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JTF-8
AD HOC GROUP FOR NUCLEAR SAFETY

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TECHNICAL NUCLEAR SAFETY STUDY OF PROJECT DOMINIC

B-52 AIRDROPS

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14. ABSTRACT

This report is a study by the JTF8 appointed Ad Hoc Committee of the adequacy of the safety features of the DOMINIC Test Series (B-52 Airdrops). This study includes test information received by 26 February 1962 and is valid for tests conducted utilizing the Test Vehicles as described herein. Additional nuclear devices which may be tested will be studied and included as amendments to this study, if so directed.

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TECHNICAL NUCLEAR SAFETY STUDY
OF
PROJECT DOMINIC
B-52 AIRDROPS

CAUTION

This document contains sensitive information. Only persons having a need-to-know will be permitted access to its contents. The approval of the Commander, JTF8 must be obtained for reproduction of any part of the document.

The Technical Nuclear Safety Analysis of this test system was prepared for the review, modification, and approval of the JTF8 Ad Hoc DOD/AEC Committee

BY

THE SAFETY ANALYSIS AND DEVELOPMENT DIVISION
DEVELOPMENT DIRECTORATE
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ABSTRACT[redacted]

This report is a study by the JTF8 appointed Ad Hoc Committee of the adequacy of the safety features of the DOMINIC Test Series (B-52 Airdrops). This study includes test information received by 26 February 1962 and is valid for tests conducted utilizing the Test Vehicles as described herein. Additional nuclear devices which may be tested will be studied and included as amendments to this study, if so directed.

Caution Note:

Because this study is concerned primarily with nuclear safety, some details may have been omitted or not considered. Also, some of the details deliberated by the Ad Hoc Committee may not be included in this report.

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LIST OF ILLUSTRATIONS AND DIAGRAMS

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I. PURPOSE AND SCOPE

A. The purpose of this study is to investigate the nuclear safety implications in the B-52 airdrop, full scale nuclear tests in the DOMINIC test series.

B. The scope of the study encompasses the entire sequence of events from removal from storage at Barbers Point to detonation of the device or its return to Barbers Point. The study examines the available handling, loading and delivery procedures, the system design, and the tests and testing sequence used on the system which apply during surface transportation at Barbers Point, assembly, flying, prearm and release, or re-safing operations.

C. This study does not consider the effects resulting from a detonation either at the intended point or any other point in time or space, but does provide an estimate of the probability of detonation at these points. Additionally, this study does not consider safety in transportation to Barbers Point or safety in storage. These matters are being considered separately by the Hazard Group of JTF-8 and/or the Service concerned.

II. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

The proposed test operation as defined in this study, and as modified by the following recommendations, will provide an acceptable level of safety in the Hawaiian area against a premature or one-point detonation.

B. Conclusion

The proposed test operation as defined in this study, and as modified by the following recommendations, will provide an acceptable level of safety enroute to the target area.

C. Conclusion

During airborne operations the Special Weapons Manual Lock provides a high degree of assurance against premature release. Withholding operation of the Manual Lock Handle until release time minus 60 seconds, as presently provided by the Concept of Operations, significantly reduces the probability of premature release.

D. Conclusion

For analysis of the effects of the test device detonation upon surface and aircraft arrays, it is necessary to determine the place at which the detonation will occur. Assuming normal fuze functioning, the point at which the detonation will occur is primarily a function of system circular probable error and secondarily a function of

[redacted]

system malfunctions and unplanned human actions. Figures 5 and 6 are graphic representation of probable and possible detonation areas.

Recommendation

1. Commander JTG 8.4 should provide estimates of circular probable error to the JTF 8 Hazards Group.

2. JTF 8 Hazards Group should employ the JTG 8.4 estimates of circular probable error and the information contained in Figures 5 and 6 as a basis for effects calculations.

E. Conclusion

A mathematical analysis of the dud and premature probabilities for this operation has been performed by Sandia Corporation. The results of this study are:

PROBABILITY SUMMARY

	39/Test Vehicle		36/Test Vehicle	
	100KT or Less	Above 100KT	100KT or less	Above 100KT
P_1	.003	.005	.007	.008
P_2	.0006	.003	.006	.008
P_3	.0003	.003	.0005	$< 10^{-6}$
P_4	$< 10^{-6}$	$< 10^{-6}$	$< 10^{-6}$	$< 10^{-6}$
P_5	$< 10^{-6}$	$< 10^{-6}$	$< 10^{-6}$	$< 10^{-6}$
P_6	$< 10^{-6}$	$< 10^{-6}$	$< 10^{-6}$	$< 10^{-6}$

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P_1 = Probability of complete dud

P_2 = Probability of impacting surface with no charge on X-Unit

P_3 = Probability of impacting surface with a charge on X-Unit

P_4 = Probability of nuclear detonation below minimum fire altitude, but prior to surface impact

P_5 = Probability of nuclear detonation after release before safe separation time

P_6 = Probability of nuclear detonation in bomb bay after DCU-9/A arming

1. With the 39/Test Vehicle, impacts on the surface would average approximately 1,000 feet per second and surface impact for the retarded 36/Test Vehicle would average approximately 326 feet per second. It should be assumed therefore that P_3 in either case is the upper limit of possible surface bursts (the impact shocks may generate a fire signal).

No probable causes of a fire signal after impact have been found in this study.

2. The sum of P_2 and P_3 should be assumed to be the upper limit of the number of possible underwater nuclear reactions resulting from dud test devices.

A kiloton of fission would give ~1 x 10^{23} neutrons.

F. Conclusion

When the Special Weapon Lock has been unlocked and the Test Vehicle prearmed by the DCU-9/A, any one of three crew members or a specific technical malfunction, can initiate premature prearmed release by actuating the Salvo Release System.

Recommendation

The Salvo Release Circuit Breaker be kept in the OUT position throughout the test mission except for an authorized jettison operation.

G. Conclusion

To assure aircraft and surface instrumentation array safety, the permissible limits of deviation from the desired ground track on the live run after the Test Vehicle has been prearmed, must be established. Informal discussion with the crew members indicates that a cone centered on the desired ground track with its apex at the target and a width of 2° on either side of the desired ground track would be acceptable.

Recommendation

The permissible limits of deviation from the desired ground track on the live run should be a 4° cone centered on the ground track. Any deviation outside these limits within the last two minutes before release should be cause for aborting that run.

H. Conclusion

The communications procedures between the Air Operations Center and the delivery aircraft have a significant effect on nuclear safety.

Recommendation

It is recommended that communications procedures, including communications checks during the live run, and a clear communication channel be established for exclusive use between the Air Operations Center and the delivery aircraft.

I. Conclusion

On a takeoff from NAS Barbers Point on runways other than 22 or 11, it is necessary to fly over populated areas.

Recommendation

[redacted] B-52 takeoffs from NAS Barbers Point with a test device on board should be from runway~~s~~ 22

J. Conclusion

Overflying inhabited islands enroute to and from the drop area creates a potentially hazardous situation.

Recommendation

Enroute flights with a test device aboard, from takeoff to the drop area should not overfly inhabited islands or large concentrations of shipping. The return flight to Barbers Point in the event of an aborted mission, should avoid populated areas to the maximum extent possible.

K. Conclusion

The NAS Barbers Point fire fighting crews are not known to be trained to handle the B-52 Aircraft/Test Vehicles in the event of an accident.

Recommendation

The NAS Barbers Point fire fighting and rescue teams should be trained to handle the B-52 aircraft/Test Vehicles prior to their arrival.

L. Conclusion

The Explosive Ordnance Disposal Teams at NAS Barbers Point are not now trained to handle the proposed test devices.

Recommendation

Immediate action be taken to insure that the Barbers Point personnel responsible for EOD be made aware of the AEC trained technical personnel who will be at Barbers Point during this operation and will available to provide assistance in necessary EOD activities.

M. Conclusion

Since the test device telemetry will be turned on for warmup during the last few minutes of the live run, indications could be received at the AOC which could require immediate technical evaluation.

These indications could cover a wide variety of situations too numerous to allow detailed pre-mission analysis.

Recommendation

A Technical Advisor thoroughly familiar with the nuclear safety ramifications of these indications should be available at the AOC.

N. Conclusion

If a condition should arise in which a prearmed **Test Vehicle** could not be safed by either the DCU-9/A or by Manual Safing Procedures in the bomb bay, landing with such a Test **Vehicle** would present a significant nuclear safety hazard.

Recommendation

Test **Vehiles** which can not be **safed** should be jettisoned in the area approved for such jettison.

III. ASSUMPTIONS AND CRITERIA

A. Validity of the Study

This study is based on design and operational information available to 26 February 1962. Significant changes in these areas incorporated after 26 February 1962 may invalidate the conclusions and recommendations herein or require additional evaluation.

B. Explanation of Terms

The terms used in this report are explained as follows:

1. Test Vehicle

A Test Vehicle consists of a ballistic case enclosing a nuclear test device, a special arming and fuzing system, the associated instrumentation, and for the 36/Test Vehicle a retardation parachute.

2. Cargo Airlift

This is the logistic transportation of Test Vehicles by cargo aircraft.

3. Staging Area Storage to B-52 Aircraft Loading Phase

Staging Area operations will include testing, disassembly, assembly, maintenance, and transportation to the B-52 Aircraft.

4. Loading Phase

The time interval between the beginning of loading, including pertinent aircraft checkout, through the completion of the release system mating and the mechanical lock check by the loading crew.

5. Pre-Takeoff Phase

The time interval between the end of loading phase and aircraft takeoff.

[redacted]

6. Flying Phase

The time interval from aircraft takeoff to release of the Test Vehicle over the target area or return to Barbers Point with the Test Vehicle. During this interval the Test Vehicle can be prearmed and released.

7. Post-Release Phase (Test Vehicle Trajectory)

The time interval from release of the prearmed Test Vehicle to detonation (or dudding).

8. Exclusion Area

Before each planned shot, Commander JTF-8 will establish an area from which air and surface traffic must be cleared for that shot and the times during which it must be clear. These areas will not necessarily be completely contained within the DANGER AREA.

9. DANGER AREA

The DANGER AREA for Operation DOMINIC is an area which will be publicly announced prior to the start of the operation and from which all air and surface traffic will thereby be warned to stay clear for the duration of the operation.

10. Aborted Mission

A mission that is terminated by an order to jettison or return to Barber's Point without release of the Test Vehicle.

11. Aborted Run (Negative Run)

A live bomb run terminated prior to release. An aborted run may be followed by either another live run or an aborted mission.

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C. Operating Procedures

Special check lists will be developed and precisely followed for assembly, disassembly, checkout and storage operations involving the Test Vehicle. The approved B-52 loading and delivery Technical Orders will be followed except where the Aircraft/Test Vehicle configuration makes it mandatory to deviate. Special checklists will be prepared to cover the deviations.

D. Production Quality Assurance

Manufacturing and production procedures were not investigated. It is assumed that contractor production quality assurance is adequate.

E. Safety Standards

The DOD Safety Standards were used as minimum criteria in evaluating the adequacy of nuclear safety for all operations performed in these tests. These standards are:

1. Prevent deliberate unauthorized arming, launching, firing, or releasing of nuclear weapons.

2. Prevent inadvertent arming, launching, firing, or releasing of nuclear weapons.

3. Prevent weapons involved in incidents or accidents or jettisoned weapons from producing a nuclear yield.

4. Insure adequate security.

F. Accidental Detonation

1. Possible causes of accidental detonation of the Test Vehicles are:

a. One-point detonation caused by fire or shock.

b. Nuclear detonation caused by functioning of the Test Vehicle electrical system.

2. [redacted]

3. The table, DOMINIC Schedule in Section V. shows the maximum nuclear contribution each device would give during a one-point detonation.

4. No direct vulnerability data are available on these Test Vehicles. It is assumed that a detonation may result from fire or shock, and that such detonation would be one-point. Therefore, the emphasis of this special study is placed on the inadvertent and premature functioning of the electrical system, which could lead to a nuclear detonation.

G. Plutonium Contamination Problem

One point detonation or burning of the Test Vehicle would result in the scattering of some plutonium, but would be unlikely to cause any unacceptable hazard, since the amount of plutonium in no device exceeds the 15 kg limit imposed on transportation and storage by Air Force Technical Order 11N-20-12.

The principal hazard remaining is that of being in the path and breathing plutonium in the resulting cloud. There would be a local area which would require decontamination.

H. Personnel Selection and Training

All personnel associated with this test operation have been carefully selected and properly trained.

IV. TEST SYSTEMS DESCRIPTION

A. B-52 Aircraft

1. The following description of the aircraft systems emphasizes features which have nuclear safety implications. The description is equally applicable to any B-52 Test/Vehicle combination. Refer to USAF/NWSSG 59-4 "Preoperational Safety Report of the B-52 Clip-In/MK-15, 28, 36 and 29 Weapon Systems," dated 5 February 1960, if more comprehensive detailed aircraft information relating to nuclear safety is desired. The referenced document presents a complete description of Production Model B-52 Aircraft.

2. The B-52 Aircraft is a long-range, strategic bomber powered by eight engines and manned for these test missions by a crew of seven: (1) a pilot; (2) a co-pilot; (3) a navigator; (4) a radar-navigator; (5) a weaponeer (located at the EWO station); (6) a radar maintenance technician; and (7) a DME operator. The B-52 will carry a Test Vehicle in the forward bomb bay and a telemetry package in the aft bomb bay on certain missions. There will be only one Test Vehicle on board the aircraft for each test mission sortie. Either B-52B (number 52-013) or B-52D (number 56-620) will be used for these tests. The special weapons equipment installed in both aircraft is described in the following paragraphs. The primary differences between the B-52B and B-52D are in the airframe configuration and aircraft power distribution systems.

3. Suspension and Release System

a. Clip-In Suspension System

IV. TEST SYSTEMS DESCRIPTION

The clip-in system for B-52 Aircraft consists of an MAU-6/A Clip-In Rack, which is attached at strong points within the bomb bay; a clip-in assembly composed of an MHU-13/C support; an adapter set attached to and stored with the Test Vehicle; and cables, wiring, and switches needed to control and monitor certain elements and functions. All release cables are enclosed in metal tubing to preclude inadvertent actuation of release devices.

