

bay temperatures for delivery of temperature sensitive munitions. For a long range approach, the aircraft electrical system will be adapted for supplying electrical power to individual munition electrical heaters. The feasibility of insulating individual munitions is also being studied. (CONFIDENTIAL)

For the delivery of spherical munitions to the target area, ballistic and dispersion data have been obtained from flight tests at Hill AFB using bucket type hoppers and clusters. A test dispenser developed by the Rheem Mfg. Co. for the Chemical Corps will be used for obtaining additional ballistic data. As a long range development, the Boeing Airplane Co. will be requested to develop equipment for release of spherical munitions from sub and supersonic bombardment type aircraft. (CONFIDENTIAL)

c. Tasks:

Task 50189 (Unclassified Title) Munition Temperature Control.
(SECRET TASK)

Contractor: Not established.

Contract: None

Principal Investigator: Not established

Completion of Development: January 1956

Completion of Test: June 1956

Object: To provide the engineering and coordination necessary to assure compatibility between bomb heating provisions as incorporated in different temperature sensitive viable agent munitions and the electrical heating provisions required to be installed in applicable aircraft. (SECRET)

Nature of Task: To assure that bomb heating requirements are maintained within the limits of the aircraft electrical system capabilities and that adequate provisions are installed in applicable aircraft.

Coordination: WADC - Equipment Laboratory, WCLE
Weapons Systems Directorate, WCOV
AMC - Procurement Division, MCP
Maintenance Division, MCM
AFAC, ACOPP
Dept. of Army, Chemical Corps Biological Labs (SECRET)

Task 50190 - (Uncl Title) Bomb Bay Dispenser (SECRET TASK)

Contractor: Not Established.

Contract: None

Principal Investigator: (Not Established)

Completion of Development: December 1956

Completion of Tests: July 1957

Object: To provide equipment for delivery of spherical munitions over the target area from subsonic and supersonic aircraft.

Nature of Task: Development of a bomb bay dispenser for suspension and release of spherical PW munitions from subsonic and supersonic bombardment type aircraft.

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Coordination: WADC - Directorate of Support, WCU
Aircraft Laboratory, WCLS
Equipment Laboratory, WCIE
Materials Laboratory, WCRT
Weapons Systems Directorate, WCOV
AFAC, ACOP
Dept. of Army, Chemical Corps Biological Labs.
(SECRET)

d. Other Information:

(1) Reference Item 11, since the Navy may carry and disseminate these munitions, that agency will be interested in this project. The Army Chemical Corps, Biological Laboratories will participate in the development of the dissemination and temperature control equipment. AFAC will participate in the testing of prototype articles. (Uncl)

(2) The following support will be required from the Air Materiel Command:

(a) Furnish funds for modification of aircraft to provide prototype installation of munition temperature control equipment for service test. Expenditure of approximately \$15,000 in FY 1955 is anticipated.

(b) Furnish funds for procurement of prototype bomb bay dispenser (1 ea.) for service test. Expenditure of approximately \$50,000 in FY 1957 is anticipated. (Uncl)

e. Background History: Development of bomb cluster adapters with internal heating and insulating equipment to reduce heat loss from certain temperature sensitive unit bombs which are clustered and carried in cluster adapters has been carried out under prior projects R555-731, R555-732, and R555-777. (Conf)

Certain BW munitions have a definite temperature range within which the viable agent remains effective. It is, therefore, necessary to control the munition temperature during flight if maximum effectiveness is to be realized. The Army Chemical Corps will provide internal electrical heaters in the individual cluster munitions for production items. Electrical heaters plus insulating material will be used to maintain the required temperature for a typical combat mission. As an interim, for present operational readiness, space heaters for B-29 and B-50 bomb bays are being developed. The long range task will be to provide an electrical system with power receptacles at each bomb station with sufficient capacity to supply the required cluster heating power. Cold chamber tests of the M-115, M-33, and E-133 BW munitions and flight tests of B-47 and B-50 aircraft have indicated that the temperatures of the munitions after a normal flight, without munition temperature control, would result in a large quantity of the viable agent being destroyed in some cases. A prototype bomb bay heater was tested in a B-50 airplane. The major difficulty encountered was operation at altitudes above 25,000 feet. At this altitude the rarified air would not support combustion. The proper design may overcome this difficulty. Data was obtained from these tests as to the required BTU output of the heaters at various altitudes up to 30,000 feet. (SECRET)

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With the inception of requirements to obtain a capability for delivery of BW weapons, investigations were made as to the effects of temperature and altitude on the viability of BW elements. In March 1951, the problem of temperature control was presented to WADC in a letter from Hq USAF, Subj: "(SECRET TITLE) Temperature Control for Airborne BW Munitions". (SECRET DOCUMENT) In October 1951, WADC presented a prepared report on the study, subj: "(SECRET Title) A Preliminary Study of Temperature Requirements for the Protection of BW Munitions During Airborne Delivery to Target Areas", (SECRET DOCUMENT). (Memorandum Report No. WCEG R-555-1350). During the period October 1951 to April 1952, bomb bay heaters were installed in a B-29 airplane for the purpose of determining the adequacy of heating bomb bays with gasoline heaters. Tests were made at varying altitudes from 10,000 to 40,000 feet. It was determined that presently available heaters, properly controlled would operate satisfactorily up to altitudes of 27,000 feet. Exhibit WCEEM-2-50 dated 20 May 1952, subj: "(Confidential Title) Bomb Bay Heating Kit for B-29 and B-50 Aircraft", (CONFIDENTIAL REPORT) covers the requirements for heaters for bomb bays for these aircraft. On the basis of the above a contract was let to the Hayes Aircraft Corp., Birmingham, Alabama, for the design and development of bomb bay heaters for service use in B-29 and B-50 aircraft. These heaters were functionally tested by the contractor and found to operate satisfactorily within the required design limitations. Development will be considered finished upon completion of final test report.(CONFIDENTIAL)

From a survey of aircraft electrical power availability for munition heating, it was determined that 150 watts per unit munition cluster could be made available. The Army Chemical Corps has been advised to design the unit munition cluster with heaters and insulation, such that under combat conditions on a typical combat mission the temperature of the unit bombs will not rise or fall beyond the allowable temperature range.(CONFIDENTIAL)

Other studies on temperatures of aircraft in flight have been made and reported in the following:

- (1) Memorandum Report No. WOSE-127 dated January 1952, (Uncl Title) "Study-Design Temperature Requirements for Operation of USAF Aircraft and Equipment Phase C Aircraft Compartment and Equipment Temperature (B-36 Aircraft)". (UNCLASSIFIED DOCUMENT)
- (2) Technical Report 206.03 WADC-TR53-119 dated May 1953, (Uncl Title) "Aircraft Temperature Requirements Research Division Project 206". (UNCLASSIFIED DOCUMENT)

Early in FY 1952 the Army Chemical Corps under MIPR 52-702-WADC Amendment I, conducted experimental tests with spherical munitions proposed for use with BW agents. Dispersion of spherical munitions was studied. Various diameters, surface contours, moments of inertia, and other factors entering into the dispersion of the sphere were investigated. Numerous drops of various test spheres were made to determine which shape gave the best dispersion pattern. (SECRET)

Under the Army Chemical Corps contract DA-18-064-CML-2028, the Rheem Mfg. Co. was given the task of evaluating the results of previous experimental tests. They were also given the task of developing a test

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dispenser for use in B-50 and B-47 aircraft for determining the effects of controlled orientation and forced ejection on the dispersion pattern of the sphere selected as having the optimum shape. The shape selected was approximately 4 3/4 inches in diameter with 9 raised, equally spaced ribs and weighing approximately 2.7 pounds. (Conf)

In order to marry the dispensing of spheres with the applicable aircraft, WADC prepared Exhibit WCLG-539 dated 19 November 1952, (Uncl Title) "Missiles, Spherical, Dispenser For" (Confidential Document) covering four (4) envisioned phases of the task. As the aircraft affected are Boeing designed and built, the Boeing Airplane Co. was recommended for sole source procurement. Due to freeze of R&D funds in late FY 1953, the purchase request was recalled and was resubmitted for procurement purposes in October 1953. (Uncl)

Ballistic drop tests were made during the fall of 1953 from a B-50 airplane using the Chemical Corps hoppers and the four inch ribbed spheres. Additional tests using the E-19 Dispenser (Rheem Dispenser) will be made during the summer of 1954. (UNCLASSIFIED)

Work has been done by the Army Chemical Corps in the dissemination of dry agents. During March and April 1952, the Army Chemical Corps, using a Navy ship, in a series of five trials disseminated between 200 and 450 pounds of inert tracer powder along a 105-135 nautical mile line. The object was to test the possibility of achieving long range aerosol cloud travel and consequent coverage of large areas at ground level under meteorological conditions in which inversions of temperature were present at low levels of the atmosphere. Details of the test program are contained in the Army Chemical Corps Biological Laboratories FT&M Division Report dated 22 September 1952, Subj: (Conf Title) Long Range Aerosol Cloud Travel Phase II". (SECRET DOCUMENT) In October 1952, the WADC, at the request of the Army Chemical Corps, modified a B-26 airplane to install equipment for aerial dispensing of dry agent powder. This equipment has been used by the Army Chemical Corps with indications that the performance of the device is satisfactory. (SECRET)

f. References:

- (1) Letter Hq ARDC to Hq WADC, ADTS-832, dated 20 August 1952, Subj: (Unclassified Title) USAF Biological and Chemical Warfare Program". (TOP SECRET LETTER)
- (2) Contract, Hayes Aircraft Corp., AF 33(600)22098, PR388659. (CONFIDENTIAL)
- (3) Contract, Army Chemical Corps, MIPR 52-702-WADC (SECRET DOCUMENT) and Amendment I. (CONFIDENTIAL DOCUMENT)
- (4) Letter Hq USAF to Hq WADC, dated March 1951, Subj: "(Secret Title) Temperature Control for Airborne BW Munitions". (SECRET LETTER)
- (5) WADC Memorandum Report No. WCEG-R-555-1350, dated October 1951, Subj: "(Secret Title) A Preliminary Study of Temperature Requirements for the Protection of BW Munitions During Airborne Delivery to Target Areas". (SECRET REPORT)
- (6) WADC Exhibit No. WCEEM-2-50, dated 20 May 1952, Subj: "(Conf Title) Bomb Bay Heating Kit for B-29 and B-50 Aircraft". (Conf Exhibit)
- (7) WADC Memorandum Report No. WCSE-127, dated January 1952, Subj: (Uncl Title) "Study-Design Temperature Requirements for Operation of USAF Aircraft and Equipment Phase C Aircraft Compartment and Equipment Temperature (B-36B Aircraft)". (UNCLASSIFIED REPORT)

