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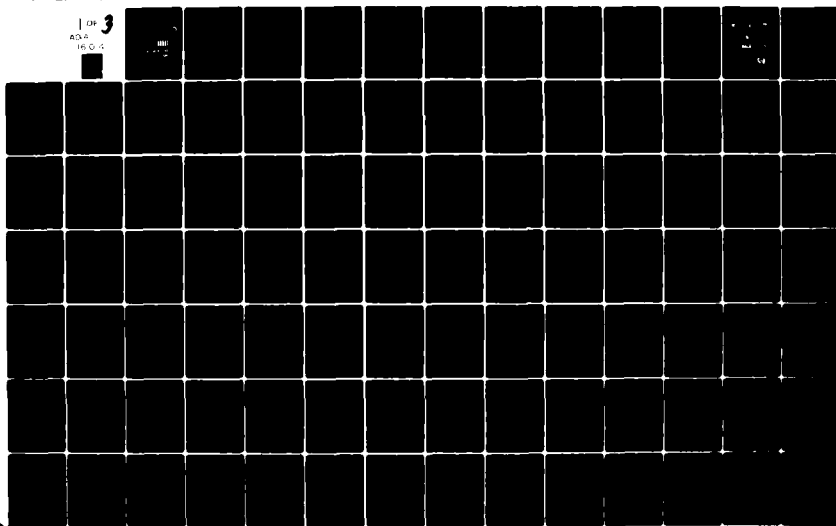
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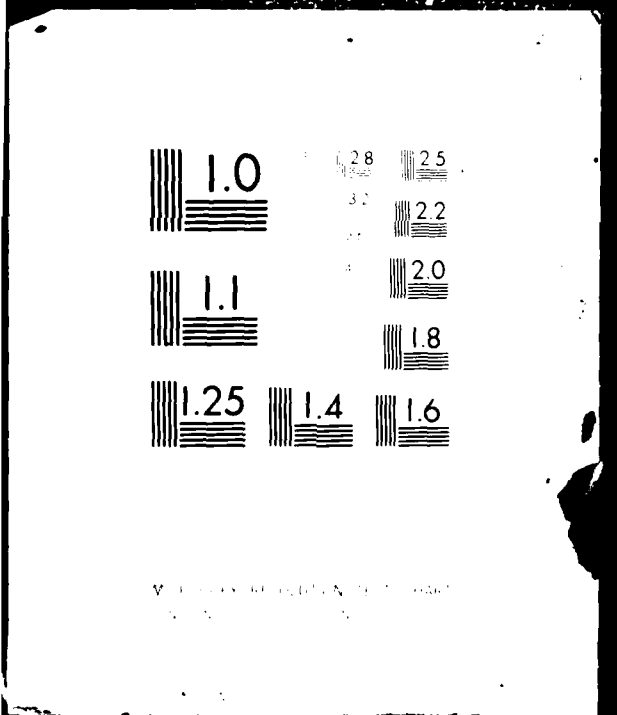
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flat trajectory study report

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ARBAT
FLAT TRAJECTORY STUDY

Final Report

Prepared under
Contract No. DAAB07-77-A-6401-2T01
CDRL A001

15 September 1981

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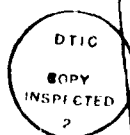
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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1	INTRODUCTION	1-1
	1.1 ARBAT Radar System	1-1
	1.2 Background	1-3
	1.3 ARBAT System Description	1-5
	1.4 Current System Configuration	1-8
2	FLAT TRAJECTORY STUDY PROGRAM	2-1
	2.1 Radar Problem	2-1
	2.2 ARBAT Radar Low Angle Coverage	2-2
3	FLAT TRAJECTORY STUDY TESTS	3-1
	3.1 Preliminary Test Plan	3-2
	3.2 Flat Trajectory Tests	3-3
	3.3 Problems and Potential Solutions	3-9
4	ANALYSIS	4-1
	4.1 Test Geometry	4-1
	4.1.1 Relationship between Radar Elevation	4-1
	4.1.2 Radar Antenna Pattern	4-5
	4.1.3 ARBAT Sequential Lobing	4-5
	4.1.4 ARBAT Detection	4-11
	4.1.5 Clutter	4-13
	4.2 Multipath Reduction Techniques	4-15
	4.3 Clutter Reduction	4-17
	4.3.1 Multipath Reduction Techniques	4-17
	4.3.2 Use Pulse Compression during Acquisition	4-17
	4.3.3 Delay Processing until Acquisition Time	4-17
	4.3.4 Increase Pulses per Frame	4-17
	4.3.5 Improve the System Stability	4-18
5	CONCLUSIONS	5-1
6	RECOMMENDATIONS	6-1
<u>Appendix</u>		<u>Page</u>
A	SCOPE OF WORK FOR AN ARBAT RADAR SYSTEM FLAT TRAJECTORY SYSTEM	A-1



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Section 1

INTRODUCTION

Section 1

INTRODUCTION

In October 1980, ITT Gilfillan was tasked to perform a nine-month Flat Trajectory Study under the BOA Contract DAAB07-77-A640. This effort was to include a one-month test program, an analysis of the result, a final report disclosing the results of the test and study, and also a set of recommendations to modify the ARBAT System for use as a test instrument for testing of tank/antitank munitions. The report herein consists of the Flat Trajectory Study Final Report.

The goal of the Flat Trajectory Study was to evaluate the capabilities of the current ARBAT Radar System being used for testing tank/antitank munitions and to make recommendations as to the hardware, software, and operational procedures which would facilitate use of the ARBAT System as a standard instrumentation radar for tank/antitank munitions testing. This goal has been satisfactorily met. The Flat Trajectory testing and study resulted in determining that the ARBAT Radar System, in its then current configuration could be used with the current procedures for tank/antitank munitions testing. However, a procedure change was recommended which facilitated the use of the ARBAT System for tank/antitank munitions testing instrumentation. An additional set of hardware and software changes are suggested that would increase the current capability of the ARBAT System for Low Trajectory testing.

1.1 ARBAT RADAR SYSTEM

The ARBAT (Application of Radar to Ballistic Acceptance Testing of ammunition) program has been directed toward achieving substantial improvements in artillery ammunition testing. Ballistic ammunition testing, until recently, has been accomplished with instrumentation only at or near the gun site by pressure gauges, velocity coils, high speed framing and/or streak cameras. Terminal ballistic data could be gathered only by visual and aural observation.

Recently, limited radar coverage of in-flight and terminal effects were available, using modified surplus Army radar equipment or highly specialized radars intended only for a particular test requirement. The results from such testing, while both gratifying and continuing, have also clearly indicated the potentially great value of a radar system specifically designed to monitor ballistic tests of a wide variety of ammunition items.