(1) MAU-6/A Clip-In Rack

The MAU-6/A Clip-In Rack is installed in the bomb bay of the B-52 to provide structural support for the clip-in assemblies. The rack is bolted to four strong points within the bomb bay, and provides four pockets to receive hooks which project upward from the clip-in assemblies. Each pocket contains a cam to retain the hook during and after loading operations, and a locking pin which extends through a hole in the hook. The cams are spring loaded to engage the hooks but can be latched in a retracted position during unloading operations. The locking pins are spring loaded into the lock position but can be latched in a retracted position during weapon loading and unloading. A mechanical linkage mounted on the aircraft structure is connected to the aircraft in-flight locking system. This mechanical linkage mates with a pusher arm on the MAU-6/A which operates the release lock system on the clip-in assembly. The linkage transmits locking and unlocking movements to the release locking elements of the clip-in assembly. The racks will retain the clip-in assembly, even under loads which would cause major structural failure of the carrier aircraft. The clip-in assembly can be retained by either the lock pins or the cams alone, without assistance from the other.

(2) MHU-13/C Support

The MHU-13/C is the basic support unit for all clip-in assemblies. The support unit includes the four suspension hooks with locking holes which mate with the MAU-6/A. The MHU-13/C has numerous mounting provisions for the attachment of the adapter sets required for specific Test Vehicles.

(3) Clip-In Assembly

The clip-in assembly needed to carry the Test Vehicles consist of an MHU-13/C support and an adapter set, the MHU-21/C for the 39/Test Vehicle and the MHU-22/C for the 36/Test Vehicle. The adapter sets attach to the MHU-13/C and contain a pullout beam, a fore and an aft band, two support trusses, a sway brace, a torque tube, four truss retainers, and electrical components and wiring.

(a) The pullout beam contains mechanical pullout cables which are attached to pullout cable supports, and a bomb release indicator switch. For the 36/Test Vehicle, a static line deploy system will be attached to the clip-in assembly to deploy the retardation system at release.

(b) The fore and aft bands which support the unit are made of high-strength stainless steel. The bands consist of right and left side band assemblies, band tensioning installations, a forward and

[redacted]

aft integral mechanical lock, and an explosive release unit.

1. The bands are attached to the MHU-13/C support by two vertical side trusses and a horizontal sway brace. The band tensions necessary to retain each weapon have been determined by a series of specific tests and have been verified by over-all static tests of clip-in assemblies. The right and left side band assemblies, both fore and aft, have saw-tooth shaped fittings which are interlocked and restrained on a common stud by nuts and mechanical locks. To release the weapon, explosive cartridges are fired to fracture the nuts and allow the bands to separate. The mechanical lock assemblies are actuated by cables. The lock cables connect to cranks on a torque tube mounted on the MHU-13/C.

2. An explosive unit junction box is mounted on the MHU-13/C. A microswitch in the box is mechanically linked to a crank on the torque tube. The actions of the torque tube, lock cables, and microswitch are interlocked by their method of connection, so that the microswitch interrupts the electrical circuits to the explosive cartridges unless the locks are unlocked. However, if one or both explosive cartridges fire while the locks are locked, the release unit will fail-safe; the bands will not separate; and the locks cannot be disengaged. The cartridges have a guaranteed no-fire sensitivity of 2-amperes for 5 minutes.

(c) A microswitch installed on the clip-in rack assembly will connect a signal to the aircraft instrumentation. This switch is mechanically held in the unactuated position before release by the Test Vehicle case.

[redacted] [redacted]

[redacted]

b. Release Systems

The B-52 Aircraft bomb release systems are identified as: (1) Normal; (2) Emergency; (3) Salvo (Jettison); and (4) Special Weapons Emergency Separation System (SWESS) (installed in aircraft #620 only). The SWESS will be disabled for this series of nuclear tests by placing the SWESS controls to either the OFF or SAFE position, safetied and sealed as applicable. Each of these release systems when actuated, releases Test Vehicles by applying an electrical signal through a switch on the Special Weapons Lock System to explosive cartridges on the clip-in assembly. None of these systems will release a Test Vehicle unless the Special Weapons Manual Lock is unlocked. The release systems, applicable to this series of nuclear test missions, are described in the following paragraphs. None of the release circuits are affected by the special aircraft instrumentation equipment installed for these test drops.

(1) Normal Release System

The normal bomb release system provides the radar-navigator with a method to release the Test Vehicles automatically, using the Bombing Navigational System (BNS) or manually by using the D-2 Bomb Release Switch. Operating the Special Weapons Manual Lock Handle unlocks the clip-in assembly mechanical lock. The Indicator Lights Switch and the Power Switch must be ON and the Salvo Control Switch must be OFF for either automatic or manual operation. When the system is operated automatically, an electrical signal from the BNS actuates a circuit which opens the bomb

[redacted] [redacted]

doors and activates the clip-in assembly explosive cartridges. After a Test Vehicle is released, an electrical pulse from the BNS or the Door Close Timer actuates a circuit which closes the bomb doors. The system is operated manually by using the Bomb Door Switch to operate the bomb doors, and using the D-2 Bomb Release Switch, to electrically activate the clip-in assembly explosive cartridges.

(2) Salvo Release System Operation

The Salvo Release System provides the pilot or radar-navigator with an emergency electrical method of releasing the Test Vehicle. Operation of either the pilot's BOMB SALVO (JETTISON) or radar-navigator's SALVO CONTROL (JETTISON) switch energizes the slavo control relay. When the salvo control relay is energized, aircraft power is simultaneously placed on the salvo door open relay, salvo control relay No. 1, and salvo control relay No. 2. When the door open relay is energized, aircraft power is applied directly to the door control valve solenoids, opening the bomb bay doors. When control relay No. 2 is energized, power is applied through a circuit, normally interrupted by the bomb bay door salvo safety switches, to the salvo release relay. The release relay directs aircraft power to the clip-in assembly explosive cartridges. The entire Salvo Release System remains energized until the bomb bay doors are manually closed. The Normal Release System is rendered inoperative during Salvo Release System operation.

(3) Emergency Release System Operation

An emergency electro-mechanical method of releasing the Test Vehicle is provided through operation of a FORWARD SPECIAL WEAPON

[redacted]

MANUAL RELEASE handle located at the radar-navigator's station. Before this handle can be pulled, the SPECIAL WEAPONS MANUAL LOCK handle must first be pulled to disengage the interlock. Pulling the forward release handle approximately 9 inches will unlatch the bomb bay doors. (The Rear Special Weapon Emergency Release handle will not unlatch the bomb bay doors, nor will it release the Test Vehicle in the forward bomb bay.) Pulling the forward release handle to its limit (approximately 18 inches) will close a rotary switch, allowing SWESS battery power (if the aircraft has SWESS provisions) or aircraft battery power to the clip-in release mechanism to release the Test Vehicle. The Test Vehicle will fall on the unlatched bomb bay door and force it to open.

(4) Special Weapons Emergency Separation System (SWESS)

The SWESS system will be disabled for the test missions. Significant components remaining in the system include:

(a) SWESS Control Switch

A two-position switch with AUTO and OFF positions located by the bomb bay. In the OFF position the switch controls power to the press-to-test circuits of the pilot's and radar-navigator's SWESS Armed Lights, and also disables SWESS release functions. This switch will be placed in the OFF position, then safetied and sealed.

(b) SWESS Battery

The SWESS battery is a nickel-cadmium battery which provides the voltage necessary to effect an emergency release using the Special Weapon Manual Release handles.

[redacted]

4. Special Weapons Lock System

The weapon locking system includes the Special Weapons Manual Lock handle, a lever on the MAU-6/A Clip-In Rack, and the clip-in assembly weapon locking system which consists of an arrangement of pulleys, brackets, cables, cranks, microswitches, and a lock valve. Operating the Special Weapons Manual Lock handle unlocks or locks the release mechanism for the Test Vehicles. Pulling the handle operates the Clip-In Assembly Locking System to place the lock valve in the unlocked position and to close the Bomb Release Mechanical Lock (BRML) microswitch. In this condition, the BRML microswitch permits an electrical release signal to reach the explosive cartridges and also causes an unlocked indication to appear in the cockpit. Releasing the Special Weapons Manual Lock handle returns the spring-loaded lock valve to the locked position and opens the BRML microswitch. In this condition, the BRML microswitch prevents an electrical release signal from reaching the explosive cartridges, and a locked indication appears in the cockpit. The cockpit indication of the locked or unlocked condition of the assembly locking device is displayed on a panel at the radar-navigator's station. The C-3 type indicators show LOCK if the clip-in assembly is locked and UNLOCKED if the assembly is unlocked. Black and white stripes are shown on the C-3 type indicators if the assembly is not fully locked, fully unlocked, or the power is removed.

5. T-249 Inflight Control and Monitor

[redacted]

IV. TEST SYSTEMS DESCRIPTION

The T-249 Inflight Control and Monitor contains an Option Selector Switch having the positions SAFE, GND, and AIR, an ON/OFF Power Switch, a red Warning Light, a Dim Control, and a selector switch locking device. For this series of nuclear tests, the T-249 will not be used to control or monitor any Test Vehicles. Instead, the T-249 will be utilized to provide release power to the companion instrument package to be dropped with the 39/Test Vehicle. In the B-52B and D Aircraft used in these tests, the T-249 is located at the weaponeer's station and it controls the rear bomb bay only.

a. Power Switch

The OFF position removes both release and monitoring power from the rear bomb bay.

b. Option Selector Switch

In either the GND or AIR positions, power is applied to actuate a release solenoid in the rear bomb bay.

c. Warning Light

The Warning Light serves to indicate a malfunction.

[redacted] [redacted]

d. Dim Control

The Dim Control does not affect the Warning Light, but it does control the T-249 panel illumination. This feature uses aircraft power and will function with the power switch ON or OFF.

e. Locking Device

A mechanical obstruction mounted on the panel must be removed before the Option Selector Switch can be moved from the SAFE position. The device is red and bears a DANGER label. It is held in place by a pin through the knob of the Option Selector Switch and has provisions for safety wiring and sealing.

6. DCU-9A Inflight Control and Monitor

The DCU-9A controls and monitors the forward bomb bay. The forward bomb bay will be used for all Test Vehicles. The DCU-9/A contains a Rotary Selector Switch having the positions SAFE, GND, AIR and OFF, a Control Arm having the positions OS and SGA, a red Warning Light, a Test Switch, a Dim Control, and a Holding Relay. The DCU-9/A is located at the navigator's station in the production aircraft. In the B-52B and D aircraft used in these tests, the DCU-9/A is located at the weaponeer's station (EWO's station) because of test mission requirements. The DCU-9/A and its associated circuits are not affected by the special instrumentation installed in the aircraft for these test drops.

a. Rotary Selector Switch

In the OFF position, aircraft power is not available to the Test Vehicle circuits. In the SAFE position, Test Vehicle safing power is applied. In either the GND or AIR positions, prearming power is applied to the Test Vehicle.

b. Control Arm

The Control Arm has OS and SGA positions. When the Control Arm is in the OS positon, the Rotary Selector Switch can be operated from OFF to SAFE and back to OFF, but cannot be rotated beyond the SAFE position. When the Control Arm is in the SGA position, the Rotary Selector Switch can be operated from SAFE to GND or AIR and back to SAFE, but cannot be returned to the OFF position.

c. Warning Light

The Warning Light serves to indicate a malfunction and comes on at any time the Test Vehicle configuration does not agree with the configuration indicated on the Rotary Selector Switch. The light also comes on as a press-to-test indication that the pullout cables are properly connected and that AMAC circuits (and the unit circuits) have proper continuity.

d. Test Switch

The Test Switch is used to verify that the Warning Light bulb is not faulty. The Rotary Selector Switch must be in either the SAFE, GND, or AIR position for the Test Switch circuit to operate.

e. Dim Control

The Dim Control does not affect the Warning Light, but it does control the DCU-9/A panel illumination. This feature uses aircraft power and will function regardless of Rotary Selector Switch position.

f. Holding Relay

The DCU-9/A contains a Holding Relay which insures that Test Vehicle safing and monitoring power remains available even if the Rotary Selector Switch is returned from GND or AIR to OFF faster than the Test Vehicle safing cycle can be completed.

7. DCU-47/A Weapon Prearming Control (Readiness Switches)

This control, located at the pilot's station, is a group of four toggle switches covered by a transparent cover. These switches provide the aircraft commander with a means to permit or to prevent Test Vehicle prearming. When in the SAFE position, these switches prevent the DCU-9/A from making any fuzing option selection other than SAFE, and will override the DCU-9/A to place the Test Vehicle fuzing option component in the SAFE position. When in the READY position, these switches permit the DCU-9/A to provide a GND or AIR prearming signal. After the Test Vehicle has been prearmed by operation of the Readiness Switch to the READY position and the DCU-9/A to the GND or AIR position, the return of either the Readiness Switch to the SAFE position or the DCU-9/A to the SAFE position will cause the Test Vehicle fuzing component to reset to its SAFE position. These switches require that two aircrew members perform independent functions to provide the Test Vehicle with the one signal required for prearming. The cover may be safetied and sealed closed if the switches are in the

SAFE position. The arrangement precludes inadvertent operation of the switches from the SAFE to the READY position. Closing the cover will place the switches in the SAFE position.

8. B-52 Aircraft Instrumentation

a. High Speed Cameras

The high speed cameras are programmed and designed to record photographs of the detonation. The photographs will be used with other data to determine yields. The cameras will be controlled by a time sequencing system which will be activated at release by a microswitch or a pullout wire on the clip-in assembly. The microswitch is mechanically held in the unactuated position before release by the Test Vehicle case. The electrical circuits for the microswitch assembly are separate and not connected to any special weapon equipment. Special wiring was installed to supply power and timing pulses to the cameras. The "run" power for the cameras is taken from the right hand AC bus and is fuzed at the bus takeoff point.

b. Bhang Meters

The Bhang Meters (2) are designed to record the magnitude of detonation. The meters are activated at release in the same manner as outlined for the cameras in paragraph 8.a. The Bhang Meter power is taken from the AC and DC bus in the tail gunners compartment. The power is taken from the bus through fuzes.

[redacted]

c. Telemetry Transmitters and Receivers (RF)

This equipment is designed to record accurate relative positions of the Test Vehicle and the drop aircraft. The antennas are located in the forward wheel well area, and aft of the bomb bay. Telemetry transmitters and receivers get voltage through fuzes off the AC and DC bus at the ECM operator's position.

c. 28 Instrumented Package

As an additional diagnostic tool, a "companion package" will be employed in the free-fall drop tests of the 39 Test Vehicle. This package will be an MK-28 ballistic shape containing gamma measuring devices and other detectors whose output is transmitted via telemetry links to the surface array. This instrumented package will provide diagnostic data to be used in the evaluation of the nuclear device following the destruction at detonation of the telemetry gear contained in the drop Test Vehicle.

e. 28 Instrumented Package Release Method

The companion package will be carried in the upper right position of the aft bomb rack in an MHU-14/C Clip-In Assembly.

