viability during storage, new supplies had to be produced during the fall and winter months of each year. Three production sites were operated in the summer; two in the winter. The rate of deterioration was high (about 50 per cent), forcing improvements in processing and packaging methods.[6]

Devices for disseminating this pathogenic agent consisted of those using a carrier (such as feathers) and those not employing a carrier. The latter had several advantages over the former. Less space was required in the delivery mechanism; there was no loss of agent (in the former, some of the agent remained attached to the feathers); also the latter permitted large target coverage per unit weight of pure agent. In the beginning, however, the emphasis had been on disseminating the

[redacted]

[redacted]

of this operation.

AMC Operational Plan 12-53

Thirty-two hundred of the M16 clusters were modified to the E73R4 cluster and the AMC began to plan for their use, if directed. AMC Operational Plan 12-53 involved the movement of the E73R4 biological cluster

[redacted]

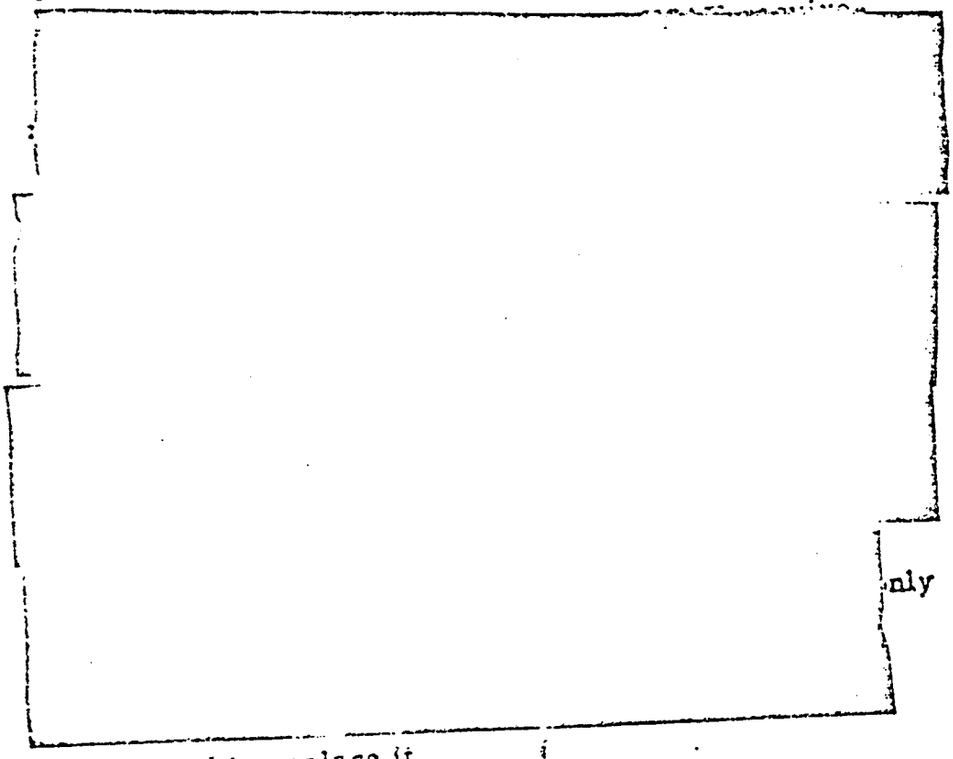
The effective date for operations was for the period 1 March through 30 May of each calendar year. As previously noted, the short life of the agent required the manufacture of fresh supplies each year. The plan was to work this way. Upon Presidential release and direction from USAF headquarters, the AMC would send out a prepared TWX to all organizations involved in the plan. MATS was to provide the aircraft. The Chemical

Corps was to load aircraft wit[redacted] filled components and furnish technical escort. The cargo would be loaded, escort taken aboard, and aircraft flown to overseas bases. From then on theater policies and plans would be followed.

In the revised plan for calendar year 1954, responsibilities were about the same. Two courier officers were to be provided by the Ogden Air Materiel Area Commander. Since appropriate flight profiles had been worked out, no additional protection was necessary for protecting the agent-fill en route to forward bases from the Zone of the Interior. Both plans were based on prestocking hardware overseas. In no case were agents to be stored outside the United States.[9]

In October 1954 the Chemical Corps had on hand in refrigerated storage, or under procurement, the required quantities of wheat and rye rust to meet Air Force requirements. Hardware was on hand for about 4,800 M115 biological bombs. A quantity of the hardware was prepositioned at two overseas bases. If required, these agents could be processed, packaged, delivered to the Air Force, and sent by air transport to overseas bases

for final assembly. Therefore, the Strategic Air Command had the capability of conducting biological anti-crop operations as part of a strategic air offensive if directed.



nly developed to replace it.

