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ARMED FORCES
SPECIAL WEAPONS PROJECT
8 JAN 1954

Operation

BUSTER - JANGLE

NEVADA PROVING GROUNDS
OCTOBER - NOVEMBER 1951

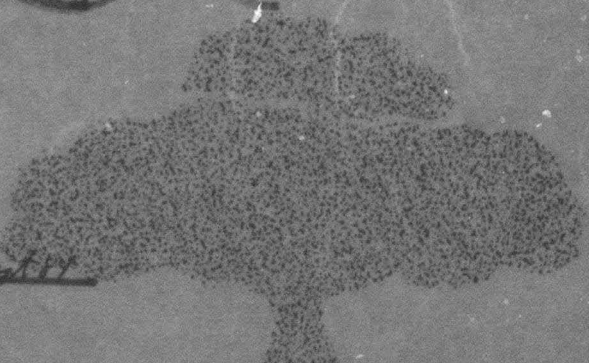
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TECHNICAL AIR OPERATIONS

Operation Buster-Jangle

by

PAUL H. FACKLER

Lt Col, USAF

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Paul H. Fackler

4925th Test Group (Atomic)
Special Weapons Command
Kirtland Air Force Base
Albuquerque, New Mexico

January 1952

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Joint DOE-DOD Review

1-2

By *m F. Loch* Date *28 Apr 84*
By DOE Date *22 June 84*

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PREFACE

In accordance with the 4925th Test Group (Atomic) Operations Plan, dated 4 October 1951, this report is submitted on the technical air operations of Operation Buster-Jangle at the AEC Nevada Proving Grounds.

Individual aircraft reports in tabular form are included as Appendixes A to C. It should be noted that all times are Pacific Standard Time.

The Radiac equipment used in terrain survey and cloud tracking was experimental, and the results as tabulated should be considered in that light. The B-21 air-conductivity equipment used on terrain survey and cloud tracking was calibrated at various altitudes over a point source but was not calibrated over a known area source. Therefore the converted readings from millivolts to milliroentgens are only a guide. Comparisons can be made between readings of millivolts above background, as shown in Appendix C, of one area vs another.

Since the planning and training phases of Buster-Jangle were limited in time, it is believed that all participating personnel performed their respective duties in an outstanding manner.

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CHAPTER 1

HISTORY OF BUSTER-JANGLE TECHNICAL AIR OPERATIONS

1.1 PLANNING PHASE

The reporting of the planning phase of Operation Buster-Jangle will be done by functional sections pertaining to manned-sampling, cloud-tracking, terrain-survey, and Special Weapons Command (SWC) Plotting Room activities. (This information is contained in Chap. 3.)

In order to meet the sampling requirement as requested by the AEC, it was determined that three B-29 type aircraft and three T-33 type aircraft would be required. Two of the three B-29's to be used for sampling were available in the SWC. The third B-29 was obtained from Air Materiel Command (AMC) storage at McClellan Air Force Base, Calif. The T-33 aircraft plus pilots, radiological officers, and maintenance personnel were obtained from the Air Proving Ground, Eglin Air Force Base, Florida. Part of the installation of the necessary sampling equipment on the B-29's was accomplished at McClellan Air Force Base. This consisted in installing an A-1 type airfoil in the aft unpressurized compartment above the fuselage. The AEC wing box filters were installed by the maintenance division of the 4925th Test Group (Atomic). Filtering units for the T-33 were fabricated by the AMC from drawings furnished to them by Tracerlab, Inc. These filtering units were incorporated in the normal tip-fuel-tank configuration. Owing to the lack of sufficient time to rework the fuel system of the T-33 to install wing fuel tanks, the aircraft range was necessarily reduced. The sampling aircraft, B-29's and T-33's, were moved to Indian Springs Air Force Base, Nevada, on 10 October 1951, and were established for Operation Buster-Jangle.

It was determined that three B-29 type aircraft would be required to accomplish cloud tracking. There existed no capability in the SWC for providing these aircraft or the equipment it would take to perform the mission. Therefore the Air Weather Service (AWS) was called upon to furnish three WB-29's. The only readily available aircraft in the AWS were from the squadron stationed at Hickam Air Force Base, Honolulu, T. H. The three WB-29's plus aircrews and maintenance crews departed Hickam Air Force Base on 30 September and arrived at McClellan Air Force Base on 1 October for instrumentation checks and calibration. The instruments used aboard the WB-29 for tracking purposes were the B-21 air-conductivity ionization chamber and the B-35 scintillation counter, plus the normal radiological instruments, dosimeters, etc. Upon completion of instrument checks and calibration, the aircraft departed McClellan Air Force Base and arrived at Kirtland Air Force Base, Albuquerque, N. Mex., on 5 October 1951. Although the cloud-tracking mission could have been more easily performed with these aircraft operating from Indian Springs, it was decided to make the main base of operation Kirtland Air Force Base because of insufficient housing and logistical support at Indian Springs.

In order to accomplish the requirement for aerial survey of ground contamination, it was decided to use three C-47 type aircraft, instrumented with the B-21 ionization chamber and

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B-35 scintillation counter. Two C-47 aircraft were placed on loan to the 4925th Test Group (Atomic) for this purpose by the 4901st Support Wing (Atomic). The third C-47 was obtained from the 1009th Special Weapons Squadron, McClellan Air Force Base.

These aircraft were modified and instrumented at McClellan Air Force Base. The training of the aircrews to accomplish terrain survey was done at Oak Ridge, Tenn., and McClellan Air Force Base. These aircraft departed Kirtland Air Force Base for Indian Springs Air Force Base on 7 October 1951, so as to allow sufficient time prior to the start of Operation Buster-Jangle for the survey of background levels within a 100-mile range of the test area. This preliminary survey was accomplished by 11 October 1951.

Early in August 1951 the requirement for a permanent record of air activities pertaining to cloud sampling, cloud tracking, and terrain survey was determined. Accordingly, a plotting and control room at the Control Point was recommended. This room subsequently became known as the SWC Plotting Room.

In the initial planning stage it was determined that a visual display of the current air situation was also desired and that the method of display should be patterned after the one used in the air control room on Operation Greenhouse. This method involves the use of edge-lighted plexiglass boards with static information placed on the front side of the boards and temporary information placed on the back side of the boards as it was received from the reporting aircraft.

It was planned that there would be three of these 6-ft-square plotting boards. One of them presented all aircraft orbit patterns and positions at H-hour, and it also plotted all aircraft positions as aircraft entered and left the prohibited area.

The second board displayed a gridded map of the area within a 100-mile radius of zero point. On this board were plotted the terrain-survey-aircraft activities, including the relative location and intensity of radioactive contamination on the ground due to fall-out from the passing atomic cloud.

The third display board had a gridded map of the area within a 300-mile radius of zero point. The atomic-cloud position was plotted on this board, as determined from the tracking-aircraft reports. Also the positions of all aircraft en route to and from Kirtland Air Force Base were plotted on this board.

The permanent record was maintained on specially prepared charts and gridded maps. To accommodate these charts, two large drafting tables and stools were constructed.

Construction plans were drawn in the SWC Plotting Room at the Los Alamos Scientific Laboratory (LASL). Supplies and equipment were requisitioned and received from base supply stock or on local purchase. Movement of supplies, equipment, and personnel to the Nevada Proving Grounds was accomplished on 3 October 1951.

1.2 OPERATIONAL PHASE

After several days' delay the Buster series of Operation Buster-Jangle was begun on 22 October 1951, with the Buster Able shot. There were two sampler B-29's, one tracker WB-29, and three terrain-survey C-47's scheduled for operational use on Buster Able.

Since there was little or no nuclear reaction, only one sampling aircraft was used. The other sampler, the tracker, and the terrain-survey missions were canceled. The sampling aircraft that did perform its mission sampled at levels from 100 ft above the ground to 7500 ft MSL, making nine passes through the dust cloud to obtain its samples.

For Buster Baker, 28 October 1951, three samplers, one tracker, and three terrain-survey missions were flown. Of the sampling aircraft, two were B-29's and the third a T-33, thus beginning the first manned-sampling operation utilizing jet aircraft on any atomic test. It was planned that only two terrain-survey aircraft would be used, owing to the narrow cone of fall-out since the wind flow was from 40° from the surface to about 25,000 ft. However, one of the aircraft lost communication; so the third aircraft was sent out to cover its area.

Buster Charlie occurred on 30 October 1951, and for this mission five samplers, two

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trackers, and three terrain-survey aircraft were used. Of the five samplers three were B-29's and two were T-33's. The third B-29 sampler was used to obtain fall-out and debris remaining in the cloud at H + 5 hr. The primary WB-29 tracking aircraft lost an engine shortly after H-hour, and a second tracker was called in to replace it. Since the wind for Buster Charlie was also from the northeast, considerable communication difficulties were encountered by the terrain-survey aircraft which were working to the west of several mountain ranges lying between the communications center and the aircraft.

The Buster Dog shot was held on 1 November 1951. For this test four samplers (two B-29's and two T-33's), two trackers, and three terrain-survey aircraft were used. This was an easy mission; the entire operation functioned normally. Good cloud samples were obtained with the T-33's operating near 40,000 ft, almost at puff altitude. The cloud was elongated by gradient wind shears, and two tracker aircraft were required to maintain good cloud following. The cloud moved rapidly to the southeast, thereby giving only small ground contamination for the terrain-survey aircraft to monitor.

On Buster Easy, 6 November 1951, five sampler aircraft (two B-29's and three T-33's), three trackers, and three terrain-survey aircraft were used. Owing to the angular shearing winds the cloud spread out over the southwestern to the southeastern quadrants, which added to the work of the terrain-survey aircraft and the cloud trackers. The sampling work was easy, however, because the whole cloud moved as a body to the southeast. All three T-33's were used on this mission to give additional high-level samples. One of the B-29 sampling aircraft and one WB-29 tracking aircraft had engine trouble on this mission.

The Jangle series was begun with Jangle Sugar, which was fired on 19 November 1951. Aircraft participating in this shot were two B-29 samplers, one WB-29 tracker, and three terrain-survey C-47's. Since the Jangle shots were to be low-energy detonations with the cloud rise not expected to be more than 15,000 ft, the T-33's were released for return to their parent organization. For these shots the sampling would be accomplished with two B-29's, one at 13,000 ft MSL and the other at 1000 to 2000 ft above the ground.

The sampling mission on Jangle Sugar was performed successfully. The tracker on this shot had a very easy mission and followed the cloud visually until it reached Salt Lake City, Utah. At this time darkness canceled further tracking because terrain features made it dangerous to continue. The three terrain-survey aircraft were used on Sugar day and Sugar + 1 day because of the high level of ground contamination.

Jangle Uncle was on 29 November 1951. The operation included two B-29 samplers, one tracker, and three terrain-survey aircraft. For this shot the B-29 samplers flew the same operational plan as for Jangle Sugar. The tracker mission for Jangle Uncle was much easier than for any in the past. The cloud moved very slowly and settled rapidly, so that by nightfall the tracking mission was completed. Because of the late H-hour, 1200 PST, and the fact that the dust still remained in the downwind area, the terrain-survey aircraft were flown on Uncle + 1 day, and the mission was completed at 1300 PST.

During the Buster test period the SWC Plotting Room operated more satisfactorily on each shot. Additional communications facilities were added after each of the first three shots, Able, Baker, and Charlie. Aircraft control was shifted from the radio room to the plotting room after H-hour, and more-direct communication with the test aircraft was achieved. A better understanding, on the part of the radio-room operators, aided in passing required information to the plotters behind the display boards. Orderly recording of information in a permanent form preserved all factual data available on each test.

1.3 ROLL-UP PHASE

The Buster roll-up began on 6 November 1951, the day after the Buster Easy shot. One B-29 sampling aircraft was flown to Sacramento Air Depot, McClellan Air Force Base, so that all four engines could be changed. This allowed the AMC to study the results of contamination

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and the effectiveness of decontamination methods.

The T-33 jet pilots, radiological directors, and maintenance personnel also were released from duty on Buster-Jangle on 6 November 1951. One T-33 was ferried to the AMC at Tinker Air Force Base, Oklahoma City, Okla.; one to the U. S. Naval Radiological Defense Laboratory (USNRDL), Naval Air Station, Moffett Field, San Francisco, Calif.; and the third T-33 was returned to its home station, Eglin Air Force Base. The T-33's ferried to Tinker Air Force Base and the Naval Air Station, Moffett Field, were to be used in studying the contamination and decontamination problems of axial-flow engines.

Personnel at Indian Springs, made surplus by the reduced air operations required for the Jangle portion of the tests, also started the homeward move.

Almost all participating personnel were returned to Kirtland Air Force Base for the two-week lapse between the Buster and the Jangle phases of the test.

The final roll-up began on 30 November 1951 after the Jangle Uncle shot which concluded this series of tests. The two remaining B-29 samplers, plus aircrews and maintenance personnel, were returned to Kirtland Air Force Base. The three WB-29's, aircrews, and maintenance personnel were released for return to their home base, Hickam Air Force Base. The three C-47 terrain-survey aircraft were required to make readings on the contaminated terrain downwind from Jangle Uncle on 30 November; so their departure from Indian Springs was delayed until 1 December 1951.

During the period from the afternoon of 29 November through 2 December, all equipment was turned into local supply or packed, crated, and properly marked for return to assigned organizations.

Roll-up of the SWC Plotting Room began on 30 November after the terrain-survey aircraft had completed their mission. The plexiglass plotting boards were removed from their frames and covered with masking tape to prevent marring. Status boards and map boards were taken down and, along with the crated records, prepared for return to Kirtland Air Force Base. Movement of this equipment and personnel was accomplished on 3 December 1951. This completed the roll-up of the technical air operations.

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CHAPTER 2

GENERAL OPERATIONS

2.1 TECHNICAL REQUIREMENTS

The function of the technical air operations at Buster-Jangle was to perform the following duties:

1. To obtain, preferably at puff altitude, a sufficient sample of the debris from each bomb so that radiochemical analysis of each weapon could be made by the AEC and by AFOAT-1.
2. To provide the required sample size of 10^{-10} of the bomb for shots Able, Baker, and Charlie, and 10^{-11} of the bomb for shots Dog, Easy, Sugar, and Uncle.
3. To track each cloud for a radius of 600 miles from point zero or until the radiation intensity was such that an industrial hazard no longer existed, whichever was sooner.
4. To survey the terrain within a 100-mile radius of point zero in order to determine levels of ground concentration as a result of fall-out as the atomic cloud moved downwind.

2.2 OPERATIONAL REQUIREMENTS

In order to accomplish the technical operations enumerated in Sec. 2.1, a supply of sufficient aircraft and equipment was required. These operational requirements were as follows:

1. In order to obtain the technically required sample, three B-29's were required; two were airborne on each test, and the third was held as a stand-by in the event of an abort. The B-29 aircraft was chosen because of its proved ability to obtain samples on previous tests. Each of these aircraft required modification to install a C-1 and an A-1 type filtering airfoil and two AEC wing box filters.
2. Because of the altitude limitations of the B-29 and the comparatively large aircrew required, it was desired to determine the feasibility of using jet type aircraft for sampling operations. The many technical and radiological problems involved brought about the decision to use a two-place jet aircraft, namely, a T-33. Three T-33's were obtained from the Air Proving Ground Command for this purpose. One was flown on Buster Baker, and, depending upon the results obtained and radiation levels received, one or more was used on succeeding tests. Each T-33 was equipped with two tip-tank filtering units in lieu of the standard fuel tanks.
3. The following radiological instruments were used on each sampling mission: AN/PDR-T1-B ionization chamber, 0- to 50-r Proteximeter, 2610A Geiger-Mueller (G-M) counter, AN/PDR-T1-B (modified to read 500 r), 247B ionization chamber, 200-mr pocket dosimeter, 10-r pocket dosimeter, and film badges.
4. The cloud-tracking effort required three B-29 aircraft, and these aircraft with aircrews were furnished by the 57th Strategic Reconnaissance Squadron (Weather), Hickam Air Force Base, of the AWS. These aircraft arrived at Kirtland Air Force Base, 5 October 1951, completely instrumented with a B-21 air-conductivity ionization chamber and a B-35 scintillation

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counter. The radiological monitor aboard these aircraft used the following radiological instruments: 2610A G-M counter, AN/PDR-T1-B ionization chamber, 200-mr dosimeter, and film badges.

5. In order to complete the ground-contamination-survey requirement within the daylight hours after shot time, three C-47 aircraft were used. Two were obtained from the 4901st Support Wing (Atomic) and were flown to McClellan Air Force Base for installation of the B-21 air-conductivity ionization chamber and the B-35 scintillation counter. The third C-47 was obtained from the 1009th Special Weapons Squadron, McClellan Air Force Base, instrumented with the B-21 and B-35 equipment.

2.3 AIRCRAFT CONTROL

The plan of operation for controlling aircraft at the Nevada Proving Grounds was that all test aircraft would become airborne under the control of their home stations. The flight progress of the bomb carrier and the movement of all other test aircraft in the test area would be under the control of the Operations Officer, 4925th Test Group (Atomic), at the Nevada Proving Grounds Control Point. Immediately after weapon detonation all aircraft control would be assumed by the officer-in-charge of cloud-sampling, cloud-tracking, and terrain-survey operations.

Because of the technical aspects of an airdrop, the aircraft controller had to be present in the radio control room during the predrop period of operations. There was insufficient space in the radio control room for the plotting boards, which would maintain the air intelligence required for directing the sampling, tracking, and survey operations; therefore it was necessary to set up remote-control radio equipment in the SWC Plotting Room. At approximately H+30 min it was necessary to move radio operators from the radio control room to the SWC Plotting Room and reestablish aircraft control from that point.

2.4 SPECIAL WEAPONS COMMAND PLOTTING ROOM

The requirement for aircraft control at the Nevada Proving Grounds Control Point included requirements for presenting a visible display of the current air situation at all times and maintaining a permanent record of the data recorded by the sampling, tracking, and terrain-survey aircraft. A description of the visual-display equipment is given in Sec. 1.1.

2.5 PERSONNEL REQUIREMENTS

Owing to the lack of personnel within the SWC, it was impossible to provide the required aircrew and maintenance personnel to perform entirely the missions of manned sampling, cloud tracking, and terrain survey. Accordingly, aircraft crews and maintenance personnel were placed on temporary duty to SWC from the 57th Strategic Reconnaissance Squadron (Weather), Hickam Air Force Base, for the WB-29's and from the Air Proving Ground, Eglin Air Force Base, for the T-33 aircraft.

Other required personnel were placed on temporary duty from SWC at Indian Springs Air Force Base and the Nevada Proving Grounds Control Point.

2.6 CLOUD-SAMPLING PLAN

The plan of the sampling operation was to obtain the best possible sample for the lowest exposure of radiation feasible. Since the planned allowable exposure for Buster-Jangle was 3.0 r per individual, a maximum exposure of 0.75 r was established for each shot. In the event that exposure exceeded 3.0 r, aircrew replacements were to be made on an individual basis.

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The sampling B-29's would be airborne at shot time, orbiting approximately 30 miles slant range to the southeast of zero point. At H+5 min the aircraft would be called off orbit by the Control Point to take up station in the vicinity of the cloud so as to observe movement and dispersal characteristics of the cloud. Penetration through the cloud would be started prior to the complete dissipation of the visible cloud.

The sampling penetrations were to be done in the following manner: The first pass at the cloud would be tangential, and, if the integrated radiation dose as read from pocket dosimeters was less than 600 mr, a second pass through the center of the visible cloud would be made. If the integrated dose was over 600 mr but under 1000 mr, the second pass would be delayed 15 min. These dosimeter readings were evaluated on the basis of past experience of the pocket dosimeters being in error by a factor of 2 higher than film-badge readings. Passes up- and down-wind through the center of the cloud would be made until the dosimeters read 1.2 r, at which time the aircraft would be returned to Indian Springs Air Force Base.

The jet aircraft were to remain on the ground at Indian Springs until notified to take off by the Control Point. Once airborne, the jets would be directed to the cloud position as determined from position reports given by the B-29 samplers. The first pass of the jets would be tangential, and their successive passes would follow that outlined above for the B-29's.

As a guide to be used in predetermining the entry time vs sample size for a standard radiation exposure for various sized weapons, the following formula was used (based on an LASL paper, by Harold F. Plank, Sampling Tactics, Operation Buster, J-8831, 12 October 1951):

$$R = \frac{(17.2 \times 10^{12})ST^{-1.2}E}{V}$$

where R = exposure (r) from film badges

S = sample size as fraction of the bomb per square foot of filter paper

T = time when sampling is started (min) after bomb burst

E = energy release of bomb (kt)

V = indicated airspeed (mph)

K = (17.2×10^{12}) = constant found experimentally to hold for B-17 drones and manned B-29's in Operation Greenhouse

The sampling altitudes of 18,000 to 24,000 ft for the B-29 and 30,000 to 36,000 ft for the T-33 were chosen on the basis of aircraft performance and an estimate of the height of the fission cloud vs the estimated height of the dust cloud. The actual sampling altitudes would depend on angular and gradient wind shears existing at burst time but would, however, stay in the general ranges selected.

The pressurization air valves would be closed at the time the aircraft started its tangential pass, and the aircrew would go on 100 per cent oxygen. This would assure a positive pressure inside the aircraft during the sampling operation, and, with the aircrew on 100 per cent oxygen, it would prevent any radioactive particles from being ingested if any should leak into the cabin. This is a standard procedure developed during Operation Sandstone and continued through Operations Ranger and Greenhouse. However, since it is unknown how much particulate matter would be brought into the aircraft through pressurization and, further, how much of the particulate matter could be filtered out, it was decided to set up an experiment for Buster Easy that would give indications along these lines. An enlarged chamber with a removable filter paper incorporated in it was fabricated and inserted in the pressurization system between the engine and the cabin. If the results of this experiment proved favorable, it would allow sampling by jet aircraft at much higher altitudes than now planned and would eliminate the problem of frosted plexiglass, which usually occurs at altitudes after the pressurization air valves are closed off.

Another experiment that was established was the taking of wide-angle motion pictures of the cloud as the aircraft approached on its sampling passes. The purpose of this experiment was to provide a visual aid in studying the tactics involved in manned sampling vs time and disper-

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sion of the atomic cloud.

The manned-sampling data appear in tabular form in Appendix A.

The training of the sampling aircrews was done at Kirtland Air Force Base by briefing, by chalk talks, and later by flights making simulated passes on cumulus type clouds. The training was designed to ensure proper air discipline, crew coordination, and knowledge of the job to be done, prior to the actual aircrew participation in a nuclear detonation.

2.7 CLOUD-TRACKING PLAN

The plan for tracking the atomic cloud was to utilize WB-29 aircraft, adequately instrumented, to follow the cloud out to a distance of 600 miles from zero point. One cloud-tracking aircraft would be airborne in the vicinity of zero point at detonation time and would follow the cloud visually as long as possible. After the cloud had dispersed to where it was no longer visible, detection would be accomplished by the highly sensitive air-conductivity and scintillation-counter instruments.

The tracking technique was to fly back and forth along the leading edge or sides of the cloud, turning every 2 or 3 min until the air-conductivity and scintillation instruments gave a measurable reading above background, then turning away before actually penetrating the cloud. The position, time, altitude, and maximum reading on each instrument were reported directly to the Control Point station. These reports were used to plot the cloud outline at various time intervals. Cloud penetration was avoided because aircraft contamination would have made the instrumentation useless.

The cloud-tracking reports (in table and map form) are in Appendix B.

2.8 TERRAIN-SURVEY PLAN

The plan of terrain-survey operations was to make a rapid survey of the fall-out area to locate any highly contaminated areas and to determine the fall-out pattern. Any "hot spots" would be checked by ground-monitoring parties to determine the personal hazard.

Immediately prior to H-hour a fall-out pattern would be predicted and laid off on a gridded map of a 100-mile radius from zero point. A grid pattern for each survey aircraft was determined, and this information plus a take-off time was given to each aircraft.

The survey aircraft would fly these grid patterns at approximately 600 ft true altitude. Using the B-21 air-conductivity equipment (plus B-35 scintillation counter on one aircraft) and portable G-M counters, the ground contamination would be determined, and the intensity readings and grid position would be radioed to the Control Point. A reading would be made for each grid square and combined into a report sent to the Control Point every 10 min. Each aircraft was equipped with a C-1 airfoil to ascertain the degree to which suspended particulate matter contributed to the B-21 readings.

The terrain-survey tabular reports appear in Appendix C.


2.9 TEST-DAY OPERATIONS

2.9.1 Able X-ray Day, 13 October 1951

Able X-ray was a dry run which pointed up small irregularities in operational and communication procedures. These irregularities were corrected on debriefing.

2.9.2 Buster Able, 22 October 1951

The Buster Able weapon, the first of the Buster series, was detonated at 0600 PST, 22 October 1951, with little or no fission taking place. This was evident after Creampuff 3 made



its first pass and could detect no beta or gamma radiation. Since this meant that the cloud consisted mainly of plutonium particles, it was decided to use only one aircraft to collect samples of the debris. Therefore Creampuff 2 was returned to Indian Springs. Creampuff 3 made a total of nine passes through the cloud at altitudes from 7500 ft MSL down to 100 ft above the ground. Adequate samples were obtained. (See Table A.1.)

Buster Able, as well as Able X-ray, was essentially a rehearsal for the cloud-tracking aircraft, since there was very little cloud and no detectable radiation to permit cloud-tracking activity.

The terrain-survey mission on this test was canceled because there was no detectable radioactive fall-out from the cloud.

2.9.3 Buster Baker, 28 October 1951

Buster Baker sampling operations pointed up a very definite need for a means of vectoring the jet aircraft to the atomic-cloud position. This was mandatory because of the limited fuel supply of the jet aircraft. The T-33's, with tip tanks used as filter units instead of fuel tanks, had a maximum flying time of 1 hr and 5 min. There was insufficient time after the aircraft arrived for the fuel system to be reworked and for wing fuel tanks to be installed on pylons. In an attempt to remedy the lack of accurate knowledge of cloud position, the B-29's were briefed, prior to Buster Charlie, to give 5-min position reports of Rosie (the code name for the atomic cloud) in degrees of bearing and miles from ground zero. The jets would be vectored into position from this information. (See Table A.2.)

One tracking aircraft followed the cloud at 20,000 ft MSL for approximately 7 hr after blast time, maintaining visual and/or instrumental contact with the cloud at all times. The atomic cloud appeared to be headed out to sea when this aircraft had to return to base; therefore a second aircraft was not called in to continue detailed tracking. The movement of the debris toward the southwest is shown in Fig. B.1 and Table B.1.