The available radar systems, being of older design and using mechanically controlled antennas, have significant limitations such as the following:

- a) Angular velocity and acceleration too slow to intercept and track high-speed projectiles within the permissible radar siting geometries.

- b) Most of these radars were either pulse or CW Doppler type, therefore the radars were limited to either a partial trajectory only, or radial velocity data capability.
- c) The systems did not perform well and in some cases could not operate at all in the high clutter and multipath environment typical to low trajectories and for all trajectories near launch and impact points.
- d) Generally, relatively low accuracy data were obtained.

The ARBAT Radar System was designed to provide instrumentation for ballistic acceptance and R&D test programs on Government proving grounds. ARBAT was also designed to support all currently produced and anticipated future ammunition items including artillery projectiles, mortar rounds and rockets. The ARBAT System is of special importance to the modern, more sophisticated ammunition items, requiring extensive instrumentation support such as the following four types:

- a) Rocket Assisted Projectiles (RAPs)
- b) Improved Conventional Munitions (ICMs), or cargo-carrying projectiles
- c) Tank/Antitank Munitions
- d) Guided Projectiles

During ballistic tests ARBAT is designed to measure all vital characteristics, such as space position and velocity, true velocity, radar cross section (rcs) and the timing and space position of special events. Data outputs are available in both real or near real time.

Because ARBAT provides processed output data in real time or immediately after the test firings, data concerning the performance of ammunition is immediately available to ammunition designers and manufacturers, thus permitting rapid elimination of problems and/or improvement of performance.

The ARBAT program objectives are as follow:

- a) Early projectile acquisition
- b) Track complete trajectory (to 0.5 degree of radar horizon)
- c) Track wide variety of rounds
 - 15 km - small rounds
 - 30 km - larger rounds
- d) Accuracy
 - Range - 0.05 percent of Range
 - Velocity - 1 m/sec
 - az/el - 2 millirad
 - rcs - 2 dB variation

e) Detect, monitor, record events

f) Data

- Display - real time with hard copy
- Recorded - near real time analysis
- Printout - event parameters and sequential trajectory data

g) Multiple sequential firing site coverage

1.2 BACKGROUND

As a result of anticipated increasingly sophisticated future testing requirements, ARRADCOM initiated a program to develop an advanced radar system intended specifically for ballistic acceptance testing of ammunition. As a result of initial analysis, ARRADCOM and TECOM, in conjunction with other Government agencies, determined that no existing radar (military or commercial), in unmodified form, could satisfy the future long term needs of ballistic testing at proving grounds.

A study contract was awarded to MITRE Corporation in 1971 to investigate various alternatives and propose a system approach based on Government testing requirements. As a result of that study, MITRE Corporation proposed a baseline design for a new radar system with the following features:

a) Coherent pulse radar system

b) Operating in C- or X-bands

c) High clutter cancellation capability

d) Antenna with

1) Electronic beam steering (with mechanical assist)

2) Narrow pencil beam

3) Low sidelobes

e) Digital signal and data processing

f) Real time data display

A design study contract was awarded to ITT Gilfillan (ITTG) in 1972 based on a Government Specification resulting from the MITRE study. A final report and drawing package was developed during this design study effort. The final report also defined a multiphase program which scheduled fabrication of the antenna; followed by fabrication, testing and documentation of the other major system elements. In 1973, ITT Gilfillan was awarded a contract to fabricate an X-band phase/frequency scan antenna for ARBAT system..

In 1975 there were more radar systems in design which had not been available during the early phases of the program. Therefore, ARRADCOM decided, in late 1975, to continue the program using a competitive approach. The objective was to assure the best possible combination of system performance at the least cost to the Government. This approach resulted in a Sept. '76 award to ITT Gilfillan of an incrementally funded contract. This program was concluded with a series of demonstration tests in October 1979.

In general, it can be stated that the test results verified the feasibility of the approach selected. Although all objectives were not tested, further effort was recommended that would lead to a system which will fully provide the necessary capabilities for future Government Proving Ground test activities.

Among the recommendations for further effort to test and enhance the ARBAT System were four separate programs.

- 1) The continuing program for the "Operation and Maintenance" (O&M) of the ARBAT System at Yuma Proving Grounds (YPG) for further evaluation of the system's usefulness as a proving ground test instrument.
- 2) A Flat Trajectory Study to determine the possible usage of the ARBAT System as a test instrument for the specific application of tank/antitank munitions testing.
- 3) A Program Enhancement Program (PEP) to increase the capabilities of the ARBAT System for current and predicted (near future) test applications.
- 4) A RETROFIT Program to replace the GFE subsystem elements with reliable and maintainable equipment capable of operation for the next 5-10 years.

In January 1980, ITT Gilfillan received an Operations and Maintenance Contract DAA001-80-C-0006 for the operation, maintenance, and repair of the ARBAT system by Field Engineers stationed at the YPG. Until January 1981, this contract included a minimal amount of development engineering support to assist in the contract and make minor system changes to improve the system capabilities, solve problems, and ensure software data compatibility with YPG and ARRADCOM requirements. This contract is currently in operation.

In October 1980, ITT Gilfillan received a nine-month program, under the BOA Contract DAAB07--77-A-6401 to perform a Flat Trajectory Study. This effort included a one-month test program, an analysis of the results, a final report documenting results of the test/analyses and a set of recommendations to modify the ARBAT system compatibility with the requirements for testing tank/antitank munitions. The information presented herein consists of that Flat Trajectory Study Final Report.

1.3 ARBAT SYSTEM DESCRIPTION

The ARBAT System was designed to fulfill the specialized mission of ballistic ammunitions testing under proving ground conditions. The system organization and functional allocations, necessary to provide the operational performance required, are discussed briefly below. Detailed descriptions of the subsystems and their specific functions are described in the Final Report of the ARBAT Development Program, under Contract DAAA-21-76-C-0546, dated February 1980. A detailed discussion of all changes to the system, since that final report, is presented in the following section.

In general, the major group assemblies are housed in the major subsystems shown in Figure 1-1. System parameters for the radar are shown in Table 1-1. This system hardware has not been modified since the Engineering Development Program. The software has had minor modifications which are reported in the following subsections.

The ARBAT radar equipment employs a pencil beam planar array antenna to ensure accurate beam positioning. The high velocity projectiles are tracked by steering the antenna electronically, by phase control in elevation and by frequency scan augmented by mechanical scan in azimuth.

