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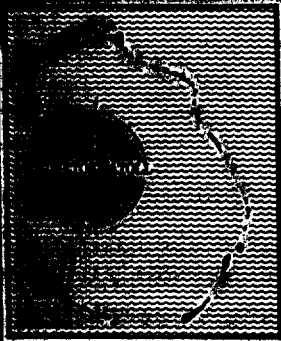
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PACIFIC PROVING GROUNDS

November 1957

Project 377

PHOTOGRAPHIC CREATING SURVEY



JOINT TASK FORCE 132

USAF

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Report to the Scientific Director

PHOTOGRAPHIC CRATER SURVEY

By

James L. Gaylord
Lt Col, U. S. Air Force

Lookout Mountain Laboratory
Los Angeles, California
March 1953

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ABSTRACT

The primary objective of Project 3.7 was to determine the exact ground-zero location of Mike device after detonation had occurred and to obtain aerial photographs showing all possible aspects of the crater.

In order to accomplish these objectives vertical aerial still photographs were obtained from an RB-50 reconnaissance aircraft at the earliest possible time consistent with radiation safety following detonation.

These photographs were then printed at the U. S. Air Force Aeronautical Chart and Information Center in St. Louis, Mo., and further assembled into a precisely controlled mosaic form in order to provide at least two methods for accurately determining ground zero therefrom.

CONTENTS

	Page
ABSTRACT	3
1 REPORT OF OPERATIONS	7
1.1 Assignment of Project	7
1.2 Photographic Operations	7
1.3 Reproduction and Photogrammetry	9
1.4 Security	9
1.5 Funding	9
2 RESULTS	17
3 RECOMMENDATIONS	17

ILLUSTRATIONS

1 Objectives of Project 3.7	8
2 RB-50 Photographic Aircraft on Fire	8
3 Photographic Mosaic of Mike Site Prior to Detonation	10
4 Photographic Mosaic of Mike Site After Detonation	11
5 Map Showing Mike Site Prior to Detonation	12
6 Map Showing Mike Site After Detonation	13
7 Graphic Presentation of Mike Crater	14
8 Profile of Mike Crater, North-South Looking West	15
9 Profile of Mike Crater, East-West Looking North	16

PHOTOGRAPHIC CRATER SURVEY

1 REPORT OF OPERATIONS

1.1 Assignment of Project

Preliminary discussions leading to assignment of Project 3.7 to Task Unit 9 (Lookout Mountain Laboratory) were held between members of the Air Research and Development Command (ARDC) and Task Unit 9 on 7 May 1952 at ARDC Headquarters in Baltimore, Md. At this time the objectives of the project were submitted to Task Unit 9 so that planning could be started.

Formal assignment was made by letter from Headquarters, ARDC, Subject: "Photographic Crater Survey, Project 3.7, Operation Ivy," dated 30 June 1952.

(a) *Objectives.* As outlined in the original memorandum of requirements and illustrated in Fig. 1, the objective of Project 3.7 was to obtain aerial photographs from which could be determined (1) the location of ground zero following detonation and (2) information as to the diameter, depth, and lip contours of the crater.

As an additional objective a requirement for an aerial mosaic of Bikini Atoll was subsequently initiated by the Commander, Task Group 132.1.

(b) *Personnel.* Personnel to accomplish Project 3.7 was provided by Task Unit 9, and duties incident to the accomplishment of the project were assigned as additional duties. This arrangement precluded any necessity for providing a separate group of personnel detailed to this project alone.

Early in the planning phase it was realized that some technical advice regarding photogrammetry would possibly be needed. Therefore the services of a qualified technician in this field were requested of the U. S. Air Force Aeronautical Chart and Information Center (ACIC). This request was granted, and one technician was detailed from that organization for service with Task Unit 9 for the period 8 October to 24 November 1952.

The advisability of having such technical advice available during the operational phase was amply borne out. Photographs made on the project were developed in the field and immediately checked by the technical advisor to ensure (1) adequate coverage of the target, (2) suitable photogrammetric quality, and (3) sufficient photographs to accomplish the project.

1.2 Photographic Operations

One RB-50 reconnaissance-type aircraft, completely equipped and manned to accomplish the photography for Project 3.7, was requested and received from the U. S. Air Force Strategic Air Command.

This aircraft arrived on 18 October 1952 and was based at Kwajalein. The crew proceeded to accomplish the assigned mission as weather permitted and had accomplished approximately 75 per cent of the necessary preliminary photography when the aircraft was destroyed in a fire