Two terrain-survey aircraft were scheduled for this test because the predicted fall-out area was too narrow to permit operation of the third airplane. However, because of loss of radio contact with the second survey airplane, a third survey airplane was dispatched to replace the second airplane.

The survey aircraft flew crosswind patterns in a southwesterly direction from zero point. The equipment operated satisfactorily, clearly defining contaminated areas. After completing the survey out to 100 miles from zero point, all aircraft returned to base. (See Tables C.1 to C.3.)

2.9.4 Buster Charlie, 30 October 1951

Buster Charlie forcefully brought out the point that complete ground control of the sampling activities was impracticable because of the difference in visibility of the cloud in the air from that on the ground. Since it was not possible to change the entire manner of operating at this late stage of the project, it was decided that the radiological directors aboard each aircraft should give frequent visibility readings of the cloud. In this manner, control, as to time of first penetration, could be retained in the Control Point.

This shot also indicated that the system of vectoring the jets by bearing and miles from point zero was too indefinite. Ten-mile-interval grid lines were drawn on a regional map and numbered across and lettered down. This was done to provide the B-29 a means of pin-pointing the exact location of the cloud. A grid position report and cloud-visibility report were to be radioed to the Control Point every 5 min so that sufficient intelligence would be available to control the aircraft. (For sampling reports on this shot, see Table A.3.)

The first cloud tracker followed the cloud visually and instrumentally from an altitude of 20,000 ft MSL for a period of 3 hr, after which time it was forced to return to base because of mechanical difficulties. A second tracking aircraft made contact with the cloud at about H+4 hr and tracked the trailing edge of the southwest-bound cloud instrumentally for about 3½ hr.

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In an attempt to circle the cloud, the aircraft encountered debris and became contaminated to such an extent that the instruments read off-scale. The aircraft was then recalled to base. Additional cloud positions were provided at 25,000 ft MSL by a sampling aircraft which followed the debris to the Pacific Coast while attempting to obtain adequate samples. (Cloud-tracking reports for this shot are given in Tables B.2 and B.3; see also Fig. B.2).

The terrain surveyed on this test was approximately the same as on Buster Baker. Instrument operation was satisfactory, and a well-defined fall-out area was reported. Radio communication difficulties were encountered because of the mountainous terrain. Several aircrew members became airsick due to flying the crosswind patterns over this rough terrain. (See Tables C.4 to C.6.)

2.9.5 Buster Dog, 1 November 1951

The sampling mission on Buster Dog was accomplished easily. There were no wind shears at the puff altitude so that the atomic cloud, although its ground speed was relatively high, did not disperse as rapidly as did previous clouds. (See Table A.4.)

Two cloud-tracking aircraft were employed on this test because the high-velocity winds caused large lateral and longitudinal dispersion of the lower cloud. The second tracker was called into operation at approximately $H + 2\frac{1}{2}$ hr. Both aircraft tracked by instruments. The first tracker was instructed to position itself on the northern edge of the cloud, and the second was to work the southern edge. Both aircraft maintained contact with the cloud until $H + 8\frac{1}{2}$ hr, when the leading edge was more than 600 miles from zero point. The topmost part of the cloud moved southeastward at an average speed of 75 knots. The lower parts of the cloud headed in the same general direction but at slower speeds. (See Tables B.4 and B.5 and Fig. B.3.)

The rapid dispersion of the atomic cloud necessitated the use of three terrain-survey aircraft on this test. Accurate readings of ground contamination were difficult because of the considerable quantity of suspended radioactivity in the air. Particular attention was given to the fall-out area around Lake Mead. Radio communications were very satisfactory for all aircraft on this mission. (See Tables C.7 to C.9.)

2.9.6 Buster Easy, 5 November 1951

Two major difficulties developed in the sampling operation on Buster Easy. First, Creampuff 3, a B-29, developed engine trouble and could not go above 31,000 ft; therefore a poor sample was obtained. Second, Creampuff 2 was returned to Indian Springs early due to misreading of instruments by the radiological monitor. He reported to the Control Point that on the first pass he had an accumulated dosage of 4500 mr. When queried on this high reading, it was reaffirmed. The aircraft was then instructed to return immediately for landing. After questioning on the ground, it was revealed that the actual reading was only 450 mr. The jets performed very well; they were able to reach the altitude of the fission cloud without difficulty.

Performing a sampling mission with pressurized cabins was tried on this shot. The results were excellent; no loss of normal cabin pressure occurred in the B-29, and no contamination was detectable inside the aircraft upon landing. The jet pressurization suffered because two filter papers were put in the system. It is believed that one filter paper would be sufficient to prevent particulate matter from entering the cabin and would allow normal pressure to be maintained. (See Table A.5.)

On this test three tracking aircraft were used. The first tracker was in the air at detonation time and tracked the cloud visually for about $2\frac{1}{2}$ hr. At $H + 1\frac{1}{2}$ hr the second tracker began instrumental tracking. The first tracker, because of mechanical difficulties, was replaced by the third tracker at about $H + 3\frac{1}{2}$ hr, and both the second and third trackers followed the cloud until approximately $H + 10$ hr. The main portion of the cloud went above 25,000 ft, where winds were from the northwest. Most of the tracking effort was spent on the early fall-out from this portion of the cloud. The lower dust cloud, extending from the surface to about 16,000 ft MSL, moved to the southwest and was tracked about $3\frac{1}{2}$ hr. (See Tables B.6 to B.8 and Fig. B.4.)

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The terrain-survey mission was accomplished without difficulty. There was very little suspended radioactivity encountered; all equipment operated satisfactorily, and all reports were submitted to the Control Point without delay. (See Tables C.10 to C.12.)

2.9.7 Jangle Sugar, 19 November 1951

The sampling requirements for Jangle Sugar, the first of the Jangle series, were increased to include sampling of the low-level dust cloud. The requirement was for the low-level aircraft to make one pass through the cloud. In order to ensure an adequate sample, two passes were made. It should be noted that the peak reading of 36 r on the first pass indicates reflected radiation from the crater and not actual radiation from the low-level dust cloud. The second pass with a peak reading of 12 r was made 1000 ft lower, 7 min later, and 5 miles farther from the crater. (See Table A.6.)

One tracking airplane was used on this test, and the cloud was followed at 16,000 ft for about 7 hr after detonation time. Visual and/or instrumental contact was maintained with the cloud at all times. The cloud headed in a north-northeast direction, and further tracking was considered impractical because of darkness and the mountainous terrain. (See Table B.9 and Fig. B.5.)

A mission was flown on 19 November 1951 with each of the three survey aircraft recording very high levels of radioactivity. A well-defined fall-out area was plotted, and a change in flight plans was directed to eliminate survey of uncontaminated areas. Darkness prevented completion of the survey on shot day; therefore a second mission was scheduled for 20 November 1951. The same area was surveyed, and clear well-defined readings were received, verifying the previous day's mission. Flying crosswind patterns also meant flying perpendicular to the mountain ranges. Extreme turbulence made the missions difficult, and several crew members became airsick. (See Tables C.13 to C.15.)

2.9.8 Jangle Uncle, 29 November 1951

The sampling requirements for Jangle Uncle were the same as for Jangle Sugar; i.e., a low-level dust-cloud sample was required in addition to the normal high-level sample. The cloud-radiation levels were low, and seven penetrations through the high portion of the cloud were necessary before it was assured that a usable sample had been obtained. Four penetrations were made on the low portion of the cloud for the same reason.

The comparatively small amount of cloud rise, 11,000 ft initially and settling gradually to 9500 ft, caused a change in normal sampling procedure as the cloud moved slowly around the mountain peaks. Flying conditions were hazardous, and sampling penetrations were made as dictated by terrain features rather than following the normal up- and downwind pattern. (See Table A.7.)

As on Jangle Sugar, only one tracking aircraft was used to follow the cloud for approximately 5 hr. Practically all contact with the cloud was visual, because low wind velocities and negligible wind shears permitted the cloud to hold together very well. This condition was fortunate because the cloud did not rise above approximately 11,000 ft MSL, and tracking became somewhat hazardous because of mountain peaks in the path of the cloud. (For detailed information on individual cloud-tracking missions, see Table B.10.)

The delay in H-hour, coupled with the problem of a low-level slow-moving cloud, prevented a terrain-survey mission on 29 November 1951. On 30 November 1951 the mission was successfully completed. Communications were excellent, and no suspended radioactivity was encountered. The air was very smooth, and only minor equipment difficulties marred an otherwise perfect mission. (See Tables C.16 to C.18.)

2.9.9 Aircraft Control

The plan for control of aircraft at the Nevada Proving Grounds operated fairly well after the dry run and Buster Able. A difficult operation was encountered in striving to maintain

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adequate control of the sampling aircraft from the porch on the Control Point building. Contact from the porch to the aircraft was through an intercommunication system to the radio operator to the aircraft and return through the same channels. Necessarily, some delays were encountered.

After surmounting difficulties involved in transferring aircraft control from the radio control room to the SWC Plotting Room, a system was established that facilitated the flow of information to and from the cloud-tracking and terrain-survey aircraft. As reports were received from the aircraft, computations were made, and the data were plotted on both the display board and the permanent record. Nonfunctioning remote-control radio equipment and atmospheric interference hindered aircraft control at times. However, most of these difficulties were corrected so that on the third and succeeding shots the communications and resulting aircraft control worked effectively within the limits of the system.

2.10 ROLL-UP PROCEDURE

The requirements for sampling of the Jangle series were reduced to obtaining single aircraft samples of 10^{-10} of the upper portion of the cloud and of 10^{-13} of the lower portion of the cloud. Further, it was anticipated that the highest altitude the cloud would attain would be 15,000 ft MSL. Thus it was decided that two B-29 samplers could accomplish the required cloud sampling. The expected low altitude of the cloud and the very limited fuel range of the T-33 at low level prompted the decision not to utilize the T-33 for sampling on the Jangle tests.

One of the B-29's was ferried to the AMC at McClellan Air Force Base, on 6 November 1951, for four engine changes so as to provide the AMC with four reciprocating engines for teardown and study of residual contamination.

To provide the AMC with an axial-flow engine for comparative studies, one of the T-33's was ferried to Tinker Air Force Base on 6 November 1951 for engine change. Likewise, to provide the USNRDL with an axial-flow engine for teardown and study, one T-33 was flown on 6 November 1951 to the Naval Air Station, Moffett Field. The third T-33 was returned the same day to the Air Proving Ground, Eglin Air Force Base, its parent organization. Thus, by 6 November 1951, two-thirds of the sample-aircraft roll-up had been completed.

The remaining two B-29 samplers departed Indian Springs Air Force Base for Kirtland Air Force Base on 30 November 1951 at the conclusion of the Jangle tests.

The cloud-tracking roll-up was completed on 30 November 1951, when the three WB-29's of the 57th Strategic Reconnaissance Squadron (Weather) departed Kirtland Air Force Base for Honolulu, T. H. A C-54 type cargo aircraft came in from Hawaii to transport material and personnel of the 57th Strategic Reconnaissance Squadron (Weather) that could not be returned on the WB-29's.

Since the terrain-survey aircraft were required to fly a mission the day following the Jangle Uncle test, their departure from Indian Springs Air Force Base was delayed until 1 December 1951. On that date the three C-47 terrain-survey aircraft were returned to their parent organizations; one was returned to the 1009th Special Weapons Squadron, McClellan Air Force Base, and the remaining two were returned to Kirtland Air Force Base.

Radiac equipment was turned in to local agencies or packed, crated, and marked for return to Kirtland Air Force Base during the period from 29 November through 1 December 1951.

Roll-up of the personnel and material required to execute Operation Buster-Jangle was thus completed by 3 December 1951.

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CHAPTER 3

OPERATING PROCEDURES

3.1 INTRODUCTION

The procedures which were followed in executing the missions of cloud tracking, cloud sampling, and terrain survey are presented in detail in this chapter. These procedures were established by the 4925th Test Group (Atomic) Operations Order dated January 1951. Annexes G, H, I, and J of that Operations Order form this chapter.

3.2 PROCEDURE FOR CLOUD-TRACKING AIRCRAFT*

1. The three cloud-tracking aircraft, on temporary duty from the 57th Strategic Reconnaissance Squadron (Weather), Hickam Air Force Base, will be based at Kirtland Air Force Base. One of the aircraft will be staged to Indian Springs at the start of the operation.
2. Aircraft Clearance: Aircraft clearance forms (Form 23) will be filed at the 4925th Test Group (Atomic) Operations. The route to the test site will be by airways to Las Vegas, then direct to Indian Springs Air Force Base, and return. The remarks section of Form 23 will show aircraft participating in the operation by inserting the code words "Coffee Cup" (Nutmeg 1 only). The pilot is authorized to change the flight plan as required to accomplish tracking.
3. Preflight of Aircraft and Special Equipment: Aircrews will preflight aircraft and check special equipment 2 hr prior to take-off.
4. Briefing: H-7 hr. Stand-by at aircraft 1 hr prior to take-off.
5. Crew Inspection: 30 min prior to take-off.
6. Engines Started: 20 min prior to take-off.
7. Plan of Operation: (a) Nutmeg 1 will be the designation for the aircraft flying the first cloud-tracking mission on each test. This aircraft will depart Kirtland Air Force Base at H-3 hr and proceed to orbit position and follow flight procedures as listed.
(b) Nutmeg 2 will depart Kirtland Air Force Base the day prior to each test, proceed to Indian Springs, and land. Nutmeg 2 will remain on stand-by on test days to take over the mission of Nutmeg 1 in case Nutmeg 1 has to abort. The necessary instructions for these changes to Nutmeg 2 will be given the aircraft commander by telephone from Keyhole (radio control at test site). In the event that Nutmeg 1 does not abort, Nutmeg 2 will assume its normal mission of continuing cloud tracking at the completion of the mission of Nutmeg 1.

* The material given in this section originally appeared in Annex G of the 4925th Test Group (Atomic) Operations Order, January 1951.

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(c) Nutmeg 3 will remain at Kirtland Air Force Base, standing by to assume the mission of Nutmeg 2 in the event that Nutmeg 1 aborts and is replaced by the aircraft at Indian Springs (Nutmeg 2). Further, if a third mission is required (for a slow-moving cloud with relatively high radiation intensities), this will be assumed by Nutmeg 3. Instructions for these changes will be telephoned from Keyhole to Catfish [radio control at the 4925th Test Group (Atomic) Center at Kirtland Air Force Base].

8. Take-off: (a) Nutmeg 2, H-22 $\frac{1}{2}$ hr. [Proceed to Neptune (radio control at Indian Springs Air Force Base), land, and await instructions from Keyhole.]

(b) Nutmeg 1, H-3 hr.

9. Position Reports: En route position reports will be made every 30 min to Catfish or Keyhole in accordance with the Communications Plan.

(a) Radio check will be made with Keyhole on channel E (143.1 Mc) when over position Dog (designation for Las Vegas, Nev., used in giving position reports). Nutmeg 1 will report "on station, at altitude" to Keyhole upon arriving on station. Nutmeg 2 will check in with Keyhole immediately after take-off from Neptune.

10. Flight Procedures: Aircraft flight path and altitude will be as directed by Keyhole.

11. Landing: All tracker aircraft will return to Kirtland Air Force Base upon the completion of each mission.

12. Postflight: (a) After landing, the crew members will remain in the vicinity of their aircraft until they have been inspected and released by the officer-in-charge, decontamination crew.

(b) A postflight check of all equipment will be made.

(c) The aircrew will report to Catfish for critique.

3.3 STANDING OPERATING PROCEDURE FOR CLOUD TRACKING (NUTMEG 1, 2, AND 3)*

1. Purpose: The purpose of this standing operating procedure is to establish a standard system for locating and tracking a radioactive cloud after the detonation of an atomic missile.

2. Personnel and Equipment: Three B-29's equipped with Radiac instruments (G-M instruments, C-1 airfoils, B-21 ionization chambers, and B-35 equipment) will be used. One radiological officer and one trained filter-box operator will assist the normal crew. The filter-box operator will be equipped with a film badge, pocket dosimeters (200-mr and 10-r capacities), and rubber surgical gloves.

3. Preflight: (a) Aircrews will preflight aircraft 2 hr prior to take-off.

(b) Radiological directors will ascertain that specialized equipment is operative and that the necessary quantity of filter paper is aboard the aircraft.

(c) The radiological director will brief the necessary crew members on the flight technique to be followed.

4. Flight procedures: (a) Nutmeg 1 will depart Able (designation for Kirtland Air Force Base used in giving position reports) and proceed to Neptune as directed in Sec. 3.2. Orbit position will be in a counterclockwise rectangular pattern 5 miles wide and 30 miles long, with the north end of the pattern over Indian Springs. Orbit altitude will be 16,000 ft MSL.

(b) After Creampuff 1 and 2 have been cleared from orbit pattern, Keyhole will direct Nutmeg 1 to ascend to 20,000 ft MSL.

(c) At approximately H+20 min, Nutmeg 1 will be cleared from orbit position to follow the cloud by visual means, staying well clear of any contamination. While following the cloud movement visually, Nutmeg 1 will not approach the cloud closer than 20 horizontal miles. This is necessary to prevent overloading the sensitive B-21 and B-35 equipment aboard the aircraft.

* The material given in this section originally appeared in Annex G, Appendix 1, of the 4925th Test Group (Atomic) Operations Order, January 1951.

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- (d) Flight-path instructions will be issued from Keyhole as necessary.
 - (e) The mission for Nutmeg 1 will terminate at approximately H + 5½ hr.
 - (f) Nutmeg 2, stationed at Neptune, will receive flight-path instruction and take-off time (approximately H + 4 hr) by telephone from Keyhole.
 - (g) Reports to Keyhole of the cloud movement (visual or instruments) will be made at 15-min intervals or more often if significant contacts are made. Reports will be made on channel 30 (8387.5 kc) primary and on channel 50 (11,610 kc) secondary.
 - (h) Filter Paper: (1) Filter paper will be inserted in the left side of the box after the aircraft becomes airborne and will not be removed until the aircraft starts descent from altitude at the completion of the mission. (2) Filter paper will be inserted in the right side of the box at the beginning of the tracking mission and will be changed each 20 min until the mission is completed. (3) Filter paper will be appropriately marked and stored in containers as provided.
5. Landing: (a) At completion of the mission, the tracking aircraft will return to Kirtland Air Force Base, land, and taxi to the designated parking area for decontamination. Personnel will not leave the vicinity of the aircraft until after completion of the inspection by the decontamination crew.
- (b) Exposed filter paper will be turned over to the 4925th Test Group (Atomic) Operations Officer for transfer to Indian Springs counting station.
6. Critique: Flight crew personnel will report to Catfish after the mission for critique.

3.4 PROCEDURE FOR B-29 SAMPLING AIRCRAFT*

1. B-29 sampling aircraft will be based at Indian Springs Air Force Base. Contact before each mission will be made with the operations officer at Neptune.
2. Aircraft Clearance: Local clearances will be filed at Base Operations at Neptune.
3. Preflight of Aircraft and Special Equipment: 2 hr prior to take-off.
4. Briefing: 2 hr prior to take-off. Stand-by at aircraft 1 hr prior to take-off.
5. Crew Inspection: 30 min prior to take-off.
6. Engines Started: 20 min prior to take-off.
7. Take-off: To be specified at briefing.
8. Position Reports: A communication check on vhf 143.1 Mc (E channel) will be made with Keyhole after the aircraft becomes airborne. A second report will be made upon reaching the assigned altitude in the orbit pattern.
9. Flight Procedures: The aircraft flight pattern and altitude will be under the direction of the radiological safety officer, except when safety of flight would be jeopardized, until the sampling operation is completed. A one-time code for reporting the estimated cloud heights will be made up for each shot and given to each of the three sampler-aircraft commanders. The aircraft will land at Neptune.
10. Postflight: (a) The aircrew will depart the aircraft in accordance with procedures in item 6, Sec. 3.5.
 - (b) Designated AEC and AFOAT-1 representatives will remove the filter paper.
 - (c) The aircrew will report for critique in the Neptune briefing room upon the call of the project officer from Keyhole.

* The material given in this section originally appeared in Annex H of the 4925th Test Group (Atomic) Operations Order, January 1951.

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3.5 STANDING OPERATING PROCEDURE FOR MANNED-AIRCRAFT SAMPLING OF AN ATOMIC CLOUD (CREAMPUFF 1, 2, AND 3)*

1. Purpose: The purpose of this standing operating procedure is to prescribe a procedure to be followed in manned-aircraft sampling of an atomic cloud. This procedure will be followed when the B-29 type aircraft are employed in the sampling operation. Three B-29's will be based at Indian Springs Air Force Base for the purpose of this operation.

2. Personnel and Equipment: Two B-29's equipped with AEC A-1 and C-1 airfoils, Radiac survey instruments, and K-24 camera will be used for each test. One radiological officer and one trainee radiological officer with normal flight-crew unit will comprise the personnel requirements on each aircraft for each sampling mission.

3. Preflight: Preflight measures will be performed as follows: (a) The crew will be thoroughly briefed by the radiological director as to the procedure to be followed during the flight.

(b) All necessary Radiac equipment will be placed on board the aircraft after checking to ensure proper operational efficiency.

(c) Permanently mounted sampling equipment will be checked for operational conditions. AEC filter paper will be installed by the AEC representative prior to each mission.

(d) The radiological director will issue film badges to all crew members.

(e) Briefing for a high-altitude mission under depressurized conditions will be performed.

(f) Prior to each mission, film for the K-24 camera will be received from, and a receipt will be given to, the AEC representative who will deliver the AEC filter paper.

4. Take-off: (a) Creampuff 1, to be designated prior to each mission.

(b) Creampuff 2, to be designated prior to each mission.

(c) Creampuff 3, stand-by alert.

(d) Filter papers will be inserted (fuzzy side forward) in A-1 and C-1 airfoils when aircraft reaches 6000 ft MSL.

(e) The two aircraft will climb to altitude (to be assigned prior to each mission) under normal pressurized conditions. The aircraft will hold in a counterclockwise rectangular pattern 5 miles wide and 30 miles long, with the north end of the pattern over Indian Springs and will report to Keyhole when on station at assigned altitude.

5. Flight Procedures: (a) The aircraft will leave the holding position upon approval from Keyhole and will proceed under the direction of the radiological officer aboard. The radiological officer will inform the pilot of the pattern to be flown to collect the necessary samples.

(b) Immediately after leaving the holding pattern, the aircraft will be depressurized, and all crew members will go on 100 per cent oxygen.

(c) The K-24 camera will be operated by the radiological officer as outlined in each briefing.

(d) An airborne log will be kept by the copilot; it will show penetration heading, altitude, airspeed, exact time of penetration, and exact time when leaving the cloud.

(e) After completion of the mission, both aircraft will return to Indian Springs, land, and taxi to the aircraft decontamination area.

6. Postflight: (a) All crew members will descend through the nose wheel door, personnel in the rear of the aircraft coming forward through the tunnel. All items of personal equipment will be left in the aircraft. Upon debarking, personnel will immediately leave the vicinity of the aircraft and process through the personnel decontamination center.

(b) The radiological officer will collect all film badges from crew members and turn them over to the health physics officer or his representative for processing and recording.

* The material given in this section originally appeared in Annex H, Appendix 1, of the 4925th Test Group (Atomic) Operations Order, January 1951.

(c) Removal of the filter papers will be accomplished by pre-designated AEC and AFOAT-1 personnel and turned over to an authorized representative for shipment to the laboratory.

(d) Aircraft will be monitored and decontaminated, if required, as provided for in the 4901st Support Wing (Atomic) Plan.

(e) A narrative summary of each mission will be written by the radiological director. This summary should be brief and concise, but it should be complete in pertinent details.

3.6 PROCEDURE FOR TERRAIN-SURVEY AIRCRAFT*

1. Terrain-survey aircraft, consisting of three C-47's provided by the 4901st Support Wing (Atomic), will be based at Neptune.

2. Briefing: Briefing will be accomplished 2 hr prior to take-off.

3. Aircraft Clearance: A local flight plan will be filed with Operations at Neptune.

4. Preflight: Crews will preflight aircraft and check out special equipment 2 hr prior to take-off.

5. Crew Inspection: 30 min prior to take-off.

6. Engines Started: 15 min prior to take-off. Take-off as directed by Keyhole.

7. Communications: Immediately after take-off, aircraft will check in with Keyhole on very high frequency in accordance with the Communications Plan.

8. The terrain-survey aircraft will conduct flights in accordance with terrain-survey procedures. Upon completion of each mission, the aircraft will land at Neptune.

9. Postflight: After landing, crew members will remain in the vicinity of their aircraft until the decontamination crew has completed their inspection.

(a) The crew will conduct a postflight equipment check.

(b) The postflight critique will be upon the call of the officer-in-charge from Keyhole.

3.7 STANDING OPERATING PROCEDURE FOR TERRAIN SURVEY (GOPHER 1, 2, AND 3)†

1. Purpose: The purpose of this standing operating procedure is to establish a standard procedure for the detection of fall-out contamination on terrain from an atomic burst after the radioactive cloud has passed.

2. Personnel and Equipment: Three C-47 type aircraft are each to be equipped with C-1 airfoil, B-21 ionization chamber, B-35 scintillation counter, and a log-rate counter meter for terrain survey. The planes are to be flown by crews assigned by the 4925th Test Group (Atomic) Operations. The flight crew for each plane is to be supplemented by one airman (to be designated and instructed by the Radiological Section) who will remove and replace filter paper in the C-1 airfoil. Two terrain-survey technicians are to be aboard each aircraft on each mission.

3. Procedure: (a) The terrain-survey aircraft will proceed from Indian Springs Air Force Base to the target area at approximately H+2 hr (as determined by Keyhole) and at 600 ft above ground level (or an altitude commensurate with flying safety) and make a survey of an area 5 miles in radius from ground zero. Subsequent to this preliminary survey the aircraft will proceed on a course as prescribed by Keyhole. This course will be frequent crosswind runs over the path described by the movement of the radioactive cloud.

(b) Radio contact will be maintained with Keyhole at all times so that the SWC Plotting

*The material given in this section originally appeared in Annex I of the 4925th Test Group (Atomic) Operations Order, January 1951.

†The material given in this section originally appeared in Annex I, Appendix 1, of the 4925th Test Group (Atomic) Operations Order, January 1951.

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Room will have a continual flow of data of the cloud track and for control of ground-survey parties.

(c) Gopher 1 will use channel E vhf 143.1 Mc for radio communication and will make position and intensity reports to Keyhole every 10 min, using the report form prepared for this purpose.