The Bomb Door Open Cam on the Time-to-Go shaft in the K system computer will close micro switches at approximately release time minus 6 seconds. The closing of these switches provides 28 Volts DC to a

[redacted] [redacted]

[redacted]

high resistance relay coil in the bomb bay and closes and locks the contacts of the relay. 28 Volts DC is supplied from this relay through contacts of a relay energized by the T-249 in the AIR or GND position to start the MC-955 timer. Power from the time-to-go relay through the door interlock switch is required to start the Timer and must be available at the closure of the Timer or the package will not be released. The power to actuate the release solenoid for the 28 package is obtained from the T-249. To obtain a release of the package, four events must happen: Unlock MHU-14C rack; select AIR or GND on the T-249; the bomb bay doors must be open; and the Door Open Pulse must be received. The release system for the forward bomb bay used for the Test Vehicle has not been modified in any way to support the release method for the instrumented package.

The aircraft system is being modified in the following manner:

(1) The Door Open Pulse is being obtained from the K system.

(2) A relay and wiring is being installed to provide this signal in the bomb bay.

(3) A "T" cable is being installed between the bomb bay connector and rack control cable.

f. Effects on Special Weapons Equipment

The special weapons equipment (DCU-9/A, DCU-47/A,

[redacted] [redacted]

[redacted]

release systems, special weapon lock system) will not be specially modified in any way to support the instrumentation outlined above, except as discussed in paragraph 7.a. The aircraft special instrumentation does not in any way tie into the fuzing and firing or release system of the aircraft. Should an electrical fault occur in the special instrumentation, the fuzes will blow and therefore will not interfere with weapon monitoring.

9. Clip-In Assembly and Aircraft Test Equipment

The aircraft bomb monitor and control circuits, the release circuits, and the clip-in assembly circuits will be tested prior to each test mission, using standard 28 volt testers. The testers to be used are:

a. F52876 Subassembly Tester

The subassembly tester is used during the premating checkout of each clip-in assembly.

b. F52875 Aircraft Tester

The aircraft tester is used during the pre-loading checkout of the aircraft wiring. The tester checks the release control, the locking system control and their respective indicating circuits.

c. AN/GWM-8A Flight Circuit Tester

The Flight Circuit Tester is used during the pre-loading checkout of the aircraft to check continuity of the control and monitor circuits.

[redacted]

[redacted]

d. Special AMAC Tester

A special AMAC tester will be used during pre-loading checkout of the aircraft to check operation of the control and monitor circuits.

B. Freefall Test Vehicle (Figure 1)

The 39/Test Vehicle will be a freefall test shape utilizing the MK-39 ballistic case. Nominal weight will be 7,000 pounds.

Pages 31 through 38 are deleted.

18. Special Support Equipment

a. Test Vehicle Instrumentation

(1) To assist in the diagnosis of both nuclear and electrical system behavior, several critical events are being telemetered in each of the tests. This telemetry is divided into two groups, FM/FM, and HRT. The FM/FM (double frequency modulation) system is used to provide data on the functional behavior of the fuzing system and samples both low voltage (28 VDC) and high voltage (2,500 VDC) events. The HRT (high resolution telemetry) system is used to provide data on the functional behavior of the nuclear system. The FM/FM and HRT systems are isolated from the fuzing and firing systems to insure that voltages from the TM systems are not impressed on the Test Vehicle circuits.

(2) In addition, each drop vehicle will contain one or more RF beacons and DME transmitters to assist in tracking by surface instrumentation and coordinate other functions in the aircraft array. The beacon used as a tracking aid is a 100 watt peak power (less than 1 watt average power) transmitter with a frequency of 2,700 - 2,900 megacycles. The DME (distance measuring equipment) transmitters produce 10 watts output at 226.7 and 256.2 megacycles. The FM/FM system produces 10 watts at 216.5 and 221.5 megacycles. These systems will be on the air at approximately release time minus 10 minutes.

(3) The FM/FM package voltages are isolated from the Test Vehicle electrical system points being measured by 24 kilohm resistors in the weapon junction box and an RC isolation network within

the TM package. The HRT package emits 20 watts at a frequency of 4,000 megacycles and is on the air at approximately release time minus 10 minutes. The voltages within the HRT package are isolated from the test device electrical system points being monitored by resistor-capacitor-diode networks which insure that no voltage can be coupled into the Test Vehicle electrical system.

(4) An analysis of the effects of the radiated energy from this telemetry equipment on all current sensitive devices in the drop units has been conducted. A test to evaluate this condition has been conducted. No difficulties were encountered.

(5) During all checkouts of the TM gear, while it is installed in the test vehicle, a monitor device will be connected to the test vehicle junction box telemetry connector to insure that no feedbacks from the TM gear are present at that connector.

b. Special Continuity Tester

This tester, powered by a 1.5 volt battery and current limited to 5.5 milliamperes, is used to check the continuity circuit in the fuze and the warhead individually. Special adapter cables will be used so that the test set may be connected to the fuze or warhead at the connectors used for installing the Ground Safing Key.

C. Sequence of Operation (Figure 3)

1. Before release, the DCU-47/A is placed in the READY position and the DCU-9/A Selector Switch is placed in the AIR position. This action operates the MC-1288 Ready/Safe Switch to the READY position.

Pages 41 through 50 are deleted.

19. Special Support Equipment

a. Radioactive Tracer Plugs

Radioactive Tracers will be installed on the outside periphery of the Test Vehicle cases immediately before aircraft taxi for takeoff. The AEC will have the responsibility of handling and installing the plugs. The plugs aid in atmospheric sampling following the Test Vehicle detonation. The plugs are radioactive and require special handling.

b. Test Vehicle Instrumentation

(1) To assist in the diagnosis of both nuclear and electrical system behavior, several critical events are being telemetered in each of the tests. This telemetry is divided into two groups, FM/FM, and HRT. The FM/FM (double frequency modulation) system is used to provide data on the functional behavior of the fuzing sytem and samples both low voltage (28 VDC) and high voltage (2,500 VDC) events. The HRT (high resolution telemetry) system is used to provide data on the functional behavior of the nuclear system. The FM/FM and HRT systems are isolated from the fuzing and firing systems to insure that voltages from the TM system are not impressed on the test device circuits.

(2) In addition, each drop aircraft will contain one or more RF beacons and DME transmitters to assist in tracking by surface instrumentation and coordinate other functions in the aircraft array. The beacon used as a tracking aid is a 100 watt peak power (less than 1 watt average power)

transmitter with a frequency of 2,700 - 2,900 megacycles. The DME (distance measuring equipment) transmitters produce 10 watts output at 226.7 and 256.2 megacycles. The FM/FM system produces 10 watts at 216.5 and 221.5 megacycles. These systems will be on the air at approximately release time minus 10 minutes.

(3) The FM/FM package voltages are isolated from the **Test Vehicle** electrical system points being measured by 1 kilohm resistors in the weapon junction box and an RC isolation network within the TM package. The HRT package emits 20 watts at a frequency of approximately 4,000 megacycles and is on the air at approximately release minus 10 minutes. The voltages within the HRT package are isolated from the test device electrical system points being monitored by resistor-capacitor-diode networks which insure that no voltage can be coupled into the test device electrical system.

(4) An analysis of the effects of the radiated energy from this telemetry equipment on all current sensitive devices in the drop units has been conducted and no areas of concern have been detected. A test to evaluate this condition has been conducted. No difficulties were encountered.

(5) During all checkouts of the telemetry gear, while it is installed in the test vehicle, a monitor device will be connected to the test device junction box telemetry connector to insure that no feedbacks from the telemetry gear are present at that connector.

c. Special Continuity Tester

This tester, powered by a 1.5 volt battery and current-limited to 5.5 milliamperes, is used to check the continuity circuit in the fuze and the warhead individually. Special adapter cables will be used so that the test set may be connected to the fuze or warhead at the connectors used for installing the Ground Safing Key.

E. Sequence of Operations - 36 Test Vehicle (Figure 4)

1. Ground Safing Key is installed and pullout rod locking pins are removed immediately before takeoff.

2. Test Vehicle is monitored through the DCU-9/A until ARM point is reached in flight.

3. The MC-1026 Ready/Safe Switch is operated to READY by enabling the circuit through the DCU-47A Readiness Switch and selecting AIR or GND on the DCU-9/A AMAC. Operation of the MC-1026 to READY closes the circuits from the MC-845 to the MC-640A and from the MC-640A to the fuzing components.

4. At release, the parachute is static-line deployed and a voltage pulse from the MC-845 Pulse Generator initiates the MC-640A Thermal Battery and the MC-543 Safe Separation Timer.

a.

Pages 54 through 57
are deleted.

V. CONCEPT OF OPERATIONS

A. Mission

This operation consists of developmental tests of certain new warheads and devices which have been mounted in ballistic cases suitable for airdrop. Data collection by airborne diagnostics, sampler aircraft and surface instrumentation is the prime purpose of these drops. The code name for this operation is DOMINIC.

B. Test Missions and Vehicles

As of 20 February 1962, 20 overwater airdrops are scheduled for this operation; however, this list may be later augmented by additional tests. Two types of ballistic cases, the MK-36 and MK-39, will be used. The 36 Test Vehicles will be dropped with parachute retardation; the 39 Test Vehicles will be dropped free-fall with a MK-28 instrumentation shape as companion. All devices will be detonated above the surface. The following is the approximate schedule of drops and the devices to be tested:

DOMINIC SCHEDULE

DEVICE	CODE NAME	TEST VEHICLE SHAPE	PREDICTED YIELD	MAXIMUM YIELD	MAX 1 PT	DATE
	CHETCO	36				~~2 Apr~~ MAY 23
	ADOBE	39				4 Apr APR 23
	SWANEE	36				6 Apr MAY 16
	AZTEC	39				9 Apr APR 25
	QUESTA	39				11 Apr APR 30

[redacted]

V. CONCEPT OF OPERATIONS

DEVICE	CODE NAME	TEST VEHICLE SHAPE	PREDICTED YIELD	MAXIMUM YIELD	MAX 1 PT	DATE
	MESILLA	39				13 Apr MAY 4
	YESO	39				16 Apr MAY 11
	YUKON	36				18 Apr MAY 2
	ARKANSAS	36				20 Apr 27 Apr
	ENCINO	39				23 Apr 14 MAY
	ROSEBUD	39				1 May 18 MAY
	TRUCKEE	36				3 May 27 June
	TANANA	36				5 May 30 MAY
	NAMBE	39				7 May 21 MAY
	PETIT	36				9 May 13 June
	MUSKEGON	36				18 May 9 MAY
	OTOWI	39				21 May 25 MAY
	SUNSET	39				23 May 28 MAY
	BIGHORN	36				25 May 20 June
	CALAVERAS	36				8 June 4 July

Military assistance in device movement/operations will be provided the AEC and will include cargo aircraft transportation, off-loading of cargo aircraft and surface transport to the storage area, installation of clip-in in the storage area, and device loading aboard B-52 Aircraft.

[redacted] [redacted]

C. Mission Aircraft

A B-52 Aircraft will be used to release the device. In addition to the B-52, there will be two C-130 Aircraft, two C-54 Aircraft, and one RC-121 Aircraft. The C-130s and C-54s will be used for diagnostic and medical experiments. The C-121 will be Alternate Control Center for the Air Operation Center (AOC) at Christmas Island. The distance from Ground Zero of these arrays will vary from shot to shot. The orbits of the support aircraft are oriented with respect to the direction of the bomb run. The directing of the bomb run is determined by surface instrumentation requirements and the direction of the wind in the target area.

D. Test Area and Target (Figure 7)

The target will be located within a rectangular area which will be designated as a danger area. This area will be approximately 600 NM by 800 NM and will encompass Christmas Island. The boundaries are 149° 20' West, 162° 40' West, and 06° 50' North, 03° 10' South. The target will be a moored structure which will have a radar beacon, multiple passive radar reflectors and an array of lights as aids to positive identification.

E. B-52 Mission Profile (Figure 7)

1. The B-52 drop aircraft will take off from Barbers Point Naval Air Station. Takeoff when climatic conditions permit will be accomplished in the direction of the sea whenever possible. Overflight of heavily

[redacted]

populated areas ~~including ocean vessels,~~ will be avoided ~~during the flight~~. Climbout and enroute flight altitudes will be blocked. ~~After takeoff, the B-52 will be under the surveillance of the RC-121 Alternate Control Aircraft which will provide navigational assistance if required.~~

2. Upon arrival in the target area and after obtaining clearance from the primary Air Operations Center, the B-52 will establish timing patterns of 16 minutes duration over the target. A minimum of four patterns will normally be performed. The racetrack pattern will be oriented in a direction away from Christmas Island.

3. The fifth orbit will normally be the actual bomb run. However, additional wind and timing runs will be made at the discretion of the aircrew or the Air Operations Center. All post release escape maneuvers performed by the B-52 will be in a direction away from Christmas Island.

F. B-52 Mission Control

Enroute control is as follows:

1. Takeoff and landing control will be exercised from the control tower at Barbers Point NAS. ~~A JTG8.4 representative in the tower will coordinate takeoffs against a master schedule prepared by the Task Group Staff.~~ ~~This~~ The tower at Barbers Point NAS ~~representative~~ will pass takeoff and landing information to the JT8.4 Command Post located at Hickam AFB.

[redacted] [redacted]

2. Following takeoff, the aircraft will proceed to the operational area under Federal Aviation Agency (FAA) control. ~~During this phase of the flight, the B-52 will be under constant surveillance by FAA control radars, the RC-121 Alternate AOC Aircraft, or radar picket ships.~~ All air traffic on the route will be blocked while the B-52 is enroute.

3. ~~Fifty miles North of the~~ at the danger zone boundary, control passes to the JTG8.4 approach control who vectors the aircraft to the ~~danger~~ WARD TARGET area. ~~At this point~~ FIFTY NM NORTH OF XMAS control of the B-52 is passed to the JTG8.4 AOC. A back-up control capability will be provided in the RC-121. Positive identification of the target is a mandatory condition for proceeding with the mission. In addition to positive identification by the aircrew, the AOC will confirm positive acquisition through precision radars/plotting boards operated by Sandia Corporation personnel. * add

4. The aircrew must receive authorization from the AOC before performing the following prearming and pre-release functions:

a. Breaking Prearm Control Seals

In no case will these operations be performed before entry into the designated target area and then only after approval is received from the AOC.

add

b. Activation of Prearming Controls

These controls will remain in the SAFE position until the B-52 is in the live bomb run pattern.

c. Breaking the Seal of the Manual Release Lock

This will be governed by the same conditions applied to seals on prearm control except that the seal may be broken outside the danger zone preliminary to jettisoning the Test Vehicle.

d. Activation of the Manual Release Lock

Except for jettisoning, this control will remain in the LOCKED position until the B-52 is ~~one~~ 9 minutes from bomb release point on the live bomb run.