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- (8) USAF Technical Report No. 206.03 WADC-TR53-119, dated May 1953, Subj: (Uncl Title) "Aircraft Temperature Requirements Research Division Project 206". (UNCLASSIFIED REPORT)
- (9) Contract - Between Army Chemical Corps and Rheem Mfg. Co. - No. DA-18-064-CML-2028. (CONF DOCUMENT)
- (10) WADC Exhibit No. WCLG-539, dated 19 November 1952, Subj: (Uncl Title) Dispenser for Spherical Missiles". (CONFIDENTIAL DOCUMENT)
- (11) Report: Army Chemical Corps Biological Laboratories, FT&M Division, dated 22 September 1952, Subj: (Conf Title) Long Range Aerosol Cloud Travel, Phase II". (SECRET REPORT)
- (12) WADC Exhibit No. WCLG-539A dated 11 March 1954 Subj: (Uncl Title) Release System for Spherical Bomblets". (CONFIDENTIAL DOCUMENT)

REASON FOR SECURITY CLASSIFICATION:

Since this document reveals intent to obtain offensive capability in BW warfare, it is classified Secret in accordance with policy outlined in letter from Hq, USAF (AFOAT) to all major Commands, dated 16 December 1952: Subj: (Unclassified) Classification Guide for Matters Concerning Biological Warfare and Chemical Warfare". (SECRET)

DOWNGRADING OF SECURITY CLASSIFICATION:

This document shall retain the security classification of Secret until such time as equipment developed under this project has been used in wartime operations for a period of 90 days at which time classification will be reduced to Confidential or until such time as policy expressed in the BW-CW Security Guide mentioned above has been revised.

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DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF CHEMICAL OFFICER
Chemical Corps Technical Committee
Army Chemical Center, Maryland

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CMLWH

TSE/5190/mm
20 May 1954

SUBJECT: Establishment of Four (4) Secret Projects in the Cml C FY 55
Program and Termination of Three (3) Consolidated Projects

TO: Chairman, Chemical Corps Technical Committee

1. References:

- a. CCTC Items 2703 and 2730 (S/RD), Chemical Corps R&D Program for FY 54, Approved 11 Sep 53.
- b. CCTC Item 2810 (S), Security Classification Review of Chemical Corps R&D Projects, 8 Apr 54.
- c. SR 705-5-1, Research and Development of Materiel, 10 Feb 54.
- d. Ltr (S), CMLRE-P-1 R&E Command, 14 May 54, Recommendations for Chemical Corps Technical Committee Action, to Chm, CCTC, w/2 Incls.

2. Discussion:

a. Reference a. identifies action of this Committee which reviewed the Chemical Corps research and development effort anticipated for FY 54 and indicated that this program consisted of 196 projects established and continued in force in accordance with applicable regulations and directives. This project listing has been revised during the fiscal year by additions and deletions by action of this Committee so that the program currently includes a total of 180 projects within the scope of the three major areas of Chemical Corps responsibility. The security classification of all of these projects was recently reviewed as recorded in reference b. to meet Staff requirements originating with the change in security procedures and abolition of the Restricted category authorized by DA Circular 127, 23 Dec 1953.

b. Reference c. identifies the basic regulation pertaining to the establishment of R&D projects in which paragraph 14 indicates that timely and periodical reviews of R&D programs should be conducted by the Technical Committees to assure conformity with the over-all Army R&D program and to eliminate any unproductive and duplicating activities. In consonance with this directive this Corps has annually reviewed its research and development effort in order to insure a completely integrated program fulfilling Chemical Corps responsibilities in the CBR area within the Department of Defense. As previously noted reference a. identifies the review conducted at the beginning of the current fiscal year.

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2. Discussion (continued):

c. Reference d. identifies correspondence which indicated that the program for FY 55 had been reviewed in accordance with all existing directives and, as a result, a total of four new projects in the CW area classified Secret were recommended for initiation at this time. Appropriate project data sheets for these projects are inclosed herewith and the tabulation below indicates the title, technical objective, and security classification for each. In connection with project 4-98-05-026, it is to be noted that this consolidates three currently approved projects, namely, 4-08-05-021, 4-98-05-022, and 4-36-07-001.

<u>Project No. & Tech Obj.</u>	<u>Title & Classification</u>	<u>Security Class. of Project</u>	<u>Priority</u>
4-04-15-027 CW-3	Gas Artillery Shell (U)	S	1-C
4-08-03-015 CW-1a	Agent SS (U)	S	1-B
4-08-06-025 CW-4a	Area GB Alarm (U)	S	1-A
*4-98-05-026 CW-3	CW Field Testing & Technology, DPG (U)	S	1-B
* Supersedes the following projects:			
4-98-05-021 CW-3	CW Field Test Technology, DPG (U)	S	1-B
4-98-05-022 CW-3 CW-4b	CW Field Testing, DPG (U)	S	1-B
4-36-07-001 IC-14	Climatological and Meteorological Factors Affecting Field Test Operations. (U)	S	2

d. The foregoing discussion indicates that timely review of the current Chemical Corps project program has shown the desirability of establishing four new projects and deleting three related projects as a result of consolidation. Each of these new projects is described in the respective project data sheet attached herewith.

3. Recommendations:

It is recommended that:

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3. Recommendations (continued):

a. The following projects be established in the Chemical Corps FY 55 project program:

(1) 4-04-15-027, Gas Artillery Shell

(2) 4-08-03-015, Agent CS

(3) 4-08-06-025, Area CB Alarm

(4) 4-98-05-026, CW Field Testing & Technology, DPG

b. The military characteristics if applicable, objectives, approach, and scope of the subject projects as listed in paragraph 21 of the pertinent project data sheet attached herewith be approved.

c. Each of the subject projects be assigned to the Technical Objective and be accorded the priority and classification indicated in the applicable project data sheet.

d. The following currently approved projects be deleted from the FY 55 program as a result of consolidation into project 4-98-05-026:

(1) 4-98-05-021, CW Field Test Technology, DPG

(2) 4-98-05-022, CW Field Testing, DPG

(3) 4-36-07-001, Climatological and Meteorological Factors Affecting Field Test Operations.

e. The Chemical Corps FY 55 project program and related documents be revised in accordance with this action.

4 Incls

Project Data Sheets for

4-04-15-027

4-08-03-015

4-08-06-025

4-98-05-026.

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PROJECT DATA SHEET

1. PROJECT TITLE: Gas Artillery Shell (U)
2. SECURITY CLASSIFICATION: Secret
3. PROJECT NUMBER: 4-04-15-027
5. REPORT DATE: 14 May 1954
6. BASIC FIELD: Ammunition
7. SUB FIELD OR SUBJECT: Munitions, Chemical
- 7a. TECHNICAL OBJECTIVE: CW-3
8. COGNIZANT AGENCY: Cml C
9. DIRECTING AGENCY: Cml C R&E Comd, A Cml C, Md.
10. REQUESTING AGENCY: AFF
11. PARTICIPATION AND/OR COORDINATION: (AR) Army; Ordnance Corps
12. CONTRACTOR AND/OR LABORATORY: Cml C Cml & Rad Labs, A Cml C, Md.
13. RELATED PROJECTS:
14. DATE APPROVED: 29 July 54, CCTC Item 2868
15. DEPT OF ARMY PRIORITY: 1-C
17. ESTIMATED COMPLETION DATES: Res (Cont)
Dev
Test
Op Eval
18. FISCAL YEARS ESTIMATES: FY 55 1COM
FY 56
20. REQUIREMENT AND/OR JUSTIFICATION: Ordnance Corps is at present developing new toxic ammunition for the 110-mm and 156-mm Howitzers and 175-mm guns under projects TAL-1464, TAL-1756 and TAL-1770, D/A projects 504-03-063, 504-03-064, 504-03-065, respectively. The projects presently contemplate development of thin wall, high explosive shell, and efforts will be made to develop equivalent shell for non-persistent agent munitions. If this is found to be feasible, these shell will have greater capacity for toxic agent than the 105-mm and 155-mm non-persistent gas artillery shell which have been developed. Further studies are also required to provide greater assurance against leakage on non-persistent gas artillery shell. A requirement for a large caliber HD Artillery Shell has been stated by the Army Field Forces. To meet this requirement Ordnance is developing Shell, Chem. 8-inch, TL9 (series) under project TAL-1876, D/A 504-03-074 for HD gas filling.
21. BRIEF OF PROJECT AND OBJECTIVE:
 - a. Brief: The objectives of this project are:
 - (1) To review work previously undertaken under Cml C Projects 4-04-15-012, GB Artillery Shell, 155-mm and 4-04-15-020, GB Artillery Shell, 105-mm with a view towards improvement of the dissemination and leakage characteristics of these weapons.
 - (2) To conduct investigations relative to the application of new artillery shell developments by the Ordnance Corps as Chemical Munitions.
 - (3) To assist the Ordnance Corps to develop an 8-inch HD Artillery Shell based on the M106 Artillery Shell.
 - (4) Since this is a general project, appropriate projects will be established as investigations and/or requirements indicate a need for specific end items.

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b. Approach: The following tasks will be undertaken:

(1) Improvement of the artillery shell with regard to leakage. This work will involve a study of a one-piece shell with a dual closure system, in coordination with Ordnance Corps development.

(2) The persistency and non-persistency tests being conducted at Dugway Proving Ground with the 105- and 155-mm GB Artillery Shell will be evaluated and the data obtained will be utilized in further dissemination studies and new shell developments.

(3) Close coordination with the Ordnance Corps will be maintained so that all new shell developments can be investigated and evaluated as possible future chemical weapons.

(4) Conduct necessary coordination with the Ordnance Corps on development of Shell, Gas, HD, 8-inch, T19 Series.

c. Subtasks: None

d. Other Information:

(1) Reference is made to Project 4-04-15-012 approved 19 Nov 1948, CCTC Item 1928 and Project 4-04-15-020, approved 25 May 1951, CCTC Item 2325.

(2) Reference Ordnance Corps Committee Item 34933, subject: "Shell, Chemical, 8-inch, T19 for 8-inch Howitzer" dated 2 June 1953.