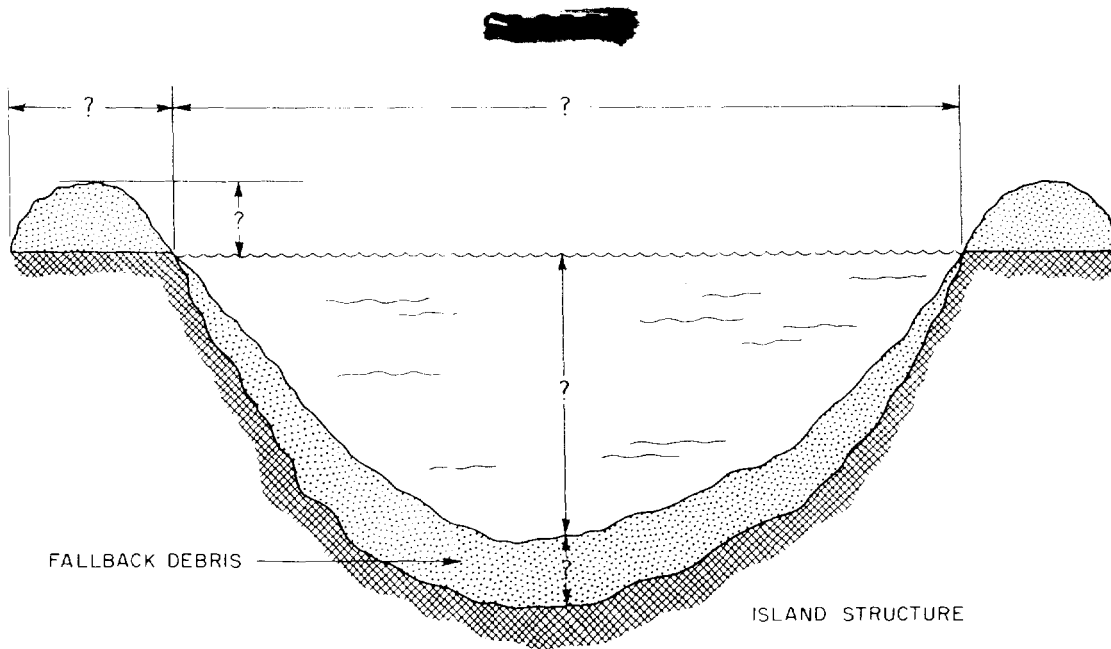


Fig. 1 — Objectives of Project 3.7.

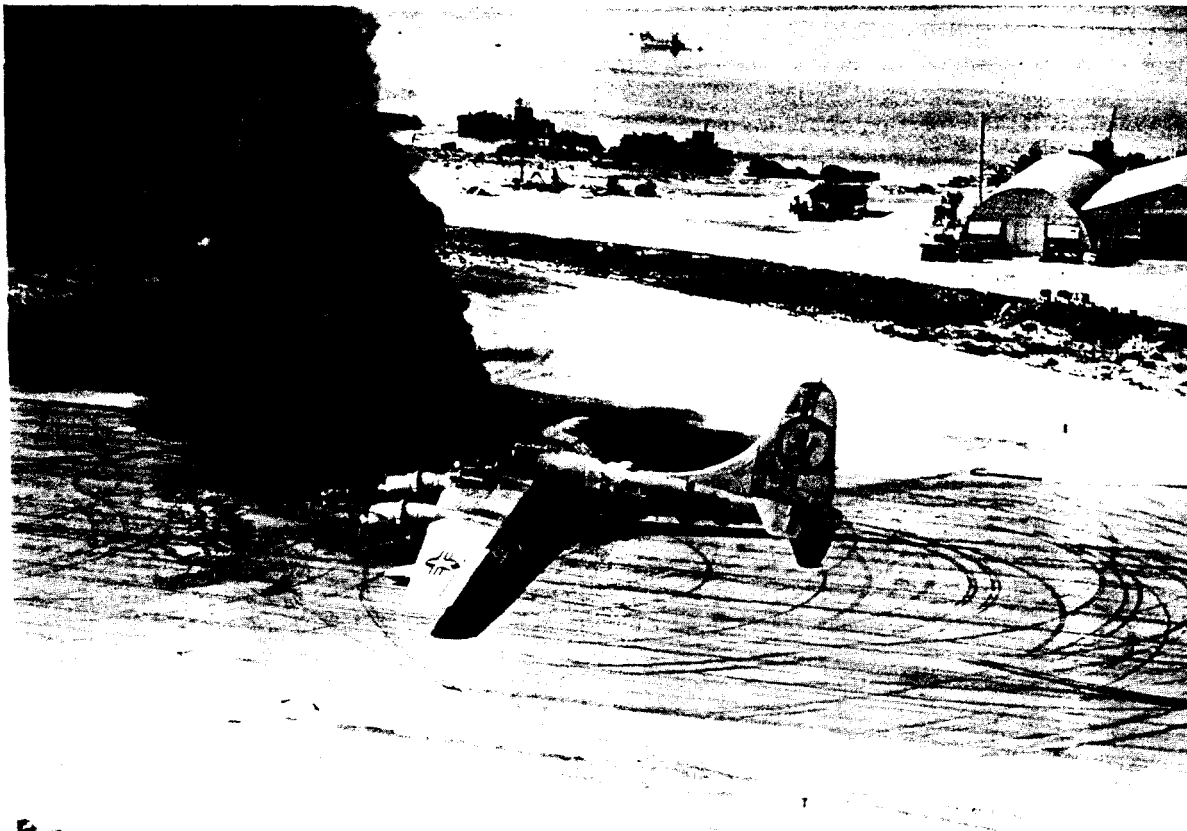


Fig. 2 — RB-50 photographic aircraft on fire.

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following a landing at Eniwetok on 23 October 1952. The film for a complete mosaic of Eniwetok Atoll, as well as preliminary blast-area photography, was destroyed in this accident. Figure 2 shows this aircraft on fire.

Request was made for an immediate replacement for this aircraft. The replacement arrived on 1 November 1952 but, owing to mechanical difficulty, was unable to participate in the air photographic mission on Mike day.