G. Mission Abort Criteria

Absolute causes for abort of the mission will include but not be limited to:

1. A change in the predicted path of the nuclear cloud which would indicate an unfavorable drift direction.

2. An aircraft out of position in the test array such that it is closer to Ground Zero than its minimum safe separation distance.

3. The invasion of the exclusion area by an uncontrolled aircraft or surface vessel.

4. Any uncertainty that the exclusion area is not clear.

5. Test array aircraft emergencies which prevent the disabled aircraft from retiring to a safe position.

6. Drop aircraft malfunctions which would preclude a safe drop and/or escape.

H. Nuclear Safety Responsibilities

1. The JTG8.4 will:

a. Provide trained loading teams to accomplish device handling, mating and loading.

b. Provide trained flight crews to accomplish the airdrop requirements.

c. Provide standard and/or approved device loading equipment.

d. Insure that approved procedures and check lists are developed in coordination with the AEC and used during all ground handling, mating and loading operations.

e. Insure that maintenance checks on Test Vehicles during handling and loading operations, performed by DOD personnel, are supervised by a qualified commissioned officer or his designated qualified representative.

f. Establish procedures which will insure that once the Test Vehicle is loaded on the aircraft, the prearming controls are safetied and sealed and the release controls are locked and sealed. These controls include the DCU-9/A Inflight Control Monitor, the DCU-47/A Readiness Switches, the SWESS controls and the Special Weapons Manual Lock handle.

g. Except as noted below, procedures will be established to insure that weapon jettison under emergency inflight conditions will be in accordance with approved USAF policy, i.e., only over open ocean areas which will insure a minimum 10 NM clearance from the nearest shoreline. Nuclear devices will be jettisoned in a safe condition only after the jettison areas have been cleared by radar and visual means to the maximum extent possible. Nuclear devices will never be jettisoned over land masses. Aircrews will be briefed and will understand that in case of an inflight emergency of such a nature as to preclude reaching the open ocean area, the aircrew, prior to bail out will insure that the device is safe and locked in the aircraft and that the aircraft is headed toward an isolated area. Due to the experimental nature of the devices being tested it may be necessary to deviate from USAF policy with respect to the SAFE configuration of the jettisoned devices. In the absence of written procedures for the jettison of devices in a configuration other than SAFE, the aircrew will contact the Commander JTF8 or his designated representative for jettison authorization.

h. Procedures will be established to insure that the aircrew understands "Inflight Manual Safing Procedures" in the event resafing cannot be accomplished by the inflight monitor and control system. Inflight manual safing procedures will only be accomplished over areas approved for jettison of unsafe devices. These procedures will be developed in coordination with the AEC.

i. Insure that coordinated procedures are in effect with the host base with regard to disaster control. Procedures will be effected which will insure that disaster control teams and base emergency response agencies are alerted for all takeoffs and landings involving nuclear devices.

2. Barbers Point Naval Air Station will be responsible for Disaster Control support for each DOMINIC operation. The Disaster Control Plan will define actions of response agencies in the event of an accident/incident involving a nuclear device.

3. Hickam Air Force Base will be responsible for providing Disaster Control support for any contingency involving nuclear devices aboard aircraft landing at Hickam AFB.

I. Security

1. The USAF two-man policy (Buddy System) will be in effect at all times when access to the nuclear device/nuclear device system is required. At least two people, each knowledgeable of the task to be performed and familiar with pertinent security directives will be present when access to the nuclear device/nuclear device system is required, etc.

2. A minimum of two armed guards will be present any time the nuclear device is outside the confines of an approved storage area. Access to the storage area or loaded aircraft will be rigidly restricted.

3. A minimum of a final SECRET clearance will be required of each person having access to the nuclear device/nuclear device system.

VI. SAFETY ANALYSIS

The following analysis considers those components, features, and procedures incorporated in the aircraft and Test Vehicle, which provide safety. This section will consider the entire test system operation as outlined in the test plan to determine whether adequate safety is provided for this test series as defined in the Scope.

A. Normal Operation

Assuming no component malfunctions, the following functions must be accomplished to achieve a nuclear detonation during the storage-to-target sequence of the test system:

1. The Ground Safing Key must be inserted.

2. The pullout rod safing pins must be removed from the Bisch Generator Pullout Rods.

3. DCU-47/A Weapon Prearming Control (Readiness Switches) must be in the READY position.

4. The DCU-9/A Selector Switch must be in the AIR position.

5. The Special Weapons Manual Lock must be unlocked.

6. Test Vehicle must be released near planned release altitude.

B. General Analysis

1. Throughout the storage-to-target sequence, nuclear safety is primarily dependent upon design features and procedures which

prevent the X-unit from being charged. Specifically those safety features incorporated in these Test Vehicles are:

a. Ground Safing Key

b. Safing Key Connector Cover (SKCC)

c. Ready/Safe Switch

d. Safe Separation Timer

e. Pullout Rod Safing Pins

2. Each of these components contributes to the over-all nuclear safety of the system. The following analysis considers the safety provided by these components and the effect on nuclear safety of combining them with other test system components while progressing through the storage-to-target sequence.

3.

4. A study conducted by Sandia Corporation concludes that there is no significant danger of Test Vehicle component operation as a result of EMR fields expected in this operation ~~generated by the telemetry~~ equipment. This study was conducted with the assumption that aircraft loadings would be conducted at the approach end of runway 4. (Add'l [illegible] Coordination of tower 8.1.4.7 & will be effected)

C. Storage-to-Loading Phase

1. During this phase of the operation, the Test Vehicle will be partially disassembled, reassembled and subjected to confidence checks by AEC personnel. The two-man rule will be enforced during these operation. After reassembly, the Safing Key Connector Cover (SKCC) is removed and a continuity test is performed on the fuze and the warhead. The SKCC is then reinstalled. The clip-in assembly is then installed by DOD personnel and the unit is moved either to the aircraft or a storage area. Implementation of the two-man rule during the test, assembly, and loading operation at Barbers Point is enhanced by the controls planned for the Safing Key Connector Cover. This cover will be locked in place during the original Test Vehicle assembly operation with two padlocks. At Barbers Point, the keys to these two padlocks will be

maintained in the custody of two different individuals. The cover will be removed three times during normal operations: (1) during the checkout operation in the assembly and test area for the fuze and warhead continuity tests; (2) during the loading operation for the same tests; and (3) during the loading operation for the insertion of the Ground Safing Key. After completion of the tests in the first two cases, the cover will be reinstalled as soon as the tests are completed.

2. The Safing Key Connector cover is removed by AEC/Sandia Corporation and access is afforded to the warhead connector during tests made on the arming and fuzing system and on the warhead. During the testing of the arming and fuzing system, there is no electrical connection to the warhead; testing of the arming and fuzing system appears to have no significant possibility of operating or actuating arming and fuzing system components to an unsafe position or condition because the tester is current-limited to 5.5 milliamperes output. The tester is self-checking in that a "zero adjust" feature would detect any failure of the current-limiting circuit. Following the arming and fuzing test, the same tester is disconnected from the fuze connector and connected to the warhead connector. Inadvertent arming of the warhead is prevented by the same current-limiting features. Deliberate arming of the warhead would be possible at this time if an individual applied a suitable power source to the warhead connector. Prevention of this action is assured primarily by

the two-man rule; mitigating factors are that the current-limited tester is the only authorized test equipment at this time.

3. During this phase, the protection afforded the warhead input connector by the locked connector cover, the absence of the Ground Safing Key which isolates the warhead from the fuze, and the administrative control exercised over these devices provide assurance against deliberate unauthorized arming of the nuclear device. The enforcement of the two-man rule provides additional assurance against deliberate, unauthorized acts leading to arming of the nuclear device.

4. In addition to the above features, protection against inadvertent arming is provided by the Ready/Safe Switch which electrically isolates the Thermal Battery Pack from the Bisch Generator, and the rest of the fuze, and interrupts the output circuit of the Bisch Generator to the Safe Separation Timer Squib. The Ready/Safe Switch is a motor-driven switch which requires a continuous electrical signal for approximately three seconds for operation. As placed in the arming and fuzing system, this switch interrupts the output of the Bisch Generator even though operation of the Bisch Generator is improbable when the Pullout Rod Safing Pin is installed.

5. Protection against extreme fire and shock environments which could result from incidents or accidents is provided by the absence of the Ground Safing Key, a thermal fuse in the Thermal

Battery Pack and the one-point safety of the nuclear device.

D. Loading Phase

1. This phase of the operation includes the mechanical installation of the clip-in assembly/Test Vehicle combination into the aircraft. During this phase, the release circuitry is connected between the aircraft and clip-in assembly, but the weapon arming and control (pullout cables) circuitry is not connected. This phase of operation ends prior to removal of the MHU-7/M Trailer, and the clip-in/Test Vehicle assembly has not changed, as far as the nuclear safety aspects are concerned. The companion instrumentation package, when used, is installed in the aft bomb bay prior to the start of Test Vehicle loading.

2. Since the AMAC system is not electrically connected to the Test Vehicle, those features which will prevent deliberate, unauthorized arming of the Test Vehicle during the storage-to-loading phase are still applicable during this phase. Protection against deliberate, unauthorized release from the clip-in assembly is provided by the absence of the explosive cartridges from the clip-in release system. The presence of the MHU-7/M Trailer under the Test Vehicle further precludes the possibility of a nuclear incident.

3. Those features which provide protection against inadvertent arming during the storage-to-loading phase are applicable

during this phase. Because the explosive cartridges are not installed in the release system during this phase, inadvertent release is highly improbable. The presence of the MHU-7/M Trailer under the Test Vehicle further precludes the possibility of a nuclear incident.

4. Since the configuration of the Test Vehicle is the same as during the storage-to-loading phase, the protection against extreme fire and shock environments remains the same.

E. Pre-Takeoff Phase

1. During this phase the following check and operations will be accomplished.

a. Initially during the pre-takeoff phase, the configuration of the Test Vehicle is as during loading. No electrical pullout connections exist between the Test Vehicle and the aircraft, and the Ground Safing Key has not been installed in the Test Vehicle; nor have the explosive cartridges been installed in the release mechanism. The MHU-7/M Trailer is in place under the Test Vehicle.

b. In addition to the checks or operations required by approved Technical Orders, the following special checks or operations will be performed at this time:

(1) The Test Vehicle telemetry may be checked with external power applied to the aircraft.

(2) The AMAC electrical system will be checked using an AN/PSM 6 multimeter and the Test Vehicle electrical system may be checked using a current limited tester, verifying circuit integrity prior to electrically connecting the Test Vehicle to the AMAC system. These checks and operations will be performed by AEC/Sandia Corporation personnel.

(3) Using external power, the SAFE condition of the Ready/Safe Switch is checked electrically by the DCU-9/A Warning Light, and by visual observation in the bomb bay prior to installing the Ground Safing Key.

(4) A stray voltage check of the release circuit is performed and then the explosive cartridges are installed in the release mechanism by the loading crew.

(5) External power is removed from the aircraft and the Ground Safing Key is installed by AEC/Sandia Corporation personnel.

(6) Using aircraft power, the SAFE condition of the Ready/Safe Switch is checked electrically by the DCU-9/A Warning Light, and by visual observation in the bomb bay after the Ground Safing Key has been installed.

(7) The removal of the Pullout Rod Safing Pins from the Bisch Generator rods completes the ground operations performed prior to taxi for takeoff. This operation is performed by AEC/Sandia Corporation personnel.

2. During the first portion of this phase there are numerous ground operations being performed by military and AEC personnel in which there are possible causes of unacceptable degradation of nuclear safety.

a. During the checking of the telemetry system, the situation is similar to that analyzed in the preceding loading phase except that a possible source of electrical power for arming the Test Vehicle is available. The isolation networks of resistors, capacitors, and diodes provide assurance against inadvertent arming. Additional safety against deliberate arming is provided by the presence of the Safing Key Connector Cover and the disconnection of the AMAC system from the Test Vehicle.

b. All other safety consideration are the same as those previously analyzed until the AMAC system is electrically connected to the Test Vehicle. Prevention of application of a Test Vehicle prearm signal (operation of the Ready/Safe Switch) is now a function of the AMAC system. No power is applied to the aircraft during these checks.

c. The DCU-9/A Ready/Safe Switch check which is then performed differs from safety situations previously analyzed in that there is some possibility of prearming power being applied by a single line-to-line short. Operation of the Ready/Safe Switch would not of itself be unacceptable. The check is considered desirable in that it gives a higher level of confidence in safety at subsequent points in the sequence. Operation of the Ready Safe/Switch during this check will be detected by the visual check and corrective action can be taken before the other actions required to arm the Test Vehicle could reasonably occur.

d. Installation of the Ground Safing Key poses the problem of access to the warhead connector, analyzed in paragraph C.2. above. Following installation, the situation is as described in subparagraph e. following:

e. At the time of the DCU-9/A Ready/Safe Switch check, control of Test Vehicle arming functions (except for Bisch pullout rod safing pins) is available in the crew compartments. Test Vehicle prearming could be effected from the crew compartment. Prevention of these prearming actions is primarily afforded by the two-man rule; mitigating factors are separation of controls and the multiplicity of actions required. From the bomb bay, it is not possible to prearm the Test Vehicle by manual operation of the Ready/Safe Switch. Removal of the pullout rod safing pins and extracting the pullout rods might be considered a safety degrading factor. Extraction of the pullout rods is not physically possible without releasing the Test Vehicle.

f. Stray voltage checks on release squib connectors give assurance that squibs will not be fired by presence of random electrical power. The installation of the release squibs does not materially increase the probability of inadvertent release since the rack lock is designed so that, if locked, the Test Vehicle will not release even if the squibs are fired.

g. Removal of the pullout rod safing pins places the system in the configuration which prevails during the remainder of this phase and which is analyzed in the following paragraph.