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PROJECT DATA SHEET

1. PROJECT TITLE: Agent SS (U)
2. SECURITY: SECRET
3. PROJECT NUMBER: 4-08-03-015
5. REPORT DATE: 14 May 1954
6. BASIC FIELD OR SUBJECT: Chemical Warfare
7. SUBFIELD OR SUBJECT SUBGROUP: Agents
- 7a. TECHNICAL OBJECTIVE: CW-1a
8. COGNIZANT AGENCY: Chemical Corps
9. DIRECTING AGENCY: Cml C Research and Engineering Command
10. REQUESTING AGENCY: Chemical Corps
11. PARTICIPATION AND/OR COORDINATION: Army (AR)
12. CONTRACTOR AND/OR LABORATORY: Cml C Chemical and Radiological Laboratories
13. RELATED PROJECTS: 4-08-03-001, 4-61-14-004
14. DATE APPROVED:
15. PRIORITY: 1-B
17. ESTIMATED COMPLETION DATES:
Research ----- Continuing
Development -----
Testing -----
Operational Evaluation -
18. FISCAL ESTIMATES: FY 55 - \$ 50M
20. REQUIREMENT AND/OR JUSTIFICATION: There is a continuing need for chemical warfare agents more effective than present agents. In meeting this requirement, it is necessary to uncover specific types of new classes of highly toxic and physiologically active materials. In the continuing search, attention should be given to natural toxic products (flora and fauna).
21. BRIEF OF PROJECT AND OBJECTIVE:
 - a. Brief. This project deals with the isolation, proof of structure, and finally the synthesis of the toxic principle found in certain shellfish. Preliminary investigation of this toxic indicates that it has a low molecular weight.
 - b. Approach. The poison is isolated from the siphons of toxic clams by extraction with acidified alcohol and purified by means of ion exchange and chromatographic columns. The structure of the purified poison will be attacked by the application of the methods common to such a problem. After the structure has been proven, the synthesis of said structure and certain analogs will be attempted.
 - c. Subtasks. None
 - d. Other Information. The toxic clams used as a source of the poison are obtained in Alaskan waters.
 1. Basic Research. Laboratory research is required to determine the structure and synthesize said poison along with certain analogs thereof.

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4-08-03-015

2. Fund Estimate: Technical Operations

Specific Tasks:

A. 01 - \$1M - 1 Professional - 1 Non-professional

02 - 1M - Travel to contractors

08 - 2M - Expendable laboratory supplies.

B. 09 - 3M - Laboratory equipment

C. 07 - 30M - Contract for identification of toxin,
Mathieson (Squibb)

3. Remarks: This project will carry on that portion of Technical Project No. 4-61-14-004, Technical Objective BW-1, that falls within Research and Engineering Command responsibility.

e. Background. Shellfish poisons have been investigated at the Camp Detrick Biological Laboratories for about five years and, prior to that time, at the University of California and at Northwestern University. The interest in this poison is based on its possible synthesis for use as basis for a new BW agent. The poison has a molecular weight of 327; it is believed that it can be synthesized. It is more toxic than any other known poison of low molecular weight and, as the hydrochloride salt, is stable to boiling in water and to drying in air. It is stable in certain soft drinks, ordinary chlorinated drinking water, and coffee.

The purpose of the research on the poison is to obtain its structure and work out a method of synthesis. Purification was accomplished by the use of cation exchange resins Amberlite IRC-50 and XE-64 followed by chromatography on alumina. The purity of the product has been established and the LD determined to be 3 to 4 micrograms per kgm of body weight by intravenous injection into experimental animals. The quantity of purified poison available for study has been extremely small and has necessitated carrying out much of the work on structural determination on a micro scale, but considerable progress has already been made on chemical studies of the poison. The molecular formula is $C_9H_{16}N_6O_3Cl_2$. The compound is optically active and has only end absorption in the ultraviolet region, indicating the absence of aromatic or conjugated unsaturation. Infrared studies indicate the presence of amidic type groups and probably hydroxyl groups. Two titrable functions are present with pK_a values of 8.0 and 11.4. Acidic functions and carbonyl groupings are not present. The presence of at least one guanidine grouping in the molecule has been established and also the presence of an arrangement of atoms capable of giving β -alanine and glycine on alkaline hydrolysis.

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Both mussel and clam poisons have been found to take up one mole of hydrogen at atmospheric pressure and 30°C in the presence of platinum or palladium catalysts. The reduction proceeds with about the same facility in acid, neutral, or alkaline aqueous solutions and is accompanied by a loss of 97 to 98 percent of the toxicity. The original poison is not regenerated by any simple oxidative treatment. The dihydro compound differs in qualitative tests from the original poison in that it does not give positive reactions with the Jaffe or Pauly reagents. The optical rotation is about 85 percent as great as that of the non-reduced poison. When treated with periodate, the dihydro compound reacts with only one mole of the reagent, while the non-reduced poison reacts with three moles of the periodate under the same conditions. A study of the infrared spectra for deuterated and non-deuterated samples of the poison and of the dihydro poison suggest that most likely a $>C = N^-$ group has been reduced or a $>C-N<$ group has been reductively cleaved in the reaction.

$$\begin{array}{c} | \\ >C-N \\ | \\ OH \end{array}$$

It has been shown that the poison takes up one mole of oxygen upon treatment with dilute alkali at room temperature. The presence of oxygen is necessary for the production of the compound with characteristic absorption in the ultraviolet. No reducible unsaturation is produced upon treatment of the poison with mild alkali in an atmosphere of hydrogen. The product of mild alkaline oxidation, after the uptake of two moles of hydrogen by catalytic reduction for each mole of oxygen consumed in its production, cannot be reversibly oxidized to the original substance with characteristic absorption in the ultraviolet. The dihydro poison, upon mild alkaline treatment, also takes up one mole of oxygen. In this case, no characteristic ultraviolet absorption is produced.

One methoxyl group has been introduced into the poison molecule upon treatment with diazomethane. No N-methyl group was found in this product. The strong basic group (pK_a 11.4) present in the poison was lost in this reaction. This may have been a result of the alkaline conditions used for the methylation.

Dehydration of the poison to an aromatic-type compound with concentrated sulfuric or phosphoric acids has not been found possible without excessive destruction of the molecule.

Vigorous acid hydrolysis of the poison has been carried out under several sets of conditions to produce a mixture of products which give characteristic absorption in the ultraviolet region and positive reactions with Weber, Sakaguchi, ninhydrin and P-dimethylaminobenzaldehyde reagents.

The Weygand test for one-diols and 1,3-diketones is negative for the poison and for the dihydro poison.

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Work has been carried out (1) with the University of California, Northwestern University, University of Illinois, and the Squibb Institute for Medical Research (Mathieson Chemical Co.) on the isolation and determination of the chemical structure of the poison, (2) with the University of California and the US Department of the Interior on the collection of toxic shellfish, (3) with the Chemical Corps Medical Laboratories on the pharmacology of the poison, and (4) at Camp Detrick Biological Laboratories.

f. Future Plans

1. A program will be initiated to determine the structure of the shellfish poison.
2. The synthesis of compounds, based on the model shellfish poison structure, will be carried out.
3. A program will be initiated for the determination of the relationship between structure and physiological activity of compounds related structurally to the shellfish poison molecule.

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PROJECT DATA SHEET

1. PROJECT TITLE: Area GB Alarm (U)
2. SECURITY: SECRET
3. PROJECT NUMBER: 4-08-06-025
5. REPORT DATE: 14 May 54
6. BASIC FIELD OR SUBJECT: Chemical Warfare
7. SUBFIELD OR SUBJECT SUBGROUP: Detection
- 7a. TECHNICAL OBJECTIVE: CW-4a
8. COGNIZANT AGENCY: Chemical Corps
9. DIRECTING AGENCY: Cml C Research and Engineering Command
10. REQUESTING AGENCY: Chemical Corps
11. PARTICIPATION AND/OR COORDINATION: Army (AR)
12. CONTRACTOR AND/OR LABORATORY: Cml C Chemical and Radiological Laboratories
13. RELATED PROJECTS: 4-08-06-006 - 4-08-06-015
14. DATE APPROVED:
15. PRIORITY: 1A
17. ESTIMATED COMPLETION DATES: Research - 1955
Development - 1956
Testing - 1957
Operational Evaluation - 1958
18. FISCAL ESTIMATES: FY 55 \$150M
20. REQUIREMENT AND/OR JUSTIFICATION: Since G-agents are extremely toxic and give little or no sensory warning of their presence, automatic warning devices are required. Alarms being developed under Project 4-08-06-006 are all of the spot-sampling type which sound when an agent cloud encompasses the alarm. The LOPAIR alarm will scan a long path and detect the presence of agent which has not yet reached the alarm device.
21. BRIEF OF PROJECT AND OBJECTIVE:
 - a. Brief (End Item)

The objective is to develop an area scanning alarm operating over long paths, utilizing infrared principles. The following characteristics will be used as a guide in the development until formal military characteristics have been prepared:

 1. Shall automatically detect and give nearly instantaneous warning by visual (light) means and by a sound system (bell) of the presence of potentially dangerous concentrations of G agents in the area scanned.
 2. Shall be able to scan a total path length on the order of 1/2 to 5 miles or less when desired.
 3. Shall be free of interference from substances likely to be encountered in the field.

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a. Brief (End Item) (continued)

4. Shall not emit visible or near infrared radiation (under 3 microns) which would reveal its location during either day or night operations.
5. Shall be capable of continuous operation for a period of at least twelve (12) hours without attention.
6. Shall be as small, compact, and easily transportable as consistent with other requirements, and the electrical power drain shall be as low as possible.
7. Shall require a minimum of supervision and maintenance, and be capable of operation in the field by enlisted personnel with a minimum of special training, training equivalent to that of "walky-talky" operators.
8. Shall be sufficiently rugged to withstand normal field usage.
9. Shall be so constructed that it will be operable in the temperature range -40°F . to 125°F . The alarm shall be capable of operation at RH values of 10 to 100% in the operational temperature range noted above.
10. Prolonged storage in any climate shall not impair the operational efficiency of the alarm. (Engineering Test temperatures range from -80°F . to 165°F .) The alarm shall be tropicalized in accordance with JAN-T-152 specifications.
11. Shall operate from 24 volt D. C. power.

b. Approach

This project is being set up to develop the LOPAIR principle into a usable end item, the feasibility having been previously determined under Project 4-08-06-015. This alarm is to be developed initially for G agents but eventually it should be possible to adapt it to a variety of toxic agents, perhaps including BW. Current LOPAIR models are too large and complex for front-line use. Initial emphasis will be to produce a prototype small and light enough for such use.

c. Subtasks. None

d. Other Information. None

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PROJECT DATA SHEET

1. PROJECT TITLE: Area GB Alarm (U)
2. SECURITY: SECRET
3. PROJECT NUMBER: 4-08-06-025
5. REPORT DATE: 14 May 54
6. BASIC FIELD OR SUBJECT: Chemical Warfare
7. SUBFIELD OR SUBJECT SUBGROUP: Detection
- 7a. TECHNICAL OBJECTIVE: CW-4a
8. COGNIZANT AGENCY: Chemical Corps
9. DIRECTING AGENCY: Cml C Research and Engineering Command
10. REQUESTING AGENCY: Chemical Corps
11. PARTICIPATION AND/OR COORDINATION: Army (AR)
12. CONTRACTOR AND/OR LABORATORY: Cml C Chemical and Radiological Laboratories
13. RELATED PROJECTS: 4-08-06-006 - 4-08-06-015
14. DATE APPROVED:
15. PRIORITY: 1A
17. ESTIMATED COMPLETION DATES: Research - 1955
Development - 1956
Testing - 1957
Operational Evaluation - 1958
18. FISCAL ESTIMATES: FY 55 \$150M
20. REQUIREMENT AND/OR JUSTIFICATION: Since G-agents are extremely toxic and give little or no sensory warning of their presence, automatic warning devices are required. Alarms being developed under Project 4-08-06-006 are all of the spot-sampling type which sound when an agent cloud encompasses the alarm. The LOPAIR alarm will scan a long path and detect the presence of agent which has not yet reached the alarm device.
21. BRIEF OF PROJECT AND OBJECTIVE:
 - a. Brief (End Item)

The objective is to develop an area scanning alarm operating over long paths, utilizing infrared principles. The following characteristics will be used as a guide in the development until formal military characteristics have been prepared.