(d) Gopher 2 will use channel F vhf 149.4 Mc for radio communication and will make position and intensity reports to Keyhole every 10 min, beginning on the hour.

(e) Gopher 3 will use channel F vhf 149.4 Mc for radio communication and will make position and intensity reports to Keyhole every 10 min, beginning at 5 min past the hour.

(f) At the completion of each mission, the aircraft will return to Neptune and proceed to the decontamination area for monitoring and decontamination as required.

(g) Filter papers will be appropriately marked and stored in flight and after landing will be turned over to the counting station at Indian Springs Air Force Base.

3.8 PROCEDURE FOR CLOUD-SAMPLING JET AIRCRAFT (CREAMPUFF 4, 5, AND 6)*

1. Three especially modified cloud-sampling jet aircraft (T-33 type) for use on the Buster tests will be based at Neptune. Contact before each mission will be made with the Operations Officer at Neptune.

2. Aircraft Clearance: Local clearances will be filed at Base Operations at Neptune.

3. Preflight of Aircraft and Special Equipment: 2 hr prior to take-off.

4. Briefing: 2 hr prior to take-off.

5. Take-off: Approximately H + 15 min (exact time will be designated prior to each mission). A spiral climb to assigned altitude will be made 10 miles to the west of Neptune.

6. Position Report: A communication check will be made with Keyhole after the aircraft becomes airborne and again, upon reaching altitude, on 143.1 Mc (E channel). Permission to enter the area and begin sampling operations will be obtained from Keyhole prior to leaving assigned station.

7. Flight Procedures: The flight pattern and altitude will be under the direction of the radiological safety officer aboard, except when safety of flight would be jeopardized, until the sampling operation is completed. The aircraft will land at Neptune.

8. Postflight: The aircrew will leave the aircraft, being extremely careful not to touch the outside skin of the aircraft, and will proceed to the decontamination area.

9. Debriefing: The aircrew will report to the Neptune briefing room for debriefing upon the call of the Project Officer.

3.9 STANDING OPERATING PROCEDURE FOR MANNED-JET-AIRCRAFT SAMPLING OF AN ATOMIC CLOUD (CREAMPUFF 4, 5, AND 6)†

1. Purpose: The purpose of this standing operating procedure is to prescribe a procedure to be followed in using manned jet aircraft for sampling an atomic cloud. Three T-33 type aircraft will be stationed at Indian Springs Air Force Base for the purpose of this operation.

2. Personnel and Equipment: Two T-33's will be used for each Buster test, and each aircraft will be equipped with two AEC airfoils (filter-paper holders). The aircrew will consist of one pilot and one experienced radiological officer. The radiological officer will carry Radiac

* The material given in this section originally appeared in Annex J of the 4925th Test Group (Atomic) Operations Order, January 1951.

† The material given in this section originally appeared in Annex J, Appendix 1, of the 4925th Test Group (Atomic) Operations Order, January 1951.

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instruments, and both pilot and radiological officer will carry a film badge and pocket dosimeters of 10-r and 200-mr capacities.

3. Preflight: (a) Normal T-33 jet-aircraft preflight will be performed.

(b) The Radiac director will thoroughly brief the pilot on flight procedures.

(c) All Radiac equipment will be checked for proper operational procedures.

(d) Permanently mounted airfoils will be checked and filter paper inserted.

(e) Briefing for a high-altitude mission under depressurized conditions will be performed.

4. Take-off: (a) Creampuff 4, to be determined on kiloton equivalent.

(b) Creampuff 5, to be determined on kiloton equivalent.

(c) A spiral climb (altitude to be determined) will be made 10 miles to the west of Indian Springs Air Force Base. A communication check will be made with Keyhole on very high frequency immediately after take-off, and a position report will be made to Keyhole when on station at assigned altitude. Holding position will be a counterclockwise circular pattern above a point 10 miles west of Indian Springs Air Force Base.

5. Flight Procedures: (a) The aircraft will leave the holding pattern upon approval of Keyhole and proceed under the direction of the Radiac director to obtain the necessary samples.

(b) Immediately after leaving the holding pattern, the aircraft will be depressurized, and the aircrew will go on 100 per cent oxygen.

(c) After completion of their missions, both aircraft will return to Indian Springs Air Force Base, land, and taxi to the aircraft decontamination area.

6. Postflight: (a) The pilot and Radiac director will remove parachutes, helmets, oxygen masks, etc., in the aircraft and leave this equipment in the aircraft. The decontamination crew will place the exit ladder against the side of the aircraft for the pilot to debark and then move the ladder aft for the Radiac director to debark. Both the pilot and the Radiac director will be extremely careful in debarking so that they will not touch the outside skin of the aircraft with any part of their bodies or clothing. Upon debarking, personnel will immediately leave the vicinity of the aircraft and will proceed to the personnel decontamination center for clearance from the area.

(b) The Radiac director will collect the film badges and dosimeters and turn them over to the health physics officer for processing and recording.

(c) Removal of the filter papers will be accomplished by predesignated AEC personnel for shipment to the laboratory.

(d) The aircraft will be monitored and decontaminated as provided for in the 4801st Support Wing (Atomic) Plan.

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CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

4.1 SAMPLING

4.1.1 Comparison of B-29 and T-33

The B-29 lacks the capability of reaching the average puff altitude, which may be 40,000 ft or more for the higher-yield weapons. The B-29 also requires a comparatively large aircrew complement; therefore more personnel are exposed to radiation dosages than is desired. It was believed that, if the use of jet type aircraft proved feasible, these two major difficulties could be overcome. The primary unknown factor in jet sampling was the amount of radiation that would be collected and retained in the accessory and turbine sections of an axial-flow engine. Also unknown was the amount of increased radiation that would be absorbed by the aircrew as a result of "shine" from the engine during descent and landing. The T-33 jet aircraft was used to make these comparative tests.

The T-33 proved superior to the B-29 for manned sampling of an atomic cloud. A study of the sampling data, as shown in Tables A.1 to A.7, reveals that, for a smaller radiation dose received, the T-33's obtained an over-all average sample better than the B-29's by a factor of 6.3. The average sample collected on Buster Easy by the T-33's was a factor of 17 better than the average of the B-29 samples. A study of film-badge readings, as shown in Table A.8, reveals that much less total radiation was absorbed by the T-33 aircrews than by the B-29 aircrews. It is also apparent from the film-badge readings that there was little or no accumulation of radiation due to shine from the engine since the film-badge readings of the pilot are slightly higher in all cases.

Although the T-33's proved vastly superior to the B-29's, the altitudes attained by the T-33's (highest, 41,000 ft) were short of the puff altitude by 3000 to 5000 ft.

It is recommended that, for the sampling of atomic clouds, the B-29 be replaced by a two-place fighter type jet aircraft having altitude characteristics superior to those of the T-33, preferably on the order of those possessed by the F-89 or F-94.

4.1.2 Assignment of Sampling Aircraft for Future Tests

The T-33's utilized on Buster-Jangle were obtained on loan from the Air Proving Ground Command. The aircraft arrived at Kirtland Air Force Base only a few days prior to the start of the project. This did not allow sufficient time for modifications to be made which would have incorporated certain recording devices that were desired. One gamma-rate recorder was installed at Indian Springs Air Force Base with considerable difficulty. The fact that these aircraft were on temporary loan prevented any permanent or extensive modifications from being made.

It is recommended that the sampling aircraft be permanently assigned to the SWC so that

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proper instrumentation can be accomplished which would allow the most effective sampling work to be done. The permanent assignment of these aircraft would also permit necessary operational testing of Radiac equipment between atomic tests.

4.1.3 Aerial-observation Aircraft

The fuel limitations of jet type aircraft mean that an aerial-observation post will have to be utilized to follow the cloud, to study its dispersal characteristics, and to report exact cloud locations, so that the jet aircraft can be vectored directly to the sampling altitude and position. This aerial-observation aircraft should have the capability of operating for several hours at an altitude of 35,000 ft.

To fulfill this aerial-observation requirement, a B-50 type aircraft is desirable. The observer in the bombardier's position should be a field-grade officer and should be thoroughly familiar with sampling operations and have a knowledge of the over-all air operation.

4.1.4 Pressurization of Sampling Aircraft

The aircraft were depressurized prior to the start of each sampling operation. This depressurization caused the nose-section plexiglass to frost over and resulted in considerable trouble, since sampling depends on visual reference to the cloud. Further, the temperature dropped rapidly upon depressurization; this drop caused discomfort and reduced the efficiency of the aircrew. A method of filtering the pressurization system was tried on Buster Easy. This method consisted in the insertion of an IPC type filter paper in the airflow conduit between the engine and the cabin. The aircraft was flown pressurized for the entire sampling mission. After landing, the aircraft was carefully checked, and no contamination was found in the cabin.

Since it was shown that sampling missions can be performed under fully pressurized conditions with complete safety to the aircrews, it is therefore recommended that all sampling aircraft be modified to incorporate a means of filtering the air in the pressurization system so that the missions can be performed with full pressurization.

4.1.5 Sampling by Actual Cloud Penetration

The previous technical procedure for manned sampling was revised completely for Buster-Jangle. The old procedure was to fly toward the cloud until the Radiac instruments gave a reading which indicated the aircraft was well within the radiation field; the aircraft then was turned away from the cloud. This would be repeated until a predetermined accumulated dosage had been received, at which time the aircraft would return to base.

The radiation field extends well beyond the area of particulate matter, and therefore it is possible to receive the predetermined allowable radiation dosage without penetrating the field of particulate matter sufficiently to obtain a usable sample by the method just described.

The procedure devised for Buster-Jangle was predicated on the assumption that flying through the cloud on an upwind-downwind path would assure a good sample because it would assure that the field of particulate matter had been flown through. It was also assumed that there would be only a small increase in radiation received by the aircrews using this procedure.

The merits of this new procedure may be determined from an examination of the data in Tables A.1 to A.7. All samples obtained on Buster-Jangle were better than the minimum required for analytical purposes, and, further, better samples were collected on Buster-Jangle than had ever been collected in the past, either by drone or manned aircraft.

It may be concluded from Buster-Jangle practice that actual cloud penetrations are feasible and desirable since such penetrations ensure usable samples for radiochemical analysis. Therefore it is recommended that all future sampling missions follow this procedure.

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4.2 CLOUD TRACKING

4.2.1 Supply of Aircraft, Equipment, and Personnel

The SWC lacked the aircraft, equipment, and personnel (both aircrew and maintenance) necessary to accomplish the cloud-tracking mission. Aid was requested and obtained from the AWS. However, because the AWS had other commitments, the three WB-29's together with aircrews and maintenance personnel had to be brought back from an overseas location, namely, Hawaii.

It is believed that the moving of three WB-29's, one C-54, and 62 aircrew and maintenance personnel from an overseas location to the Zone of Interior (some 6700 miles round trip) is uneconomical. This situation will be aggravated by the frequency of repeated continental atomic tests. Therefore it is recommended that this cloud-tracking capability be established within the SWC and maintained on a permanent basis.

4.2.2 Base for Cloud-tracking Aircraft

The three cloud-tracking aircraft were based at Kirtland Air Force Base, some 550 miles from the test area, owing to lack of housing and logistical support at Indian Springs Air Force Base. This resulted in a considerable lack of coordination in briefings and debriefings for each mission. Although the cloud-tracking mission was accomplished in an excellent manner, it was done at the cost of much greater effort than would have been necessary if the controlling personnel from the Control Point could have personally attended the briefings and debriefings.

More efficient and effective results could have been obtained from the cloud-tracking effort had the aircraft and personnel been based at Indian Springs Air Force Base. It is therefore recommended that for future tests the cloud-tracking aircraft and personnel be based at Indian Springs.

4.2.3 Liaison with Rad-Safe, LASL

In accordance with requirements it was necessary that the atomic cloud be followed for a distance of 600 miles from the test area or until the radiation remaining in the cloud no longer presented an industrial hazard, whichever was sooner. This mission was accomplished. However, in discussion with Health Division personnel at LASL, it was determined that a more effective mission could be accomplished if the actual radiation intensities in the cloud could be determined as well as the direction and rate of movement. This would provide concrete information upon which to base decisions relative to opening or closing civil airways and air-space areas.

It is concluded that closer liaison should be established with the Health Division, LASL, to effect the best possible utilization of aircraft and flying hours and an intelligent accomplishment of the over-all mission. It is therefore recommended that, for future continental tests, effective liaison be established.

4.3 TERRAIN SURVEY

4.3.1 Procurement of Usable Instrumentation

The mission of terrain survey, as established, was very well executed; however, it is believed that improvement can be made in its effectiveness. The B-21 air-conductivity equipment and the B-35 scintillation counter are both experimental types of equipment, and their results have to be regarded as such. Major deficiencies of the B-21 and B-35 equipment are the lack of calibration with an area source and the absence of conversion tables that would allow the readings of millivolts and counts per minutes to be interpreted in terms of milliroentgens. If these deficiencies were corrected, the readings would be usable by the Health Division, LASL,

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in the execution of their responsibility of radiological safety.

Instruments of proved and usable quality should be permanently assigned to the SWC in order to accomplish aerial surveys of ground contamination. It is therefore recommended that specifications be prepared from which usable instrumentation can be procured.

4.3.2 Requirements for Suitable Aircraft

It is axiomatic that an aerial survey of ground contamination must be accomplished at low altitude. The mountainous terrain in the Nevada Proving Grounds area makes low flying extremely hazardous. The aircraft used for this mission should be able to fly at slow speeds, but they should also have abundant emergency power which would enable them to pull up sharply. The C-47's used on Buster-Jangle qualify on the slow-airspeed portion of the requirements, but they lack the emergency power needed for that type terrain.

The C-47 is not a suitable aircraft for terrain-survey missions at the Nevada Proving Grounds. It is therefore recommended that various types of aircraft be investigated to determine a more suitable airplane to perform low-altitude terrain-survey missions over mountainous terrain.

4.4 AIRCRAFT CONTROL

The missions of sampling, cloud tracking, and terrain survey were controlled by radio from the Control Point. The radio operators usually worked with headsets on, which necessitated either that each message be written and then handed to the officer-in-charge or that the message be called to the officer-in-charge over an intercommunication system or by telephone. The answering message had to be returned by one of the above means. This caused undue delays in getting information to and from the aircraft.

It is believed that the control of test aircraft in the area should be by instantaneous communications between ground control and the aircraft. Therefore it is recommended that officers from this organization, thoroughly familiar with their particular type of mission, act as radio operators to effect instantaneous control of their respective mission. This control would be effected under the over-all control of a senior controller familiar with all air operations in the test area.

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APPENDIX A

MANNED SAMPLING

31-32

~~RESTRICTED SECRET SECURITY INFORMATION~~

Table A.1—MANNED-SAMPLING DATA FOR BUSTER ABLE

Shot Time: 0600:00 PST, 22 October 1951

Maximum Height of Cloud: 8400 Ft MSL

Aircraft	Pene- tration No.	Altitude, ft MSL	Enter cloud, PST	Exit cloud, PST	Time in cloud, sec	Peak intensity, r	Time from 1 r to 1 r, sec	Cumulative dosimeter reading, mr	Max. A/C intensity on landing, mr/hr	Sample size per sq ft of filter paper
Creampuff 3 B-29 No. 599	1	7500	0619:00	0619:05	5	0	0	0		
	2	6500	0625:00	0625:07	7	0	0	0		
	3	5600	0630:00	0630:07	7	0	0	0		
	4	4200	0636:30	0636:32	2	0	0	0		
	5	4000	0646:00	0646:02	2	0	0	0		
	6	4300	0651:00	0651:02	2	0	0	0		
	7	4300	0710:00	0710:10	10	0	0	0		
	8	5400	0715:00	0715:02	2	0	0	0		
	9	5300	0720:00	0720:02	2	0	0	0	0.0	2.1×10^{-3}
Creampuff 2* B-29 No. 386										

*No contact with cloud was made.

Table A.2—MANNED-SAMPLING DATA FOR BUSTER BAKER

Shot Time: 0720:10 PST, 28 October 1951
 Maximum Height of Cloud: 25,000 Ft MSL

Aircraft	Pene- tration No.	Altitude, ft MSL	Enter cloud, PST	Exit cloud, PST	Time in cloud, sec	Peak intensity, r	Time from 1 r to 1 r, sec	Cumulative dosimeter reading, mr	Max. A/C intensity on landing, mr hr	Sample size per sq ft of filter paper
Creampuff 1 B-29 No. 285	1	24,500	0810:00	0810:40	40	10	15	10		
	2	18,600	0823:00	0824:00	60	15	100	80		
	3	18,500	0829:45	0830:30	45	30	75	500		
	4	18,500	0837:00	0837:45	45	8	50	550		
	5	18,000	0844:00	0844:45	45	24	60	700		
	6	18,000	0847:55	0849:00	65	22	75			
	7	18,000	0852:00	0853:30	90	14	120	1200	500	0.9×10^{-3}
Creampuff 3 B-29 No. 599	1	21,000	0831:10	0831:35	25	50	25	600		
	2	21,000	0842:21	0842:24	3	50	20	750		
	3	21,000	0853:17	0854:01	44	20	15	1000		
	4	21,000	0900:05	0900:25	20	30	25	1200	200	1.4×10^{-3}
Creampuff 4 T-33 No. 951	1	21,000	0920:00			6		55		
	2	17,000				39*		300		
	3	18,500				5		450		
	4	17,000				15*		480	1600	4.2×10^{-3}

*Estimated readings because the 0- to 50-r scale was inoperative.

Table A.3—MANNED-SAMPLING DATA FOR BUSTER CHARLIE

Shot Time: 0700:31 PST, 30 October 1951

Maximum Height of Cloud: 32,000 Ft MSL

Aircraft	Pene- tration No.	Altitude, ft MSL	Enter cloud, PST	Exit cloud, PST	Time in cloud, sec	Peak intensity, r	Time from 1 r to 1 r, sec	Cumulative reading, mr	Direction and distance from zero point Deg Miles	Max. A/C intensity on landing, mr/hr	Sample size per sq ft of filter paper
Creampuff 1 B-29 No. 285	1	24,000	0913:00	0914:00	60	5	25	100	200 60		
	2	24,000	0916:00	0917:00	60	8	60	150	200 60		
	3	24,000	0933:00	0933:30	30	8	85	450	200 65		
	4	22,000	1039:00			0.05		600	200 68	700	1.85×10^{-10}
Creampuff 3 B-29 No. 599	1	29,000	N-1300 (approx.)			0.015	0	0			
	2	25,000				0.150	0	7			
	3	25,000				0.140	0	12			
	4	25,000				0.160	0	20			
	5	24,000				0.100	0	25		100	0.38×10^{-10}
Creampuff 2 B-29 No. 386	1	18,000	0857:00			0.80	0	20	255 25		
	2	18,000				0.60	0	30	250 20		
	3	19,000				0.10	0	100	255 45		
	4	19,000				0.02	0	110	255 35		
	5	16,500				0.10	0	110	230 30		
	6	13,000				0.10	0	120	350 15		
	7	13,000				0.05	0	120	285 90	120	0.25×10^{-10}
Creampuff 4 T-33 No. 920	1	24,300	1005:00			1.5	23	10	245 110		
	2	24,000				3.4	59	33	245 110		
	3	22,000				1.5	43	40	245 110		
Creampuff 5* T-33 No. 950	4	21,000	1023:00			0.02	0	80	260 100	1100	3.0×10^{-10}

*No contact with cloud was made.

Table A.4—MANNED-SAMPLING DATA FOR BUSTER DOG

Shot Time: 0730:07 PST, 1 November 1951
 Maximum Height of Cloud: 41,000 Ft MSL

Aircraft	Penetration No.	Altitude, ft MSL	Enter cloud, PST	Exit cloud, PST	Time in cloud, sec	Peak intensity, r	Time from 1 r to 1 r, sec	Cumulative dosimeter reading, mr	Direction and distance from zero point		Max. A C intensity on landing, mr/hr	Sample size per sq ft of filter paper
									Deg	Miles		
Creampuff 1 B-29 No. 285	1	29,000	0904:00	0905:30	90	16	95	250	125	117		
	2	29,000	0910:15	0912:00	105	10	140	400	131	108		
	3	29,000	0913:00	0914:30	90	7	90	420	131	110		
	4	28,500	0922:00	0923:30	90	6	120	450	123	112		
	5	28,500	0926:00	0927:00	60	8	150	600	121	120		
	6	28,600	0937:00	0938:20	80	4	80	650	125	117		
	7	28,600	0943:00	0944:30	90	4.4	150		137	148		
	8	28,800	0951:30	0952:00	30	2	45		130	121	1200	2.2×10^{-10}
	9	28,800	0957:30	0958:15	45	2.6	50	650	134	141		
Creampuff 3 B-29 No. 599	1	27,000	0900:00			20	140	450	137	82		
	2	28,000				12	360	800	124	107		
	3	26,000				0.3		950	126	103	2000	1.87×10^{-10}
Creampuff 4 T-33 No. 920	1	30,000	0900:00			3	95	60	140	74		
	2	34,000	0902:00			10	82	200	144	110		
	3	39,000	0913:00			20	110	600	144	110		
	4	40,000	0915:00			2	55	800	144	110		
	5	41,000	0919:00			22	40	1000	141	115	4100	1.7×10^{-10}
Creampuff 5 T-33 No. 950	1	37,000	0903:00	0905:30	145	10	205	400	158	87		
	2	38,500	0914:00	0917:00	180	15	180	850	162	108	2500	2.8×10^{-10}

Table A.5—MANNED-SAMPLING DATA FOR BUSTER EASY

Shot Time: 0829:58 PST, 5 November 1951
 Maximum Height of Cloud: 42,000 Ft MSL

Aircraft	Pene- tration No.	Altitude, ft MSL	Enter cloud, PST	Exit cloud, PST	Time in cloud, sec	Peak intensity, r	Time from 1 r to 1 r, sec	Cumulative dosimeter reading, mr	Direction and distance from zero point Deg Miles	Max. A/C intensity on landing, mr/hr	Sample size per sq ft of filter paper
Creampuff 1 B-29 No. 285	1	30,500	0954:00	0957:00	180	1.2		20		30	0.05×10^{-10}
	2	31,000	1012:00	1014:00	120	0.5		30		460	0.19×10^{-10}
Creampuff 2 B-29 No. 386	1	37,500	1002:00	1007:00	300	40	240	500	153 67	3600	4.3×10^{-10}
	1	38,500	1034:00			32	135	400	175 103		
	2	38,000	1047:00			28	140	1000	175 103		
Creampuff 4 T-33 No. 920	3	38,000	1049:00			20	95	1400	174 104		
	1	37,800	1036:00	1037:00	60	3	50	50	152 115		
	2	37,600	1042:00	1043:30	90	2	50	100	152 115		
Creampuff 5 T-33 No. 950	3	37,400	1046:00	1048:00	120	40	117	680	171 102	3600	2.1×10^{-10}
	1	37,000	1032:00	1033:00	60	2.5	57	75	153 67		
Creampuff 6 T-33 No. 951	2	40,000	1034:00			8	25	200	158 109		
	3	40,000	1036:00			11	25	500	158 109		
	4	40,000				20	30	880	158 110	1800	3.8×10^{-10}

Table A.6 — MANNED-SAMPLING DATA FOR JANGLE SUGAR*

Shot Time: 0900:00 PST, 19 November 1951
Maximum Height of Cloud: 14,000 Ft MSL

Aircraft	Pene- tration No.	Altitude, ft MSL	Enter cloud, PST	Exit cloud, PST	Time in cloud, sec	Peak intensity, r	Time from 1 r to 1 r, sec	Cumulative dosimeter reading, mr	Direction and distance from zero point		Max. A/C intensity on landing, mr/hr
									Deg	Miles	
Creampuff 2 B-29 No. 386	1	12,500	1005:10	1006:12	62	20	62	150	17	45	1000
	2	12,500	1012:40	1013:55	75	30	105	500	14	55	
Creampuff 3 B-29 No. 599	1	5,500	0930:00	0931:00	60	36	90	300	12	36	10
	2	4,500	0937:00	0937:35	35	12	60	475	13	40	

*The sizes of the samples collected were unknown at the time of writing.

Table A.7 — MANNED-SAMPLING DATA FOR JANGLE UNCLE*

Shot Time: 1200:00 PST, 29 November 1951
Maximum Height of Cloud: ~12,000 Ft MSL

Aircraft	Pene- tration No.	Altitude, ft MSL	Enter cloud, PST	Exit cloud, PST	Time in cloud, sec	Peak intensity, r	Time from 1 r to 1 r, sec	Cumulative dosimeter reading, mr	Direction and distance from zero point		Max. A/C intensity on landing, mr/hr
									Deg	Miles	
Creampuff 2 B-29 No. 386	1	10,000	1320:00	1321:00	60	3	60	15	50	42	700
	2	8,500	1334:00	1335:00	60	4.4	95	75	44	48	
	3	9,200	1339:00	1340:00	60	2.8	100	115	43	50	
	4	9,500	1344:00	1347:00	180	4.2	265	190	44	48	
	5	8,000	1350:00	1352:00	120	0.5	0	240	45	46	
	6	9,500	1359:00	1402:00	180	2.4	90	295	51	56	
	7	8,000	1420:00	1422:00	120	0.3	0	340	37	62	
Creampuff 3 B-29 No. 599	1	7,500	1303:00	1304:20	80	0.2	0	10	25	14	300
	2	5,500	1310:40	1311:45	95	1.1	5	15	25	14	
	3	8,000	1320:40	1322:00	80	2	8	20	27	16	
	4	6,000	1323:50	1327:20	210	1	2	40	27	16	

*The sizes of the samples collected were not known at the time of writing.