In acquiring a target, the antenna is directed towards the acquisition point, held at a fixed elevation, and given a limited azimuth or elevation scan about the expected acquisition position of the projectile. To acquire the target, the radar systems must have seen and processed information from three consecutive scans. After acquisition, the target is tracked by sequential lobing. The derived error signals are used to command phase shifters in the antenna and the selection of crystal controlled oscillators for mixing in the frequency synthesizer to keep the pencil beams on target. Tracking is thus by inertialess electronic steering. The azimuth mechanical control serves only to keep the frequency controlled aperture in the vicinity of the target azimuth. The mechanical azimuth will, in general, be adjusted by the signal and data processor control equipment to keep the beam in the center of its range. During the early part of tracking it is expected that the beam will be away from this central position until the target projectile's angular rates have decreased. This dual system of control provides high rate inertialess control with an economical antenna design.

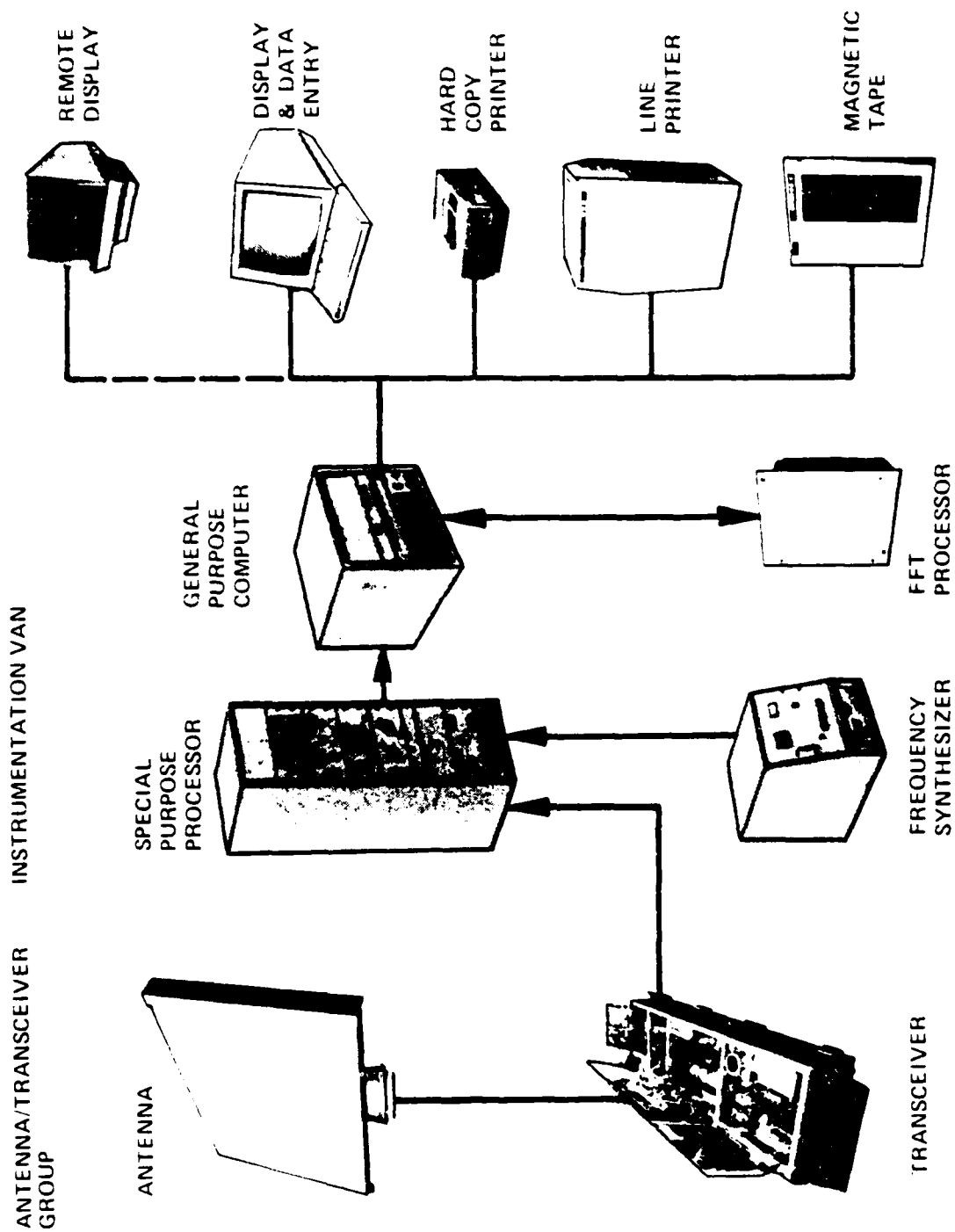


Figure 1-1. Functional Organization of ARBAF

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Table 1-1. Functional Performance

Beam Positioning (Electronic)

Azimuth: 7.7 degrees minimum

Rate of position variation: Limited only by logic state change time, signal propagation time and clock rate (22 MHz).

Scan Technique: Frequency variation (Synthesizer digital control)

Elevation: ± 35 degrees minimum

Elevations scan technique: Phase control via diode phase shifters in each array waveguide section

Azimuth (Mechanical): ± 170 degrees minimum

Azimuth rotation rate: 40 degrees/sec² minimum (servo control)

Elevation (Mechanical): ± 25 degrees by manual tilt-back (jack-screw mechanism)

Electrical Specifications

Frequency: X-band, 9.3 to 10 GHz

Scan (Azimuth) 7.7°

Scan (Elevation) $\pm 35^\circ$

Beam size at center frequency:

Azimuth:	at 0° elevation:	0.55°
	at $\pm 35^\circ$ elevation	0.67°
Elevation:	at 0° elevation	0.66°
	at $\pm 35^\circ$ elevation	0.81°

Beam Pointing error (electrical)

Elevation	0.37 mrad
-----------	-----------

Elevation beam switching time	1.0 MHz
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Sidelobe level (at center frequency):

Azimuth @ 0° elevation scan	-25 dB
@ $\pm 35^\circ$ elevation scan	-23 dB
Elevation @ 0° elevation scan	-25 dB
@ $\pm 35^\circ$ elevation scan	-23 dB

Terminal Gain @ 0° elevation scan at center frequency	46.0 dB min
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Note: The above specification is based on an average phase shifter insertion loss of 2.5 dB.

Power Capability:	30 kW peak Typical (Minimum 25 kW)
	300W avg Typical (Minimum 250 kW)

A Pulse Doppler techniques, using pulse compression derived from a coded phase modulated signal with range and frequency ambiguity, are used to meet the performance requirements for tracking range and for measuring radial velocity (by Doppler measurement). Range and Doppler frequency tracking are performed in an accurate manner by developing the range error and frequency error signals from a conventional early/late digital range gate tracker and a split FFT filter frequency tracker.

The transmitter and receiver comprise a fully coherent amplifier chain controlled by a frequency synthesizer tuning over a wide frequency band. This configuration is required to satisfy the demands of frequency scanning and Doppler data extraction.