Several missions were flown to the crater area as weather permitted, and all photography necessary to Project 3.7 was obtained prior to King shot.

All film was developed in the Forward Area and evaluated by the technical advisor together with other personnel concerned.

1.3 Reproduction and Photogrammetry

Upon return of the Task Unit to the Zone of the Interior, the negatives were couriered to the ACIC at St. Louis, Mo., where the printing and photogrammetry necessary to complete the project were accomplished.

Reproduction at the ACIC consisted of the following:

1. A photographic mosaic of Eniwetok Atoll made to a scale of 1 to 25,000. This mosaic consisted of five separate sheets, one of which depicted the terrain features of Mike site after detonation. This sheet was used for plotting ground zero and Mike crater characteristics. Figures 3 and 4 are photographic mosaics of Mike site before and after detonation.
2. Lithographic line charts of Eniwetok Atoll made to a scale of 1 to 25,000, depicting Mike site as it appeared after detonation. Figures 5 and 6 are pre- and postdetonation charts of Mike site.
3. Photographic mosaics and lithographic line charts of Bikini Atoll at a scale of 1 to 25,000, as required by the Commander, Task Group 132.1.
4. A large-scale aerial mosaic of Eniwetok Island proper, as required by the Commander, Task Group 132.1, for use by Task Group 132.2, Eniwetok.
5. Profile drawings of the Mike crater looking east to west and looking south to north. These were prepared from an uncontrolled field sketch prepared by the engineering firm of Holmes and Narver from soundings made of the Mike crater. Figure 7 is a graphic presentation of the Mike crater, and Figs. 8 and 9 are charts of the profile determined from a contour sketch made from sounding information.

It should be emphasized here that all material prepared for Project 3.7 by the ACIC was to specifications which stated that the accuracy would be the best possible consistent with control data available and within the time limits set for completion of such reproduction. Therefore in many cases the accuracy was not of the degree desired or possible because of the limited time for completion and because of the unprecise nature of control data available. In the case of mosaics and charts of Bikini, no control data of any nature were available at the time of reproduction; hence this material is entirely uncontrolled.

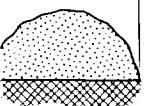
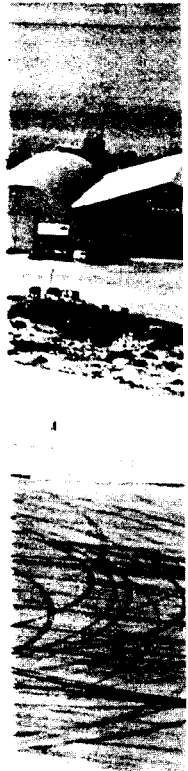
1.4 Security

Rigid security controls were established for handling all film and classified material connected with the project. Film of the postblast crater area was classified as Top Secret Restricted Data and subsequently downgraded to Secret Restricted Data by order of the Commander, Joint Task Force 132.

All personnel handling this material, both within Task Unit 9 and at the ACIC, were properly cleared to handle material of this classification.

1.5 Funding

Funds in an amount totaling \$35,000 were obtained from the ARDC, U. S. Air Force, to accomplish the project. After reviewing the actual expenditures at partial completion stages of



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Fig. 3—Photographic mosaic of Mike site prior to detonation (not to scale).