Table A.8—FILM-BADGE READINGS IN ROENTGENS FOR PERSONNEL PARTICIPATING IN THE MANNED-SAMPLING MISSIONS ON BUSTER-JANGLE

Position	Buster					Jangle			Buster-Jangle total
	Baker	Charlie	Dog	Easy	Total	Sugar	Uncle	Total	
Creampuff 1									
Pilot	1.30	0.56	1.72		3.58				3.58
Copilot	1.30	0.52	1.38		3.20				3.20
Engineer	1.40	0.62	1.80		3.82				3.82
Radiological officer	1.30	0.50	1.50		3.30	0.38		0.38	3.68
Radiological officer	1.30	0.50	1.75		3.55				3.55
Left scanner	1.70	0.64	2.10		4.44				4.44
Right scanner	1.40	0.62	2.00		4.02				4.02
Scanner	1.40	0.52	1.72		3.64				3.64
Radiological officer	0.52		1.03		1.55	0.60	0.05	0.65	2.20
ARDC	1.60			1.10	2.70				2.70
Creampuff 2									
Pilot		0.12	0.06	0.86	1.04	0.68	0.44	1.12	2.16
Copilot		0.11		0.73	0.84				0.84
Engineer		0.12	0.06	0.90	1.08	0.65	0.38	1.03	2.11
Radiological officer	1.20	0.07	0.07	0.77	2.11				2.11
Left scanner		0.16	0.06	1.11	1.22	0.74	0.40	1.14	2.36
Right scanner		0.14		0.98	1.12	0.68	0.62	1.30	2.42
Scanner		0.14	0.14	1.10	1.38	0.74	0.07	0.81	2.19
Radiological officer		0.12	0.06		0.18		0.31	0.31	0.49
Creampuff 3									
Pilot	1.20		1.30	0.13	2.63	0.56	0.07	0.63	3.26
Copilot	1.30	0.46	1.21	0.13	3.10	0.62		0.62	3.72
Engineer	1.11	0.07	1.18	0.13	2.49	0.37	0.05	0.42	2.91
Left scanner	1.30		1.60	0.13	3.03	0.53		0.53	3.56
Right scanner	1.60		1.60	0.13	3.33	0.52		0.52	3.85
Scanner	1.20		1.73	0.09	3.02	0.50		0.50	3.52
Radiological officer	1.30			0.13	1.43				1.43
ARDC	1.40		1.55	0.10	3.05				3.05
Creampuff 4									
Pilot	0.60	0.14	1.03	1.32	3.09				3.09
Radiological officer		0.13	0.96	1.15	2.24				2.24
Creampuff 5									
Pilot			0.83	0.64	1.47				1.47
Radiological officer			0.80	0.56	1.36				1.36
Creampuff 6									
Pilot			0.06	0.88	0.94				0.94
Radiological officer			0.06	0.80	0.86				0.86

[REDACTED]

APPENDIX B

CLOUD TRACKING

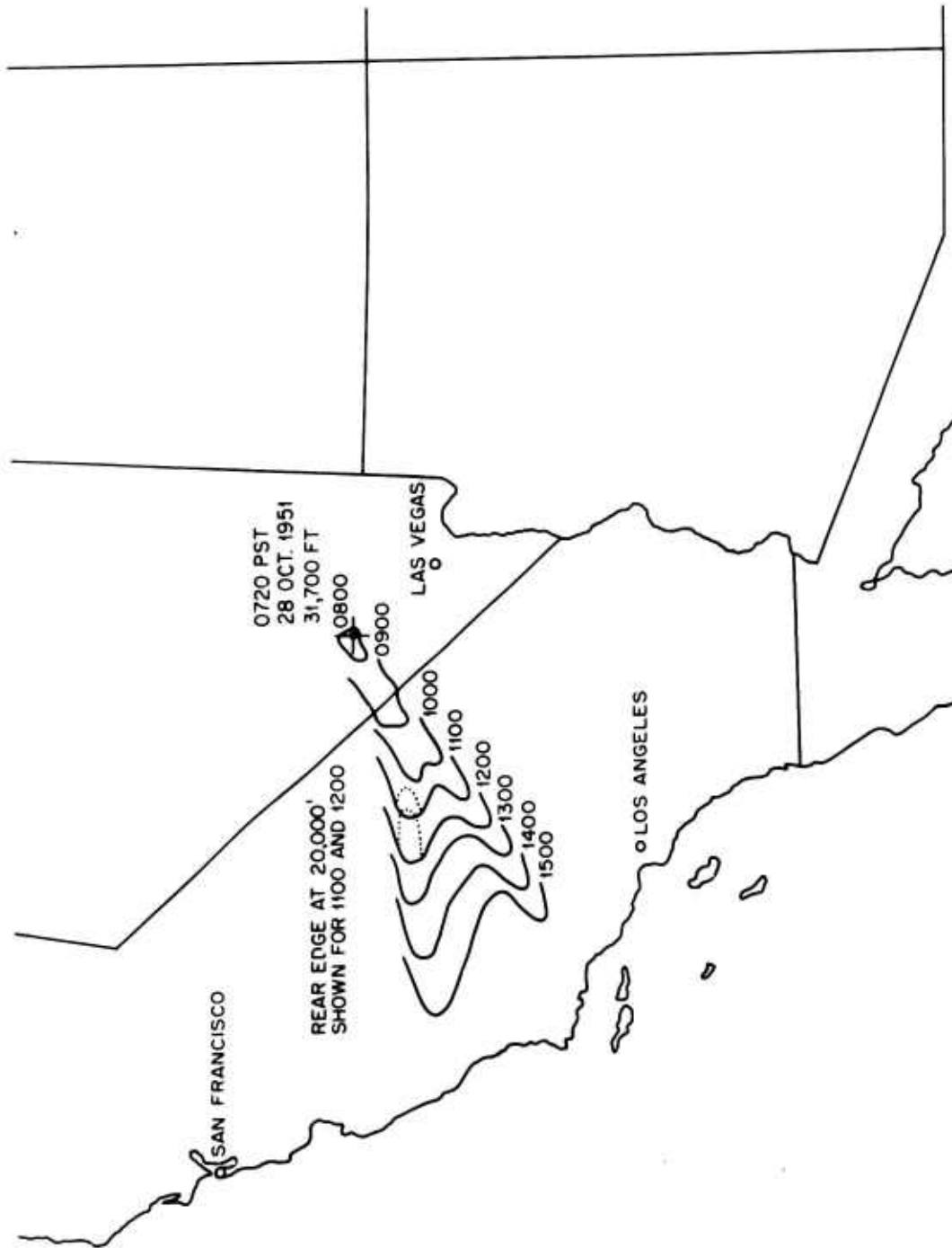


Fig. B.1—Outline of Buster Baker cloud at 1-hr intervals. Data by SWC and AWS; analysis by HQ, USAF (AFOAT-1).

Table B.1 — CLOUD-TRACKING DATA OBTAINED BY NUTMEG 2 ON BUSTER BAKER
 Flight Data: Aircraft No. 1819; Take-off Time, 0515; Time on Station, 0732;
 Landing Time, 1825; Total Flying Time, 13 Hr and 10 Min

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading Mv	B-35 reading Mr	Altitude of cloud top, ft	Altitude of cloud base, ft	Direction of cloud movement, deg	Cloud speed, knots	Estimated distance from cloud, miles	Location of cloud Latitude Longitude
1	8R29	0800	20,000	0	280-280	0	28,000	5,000	320	40	15	37°07'N 116°15'W
2	8T29	0815	20,000	0	285-285	0	28,000	5,000	205	50	*	36°48'N 116°15'W
3	8W27	0830	20,000	0	285-285	0	28,000	8,000	217	50	*	36°18'N 116°35'W
4	8T27	0845	20,000	0	280-280	0	28,000	8,000	223	35	*	36°48'N 116°35'W
5	8T25	0900	20,000	0	285-285	0	28,000	8,000	240	45	*	36°48'N 116°55'W
6	8T25	0914	20,000	10	285-920	0.469	28,000	8,000	240	32	*	36°48'N 116°55'W
7	8U39	0920	20,000	0	285-285	0	28,000	9,000	230	25	*	36°38'N 116°15'W
8	8U24	0930	20,000	0	285-285	0	28,000	10,000	240	25	*	36°38'N 117°05'W
9	8U29	0937	20,000	0	285-335	0.020	28,000	10,000	240	25	*	36°38'N 116°15'W
10	8W21	0950	20,000	0	285-645	0.182	28,000	9,000	240	30	0.5	36°18'N 117°35'W
11	8W23	0954	20,000	3	285-680	0.233	28,000	10,000	240	30	0.5	36°18'N 117°15'W
12	8X20	1002	20,000	0.12	285-1000	0.552	28,000	11,000	230	30	2	36°08'N 117°45'W
13	8V19	1007	20,000	0.12	285-1000	0.552	28,000	12,000	230	30	1.5	36°28'N 117°55'W
14	8X23	1013	20,000	0	285-540	0.129	28,000	12,000	235	30	2	36°08'N 117°15'W
15	8W22	1023	20,000	0.30	285-3000	5.452	28,000	12,000	240	30	1	36°18'N 117°25'W
16	8X23	1036	20,000	0	290-290	0	28,000	14,070	240	30	4	36°08'N 117°15'W
17	8X24	1040	20,000	0.40	290-3000	5.449	28,000	14,000	240	30	1	36°08'N 117°05'W
18	8X20	1057	20,000	2	300-6200	23.345	28,000	14,000	240	30	1	36°08'N 117°45'W
19	8W20	1100	20,000	4	300-8200	40.045	28,000	13,000	240	30	1	36°18'N 117°45'W
20	8V19	1105	20,000	0.5	300-1350	1.045	28,000	15,000	240	30	1	36°28'N 117°55'W
21	14B26	1115	20,000	0	300-300	0	30,000	16,000	240	30	*	35°48'N 117°45'W
22	8X19	1120	20,000	0.9	300-3000	5.445	30,000	17,000	250	30	*	36°08'N 117°55'W
23	8V18	1127	20,000	0	300-700	0.243	30,000	17,000	240	30	1.5	36°28'N 118°05'W
24	8W18	1131	20,000	0.6	300-2700	4.145	30,000	17,000	240	30	*	36°18'N 118°05'W
25	8X18	1133	20,000	0	300-300	0	30,000	17,000	240	30	*	36°08'N 118°05'W

Table B.1—(Continued)

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading			B-35 reading	Altitude of cloud		Direction of cloud movement, deg	Cloud speed, knots	Estimated distance from cloud, miles	Location of cloud	
					Mv	Mr	Mr		top, ft	base, ft				Latitude	Longitude
26	8X17	1141	20,000	0.95	300-3400	6.945	47,000		18,000		240	25	*	36°08'N	118°15'W
27	8X16	1151	20,000	0	275-275	0	0		18,000		240	25	*	36°08'N	118°25'W
28	8X16	1201	20,000	0.2	280-1400	1.054	48,000		18,000		250	30	1.5	36°08'N	118°25'W
29	8X15	1210	20,000	0.1	280-1500	1.254	52,000		18,000		250	35	1.5	36°08'N	118°35'W
30	14B22	1218	20,000	0.12	280-740	0.288	24,000		18,000		255	35	1	35°48'N	118°25'W
31	8W18	1226	20,000	0.05	270-500	0.110	9,000		18,000		255	35	1	36°18'N	118°05'W
32	8V15	1230	20,000	0	270-400	0.056	5,000		18,000		255	30	2	36°28'N	118°35'W
33	8V16	1238	20,000	0	275-330	0.022	2,000		18,000		270	30	1	36°28'N	118°25'W
34	8V17	1250	20,000	0	275-275	0	0		19,000		270	30	*	36°28'N	118°15'W
35	8X13	1259	20,000	0.06	275-600	0.176	11,000		18,000		265	35	0.5	36°08'N	118°55'W
36	8V12	1309	20,000	0	275-310	0.014	1,000		18,000		270	35	*	36°28'N	119°05'W
37	8W12	1313	20,000	0	275-330	0.022	2,000		18,000		270	35	*	36°18'N	119°05'W
38	8X11	1325	20,000	0	285-285	0	0		18,000		270	35	*	36°08'N	119°15'W
39	14D18	1333	20,000	0	215-275	0.017	0		22,000		270	35	*	35°28'N	119°05'W
40	14F21	1345	20,000	0	270-270	0	0		25,000		270	35	*	35°08'N	118°35'W
41	14C23	1355	20,000	0	280-280	0	0		29,000				*	35°38'N	118°15'W
42	14A18	1404	20,000	0.4	285-885	0.433	1,000		29,000				1	35°58'N	119°05'W
43	14B17	1406	20,000	0.6	280-1000	0.577	57,000		29,000		260	30	*	35°48'N	119°15'W
44	14A16	1408	20,000	0.05			0		29,000		260	30	*	35°58'N	119°25'W
45	14B15	1410	20,000	0.01	239-540	0.131	2,000		29,000		260	30	0.5	35°48'N	119°35'W
46	14B13	1414	20,000	0.04	280-610	0.181	11,000		29,000		260	30	*	35°48'N	119°55'W
47	14A12	1420	20,000	0.01	275-510	0.114	8,000		29,000		260	30	1	35°58'N	120°05'W
48	14B13	1425	20,000	0	275-275	0	0		30,000		260	30	*	35°48'N	119°55'W
49	8W6	1430	20,000	0	270-270	0	0		30,000		260	30	*	36°18'N	118°25'W
50	14B11	1440	20,000	0	280-465	0.087	1,000		29,000		260	30	*	35°48'N	120°15'W

* Unknown.

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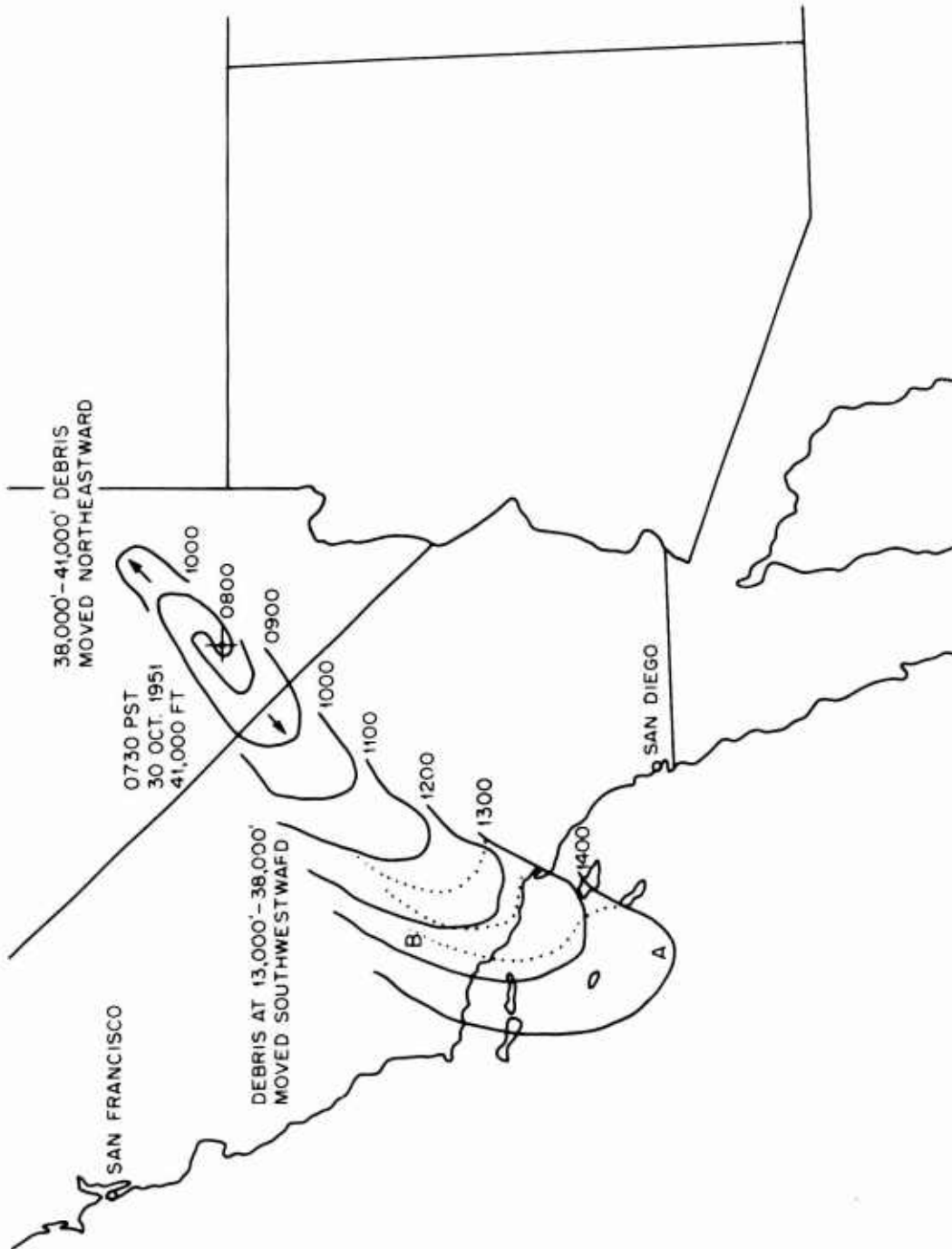


Fig. B.2—Outline of Buster Charlie cloud at 1-hr intervals. —, leading edge of all debris. . . ., trailing edge at 18,000 to 25,000 ft. A, debris above 25,000 ft in this position at 1400 PST. B, debris at 20,000 ft in this position at 1400 PST. Data by SWC and AWS; analysis by HQ, USAF (AFOAT-1).

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Table B.2 — CLOUD-TRACKING DATA OBTAINED BY NUTMEG 1 ON BUSTER CHARLIE

Flight Data: Aircraft No. 1816; Take-off Time, 0400; Time on Station, 0616;
Landing Time, 1300; Total Flying Time, 9 Hr

Report No.	Position, Grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading			B-35 reading	Altitude of cloud		Direction of cloud movement, deg	Cloud speed, knots	Estimated distance from cloud, miles	Location of cloud	
					Mv	Mr			top, ft	base, ft				Latitude	Longitude
1	8T31	0737	24,000	0	190-190	0	0	0	30,000	5,000	180	15	8	36°48'N	115°55'W
2	8T32	0747	24,000	0	190-190	0	0	0	32,000	26,000	90	15.2	12	36°48'N	115°45'W
3	8U29	0751	24,000	0	190-190	0	0	0	25,000	6,000	190	25.2	20	36°48'N	116°15'W
4	8P32	0805	21,500	0	190-190	0	0	0	32,000	29,000	90	25.2	20	37°28'N	115°45'W
5	8U37	0812	20,000	0	270-270	0	0	0	25,000	6,000	200	15	20	36°37'N	114°55'W
6	8N30	0820	20,000	0	275-275	0	0	0	32,000	29,000	350	40	10	37°48'N	116°05'W
7	8R31	0829	20,000	20	275-325	0.020	2000	0	35,000	32,000	0	45	5	37°08'N	115°55'W
8	8R32	0838	20,000	0	275-285	0.004	1200	0	35,000	33,000	350	40	1	37°08'N	115°45'W
9	8W26	0850	20,000	0	275-275	0	0	0	25,000	24,000	190	40	8	36°18'N	116°45'W
10	8W24	0903	20,000	0.1	270-375	0.043	6000	0	25,000	24,000	200	45	10	36°18'N	117°05'W
11	8T24	0906	20,000	0	270-360	0.037	4500	0	28,000	24,000	200	40	1	36°48'N	117°05'W
12	8W26	0911	20,000	0	275-390	0.049	9000	0	25,000	24,000	200	40	1	36°18'N	116°45'W
13	8V28	0915	20,000	0	280-365	0.035	5400	0	25,000	24,000	200	40	1	36°28'N	116°25'W
14	8V29	0918	20,000	0	275-310	0.014	1900	0	25,000	24,000	200	40	1	36°28'N	116°15'W
15	8V30	0922	20,000	0	270-280	0.004	0	0	25,000	24,000	195	40	1.5	36°28'N	116°05'W
16	8V33	0930	20,000	0	270-270	0	0	0	25,000	24,000	195	40	10	36°28'N	115°35'W
17	8P34	0940	20,000	0	270-270	0	700	0					*	37°27'N	115°25'W
18	8O34	0943	20,000	0	270-270	0	900	0			15		*	37°37'N	115°25'W

* Unknown.

Table B.3 — CLOUD-TRACKING DATA OBTAINED BY NUTMEG 2 ON BUSTER CHARLIE

Flight Data: Aircraft No. 7335; Take-off Time, 0835; Time on Station, 0930; Landing Time, 1755; Total Flying Time, 9¹/₂ Hr

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading		B-35 reading	Location of cloud	
					Mv	Mr		Latitude	Longitude
1	8N31	1110	20,000	0	0	0	400	37°48'N	115°55'W
2	8U32	1120	20,000	0	0	0	0	36°38'N	115°45'W
3	8V29	1130	20,000	0	0	0	800	36°28'N	116°15'W
4	8X24	1140	20,000	0	260-260	0	0	36°08'N	117°05'W
5	14C26	1150	20,000	0	265-265	0	0	35°38'N	117°45'W
6	14B24	1200	20,000	0	265-275	0.004	0	35°48'N	118°05'W
7	14A23	1201	20,000	0	275-347	0.031	0	35°47'N	118°15'W
8	14B22	1205	20,000	0	270-370	0.041	1,000	35°48'N	118°25'W
9*	14D23	1211	20,000	0	270-400	0.056	1,800	35°28'N	118°15'W
10	14F20	1220	20,000	0	270-460	0.088	3,400	35°08'N	118°45'W
11*	14H19	1225	20,000	0.13	275-800	0.346	28,000	34°48'N	118°55'W
12	14I20	1230	20,000	0	280-280	0	0	34°38'N	118°45'W
13	14K21	1235	20,000	0	300-610	0.169	1,400	34°18'N	118°35'W
14	14K20	1246	20,000	0.1	300-730	0.270	21,000	34°18'N	118°45'W
15	14J19	1250	20,000	0.03	270-570	0.156	57,200	34°48'N	118°55'W
16	14H19	1255	20,000	0.2	300-1900	2.045	57,000	34°28'N	118°55'W
17	14I18	1300	20,000	0.07	300-820	0.355	2,100	34°38'N	119°05'W
18	14J21	1307	20,000	0	280-280	0	0	34°28'N	118°35'W
19	14H18	1320	20,000	0.4	275-2000	2.256	57,000	34°48'N	119°05'W
20	14K18	1330	20,000	0.03	275-450	0.080	8,000	34°18'N	119°05'W
21	14J19	1333	20,000	0.01	275-540	0.135	6,000	34°28'N	118°55'W
22	14I21	1340	20,000	0	270-270	0	0	34°38'N	118°35'W
23	14F20	1350	20,000	0	275-275	0	0	35°08'N	118°45'W
24	14E20	1355	20,000	0	275-470	0.091	3,000	35°18'N	118°45'W
25	14C21	1358	20,000	15	270-17,000	16.598	55,000	35°38'N	118°35'W
26	14E22	1405	20,000	0.15	600-600	0	17,000	35°18'N	118°25'W
27	14F24	1415	20,000	0	570-570	0	0	35°08'N	118°05'W
28	14E26	1425	20,000	0	560-560	0	0	35°18'N	117°45'W
29	14A25	1435	20,000	0	570-760	0.154	3,000	35°58'N	117°55'W

* Estimated to be 1 mile from the cloud; the distance from the cloud was unknown for all other reports.

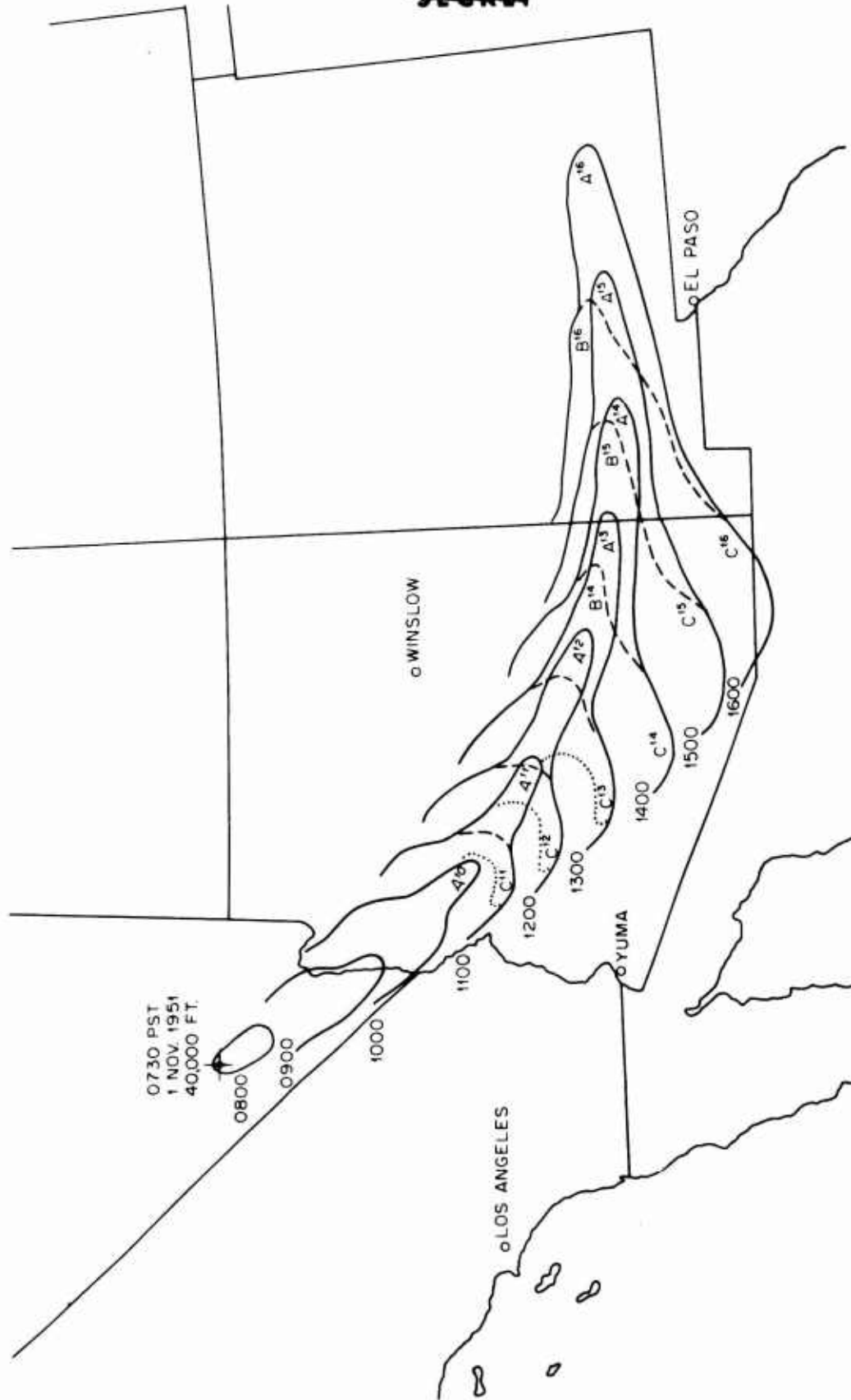


Fig. B.3—Outline of Buster Dog cloud at 1-hr intervals. —, leading edge of all activity. ---, leading edge at 18,000 to 25,000 ft. . . ., trailing edge. A¹⁴, 40,000-ft debris at 1400 PST. B¹⁴, 30,000-ft debris at 1400 PST. C¹⁴, 20,000-ft debris at 1400 PST. Data by SWC and AWS; analysis by HQ, USAF (AFOAT-1).