The E86

The 750-pound E86 anti-crop bomb utilized the basic principles of the E73 but eliminated its deficiencies. Designed for external carriage on fighter-bomber aircraft, it could disseminate dry anti-crop agents by means [redacted] er a large target area from such aircraft as the B-47 and B-52. Its use would require no major changes

in organization, training, and logistics support. In general, such requirements would be less restrictive than those for the E73 bomb. The fiscal year 1953 buying program included 6,000 bomb clusters of the E86. Funds had been made available because of the reduction in requirements for chemical munitions. Development had begun in October 1951, and in October 1952 was assigned to the Ralph M. Parsons Company.* Completion for operational use was not expected before January 1958. Coordination of Air Force and Chemical Corps efforts in determining the effectiveness of these munitions was achieved by the establishm[redacted] (later redesignated 11a [redacted]

The E77

The E73 and E86 bomb had to be delivered by piloted aircraft. The E77 was designed for delivery of dry anti-crop

---

* The Parsons contract involved two or three million dollars a year. Established in 1952, it was a continuing project. The company was handling five or six munition projects and also doing much work on research and new techniques and devices for forming aerosols. It was responsible for operating the Horton sphere. The company functioned at Camp Detrick under a project officer who was a civilian under Civil Service.

agents by free-floating unmanned balloons. Thus, attacks could be made without competing for aircraft sorties. This delivery method was comparatively cheap. Work on the E77 began in 1950. Preliminary military characteristics were accepted by the Chemical Corps Technical Committee in April 1951 and were revised in November 1952. Proposed USAF military characteristics were sent to ARDC for approval in August 1953 and were published on 2 December 1953. By that time the development was receiving a high priority. Participants in the development included the Chemical Corps, WADC, the Air Force Cambridge Research Center (Cambridge, Massachusetts), and General Mills Corporation.* This munition represented about one-sixth of all development effort that had been expended on biological warfare munitions.[12]

The E77 was to consist of a balloon gondola carrying five biological containers with the necessary auxiliary equipment consisting of a heating mechanism, a mechanism

---

* Balloons were being manufactured by General Mills Research, Inc., and the Wenzen Research Co., St. Paul, Minnesota. The latter company was willing to expand for large scale production.

for ejecting the agent-carrier mi[redacted] from containers, and an apparatus for neutralizing the agent in the event of forced ejection over friendly territory. The balloon was to be lifted by hydrogen gas. Although helium was safer, it was more expensive. Moreover, because of logistics problems, helium was impractical for use in extensive operations.

This munition was considered a strategic weapon. It was to be launched by a special group assigned or attached to the theater air commander. Five launching sites were planned. Training was to be the sole responsibility of the 1110th Air Support Group, Headquarters Command, stationed at Lowry Air Force Base, Colorado. A hard core of trained personnel existed and could be expanded if necessary. Air and Airways Communication Center and Air Weather Service were to cooperate in tracking.

[redacted]

The E77 development program had not run smoothly. Military specifications were deficient. Engineering

64

difficulties included generator troubles. Storage was difficult because the heater designed for the munition employed a catalyst, shelf life of which was only six months. A major problem was the job of determining the optimum weight ratio of agent to hardware and the crop area which could be infected by the contents of a single munition.[14] In addition, Headquarters Command protested that its mission was hampered by the lack of definition of policy. The people at AMC headquarters were disturbed because the over-all balloon delivery program did not have an AMC monitor. And the monitoring people at USAF headquarters were disturbed by the removal of this munition from the Air Force operating document without their knowledge. This action had resulted from an AMC request either to establish a realistic capability date or delete the munition altogether. This had led to a staff study which concluded that balloons were not suitable for delivery of biological warfare agents and a recommendation[* 15] that work on all such systems be discontinued.

---

* The Special Weapons Division at Headquarters, ARDC, conceded that the balloon had a certain value in the Civil War, but did not believe it warranted much consideration as a strategic weapon system.

Another factor delaying the program was the failure of the Deputy Chief of Staff, Operations, to approve an operational and logistical concept for a balloon delivery system. The proposed concept was as follows: Agent and all components of the agent container were to be stored within the Zone of the Interior; hardware was to be stored at the launching sites; and upon short notice, agent and agent components were to be assembled into a complete operational unit for air shipment to the launching sites, where storage was not expected to exceed 90 days. The preparation of the E77 for an operational flight would require only the insertion of the assembled containers into the waiting hardware, plus a few simple adjustments. This concept had been agreed to orally by AMC and WADC in November 1953, but the Air Staff was reluctant to commit personnel and to activate units until test results showed the use of balloons to deliver biological munitions to be practical. * 16

---

* Operational suitability testing was to consist primarily of handling and functioning of munitions under conditions directed by results of development testing. It was not to include hot tests.