 1. Shall automatically detect and give nearly instantaneous warning, by visual (light) means and by a sound system (bell) of the presence of potentially dangerous concentrations of G agents in the area scanned.
 2. Shall be able to scan a total path length on the order of 1/2 to 5 miles or less when desired.
 3. Shall be free of interference from substances likely to be encountered in the field.

~~CONFIDENTIAL~~a. Brief (End Item) (continued)

4. Shall not emit visible or near infrared radiation (under 3 microns) which would reveal its location during either day or night operations.

5. Shall be capable of continuous operation for a period of at least twelve (12) hours without attention.

6. Shall be as small, compact, and easily transportable as consistent with other requirements, and the electrical power drain shall be as low as possible.

7. Shall require a minimum of supervision and maintenance, and be capable of operation in the field by enlisted personnel with a minimum of special training, training equivalent to that of "walky-talky" operators.

8. Shall be sufficiently rugged to withstand normal field usage.

9. Shall be so constructed that it will be operable in the temperature range -40°F. to 125°F. The alarm shall be capable of operation at RH values of 10 to 100% in the operational temperature range noted above.

10. Prolonged storage in any climate shall not impair the operational efficiency of the alarm. (Engineering Test temperatures range from -80°F. to 165°F.) The alarm shall be tropicalized in accordance with JAW-T-152 specifications.

11. Shall operate from 24 volt D. C. power.

b. Approach

This project is being set up to develop the LOPAIR principle into a usable end item, the feasibility having been previously determined under Project 4-08-06-015. This alarm is to be developed initially for G agents but eventually it should be possible to adapt it to a variety of toxic agents, perhaps including BW. Current LOPAIR models are too large and complex for front-line use. Initial emphasis will be to produce a prototype small and light enough for such use.

c. Subtasks. None

d. Other Information. None

4-08-06-025

~~SECRET~~~~CONFIDENTIAL~~Background

The name LOPAIR has been coined to indicate the long-path infrared detection system in which the atmosphere itself is scanned rather than a sample in an absorption cell.

Work on the LOPAIR system is currently being stressed because it is potentially superior to spot-sampling systems in that large areas can be scanned at one time, and the system is potentially applicable to all G agents and possibly other CW agents, and BW agents. Field tests have been run at Carroll's Island with GB munitions, and detection has been made as the agent cloud passed through the infrared beam. Semiquantitative data obtained in these tests indicated that a path of less than 300 ft. would permit a detection of less than 0.1 mmg. GB/l. of air. Subsequent determinations of the GB vapor absorption coefficient by specially devised techniques yielded results which indicated that a path length of 200 to 225 feet would give an attenuation of 1% at the detecting wave length for 0.1 mmg. GB/l.

It has also been demonstrated with the modified laboratory spectrometer now being used as a LOPAIR instrument that operation over path lengths of at least 1,000 ft. should be possible. Improved instrumentation now being developed should permit even greater paths where topography and other conditions allow.

Work is also continuing on the development of more efficient optics and filters. Recent developments in these fields may make possible considerable reductions in size and complexity of the equipment, as well as increasing the ease of using this system for the almost simultaneous detection of other CW agents. Extensive studies have been made of possible interferences to be encountered in highly industrialized areas as well as in the field, where smokes and fumes are likely to be encountered. To date, no interferences have been found which should affect a bichromator system.

The Armour Research Foundation (contract DA18-108-CML-4320) constructed an instrument similar to that made at CRL. Interference studies were run in the Chicago area, and none were encountered. A new-type infrared source was developed, utilizing a rugged ceramic radiant, fueled by either gasoline or propane. A small, 2-1/2-lb. propane cylinder can operate the source for approximately 25 hours. Armour is continuing this work under contract DA18-108-CML-5065 and is engaged in converting their study instrument to a bichromator or two-wave length comparison instrument in order to prevent false alarms from objects intercepting the beam path and attenuation of the beam by dust and smoke, etc.

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The Farrand Optical Company (contract DA18-108-CML-4819) is developing a small, portable LOPAIR unit for field use. This instrument will utilize a trichromator (three-wave-length comparison) principle for increased sensitivity and stability. This unit is now being assembled, and delivery is scheduled in the near future.

f. Future Plans

1. Development of improved optics for collecting radiation from distant sources.
2. Investigation of narrow-band interference filters to replace prism or grating.
3. Continue tests to determine effect of fog, rain, smoke, and other atmospheric materials on the system.
4. Test prototype alarm when received from Farrand Optical Company.
5. Investigate and prepare a miniaturized prototype to meet stated requirements.

g. References: None

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GL3

Project Data Sheet

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1. PROJECT TITLE: CW Field Testing & Technology, DPG (U)
2. SECURITY CLASSIFICATION: Secret
3. PROJECT NUMBER: 4-98-05-026
5. REPORT DATE: 14 May 54
6. BASIC FIELD OR SUBJECT: Special Tests & Operational Evaluation
7. SUB FIELD OR SUBJECT: Field (Met)
- 7a. TECHNICAL OBJECTIVE: CW-3 (CW-4b - IO-14)
8. COGNIZANT AGENCY: Cml C
9. DIRECTING AGENCY: Cml C R&E Comd, A Cml C, Md.
10. REQUESTING AGENCY: Cml C
11. PARTICIPATION AND/OR COORDINATION: (AR) Army, USAF, Sig C (C)
12. CONTRACTOR AND/OR LABORATORY: Dugway Proving Ground
13. RELATED PROJECTS:
14. DATE APPROVED:
15. PRIORITY: 1-B
17. ESTIMATED COMPLETION DATES: Res -
Dev -
Test - Cont
Op Eval -
18. FY FISCAL ESTIMATES: 55 - 1800M
19. SUPERSEDED PROJECTS: 4-98-05-021, 4-98-05-022 and 4-36-07-001.

20. REQUIREMENT AND/OR JUSTIFICATION: This project is needed to determine the field characteristics of CW munitions and agents as to functioning, aimability, agent concentration, and ground coverage, and the suitability of Chemical Corps items of materiel for detection, protection, and decontamination under field conditions. In addition, this project is necessary to develop and maintain a physical and technological capability to support the development program as required to accomplish field testing as outlined above. This capability of necessity includes suitable methods and techniques for the measurement and forecasting of atmospheric factors affecting the evaluation of field tests of CBR agents.

21. BRIEF OF PROJECT AND OBJECTIVE:

a. Brief. (Applied Research) The purpose of this project is to develop and improve techniques, methods and instrumentation essential to field evaluation of Chemical Corps materiel utilized in chemical warfare. Determine in the field such characteristics of CW munitions and agents as functioning, aimability, agent concentrations and ground coverage as well as suitability of items for detection, protection and decontamination. Also methods and techniques for the measurement and forecasting of atmospheric factors affecting the evaluation of field tests of chemical, biological and radiological agents will be provided.

b. Approach. Tests will be made on one or more of each munition filled with either a simulant or a CW agent fired statically or dynamically. CW agents will be studied in test chambers and in the field using sampling devices and test animals. Sampling devices will be

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used in field grids to determine agent concentration, cloud travel, persistency, and dosage areas for various time intervals. An estimate of the agent's probable effect on man will be determined by the use of test animals on field grids. Individual items of CW materiel used in detection, protection, and decontamination of CW agents will be tested according to military characteristics and operational requirements.

A continuous critical evaluation of present techniques, methods and equipment utilized in CW field testing will be made. Based upon this evaluation, necessary steps will be taken to increase the reliability which can be assigned to test results. Action will also be taken to develop and procure suitable instrumentation applicable to field sampling, laboratory analysis, and data collection and processing.

Methods will be developed for forecasting relevant atmospheric factors in relation to scheduled field tests. Initial investigation will be confined to DPG until the need for additional test sites, such as tropical and/or arctic sites, is indicated; investigation may then be extended to these other sites. Data from a network of surface wind vector stations, together with detailed temperature, humidity, pressure and wind vector profiles, up to intermediate atmospheric layers, will be gathered and compared with the concurrent synoptic situations to determine the existence of systematic relationships between the values of the various parameters. Current methods for utilization of the meteorological factors in the evaluation of field tests will be investigated to determine their validity and limitations.

c. Subtasks.

- (1) Development of improved devices for collecting CW vapors and aerosols.
- (2) Development of improved analytical techniques and methods.
- (3) Synthesis and purification of compounds necessary for use in field test program which are not available from other sources.
- (4) Development of improved methods for biological assay of CW agents.
- (5) Laboratory study of kinetics of reaction between agents and decontaminants.
- (6) Analysis of CW agents and mixtures of agents.
- (7) Measurement of physical properties of compounds and mixtures used in field test program.
- (8) Field test support, including instrumentation methods, and additional items for telemetering network.

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(9) Research on the effect of meteorological parameters and physical factors involved in the prediction of agent cloud travel and diffusion.

d. Other Information: None.