Control of the radar system is accomplished by a data processing system incorporating a GP computer that operates in real time to control acquisition, tracking and output of digital data. The principal output of the system is the data recorded on magnetic tape and supplied to a central computer at an arsenal or munitions proving ground. Monitoring of the data obtained on a test round is available in real time by means of a graphic display, with an internal refresh capability. Hard copy of this display is also available.

Radar control and data processing functions are performed by an integrated group of commercial digital equipment which is housed in a 25-foot instrumentation van. The central item of this group of commercial digital equipment is a General Purpose computer. This computer has a high speed input/output bus serviced by high speed memories, and a disk memory system. For low speed processing, a separate bus interfaces with a keyboard control and display system. The functions of signal processing consisting of time weighting, coherent and incoherent signal integration, and digital filtering by FFT processing are performed in a separate programmable array processor. Support software and diagnostics are supplied with the equipment.

The antenna transceiver subsystem is transported on a special low-bed vehicle and when placed on a prepared pad, a solid operational structure is formed. The low-bed trailer is positioned in conjunction with a raised reinforced concrete pad. A temporary jack system transfers the load, and the bed of the trailer and is securely bolted to the pad.

The radar displays, controls, and signal and data processing subsystem are installed in one end of the instrumentation van. A duplicate display is installed at the other end for use by personnel monitoring the tests. Adequate space is available around the equipment racks for maintenance functions and future expansion.

1.4 CURRENT SYSTEM CONFIGURATION

A detailed description of the ARBAT System and subsystem, as of January 1980, is contained in the Final Report of the ARBAT Development Program under Contract DDAA-21-76-C-0546. A description of the changes to the system used for the Flat Trajectory Study, testing and analysis is described in this section.

There have been no hardware modifications to the system since January 1980 other than normal maintenance and repair. The only changes noted have been minor changes to the real-time tracking program and major changes to the nonreal-time analysis software.

Tracking Program Changes - During the period January-May 1980 there were two minor changes to the tracking program to correct deficiencies noted in the November 1979 ARBAT Demonstration Tests. They are described as follows:

- 1) Correction of Doppler Velocity Tracking Algorithm - During the demonstration tests, a tracking problem was detected on extremely high QE shots (QE 1200 mills). This problem was traced to the inability of the Doppler tracking algorithm to track the projectile when the radial component from the projectile to the radar decreased. That is, when the Doppler velocity passed from positive value through zero velocity to a negative value. This problem was corrected and the ARBAT System currently tracks such trajectories without problems. The problem was corrected by means of the following changes:
 - a) The MTI capability of the radar was removed for elevations above five degrees by removing all purged filters except filter zero and by adding the capability to measure received signal frequencies in filter zero when the MTI capability was removed.
 - b) Conversion of the velocity tracking algorithm from an alphasfilter (zero order) to an alpha-beta filter (first order).
- 2) Removal of CFAR* Algorithm during RAP Ignition - Following the ARBAT Demonstration in October 1979, a problem was discovered while attempting to track through RAP ignition. The RAP trajectory was lost while trying to track through the ignition event. During ignition, the RAP trajectory was lost due to failure of the CFAR algorithm to account for the spectral broadening of the received signal during the RAP acceleration. This problem was corrected by removal of the CFAR algorithm when the received signal level is greater than the received clutter level.

Analysis Programming Changes - Between January 1980 and March 1981 several changes were made to the analysis program to increase the processed data accuracy, to add new variables to examine, and to make the ARBAT analysis tapes compatible with the YPG Data Processing Center. At the start of the Program Enhancement Program (March 1981), this analysis program was modified to add the algorithms necessary for event detection and to add the event printout capability. Since the January 1980 time period, the following items have been added to the program:

*Constant False Alarm Rate

- a) Output of Radar Coordinates (range, azimuth, elevation, Doppler velocity).
- b) Addition of the Summary Bias to improve calibration
- c) Conversion of the sample rate from a variable rate of approximately 50 milliseconds to a sample rate of exactly 50 milliseconds dependent upon the YPG range timing system (to be able to compare ARBAT data to other YPG instrumentation data).
- d) Adding data storage of data samples plus and minus 0.5 second from the current time sample for use in the event algorithm.
- e) Addition of a parabolic impact prediction algorithm using the sorted past 0.5 second data.
- f) Addition of Doppler velocity change event detection algorithm based upon the change of rate-of-change of the Doppler velocity.
- g) Addition of the BLUE* Filter data estimation algorithm which takes into account projectile trajectory changes.
- h) Addition of the event printout capability.

Analysis of the Flat Trajectory Tests was performed using the event printout capability of this revised analysis program. The event printout is capable of detecting and reporting on the following events:

- a) Gunfire parameters
- b) Track acquisition
- c) RAP ignition
- d) RAP burnout
- e) Projectile reacquire
- f) Unknown events (frequently lost track or loss of Doppler measurement).
- g) Impact prediction.

The data, which are output for each event, include the following variables:

- a) Event time in range coordinates
- b) Event time since gunfire

*BLUE = Best Linear Unbiased Estimator

- c) Projectile position in radar coordinates (range, azimuth, elevation)
- d) Projectile position in YAG Range Coordinates (X-East, Y-North, Z-Vertical)
- e) Projectile position in gun coordinates (horizontal range, drift, altitude)
- f) Projectile true velocity
- g) Impact extrapolation time (impact prediction event).

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Section 2

FLAT TRAJECTORY STUDY

Section 2

FLAT TRAJECTORY STUDY PROGRAM

Since tank warfare was initiated, a parallel effort in antitank warfare has been ongoing. This effort has resulted in antitank munitions of increasing sophistication. As the tank/antitank munitions increased in complexity, the instrumentation requirements to test the weapons and ammunition also became more complex. Due to the special nature of tank/antitank warfare, instrumentation is needed which has been specialized for this special nature. The characteristics of tank/antitank munitions, which are more important than in other types of munitions, are as follow:

- 1) Near flat trajectories (QE = 0-8 mils = 0.5 degree elevation)
- 2) High velocities (1500-2000 meters/second)
- 3) Small sizes (75-105 millimeter diameter)
- 4) Body motions (angle of attack, precession, spin).

Early methods to instrument the tank/antitank warfare testing were quite crude. Techniques, such as velocity coils and solid targets, provided a minimal amount of data only at a particular trajectory point and were easily destroyed. Early radars had trouble tracking the tank/antitank projectiles due to clutter, rapid projectile motions, and small radar returns. Optical techniques were expensive and could not acquire and track projectiles.

Development of the ARBAT Radar System in 1979, and its early successes in tracking low trajectory munitions, led to questions concerning the applicability of the ARBAT radar to tank/antitank munition testing instrumentation. The Flat Trajectory Study is the outgrowth of those questions concerning the ability of the ARBAT System to acquire, track, and provide trajectory data of tank/antitank munitions along their trajectories.