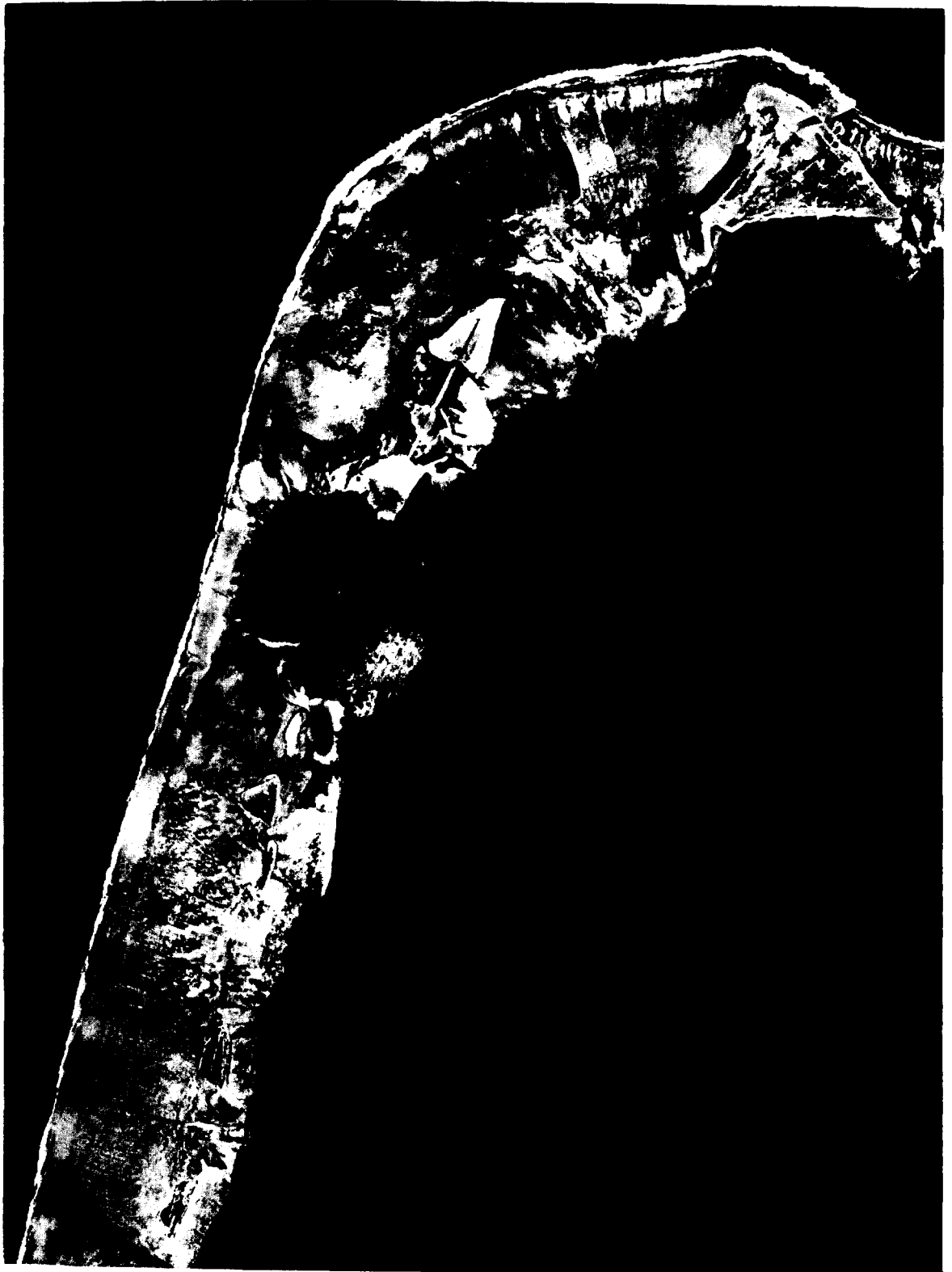


Fig. 4—Photographic mosaic of Mike site after detonation (not to scale).

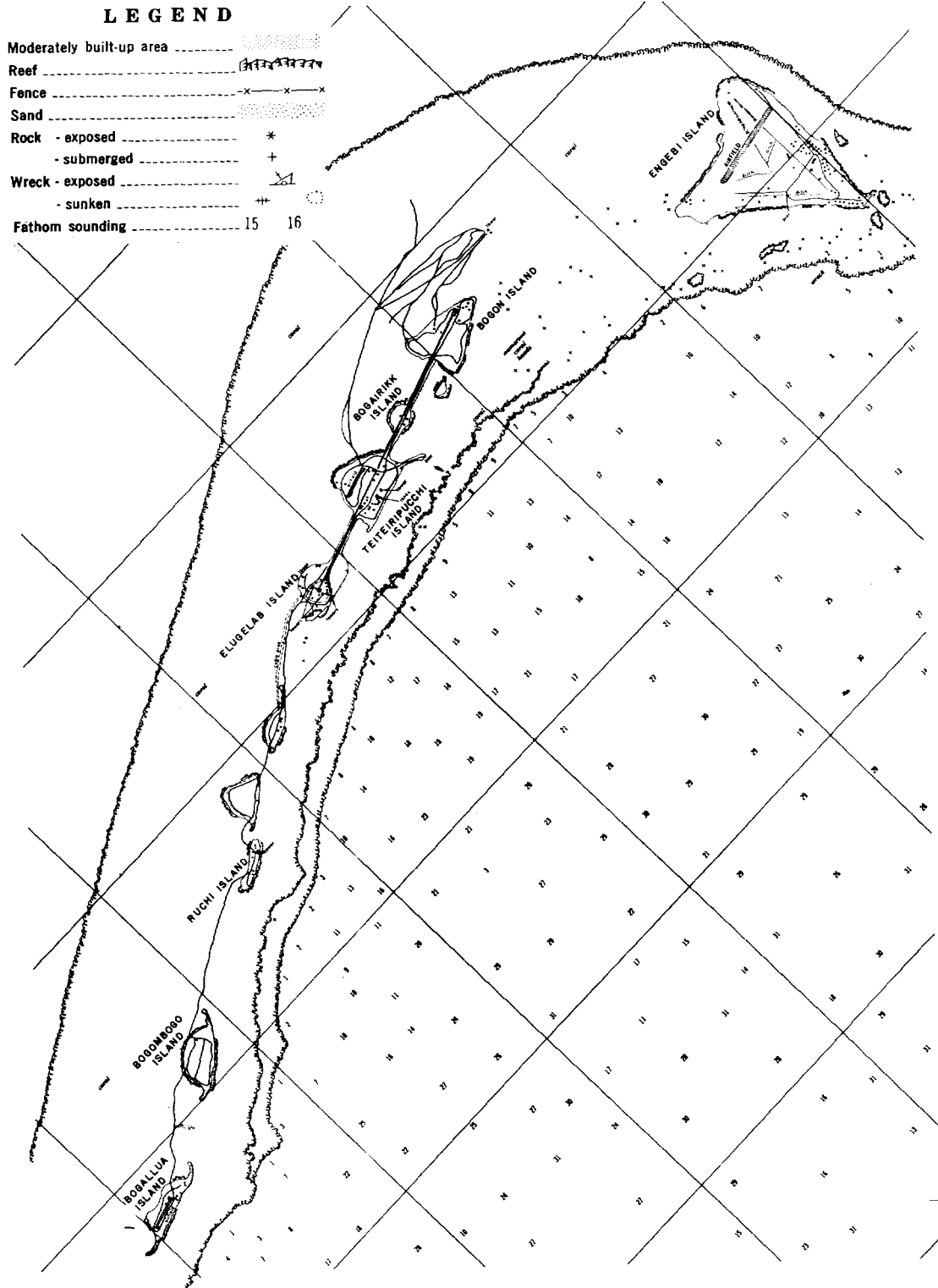


Fig. 5—Map showing Mike site prior to detonation (not to scale).