Table B.4 — CLOUD-TRACKING DATA OBTAINED BY NUTMEG 1 ON BUSTER DOG

Flight Data: Aircraft No. 7335; Take-off Time, 0530; Time on Station, 0715;
Landing Time, 1800; Total Flying Time, 12 1/2 Hr

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading Mv	Mr	B-35 reading	Altitude of cloud top, ft	Altitude of cloud base, ft	Direction of cloud movement, deg	Cloud speed, knots	Estimated distance from cloud, miles	Location of cloud	
													Latitude	Longitude
1	8W31	0800	20,000	0	360-360	0	0	30,000	26,000	330	50	10 NE	36°18'N	115°55'W
2	8W35	0807	20,000	0	360-360	0	0	30,000	27,000	310	75	13 N	36°18'N	115°15'W
3	8U36	0818	20,000	0	360-360	0	0	32,000	28,000	310	65	10 SE	36°37'N	115°05'W
4	8X38	0830	20,000	0	360-360	0	0			315	85	12 W	36°05'N	114°45'W
5	14B41	0840	20,000	0	350-350	0	0			315	85	10 NE	35°45'N	115°15'W
6	13C1	0850	20,000	0	360-360	0	0			330	85	10 N	35°35'N	114°55'W
7	13A2	0900	20,000	0	360-360	0	0			330	85	10 S	35°55'N	114°45'W
8	13D2	0910	20,000	0	360-370	0.003	500					4	35°25'N	114°45'W
9	13D1	0916	20,000	0	360-395	0.016	1,300					*	35°25'N	115°55'W
10														
11	13E4	0927	20,000	0	360-410	0.024	2,300					*	35°15'N	114°25'W
12	13D5	0934	20,000	0.1	360-1600	0.071	47,000					1	35°26'N	115°15'W
13	13F5	0945	17,000	0	385-435	0.067	4,300					1.5	35°06'N	114°15'W
14	13F4	0946	17,000	0	285-375	0.037	3,000					*	35°06'N	114°25'W
15	13D4	1000	17,000	0	285-285	0	0					1	35°26'N	114°25'W
16	13D4	1002	17,000	0	285-560	0.050	7,900					1	35°26'N	114°25'W
17	13E5	1005	17,000	0.1	285-960	0.514	7,900					1	35°16'N	114°15'W
18	13F6	1010	17,000	0	285-350	0.027	1,000					1	35°06'N	114°05'W
19	13F3	1020	17,000	0	285-285	0	0					*	35°05'N	114°35'W
20	13E2	1026	17,000	0.1	285-345	0.024	3,700					1	35°15'N	114°45'W
21	13C1	1038	17,000	0.05	285-630	0.194	3,700					*	35°35'N	114°55'W
22	13C2	1051	18,000	0.1	285-515	0.115	6,000					*	35°35'N	107°45'W
23	13D3	1056	18,000	0.05	285-315	0.021	400					*	35°25'N	114°35'W
24	13F3	1059	17,000	0.02	285-660	0.217	5,300					*	35°05'N	114°35'W
25	13I4	1110	17,000	0	285-285	0	0					*	34°35'N	114°25'W
26	13I7	1120	17,000	0	285-285	0	0					*	34°37'N	114°55'W
27	13G8	1122	17,000	0	285-385	0.042	1,000					*	34°55'N	113°45'W
28	13H9	1124	17,000	2.0	285-2950	4.82	47,300					*	34°47'N	113°35'W
29	13J11	1133	17,000	0	280-470	0.084	4,000					1	34°27'N	113°15'W
30	13I12	1135	17,000	0.4	285-770	0.314	5,000					1.5	34°37'N	113°05'W
31	13K14	1140	20,000	0.4	285-735	0.282	5,000					*	34°17'N	112°45'W
32	13N15	1144	17,000	0	285-350	0.027	2,300					1	33°48'N	112°45'W
33	13O4	1150	17,000	0	285-330	0.018	2,100					1	33°35'N	114°25'W
34	13Q14	1202	17,000	0	285-285	0	0					*	33°18'N	112°45'W
35	13P16	1210	17,000	0	285-285	0	0					*	33°27'N	112°25'W

Table B.4 — (Continued)

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading		B-35 reading	Altitude of cloud top, ft	Altitude of cloud base, ft	Direction of cloud movement, deg	Cloud speed, knots	Estimated distance from cloud, miles	Location of cloud	
					Mv	Mr							Latitude	Longitude
36	13P16	1211	17,000	0.3	285-330	0.018	1,000					*	33°27'N	112°25'W
37	13N18	1217	17,000	0.02	285-400	0.050	400					*	33°48'N	112°05'W
38	13L21	1230	20,000	0	360-360	0	0					*	34°08'N	111°35'W
39	13O19	1237	20,000	0	360-650	0.179	6,600					*	33°38'N	111°55'W
40	13H19	1252	20,000	0	0	0	0					*	34°49'N	111°55'W
41	13J16	1301	20,000	0	360-360	0	0					*	34°27'N	112°25'W
42	13J14	1317	20,000	0	370-370	0	0					*	34°27'N	112°45'W
43	13M15	1320	20,000	0	360-360	0	0					*	35°58'N	112°35'W
44	13N17	1324	20,000	0.1	360-960	0.483	3,800					*	33°48'N	112°15'W
45	13O20	1329	20,000	0	360-525	0.089	1,000					*	33°38'N	111°45'W
46	13P22	1334	20,000	0.004	370-525	0.084	1,000					*	33°23'N	111°25'W
47	13Q22	1338	20,000	0.1	370-1000	0.517	56,000					*	33°18'N	111°25'W
48	13P25	1345	20,000	0	370-1900	2.17	56,000					*	33°28'N	110°55'W
49	13O26	1346	20,000	0.5	370-2700	4.18	56,400					*	33°38'N	110°45'W
50	13Q27	1350	20,000	0.1	370-1000	0.517	56,000					*	33°18'N	110°35'W
51	13O25	1355	20,000	0.1	370-775	0.293	6,300					*	33°38'N	110°55'W
52	13O25	1403	20,000	0.5	370-300	0	5,400					*	33°38'N	110°55'W
53	13R25	1408	20,000	0.02	450-540	0.051	700					*	33°08'N	110°55'W
54	13S24	1410	20,000	0.1	500-2900	4.85	44,200					*	32°58'N	111°05'W
55	13U22	1420	20,000	0	500-1000	0.448	3,500					*	32°38'N	111°25'W
56	13X23	1426	20,000	0	410-610	0.124	6,500					*	32°09'N	111°15'W
57	13X21	1431	20,000	0	600-890	0.262	12,000					*	32°90'N	111°35'W
58	16B15	1440	20,000	0	420-425	0	1,500			120	50	*	31°47'N	111°35'W
59	16C19	1448	20,000	0	400-400	0	0					*	31°38'N	110°55'W
60	16B19	1451	20,000	0	400-530	0.072	5,000			130	50	*	31°47'N	110°55'W
61	16A23	1457	20,000	0	500-530	0.018	500					*	31°57'N	110°15'W
62	13X32	1506	20,000	0	400-440	0.020	500					*	32°06'N	109°45'W
63	13W34	1512	20,000	0.25	400-1400	0.990	17,500					*	32°17'N	109°25'W
64	13X36	1515	20,000	0	400-400	0	0					*	32°06'N	109°05'W
65	13X37	1518	20,000	0.25	400-1800	1.80	25,500					*	32°06'N	108°55'W
66	13W40	1523	20,000	0.1	400-1400	1.002	7,500					*	32°15'N	108°25'W
67	12V1	1530	20,000	0	400-465	0.034	1,500					*	32°25'N	107°55'W
68	12T3	1539	20,000	4.5	400-17,100	17.002	52,500					*	32°45'N	107°55'W
69	12V10	1550	20,000	0	2500-2500	0	0					*	32°28'N	106°25'W
70	12S10	1600	20,000	0	Off	0	Off					*	32°57'N	106°25'W

* Unknown.

Table B.5 — CLOUD-TRACKING DATA OBTAINED BY NUTMEG 2 ON BUSTER DOG

Flight Data: Aircraft No. 1819; Take-off Time, 1000; Time on Station, 1100; Landing Time, 1730; Total Flying Time, 7 1/2 Hr

Report No.	Position, Grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading		B-35 reading	Altitude of cloud top, ft	Altitude of cloud base, ft	Direction of cloud movement, deg	Cloud speed, knots	Estimated distance from cloud, miles	Location of cloud	
					Mv	Mr							Latitude	Longitude
1	8W35	1010	21,000	5.5	BG-550	0.133	20,000					*	36°17'N	115°15'W
2	14C42	1020	32,000	2	190-190	0	3,000					*	35°35'N	115°05'W
3	13D2	1027	15,000	20	200-1000	0.577	15,000					*	35°25'N	114°45'W
4	13G3	1038	19,000	1.2	290-290	0	0	35,000		160		20 SE	34°55'N	114°35'W
5	13F7	1045	20,000	20	290-1500	1.249	21,000	35,000	18,000	160		*	35°07'N	113°55'W
6	13I9	1055	20,000	0.4	550-550	0	0	35,000	18,000	160		*	34°38'N	111°55'W
7	13J11	1057	20,000	16	550-1600	1.317	1,500	35,000	18,000	160	57	1 SE	34°27'N	113°15'W
8	13K10	1101	20,000	20	550-750	0.160	5,000	35,000	18,000	160	57	1	34°17'N	113°25'W
9	13N11	1114	20,000	0.2	400-400	0	0					*	33°48'N	113°15'W
10	13M10	1120	20,000	0.4	350-10,500	6.925	6,000					*	33°58'N	113°25'W
11	13M12	1125	20,000	20	350-1200	0.825	1,100			160	57	1 N	33°58'N	113°05'W
12	13M12	1128	20,000	20	350-1000	0.525	8,000			160	57	1 W	33°58'N	113°05'W
13	13N11	1134	20,000	1.0	300-400	0.043	4,000			160	57	1 SW	33°48'N	113°15'W
14	13N12	1138	20,000	1.4	300-700	0.243	12,500			160	57	1 N	33°48'N	113°05'W
15	13L14	1143	20,000	9.5	300-400	0.043	6,500			160	57	1 NW	34°08'N	112°45'W
16	13M14	1147	20,000	20	320-700	0.237	7,000			160	57	1 NW	33°58'N	112°45'W
17	13N14	1150	20,000	20	320-570	0.137	10,000			160	57	1 NW	33°48'N	112°45'W
18	13Q13	1153	20,000	20	320-420	0.047	5,000			160	57	1 NW	33°38'N	112°55'W
19	13O11	1201	20,000	0	310-345	0.014	0			160	57	1 N	33°38'N	113°15'W
20	13N13	1210	20,000		310-310	0	0			160	57	*	33°48'N	113°15'W
21	13O13	1213	20,000	0.14	310-570	0.140	5,000			160	57	1 SE	33°48'N	112°55'W
22	13P13	1215	20,000	0.14	310-370	0.025	3,000			160	57	1 SE	33°28'N	112°55'W
23	13R14	1225	20,000	10	310-485	0.084	8,000			160	57	2 N	33°08'N	112°45'W
24	13Q16	1230	20,000	4	310-410	0.045	5,000			160	57	2 N	33°18'N	112°25'W
25	13Q17	1233	20,000	2	310-440	0.058	5,000			160	57	1.5 NW	33°18'N	112°15'W
26	13P19	1238	20,000	2	300-495	0.092	6,000			160	57	1 NW	33°28'N	111°55'W
27	13P20	1241	20,000	1.5	310-370	0.025	2,000			160	57	2 NW	33°28'N	111°45'W
28	13P21	1243	20,000	2	310-545	0.122	8,000			160	57	1 N	33°28'N	111°35'W
29	13P23	1246	20,000	0.7	310-385	0.032	2,000			160	57	2 NW	33°28'N	111°15'W
30	13P21	1253	20,000	0.18	315-490	0.086	6,000			160	57	1 NW	33°28'N	111°35'W
31	13Q20	1257	20,000	20	315-395	0.035	3,000			160	57	1 NW	33°18'N	111°45'W
32	13R19	1300	20,000	7	315-410	0.043	2,500			160	57	1 NW	33°08'N	111°55'W
33	13T19	1305	20,000	6	315-380	0.028	1,500			160	57	1 NW	32°48'N	111°55'W
34	13U17	1314	20,000	20	310-350	0.017	2,500			160	57	*	32°38'N	112°15'W
35	13U17	1315	20,000	20	310-695	0.236	27,000			160	57	*	32°38'N	112°15'W

Table B.5—(Continued)

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M mr	B-21 reading		B-35 reading	Altitude of cloud top, ft	Altitude of cloud base, ft	Direction of cloud movement, deg	Cloud speed, knots	Estimated distance from cloud, miles	Location of cloud	
					Mv	Mr							Latitude	Longitude
36	13U16	1325	20,000	20	320-480	0.082	6,000			140	57	1 N	32°38'N	112°25'W
37	13T17	1327	20,000	4	300-300	0	0			140	57	*	32°48'N	112°15'W
38	13T17	1328	20,000	20	300-4200	10.745	5,000			140	57	1 SE	32°48'N	112°15'W
39	13V19	1338	20,000	0	300-300	0	0			140	57	*	32°28'N	111°55'W
40	13V19	1339	20,000	1	300-300	0	2,500			140	57	1 N	32°28'N	111°55'W
41	13V22	1345	20,000	0	310-310	0	0			130	57	*	32°28'N	111°25'W
42	13V23	1348	20,000	0.5	310-380	0.030	3,000			130	57	1 NW	32°28'N	111°15'W
43	13U25	1355	20,000	1	310-415	0.047	4,000			130	57	1 NW	32°38'N	110°55'W
44	13T26	1359	20,000	2	310-460	0.072	7,000			130	57	1 NW	32°48'N	110°45'W
45	13T28	1404	20,000	2	310-425	0.049	3,500			130	57	1 NW	32°48'N	110°25'W
46	13U29	1407	20,000	0	310-310	0	0			130	57	*	32°38'N	110°15'W
47	13U27	1411	20,000	1	310-370	0.025	2,000			130	57	1.5 NW	32°38'N	110°35'W
48	13W25	1417	20,000	2	310-415	0.047	5,000			130	57	1 NW	32°18'N	110°55'W
49	13X25	1421	20,000	2	310-370	0.025	3,000			130	57	1.5 NW	32°08'N	110°55'W
50	13X23	1424	20,000	2	310-530	0.112	800			130	57	1 NW	32°08'N	111°15'W
51	16B15	1432	20,000	0.5	300-300	0	0			130	57	*	31°48'N	111°35'W
52	13X21	1436	20,000	7	300-4500	12.345	8,000			130	57	1 N	32°08'N	111°35'W
53	13X21	1440	20,000	6	300-430	0.058	0			130	57	1 N	32°08'N	111°35'W
54	13X20	1444	20,000	4	300-460	0.085	7,000			130	57	1	32°08'N	111°45'W
55	16A17	1454	20,000	2	300-470	0.080	7,000			130	57	1 NW	31°56'N	111°15'W
56	16B20	1459	20,000	0.8	300-370	0.025	1,500			130	57	1 NW	31°48'N	110°45'W
57	16B23	1504	20,000	0.1	310-365	0.022	1,000			130	57	1.5 NW	31°48'N	110°15'W
58	16C27	1514	20,000	0	300-300	0	0					*	31°38'N	109°35'W
59														
60	16B32	1525	20,000	0	300-300	0	0					*	31°48'N	108°45'W
61	16B34	1529	20,000	0	300-300	0	0					*	31°48'N	108°25'W
62	13W42	1539	20,000	0.4	300-595	0.162	6,500			130	57	0.5 NW	32°15'N	108°05'W
63	12V3	1546	20,000	0.1	310-385	0.032	2,000			130	57	1 NW	32°25'N	107°35'W
64	12T6	1555	20,000	8	300-2000	2.245	12,000			120	57	*	32°45'N	107°05'W
65														
66	12S11	1607	20,000	0.1	310-470	0.007	5,000			120	57	*	32°58'N	106°15'W
67	12P13	1617	20,000	0	310-310	0	0					*	33°28'N	105°55'W

*Unknown.

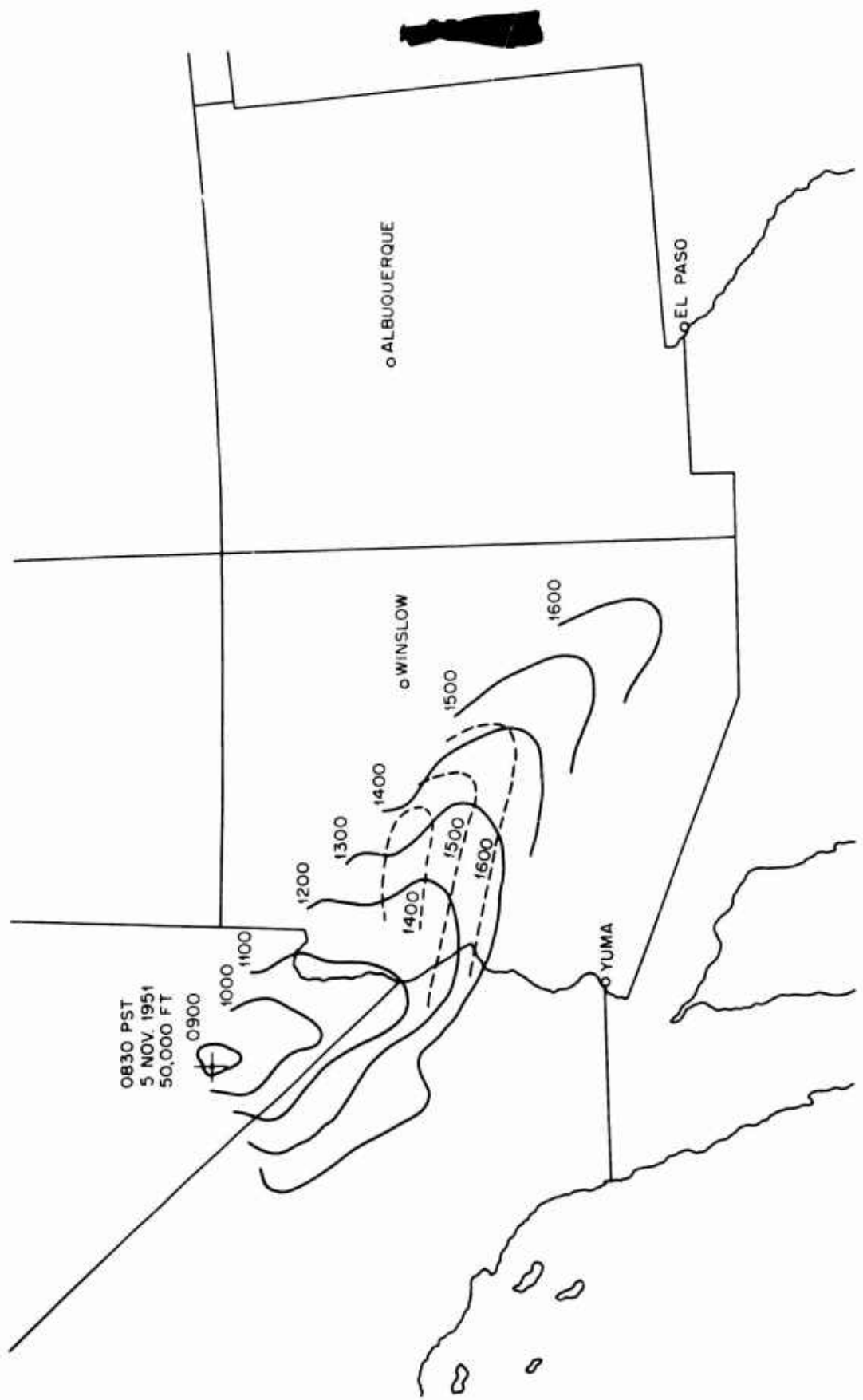


Fig. B.4—Outline of Buster Easy cloud at 1-hr intervals. —, leading edge of all debris. - - -, 18,000- to 25,000-ft debris. Data by SWC and AWS; analysis by HQ, USAF (AFOAT-1).

Table B.6 — CLOUD-TRACKING DATA OBTAINED BY NUTMEG 1 ON BUSTER EASY

Flight Data: Aircraft No. 1816; Take-off Time, 0530; Time on Station, 0802; Landing Time, 1530; Total Flying Time, 10 Hr

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M mr	B-21 reading		B-35 reading	Altitude of cloud top, ft	Altitude of cloud base, ft	Direction of cloud movement, deg	Cloud speed, knots	Estimated distance from cloud, miles	Location of cloud	
					Mv	Mr							Latitude	Longitude
1	8T34	0900	20,000	0	300-300	0	0	38,000	34,000	138	45	30	36°47'N	115°25'W
2	8U34	0910	20,000	0	380-380	0	0	38,000	34,000	138	45	20	36°37'N	115°25'W
3	8W35	0920	25,000	0	375-375	0	0	38,000	34,000	145	45	20	36°17'N	115°15'W
4	8T35	0930	22,000	0	310-310	0	0	38,000	34,000	145	45	10	36°47'N	115°15'W
5	8X34	0940	22,000	0	320-320	0	0	38,000	37,000	170	45	1	36°07'N	115°25'W
6	8X33	0944	22,000	0	320-470	0.074	2,400	38,000	37,000	170	45	9	36°07'N	115°35'W
7	14B38	0947	22,000	0	320-430	0.052	4,000	38,000	37,000	170	45	5	35°46'N	115°45'W
8	14B38	0949	22,000	0	320-420	0.047	4,400	38,000	37,000	170	45	5	35°46'N	115°45'W
9	14C39	0953	27,000	0	320-420	0.047	4,200	38,000	37,000	170	60	5	35°36'N	115°35'W
10	14B40	0956	22,000	0	320-400	0.037	3,200	38,000	37,000	170	60	5	35°46'N	115°25'W
11	14B40	0959	22,000	0	330-520	0.98	5,800	38,000	37,000	170	63	4	35°46'N	115°25'W
12	8W36	1007	22,000	0	330-480	0.073	3,800	38,000	37,000	170	63	5	36°17'N	115°05'W
13	8V36	1012	22,000	0	320-340	0.009	0	38,000	37,000	120	63	15	36°27'N	115°05'W
14	8V38	1017	22,000	0	300-340	0.015	600	38,000	37,000	170	62	6	36°27'N	114°45'W
15	14A42	1027	22,000	0	310-310	0	0	38,000	37,000	170	63	10	35°55'N	115°05'W
16	14A41	1028	21,000	0	310-400	0.040	1,600	38,000	37,000	170	63	7	35°55'N	115°15'W
17	14D40	1037	20,000	0	310-420	0.050	2,400	38,000	37,000	170	63	3	35°25'N	115°25'W
18	14E41	1039	20,000	0	300-385	0.035	2,600	38,000	37,000	170	63	3	35°15'N	115°15'W
19	14F40	1049	19,000	0	280-280	0	0	38,000	37,000	170	48	10	35°05'N	115°25'W
20	14E40	1050	19,000	0	260-300	0.015	1,000	38,000	37,000	170	48	4	35°15'N	115°25'W
21	14C42	1101	18,000	0	260-260	0	0	0	0	90	45	15	35°35'N	115°05'W
22	14B42	1103	18,000	0	260-290	0.011	400	0	0	90	45	15	35°45'N	115°05'W
23	13A4	1113	18,000	0	250-250	0	0	0	0	*	*	*	35°55'N	114°25'W
24	8X40	1123	18,000	0	250-250	0	0	0	0	*	*	*	36°06'N	114°25'W
25	8V37	1133	18,000	0	250-250	0	0	0	0	*	*	*	36°25'N	114°55'W

Table B.6—(Continued)

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading		B-35 reading	Altitude of cloud top, ft	Altitude of cloud base, ft	Direction of cloud movement, deg	Cloud speed, knots	Estimated distance from cloud, miles	Location of cloud	
					Mv	Mr							Latitude	Longitude
26	8S37	1134	19,000	0	260-260	0	0						36°55'N	114°55'W
27	8P38	1153	17,000	0	260-260	0	0						37°25'N	114°45'W
28	8Q41	1203	19,000	0	270-270	0	0						37°15'N	114°15'W
29	8Q42	1210	19,000	0	270-270	0	0						37°15'N	114°05'W
30	9S1	1214	18,000	0	270-270	0	0						36°55'N	113°55'W
31	8W41	1224	18,000	0	260-260	0	0						36°15'N	114°15'W
32	13B4	1234	18,000	0	240-1000	5.66	60,000						35°45'N	114°25'W
33	13C6	1238	18,000	0	265-230	0.284	2,500					0.5 S	35°35'N	114°05'W
34	13C7	1240	18,000	0	265-425	0.069	1,200					1 S	35°38'N	113°55'W
35	13C8	1243	18,000	0	260-490	0.106	1,200						35°38'N	113°45'W
36	13E9	1253	18,000	0	255-255	0	0						35°18'N	113°35'W
37	13D6	1258	18,000	0	255-330	0.027	700					4	35°27'N	114°05'W
38	13E5	1302	18,000	0	260-570	0.158	4,500				38	1	35°17'N	114°15'W
39	13F3	1309	18,000	0	260-260	0	0						35°07'N	114°35'W
40	13H1	1314	18,000	0	260-260	0	0						34°47'N	114°55'W
41	13G5	1324	18,000	0	260-260	0	0						34°56'N	114°25'W
42	13L4	1334	18,000	0	260-260	0	0						34°06'N	114°25'W
43	13N8	1344	18,000	0	260-260	0	0						33°47'N	113°45'W
44	13O12	1354	18,000	0	260-260	0	0						33°37'N	113°05'W
45	13P17	1404	18,000	0	260-260	0	0						33°27'N	112°15'W

* Unknown.