3. Following completion of the above operations, the configuration of the aircraft and Test Vehicle is such that the Test Vehicle can be prearmed and released using aircraft special weapon controls.

a. Protection against the deliberate, unauthorized release of a prearmed Test Vehicle is provided by the physical separation of prearm and release controls such that these functions must be performed at three separate aircrew stations. In order to provide the Test Vehicle with the prearm signal, the DCU-9/A (Weaponeer's Station) Selector Switch must be positioned to GND or AIR, and the DCU-47/A Readiness Switch (Pilot's Station) positioned to READY. To accomplish release, the Special Weapons Manual Lock handle (Weaponeer's Station) must be positioned to UNLOCK, and the release system actuated.

b. Protection against inadvertent release of a prearmed Test Vehicle due to human error is provided by the placement, unique design, safetying, and sealing of the prearm and release controls. Release of a prearmed Test Vehicle through component failure would require a unique series of events to occur in the proper sequence. The DCU-47/A (Readiness Switches) and the DCU-9/A control the operation of the Ready/Safe Switch in the Test Vehicle. The Special Weapon Manual Lock is spring loaded to the LOCKED position and requires the application of a constant force to reposition the lock to the UNLOCKED position and retain it in this position. The Special Weapon Manual Lock is designed such that it will interrupt the release circuit when in the LOCKED position. Should the release cartridges be fired while the Special Weapon Manual Lock is in the LOCKED position, the release mechanism cannot actuate, and the Special Weapons Manual Lock cannot be subsequently unlocked. A release due to technical malfunctions requires two independent failures in the proper sequence. Prior to mating, the prearm and release controls were checked for proper operation, their circuits checked for electrical shorts and opens, and then the controls were safetied and sealed in the LOCKED or SAFE position as applicable. Also, the DCU-9/A checks verified circuit continuity, and the SAFE condition of the Ready/Safe Switch. If the situation occurred which would inadvertently release an unarmed Test Vehicle during this phase, the likelihood of a one-point HE detonation is considered to be extremely remote because of the low impact velocity encountered in this situation.

c. Protection against extreme fire and shock environments is provided by the relative insensitivity of the

Ready/Safe Switch and Safe Separation Switch to operation as a result of these environments, and by the thermal fuze in the Thermal Battery Pack. The Ready/Safe Switch and the Safe Separation Switch are motor driven and require continuous electrical signals for operation. The thermal fuze in the Thermal Battery Pack will open in a high temperature environment and open the output circuit of the thermal battery before the heat environment reaches a temperature sufficient to ignite the thermal battery, thus the isolation of the power source from the arming and fuzing system will be maintained.

F. Flying Phase

1. The B-52 Aircraft will take-off from Barber's Point NAS over the water, whenever practical possible, to avoid populated areas and will proceed directly to the target area. Departure from Hawaii will be standard FAA procedures. Positive control will be exercised along the route to the target area. Overflight of heavily populated areas including ocean vessels will be avoided during the flight. Christmas Island Approach Control will assume control At the boundary of ~~50 NM North of~~ the Danger ~~Area.~~ Fifty miles north of Christmas ~~At the boundary of the Danger Area,~~ control passes to the Air Operations Center (AOC). After receiving clearance from the AOC, a minimum of four wind and timing runs will be made over the target by the B-52 to refine live bomb run control. The Command, "Prepare for Release", will be given by the Air Operations Center (AOC) to the B-52.

2. Takeoff and Climb

Since the DCU-9/A Selector Switch is OFF during takeoff and climb to cruising altitude, all aircraft power is removed from the Test Vehicle Control and Monitor Circuits. The other safety features outlined in paragraph 3 of the Pre-takeoff Phase, which provide protection against inadvertent and deliberate acts, are also applicable during takeoff and climb. An aircraft accident involving fire and shock will result in at most a one-point non-nuclear detonation. Based upon 1961 B-52 operating statistics, the B-52 accident rate is 1.8 accidents per one hundred thousand flying hours. Based on four years (1958-1961) of B-52 operating statistics, it is estimated that the takeoff accident rate is 0.45 accidents per one hundred thousand flying hours. The probability of a crash causing a one-point, non-nuclear detonation is less well established but can probably be considered as on the order of 1 in 10 to 1 in 100.

3. Cruise

a. Since the DCU-9/A Selector Switch is turned to SAFE, after cruising altitude is reached, continuous safing/monitor power is applied to the Test Vehicle. After cruising altitude is reached, a prearmed release will permit the arming and fuzing system to function as designed, and the Test Vehicle will detonate at the preset height of burst. The actions necessary to accomplish a prearmed release will not be accomplished until the delivery aircraft is within the designated test area and the delivery crew has received and verified the command, "Prepare for Release."

b. During this interval, protection against deliberate unauthorized prearmed release is provided by the physical separation of the prearm and release controls such that these functions must be performed at three separate aircrew stations, as previously described.

c. Protection against inadvertent prearmed release is provided by physical separation of controls, plus the seals on the DCU-9/A, DCU-47/A, and the Special Weapons Manual Lock Handle.

d. Protection against nuclear yield resulting from any aircraft accident or incident is provided by the above separation of controls and by the one-point safety of the devices involved.

4. Preparation for Release (Figure 8)

a. The command "Prepare for Release" will be given the delivery crew at release time minus fifteen minutes at which time the delivery crew will start through the preparation for release check list; at release time minus 13 minutes the bombing equipment check is started; at release time minus 11 minutes the pilot positions the Ready/Safe Switch to ready position; at release time minus 10 minutes the Test Vehicle telemetry is turned on and provides a ground monitor capability for all the Test Vehicle electrical system functions being monitored; at release time minus 9 minutes the weaponeer checks the DCU-9/A ~~and sets~~ it to the AIR position (when the companion package is carried the T-249 is set to AIR position at this time); at release time minus ~~5~~ 4 minutes the pilot rolls out on the final turn of the bomb run, the radar-navigator takes control of the aircraft on autopilot and starts his bomb run; at release time minus 70 seconds the bomb doors are manually opened; at release time minus 60 seconds the weaponeer unlocks the Test Vehicle with the manual lock handle, the unlock conditions are verified by the radar-navigator on his C-3 indicator. An abort directive from the other members of the crew or the AOC may be given at anytime in the run up to five seconds prior to release. This five second time is based on crew and control reaction.

b. During this period the features or functions providing nuclear safety are sequentially removed and the vulnerability of the system to inadvertent or deliberate release of a prearmed Test Vehicle is greater than during any period of the storage-to-target sequence.

(1) Operation of the Readiness Switches to READY and the DCU-9/A to AIR (armed) will prearm the Test Vehicle; however, no release can occur until the manual lock handle is operated. Separate actions of two individuals are still required to release the Test Vehicle at this time.

(2) At release time minus 70 seconds the manual lock handle is operated and the release system manual lock unlocks. When the lock is fully unlocked, it closes a microswitch which, up to this time, has prevented any spurious signals from reaching the release system explosive cartridges. If any such spurious signals exist at the time the microswitch closes, this signal will reach the cartridges and, if of sufficient magnitude, fire them. The existence of a signal of sufficient magnitude (above two amperes) is very unlikely considering the extensive testing of the circuits during the test preparations.

(3) The test system is now vulnerable to a premature prearmed release, but this vulnerability would exist for a period of one minute. The probability of a premature release due to a technical malfunction is greatest at the instant the lock is unlocked.

(4) After the manual lock handle has been actuated, an inadvertent release of a prearmed Test Vehicle can occur as a result of a simple technical malfunction or inadvertent action. A deliberate release of a prearmed Test Vehicle can be accomplished by depressing the Salvo button at either the pilots' or radar-navigator's station, by pulling the manual release handle at the navigator's station, or the radar navigator could release by operation of his slew handle, or by depressing the manual (pickle) switch.

(5) Consideration of these possibilities has led to an examination of possible lateral errors in Test Vehicle impact point.

Lateral error might be caused by such technical malfunctions as an autopilot failure in which the aircraft would be abruptly turned at its maximum turning rate just before reaching Test Vehicle release point and the Test Vehicle is released before corrective action can be taken. A similar error could be caused if an abrupt turn were initiated, either inadvertently or deliberately, by the pilot or the radar navigator. An analysis was made based upon the assumption that the aircraft, while on final bomb run, is abruptly turned at maximum rate of turn for five seconds (it is considered that action to disarm and prevent Test Vehicle release could be taken within five seconds after the turn is started) and the Test Vehicle is then released. Conservatism was introduced in assuming a no-wind condition, and an additional four degree departure from intended track at the beginning of the run. Under these conditions for the 39/Test Vehicle it appears that there is a possible maximum lateral error of approximately 10,000 feet from the track made good prior to the abrupt turn. For the 36/Test Vehicle the maximum possible lateral error, under the above conditions, would be approximately 5,500 feet.

(6) Information relative to the allowable deviation of the aircraft on its live bomb run from the planned flight path is not known at this time. However, discussion with the aircraft flight crew and Sandia Corporation personnel indicates that a

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maximum allowable deviation of ±2° from the desired ground track is reasonable in the last two minutes of the live bombing run. If experience in the practice bomb drop series indicates that the ±2° deviation is too restrictive, then a change to a more suitable deviation should be allowed provided the impact or weapon effects of such additional deviation are considered. Regardless of the type of bombing utilized, i.e., offset, direct visual or radar, or release by ADC plot, any departure of the aircraft from the permissible deviation corridor in the last two minutes of the live bombing run should be cause for an aborted run.

(7) Figures (5) and (6) are drawings of possible impact areas considering maximum lateral error in paragraph (5) above and the reasonable permissible deviation from desired ground track as discussed in paragraph (6) above. The figures are computed using assumed CEP data but may be redrawn using CEP data supplied by JTG 8.4 in order that the Hazard Group may more precisely compute weapon effects on the surface instrumentation and aircraft arrays.

c. The approximate positions of the various members of the flight crew of a B-52 enables them to monitor the actions of each other and permits early discovery and/or remedial actions of overt or covert acts of single crew members. The pilot and co-pilot monitor the action of each other and during the bombing run both monitor the bombing run by pilot direction indicator and time to go indicators. The weaponeer is monitored by the DME operator and the DME operator is monitored by the weaponeer. The navigator who has received the same training as the Radar Navigator monitors the bomb run through a radar repeater scope. Manual inputs to the bombing computer are calculated by both the Radar Navigator and navigator and displayed to both. Any action to alter these inputs by either is obvious to the other.

d. The capability of the Pilot or co-pilot to release a prearmed Test Vehicle by use of the salvo release system is considered to increase the exposure of this test series to deliberate acts and increases the possibility of inadvertent release due to shorts in the salvo system. The only requirement for the enabling of the salvo system is to permit the Test Vehicle to be released if there is a failure of the normal, manual (pickle) and manual release systems. If the salvo system is not enabled, the only release systems remaining enabled are located at the radar-navigators and navigators station.

e. An inflight accident after prearming and unlocking have been accomplished which results in pulling the pullout rods either by separation of the Test Vehicle from the aircraft or by structural failure, will result in normal function of the Test Vehicle and a full scale detonation.

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G. Post-Release Phase (Vehicle Trajectory)

1. 39/Test Vehicle

a. For the purpose of the discussion, it is assumed that the Test Vehicle has been prearmed and released at a preplanned and programmed point and time in space. Nuclear safety after release is entirely dependent upon the reliability and the premature probabilities of the Test Vehicle components. The Safe Separation Timer in series with the arming and firing system assures the safe separation of the delivery aircraft before the arming and firing system is enabled. For those Test Vehicles with a nominal yield exceeding 100 KT, if the Test Vehicle does not detonate at the firing altitude, the X-unit will be discharged through a disabling system prior to contacting the water. The nominal and maximum yields shown in the descriptive section, are based on independent calculations by representatives of the nuclear laboratories specifically for this study.

b. The Test Vehicle fuzing system is designed to preclude a full-scale detonation either before the expiration of a safe separation time (to assure drop aircraft escape) or on the surface at ground zero. The Sandia Corporation has completed an

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a priori statistical analysis to determine the probability of a detonation in these areas. The significant values from that study are listed in paragraph 3 of this phase.

2. 36/Test Vehicle

a. For the purpose of the discussion it is assumed that the Test Vehicle has been prearmed and released at a preplanned and programmed point and time in space. Nuclear safety after release is entirely dependent upon the reliability and the premature probabilities of the Test Vehicle components. The static line deployment of the retardation system provides a simple and positive initiation of the retardation system. The Safe Separation Timer in series with the barometric arming and timer firing system assures the safe separation of the delivery aircraft before the arming and firing system is enabled. For those Test Vehicles with a nominal yield exceeding 100 KT, if the Test Vehicle does not detonate at the firing altitude, the X-unit will be discharged through a disabling system prior to contacting the water. The nominal and maximum yields shown in the descriptive section, are based on independent calculations by representatives of the nuclear laboratories specifically for this study.

b. The Test Vehicle fuzing system is designed to preclude a full-scale detonation either before the expiration of a safe separation time (to assure drop aircraft escape) or after a minimum distance ($90W^{1/3}$) above the surface at ground zero. The Sandia Corporation has completed an a priority statistical analysis to determine the probability of a detonation in these areas. The significant values from that study are listed in paragraph 3 of this phase.

3. PROBABILITY SUMMARY

	39/Test Vehicle		36/Test Vehicle	
	100 KT or Less	Above 100 KT	100 KT or Less	Above 100 KT
P_1	.003	.005	.007	.008
P_2	.0006	.003	.006	.008
P_3	.0003	.003	.0005	10^{-6}
P_4	10^{-6}	10^{-6}	10^{-6}	10^{-6}
P_5	10^{-6}	10^{-6}	10^{-6}	10^{-6}
P_6	10^{-6}	10^{-6}	10^{-6}	10^{-6}

P_1 = Probability of complete dud

P_2 = Probability of impacting surface with no charge on X-unit

P_3 = Probability of impacting surface with a charge on X-unit

P_4 = Probability of nuclear detonation below minimum fire altitude, but prior to surface impact

P_5 = Probability of nuclear detonation after release before safe separation time

P_6 = Probability of nuclear detonation in bomb bay after DCU-9/A arming

a. With the 39/Test Vehicle, impacts on the surface would average approximately 1,000 feet per second and surface impact for the retarded 36/Test Vehicle would average approximately 326 feet per second. It should be assumed therefore that P_3 in either case is the upper limit of possible surface bursts (the impact shocks may generate a fire signal).

No probable causes of a fire signal after impact have been found in this study.

b. The sum of P_2 and P_3 should be assumed to be the upper limit of the number of possible underwater nuclear reactions resulting from dud test devices.

A kiloton of fission would give $\sim 1 X 10^{23}$ neutrons.

H. Aborted Run (negative run)

1. Abort will be executed upon decision of the B-52 aircrew or Command Post (AOC) that an unsafe condition exists, or that the airdrop cannot be completed in such a manner as to fulfill overall test requirements. In the event the live bombing run is aborted after the command "Prepare for Release" has been given, the following immediate response procedures will be performed by the crew: the Radar-Navigator will remove the Bomb-Nav System from the bombing mode to track and the intervalometer to "train" and "zero" positions thereby disabling the K-system; the pilot turns the Readiness Switch to "SAFE", and the weaponeer locks the bomb rack and "Safes" the DCU-9/A. The aborted mission check-list will then be accomplished by all crew members. In the event that release fails to occur at the release point on the live bombing run, the aircrew will immediately disable the bomb-nav system as described above, safe the Test Vehicle and lock the bomb racks in accordance

with the aborted mission checklist. At the discretion of the Commander JTF-8, a new H-hour may be established with an accompanying command to "Prepare for Release".