2.1 RADAR PROBLEM

The "near flat trajectories" of tank/antitank munitions present special problems to a radar attempting to acquire, track, and measure accurate trajectory information. These problems all involve the effects of the direct radar signal received during the radar-target-radar signal path due to a secondary ground reflection path. Unless special techniques have been designed into the radar, the radar cannot be used to acquire, track, and collect information when the main radar beam is intercepting the surface.

When the radar beam intercepts the surface, there are two separate causes of problems which are generated as mentioned below.

- 1) Multipath Effects - the result of coherent ground scatter
- 2) Clutter Effects - the result of incoherent ground scatter.

The effect of the surface upon radio waves is to scatter the signal in all directions. The scattered signal can be decomposed into two components: a coherent signal where the scattered signal is a distorted replica of the incoming signal; and an incoherent signal where the phase is not preserved and the signal appears noise-like. The multipath effect on the radar signal can be described via Figure 2-1 illustrating the geometry of the direct and scattered coherent signals at low elevation angles. The received signal at the radar antenna is the vector sum of the direct radar return and the radar return from a path reflected from the surface. The coherent sum results in an oscillating constructive and destructive interference as a function of the elevation angle of the target above the surface as seen from the radar. As the elevation angle approaches zero, the scattering surface behaves as a near perfect reflector resulting in the complete destructive interference of the composite signal. Figure 2-2 illustrates a typical multipath signal return as a function of target elevation angle.

This multipath effect contributes to a radar systems' inability to track properly in two respects. In a sequential lobing radar such as the ARBAT System, the received signal amplitude is the result of the incoherent sums of two lobes spaced slightly apart in angle. The angular position measurement is based upon the difference between the signal returned from each lobe (normalized to the received signal). If the radar is lobing in elevation and being affected by multipath, then the received signal amplitude follows the curve in Figure 2-2. Since the ability to track accurately is dependent upon the ratio of this received signal to its limiting noise-like component (signal-to-noise ratio), the radar loses its tracking ability when the coherent scatter becomes a significant destructive interference. Even more important, the difference between the lobing elevation beams becomes grossly affected by the multipath and can no longer be used to determine the position of the target between the lobing beams.

The effect of incoherent scattering or ground clutter is to add a noise-like component to the incoming signal. This clutter generally differs from noise only in its first and second-order statistics, however, its effect is identical to front end thermal noise of very large average power. The incoherent scattering may also be decomposed into its two source types, 1) incoherent time independent scatters (leaves/rain), and 2) incoherent time dependent scatters (rocks/buildings). Radar design techniques such as pulse compression can be utilized which use the time independency property to reduce the clutter effects.

2.2 ARBAT RADAR LOW ANGLE COVERAGE

The initial design criteria for the ARBAT Radar System were the acquisition, tracking, and measurement capabilities down to an elevation angle of 0.5 degree above the surface. All tracking below the 0.5 degree elevation was to be accomplished via computer-driven coasting -- extrapolation from past data until a predicted impact. To accomplish the operation of the ARBAT System to 0.5-degree elevation, the ARBAT Radar was designed with the three following features as follows:

- 1) Small beamwidth/low sidelobe antenna design
- 2) MTI processing based upon FFT Signal Processing
- 3) Pulse compression.

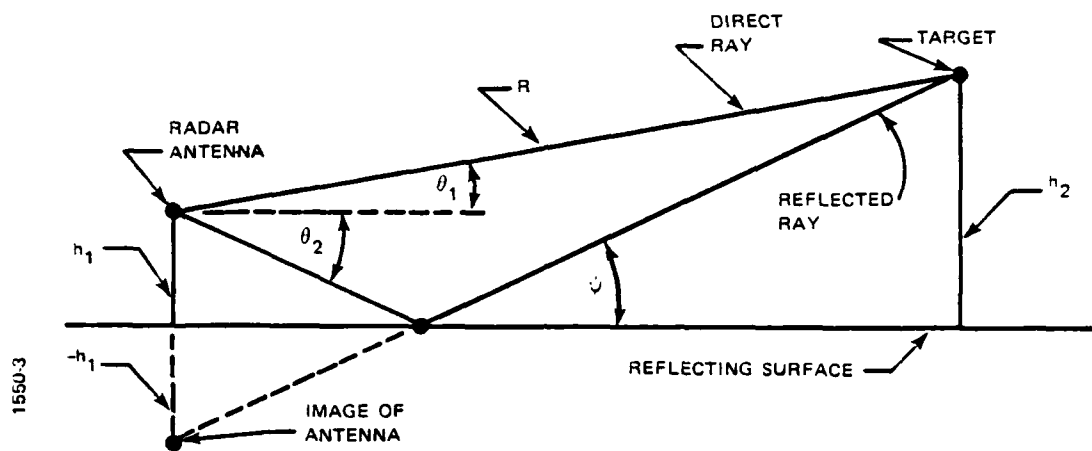


Figure 2-1. Geometry of reflection from a plane earth

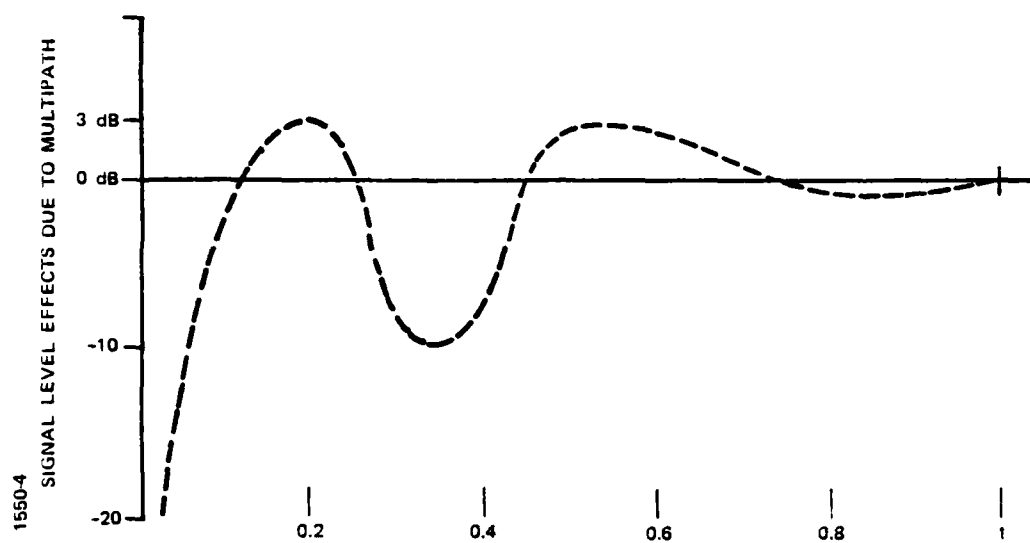


Figure 2-2. Elevation angle θ_1

The 10 x 12-foot ARBAT antenna is a horizontally, polarized, X-band planar array formed by 167 closely spaced parallel waveguide sections. Each section contains dual radiating slots across the face of the array. The signal/coupling was designed with a 25 dB Taylor taper for low sidebands. The beam formed was to have the following characteristics (as indicated in the ARBAT Antenna Test Report dated April 1978 under Contract DAAA-21-76-C-0546):

Azimuth beamwidth	0.55 degree (3 dB)
Elevation beamwidth	0.66 degree (3 dB) 1.2 degrees (25 dB)
Sidelobe level	-22 to 25 dB sidelobe level
Cross polarization	15 dB at 80 degrees away from main beam.