Moderately built-up area
 Reef
 Fence
 Sand
 Rock
 Wreck
 Fathom

Fig. 6

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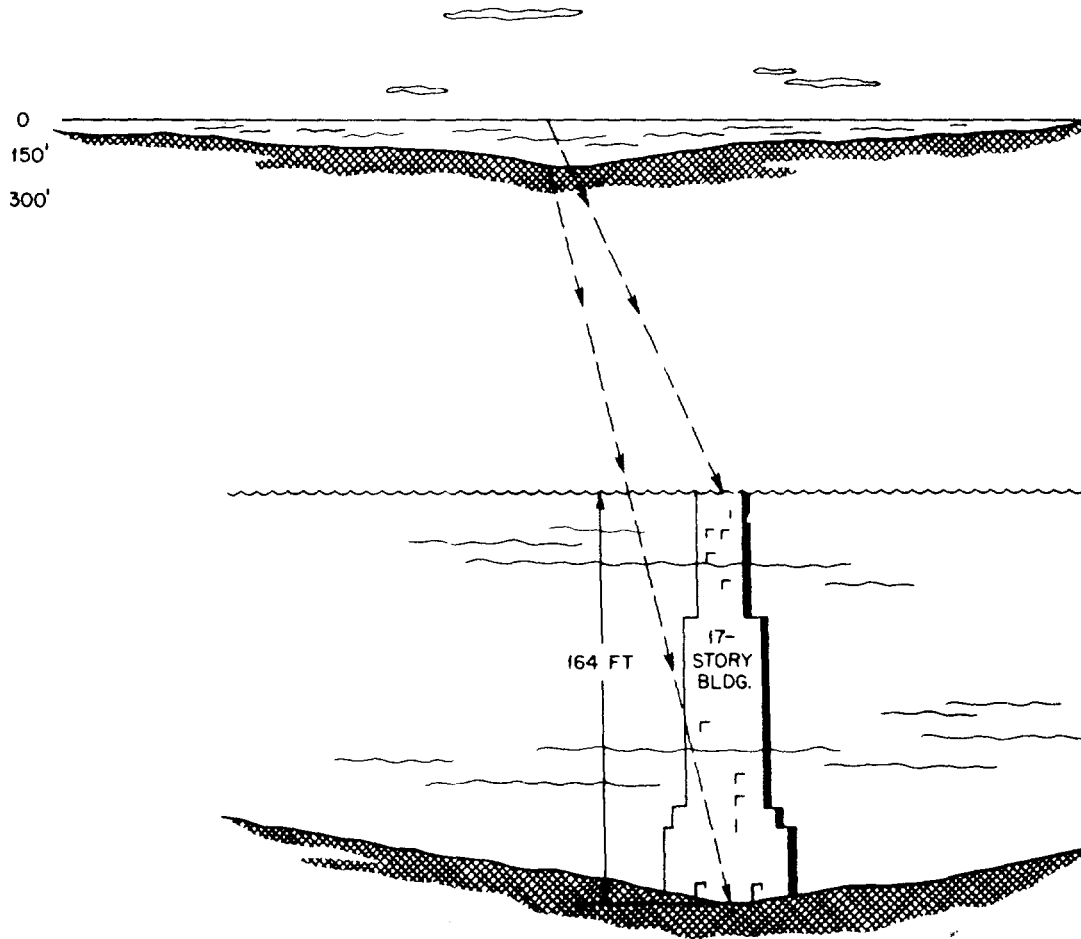


Fig. 7—Graphic presentation of Mike crater.