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Establishment of Four (4) Secret Projects in the Cml C FY 55 Program
and Termination of Three (3) Consolidated Projects

Concurrence Signatures

/s/J.C.Bones, LtCol, USAF AFDFR, A Cml C, Md.	/s/T.E.Hedman Signal Corps	/s/Dr.B.Berger Asst/RW&NTM, R&E Comd
/s/L.W.Cather, Col, GS R&D Sec, OCAFF	/s/F.A.Abruscato Ind Div, Mat Comd	/s/H.E.Staples, LtCol, RCE Canadian Army Staff
/s/S.E.Baker, LtCol, CmlC PT&I Div, OCCmLO	/s/J.F.Schaeffer Chemical Corps Board	/s/H.S.Etter, Cmdr, MC, USN BuMed&Surg, Navy Dept
/s/E.L.Claussen Corps of Engineers	/s/J.M.Davidson BuShips, Navy Dept	/s/S.J.Curtis BJSM (Air)
/s/I.R.Mollen, LtCol, CmlC P&E O, R&E Comd	/s/D.L.Irgens, Cmdr, USN BuAero, Navy Dept	/s/V.F.LaPiana, LtCol, CmlC R&D Div, OCCmLO
/s/C.M.Bartlett, Maj, CmlC Inspec Div, Mat Comd	/s/F.V.Ludden Ordnance Corps	/s/Dr.R.L.Fox Asst Ch/TCW, R&E Comd
/s/R.C.Morris, LtCol, CmlC Sup Div, Mat Comd	/s/L.T.Fleming Transportation Corps	/s/J.J.Hayes, Col, CmlC ACCmLO/EW
/s/Leo Walsh Mat Div, OCCmLO	/s/J.B.S.Hamilton, LtCol BAS, ADW&T (RE & SW)	/s/J.C.Braxton, LtCol, CmlC Ln O, CmlC Tng Comd
/s/G.E.Ferguson, Maj, USMC Hq, USMC	/s/Richard Raymond Quartermaster Corps	/s/Dr.L.D.Fothergill Scientific Adviser/BW Cp Detrick, Md.

/s/C.M.Fraudendorf, LtCol, Inf
AFF Ln O, A Cml C, Md.

ACCEPTED BY THE CHEMICAL CORPS
TECHNICAL COMMITTEE, 29 July 1954:

/s/T. S. ECKERT
Secy, CCTC

APPROVED FOR THE CHIEF CHEMICAL
OFFICER, 29 July 1954:

/s/WILLIAM E. R. SULLIVAN
Colonel, CmlC
Chairman, CCTC

APPROVED BY ORDER OF THE SECRETARY
OF THE ARMY, 29 July 1954:

/s/DONALD H. BEHRENS, Major, GS
ACofS, G-4

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DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF CHEMICAL OFFICER
Chemical Corps Technical Committee
Army Chemical Center, Maryland

TSE/5190/ih
28 May 1954

CMLWH

SUBJECT: Military Characteristics for Air Force BW and CW Detection Systems

TO: Chairman, Chemical Corps Technical Committee

1. References:

- a. CCTC Item 2224 (S), Military Requirements and Characteristics for Air Force Defense Materiel, 11 Jan 1951.
- b. Ltr(S), WCLEI-4 WADC, 18 Aug 1953, Air Force Requirements for BW and CW Detection Systems, to CG, Cml C R&E Comd, w/4 Incls.
- c. Ltr(C), CMLRE-CWD-3 R&E Comd, 21 Apr 1954, Air Force Requirements for BW and CW Detection Systems, to Secy, CCTC.

2. Discussion:

a. Reference a. identifies approved action of this Committee which established military requirements for four (4) items peculiar to the Air Force with approval of military characteristics applicable to each. One of these requirements was for a "Rapid Detection Device for Airborne Toxic Agents" for which the following statement of characteristics was approved:

"PURPOSE: To provide sufficient warning of the appearance of toxic (CW and BW) agents to permit activation of protective measures before wide spread of exposure of personnel occurs."

- "PERFORMANCE:
1. The device shall be capable of continuous and automatic operation to provide warning of the appearance of effective concentrations of CW and BW agents.
 2. The device shall be capable of detecting the appearance of all CW and BW agents

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- regardless of the physical state of the agent.
3. The device shall be capable of discriminating between CW or BW agents and non-toxic or nonpathogenic materials.
 4. The device shall be suitable for storage and employment within the temperature range of plus 160°F and minus 65°F.
 5. The device of supplementary equipment should be capable of determining the specific agent detected to enable preparation for intelligent activation of suppressive and therapeutic measures."

"TACTICAL DESIGN FEATURES:

1. The device shall be mobile, capable of air transportation, and airborne operations.
2. The device shall be self-contained with respect to operational power."

b. In connection with the Air Force requirements for detection of BW and CW agents reference b. stated that the USAF had operational requirements for four (4) systems; namely, (1) Sampling System for Detection of BW Agents within the Aircraft, (2) Rapid Detection System for BW Agents at Air Installation, (3) Rapid Detection System for Toxic CW Agents in Operating Aircraft, and (4) Rapid Detection System for Toxic CW Agents at Air Installations, for which applicable military characteristics Nos. 325, 324, 328 and 327 were transmitted. These are reproduced and inclosed herewith. In connection with these requirements, reference b. requested the Cml C R&E Command to undertake work specified in three (3) Cross-Servicing Orders based upon Military Characteristics Nos. 325 and 328. Reference b. further noted informal agreements with Chemical Corps personnel to the effect that the Chemical Corps would assume responsibility for funding and development of BW and CW detection systems in accordance with assignment of primary cognizance. In view of these agreements and assignments therefor, it was requested that the Cml C R&E Command develop (1) a rapid detection system for BW agents at air installations and (2) a rapid detection system for toxic CW agents at air installations, and subsequently, to supply to the Air Force at the earliest practicable date two (2) interim models of each system and ultimately two (2) fully engineered prototypes of each designed in accordance with the applicable USAF characteristics Nos. 325 and 328 noted above. Target dates of June 1954 and December 1953 were established, respectively, for the availability of this equipment. Chemical Corps work on development to meet these requirements is being conducted under projects 4-08-06-015, Detection Methods and Materials for Toxic Agents, and 4-11-05-011,

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Procedures and Equipment for Rapid Detection of BW Agents.

c. Reference c. indicates the Cml C R&E Command review of the correspondence of reference b. wherein it is pointed out that the military characteristics reproduced in paragraph a. above were superseded by Air Force characteristics No. 327 and the parallel characteristics for BW detection; namely, No. 324 and 325. In addition, it was noted that the Air Force considers that the Army detection devices will fulfill the requirements for Air Force characteristic No. 327. Since the Army has no requirements for an installation alarm, it was considered that the field alarm being developed under project 4-08-06-006 would fulfill this need. Since there is nothing unduly restrictive in Air Force characteristic No. 327, prototypes developed under project 4-08-06-006 are expected to satisfy Air Force needs. It was also noted that Air Force characteristic No. 328 should be substituted for those approved by reference a. and reproduced in paragraph a. above and further identified as Air Force characteristic No. 173, in developing alarms for operating aircraft. In accordance with the terms of the Cross-Servicing Order (33-616) 53-20, priority would be given to GB alarms. Sensor elements of the present prototypes are expected to provide warning elements of the systems to be incorporated into aircraft by WADC. Reference c. noted further that the applicable military characteristics had been forwarded to CRL for guidance of work being carried out under projects 4-08-06-006 and 4-08-06-015. As a consequence, reference c. requested appropriate approval action by this Committee noting that the characteristics approved originally by reference a. were now considered obsolete.

d. The foregoing discussion briefly reviews Air Force requirements for BW and CW detection systems and notes that applicable characteristics previously approved have been superseded by publication of more detailed Air Force characteristics reproduced and inclosed herewith. Appropriate approval action on these new characteristics and supersession of the older list are noted below.

3. Recommendations:

It is recommended that:

a. The Air Force military characteristics inclosed herewith and identified as follows be approved:

- (1) Rapid Detection System for Airborne BW Agents at Air Force Installations (No. 324)
- (2) Sampling System for Detection of BW Agents in Operating Aircraft (No. 325)
- (3) Rapid Detection System for Toxic Airborne CW Agents at Air Force Installations (No. 327)
- (4) Rapid Detection System for Toxic CW Agents in Operating Aircraft (No. 328)

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- b. The military characteristics reproduced in paragraph 2.a. above be considered superseded by those of Inclosure 4 (No. 328).
- c. The military characteristics of Inclosure 1 and 2 be considered applicable to the work of Project 4-11-05-011, Procedures and Equipment for Rapid Detection of BW Agents.
- d. The characteristics of Inclosures 3 and 4 be considered applicable to the work of Project 4-08-06-015, Detection Methods and Materials for Toxic Agents.

4 Incls

1-AF MC 324
2-AF MC 325
3-AF MC 327
4-AF MC 328

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
DIRECTORATE OF REQUIREMENTS, DCS/D

M. C. No. 324
AFDRQ No. CSE-53-S4
DATE 3 February 1953

MILITARY CHARACTERISTICS FOR
RAPID DETECTION SYSTEM FOR AIRBORNE BW AGENTS
AT AIR FORCE INSTALLATIONS

(This Military Characteristic supersedes M. C. No. 173, "Rapid Detection Device for Airborne Toxic Agents", 27 November 1950.)

1. Mission

This requirement is for a technical development which it is anticipated will have application to Supporting Service activities for passive defenses.

2. Objective

To provide a means for rapid detection of hazardous concentrations of airborne anti-personnel biological warfare agents around and within the boundaries of utilized areas at Air Force installations.

3. Evaluation of Intelligence Factors

A survey of current intelligence establishes the capability of the enemy to wage biological warfare against the United States.

4. Proposed Service Employment

To be used around and within the boundaries of utilized areas at an Air Force installation. This system to be used in conjunction with an effective warning not using existing facilities and equipment so far as possible.

5. Availability Date

Systems capable of detecting existing BW agents should be available at the earliest possible date. The availability of suitable systems for detecting new BW agents should be in consonance with intelligence information that these agents are available to prospective enemy nations.

6. Pertinent Statements Relating To

a. Cost. Lowest possible consistent with providing a suitable capability.

b. Personnel Involved and Skills Required. Skills beyond the level of average Air Force personnel must not be required.

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c. Specialized Support Equipment. An efficient system for warning which may be used in conjunction with the detector is required.

d. Proposed Basis of Issue. One unit or system which can effectively complete the requirement in paragraph 2 to each Air Force installation.