The 41 plastic balloons launched from Vernalis, California, between 8 October--13 December 1954 demonstrated that the military characteristics for the 124A system had been met. The equipment could be considered a general purpose carrier and could be flown with the E77 bomb or an equal weight payload for any purpose contemplated in balloon probing or transport systems. 17

Meantime, the AMC project monitor for the E77 project had voiced his disapproval of testing plans. He did not believe that the test directive met AMC requirements. Moreover, he disapproved of the concept calling for mixing the agent in the Zone of the Interior and transporting it to the launching sites since this concept was not compatible with the 90-day operational concept and would result in serious logistic and production problems. A preferable method seemed to be to fly nitrogen packed agent concentrate to an overseas installation and then mix it with the carrier at that point. This concept (calling for overseas mixing of the agent and carrier) was feasible technically. However, it called for mixing equipment which was somewhat more elaborate than at first contemplated. 18

64 Civ 21061

Anti-Crop Spray System

The M115 and E77 bombs were designed to disseminate anti-crop pathogens. A second broad category of anti-crop agents consisted of chemical agents, divided into two groups: (1) growth inhibitors and (2) defoliants. As indicated earlier, these agents had been considered in the biological warfare area, despite the fact that they were not living substances. Unlike micro-organisms, they do not multiply and spread. Commercially they were referred to as weed killers, and one of the best known was 2, 4-D, which was manufactured to the extent of millions of pounds annually. Chemical agents were quicker to act than pathogenic agents and were not subject to weather or to crop resistance. But their delivery by spraying operations would require more sorties and would also affect a smaller portion of the Soviet diet. Attack of an entire food crop complex of a country with chemical agents was not considered feasible; a spray sortie might be effective, but only after the crop yield had already been reduced by pathogenic agents.

In test trials of a spray technique conducted at Avon Park (Florida) in 1950 and 1951, C-47 aircraft were able to destroy a broad-leaf crop area at the rate of three square

miles per minute of flight time. An intelligence study assumed that a B-50 could disseminate 2,500 gallons of [redacted] with similar destructiveness while spraying at 500-foot altitude.[20]

In September 1951 the Air Force discussed the possible use of chemical spray again [redacted] but the proposal met [redacted]

[redacted]

to the second study on the grounds that it was based on [redacted]

However, the Air Force continued to be interested in this type of operation. The following year the Air Force stated a requirement for killing crop[redacted] and to get this capability bought 100 spray systems for B-29 and B-50 bombay installation and 3,625 tons (7,250,000 pounds) of concentrated [redacted] chemical agent. Everything was shipped to the Air Force installation at Spokane, Washington, where it remained for any future emergency use. The development and procurement of the spray tank was a crash project and was [redacted] It was a USAF headquarters-directed project. Participants included AMC, WADC, ARDC, and APGC. Procurement was initiated in October 1952. Scheduled for completion by 1 April 1953, the project was completed five days ahead of time.

The results were satisfactory. Tests run in February and March 1953 indicated that spraying up to an altitude of 2,500 feet was feasible. The Air Force had an immediate capability for spraying chemical anti-crop agents from

B-29, B-50, and C-119 type aircraft.* The system enabled the Air Force to attack specific broad leaf crops for which no suitable pathogens existed. However, it should be noted that the 1-A priority accorded this project delayed work in the anti-personnel area.

The existing anti-crop chemical capability was not to be extended. B-29 and B-50 aircraft were going out of active inventory, and future potential carriers and systems had basic limitations.

In one respect Project [redacted] was unique. Normally the Army bought bombs, while the Air Force bought aircraft. But in this case the entire project was handled by the USAF dealing directly with civilian concerns. Therefore, some question of legality, or at least of ethics, might

22

* The original requirement specified internal carriage of the spray system by B-47 type aircraft also. However, this requirement was removed. On 3 June 1953 the system was standardized as the Spray System, Airborne, Type MC-1. Spray tanks capable of being carried by fighter-bombers were also under development by WADC. The spray tank developed by the Navy had proved too complicated, too heavy, and too expensive for Air Force use.