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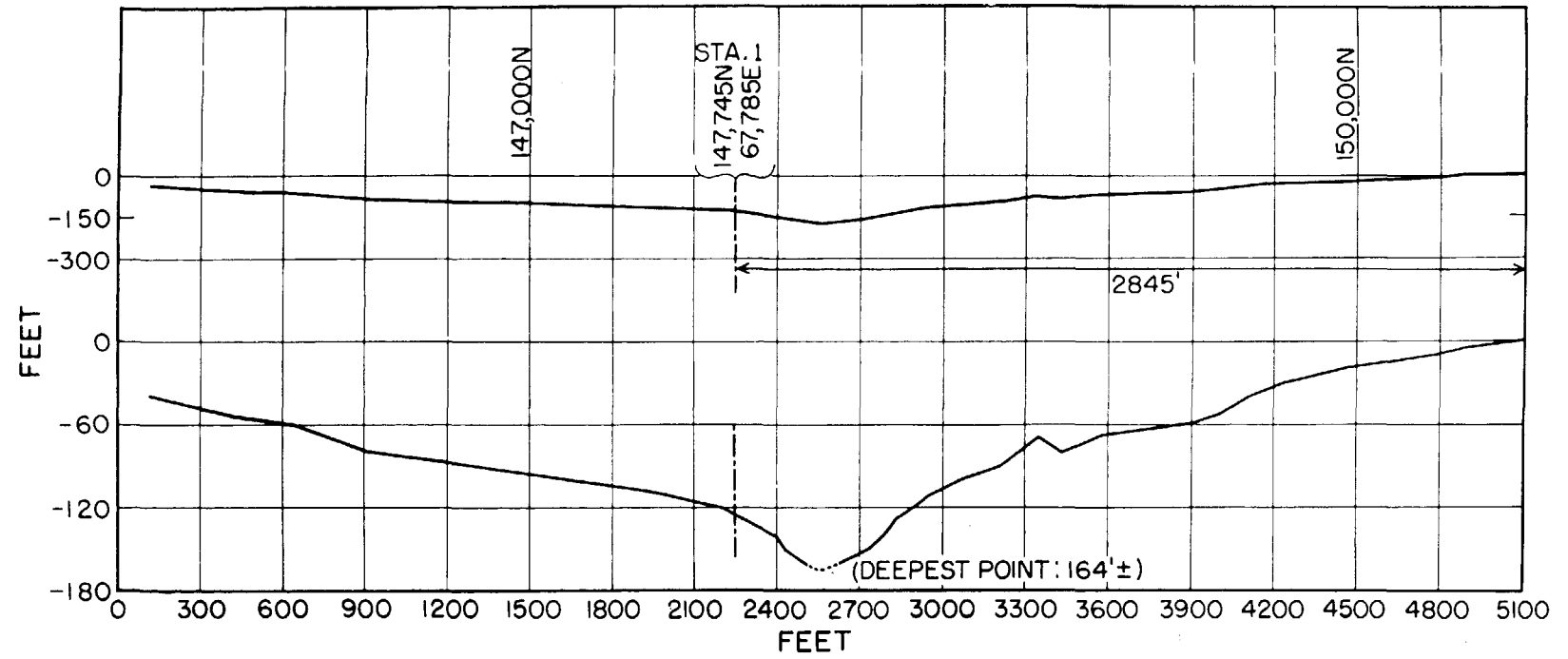


Fig. 8—Profile of Mike crater, North-South looking West.

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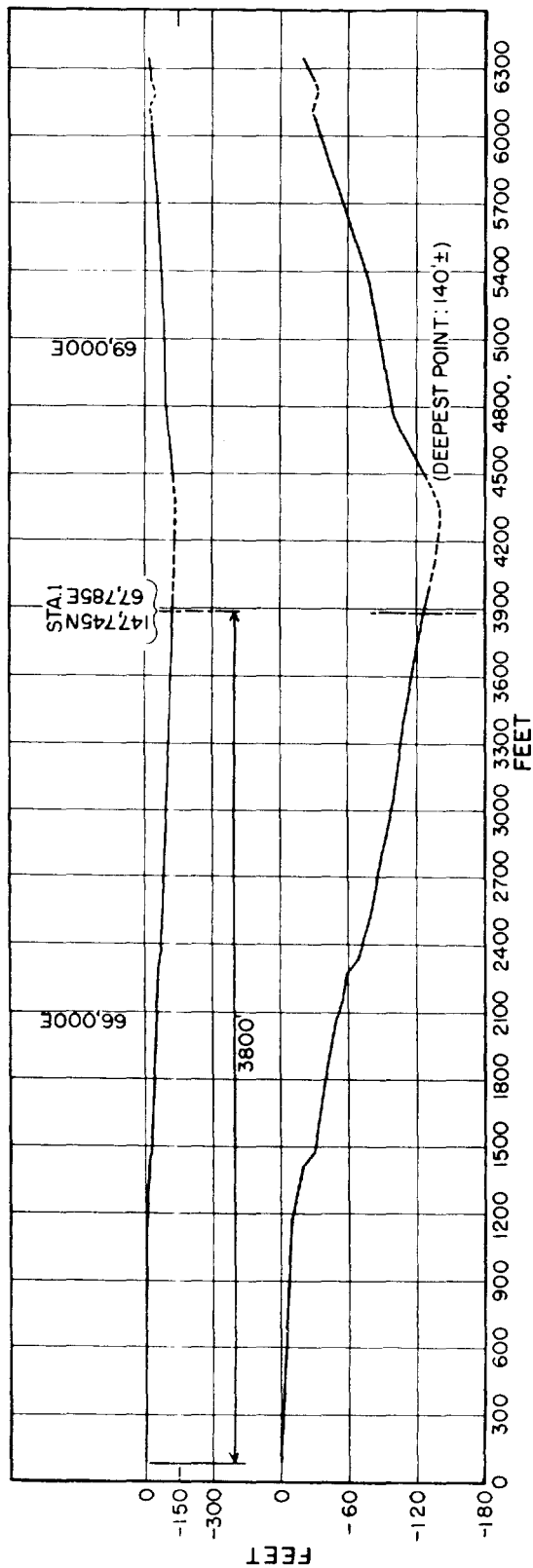


Fig. 9—Profile of Mike crater, East-West looking North.