2. The immediate response of the pilot or weaponeer to a command to abort the run, will prevent a prearmed release. After all of the three crew members mentioned above, have responded to the command to abort the run, the Test Vehicle/aircraft will be in essentially the same configuration as existed prior to preparation for release. This assumes no equipment malfunctions which prevent accomplishment of the above actions.

3. There may be aborted runs in which malfunctions prevent the return of the Test Vehicle/aircraft to a safe condition. Refer to para I below for a discussion of this condition.

I. Aborted Mission

1. If the Test Vehicle has not been prearmed and the release system is LOCKED, or if the aborted run procedures discussed in paragraph H above have been accomplished successfully, nuclear safety is primarily dependent on the same features as outlined in the Flying Phase.

2. If, for any reason, the DCU-9/A will not safe an armed Ready/Safe Switch, the aborted mission procedure will require manual safing by entry into the bomb bay. Manual safing procedures

will be over approved jettison areas (approved for jettison of unsafe devices) and will include: disconnecting the Bisch Generator rods, positioning the Ready/Safe Switch to SAFE, and removing the Ground Safing Key (if accessible). If, as a result of an aborted live bomb run, the bomb rack cannot be determined electrically to be relocked, all release rack circuit breakers will be removed from their circuits, the rack select switch will be in the AFT position. Manual locking procedures can be accomplished in the bomb bay.

3. Telemetry Malfunctions

It is possible that a malfunction of a critical fuzing component will be indicated on the telemetry receivers located in the surface instrumentation during the 10 minutes prior to Test Vehicle release. This malfunction would not necessarily be indicated by the DCU-9/A. Since this condition could exist in any one of 10 or more critical circuits, recommended corrective actions cannot be predicted in advance. It is anticipated that a technical advisor to the Commander JTF-8 will be available to assist in determining an appropriate, safe, course of action.

J. Jettison

1. When jettison of a Test Vehicle in a SAFE configuration is required, USAF Jettison policy will be followed.

2. In those instances where the Test Vehicle cannot be determined to be safe and the Commander JTF-8 has directed jettisoning, the Test Vehicle will be jettisoned only within the Danger Area.

K. Security

The following positive measures have been established to insure adequate security throughout this test series:

1. The two-man policy (Buddy System) will be in effect at all times when access to the Test Vehicle/Test System is required.

2. At least two people, each knowledgeable of the task to be performed and familiar with the pertinent security directives, will be present when access to the Test Vehicle/Test System is required.

3. Test Vehicles being transported outside a secure area will be guarded continuously by at least two armed guards.

4. Test Vehicles will be stored in locked and guarded facilities.

5. A minimum of a final SECRET clearance will be required of all personnel having access to the Test Vehicle/Test System.

L. EOD and Disaster Control

The present EOD capabilities of Barbers Point NAS will be employed for this operation. However, there is no information avilable at this time which indicates that these personnel have been furnished the data required to formulate training plans and procedures related to these specific nuclear devices. Neither is it clear that this information can be provided formally on the existing time scales. There will be available at Barbers Point representatives of the AEC nuclear and ordnance laboratories whose knowledge and assistance should be used to insure the adequacy of efforts in the event of an accident.

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APPENDIX A

SAFETY SUMMARY

I. PURPOSE AND SCOPE

This summary presents the nuclear safety implications of device and test system features which provide nuclear safety and recommends Safety Rules and Emergency Procedures to be followed for the Test Vehicles in the DOMINIC Test Series.

II. FREE-FALL 39/TEST VEHICLE DESCRIPTION

A. The 39/Test Vehicle external configuration is as follows:

Weight	Length	Diameter
7,000 lbs	136.25"	34.5"

B. Nuclear Device Description (Internal)

See Table 1.

III. RETARDED 36/TEST VEHICLE DESCRIPTION

A. The 36/Test Vehicle external configuration is as follows:

Weight	Length	Diameter
9,200 lbs	149.6"	56.2"

B. Nuclear Device Description (Internal)

See Table 2.

Pages A-2 and A3 are deleted.

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IV. PROBABILITY SUMMARY

	39/Test Vehicle		36/Test Vehicle	
	100 KT or Less	Above 100 KT	100 KT or Less	Above 100 KT
P_1	.003	.005	.007	.008
P_2	.0006	.003	.006	.008
P_3	.0003	.003	.0005	10^{-6}
P_4	10^{-6}	10^{-6}	10^{-6}	10^{-6}
P_5	10^{-6}	10^{-6}	10^{-6}	10^{-6}
P_6	10^{-6}	10^{-6}	10^{-6}	10^{-6}

P1 = Probability of complete dud

P_2 = Probability of impacting surface with no charge on X-unit

P_3 = Probability of impacting surface with a charge on X-unit

P_4 = Probability of nuclear detonation below minimum fire altitude, but prior to surface impact

P_5 = Probability of nuclear detonation after release before safe separation time

P_6 = Probability of nuclear detonation in bomb bay after DCU-9/A arming

A. With the 39/Test Vehicle, impacts on the surface would average approximately 1,000 feet per second and surface impact for the retarded 36/Test Vehicle would average approximately 326 feet per second. It should be assumed therefore that P_3 in either case is the upper limit of possible surface bursts (the impact shocks may generate a fire signal).

No probable causes of a fire signal after impact have been found in this study.

B. The sum of P_2 and P_3 should be assumed to be the upper limit of the number of possible underwater nuclear reactions resulting from dud test devices.

A kiloton of fission would give $\sim 1 \text{ X } 10^{23}$ neutrons.

V. SAFETY FEATURES

A. General (One-Point)

In the event of a one-point detonation of these Test Vehicles, such as could be caused by fire or shock, the probability of a significant nuclear contribution is extremely remote. Some scattering of nuclear material could occur which may require decontamination. However, this is not expected to cause a significant biological hazard.

V. SAFETY FEATURES

B. Specific Safety Features of These Test Vehicles and Aircraft

Certain safety features and controls are incorporated into the Test Vehicle to prevent the inadvertent, accidental, or unauthorized operation of those elements necessary for the production of a nuclear detonation. Some of the more important of these features and control are:

1. Test Vehicles

a. Ready/Safe Switch

This motor-driven, low-voltage, safing switch is controlled and monitored by the DCU-9/A Inflight Control Tester. In the S (SAFE) position, the switch interrupts the lines between the Pulse Generator and the Low Voltage Battery activation circuits, thereby precluding the operation of critical fuze components in the Test Vehicle. During ground operations, the switch can be manually operated to the S (SAFE) position, but it cannot be manually armed.

b. Pullout Rod Safing Pins

These non-shear safing pins are used to prevent extraction of the pullout rods during ground handling operations. The pins are manually inserted and extracted from the Bisch Generator pullout rods.

c. Ground Safing Key

This key is a connecting cable link used to electrically isolate the arming and fuzing system from the warhead firing system. This key acts as a ground handling safety device and it will not be installed until immediately before aircraft takeoff. Installation is accomplished through an access door in the Test Vehicle case.

d. Safing Key Connector Cover

The cover for the Ground Safing Key connector is designed to be positioned over the connector on the nuclear device and locked in place by two padlocks.

2. B-52 Aircraft Safety Features

a. DCU-9/A Inflight Control and Monitor

It has been recommended by the Ad Hoc Committee that the T-249 be placed with the DCU-9/A. The DCU-9/A contains a Rotary Selector Switch having the positions SAFE, GND, AIR and OFF, a Control Arm having the positions OS and SGA, a red Warning Light, a Test Switch, a Dim Control, and a Holding Relay. The DCU-9/A is located at the navigator's station in the production aircraft. In the B-52B and D aircraft used in these tests, the DCU-9/A is located at the weaponeer's station (EWO's station) because of test mission requirements.

(1) Rotary Selector Switch

In the OFF position, aircraft power is not available to the Test Vehicle circuits. In the SAFE position, Test Vehicle safing power is applied. In either the GND or AIR positions, prearming power is applied and the intended fuzing option is selected.

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(2) Control Arm

The Control Arm has OS and SGA positions. When the Control Arm is in the OS position, the Rotary Selector Switch can be operated from OFF to SAFE and back to OFF, but cannot be rotated beyond the SAFE position. When the Control Arm is in the SGA position, the Rotary Selector Switch can be operated from SAFE to GND or AIR and back to SAFE, but cannot be returned to the OFF position.

(3) Warning Light

The Warning Light serves to indicate a malfunction and comes on at any time the Test Vehicle configuration does not agree with the configuration indicated on the Rotary Selector Switch. The light also comes on as a press-to-test indication that the pullout cables are properly connected and that AMAC circuits (and the unit circuits) have proper continuity.

(4) Test Switch

The Test Switch is used to verify that the Warning Light bulb is not faulty. The Rotary Selector Switch must be in either the SAFE, GND, or AIR position for the Test Switch circuit to operate.

(5) Dim Control

The Dim Control does not affect the Warning Light, but it does control the DCU-9/A panel illumination. This feature uses aircraft power and will function regardless of Rotary Selector Switch position.

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(6) Holding Relay

The DCU-9/A contains a Holding Relay which insures that Test Vehicle safing and monitoring power remains available even if the Rotary Selector Switch is returned from GND or AIR to OFF faster than the Test Vehicle safing cycle can be completed.

b. Special Weapons Lock System

The Special Weapons Lock System consists of mechanical or electrical/mechanical actuating systems and of linkage arrangements which control locking devices on the Universal Clip-in. The locking devices on the clip-in assemblies are of "Fail Safe" design in that they will remain in, or revert to, the locked condition if the actuating cables and linkage arrangement should fail. The Special Weapons Lock System is controlled by the Special Weapons Manual Lock Handle located at the weaponeer's station. To unlock the clip-in subassembly, , the handle is pulled and a ball in the cable is engaged in a slot in the handle socket. The Special Weapons Manual Lock Handle can be safety wired and sealed in the LOCKED position. This lock is reversible in flight, and when in the LOCKED position, it prevents Test Vehicle release by any release system.

c. DCU-47/A Weapon Prearming Control (Readiness Switches)

This control, located at the Pilot's station, is a group of four toggle switches guarded by a transparent cover. These switches provide the aircraft commander with a means to permit or prevent bomb prearming. When in the SAFE position, these switches prevent the DCU-9/A from selecting any fuzing option other than SAFE. When in a READY position, the DCU-47/A permits the DCU-9/A to provide a prearming signal. After a Test Vehicle has been prearmed, operation of either the Readiness Switch or the DCU-9/A to the SAFE position will cause the Ready/Safe Switch to reset to its SAFE position. The Readiness Switches require that actions be performed at two separate aircrew stations in order to provide the bomb with the one signal required for prearming. The cover precludes inadvertent operation of any switch from the SAFE to the READY position and has provision for safetying and sealing. Closing the cover will place all the switches in the SAFE position.

VI. EMERGENCY PROCEDURES

The following are the minimum procedures to be accomplished by the delivery crew when performing in-flight emergency procedures:

A. Aborted Run

1. Bomb-Nav System to "Track" (R/N)
2. Intervalometer to "Train" and "Zero" (R/N)
3. Readiness Switch DCU-47/A to SAFE (Pilot)
4. Special Weapons Manual Lock "Lock" (Weaponeer)
5. DCU-9/A to SAFE (Weaponeer)

[redacted]

B. **Manual Safing**

1. Special Weapons Manual Lock - LOCKED

2. Entry into bomb bay will be over an approved jettison area. (Approved for jettison of devices not known to be SAFE)

3. Altitude will be above 15,000 feet.

4. Disconnect Bisch Generator Rods

5. Position Ready/Safe Switch to SAFE

6. Remove Ground Safing Key

C. **Manual Locking (Special Weapons Manual Lock Failure)**

1. DCU-9/A - SAFE, TESTED, POWER OFF

2. Remove all release rack circuit breakers from their circuits.

3. Rack select switch will be placed to AFT position.

4. Entry into bomb bay will be over an approved jettison area.

D. **Aborted Mission**

1. Refer to those steps under "Aborted Run" paragraph A. above.

2. DCU-9/A SAFE, TESTED, POWER OFF

3. Remove release system circuit breakers from circuits.

4. Report status and receive clearance from AOC to proceed to Barbers Point.

[redacted] [redacted]

[redacted]

E. Jettison (Safed Weapon)

(To be accomplished over authorized jettison area)

1. Position DCU-9/A Inflight Control Monitor Switch to SAFE position tested and turned OFF.

2. Position DCU-47/A Readiness Switches to SAFE.

3. Disconnect Bisch Generator Pullout Rods (if time permits).

4. Remove Ground Safing Key (if time permits).

F. Jettison (Unsafe or Unknown Condition)

1. To be accomplished only after authorization by Commander, JTF8 and within the exclusion area.

G. EOD (Render Safe Procedures)

VII. TEST MISSION SAFETY RULES

A. General

The following safety rules apply to all phases of the test mission. They are designed to provide positive measures to:

1. Prevent Test Vehicles involved in accidents or incidents from producing a nuclear yield.

2. Prevent deliberate arming, launching, firing or releasing except in the target area in accordance with the test mission directive or for authorized jettison in the event of an inflight emergency.

[redacted] [redacted]

3. Prevent inadvertent arming, launching, firing or releasing.

4. Insure adequate security.

B. Safety Rules

1. Security

a. Boundaries will be established for areas in which Test Vehicles are stored and/or maintained, loaded onto or unloaded from aircraft, and in which aircraft with Test Vehicles loaded aboard are parked, with provisions for adequate physical protection, guards and procedures to preclude unauthorized access.

b. At least a SECRET clearance to include, as a minimum, a favorable National Agency Check is required for personnel directly associated with operations involving Test Vehicles or aircraft with Test Vehicles loaded aboard.

2. Two-Man Concept

During any operation affording access to a Test Vehicle or aircraft with a Test Vehicle loaded aboard, a minimum of two authorized persons, each capable of detecting incorrect or unauthorized procedures with respect to the task to be performed and familiar with pertinent safety and security requirements, will be present. The number of personnel authorized such access will be held to a minimum consistent with the operation to be performed.

[redacted]

3. Checklists and Procedures

Procedures and Checklists which follow precisely the approved B-52 loading and delivery Technical Orders will be used for this test, except where Test Aircraft/Test Vehicle configuration make it mandatory to deviate. Special procedures and checklists will be prepared to cover the deviations.

4. Test Vehicle Storage, Maintenance and Checkout

a. Test Vehicles will be stored in locked and secure facilities.

b. Continuity testers will be current limited in order not to activate the most sensitive components in the Test Vehicle.

c. The Test Vehicle/Ready Safe Switch will be maintained in the S (SAFE) position and the Pullout Rod Safing Pins will be inserted in the pullout rods during all storage, maintenance and checkout operations.

d. The Ground Safing Key will not be inserted in the Test Vehicle during any storage, maintenance or checkout operations.

e. The Ground Safing Key Connector Cover will be locked in place except for authorized operations.