Table B.7 — CLOUD-TRACKING DATA OBTAINED BY NUTMEG 2 ON BUSTER EASY

Flight Data: Aircraft No. 7335; Take-off Time, 0945; Time on Station, 1040; Landing Time, 1830; Total Flying Time, 8 Hr and 50 Min

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading		B-35 reading	Altitude of cloud top, ft	Altitude of cloud base, ft	Location of cloud	
					Mv	Mr				Latitude	Longitude
1	8X35	1000	12,000	0	450-450	0	0			36°06'N	115°15'W
2	8X36	1010	17,000	0	525-525	0	0			36°06'N	115°05'W
3	14A39	1017	20,000	0	550-635	0.063	4,000			35°55'N	115°35'W
4	8X31	1024	20,000	0.05	550-785	0.192	20,000	17,000	16,000	36°06'N	115°55'W
5	8X30	1032	20,000	0.02	550-840	0.247	19,500			36°07'N	116°05'W
6*	14B34	1042	20,000	0.05	550-960	0.379	35,000			35°47'N	116°25'W
7	14A36	1050	15,000	0	450-620	0.110	8,500	15,000	16,000	35°57'N	116°05'W
8	8W26	1057	15,000	0	450-620	0.110	8,500	15,000	14,000	36°18'N	116°45'W
9	8W26	1106	15,000	0	470-535	0.038	2,000	14,000	13,000	36°18'N	116°45'W
10	14A28	1114	15,000	0	470-600	0.085	7,000	14,000	13,000	35°57'N	117°25'W
11	14C35	1120	15,000	0.02	490-630	0.096	0	15,000	14,000	35°37'N	116°15'W
12	14A37	1133	15,000	0.05	500-1800	0.175	48,000	15,000	14,000	35°55'N	115°55'W
13	14B38	1137	15,000	0	500-550	0.022	1,000	15,000	14,000	35°37'N	116°05'W
14	14C36	1141	15,000	0.15	500-1200	0.738	48,000	15,000	14,000	35°45'N	115°45'W
15*	14B33	1151	15,000	0	500-610	0.073	3,000	15,000	14,000	35°47'N	116°35'W
16*	14A31	1159	15,000	0	490-610	0.081	3,000	14,000	13,000	35°57'N	116°55'W
17	8V24	1210	15,000	0	500-500	0	0	12,000	11,000	36°28'N	117°05'W
18	14B32	1220	15,000	0	500-500	0	0			35°47'N	116°45'W
19	14B34	1226	15,000	0	490-560	0.045	5,000	16,000	15,000	35°27'N	116°45'W
20	14D36	1234	15,000	0	500-620	0.082	8,000	17,000	16,000	35°27'N	116°05'W
21	14D39	1243	15,000	0	480-520	0.014	1,000	15,000	14,000	35°25'N	115°35'W
22	14E40	1248	15,000	0.05	480-1000	0.468	26,000			35°15'N	115°25'W
23	14E42	1301	15,000	0	490-490	0	0			35°15'N	115°05'W
24	14D42	1304	15,000	0	490-2700	4.398	8,000			35°25'N	115°05'W
25	14E2	1307	15,000	0	490-650	0.112	4,500			35°17'N	114°35'W
26	13F5	1317	18,000	0	500-730	0.173	10,000		19,000	35°17'N	114°15'W
27	13F9	1325	18,000	0.02	520-1000	0.444	37,000			35°07'N	113°35'W
28	13E12	1335	12,000	0	530-700	0.128	8,000			35°17'N	113°05'W
29	13C12	1345	18,000	0	530-530	0	0			35°37'N	113°05'W
30	13E10	1353	18,000	0	540-780	0.194	20,000			35°17'N	113°25'W
31	13F9	1358	18,000	0	540-1200	0.723	4,500			35°07'N	113°35'W
32	13E12	1405	18,000	0.05	540-1000	0.431	24,000			35°17'N	113°05'W
33	13F15	1415	18,000	0	540-540	0	0			35°07'N	112°35'W
34	13G14	1417	18,000	0.20	540-1200	0.723	4,500			34°57'N	112°45'W
35	13J16	1430	18,000	0	530-530	0	0			34°28'N	112°25'W
36	13I15	1435	18,000	0	520-520	0	0			34°38'N	112°35'W
37	13K15	1439	18,000	0.05	530-730	0.155	10,000			34°48'N	112°35'W
38	13I13	1444	18,000	0.02	520-760	0.188	11,000			34°38'N	112°55'W
39	13H7	1459	18,000	0.07	520-680	0.079	7,000			34°48'N	113°55'W
40	13H4	1510	18,000	0	530-720	0.146	7,000			34°48'N	114°25'W
41	13H1	1521	18,000	0	540-540	0	0			34°48'N	114°55'W
42	14H41	1524	18,000	0.05	540-930	0.351	10,000			34°45'N	115°15'W
43	14I3A	1537	18,000	0	540-540	0	0			35°35'N	115°45'W
44	14G37	1540	18,000	0.04	540-750	0.146	1,000			34°55'N	115°55'W
45	14H35	1545	18,000	0	540-700	0.121	4,000			34°47'N	116°15'W
46	14G32	1555	18,000	0	500-500	0	0			34°55'N	116°45'W
47	14D35	1607	18,000	0	500-500	0	0			35°27'N	116°15'W
48	14C40	1616	18,000	0	500-500	0	0			35°35'N	115°25'W
49	13D1	1626	18,000	0	500-500	0	0			35°27'N	114°55'W
50	13G5	1636	18,000	0	520-520	0	0			34°57'N	114°15'W
51	13G12	1650	18,000	0	500-500	0	0			34°57'N	113°05'W
52	13I16	1700	18,000	0	520-520	0	0			34°38'N	112°25'W
53	13H20	1710	18,000	0	520-520	0	0			34°48'N	111°45'W
54	13H2A	1721	18,000	0	520-520	0	0			34°48'N	110°45'W
55	13I3U	1725	18,000	0	520-520	0	0			34°38'N	110°05'W

Table B.7—(Continued)

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading		B-35 reading	Altitude of cloud top, ft	Altitude of cloud base, ft	Location of cloud	
					Mv	Mr				Latitude	Longitude
56	13J34	1739	20,000	0	520-520	0	0			34°27'N	109°25'W
57	13G41	1749	18,000	0	520-520	0	0			34°55'N	108°15'W
58	12G2	1800	18,000	0	520-520	0	0			34°55'N	107°45'W

*Reports 15 and 16 showed the direction of cloud movement to be 180° and a cloud speed of 25 knots; all other reports did not give this information. For report 16 the distance from the cloud was estimated to be 3 miles; this information was unknown for all other reports.

Table B.8—CLOUD-TRACKING DATA OBTAINED BY NUTMEG 3 ON BUSTER EASY

Flight Data: Aircraft No. 1819; Take-off Time, 1145; Time on Station, 1345; Landing Time, 1920; Total Flying Time, 7 Hr and 35 Min

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading		B-35 reading	Altitude of cloud base, ft	Estimated distance from cloud, miles	Location of cloud	
					Mv	Mr				Latitude	Longitude
1	13E7	1407	20,000	0.5	260-2100	2.160	0		*	35°18'N	113°55'W
2	13E9	1411	20,000	0.3	260-550	0.143	0		*	35°18'N	113°35'W
3	13E11	1415	20,000	0.2	260-425	0.070	0		*	35°17'N	113°15'W
4	13G15	1425	20,000	0.15	270-360	0.037	0		*	34°57'N	112°35'W
5	13G15	1426	20,000	0.15	270-570	0.156	0		*	34°57'N	112°35'W
6	13I18	1437	20,000	0	270-270	0	0		*	34°37'N	112°05'W
7	13J16	1447	20,000	0	270-270	0	0		*	34°27'N	112°25'W
8	13I15	1450	20,000	0.6	270-40,000	9.758	0		*	34°36'N	112°35'W
9	13K12	1500	20,000	0	270-270	0	0	19,000	4 N	34°17'N	113°05'W
10	13K8	1510	20,000	0	280-280	0	0	19,000	4 N	34°15'N	113°45'W
11	13J4	1520	20,000	0	280-280	0	0	19,000	4 NW	34°26'N	114°25'W
12	13I4	1523	20,000	0.13	280-335	0.022	0		*	34°35'N	114°25'W
13	13J7	1529	20,000	0.1	280-320	0.015	0		*	34°25'N	113°55'W
14	13K7	1531	20,000	0.15	280-330	0.020	0		*	34°16'N	113°55'W
15	13K10	1532	20,000	0.03	280-370	0.037	0		*	34°18'N	113°25'W
16	13K12	1540	20,000	0.03	280-345	0.026	0		*	34°17'N	113°05'W
17	13L13	1554	20,000	0.05	280-375	0.039	0		*	34°07'N	112°55'W
18	13L16	1556	20,000	0.08	270-1000	0.566	0		*	34°08'N	112°25'W
19	13N18	1558	20,000	0.15	270-880	0.428	0		18	33°47'N	112°05'W
20	13M22	1605	20,000	0.1	270-760	0.310	0		*	33°58'N	111°25'W
21	13J23	1613	20,000	0	280-280	0	0		*	34°27'N	111°15'W
22	13M22	1622	20,000	0	280-515	0.115	0		*	33°47'N	111°25'W
23	13O20	1634	20,000	0.04	265-350	0.034	0		*	33°37'N	111°45'W
24	13O17	1644	20,000	0	265-335	0.026	0		*	33°38'N	112°15'W
25	13Q16	1647	20,000	0.04	265-1000	0.567	0		*	33°38'N	112°25'W
26	13N14	1654	20,000	0.03	270-325	0.02	0		*	33°47'N	112°45'W
27	13N11	1701	20,000	0.02	270-315	0.02	0		*	33°47'N	113°15'W
28	13M8	1710	20,000	0	270-330	0.02	0		*	33°56'N	113°45'W
29	13N11	1719	20,000	0	270-430	0.071	0		*	33°47'N	113°15'W
30	13Q14	1729	20,000	0.03	275-360	0.035	0		*	33°36'N	112°45'W
31	13P16	1732	20,000	0.04	270-465	0.09	0		*	33°26'N	112°25'W
32	13Q19	1738	20,000	0.05	270-500	0.11	0		*	33°18'N	111°55'W
33	13Q22	1744	20,000	0.02	270-450	0.08	0		*	33°18'N	111°25'W
34	13S28	1758	20,000	0	290-290	0	0		*	32°57'N	110°25'W
35	13S32	1808	20,000	0	280-280	0	0		*	32°57'N	109°45'W
36	13R38	1822	20,000	0	290-290	0	0		*	33°08'N	108°45'W
37	12O1	1837	20,000	0	290-290	0	0		*	33°36'N	107°55'W

*Unknown.

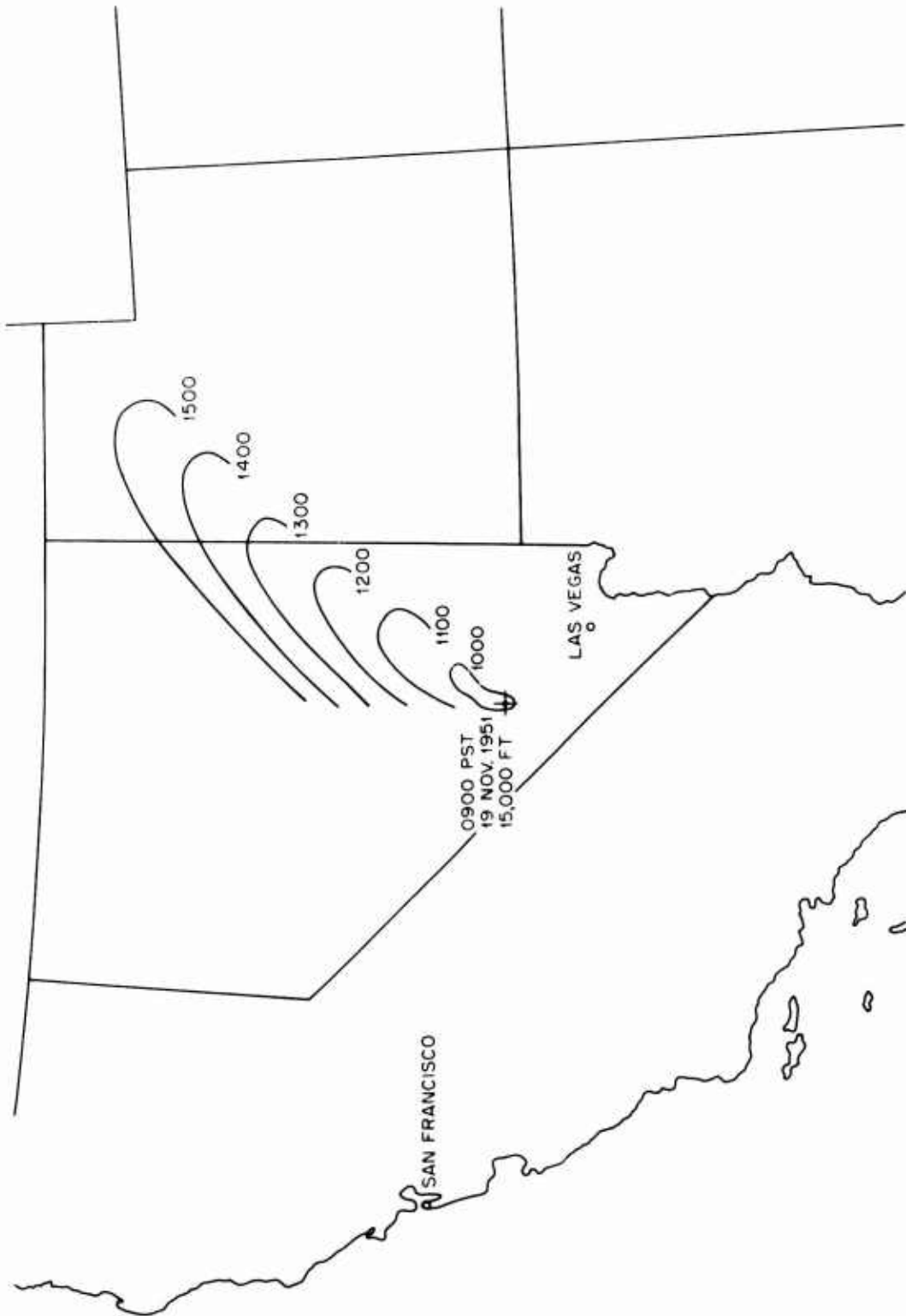


Fig. B.5—Outline of Jangle Sugar cloud at 1-hr intervals. Data by SWC and AWS; analysis by HQ, USAF (AFOAT-1).

Table B.9 — CLOUD-TRACKING DATA OBTAINED BY NUTMEG 1 ON JANGLE SUGAR

Flight Data: Aircraft No. 1819; Take-off Time, 0730; Time on Station, 0800; Landing Time, 1830; Total Flying Time, 11 Hr

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading Mv	Mr	B-35 reading	Altitude of cloud top, ft	Altitude of cloud base, ft	Direction of cloud movement, deg	Cloud speed, knots	Estimated distance from cloud, miles	Location of cloud Latitude	Longitude
1	8S30	0930	16,000	0	210-210	0	0	15,000	10,000	010	40	•	36°57'N	116°15'W
2	8O30	0940	16,000	5	210-700	0.272	8,000	15,000	10,000	010	40	0.5	37°37'N	116°05'W
3	8O33	0948	16,000	5	210-620	0.208	5,200	15,000	10,000	020	45	0.5	37°37'N	115°35'W
4	8N33	1000	16,000	20	210-600	0.194	5,500	15,000	10,000	020	40	1	37°47'N	115°35'W
5	8N34	1009	16,000	2.0	210-530	0.144	1,800	15,000	10,000	025	40	1 NE	37°47'N	115°25'W
6	8M32	1014	16,000	2.5	210-580	0.180	2,600	15,000	10,000	040	40	1 N	37°57'N	115°45'W
7	8N31	1025	16,000	0	210-230	0.005	0	15,000	10,000	040	40	0.5	37°47'N	115°55'W
8	8M33	1030	16,000	0	210-500	0.126	2,800	15,000	10,000	040	40	1 E	37°57'N	115°35'W
9	8M35	1035	15,000	0	190-285	0.027	1,000	15,000	10,000	040	40	0.5 NE	37°57'N	115°15'W
10	8L35	1038	15,000	0	190-320	0.040	500	15,000	10,000	040	40	0.5 NE	38°07'N	115°15'W
11	8L36	1039	15,000	0	190-340	0.049	1,400	15,000	10,000	040	40	0.5 NE	38°07'N	115°05'W
12	8K33	1044	15,000	0.05	185-310	0.038	800	15,000	10,000	040	40	0.5 E	38°17'N	115°35'W
13	8K35	1047	15,000	0.15	190-830	0.399	8,000	15,000	10,000	040	40	0 N	38°17'N	115°15'W
14	8K36	1054	15,000	0.03	190-320	0.040	800	15,000	10,000	040	40	0.5 NE	38°17'N	115°05'W
15	8K35	1058	15,000	0.04	190-320	0.040	2,000	15,000	10,000	040	40	0.5 NE	38°17'N	115°15'W
16	8J34	1102	15,000	0	190-270	0.021	4,000	15,000	10,000	040	40	1 NE	38°27'N	115°25'W
17	8J36	1106	15,000	0.13	200-510	0.135	2,200	15,000	10,000	060	40	0 NE	38°37'N	115°5'W
18	8R37	1115	15,000	0.08	190-710	0.286	6,600	15,000	10,000	060	40	0 NE	38°35'N	114°55'W
19	8J35	1120	15,000	0.02	190-250	0.016	500	15,000	10,000	060	40	0.5 NE	38°27'N	115°15'W
20	8H37	1125	15,000	0.08	190-600	0.199	5,500	15,000	10,000	060	40	0.25 NE	38°45'N	114°55'W
21	8J38	1133	15,000	0.1	200-590	0.190	4,000	15,000	10,000	060	45	0.5 NE	38°25'N	114°45'W
22	8H37	1139	15,000	0	190-220	0.007	600	15,000	10,000	060	45	0.5 S	38°45'N	114°55'W
23	8I38	1142	15,000	0.12	190-820	0.389	12,000	15,000	10,000	060	45	0 S	38°35'N	114°45'W
24	8H38	1145	15,000	0.02	190-520	0.143	6,500	15,000	10,000	060	45	0.25 S	38°45'N	114°45'W
25	8H39	1146	15,000	0	190-410	0.182	3,000	15,000	10,000	060	45	0.5 S	38°45'N	114°35'W
26	8F39	1154	15,000	0.02	190-390	0.072	3,000	15,000	10,000	040	45	0.5 NE	39°5'N	114°35'W
27	8F38	1158	15,000	0.07	190-510	0.137	3,000	15,000	10,000	040	45	0.5 NE	39°5'N	114°45'W
28	8F39	1202	15,000	0.12	190-1000	0.587	40,500	15,000	10,000	040	45	0 NE	39°5'N	114°35'W
29	8G31	1212	15,000	0.04	200-550	0.160	3,400	15,000	10,000	035	45	0.5 NE	38°55'N	114°15'W
30	8F39	1218	15,000	0.03	190-260	0.019	600	15,000	10,000	035	45	1	39°5'N	114°35'W
31	8E42	1228	15,000	0	190-190	0	0	17,000	10,000	035	45	1 NE	39°15'N	114°5'W
32	8E42	1229	15,000	0.04	190-570	0.252	5,200	17,000	10,000	035	45	0.25 NE	39°15'N	114°5'W
33	8E40	1237	15,000	0.06	200-700	0.275	4,600	17,000	10,000	035	45	0.5 NE	39°15'N	114°25'W
34	8C42	1241	15,000	8.0	200-1000	0.585	5,500	17,000	10,000	035	45	0 NE	39°35'N	114°5'W
35	9E1	1252	15,000	0	190-190	0	0	17,000	10,000	035	45	1 NE	39°17'N	113°55'W

Table B.9—(Continued)

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading		B-35 reading	Altitude of cloud		Direction of cloud movement, deg	Cloud speed, knots	Estimated distance from cloud, miles	Location of cloud	
					Mv	Mr		top, ft	base, ft				Latitude	Longitude
36	9D1	1253	15,000	0.02	190-255	0.018	600	17,000	10,000	035	45	1 NE	39°27'N	113°55'W
37	9D1	1255	15,000	0	190-260	0.019	800	15,000	10,000	035	45	1 NE	39°27'N	113°55'W
38	9C1	1257	15,000	0.06	190-850	0.419	20,000	15,000	10,000	035	45	0.25 NE	39°37'N	113°55'W
39	9B1	1259	15,000	0.02	190-460	0.109	4,800	15,000	10,000	035	45	0.5 NE	39°47'N	113°55'W
40	8B42	1305	15,000	2.0	190-1000	0.587	7,000	15,000	10,000	035	45	0 NE	39°45'N	114°05'W
41	9A2	1310	15,000	0.13	200-1000	0.585	7,000	15,000	10,000	035	45	0.25 NE	39°57'N	113°45'W
42	9C2	1315	15,000	0.13	190-470	0.114	4,000	15,000	10,000	035	45	0.5 NE	39°37'N	113°45'W
43	9C2	1317	15,000	0.07	190-670	0.252	8,000	15,000	10,000	035	45	0.5 NE	39°37'N	113°45'W
44	9D1	1320	15,000	0.06	190-550	0.162	6,000	15,000	10,000	035	45	0.5 NE	39°27'N	113°55'W
45	9B3	1326	15,000	0.13	190-1000	0.587	14,000	15,000	10,000	035	45	0.5 NE	39°47'N	113°35'W
46	9B3	1330	15,000	0.5	190-1000	0.587	55,000	15,000	10,000	035	45	0 NE	39°47'N	113°35'W
47	9A2	1336	15,000	0.01	190-380	0.087	3,000	15,000	10,000	035	45	1 NE	39°57'N	113°45'W
48	5X21	1340	15,000	0.4	190-850	0.419	15,000	15,000	10,000	035	45	0.5 NE	40°09'N	113°35'W
49	9A4	1349	15,000	7.0	190-1000	0.587	55,000	15,000	10,000	035	45	0 NE	39°57'N	113°25'W
50	9B4	1355	15,000	1.1	190-430	0.112	3,000	15,000	10,000	035	45	1 NE	39°47'N	113°25'W
51	9A5	1359	15,000	0.8	190-500	0.131	5,000	15,000	10,000	035	45	1 NE	39°57'N	113°15'W
52	5X24	1405	15,000	1.4	190-1000	0.627	55,000	15,000	10,000	035	45	0 NE	40°09'N	113°05'W
53	5W22	1409	15,000	0.6	190-1000	0.627	55,000	15,000	10,000	035	45	0 N	40°19'N	113°25'W
54	5W24	1413	15,000	0.6	200-1000	0.585	50,000	15,000	10,000	035	45	0 N	40°19'N	113°05'W
55	9A6	1421	15,000	0.1	200-340	0.070	4,000	15,000	10,000	035	45	1 E	39°56'N	113°05'W
56	9A4	1425	15,000	0.1	200-470	0.112	5,000	15,000	10,000	035	45	0.5 E	39°57'N	113°25'W
57	9A5	1427	15,000	0.1	200-450	0.101	500	15,000	10,000	035	45	0.5 E	39°57'N	113°15'W
58	5W25	1434	15,000	0.03	200-1000	0.585	50,000	15,000	10,000	035	45	0 E	40°19'N	112°55'W
59	5V25	1438	15,000	0.3	200-1000	0.585	50,000	15,000	10,000	035	45	0 E	40°29'N	112°55'W
60	5U23	1449	15,000	0.1	210-620	0.208	7,500	15,000	10,000	035	45	0.5 NE	40°39'N	113°15'W
61	5U21	1453	15,000	0.1	210-510	0.132	5,000	15,000	10,000	030	45	1 NE	40°39'N	113°45'W
62	5S20	1459	15,000	0.1	210-590	0.187	6,000	15,000	10,000	030	45	0.5 NE	40°59'N	113°45'W
63	5S18	1504	15,000	0	220-290	0.023	0	15,000	10,000	025	45	1 NE	40°59'N	114°05'W
64	5T18	1510	15,000	0	220-330	0.038	1,000	15,000	10,000	030	45	1 W	40°49'N	114°05'W
65	5R20	1522	15,000	0	210-360	0.050	1,000	15,000	10,000	030	45	0.5 NE	41°09'N	113°45'W
66	5S21	1525	15,000	0.1	210-220	0.062	2,000	15,000	10,000	030	45	0.5 NE	40°59'N	113°55'W
67	5T22	1527	15,000	0.05	210-500	0.130	5,000	15,000	10,000	030	45	0.5 NE	40°49'N	113°25'W
68	5T23	1529	15,000	0.1	210-610	0.200	8,005	15,000	10,000	030	40	0.25 NE	40°49'N	113°15'W
69	5S24	1534	15,000	0.1	210-310	0.032	3,000	15,000	10,000	030	40	0.25 NE	40°59'N	113°05'W
70	5S25	1538	15,000	0.05	210-290	0.025	1,000	15,000	10,000	030	40	1 NE	40°59'N	112°55'W
71	5T25	1539	15,000	0.1	210-550	0.160	5,000	15,000	10,000	030	40	0.25 NE	40°49'N	112°55'W
72	5S26	1545	15,000	0.2	210-840	0.4	12,000	15,000	10,000	035	40	0.25 N	40°59'N	112°45'W
73	5R28	1550	15,000	0.3	210-820	0.454	22,000	15,000	10,000	035	40	0 N	41°09'N	112°25'W
74	5U32	1606	15,000	0	210-210	0	0	15,000	10,000	035	40	0 N	40°38'N	111°45'W

• Unknown.