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the project, all funds exceeding \$10,000 were returned as surplus to the needs of the project.

Funding for Project 3.7 was projected on the basis of prevailing costs for anticipated re-production to be done at the ACIC. Subsequent to initial planning and budgeting, a readjustment of internal funds of ACIC made it unnecessary to transfer any funds to that installation. Therefore all funds for this purpose were saved.

Further costs were anticipated in procurement of precision aerial mapping equipment. However, suitable equipment was located within the Air Force at Ramey Air Force Base, Puerto Rico, and flown to the operational site in the photographic aircraft; therefore funds anticipated for this material were saved.

As a consequence of these savings practically all the funds allocated for Project 3.7 were returned. Of the \$35,000 obligated, only \$5,500 was eventually expended.

2 RESULTS

The first objective of Project 3.7, to obtain ground-zero location after detonation, was fully accomplished through aerial photographs obtained on the project. Information for plotting ground zero was supplied in two forms:

1. The Overlay Method: This method, reportedly the most accurate, utilizes the overlay system. A vertical mosaic of the area prior to detonation is prepared and printed to an accurate scale. Photographs of the postblast area are then prepared and printed by rectification to the exact scale of the preblast mosaic. The preblast mosaic is then superimposed on the postblast mosaic, and zero point is punched through.

2. Triangulation Method: In this system pre- and postblast mosaics of the area surrounding zero point are prepared. Then, utilizing bench marks so worked as to be visible in the aerial photographs, ground zero is plotted by back triangulation.

The second objective of the project was effective in a general way only. Repeated mechanical difficulties with the survey aircraft, together with adverse weather conditions, precluded early photography of the crater area.

Since the crater area was largely submerged in water, few of its physical aspects were apparent in aerial photographs. A general impression as to diameter could be obtained by inspection of photographs depicting water area newly created where land masses had once stood.

The submarine topography of the crater appears to be generally as depicted in Figs. 8 and 9.

3 RECOMMENDATIONS

No major problems were encountered in the conduct of Project 3.7 (other than the unavoidable loss of the project aircraft), and it is recommended that any future projects of this nature be conducted in the same manner.

Operationally no additional personnel was required since the project was accomplished as an additional duty of Task Unit 9.

The importance of field development of aerial negatives in order that results and coverage can be quickly ascertained cannot be emphasized too strongly.

It is further recommended that the services of a qualified technical advisor such as used on Project 3.7 be made available during the entire Forward Area phase of such projects. Much time can be saved thereby through proper flight-line planning and positive checks as to adequate coverage following each photographic flight.

It is recommended that the services of the ACIC, U. S. Air Force, be utilized for any photogrammetry and/or charting services required in connection with any future projects of this nature. This facility has adequate skilled personnel and equipment to provide material with the highest degree of accuracy desired consistent with any imposed time limitations and

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engineering control supplied. Additionally this installation has established a separate section staffed with properly cleared and qualified personnel to accomplish projects of this nature. Since these procedures have been established, it is believed that such facilities should continue to be utilized when a need exists.

Some confusion existed as to the primary and secondary requirements for Project 3.7. It was first established that the primary requirement was to determine ground zero and the secondary requirement was to determine certain crater dimensions. These requirements were delineated in the formal letter of assignment. Subsequent correspondence from the Armed Forces Special Weapons Project, after the conclusion of Project 3.7, stated that the objective was to obtain crater dimensions such as diameter and lip contours within two days after detonation. This letter made no mention of any requirement for determining ground zero.

It is recommended that on future projects of this nature the requirements for accomplishment of the entire project be delineated in such a precise and clearly defined manner that no possibility of any equivocal interpretation will exist.

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48-49	Commander, Operational Development Force, U. S. Atlantic Fleet, U. S. Naval Base, Norfolk 11, Va., ATTN: Air Department	99
50-51	Commandant, U. S. Marine Corps, Washington 25, D. C., ATTN: Code AO3H	100-103
52-53	President, U. S. Naval War College, Newport, R. I.	104
54	Superintendent, U. S. Naval Postgraduate School, Monterey, Calif.	105
55	Commanding Officer, U. S. Naval Schools Command, U. S. Naval Station, Treasure Island, San Francisco, Calif.	106-107
56-57	Director, USMC Development Center, USMC Schools, Quantico, Va., ATTN: Tactics Board	108
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60	Commanding Officer, U. S. Fleet Training Center, Naval Station, San Diego 36, Calif., ATTN: (SPWP School)	112-113
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62-63	Commanding Officer, U. S. Naval Unit, Chemical Corps School, Army Chemical Training Center, Ft. McClellan, Ala.	115
64	Joint Landing Force Board, Marine Barracks, Camp Lejeune, N. C.	116
65	Commander, U. S. Naval Ordnance Laboratory, Silver Spring 19, Md., ATTN: R	117-118
65	Commander, U. S. Naval Ordnance Laboratory, Silver Spring 19, Md., ATTN: EH	119
65	Commander, U. S. Naval Ordnance Test Station, Inyokern, China Lake, Calif.	120
66-68	Officer-in-Charge, U. S. Naval Civil Engineering Research and Evaluation Laboratory, Construction Battalion Center, Port Hueneme, Calif., ATTN: Code 753	121-122
69	Commanding Officer, U. S. Naval Medical Research Institute, National Naval Medical Center, Bethesda 14, Md.	123
70	Director, U. S. Naval Research Laboratory, Washington 25, D. C.	124
71	Commanding Officer and Director, U. S. Navy Electronics Laboratory, San Diego 52, Calif., ATTN: Code 210	125
72-73	Commanding Officer, U. S. Naval Radiological Defense Laboratory, San Francisco 24, Calif., ATTN: Technical Information Division	126-127
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77	Commanding Officer and Director, U. S. Naval Engineering Experiment Station, Annapolis, Md., ATTN: Code 705	133
78		
79		
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80-81	Asst. for Atomic Energy, Headquarters, USAF, Washington 25, D. C., ATTN: DCS/O	134
82	Asst. for Development Planning, Headquarters, USAF, Washington 25, D. C.	135
83-84	Director of Operations, Headquarters, USAF, Washington 25, D. C.	136
85	Director of Operations, Headquarters, USAF, Washington 25, D. C., ATTN: Operations Analysis Division	137
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93		
94-95		
96-97		