Figure 2-3 illustrates the midscan elevation beam pattern.

The ARBAT Radar System uses an MTI processing system based upon separating the spectral components via a 16-point FFT of the time-weighted radar signal return. A measure of performance of an MTI processing system to separate the signal from a strong clutter return is known as the MTI improvement factor (I). The MTI improvement factor is defined as the signal-to-clutter ratio at the output of the MTI system compared with that at the input, where the signal is understood as that averaged informally over all radial velocities. This improvement factor is limited by the statistics of the clutter and by system parameters and stabilities. These items of concern are listed following:

- 1) Clutter Motion
 - a) Spectral width
 - b) Antenna scanning rate
 - c) Mean velocity placement within the MTI passband
- 2) Target motions
- 3) Pulse timing jitter
- 4) Pulsewidth jitter
- 5) Phase stability
 - a) Transmitter
 - b) Synthesizer
- 6) Stray signals (source spurs)
- 7) Amplitude instabilities.

NUM POINTS = 2919, NUM TRUNCATED = 2288
 X RANGES FROM 949.496 TO 1174.68
 Y RANGES FROM 24.0317 TO 62.0138
 CHANGE SCALE? (Y/N):

8/26/80 TRK # 1 ELEV BEAM — SOFO
 MEAS SIG W/O WGH

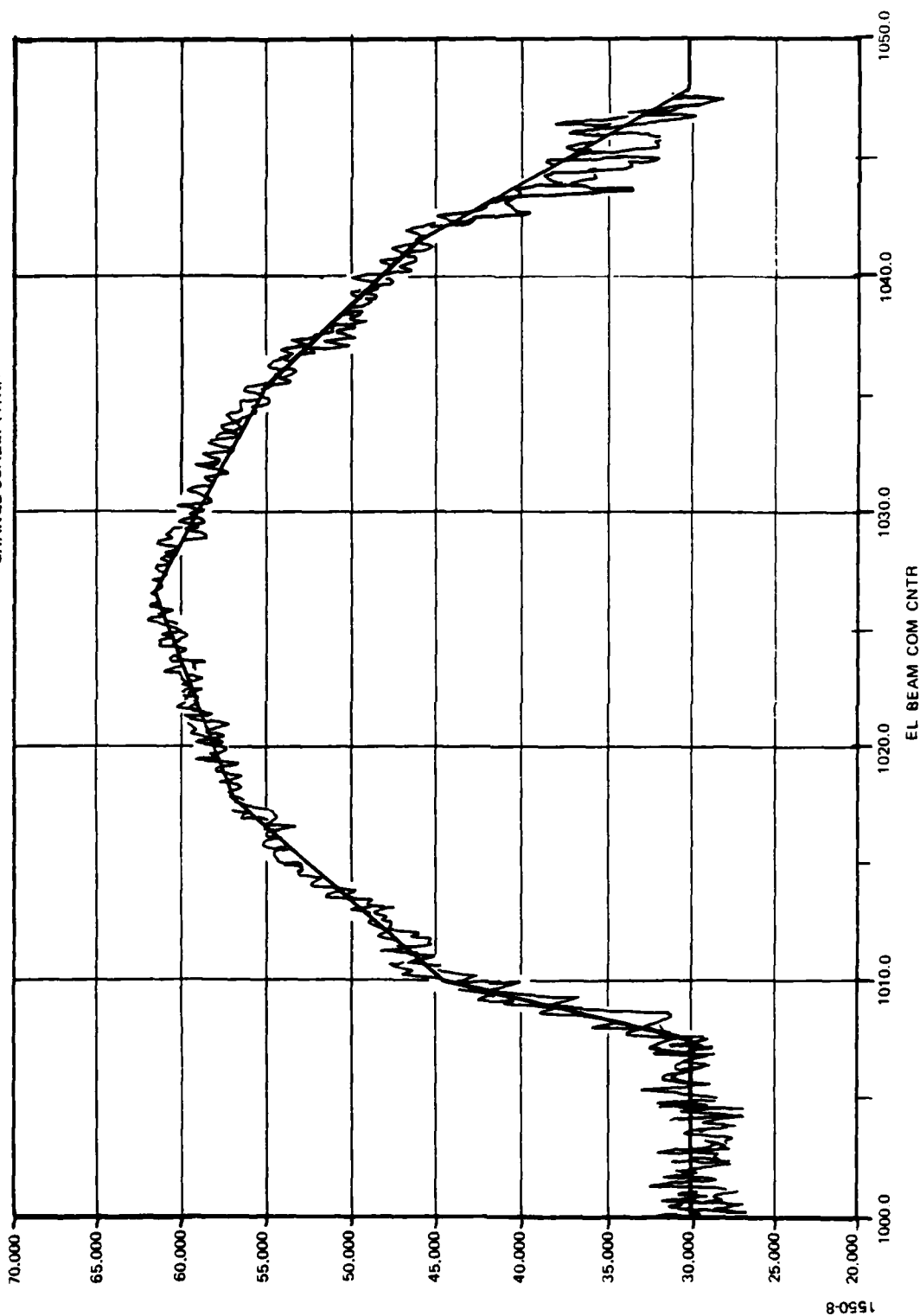


Figure 2.3 A plot of the two-way antenna pattern using an MTI calibration reflector, measured at YPG

The ARBAT transmitter, receiver, and synthesizer subsystems which determine its MTI improvement factor were provided as GFE. These subsystems were originally part of the AN/TPQ-28 mortar locating radar and their basic performance capabilities were not improved for the ARBAT application. The current ARBAT has an MTI improvement factor of about 25 dB. This value is limited by its transmitter phase stability and synthesizer spurs.