Table B.10 — CLOUD-TRACKING DATA* OBTAINED BY NUTMEG 1 ON JANGLE UNCLE

Report No.	Position, grid	Time, PST	Aircraft altitude, ft	G-M reading, mr	B-21 reading		Altitude of cloud top, ft	Direction of cloud movement, deg	Cloud speed, knots	Location of cloud	
					Mv	Mr				Latitude	Longitude
1	8Q31	1240	16,000	0	215-325	0.036				37°18'N	115°55'W
2	8Q31	1245	16,000	0.3	215-1000	0.581	10,500	170		37°18'N	115°55'W
3	8Q32	1250	16,000	0.06	200-445	0.098	10,500	170	25	37°18'N	115°45'W
4	8Q32	1233	16,000	0.05	200-525	0.144	10,500	170	25	37°18'N	115°45'W
5	8P32	1300	16,000	0	200-350	0.042	15,000	170	25	37°28'N	115°45'W
6	8Q32	1304	16,000	0.05	200-380	0.065	10,500	170	25	37°18'N	115°45'W
7	8Q31	1308	16,000	0	200-270	0.019	10,500	150	20	37°18'N	115°55'W
8	8Q33	1312	16,000	0.1	200-370	0.060	10,500	150	20	37°18'N	115°35'W
9	8Q33	1315	16,000	0	200-280	0.023	10,500	150	20	37°18'N	115°35'W
10	8P33	1317	16,000	0	200-345	0.050	10,500	150	20	37°28'N	115°35'W
11	9P33	1323	16,000	0	200-390	0.070	10,500	150	20	37°28'N	115°35'W
12	8Q33	1325	16,000	0	270-430	0.090	10,500	150	20	37°18'N	115°35'W
13	8P33	1329	16,000	0	200-370	0.060	10,500	150	20	37°28'N	115°35'W
14	8Q30	1334	16,000	0	200-230	0.008	10,500	150	20	37°18'N	116°05'W
15	8Q33	1340	16,000	0	200-335	0.045	10,500	150	30	37°18'N	115°35'W
16	8P34	1346	14,000	0	170-280	0.029	10,500	150	30	37°28'N	115°25'W
17	8P34	1349	14,000	0	170-410	0.086	10,000	140	25	37°28'N	115°25'W
18	8O34	1351	14,000	0	170-400	0.080	10,000	140	25	37°38'N	115°25'W
19	8O32	1354	14,000	0	170-480	0.123	10,000	140	25	37°38'N	115°45'W
20	8O33	1357	14,000	0.06	170-680	0.264	10,000	140	25	37°38'N	115°35'W
21	8P33	1400	14,000	0.04	170-515	0.144	8,500			37°28'N	115°38'W
22	8P34	1402	14,000	0	170-250	0.020	8,500			37°28'N	115°25'W
23	8P33	1405	14,000	0	170-335	0.051	8,500			37°28'N	115°35'W
24	8P33	1407	14,000	0	170-335	0.051	8,500			37°28'N	115°35'W
25	8O33	1410	14,000	0	170-520	0.147	8,500	60	25	37°38'N	115°35'W
26	8P34	1415	14,000	0.06	170-490	0.129	8,500	60	25	37°28'N	115°25'W
27	8O34	1417	14,000	0.25	170-815	0.388	8,500	060	25	37°38'N	115°25'W
28	8O34	1420	14,000	0	170-500	0.135	8,500	60	25	37°38'N	115°35'W
29	8N34	1424	14,000	0	170-290	0.034	8,500	60	25	37°48'N	115°25'W
30	8N33	1426	14,000	0	170-230	0.034	8,500	60	25	37°18'N	115°35'W
31	8N32	1429	14,000	0	170-260	0.023	8,500	60	25	37°48'N	115°45'W
32	8N33	1436	14,000	0	120-315	0.051	8,500	60	25	37°48'N	115°35'W
33	8N34	1439	14,000	0	170-260	0.023	8,500	60	25	37°48'N	115°25'W
34	8O35	1441	14,000	0	170-350	0.058	8,500	60	25	37°38'N	115°15'W
35	8P35	1445	14,000	0	170-420	0.091	8,500	60	25	37°28'N	115°15'W
36	8P34	1447	14,000	0	170-530	0.153	8,500			37°28'N	115°25'W
37	8O34	1450	14,000	0	170-360	0.062	8,500	60	20	37°38'N	115°25'W
38	8O34	1452	14,000	0	170-380	0.071	8,500	60	20	37°38'N	115°25'W
39	8O34	1455	15,000	0.04	120-405	0.091	8,500	60	20	37°38'N	115°25'W
40	8O35	1459	14,000	0.1	120-670	0.263	8,500	60	20	37°38'N	115°15'W
41	8O36	1503	14,000	0.1	170-600	0.203	8,500	60	20	37°38'N	115°05'W
42	8N35	1508	14,000	0.07	170-350	0.058	8,500	60	20	37°48'N	115°15'W
43	8N35	1510	14,000	0	170-270	0.025	8,500	60	20	37°48'N	115°15'W
44	8N36	1513	14,000	0.3	170-870	0.443	8,500	60	20	37°48'N	115°05'W
45	8O35	1520	14,000	0.06	170-465	0.116	8,500	60	20	37°38'N	115°15'W
46	8N36	1523	14,000	0.05	170-470	0.118	8,500	60	20	37°48'N	115°05'W
47	8M35	1528	14,000	0.04	170-305	0.040	8,500	60	20	37°58'N	115°15'W
48	8N37	1534	14,000	0	170-320	0.044	8,500	60	20	37°45'N	114°55'W
49	8O36	1540	14,000	0.1	170-670	0.256	8,500	060	20	37°38'N	115°05'W
50	8N37	1546	14,000	0.05	170-504	0.138	8,500	60	20	37°45'N	114°55'W
51	8M36	1552	14,000	0.04	170-430	0.09	8,500	60	20	37°58'N	115°05'W
52	8N37	1558	14,000	0.08	170-570	0.181	8,500	60	20	37°45'N	114°55'W
53	8O37	1601	14,000	0	170-305	0.040	8,500	60	20	37°35'N	114°55'W
54	8N36	1608	14,000	0.04	170-480	0.123	8,500	60	20	37°48'N	115°05'W
55	8M38	1615	14,000	0	170-480	0.123	8,500	60	20	37°55'N	114°45'W
56	8M37	1621	14,000	0.1	170-620	0.217	8,500	60	20	37°55'N	114°55'W
57	8L36	1624	14,000	0.16	170-700	0.287	8,500	60	20	38°07'N	115°05'W
58	8M38	1629	14,000	0.04	170-370	0.066	8,500			37°55'N	114°45'W
59	8N38	1633	14,000	0	170-430	0.096				37°45'N	114°45'W
60	8N38	1635	14,000	0	170-290	0.034				37°45'N	114°45'W
61	8M38	1637	14,000	0.04	170-500	0.135				37°55'N	114°45'W
62	8M38	1640	14,000	0.18	170-850	0.423				37°55'N	114°45'W

*The estimated distance and direction from the cloud was unknown for all reports.

~~SECRET~~



APPENDIX C

TERRAIN SURVEY



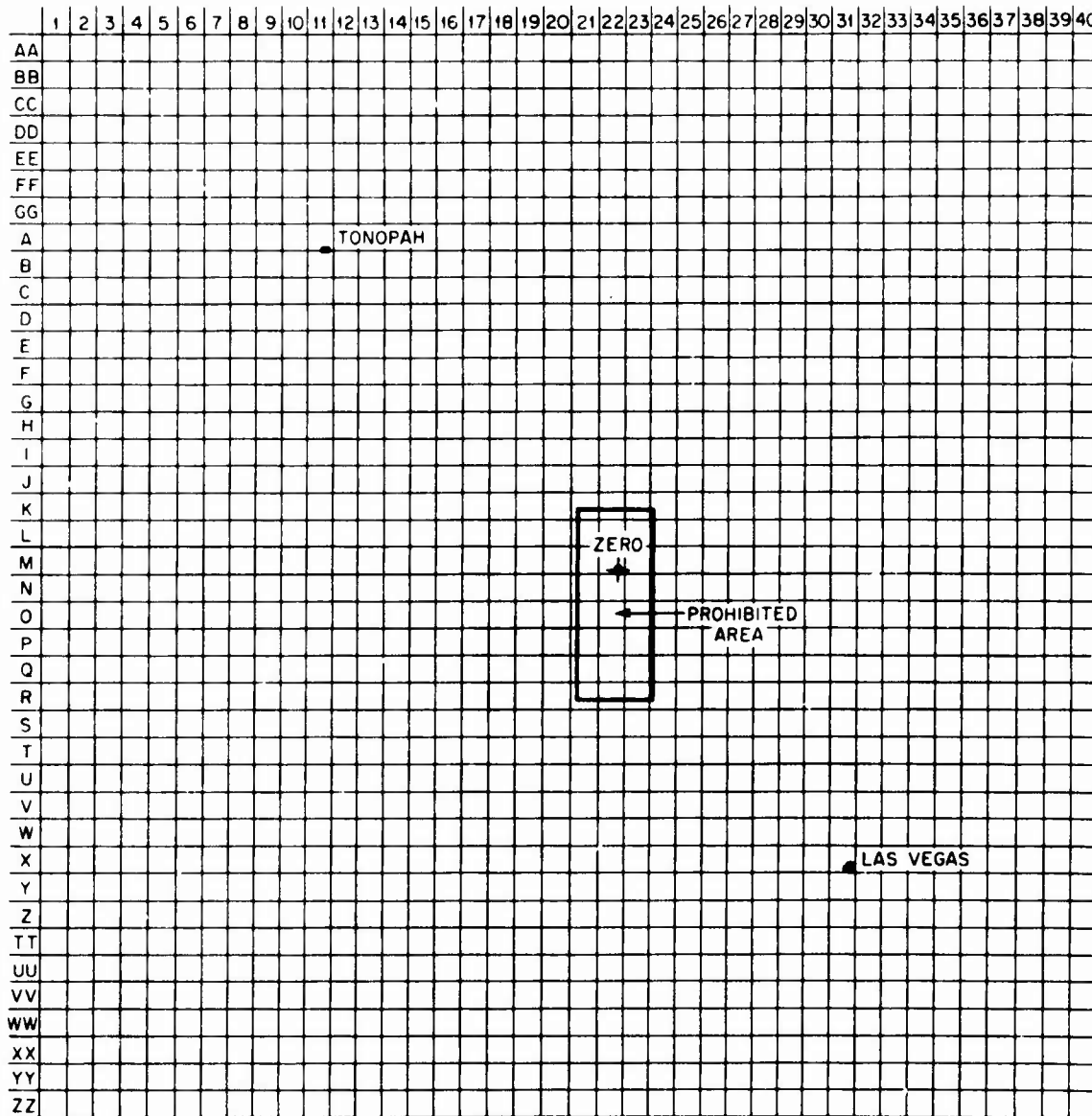


Fig. C.1—Map of coordinates to be used in determining terrain-survey-plane positions in Tables C.1 to C.18.

Table C.1 — TERRAIN-SURVEY DATA OBTAINED BY GOPHER 1 ON BUSTER BAKER

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	L22	1116	600	BG 52-52	0	0.60	0	N22-0.054
2	P22	1129	600	BG 50-50	0	0.60	0	O22-0.001
3	M21	1144	600	BG 46-46	0	0.60	0	O22-0.001
4	O20	1159	600	BG 72-725	0	0.14	0.317	
5	P19	1214	600	BG 70-355	0	0.09	0.074	
6	N09	1220	400	BG 48-48	0	0.07	0	
7	M18	1224	600	BG 40-40	0	0.06	0	
8	O18	1229	400	BG 72-125	0	0.09	0.006	
9	Q18	1235	600	BG 65-200	0	0.09	0.020	
10	S18	1240	400	BG 45-45	0	0.06	0	
11	T17	1245	700	BG 66-66	0	0.05	0	
12	R17	1249	600	BG 64-140	0	0.08	0.008	
13	Q17	1254	500	BG 72-110	0	0.09	0.005	R17-0.058
14	O17	1300	400	BG 90-90	0	0.07	0	
15	N16	1305	700	BG 70-70	0	0.06	0	
16	O16	1310	500	BG 75-75	0	0.05	0	
17	Q16	1315	700	BG 55-55	0	0.05	0	
18	R16	1320	600	BG 65-205	0	0.08	0.021	
19	T16	1324	300	BG 66-90	0	0.07	0.002	S16-0.017
20	V16	1329	700	BG 47-115	0	0.07	0.006	U16-0.016

Table C.2 — TERRAIN-SURVEY DATA OBTAINED BY GOPHER 2 ON BUSTER BAKER

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	Q15	1130	800	BG 68-350	0	0.16	0.072	
2	W15	1145	600	BG 50-310	0	0.14	0.057	
3	X14	1200	600	BG 54-315	0	0.15	0.059	
4	R14	1215	900	BG 57-300	0	0.18	0.053	
5	W13	1230	2000	BG 55-550	0	0.15	0.181	
6	W13	1245	700	BG 50-780	0	0.20	0.370	
7	X12	1300	800	BG 700-700	0	0.20	0	
8	U11	1315	600	BG 200-200	0	0.18	0	
9	Z11	1330	600	BG 420-420	0	0.20	0	
10	VV10	1345	600	BG 390-390	0	0.14	0	
11	W10	1400	700	BG 245-245	0	0.19	0	
12	ZZ9	1500	600	BG 270-270	0	0	0	
13	VV7	1420	700	BG 270-280	0	0	0	

Table C.3 — TERRAIN-SURVEY DATA OBTAINED BY GOPHER 3 ON BUSTER BAKER

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr
1	S15	1350	600	BG 20-20	0	0.40	0
2	W15	1405	500	BG 20-130	6,000	0.50	0.009
3	W14	1420	500	BG 30-180	8,000	0.20	0.018
4	S14	1430	600	BG 20-20	1,000	0.10	0
5	Q14	1436	600	BG 40-40	0	0.10	0
6	U13	1450	2300	BG 40-40	800	0.10	0
7	V10	1500	1400	BG 40-140	16,000	0.15	0.010
8	TT11	1510	500	BG 40-200	11,000	0.20	0.022
9	WW11	1520	700	BG 40-180	2,000	0.20	0.018
10	WW10	1530	600	BG 40-120	5,000	0.10	0.008
11	TT10	1540	500	BG 60-180	6,000	0.10	0.013
12	Z9	1550	900	BG 60-200	1,000	0.15	0.021
13	UU8	1600	900	BG 60-50	8,000	0.10	0
14	XX8	1610	600	BG 60-130	7,000	0.10	0.008
15	ZZ7	1620	500	BG 100-320	15,000	0.10	0.055
16	XX7	1630	600	BG 100-200	8,000	0.10	0.017
17	TT7	1640	600	BG 100-180	8,000	0.10	0.013

Table C.4—TERRAIN-SURVEY DATA OBTAINED BY GOPHER 1 ON BUSTER CHARLIE

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	P19	1050	500	BG 110-110	0	0.150		
2	M19	1106	600	BG 70-70	0	0.150		O19-0.469; N19-1.189
3	P18	1110	600	BG 150-730	0	0.300	0.312	
4	N17	1120	700	BG 100-100	0	0.150		Q17-0.516; P17-0.351
5	N16	1130	600	BG 120-120	0	0.150		
6	R15	1140	700	BG 120-750	0	0.330	0.334	Q16-0.316; P16-0.249
7	O15	1150	600	BG 150-150	0	0.200		Q15-0.312; P15-0.013
8	N14	1200	500	BG 150-150	0	0.200		
9	Q14	1210	300	BG 145-625	0	0.300	0.226	
10	R13	1220	600	BG 150-770	0	0.250	0.349	R14-0.205; S14-0.005; S13-0.130
11	O13	1230	700	BG 175-175	0	0.175		
12	N11	1250	600	BG 180-180	0	0.820		
13	Q12	1300	700	BG 180-180	0	0.200		
14	T11	1310	200	BG 200-820	0	0.300	0.387	S12-0.023; K12-0.052
15	Q11	1320	500	BG 200-200	0	0.200		
16	P10	1330	600	BG 170-170	0	0.200		
17								
18	S9	1350	1200	BG 180-180	0	0.200		T10-0.086
19	T8	1450	400	BG 180-180	0	0.200		
20	S7	1500	3000	BG 165-165	0	0.200		
21	T6	1510	2000	BG 170-170	0	0.200		
22	Q5	1520	900	BG 170-170	0	0.200		
23	Q4	1530	600	BG 200-200	0	0.150		
24	S5	1540	600	BG 180-180	0	0.200		
25	W5	1550	600	BG 180-180	0	0.200		
26	T5	1600	700	BG 160-160	0	0.150		
27	U4	1610	600	BG 160-160	0	0.150		
28	W3	1620	500	BG 165-165	0	0.200		
29	Y1	1630	600	BG 160-160	0	0.200		

Table C.5—TERRAIN-SURVEY DATA OBTAINED BY GOPHER 2 ON BUSTER CHARLIE

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	S20	1053	600	BG 60-10	0	0.01		
2	Q18	1103	600	BG 65-120	0	0.03	0.007	
3	U18	1113	600	BG 58-130	0	0.03	0.008	
4	R17	1123	600	BG 65-150	0	0.04	0.010	
5	T16	1133	800	BG 57-110	0	0.03	0.006	R16-0.528
6	W16	1143	800	BG 50-110	0	0.04	0.007	
7	T15	1153	600	BG 57-140	0	0.03	0.009	
8	V14	1203	600	BG 52-150	0	0.02	0.012	
9	Y13	1213	800	BG 50-130	0	0.05	0.009	
10	U13	1223	1000	BG 55-110	0	0.03	0.006	
11	U12	1233	800	BG 55-150	0	0.04	0.011	
12	X12	1243	800	BG 55-140	0	0.02	0.009	
13	TT11	1253	600	BG NEG-100	0	0.04		
14	X11	1303	700	BG NEG-130	0	0.02		
15	U10	1313	800	BG NEG-500	0	0.07		
16	X10	1323	600	BG NEG-130	0	0.02		
17	VV10	1333	600	BG NEG-90	0	0.05		
18	TT9	1343	700	BG NEG-100	0	0.04		
19	W9	1353	700	BG NEG-400	0	0.05		
20	Z8	1403	500	BG NEG-120	0	0.09		
21	XX8	1417	500	BG NEG-110	0	0.08		
22	Y7	1433	600	BG NEG-390	0	0.05		
23	X6	1443	600	BG NEG-160	0	0.06		
24	TT6	1453	600	BG NEG-210	0	0.06		
25	XX6	1503	700	BG NEG-200	0	0.07		
26	XX5	1515	500	BG NEG-212	0	0.08		
27	TT5	1523	800	BG NEG-240	0	0.07		
28	X4	1533	600	BG NEG-150	0	0.04		
29	VV4	1543	800	BG NEG-180	0	0.04		
30	ZZ4	1553	600	BG NEG-200	0	0.04		

Table C.6—TERRAIN-SURVEY DATA OBTAINED BY GOPHER 3 ON BUSTER CHARLIE

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr
1	V21	1040	600	BG 150-180	500	0.10	0.006
2	Y21	1050	700	BG 150-150	0	0.10	
3	TT21	1059	600	BG 160-170	0	0.10	0.002
4	Y20	1110	600	BG 160-170	0	0.10	0.002
5	W20	1120	700	BG 160-160	0	0.10	
6	T20	1130	600	BG 160-160	0	0.10	
7	V19	1140	600	BG 160-160	0	0.10	
8	TT19	1150	500	BG 160-180	0	0.11	0.004
9	TT18	1200	700	BG 150-150	0	0.10	
10	W18	1210	500	BG 150-150	0	0.10	
11	X17	1220	300	BG 160-200	500	0.10	0.008
12	VV16	1230	800	BG 160-160	0	0.10	
13	X16	1240	600	BG 160-160	0	0.10	
14	UU15	1250	700	BG 170-170	0	0.10	
15	WW14	1300	900	BG 140-140	0	0.10	
16	TT13	1310	800	BG 160-160	0	0.10	
17	WW13	1320	800	BG 140-140	0	0.10	
18	XX12	1330	600	BG 120-120	0	0.10	
19	VV11	1340	400	BG 140-140	0	0.10	
20	ZZ11	1350	600	BG 120-120	0	0.10	
21	WW10	1400	500	BG 120-120	0	0.10	
22	YY9	1410	650	BG 130-130	0	0.10	
23	ZZ8	1420	2000	BG 140-140	0	0.10	

Table C.7—TERRAIN-SURVEY DATA OBTAINED BY GOPHER 1 ON BUSTER DOG

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	O25	1100	600	BG 105-105	0	0.15		
2	N26	1110	500	BG 100-100	0	0.15		P25-0.092
3	Q28	1120	500	BG 105-105	0	0.14		
4	Q29	1130	600	BG 110-110	0	0.11		
5	T30	1140	700	BG 100-100	0	0.13		T29-0.031
6	Q30	1150	500	BG 115-115	0	0.14		
7	U31	1200	900	BG 110-110	0	0.15		
8	T32	1210	600	BG 100-100	0	0.15		
9	U34	1220	600	BG 90-90	0	0.15		
10	T34	1230	600	BG 85-85	0	0.13		
11	V35	1240	500	BG 85-85	0	0.12		
12	W36	1250	600	BG 80-80	0	0.11		
13	V37	1300	600	BG 85-85	0	0.14		
14	Y37	1310	1000	BG 70-70	0	0.12		
15	V38	1320	600	BG 65-65	0	0.13		
16	X39	1330	600	BG 65-65	0	0.13		
17	Y40	1340	700	BG 70-70	0	0.10		

Table C.8—TERRAIN-SURVEY DATA OBTAINED BY GOPHER 2 ON BUSTER DOG

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	W26	1103	800	BG 79-170	0	0.05	0.013	
2	Y27	1113	700	BG 58-110	0	0.06	0.006	X27-0.210
3	Y28	1123	600	BG 46-120	0	0.05	0.008	
4	Z29	1133	800	BG 26-100	0	0.04	0.005	X29-0.055
5								
6	ZZ29	1153	600	BG 54-110	0	0.04	0.007	
7	WW30	1203	600	BG NEG-110	0	0.03	0.008	
8	TT30	1213	600	BG NEG-150	0	0.04	0.013	
9	VV31	1223	700	BG NEG-140	0	0.05	0.011	
10	ZZ32	1233	600	BG NEG-110	0	0.03	0.008	WW31-0.075
11	VV32	1243	600	BG NEG-100	0	0.06	0.006	
12	YY33	1253	600	BG NEG-130	0	0.05	0.010	VV33-0.037
13	XX34	1303	700	BG NEG-170	0	0.05	0.017	
14	ZZ35	1313	600	BG NEG-110	0	0.04	0.008	
15	XX36	1323	600	BG NEG-250	0	0.06	0.037	
16	YY37	1333	600	BG NEG-260	0	0.06	0.040	XX37-0.140
17	ZZ38	1343	600	BG NEG-110	0	0.05	0.008	
18	XX38	1353	600	BG NEG-100	0	0.05	0.006	YY38-0.220
19	YY39	1403	700	BG NEG-110	0	0.06	0.008	
20	ZZ40	1413	600	BG NEG-120	0	0.02	0.009	
21	WW40	1422	600	BG NEG-110	0	0.02	0.008	

Table C.9— TERRAIN-SURVEY DATA OBTAINED BY GOPHER 3 ON BUSTER DOG

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	S24	1107	600	BG 70-70	0	0.20		P24-0.067
2	R25	1117	350	BG 80-140	3,000	0.30	0.007	
3	R26	1127	400	BG 80-400	54,000	0.30	0.094	Q25-0.094
4	V27	1137	800	BG 30-80	0	0.20		S26-0.011
5								T26-0.005; U26-0.004
6	S28	1147	600	BG 80-200	14,000	0.20	0.019	R27-0.120
7	WW29	1157	750	BG 80-120	6,000	0.20	0.005	T28-0.009, U28-0.011
8	V35	1202	500	BG 80-350	34,000	0.25	0.071	U30-0.042; U29-0.075; V29-0.007
9	Y31	1217	700	BG 80-80	0	0.20		W30-0.009; X30-0.007
10	X32	1228	600	BG 80-120	3,000	0.20	0.005	X31-0.090; W31-0.019
11	UU32	1237	1000	BG 80-100	0	0.20	0.002	T32-0.042
12	YY37	1247	700	BG 60-60	0	0.20		Z33-0.051
13	Z34	1257	500	BG 60-60	0	0.10		
14	WW34	1307	1200	BG 80-100	6,000	0.15	0.002	UU34-0.040; VV34-0.120
15	Z35	1317	800	BG 60-60	0	0.15		WW35-0.064
16	UU36	1327	700	BG 70-70	0	0.13		
17	TT36	1337	600	BG 80-80	0	0.15		
18	VV38	1347	400	BG 80-80	0	0.15		
19	TT40	1357	500	BG 60-60	0	0.15		
20	UU37	1407	650	BG 70-70	0	0.15		

Table C.10—TERRAIN-SURVEY DATA OBTAINED BY GOPHER 1 ON BUSTER EASY

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	O21	1130	600	BG 60-60	0	0.01		O22-0.011; O23-0.024
2	Q22	1140	500	BG 65-210	0	0.17	0.023	P22-0.016; P21-0.015; P20-0.0; O20-0.0
3	R19	1150	600	BG 65-65	0	0.07		Q19-0.9; Q20-0.002; Q21-0.006
4	S22	1200	500	BG 80-215	0	0.13	0.023	R22-0.008; R21-0.0; R20-0.0
5	S19	1210	600	BG 85-85	0	0.08		S20-0.0; S21-0.0; S22-0.011
6	T20	1220	600	BG 80-80	0	0.10		T19-0.0; T18-0.0; S18-0.0
7	U19	1230	600	BG 90-90	0	0.08		U20-0.003; U21-0.009; T21-0.014
8	V19	1240	800	BG 110-110	0	0.09		V18-0.0; V17-0.022; U17-0.010; U18-0.0
9	W20	1250	500	BG 105-105	0	0.09		W21-0.0; V21-0.0; V20-0.008; V19-0.0
10	W16	1300	900	BG 85-320	0	0.17	0.056	W17-0.031; W18-0.028; W19-0.0
11	Z19	1310	600	BG 90-195	0	0.14	0.017	X16-0.050
12	Y20	1320	500	BG 80-300	0	0.17	0.051	X20-0.0; X19-0.002; X18-0.021
13	Y16	1330	1100	BG 75-210	0	0.14	0.022	Y17-0.025; Y18-0.061; Y19-0.132
14	Z15	1340	600	BG 120-120	0	0.08		Y15-0.0; Z16-0.035
15	UU15	1350	600	BG 95-95	0	0.08		UU15-0.0; UU16-0.011; TT16-0.013; TT15-0.004
16	Z16	1410	600	BG 75-75	0	0.06		Z19-0.022; Z18-0.0; Z17-0.022
17	TT18	1420	600	BG 85-180	0	0.13	0.014	TT19-0.0; TT20-0.0
18	UU18	1430	900	BG 90-90	0	0.08		UU17-0.019; TT17-0.018
19	VV19	1440	600	BG 80-240	0	0.12	0.030	VV20-0.006; UU16-0.0; UU19-0.007
20	VV20	1450	500	BG 135-135	0	0.11		VV16-0.0; VV17-0.0; VV18-0.0
21	VV13	1500	600	BG 110-110	0	0.08		VV14-0.0
22	X22	1530	600	BG 90-90	0	0.08		Y22-0.0; Z22-0.0
23	T22	1540	600	BG 80-80	0	0.08		U22-0.0; V22-0.0; W22-0.0
24	S22	1543	600	BG 80-80	0	0.09		