64 D 4/21061

be said to have existed. However, the project was a source of satisfaction to the Air Force. The Air Force had on occasion chafed under the slowness of the Chemical Corps to take procurement action; and in this instance it had proved itself capable of producing a satisfactory end item on short notice when the urgency of the requirement demanded it.[23]

Defoliants

In May 1953 the Air Force became interested in the possibility of using the spray tank for disseminating chemical agents that could defoliate plants.** This was not a new idea. In the fall of 1943 the Chief of Staff had directed

---

* Not all were agreed on this. Some said that the purchase was in direct conflict with Munitions Board instructions. Others saw no objection to Air Force procurement of commercial agents. Some were of the opinion that the Chemical Corps was not informed of the project. Others noted that coordination with the Chemical Corps was made informally, and that the secrecy of the project stemmed primarily from the fact that to disclose the project would have compromised security and made the price of the chemicals go up on the commercial market.

** A weapons system for defoliation of plants could be used to clear front line areas for observation; deny the enemy the use of vegetation for concealment purposes; establish visual navigational aids over vast forested areas; increase susceptibility of vegetation to burning; and control the vegetation on bombing and gunnery ranges and paratroop drop areas.

the Chemical Warfare Service to investigate this type of operation, and static field trials were carried out in 1944. As a result of experience gained during the assault on Iwo Jima and Okinawa in 1945, the Army had set up a project [redacted] to develop weapons and tactics to deal with hidden pillboxes, gun emplacements, and defensive positions. In 1946 Camp Detrick was searching for more potent defoliating agents, but no requirement existed; and since there was a shortage of manpower and funds, Detrick terminated the work. In general, only sporadic interest had been manifested by the military in the use of defoliant compounds. No one service or group had maintained interest long enough to insure a satisfactory program. However, in 1954 the Air Force established a requirement for a defoliation agent and disseminating device, and ARDC was asked to begin work. Proposed military characteristics specified a munition and agent suitable for use by strategic and tactical air weapon systems in support of ground operations.

24

Certain considerations prompted the WADC to recommend giving this requirement a low priority, pending

further study. No agent known at that time even remotely met the requirements as interpreted by that development center. To deliver the existing defoliants would require from 25,600 to 64,000 pounds per square mile, and delivery would have to be repeated in successive flights, thus destroying the element of surprise. Delivery at low altitudes made the aircraft vulnerable to enemy fire, and new spraying techniques would have to be developed for delivery by high speed aircraft. In January 1955 proposed military characteristics for defoliants prepared by the WADC were at USAF headquarters. However, little could be done in this area of development until the services had a suitable agent.

25

Anti-Animal Biological Warfare Program

The possible use of biological agents against livestock had occupied a relatively unimportant place in the over-all biological warfare program. The Air Force had endorsed research in this area but had never stated a munition requirement because progress had not justified extensive financial expenditures.

Many biological agents were effective against both crops and animals. Agents peculiar to animals were those

causing hoof-and-mouth disease, rinderpest, fowl plague, Newcastle disease, and hog cholera. Of greatest military interest were fowl plague; hoof-and-mouth disease (a debilitating disease affecting cloven-hoofed animals and having a varied mortality rate); and rinderpest (which affected cattle and water buffalo chiefly and was usually fatal). The United States was particularly vulnerable to those diseases.

Considerable work had been done on hog cholera. Tests using the E73 feather bomb to disseminate agents causing hog cholera had been highly successful. But extensive research in the anti-animal field had been prevented by government regulations which prohibited bringing animal diseases into the United States. More adequate research seemed assured when the Chemical Corps secured [redacted]

Also, work had been conducted under contract with educational and commercial organizations.

However, work by the military services on anti-animal agents was largely terminated by a Department of Defense directive which transferred responsibility to

the United States Department of Agriculture. [redacted]

June 1954 in order to give the Agriculture Department time to budget for research.[26] [redacted] meeting in the fall of 1953, noted with regret this restriction of effort. Conferees were favorably impressed with the unmanned balloon system and the E73 bomb, both of which could disseminate either crop or animal agents--or more significantly, a mixture of the two.[27] Apparently their evaluation of the potential of anti-animal agents differed from that submitted by the Weapons Systems Evaluation Group in 1952. That group had dismissed anti-animal biological warfare as relatively insignificant. It noted that meat accounted for only five per cent of the caloric intake [redacted] and that tractors represented only half of the farm power. But the 1952 report had been limited in its approach; it had failed to consider

factors having an important bearing on the matter. And some Air Force officers remained convinced that any cutback in this research constituted a serious mistake. How could any real capability be developed in defense techniques unless more was known of the potential afforded by offensive operations?

In review, the M115 and the chemical spray system provided the Air Force with an immediate capability to attack food crops. The E77 was nearing completion, and better munition types were under development. The Air Force was still interested in agents to defoliate plants, but had terminated work on anti-animal research. Although it was maintaining its anti-crop capability, the advisability of expanding effort in this area was being questioned. The feasibility of planning for all anti-food operations was receiving close scrutiny at high policy levels.