The ARBAT System was designed for pulse compression using an 11-bit Barker code. It was designed for approximately 10 dB clutter improvement in rain conditions. Pulse compression provides clutter reduction on clutter which is statistically independent within a pulsewidth as is normally found in rain (and possibly in RAP exhaust plumes). Its clutter rejection is limited with ground clutter to scatter by the vegetation disturbed by the wind. At best, one would expect only a 1-2 dB improvement. During the Flat Trajectory Tests, the pulse compression processing system of the ARBAT System was not in operation.

Section 3

FLAT TRAJECTORY STUDY TESTS

Section 3

FLAT TRAJECTORY STUDY TESTS

The ARBAT Radar System has had very limited testing with low trajectory projectiles as mentioned in Section 2.2. In addition, there has been no testing of the tank/antitank munitions (high muzzle velocity, 90-105 mm diameter, flat trajectory projectiles). This limited testing of the ARBAT System for low trajectory applications caused the following questions to be asked:

- 1) What are the limitations of the current ARBAT System to track the current and projected future tank/antitank munitions?
- 2) Are there any minor (inexpensive) changes which may be made to the current system which would significantly improve its capability for tank/antitank munition instrumentation applications.
- 3) What major changes are necessary to the system to enable it to be used for tank/antitank munition instrumentation applications?
- 4) Will any proving ground or ARBAT test procedure(s) change significantly the capability of the ARBAT System to track tank/antitank munitions?

To obtain answers to these questions, the Flat Trajectory Study was proposed by ARRADCOM and TECOM at YPG. The proposed Flat Trajectory Study had the following objectives:

- a) Conduct engineering tests at Yuma Proving Ground (YPG) by tracking with the ARBAT radar flat trajectory projectiles fired from 105 mm and 90 mm guns.
- b) Evaluate the test data.
- c) Make recommendations for the ARBAT system improvement.

This study was to be the first part of a plan to modify the ARBAT Radar System for tank/antitank munitions testing. The modification plan is composed of the following phases:

- 1) Flat Trajectory Study (1980) - evaluate the system, propose changes.
- 2) Performance Enhancement Program (1981) - make minor software changes, make proving ground/ARBAT procedure changes.
- 3) RETROFIT (1982) - make major changes.

The proposed study resulted in the Flat Trajectory Study under the DDA Contract DAA307-77-A-0401 in October 1980. The goal of this study was to determine the current feasibility of using the ARBAT System for tank/antitank munition testing and if not, to determine the changes necessary to make it compatible with those requirements. The complete SOW for the Flat Trajectory Study is included herein as Appendix A. The work was to be accomplished in three stages.

- 1) Initial Test Investigations - A series of test rounds shall be fired using the flat trajectory weapons with the weapon adjusted to fire at relatively high elevation angles. After these initial rounds are fired, the weapon elevation angle would be gradually reduced and further tracking attempted as the weapon is brought closer to its normal flat trajectory firing position. The ARBAT radar system, in its present configuration, will be exercised to achieve the acquisition and tracking of the above targets. At the end of this initial test period the results will be reviewed and the data developed would become the basis for the next step in the overall effort.
- 2) System Study and Analysis - During this phase of the effort the initial test data obtained in part 1 will be thoroughly evaluated with respect to characterizing the current system and to specifying improvements to the existing system through software and hardware changes.
- 3) System Improvement Recommendations - During this phase the improvements to the existing system will be reviewed and formally proposed. A careful attempt will be made to separate the minor/major changes in both hardware and software. These changes will become the basis of a final deliverable at the end of the phase.

3.1 PRELIMINARY TEST PLAN

During late August and September, 1980, several meetings took place jointly between TECOM (YPG), ARRADCOM, and ITTG representatives concerning the nature of the proposed flat trajectory tests. These meetings resulted in the development of a preliminary test plan which verified previous ARBAT demonstrations and test results, and then tested its low trajectory characteristics using antitank 90 mm and 105 mm munitions. This preliminary test plan is enclosed as Appendix B.

The low trajectory tests was to be conducted by first establishing the ARBAT capability by using a higher QE than that normally used, and then lowering the gun QE until the ARBAT System could no longer acquire the target. Once the lower limit of the QE was obtained, the acquisition gate elevation angle would be lowered until its minimum was reached. Gun site 17 was agreed upon as the gunsite which would minimize the azimuth rate during acquisition, minimize the input clutter, and provide an explosion-proof shelter.

3.2 FLAT TRAJECTORY TESTS

The Flat Trajectory Tests took place on five separate dates. During these tests, a number of unexpected problems relating to tank/antitank munition characteristics appeared which caused severe problems in the acquisition and tracking of these projectiles. After the initial set of 105 mm firings to verify the previous results were performed, the preliminary test plan became difficult to follow. Instead of following the test plan, many of the shots were used to explore the difficulties in tracking. The type and number of shots taken each day are tabulated in Table 3-I. Expansion of the data is presented as Table 3-II, indicating the QE and intercept time (and elevation angle). An additional breakdown of the data of individual shots is presented in the reproduction of the original operational Log Notebook presented in Appendix C, and the Gunfire Event Data are presented in the Event Analysis of each shot is in Appendix D.

Table 3-1. Flat Trajectory Test Items

	<u>Date</u>	<u>Target (mm)</u>	<u>Velocity (m/sec)</u>	<u>Rounds</u>
1550 5	Oct 29	105	494	21
		90	914	20
	Oct 31	105	732	20
	Nov 4	105	732	20
		90	914	5
	Nov 7	90	914	20
	Nov 21	90	914	20

Table 3-II. Itemized Flat Trajectory Tests

October 29 105 mm $V_0 = 494$ m/s LOF = 90° Tilt = 20°

<u>Rnds</u>	<u>Take Number</u>	<u>QE</u>	<u>Acquisition Time</u>	<u>Acquisition Angle ($^\circ$)</u>	<u>Malfunction</u>	<u>Miss</u>	<u>Lost Track</u>	<u>Full</u>
4	576-580	600	50	1.35	1	1	-	2
5	581-585	900	180	5.5	-	3	-	2
5	586-590	1100	400	12.5	-	-	-	5
3	591-593	300	125	1.63	-	2	-	1
4	594-597	300	225		-	1	-	3

October 29 90 mm $V_0 = 914$ m/s LOF = 85° Tilt = 20°

<u>Rnds</u>	<u>Take Number</u>	<u>QE</u>	<u>Acquisition Time</u>	<u>Acquisition Angle ($^\circ$)</u>	<u>Malfunction</u>	<u>Miss</u>	<u>Lost</u>	<u>Full</u>
3	1-3	300	400	-	1	2	-	-
1	4	300	500	-	-	1	-	-
1	5	300	600	-	-	1	-	-
3	6-8	400	600	-	-	3	-	-
3	9-11	400	700	-	-	2	-	1
9	12-20	400	500	10.1	-	7	2	-