7. Agreed values

a. The system will be capable of continuous and unattended operation to provide detection of the presence of hazardous concentration of airborne anti-personnel BW agents.

b. Inasmuch as is feasible, specific identification should be included but only if this requirement will not alter or detail development of a system capable of detecting a BW hazard regardless of its identity. An ability to determine the identity of the agent at the time of detection is desirable since it will aid in the rapid activation of specific protective and therapeutic measures.

c. Be compact of minimum weight and be air transportable.

d. Be capable of withstanding temperatures within the range of plus 160°F to - 65°F, however, actual detection range will be governed by the effective pathological range of the agents.

e. Be capable of withstanding and operating under conditions of moisture likely to be encountered at any USAF installation.

f. Be sufficiently rapid in detecting ability to enable enactment of warning and protective measures prior to any marked increase in the airborne BW hazard.

g. If requiring power, be capable of continuously effective operation with minimum power requirements. Have inherent qualities to allow for the employment of existing emergency power systems.

h. System shall be such that conditions at any point on the Air Force installation will be indicated at that point and communicated to a central location utilizing existing base communication nets and alarm systems to the maximum extent.

8. This Military Characteristic is related to the following Military Characteristics. Complementary employment of equipment derived is desirable. MC 325, "Sampling System for Detection of BW Agents in Operating Aircraft"; MC 327, "Rapid Detection System for Toxic Airborne CW Agents at Air Force Installations"; MC 328, "Rapid Detection System for Toxic CW Agents in Operating Aircraft".

/s/ Lewis L. Mundell
/t/ LEWIS L. MUNDELL
Colonel, USAF
Deputy Director of Requirements

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
DIRECTORATE OF REQUIREMENTS, DCS/D

M. C. No. 325
AFDRQ No. CSE-53-S5
DATE 3 February 1953

MILITARY CHARACTERISTICS FOR
SAMPLING SYSTEM FOR DETECTION OF BW AGENTS
IN OPERATING AIRCRAFT

1. Mission

This requirement is for a technical development which it is anticipated will have application to Strategic Air, Tactical Air and Air Transport systems. No specific weapon system or supporting system is applicable at this time.

2. Objective

To provide a system of sampling for BW agents within an aircraft to enable subsequent effective identification.

3. Availability Date

The availability of the system should be in consonance with the delivery date of BW agents and Agent-munition combination.

4. Proposed Service Employment

This sampling system will be employed within aircraft operating with a potential BW hazard aboard. The samples taken will be processed in order to determine whether or not individuals within the aircraft were exposed to the BW hazard.

5. Pertinent Statements Relating To

- a. Cost. Lowest possible consistent with a suitable capability.
- b. Personnel Involved and Skills Required. Skills beyond the level of the average Air Force crew personnel must not be required.
- c. Specialized Support Equipment. A laboratory sufficiently equipped to process the samples is required.
- d. Proposed Basis of Issue. One sampling system for each aircraft engaged in combat operation or operational support where biological agents and/or munitions will be carried. (Ref. para. 3)

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e. Requirements for New Organizations. Not applicable.

6. Agreed Values

a. The equipment must be capable of continuous and unattended air sampling for BW agents in all compartments accessible to crew members within the aircraft.

b. Be capable of withstanding temperature ranges of plus 160°F to minus 65°F as well as humidity and pressure ranges likely to be encountered in aircraft operation. However, actual sampling range would be governed by the effective pathological range of the agents.

c. Be designed for compatibility with the laboratory facility.

d. Be of minimum weight and occupy minimum space.

e. The samplers be easily installed and removed from the aircraft by unskilled personnel.

f. Be easily maintained in the field.

7. This Military Characteristic is related to the following Military Characteristics. Complementary employment of equipments derived is desirable. MC 327, "Rapid Detection System for Toxic Airborne CW Agents at Air Force Installations"; MC 324, "Rapid Detection Systems for Airborne CW Agents at Air Force Installations"; MC 328, "Rapid Detection System for Toxic CW Agents in Operating Aircraft".

/s/ Lewis L. Mundell
/t/ LEWIS L. MUNDELL
Colonel, USAF
Deputy Director of Requirements

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
DIRECTORATE OF REQUIREMENTS, DCS/D.

M. C. No. 327
AFDRQ No. CSE-53-S6
DATE 3 February 1953

MILITARY CHARACTERISTICS FOR
RAPID DETECTION SYSTEM FOR TOXIC AIRBORNE CW AGENTS
AT AIR FORCE INSTALLATIONS

(This Military Characteristic supersedes M. C. No. 173, "Rapid Detection Device for Airborne Toxic Agents," 27 November 1950.)

1. Mission

This requirement is for a technical development which it is anticipated will have application to Supporting Service activities for passive defense programs.

2. Objective

To provide a means of rapid detection of hazardous concentrations of toxic airborne chemical warfare agents around and within the boundaries of utilized areas at an Air Force installation.

3. Evaluation of Intelligence Factors

A survey of current intelligence establishes the capability of the enemy to wage chemical warfare against the United States.

4. Proposed Service Employment

To be used around and within the boundaries of utilized areas at an Air Force installation. This system to be used in conjunction with an effective warning not using existing facilities and equipment so far as possible.

5. Availability Date

Systems capable of detecting existing CW agents should be available at the earliest possible date. The availability of suitable systems for detecting new BW agents should be in consonance with intelligence information that these agents are available to prospective enemy nations.

6. Pertinent Statements Relating To

a. Cost. Lowest possible consistent with providing a suitable capability.

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b. Personnel Involved and Skills Required. This system should require no manual manipulation for its detection function. Skills beyond the level of average Air Force personnel must not be required.

c. Specialized Support Equipment. An efficient system for warning which may be used in conjunction with the detector is required.

d. Proposed Basis of Issue. One unit or system per Air Force installation which can effectively complete the requirement in paragraph 2 to each Air Force installation.

7. Agreed Values

a. Capable of continuous and unattended operation to provide detection of the presence of hazardous concentrations of toxic airborne CW agents.

b. Inasmuch as is feasible, specific identification should be included but only if this requirement will not alter or detain development of a system capable of detecting a CW hazard regardless of its identity. An ability to determine the identity of the agent at the time of detection is desirable since it will aid in the rapid activation of specific protective and therapeutic measures.

c. Be compact of minimum weight and be air transportable.

d. Be capable of withstanding temperatures within the range of plus 160°F to minus 65°F, however, actual detection range would be governed by the effective toxic range of the agents.

e. Be capable of withstanding and operating under conditions of moisture likely to be encountered during contemplated employment.

f. Be sufficiently rapid in detecting ability to enable enactment of warning and protective measures prior to any marked increase in the airborne CW hazard.

g. If requiring power, be capable of continuously effective operation with minimum power requirements. Have inherent qualities to allow for the employment of existing emergency power systems.

h. System shall be such that conditions at any point on the Air Force installation will be indicated at that point and may be communicated to a central point, utilizing existing base communication nets or alarm systems.

8. This Military Characteristic is related to the following Military Characteristics. Complementary employment of equipment derived is

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desirable. MC 325, "Sampling System for Detection of BW agents in Operating Aircraft"; MC 324, "Rapid Detection System for Airborne BW Agents at Air Force Installations"; MC 328, "Rapid Detection Systems for Toxic CW Agents in Operating Aircraft".

/s/ Lewis L. Mundell
/t/ LEWIS L. MUNDELL
Colonel, USAF
Deputy Director of Requirements

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, UNITED STATES AIR FORCE
DIRECTORATE OF REQUIREMENTS, DCS/D

M. C. No. 328
AFDRQ No. CSE-53-S7
DATE 3 February 1953

MILITARY CHARACTERISTICS FOR
RAPID DETECTION SYSTEM FOR TOXIC CW AGENTS
IN OPERATING AIRCRAFT

(This Military Characteristic supersedes M. C. No. 173, "Rapid Detection Device for Airborne Toxic Agents, 27 November 1950.)

1. Mission

This requirement is for a technical development which it is anticipated will have application to Strategic Air, Tactical Air and Air Transport systems. No specific weapons system or supporting system is applicable at this time.

2. Objective

To provide a means for rapid detection of leaking toxic chemical munitions or containers that create a concentration hazardous to occupants of the transporting aircraft.

3. Proposed Service Employment

To be used in aircraft engaged in delivering or transporting filled toxic chemical munitions or bulk toxic chemical agents.

4. Background and/or Related Information

The principles involved in "G" detection and color change detection devices may be considered.

5. Availability Date

Systems capable of detecting existing CW agents should be available at the earliest possible date. The availability of suitable systems for detecting new CW agents should be in consonance with the appearance of those agents.

6. Pertinent Statements Relating to

a. Cost. Lowest possible consistent with providing a suitable capability.

b. Personnel Involved and Skills Required. Skills beyond the level of average Air Force crew personnel must not be required.

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c. Specialized Support Equipment. Not Applicable.

d. Proposed Basis of Issue. Issue one unit or system per aircraft engaged in transporting toxic chemical warfare munitions or toxic chemical warfare bulk agents.

7. Agreed Values

a. The system to be capable of continuous and unattended operation to provide detection and warning of the presence of hazardous concentrations of the toxic chemical warfare agent or agents being transported.

b. Capable of providing warning to all compartments within the aircraft accessible to crew member.

c. Capable of withstanding temperature range of plus 160°F to minus 65°F as well as humidity and pressure ranges likely to be encountered in aircraft operation. However, actual detection and warning range would be governed by the effective toxic range of the agents.

d. Be of minimum weight and occupy minimum space.

e. Be easily maintained, installed and removed by field personnel.

8. This Military Characteristic is related to the following Military Characteristics. Complementary employment of equipment derived is desirable. M. C. 324, "Rapid Detection System for Airborne BW Agents at Air Force Installations"; M. C. 325, "Sampling System for Detection of BW Agents in Operating Aircraft"; M. C. 327, "Rapid Detection System for Toxic Airborne CW Agents at Air Force Installations".

/s/ Lewis L. Mundell
/t/ LEWIS L. MUNDELL
Colonel, USAF
Deputy Director of Requirements

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Item 2873

Military Characteristics for Air Force BW and CW Detection Systems

Concurrence Signatures

/s/J.C.Bones, LtCol, USAF AFDFR, A Cml C, Md.	/s/T.E.Hedman Signal Corps	/s/Dr.B.Berger Asst/RW&NTM, R&E Comd
/s/L.W.Cather, Col, GS R&D Sec, OCAFF	/s/F.A.Abruscato Ind Div, Mat Comd	/s/W.P.Swain BuOrd, Navy Dept
/s/S.E.Baker, LtCol, CmlC PT&I Div, OCCmLO	/s/J.F.Schaeffer Chemical Corps Board	/s/H.S.Etter, Cmdr, MC, USN BuMed&Surg, Navy Dept
/s/E.L.Claussen Corps of Engineers	/s/J.M.Davidson BuShips, Navy Dept	/s/S.J.Curtis BJSM (Air)
/s/I.R.Mollen, LtCol, CmlC P&E O, R&E Comd	/s/D.L.Irgens, Cmdr, USN BuAero, Navy Dept	/s/V.F.LaPiana, LtCol, CmlC R&D Div, OCCmLO
/s/C.M.Bartlett, Maj, CmlC Inspecc Div, Mat Comd	/s/F.V.Ludden Ordnance Corps	/s/Dr.R.L.Fox Asst Ch/TCW, R&E Comd
/s/R.C.Morris, LtCol, CmlC Sup Div, Mat Comd	/s/L.T.Fleming Transportation Corps	/s/J.J.Hayes, Col, CmlC ACCmLO/BW
/s/Leo Walsh Mat Dov, OCCmLO	/s/J.B.S.Hamilton, LtCol BAS, ADW&T (RE & SW)	/s/J.C.Braxton, LtCol, CmlC Ln O, CmlC Tng Comd
/s/G.E.Ferguson, Maj, USMC Hq, USMC	/s/Richard Raymond Quartermaster Corps	/s/Dr.L.D.Fothergill Scientific Adviser/BW Cp Detrick, Md.