Table C.11 — TERRAIN-SURVEY DATA OBTAINED BY GOPHER 2 ON BUSTER EASY

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	R25	1112	800	BG 62-950	0	0.040	0.548	
2	Q25	1115	800	BG 61-1100	0	0.040	0.798	
3	P24	1121	600	BG 54-1200	0	0.030	0.899	
4	P23	1123	700	BG 56-1800	0	0.030	1.898	
5	Q23	1127	700	BG 55-250	0	0.025	0.035	
6	Q24	1129	600	BG 52-105	0	0.015	0.006	
7	R24	1131	800	BG 68-300	0	0.045	0.052	
8	S25	1140	700	BG 54-95	0	0.015	0.005	R23-0.057; S23-0.144; S24-0.037; S26-0.003; S27-0.006; T27-0.002
9	T25	1153	600	BG 16-10	0			T26-0.001
10	U22	1203	700	BG 60-110	0	0.015	0.006	T24-0.077; T23-0.016; T22-0.012
11	U23	1213	800	BG 56-145	0	0.025	0.010	
12	U28	1223	800	BG 58-70	0	0.010	0.001	U24-0.019; U25-0.002; U26-0.003; U27-0.002
13	V26	1233	800	BG 76-220	0	0.020	0.024	V28-0.006; V27-0.014
14	V22	1243	800	BG 62-110	0	0.010	0.006	V25-0.011; V24-0.005; V23-0.005
15	W25	1253	800	BG 66-170	0	0.010	0.014	W22-0.009; W23-0.006; W24-0.004
16	W27	1303	800	BG 69-90	0	0.010	0.002	W26-0.009
17	X28	1313	800	BG 53-90	0	0.010	0.004	W28-0.002; W29-0.003; X29-0.003
18	X24	1323	700	BG 54-100	0	0.020	0.005	X27-0.026; X26-0.006; X29-0.005
19	Y23	1333	600	BG 55-120	0	0.030	0.007	X23-0.008; X22-0.007; X21-0.007; Y22-0.004
20	Y27	1344	800	BG 58-100	0	0.010	0.004	Y24-0.003; Y25-0.003; Y26-0.017
21	Y30	1353	600	BG 45-90	0	0.015	0.004	Y28-0.005; Y29-0.007
22	Z26	1403	800	BG 51-50	0	0.035		Z30-0.003; Z29-0.003; Z28-0.003; Z27-0.007
23	X22	1415	700	BG 50-110	0	0.015	0.007	Z25-0.007; Z24-0.004; Z23-0.002; Z22-0.005
24	TT22	1423	700	BG 80-0	0	0.025		Z21-0.005; TT21-0.006
25	TT26	1433	600	BG NEG-130	0	0.030	0.010	TT23-0.006; TT24-0.005; TT25-0.009
26	TT29	1443	600	BG NEG-80	0	0.020	0.004	TT27-0.006; TT28-0.003
27	UU30	1453	700	BG NEG-90	0	0.010	0.005	TT31-0.006; TT30-0.004; UU31-0.003
28	UU26	1503	600	BG NEG-100	0	0.010	0.006	UU29-0.004; UU28-0.004; UU27-0.009
29	UU23	1513	700	BG NEG-90	0	0.040	0.005	UU25-0.004; UU23-0.003
30	UU21	1515	700	BG NEG-90	0	0.010	0.005	
31	Z24	1533	600	BG 54-80	0	0.020	0.003	
32								
33	S24	1551	700	BG 43-120	0	0.010	0.008	U24-0.012; T24-0.021

Table C.12—TERRAIN-SURVEY DATA OBTAINED BY GOPHER 3 ON BUSTER EASY

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	XX25	1157	600	BG 80-80	0	0.050		W21-0.002; VV23-0.002; VV24-0.0
2	VV28	1207	800	BG 80-80	0	0.050		VV26-0.015; VV27-0.001
3	VV31	1217	600	BG 70-80	400	0.050	0.001	VV29-0.0; VV30-0.0
4	WW29	1227	800	BG 70-70	0	0.050		VV30-0.0; WW31-0.001; WW32-0.002; VV32-0.003
5	WW26	1237	600	BG 70-120	6,600	0.100	0.006	WW28-0.0; WW27-0.003
6	WW22	1247	500	BG 70-90	600	0.020	0.002	WW25-0.001; WW24-0.001; WW23-0.002
7	WW18	1257	50	BG 70-200	5,000	0.010	0.020	WW21-0.003; WW20-0.028; WW19-0.010
8	WW15	1307	700	BG 70-110	14,000	0.100	0.005	WW17-0.006; WW16-0.003
9	XX16	1317	600	BG 70-100	0	0.050	0.003	WW14-0.006; XX14-0.006; XX15-0.003; XX16-0.003
10	XX21	1327	650	BG 70-200	300	0.100	0.020	XX18-0.037; XX19-0.037; XX20-0.016
11	XX25	1337	600	BG 70-70	0	0.050		XX22-0.003; XX23-0.001; XX24-0.0
12	XX28	1347	800	BG 70-100	200	0.100	0.003	XX25-0.001; XX26-0.008; XX27-0.025
13	YY30	1357	500	BG 70-80	0	0.050	0.001	XX28-0.001; XX29-0.0; XX30-0.001
14	YY26	1407	600	BG 70-120	1,000	0.100	0.006	YY29-0.0; YY28-0.020; YY27-0.012
15	YY21	1417	1100	BG 70-140	3,000	0.100	0.008	YY25-0.001; YY24-0.0; YY23-0.0; YY22-0.0
16	YY18	1427	500	BG 70-210	7,000	0.100	0.023	YY20-0.031; YY19-0.025
17	YY14	1437	600	BG 70-100	0	0.075	0.003	YY17-0.020; YY16-0.012; YY15-0.005
18	ZZ18	1447	650	BG 70-180	4,000	0.100	0.016	YY14-0.005; ZZ14-0.003; ZZ15-0.003; ZZ16-0.020; ZZ17-0.016
19	ZZ21	1457	550	BG 70-190	6,000	0.100	0.018	ZZ19-0.020; ZZ20-0.018
20	ZZ25	1507	700	BG 70-70	0	0.050		ZZ22-0.0; ZZ23-0.0; ZZ24-0.0
21	ZZ24	1517	600	BG 70-120	3,000	0.070	0.006	ZZ26-0.008; ZZ27-0.016; ZZ28-0.025
22	ZZ32	1527	700	BG 70-90	0	0.050	0.002	ZZ31-0.003; ZZ30-0.002
23	ZZ33	1528	700	BG 70-90	0	0.500	0.002	
24	Z26	1557	800	BG 70-110	2,400	0.100	0.005	
25	X25	1607	2600	BG 90-100	0	0.100	0.001	Y26-0.002; X26-0.002
26	T26	1617	600	BG 80-80	0	0.050		W26-0.0; V26-0.0; U26-0.0

Table C.13—TERRAIN-SURVEY DATA OBTAINED BY GOPHER 1 ON JANGLE SUGAR

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
First Mission, 19 November 1951								
1	I19	1247	600	BG 60-60	0	0	0	J20-0.0; L20-0.0
2	G19	1257	600	BG 50-50	0	0	0	G20-0.011; H20-0.004; H19-0.0
3	F19	1307	500	BG 65-65	0	0	0	F19-0.0; G18-0.0
4	E18	1317	600	BG 65-65	0	0.08	0	E19-0.0; F20-0.0
5	D18	1327	600	BG 65-65	0	0.06	0	D17-0.0; E17-0.0
6	C19	1337	1200	BG 80-80	0	0.05	0	D20-0.005; D19-0.0; C20-0.007
7	B16	1340	300	BG 70-70	0	0.04	0	C16-0.0; C17-0.0; C18-0.0
8	A19	1357	800	BG 80-80	0	0.05	0	B19-0.0; B18-0.0; B17-0.0
9	GG19	1407	400	BG 105-105	0	0.05	0	GG20-0.0; B20-0.0; A19-0.0
10	GG15	1427	800	BG 70-70	0	0.04	0	A15-0.0; A16-0.0; A17-0.0; A18-0.0
11	FF20	1437	550	BG 110-235	0	0.07	0.026	GG17-0.0; GG16-0.0; GG18-0.0; GG19-0.0; GG20-0.0
12	BB20	1447	1100	BG 100-150	0	0.07	0.005	CC20-0.034; DD20-0.028; EE20-0.029
13	CC19	1457	600	BG 100-165	0	0.05	0.009	BB19-0.011; AA19-0.009; AA20-0.009
14	FF19	1507	700	BG 95-95	0	0.04	0	EE19-0.0; DD19-0.0
15	BB18	1517	500	BG 90-90	0	0.05	0	DD18-0.0; EE18-0.0; FF18-0.0
16	AA16	1527	600	BG 90-150	0	0.05	0.016	

Table C.13—(Continued)

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
Second Mission, 20 November 1951								
1	L23	0750	500	BG 100-22,000	0	2		L22-0.0; H22-0.0; M23-0.02
2	K24	0800	500	BG 90-90	0	0.03	0	K25-0.0; L25-0.0 L24-0.0
3	J23	0810	600	BG 100-5100	0	5.5	15.8	J22-0.093; K22-0.008; K23-36.2
4	J27	0820	600	BG 90-90	0	0.05	0	J24-0.0; J25-0.0; J26-0.0
5	I26	0830	800	BG 90-90	0	0.04	0	I27-0.0; I28-0.0; J28-0.0
6	I24	0840	500	BG 90-90	0	0.06	0	I25-0.0
7	H21	0850	700	BG 100-100	0	0.05	0	I21-0.003; I22-0.031; I23-6.1
8	H25	0900	600	BG 70-70	0	0.05	0	H23-1.1; H24-2.6; H22-0.023
9	H28	0910	800	BG 90-90	0	0.06	0	H27-0.0; H26-0.0
10	G26	0920	250	BG 85-85	0	0.04	0	G27-0.0; G28-0.0; G29-0.0
11	G22	0930	450	BG 90-250	0	0.04	0.032	G23-0.208; G24-2.2; G25-0.603
12	F22	0940	700	BG 100-240	0	0.06	0.028	F21-0.0; G21-0.0
13	F26	0950	600	BG 85-85	0	0.05	0	F25-0.0; F24-0.992; F23-0.346
14	E29	1000	1200	BG 85-85	0	0.05	0	F29-0.0; F28-0.0; F27-0.0
15	E29	1010	500	BG 90-450	0	0.1	0.119	E26-0.0; E27-0.0; E28-0.0
16	E21	1020	600	BG 100-100	0	0.04	0	E22-0.0; E23-0.0; E24-0.0
17	D22	1030	600	BG 100-440	0	0.05	0.112	D21-0.0
18	D26	1040	700	BG 70-70	0	0.05	0	D25-0.0; D24-0.0; D23-0.0
19	D29	1050	600	BG 80-80	0	0.04	0	D28-0.0; D27-0.0; D27-0.0
20	D33	1100	600	BG 70-70	0	0.05	0	D32-0.0; D31-0.0; D30-0.0

Table C.14— TERRAIN-SURVEY DATA OBTAINED BY GOPHER 2 ON JANGLE SUGAR

Report No.	Position,* grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	G-M reading, mr	B-21 reading, mr	Remarks
First Mission, 19 November 1951							
1	I27	1236	600	BG 77-100	0.01	0.002	
2	H27	1244	600	BG 81-110	0.01	0.004	
3	F26	1254	600	BG 85-90	0.01	0	
4	E29	1304	500	BG 88-90	0.01	0	F18-0.0; G18-0.0
5	E27	1314	700	BG 88-90	0.01	0	
6	D26	1322	600	BG NEG-11,000	0.05	80	
7	D30	1334	800	BG 87-10,000	0.02	60.8	
8	C29	1344	600	BG 90-10,000	0.04	60.8	
9	B28	1354	700	BG 89-10,000	0.025	60.8	
10	B32	1404	800	BG 90-10,000	0.015	60.8	B29-60.8; B30-60.8; B31-60.8
11	A29	1414	600	BG NEG-10,000	0.02	60.8	A31-60.8; A30-60.8
12	GG28	1424	800	BG NEG-10,000	0.01	60.8	A28-60.8; A27-60.8; GG27-60.8
13	GG32	1434	700	BG NEG-10,000	0.02	60.8	GG29-60.8; GG30-60.8; GG31-60.8
14	DD33	1444	700	BG NEG-10,000	0.01	60.8	GG32-60.8; GG34-60.8
15	EE30	1454	700	BG NEG-10,000	0.01	60.8	DD32-60.8; DD34-60.8; EE31-60.8
16	DD27	1504	700	BG NEG-600	0.01	0.220	EE29-0.006; EE28-0.152; EE27-0.013
17							
18	AA28	1514	600	BG NEG-550	0.07	0.183	CC27-0.152; BB27-0.055; AA27-0.088
Second Mission, 20 November 1951							
1	GG21	0817	600	BG NEG-250	0.03	0	C21-0.018; B21-0.006; A21-0.012
2	A22	0827	700	BG 95-250	0.03	0.032	FF21-0.026; FF22-0.023; GG22-0.023
3	B23	0837	600	BG 100-550	0.05	0.172	B22-0.061; C22-C 093; C23-0.215
4	GG24	0847	700	BG NEG-320	0.04	0.061	GG23-0.034; A23-0.093; FF23-0.023; FF24-0.034
5	C24	0857	800	BG 92-550	0.07	0.178	A24-0.124; B24-0.259
6	FF25	0907	600	BG NEG-350	0.02	0.075	B25-0.069; C25-0.147; A25-0.085; GG25-0.055
7	B27	0947	700	BG 90-190	0.02	0.016	GG26-0.055; GG27-0.013; A27-0.004
8	GG28	0957	800	BG NEG-100	0.03	0.006	C28-0.005; C27-0.019; B28-0.006; A28-0.004
9	B29	1007	800	BG 88-100	0.01	0.001	FF29-0.006; FF28-0.028; GG29-0.008; A29-0.004
10	A30	1017	600	BG 80-100	0.02	0.002	C29-0.0; C30-0.001; B30-0.002
11	A31	1027	800	BG 80-100	0.01	0.002	FF30-0.006; GG30-0.008; FF31-0.006; GG31-0.006
12	B32	1037	700	BG 85-90	0.02	0	B31-0.0; C31-0.001; C32-0.001
13	FF33	1047	500	BG NEG-100	0.01	0.006	A32-0.002; GG32-0.006; FF32-0.006

* All readings taken between grid O-21 and grid EE-29 must be considered in error because of changing scales and lack of recalibration.

Table C.15 — TERRAIN-SURVEY DATA OBTAINED BY GOPHER 3 ON JANGLE SUGAR

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
First Mission, 19 November 1951*								
1	F22	1210	700	BG 80-120	1,000	0.01	0.005	
2	L26	1220	400	BG 80-80	0	0.05	0	M23-0.003; M24-0.0; M25-0.0
3	L22	1230	600	BG 80-320	22,000	0.15	0.057	L25-0.0; L24-0.002; L23-0.002
4	K24	1240	500	BG 80-90	300	0.07	0.001	K22-9.8; K23-0.005
5	J24	1250	700	BG 80-50,000	60,000	20		
6	I23	1300	1500	BG 80-5000	60,000	1.5	15.2	
7	I26	1310	1100	BG 80-120	2,500	0.1	0.005	
8	H23	1320	900	BG 100-2000	60,000	4	2.3	H26-0.0; H25-0.0; H24-39
9	G22	1326	400	BG 150-800	25,000	0.1	0.377	H22-0.062; H21-0.0; G21-0.010
10	G25	1340	700	BG 150-150	0	0.03	0	G23-22.0; G24-60.8
11	F24	1350	600	BG 100-3000	60,000	1	5.5	G26-0.0; F26-0.0; F25-6.08
12	E21	1400	500	BG 100-100	0	0.05	0	F23-0.384; F22-0.018; F21-0.003
13	E25	1410	500	BG 120	60,000	1.5		E22-0.06; E23-12.31; E24-0.0
14	D25	1420	600	BG 120-2000	60,000	0.25	2.3	E26-0.046; D26-0.486
15	C21	1430	1500	BG 120-180	1,000	0.01	0.010	D24-1.3; D23-0.431; D22-0.143; D21-0.010
16	C23	1440	1500	BG 120-800	44,000	2	0.381	C22-0.089; C23-0.143
17	B26	1450	2000	BG 120-360	3,000	0.1	0.070	C25-0.221; C26-0.381
18	B22	1500	1500	BG 120-500	14,000	0.1	0.143	B25-0.080; B24-0.080; B23-11.3
19	A25	1510	900	BG 120-850	44,000	0.1	0.431	A22-0.143; A23-0.334; A24-0.249
20	GG23	1520	800	BG 120-500	14,000	0.07	0.143	GG26-0.121; GG25-0.421; GG24-0.249
21	FF22	1530	600	BG 120-440	9,000	0.05	0.109	GG22-0.089; GG21-0.066; MM21-0.09; EE21-0.06
22	FF26	1540	900	BG 120-500	14,000	0.1	0.143	FF23-0.241; FF24-0.064; FF25-0.381
23	EE23	1550	500	BG 150-460	14,000	0.07	0.121	EE26-0.143; EE25-0.143; EE24-0.121
24	DD22	1600	600	BG 120-380	6,000	0.05	0.079	EE22-0.019; EE21-0.014; DD21-0.025

Table C.15—(Continued)

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
Second Mission, 20 November 1951								
1	EE22	0823	600	BG 140-250	1,600	0.05	0.026	DD22-0.012
2	BB23	0833	200	BG 140-250	1,400	0.05	0.026	EE23-0.044; DD23-0.033; CC23-0.023
3	EE24	0834	700	BG 140-220	1,600	0.05	0.017	BB24-0.021; CC24-0.024; DD24-0.012
4	BB26	0853	600	BG 140-270	3,000	0.04	0.031	DD25-0.078; EE25-0.060; CC25-0.024; BB25-0.035
5	EE27	0903	600	BG 130-380	400	0.04	0.078	CC26-0.108; DD26-0.114; EE26-0.069
6	BB28	0913	600	BG 130-260	1,300	0.03	0.030	DD27-0.045; CC27-0.030; BB27-0.030
7	EE28	0923	1400	BG 145-240	0	0.04	0.023	CC28-0.013; DD28-0.098
8	BB30	0933	600	BG 120-120	0	0.03	0	DD29-0.002; EE29-0.0; CC29-0.035; BB29-0.046
9	EE37	0943	600	BG 120-120	0	0.02	0	CC31-0.0; CC30-0.0; DD30-0.001; EE30-0.0
10	CC32	0953	600	BG 120-120	0	0.02	0	DD31-0.0; BB31-0.001; BB32-0.0
11	CC33	1003	1000	BG 120-120	0	0.03	0.001	EE32-0.0; DD32-0.0; EE33-0.0; DD33-0.0
12	DD34	1013	500	BG 120-130	0	0.03	0.001	BB33-0.001; BB34-0.0; CC43-0.0
13	BB26	1023	700	BG 120-120	0	0.03	0	EE35-0.0; EE34-0.001; CC35-0.0; DD35-0.0; BB35-0.0
14	EE37	1033	600	BG 120-120	0	0.02	0	CC36-0.0; DD36-0.0; EE36-0.0
15	BB38	1043	500	BG 120-130	400	0.03	0.008	DD37-0.0; CC37-0.0; BB37-0.0
16	EE29	1053	900	BG 120-120	0	0.03	0	CC38-0.0; DD38-0.0; EE38-0.0
17	CC40	1103	600	BG 120-120	0	0.02	0	CC39-0.0; DD39-0.0; BB39-0.0; BB40-0.0

* Correlation and time response of the instruments do not represent a true picture, since the high intensities caused many full-scale indications on the equipment.

Table C.16—TERRAIN-SURVEY DATA OBTAINED BY GOPHER 1 ON JANGLE UNCLE*

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	N21	0750	700	BG 100-320	0	0.04	0.056	
2	J21	0800	400	BG 80-225	0	0.04	0.026	K21-0.0; L21-0.0; M21-0.0
3	M22	0810	600	BG 100-1000	0	0.08	0.602	L22-0.594; K22-0.994; J22-0.105
4	L23	0820	500	BG 100-9500	0	20	55.0	M23-0.292; N23-0.384; N22-0.602
5	I23	0830	500	BG 100-1500	0	0.35	1.294	J23-0.0; K23-0.0
6	I24	0840	400	BG 100-1050	0	0.25	0.694	H24-0.384; H23-0.252
7	L24	0850	400	BG 100-60	0	0.08	0.252	K24-0.383; J24-1.694
8	M25	0900	400	BG 80-280	0	0.04	0.042	N25-0.0; N24-0.014; M24-0.146
9	I25	0910	700	BG 100-1350	0	0.3	1.044	J25-0.489; K25-0.049; L25-0.394
10	E25	0920	500	BG 100-400	0	0.04	0.092	F25-0.202; G25-0.105; H25-0.128
11	G26	0930	600	BG 100-365	0	0.05	0.075	F26-0.034; E26-0.022
12	J26	0940	500	BG 65-65	0	0.02	0	I26-0.024; H26-0.028
13	N26	0950	500	BG 80-80	0	0.01	0	M26-0.005; L26-0.19; K26-0.187
14	M27	1000	400	BG 80-80	0	0.01	0	N27-0.0
15	G27	1010	600	BG 100-210	0	0.03	0.020	H27-0.0; I27-0.0; J27-0.0; K27-0.0; L27-.0
16	C27	1020	600	BG 80-218	0	0.03	0.024	D27-0.049; E27-0.027; F27-0.012
17	C28	1030	550	BG 90-250	0	0.03	0.032	B28-0.012; B27-0.016
18	G28	1040	500	BG 90-150	0	0.03	0.008	F28-0.035; E28-0.004; D28-0.010
19	K28	1050	600	BG 100-100	0	0.01	0	J28-0.0; H28-0.0; I28-0.0
20	N38	1058	500	BG 80-80	0	0.01	0	M28-0.0; L28-0.0; K28-0.0

* This mission was flown the day after the shot.

Table C.17 — TERRAIN-SURVEY DATA OBTAINED BY GOPHER 2 ON JANGLE UNCLE

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	F33	0804	70	BG 90-62	0	0.035	0	I33-0.0; H33-0.0; G33-0.0
2	A33	0814	600	BG NEG-70	0	0.015	0.003	E33-0.0; D33-0.0; C33-0.0; B33-0.003
3	CC33	0824	700	BG NEG-120	0	0.045	0.009	GG33-0.003; FF33-0.004; EE33-0.010; DD33-0.009
4	BB34	0834	700	BG NEG-110	0	0.04	0.008	BB33-0.009; AA33-0.010; AA34-0.010
5	GG34	0844	600	BG NEG-100	0	0.02	0.001	CC34-0.006; DD34-0.009; EE34-0.011; FF34-0.010
6	E34	0854	600	BG 89-100	0	0.02	0.001	A34-0.005; B34-0.006; C34-0.004; D34-0.004
7	G35	0904	600	BG 90-130	0	0.04	0.005	F34-0.004
8	H35	0919	600	BG 92-90	0	0.04	0	H34-0.003
9	G35	0924	600	BG 95-85	0	0.04	0	
10	C34	0936	600	BG 85-90	0	0.05	0	E35-0.001; F35-0.0; D35-0.002
11	FF35	0944	600	BG NEG-90	0	0.03	0.005	B35-0.001; A35-0.005; GG35-0.005
12	BB35	0953	800	BG NEG-95	0	0.04	0.005	DD35-0.005; EE35-0.005; CC35-0.006
13	DD36	1005	600	BG NEG-100	0	0.035	0.006	AA35-0.009; AA36-0.005; BB36-0.006; CC36-0.008
14	GG36	1014	800	BG NEG-100	0	0.025	0.006	EE36-0.006; FF36-0.006
15	D36	1025	600	BG 87-68	0	0.015	0	A36-0.006; B36-0.0; C36-0.0
16	G37	1034	1000	BG NEG-65	0	0.035	0.002	E36-0.0; F36-0.0
17	C37	1044	600	BG 81-60	0	.015	0	F37-0.0; E37-0.0; D37-0.0

Table C.18—TERRAIN-SURVEY DATA OBTAINED BY GOPHER 3 ON JANGLE UNCLE*

Report No.	Position, grid	Time of position, PST	A/C altitude, ft	B-21 reading, mv	B-35 reading	G-M reading, mr	B-21 reading, mr	Remarks
1	L28	0753	700	BG 120-140	400	0.04	0.002	M29-0.006
2	I29	0803	1100	BG 120-120	0	0.03	0	K29-0.001; J29-0.0
3	H29	0813	1100	BG 100-100	0	0.02	0	
4	D29	0823	800	BG 110-180	1400	0.04	0.011	G29-0.002; F29-0.011; E29-0.001
5	FF29	0833	600	BG 110-220	2500	0.06	0.020	C29-0.026; B29-0.028; A29-0.032; GG29-0.0
6	B30	0843	600	BG 110-160	1200	0.04	0.007	FF30-0.0; GG30-0.018; A30-0.023
7	F30	0853	700	BG 110-110	400	0.03	0	C30-0.005; D30-0.002; E30-0.0
8	I30	0903	800	BG 105-110	0	0.05	0	F30-0.0; G30-0.0; H30-0.001
9	M30	0913	600	BG 105-125	600	0.04	0.003	J30-0.002; K30-0.002; L30-0.002
10	I31	0923	500	BG 105-140	1000	0.04	0.004	M31-0.0; L31-0.002; K31-0.002; J31-0.004
11	E31	0933	900	BG 105-120	400	0.04	0.002	H31-0.0; G31-0.002; F31-0.004
12	A31	0943	600	BG 110-180	3000	0.05	0.011	D31-0.002; C31-0.0; B31-0.001
13	DD31	0953	600	BG 110-150	1700	0.04	0.005	GG31-0.001; FF31-0.001; EE31-0.002
14	AA32	1003	600	BG 110-150	1800	0.30	0.005	CC31-0.007; BB31-0.011; AA31-0.006
15	DD32	1013	600	BG 110-140	1400	0.04	0.003	BB32-0.002; CC32-0.003
16	A32	1023	600	BG 110-130	400	0.04	0.002	EE32-0.002; FF32-0.001; GG32-0.0
17	E32	1033	600	BG 100-120	600	0.03	0.003	B32-0.0; C32-0.0; D32-0.0
18	I32	1043	1100	BG 110-110	0	0.02	0	F32-0.003; G32-0.001; H32-0.004
19	M32	1053	700	BG 105-120	0	0.03	0.002	G32-0.0; K32-0.002; L32-0.003

* It is the opinion of the operator that all readings obtained from radioactivity were due to fall-out on the ground.

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