5. Test Vehicle Ground Transportation, Loading and Unloading

a. Test Vehicles will be guarded by at least two armed escorts whenever being ground transported outside a secure area.

[redacted] [redacted]

[redacted]

b. The Test Vehicle Ready/Safe Switch will be maintained in the S (SAFE) position and the Pullout Rod Safing Pin will be inserted in the Pullout Rods during all ground transportation, loading and unloading operations.

c. The Ground Safing Key will not be inserted in the Test Vehicle during any ground transportation loading and unloading operations.

d. The Safing Key Connector Cover will be locked in place during all ground transportation, loading and unloading operations.

6. Ground Operations Involving Delivery Aircraft with Test Vehicles Loaded Aboard

a. Configuration for ground operations involving aircraft with Test Vehicles loaded aboard will be as follows:

(1) Readiness Switches (DCU-47/A) - SAFE - cover down, safetied and sealed.

(2) DCU-9/A Control Arm - OS (OFF-SAFE) - safetied and sealed.

(3) SWESS Arm/Safe Switches - SAFE - covers down, safetied and sealed.

(4) Bomb Bay SWESS Auto/Off Switch - OFF - safetied and sealed.

(5) Special Weapons Manual Lock Handle - LOCKED - safetied and sealed.

[redacted] [redacted]

(6) The Salvo and Normal Release circuit breakers will be in the OFF (OUT) position.

(7) Manual and electrical bomb release system controls will not be operated to their release or on position.

b. Seals will be afforded administrative controls which will insure detection in the event the integrity of a seal is violated.

c. The Safing Key Connector Cover will not be unlocked and the Ground Safing Key will not be inserted until after the Test Vehicle is completely loaded aboard the delivery aircraft. Insertion of the Ground Safing Key and extraction of the Pullout Rod Safing Pins will not be accomplished until as late in the pre-takeoff phase as is consistent with test mission requirements.

7. <u>Flying Operations Involving Delivery Aircraft with Test Vehicles Loaded Aboard</u>

a. Configuration will be as outlined in paragraphs B.6.a.(1) through B.6.a.(6) above.

b. Delivery aircraft will proceed along designated routes and will be under positive control. Designated routes will avoid inhabited areas.

c. Safety seals on the DCU-9/A Control Lever and the Readiness Switches cover will not be broken until a "Prepare for Release" command is received. The safety seal on the Special

Weapon Manual Lock Handle will not be broken and the Normal Release Circuit Breaker will not be placed to ON (IN) until a "Prepare for Release" command is received except for inflight emergencies requiring jettison.

d. The Special Weapons Manual Lock will not be unlocked until 60 seconds prior to planned release time except for inflight emergencies requiring jettison.

e. Manual and electrical Test Vehicle release system controls will not be operated to the release or on positions prior to receipt of the "Prepare for Release" command except for authorized Test Vehicle Jettison.

f. Safed Test Vehicle Jettison will be in accordance with approved Air Force procedures and policies. Those Test Vehicles which cannot be safed will be jettisoned in accordance with Commander JTF8 instructions.

8. Training

Whenever training Test Vehicles (non-nuclear) are utilized during training, each of the above rules which is appropriate to a particular phase of the operation will be implemented.

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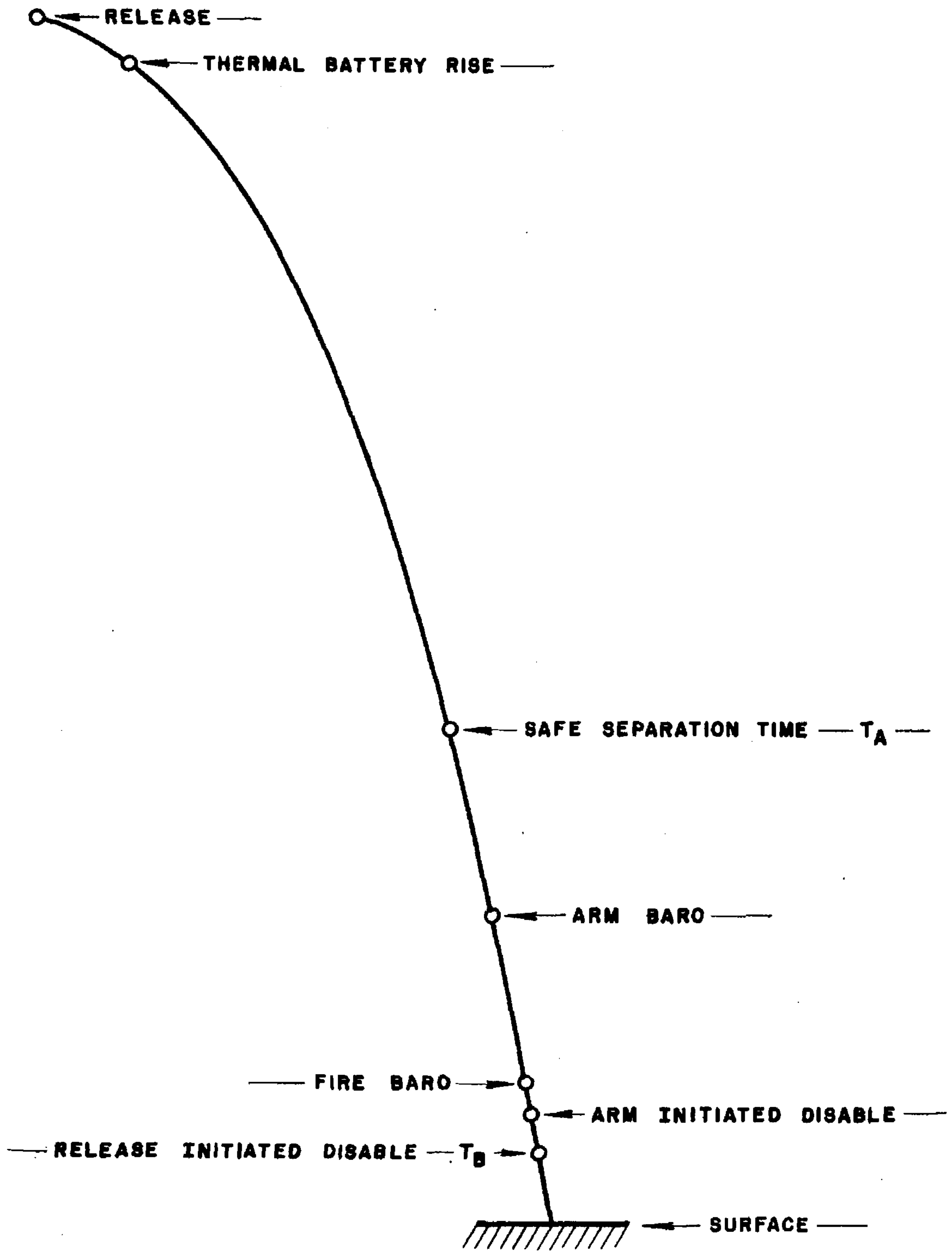

FREEFALL TRAJECTORY SEQUENCE
FIGURE 3

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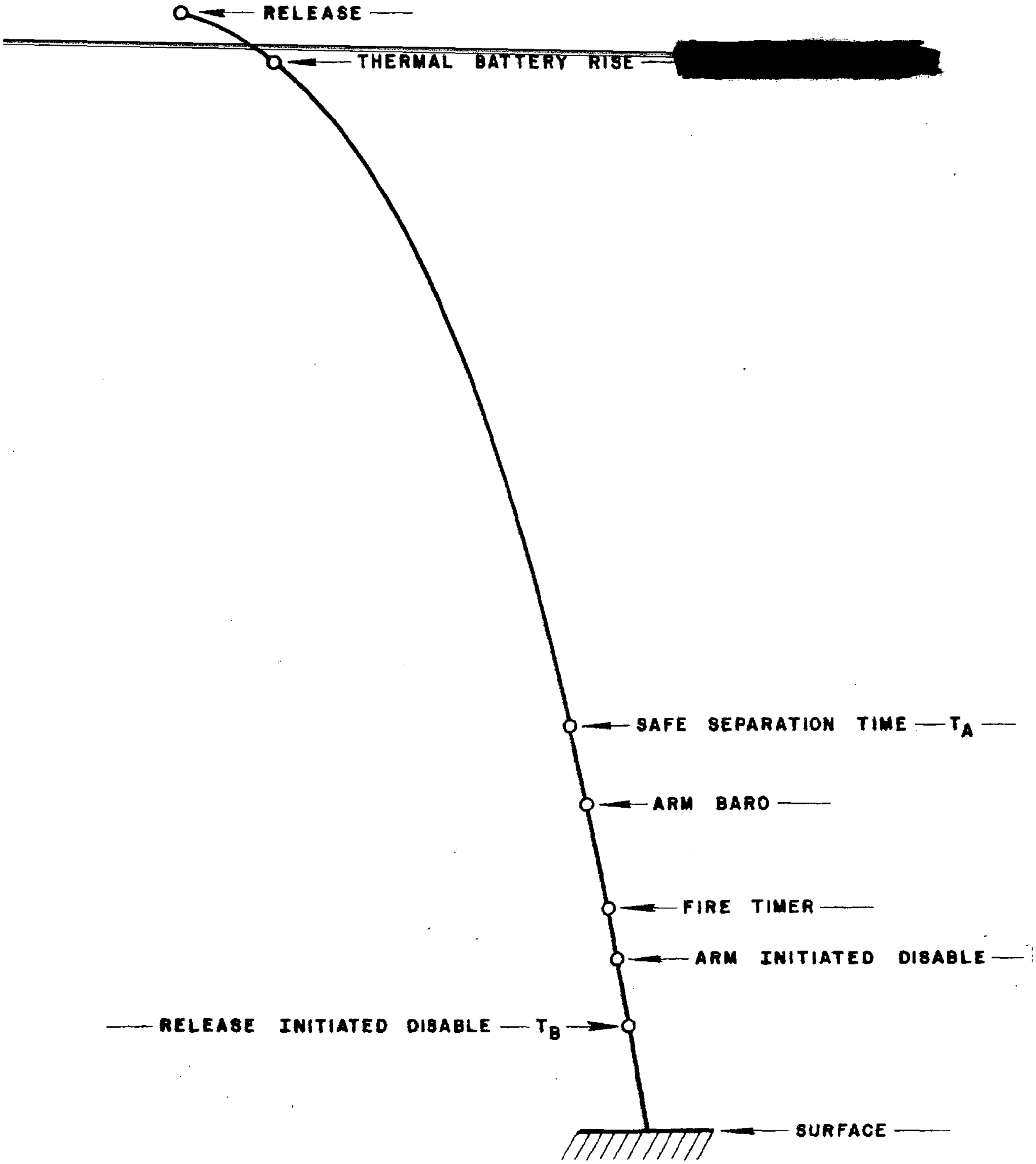
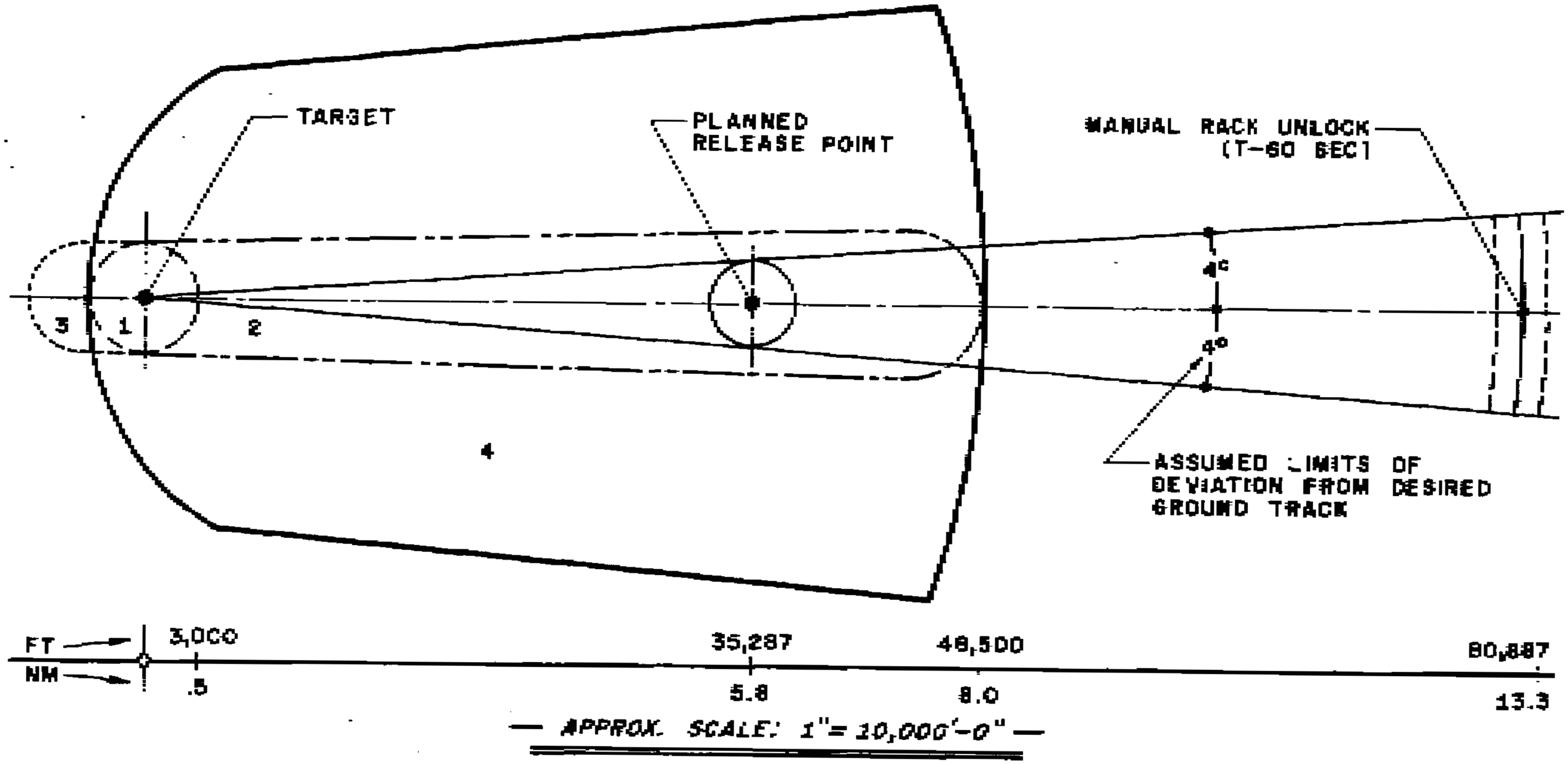


RETARDED TRAJECTORY SEQUENCE
FIGURE 4

SWVNA-2-17



Probable impact area:

-with normal release, Area 1
-with premature release, Area 2
-for late rel. with backup sys., Area 3
-with release as discussed in para -4.b.(5)
Safety Analysis, Area 4

Basis for Computation

1. CEP for 36 assumed as 3000 ft.
2. Deviation B-52 outside corridor (Sec. 3.) basis for automatic abort - 5 sec. reaction.
3. Aircraft heading changes limited to 5° in last 3 min. of run.
4. No wind, TAS 450 Kts. Release Alt - 45,000 ft.
5. Estimated traj. - 36,000 ft.