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Commanding General, U. S. Air Forces Europe, APO 633, c/o PM, New York, N. Y.	144
Commanding General, Far East Air Forces, APO 925, c/o PM, San Francisco, Calif.	145
Commanding General, Alaskan Air Command, APO 942, c/o PM, Seattle, Wash., ATTN: AAOTN	146-147
Commanding General, Northeast Air Command, APO 862, c/o PM, New York, N. Y., ATTN: Def. Division, D/O	148-149
Commanding General, Strategic Air Command, Offutt AFB, Omaha, Neb., ATTN: Chief, Operations Analysis	150
Commanding General, Tactical Air Command, Langley AFB, Va., ATTN: Documents Security Branch	151-153
Commanding General, Air Defense Command, Ent AFB, Colo.	154
Commanding General, Air Materiel Command, Wright-Patterson AFB, Dayton, Ohio, ATTN: MCAIDS	155-156
Commanding General, Air Training Command, Scott AFB, Belleville, Ill.	157-158
Commanding General, Air Research and Development Command, P. O. Box 1395, Baltimore, Md., ATTN: RDDN	159-161
Commanding General, Air Proving Grounds Command, Eglin AFB, Fla., ATTN: AG/TRB	162
Commanding General, Air University, Maxwell AFB, Ala.	163-164
Commandant, Air Command and Staff School, Maxwell AFB, Ala.	165-166
Commandant, Air Force School of Aviation Medicine, Randolph AFB, Tex.	167-168
Commanding General, Wright Air Development Center, Wright-Patterson AFB, Dayton, Ohio, ATTN: WCOESP	169-174
Commanding General, Air Force Cambridge Research Center, 230 Albany Street, Cambridge 39, Mass., ATTN: Atomic Warfare Directorate	175
Commanding General, Air Force Cambridge Research Center, 230 Albany Street, Cambridge 39, Mass., ATTN: CRTSL-2	176
Commanding General, Air Force Special Weapons Center, Kirtland AFB, N. Mex., ATTN: Chief, Technical Library Branch	177-179
Commandant, USAF Institute of Technology, Wright-Patterson AFB, Dayton, Ohio, ATTN: Resident College	180
Commanding General, Lowry AFB, Denver, Colo., ATTN: Dept. of Armament Training	181-185
Commanding General, 1009th Special Weapons Squadron, Tempo "T," 14th and Constitution Sts., NW, Washington 25, D. C.	186-188
The RAND Corporation, 1700 Main St., Santa Monica, Calif., ATTN: Nuclear Energy Division	189-190
 OTHER DEPARTMENT OF DEFENSE ACTIVITIES	
Executive Secretary, Joint Chiefs of Staff, Washington 25, D. C.	191
Director, Weapons Systems Evaluation Group, OSD, Rm 2E1006, Pentagon, Washington 25, D. C.	192
Asst. for Civil Defense, OSD, Washington 25, D. C.	193
Chairman, Armed Services Explosives Safety Board, D/D, Rm 2403, Barton Hall, Washington 25, D. C.	194
Asst. Secretary of Defense, Research and Development, Washington 25, D. C., ATTN: Technical Library	195
Executive Secretary, Military Liaison Committee, PO Box 1814, Washington 25, D. C.	196
Commandant, National War College, Washington 25, D. C., ATTN: Classified Records Section, Library	197
Commandant, Armed Forces Staff College, Norfolk 11, Va., ATTN: Secretary	198
Commanding General, Field Command, Armed Forces Special Weapons Project, PO Box-5100, Albuquerque, N. Mex.	199-204
Chief, Armed Forces Special Weapons Project, PO Box 2610, Washington 13, D. C.	205-213

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 148-149
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 151-153
 154
 155-156
 157-158
 159-161
 162
 163-164
 165-166
 167-168
 169-174
 175
 176
 177-179
 180
 181-185
 186-188
 189-190
 191
 192
 193
 194
 195
 196
 197
 198
 199-204
 205-213

ATOMIC ENERGY COMMISSION ACTIVITIES

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University of California Radiation Laboratory, PO Box 808, Livermore, Calif.,
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 Technical Information Service, Oak Ridge, Tenn. (surplus) 247-275

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