/s/C.M.Freudendorf, LtCol, Inf
AFF Ln O, A Cml C, Md.

ACCEPTED BY THE CHEMICAL CORPS
TECHNICAL COMMITTEE, 29 July 1954:

/s/T. S. ECKERT
Secy, CCTC

APPROVED FOR THE CHIEF CHEMICAL
OFFICER, 29 July 1954:

/s/WILLIAM E. R. SULLIVAN
Colonel, CmlC
Chairman, CCTC

APPROVED BY ORDER OF THE SECRETARY
OF THE ARMY, 29 July 1954:

/s/DONALD H. BEHRENS, Major, GS
ACofS, G-4

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(Revised)
Report "R"
Copy No. _____
(41 Pages)

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF CHEMICAL OFFICER
Chemical Corps Technical Committee
Army Chemical Center, Maryland

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TSE/5190/amf
11 June 1954

CMLWH

SUBJECT: Chemical Corps BW Program for FY 55

TO: Chairman, Chemical Corps Technical Committee

1. References:

- a. CCTC Items 2703 & 2730 (S/RD), Chemical Corps R&D Program for FY 54, approved 11 Sep 1953.
- b. CCTC Item 2810 (S), Security Classification Review of Chemical Corps R&D Projects, 8 Apr 1954.
- c. Progress Report (S), Chemical Corps R&D BW Projects, 31 Dec 1953.
- d. SR 705-5-1, Research and Development, Type Classification, and Modification of Materiel, 10 Feb 1954.
- e. SR 705-20-1, Priorities for Research and Development Projects, 14 May 1952.
- f. Ltr (S), CMLCD-5, Cg Detrick, Md., 9 June 1954, Proposed Consolidation of BW Research and Development Projects, to Secy, CCTC, w/21 Incls.

2. Discussion:

a. Reference a. identifies action of this Committee that reviewed the complete Chemical Corps project program for FY 54 which was approved with a total of 195 projects continued or established in accordance with applicable regulations and directives. The security classification of these projects was recently reviewed as recorded in reference b. in order to meet Staff requirements originating with changes in security procedures and elimination of the Restricted category as directed by D/A Circular 127, 23 Dec 1953. Of all projects in the Chemical Corps FY 54 program, 60 are assigned primary technical objectives in the BW area. Two of these projects were terminated by action of CCTC Item 2768, 17 Dec 53, and work on five (5) others, namely, 4-04-14-010, 4-16-16-005, -005, -006, and -007, which are concerned with cluster adapters and war-

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heads, is done at Army Chemical Center, Maryland, and is reported with the R&E Command section of the program. As the result, fifty-three (53) projects are now active at Camp Detrick under the direct supervision of the ACCmLO/BW and constitute Cml C Program 7B. All R&D projects in the CW and RW fields are included in Program 7A which is assigned to the R&E Command at Army Chemical Center, Maryland. Reference c. identifies the latest cumulative annual progress report on the BW projects of Program 7B.

b. Reference d. is the basic regulation governing establishment of R&D projects in which paragraph 14. directs that timely and periodic review of these programs should be conducted by the Technical Committees to assure conformity with the over-all Army R&D guidance and to eliminate any unproductive or duplicating activities. Similarly, reference e. identifies the basic regulation governing the assignment of priorities for R&D projects and directs that these be reviewed semi-annually. In consonance with these regulations, this Corps has reviewed its R&D projects annually in order to insure a completely integrated program fulfilling Chemical Corps responsibilities in the CER area. With division of the over-all R&D effort into Programs 7A and 7B as noted above, this review is now conducted separately for the CW-RW work (7A) apart from the subject BW program (7B). Projects in Program 7A are to be considered in other actions before this Committee, consequently, it is the purpose of this paper to cover only those in the BW area under Program 7B.

c. In connection with the review of the subject program, reference f. indicated that this had been done and that major emphasis had been given to reduction of the number of projects for FY 55 in order to improve the management thereof and, in consonance with informal Staff guidance, to eliminate projects of small dollar-wise proportions and at the same time assure consolidated projects with precise titles that preclude duplication. As a result, reference f. proposed reduction of the currently approved BW projects to a total of twenty-two (22) of which twelve (12) are new projects resulting from consolidations, and ten (10) are continued from the current fiscal year. Of the ten (10) continued projects, six (6) are re-numbered for security reasons. Proposed action on the 53 existing BW projects with deletions and additions thereto is indicated in the FY 54-55 BW Program Summary identified as Inclosure 1 herewith. Project Data Sheets for the twelve (12) new projects prepared by Camp Detrick are also inclosed and incorporate all essential data thereon in conformance with the requirements of reference d. Appropriate recommendations to approve the subject program are noted below.

3. Recommendations:

It is recommended that:

- a. The 43 projects marked (#) and listed in Inclosure 1 for cancellation be terminated for the reason indicated and not included in the Cml C FY 55 BW Program.

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- b. The twelve (12) new projects marked (%) and listed in Inclosure 1 be established in the Chemical Corps FY 55 BW Program.
- c. The technical objective, priority, security classification, requirement, brief, and approach for each of the twelve (12) new projects, as indicated in the Project Data Sheet therefor, be approved.
- d. The ten (10) projects listed in Inclosure 1 for continuation in the FY 55 program, with the changes indicated therefor, be approved.
- e. The BW section of the Cml C FY 55 R&D Program, identified as Program 7B, consist of the twenty-two (22) new and continued projects described herein.
- f. All publications affected by this action be revised accordingly.

13 Incls

- 1- FY 54-55 Summary
- Project Data Sheets for:
- 2- 4-04-14-021
- 3- 4-11-01-004
- 4- 4-11-02-064
- 5- 4-11-05-013
- 6- 4-72-06-015
- 7- 4-72-08-002
- 8- 4-92-02-029
- 9- 4-92-02-030
- 10- 4-92-02-031
- 11- 4-92-02-032
- 12- 4-92-02-033
- 13- 4-98-05-027

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FY 54-55 BW PROJECT PROGRAM SUMMARY **

Project No. & Tech. Obj.	Title & Classification	Sec. of Project	Prior-ity	Current Action
#4-04-14-001 BW-5 (AW-4)(CW-3)	Air Contaminating BW Munitions (S)	S	1-B	Consolidate in 4-04-14-021.
#4-04-14-002 BW-5 (AW-4)	Surface Contaminating BW Munitions (S)	S	1-B	Consolidate in 4-04-14-021.
#4-04-14-003 BW-5	Adoption of BW Disseminators to Guided Missile Warheads (S)	S	1-B	Consolidate in 4-04-14-021.
4-04-14-004 75% BW-5 25% BW-1a	Special BW Operations (C)	TS	1-A	Continuo.
4-04-14-006 BW-5	1/2-lb. Biological Bomb (S)	S	1-B	Cont. w/title (C) & No. changed to 4-04-14-022 for security reasons.
#4-04-14-008 (AW-4) BW-5 (CW-3)	Distribution Systems for BW Munitions (S)	S	1-B	Consolidate in 4-04-14-021.
4-04-14-011 BW-5	Biological Bomb for Balloon Delivery (S)	S	1-B	Continuo. /No. changed to 4-04-14-023 for security reasons.
4-04-14-013 BW-5	Biological Bomb, Continuous Generator (S)	S	1-A	Continuo w/No. changed to 4-04-14-024 for security reasons.
4-04-14-014 BW-5	BW Mine (S)	S	1-B	Continuo w/No. changed to 4-04-14-025 for security reasons.
4-04-14-016 BW-5	750-lb. Biological Bomb (S)	S	1-B	Continuo w/No. changed to 4-04-14-026 for security reasons & title (C).

- **Note:**
- (1) Continued projects have no diacritical marking.
 - (2) Percentage-wise Tech. Objs. indicate split funding.
 - (3) Legend: # Project deleted for reason noted.
% New projects added.

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Project No. & Tech. Obj.	Title & Classification	Sec. of Project	Prior-ity	Current Action
4-04-14-017 BW-5	10-oz. Spherical Biological Bomb (S)	S	1-B	Continue w/No. changed to 4-04-14-027 for security reasons & title (C).
#4-04-14-018 BW-5	1 1/4-lb. Spherical Biological Bomb (S)	S	1-B	Consolidate in 4-04-14-021.
4-04-14-020 BW-5	Amphibicus BW Aerosol Generator (S)	S	1-C	Continue.
%4-04-14-021 BW-5	BW Munitions Research (C)	S	1-B	Establish new project per inclosed data sheet.
#4-11-01-001 75% BW-1a 25% BW-1b	Screening & Evaluation of Viruses & Rickettsiae as BW Agents (S)	S	1-B	Consolidate in 4-11-02-064.
#4-11-01-002 BW-3a	Screening of Plant Pathogens as BW Agents (S)	S	1-C	Consolidate in 4-11-01-004.
#4-11-01-003 75% BW-1a 25% BW-1b	Screening & Evaluation of Bacteria & Fungi as BW Agents (S)	S	1-B	Consolidate in 4-11-02-064.
%4-11-01-004 BW-3a	Anticrop Warfare (C)	S	1-B	Establish new project per inclosed data sheet.
#4-11-02-008 BW-3a	Screening of Chemical Anticrop Agents (S)	S	1-C	Consolidate in 4-11-01-004.
#4-11-02-023 BW-1a	Combinations of BW Agents (S)	S	1-B	Consolidate in 4-11-02-064.
#4-11-02-057 50% BW-2a 50% BW-2b	Miscellaneous Exotic Anti-Animal Agents (S)	S	1-B	Consolidate in 4-11-02-064.
#4-11-02-058 75% BW-1a 25% BW-1b	Development of Viruses & Rickettsiae as BW Agents (S)	S	1-B	Consolidate in 4-11-02-064.
#4-11-02-059 75% BW-1a 25% BW-1b	Development of Bacteria & Fungi as BW Agents (S)	S	1-B	Consolidate in 4-11-02-064.
#4-11-02-060 90% BW-3a 10% BW-3b	Development of Chemical Anticrop Agents (S)	S	1-C	Consolidate in 4-11-01-004.