PROBABLE IMPACT AREAS—
39 TEST VEHICLES(FREE-FALL)

FIGURE 5

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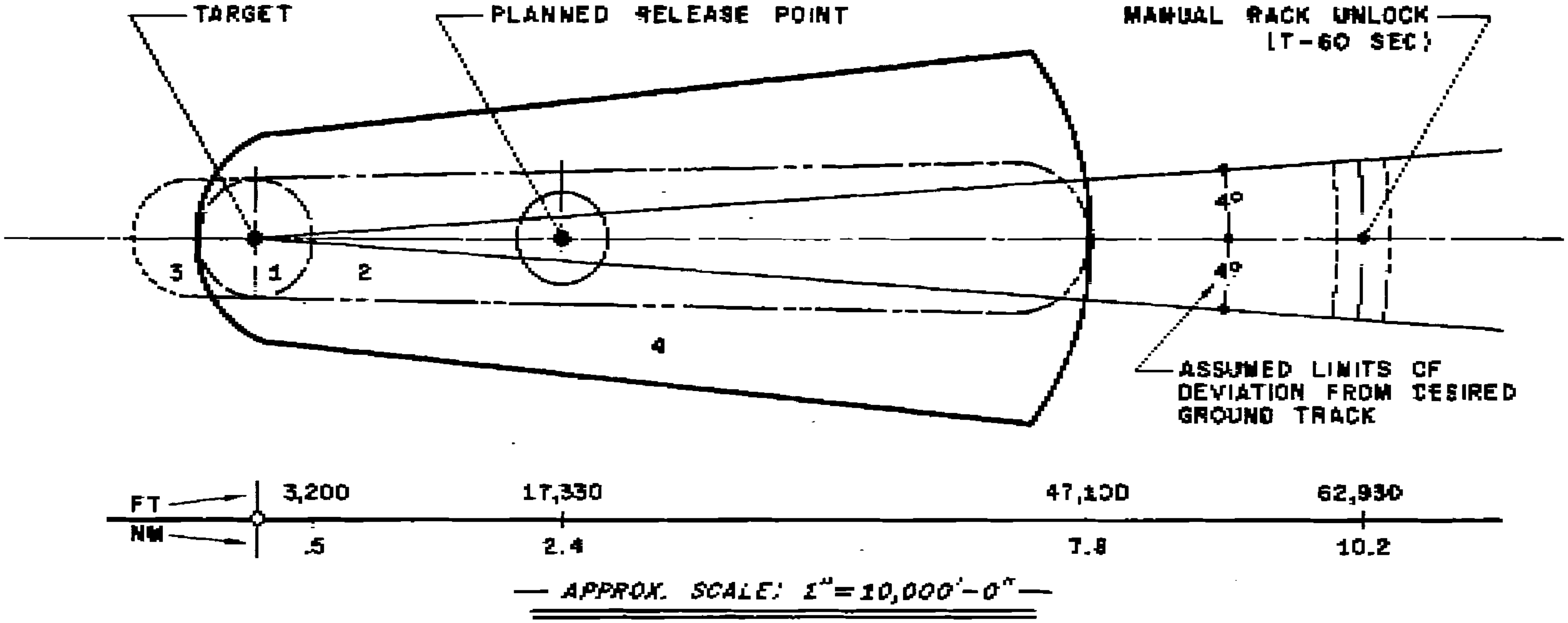
[redacted]

[redacted]



Probable impact area:

-with normal release, Area 1
-with a premature release, Area 2
-for late release with backup system, Area 3
-with release as discussed in para - 4.b.(5) Safety Analysis, Area 4

Basis for Computation

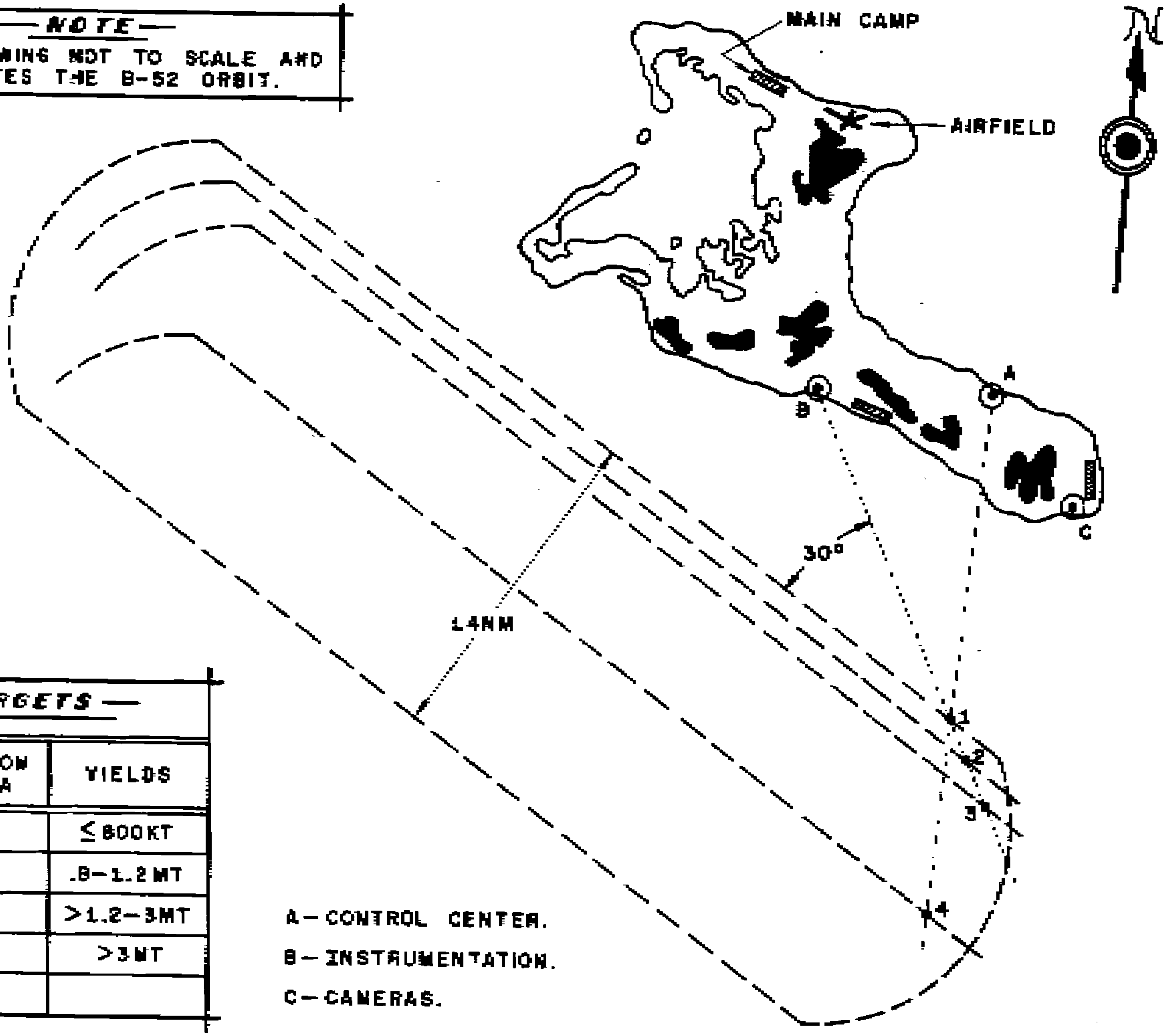
1. CEP for 36 estimated to be 3200 ft.
2. Deviation 3-52 outside corridor (Sec. E.) basis for automatic abort - 5 sec. reaction.
3. Aircraft heading changes limited to 5° in last 3 min. of run.
4. No wind. TAS - 450 Kts.,
5. Estimate trajectory - 17,000 ft.

PROBABLE IMPACT AREAS-
36 TEST VEHICLES (RETARDED)

FIGURE 6

— NOTE —

THIS DRAWING NOT TO SCALE AND APPROXIMATES THE B-52 ORBIT.

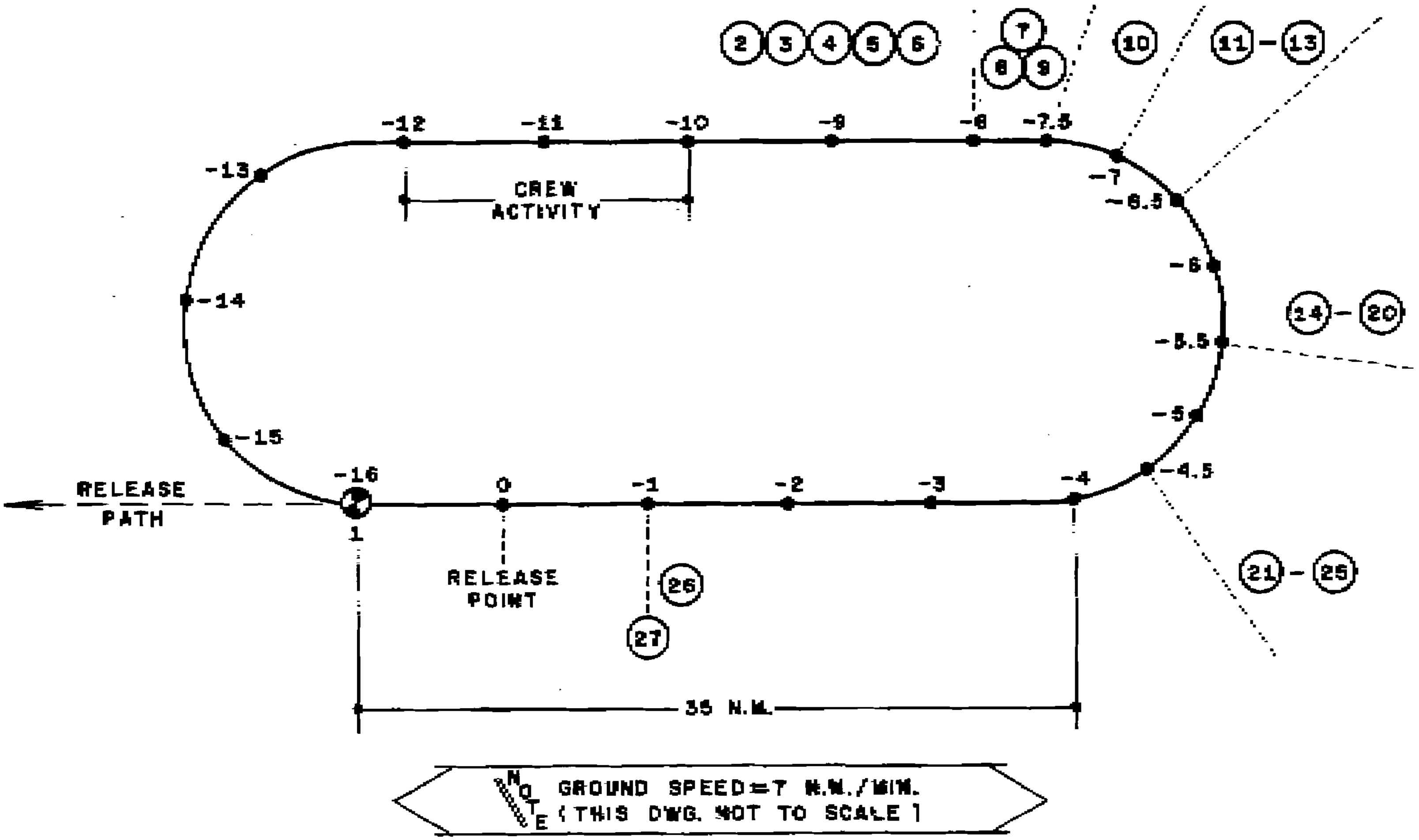


A — CONTROL CENTER.
B — INSTRUMENTATION.
C — CAMERAS.

— TARGETS —

NO.	DIST. FROM POINT A	YIELDS
1	10NM	≤ 800KT
2	12NM	.8—1.2 MT
3	15NM	>1.2—3MT
4	20NM	>3MT

AIRCRAFT GROUND TRACK RELATIVE TO CHRISTMAS ISLAND TARGET & INSTRUMENTATION
FIGURE 7



NOTES: 1. NUMBERS INSCRIBED IN THE CIRCLES CORRESPOND TO THE CHECK LIST NUMBERS UNDER "PREPARATION FOR RELEASE".
2. NUMBERED PATTERN POINTS = MINUTES PRIOR TO RELEASE.

AIR CREW CHECK LIST
DURING RACE TRACK PATTERN

FIGURE 8

[redacted]

PREPARATION FOR RELEASE CHECKLIST - (EXTRACT)
(Refer to Figure 8)

1-6 - Prepare for Release - RECEIVED AND ACKNOWLEDGED
- O-15 Camera - ONE EVERY SCAN
- Normal Release, Salvo, Rack CB's - IN
- Thermal Curtains, Optic Door and Interior Lights - CLOSED, FASTENED AND ON
- Camera Door - OPEN
- Released Light - OFF, TESTED
- BRIC - SELECT, LIGHT ON
- Readiness Switch - ALL SWITCHES READY

7 - DCU-9/A Control Arm - SGA
- DCU-9/A Selector Switch - SAFE
- DCU-9/A Warning Light - OFF, TESTED
- DCU-9/A Selector Switch - AIR

8 - Aft T-249 Power Switch - ON
- Aft T-249 Selector Switch - SAFE
- Aft T-249 Warning Light - OFF, TESTED
- Aft T-249 Selector Switch - AIR

9 - Fwd and Aft Manual Release (If Applicable) - SEAL BROKEN (013 Only)

10-25 - Rack Select Switch - FWD
- Master Power Switch - ON
- Master Power Light - ON
- Manual - Automatic - AUTO

26 - Bomb Doors - OPEN
- Bomb Door Open and Not Latched Lights - ON

27 - Manual Lock Handle - PULLED AND STOWED
- C-3 Indicators - UNLOCKED
- Release - RELEASE
- Release Light - ON

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