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Project No. & Tech. Obj.	Title & Classification	Sec. of Project	Priority	Current Action
#4-11-02-061 75% BW-2b 25% BW-2a	Diseases of Ruminants & Horses of BW Significance (S)	S	1-B	Cancel per Staff guidance.
#4-11-02-062 90% BW-3a 10% BW-3b	Development of Plant Pathogens as BW Agents (S)	S	1-B	Consolidate in 4-11-01-004.
#4-11-02-063 BW-1a	Drying & Other Stabilizing Procedures for BW Agents (S)	S	1-B	Consolidate in 4-92-02-029.
#4-11-02-064 75% BW-1a 25% BW-1b	BW Antipersonnel Screening & Evaluation (C)	S	1-B	Establish new project per data sheet inclosed.
#4-11-04-001 BW-5	Apparatus, Methods & Techniques for Assessment of BW Munitions (S)	S	1-C	Consolidate in 4-98-05-027.
#4-11-04-003 BW-1a	Cloud Chamber Studies on BW Aerosols (S)	S	1-B	Consolidate in 4-11-02-064.
#4-11-04-004 BW-5	Arthropod Dissemination of BW Agents (S)	S	2	Consolidate in 4-11-02-064.
#4-11-04-005 BW-5 (CW-3)	Field Behavior of Aerosol Clouds (U)	S	1-B	Consolidate in 4-98-05-027.
#4-11-05-004 BW-4c	Materials & Methods for Decontamination in BW (U)	S	1-B	Consolidate in 4-11-05-013.
#4-11-05-008 BW-4b	Studies of Vulnerabilities to BW Agents (U)	S	1-B	" "
#4-11-05-010 BW-4a	Biological Detection & Analysis of Field Samples (U)	S	1-A	" "
#4-11-05-011 BW-4a	Procedures & Equipment for Rapid Detection of BW Agents (C)	S	1-A	" "
#4-11-05-012 BW-4b	Physical Protection of Personnel Against BW Agents (U)	C	2	" "
#4-11-05-013 33% BW-4a 33% BW-4b 34% BW-4c	BW Detection, Decontamination & Protection (U)	C	1-A	Establish new project per data sheet inclosed.

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Project No. & Tech. Obj.	Title & Classification	Sec. of Project	Prior-ity	Current Action
#4-36-03-004 IO-14	Meteorology of Cloud Travel (U)	S	1-C	Consolidate in 4-98-05-027.
4-61-07-001 BW-4b	BW Occupational Hazards & Related Safety Measures (S)	S	1-B	Continue with title (U).
4-61-09-004 BW-1b	Biological Measures for Protection of Personnel Engaged in BW Research (S)	S	1-B	" "
#4-61-14-004 75% BW-1a 25% BW-1b	Isolation & Purification of Microbiological Poisons (C)	S	1-B	Consolidate in R&E Comd Project 4-08-03-015.
#4-64-03-001 75% BW-1a 25% BW-1b	Nutrition of Potential BW Agents (S)	S	1-C	Consolidate in 4-11-02-064.
#4-64-04-001 SR-4	Chemical Methods Applicable to BW Research (C)	S	2	" "
#4-64-05-001 SR-4	Application of Statistical Methods to BW Research (U)	S	1-C	" "
#4-64-06-002 75% BW-1a 25% BW-1b	Physical Characterization of BW Agents & Their Derivatives (S)	S	2	" "
#4-64-09-001 75% BW-1a 25% BW-1b	Pathology of Diseases of Man & Animals Caused by BW Agents (U)	S	1-C	" "
%4-72-06-015 45% BW-1a 10% BW-4a, b&c 45% BW-5	BW Product Engineering & Plant Design (C)	S	1-B	Establish new project per data sheet inclosed.
%4-72-08-002 50% BW-1a 50% BW-5	BW Equipment & Facilities Development (U)	U	2	" "
#4-85-09-003 SR-4	In-Service Training, CCBL (U)	U	3	Consolidate in Overhead.
#4-90-20-004 50% BW-1a 50% BW-5	Maintenance & Operation of Auxiliary Equipment & Facilities, CCBL (U)	U	2	" "
#4-90-20-011 50% BW-1a 50% BW-5	Fabrication, Installation & Repair of Equipment, CCBL (U)	U	2	" "

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Project No. & Tech. Obj.	Title & Classification	Sec. of Project	Prio-ity	Current Action
#4-92-02-019 50% BW-1a 50% BW-5	Engineering Research & Design Applicable to BW, CCBL (U)	S	2	Consolidate in 4-72-06-015 & 4-72-08-002.
#4-92-02-021 BW-1a	Pilot Plants for Viral & Rickettsial BW Agents (S)	S	1-B	Consolidate in 4-92-02-030.
#4-92-02-027 BW-1a	Production Processes for Bacterial & Fungal BW Agents (S)	S	1-B	Consolidate in 4-92-02-029.
#4-92-02-028 BW-1a	Pilot Plant for Bacterial & Fungal BW Agents (S)	S	1-B	Consolidate in 4-92-02-030.
%4-92-02-029 BW-1a	BW Agent Process Development (C)	S	1-B	Establish new project per data sheet inclosed.
%4-92-02-030 BW-1a	BW Agent Pilot Plant Development (C)	S	1-B	" "
%4-92-02-031 BW-1a	Wet Suspension of <u>Bacterium</u> <u>tularensis</u> (S)	S	1-B	" "
%4-32-02-032 BW-1a	Wet Suspension of <u>Bacillus</u> <u>anthracis</u> (S)	S	1-B	" "
%4-92-02-033 BW-1a	Dry <u>Bacillus anthracis</u> (S)	S	1-B	" "
#4-98-05-020 BW-5	Field Test Operations (U)	S	1-B	Consolidate in 4-98-05-027
#4-98-05-024 BW-5 (BW-4, b&c)	BW Field Testing, DPG (U)	S	1-B	" "
#4-98-05-025 BW-5	BW Field Test Technology (U)	S	1-B	" "
%4-98-05-027 BW-5	BW Assessment (U)	S	1-B	Establish new project per data sheet inclosed.

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PROJECT DATA SHEET

1. PROJECT TITLE: BW Munitions Research (C)
2. SECURITY CLASSIFICATION: Secret
3. PROJECT NUMBER: 4-04-14-021
5. REPORT DATE: 9 June 1954
6. BASIS FIELD OR SUBJECT: Ammunition
7. SUBFIELD OR SUBJECT: Munitions, Biological Warfare
- 7a. TECHNICAL OBJECTIVE: BW-5
8. COGNIZANT AGENCY: Cml C
9. DIRECTING AGENCY: ACCm10/BW
10. REQUESTING AGENCY: CmlC, AFF, USAF
11. PARTICIPATION AND/OR COORDINATION: (AR) Army: USAF (2172): Ord C (Pers & fac); NRL (Pers & fac); CML C C&RL (Pers & fac); NOL (Pers & fac)
12. CONTRACTOR AND/OR LABORATORY: M Division, Camp Detrick, New York University (See 21 d. below) DA-18-064-CML-2518
13. RELATED PROJECTS: 4-04-04-006, 4-04-14-011, 4-04-14-013, 4-04-14-014, 4-04-14-016, 4-04-14-017, 4-04-14-020
15. PRIORITY: 1-B
17. ESTIMATED COMPLETION DATES: Res. - Cont.
Dev - Cont.
18. FISCAL ESTIMATES: FY 54 - 537 M
FY 55 - 866 M
FY 56 - 1665 M
19. SUPERSEDED REPORTS: Project Cards 4-04-14-001, 4-04-14-002 & 4-04-14-008, dated 1 Jul 52; 4-04-14-018 dtd 1 Oct. 52; & 4-04-14-003, dtd 1 Jul 51
20. REQUIREMENT AND/OR JUSTIFICATION: There is a requirement for a project to investigate means of producing biological aerosols from both liquid and dry biological materials, and to determine methods for delivering and dispersing BW munitions so that the potentialities of the agent aerosol can be realized.
21. BRIEF OF PROJECT AND OBJECTIVE:
 - a. Brief. (Applied Research) This is a general development project of a continuing nature for the scientific study of factors controlling the dissemination of BW agents from munitions and the distribution of these munitions by various means. Its objective is to furnish data from which specific end-item munitions can be developed. To achieve this, it is necessary to investigate candidate agent dissemination and munition distribution systems, and to develop new concepts and methods for accomplishing these ends with greater effectiveness.
 - b. Approach. The problem of dissemination of BW agents will be approached by study and evaluation of candidate aerosol producing devices and methods for contaminating surfaces, by investigation of the inter-relationships of various physical and biological properties of agent-fill and aerosol production techniques, and examination of the effects of physical forces upon the agent (such as heat, shear, shock and pressure) encountered during dissemination. The problem of munition

distribution will be approached by investigation of self-dispersing aerodynamic shapes of unit bomb size; by developing dispensers capable of dispensing these bombs directly from aircraft; by studies of clusters which achieve lateral dispersion through rotation, controllable tail surfaces, retractable lift surfaces, or other such means; and by methods not employing aircraft such as marine and land mines or generators, guided missiles and similar factors.

c. Sub-tasks. An outline of subtasks currently envisaged is given below. This outline may change as research adds to our knowledge and capability.

- (1) Aerosol generation (non-explosive)
- (2) Aerosol generation (explosive)
- (3) Munition dispersion
- (4) Instrumentation
- (5) Fuze Investigations
- (6) Support of standardized and interim items

d. Other Information. Contracts:

Aeroprojects, Incorporated	DA-18-064-CML-2026
Ralph M. Parsons Co.	DA-18-064-CML-2283
George Washington University	DA-18-064-CML-2307
Armour Research Foundation	DA-18-064-CML-2456
Minneapolis-Honeywell Regulator Co.	DA-18-064-CML-2238
Aircraft Armaments, Inc.	DA-18-064-CML-1857
Battelle Memorial Inst.	DA-18-064-CML-1914
Rheem Manufacturing Co.	DA-18-064-CML-2028
University of Maryland	DA-18-064-CML-2520
Armour Research Foundation	DA-18-064-CML-2371
Naval Research Laboratories	CMLRE 18-55
Bureau of Mines, Dept. of Interior	CD 3-679