October 31 105 mm $V_0 = 732$ m/s LOF = 85° Tilt = 20°

<u>Rnds</u>	<u>Take Number</u>	<u>QE</u>	<u>Acquisition Time</u>	<u>Acquisition Angle ($^\circ$)</u>	<u>Malfunction</u>	<u>Miss</u>	<u>Lost</u>	<u>Full</u>
4	101-104	300	550	5.9	1		-	3
7	105-111	250	550	4.7	-	4	1	2
2	112-113	200	480	3.9	-	-	-	2
3	114-116	175	520	3.4	-	-	1	2
1	117	150	550	2.6	-	-	-	1
1	118	125	520	2.3	-	-	-	1
1	119	100	530	1.67	-	-	-	1
1	120	75	520	1.16	-	-	-	1

1550-6 (1 of 3)

Table 3-II. Itemized Flat Trajectory Tests (continued)

November 4 105 mm $V_0 = 732$ LOF = 85° Tilt = 20°

<u>Rnds</u>	<u>Take Number</u>	<u>QE</u>	<u>Acquisition Time</u>	<u>Acquisition Angle ($^\circ$)</u>	<u>Malfunction</u>	<u>Miss</u>	<u>Lost</u>	<u>Full</u>
2	121-122	200	530	389	-	-	-	2
3	123-125	100	500	1.7	-	1	2	-
3	126-128	150	560	2.6	-	-	-	3
3	129-131	100	500	1.80	-	1	-	2
5	132-136	80	480	1.32	-	3	1	1
4	137-140	70	500	1.20	-	4	-	-

November 4 90 mm $V_0 = 914$ LOF = 85° Tilt = 20°

5	21-25	300	500	10.1	-	5	-	-
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November 7 90 mm $V_0 = 914$ m/s LOF = 85° Tilt = 20°

<u>Rnds</u>	<u>Take Number</u>	<u>QE</u>	<u>Acquisition Time</u>	<u>Acquisition Angle ($^\circ$)</u>	<u>Malfunction</u>	<u>Miss</u>	<u>Lost</u>	<u>Full</u>
10	26-35	300	800	37	-	6	2	2
3	36-38	200	1560	7.2	-	-	1	2
2	39-40	100	1350	3.4	-	-	-	2
5	41-45	50	1350	1.52	-	-	3	2

November 21 90 mm $V_0 = 914$ m/s LOF = 85° Tilt = 20°

<u>Rnds</u>	<u>Take Number</u>	<u>QE</u>	<u>Acquisition Time</u>	<u>Acquisition Angle ($^\circ$)</u>	<u>Malfunction</u>	<u>Miss</u>	<u>Lost</u>	<u>Full</u>
7	46-52	200	540	4.8	1	2	4	2
2	53-54	100	620	2.1	-	1	-	2
6	55-60	60	1.18	1.80	3	2	2	1
2	61-62	40	190	0.91	-	-	2	-
3	63-65	35	1740	0.80	-	-	3	-

1550-6 (2 of 3)

Table 3-II. Itemized Flar Trajectory Tests (Continued)

Legend

V_0	=	muzzle velocity (meters/second)
LOF	=	line at fire - degrees from YPG North
Tilt	=	mechanical tilt added to the ARBAT antenna
Rnds	=	number of rounds fired
QE	=	quadrant elevation angle - mils
Aq Time	=	acquisition time from gunfire - milliseconds (set by operator)
Aq Angle	=	resulting acquisition elevation angle from horizontal plane from the Radar
Malfunction	=	equipment malfunction preventing radar acquisition (gunfire switch did not function)
Miss	=	no attempted radar acquisition
Loss	=	target was acquired and then lost in track
Full	=	full track of target trajectory was accomplished

1550-6 (3 of 3)

As planned, the initial portion of the Flat Trajectory Test was used to verify previous test results. The previous test of the ARBAT System took place on 25 January 1980 when the test plan was similar to test plans used for testing during October and December 1979. During this time period, work was performed to solve one of the problems with high QE shots. This was accomplished and demonstrated during the 25 January test performance. During this portion of the Flat Trajectory Tests the results were similar to the 25 January results, except that there were a few more misses during the testing.

Following these demonstration shots the low QE shots were started. Immediately, certain problems became obvious. Even though the system was relatively successful with the higher QE 105 mm shots, the ARBAT System was not able to acquire the faster, smaller, lower QE shots. A considerable amount of time was spent examining the data and adjusting parameters (mainly rcs, acquisition angle (time), and calibration (biases) in an attempt to analyze and solve the problems. An understanding of some of the problems was not accomplished until midway through the test firing on 31 October. The major problem during this acquisition phase were extreme sensitivity in acquisition of the faster low QE shots due to the target missing the center of the search gate volume. This sensitivity is due to the limited time in which the faster target is in the search gate, and to the limited elevation change of the target. It was found that the ARBAT System, during these tests, had two other problems which were not apparent before the test.

- 1) At that time the angular pointing calibration was not accurate to the required 0.2 degree.
- 2) During a shot the ARBAT antenna mechanical tilt could slip by as much as 0.1° - 0.2° .

Once a good calibration had been made and the tilt slippage was checked and corrected after every shot, the acquisition rate of the target improved significantly. This improvement occurred during tracks 108-110 of 31 October.

After the acquisition problems were solved, an attempt was made to return to the original test plan. The test plan was followed except when it was found that the system required recalibration. These new shots at lower and lower QEs resulted in new problems being uncovered which were heretofore unknown. As these problems became known, attempts were made to solve them or to reduce their effects.

The problems which had the greatest impact on the test schedule for later test days were the difficulties encountered due to the high azimuth rate. The original plan was to reduce the acquisition elevation angle at each QE until the acquisition was lost due to clutter. Unfortunately, the minimum elevation angle was not caused by clutter, but by the difficulty of establishing a track due to the azimuth rate. When a target with a high azimuth rate is detected and a firm track is established the servo commands

are initiated. However, due to the inertia of the antenna, it doesn't begin to move until some 50 milliseconds later and does not catch up with the target for some 400-500 milliseconds. During this time, the azimuth tracking is accomplished by frequency scan - the azimuth beam is moved in the azimuth angle by changing the transmission frequency. For a fast target this rapid frequency change can cause two problems.

- 1) The frequency can exceed the frequency limits which can be generated by the radar.
- 2) The changing frequency caused elevation tracking problems due to cross coupling between azimuth and elevation (beam position interaction).

The limiting azimuth scan rate was about 12 degrees per second. This limiting scan rate required the acquisition range to be set such that the acquisition angle was well above the elevation angles which contain clutter except for the extremely low QE shots, thus, the minimum acquisition angle occurred at the test firings where the QE was 35-40 mils.

Once a good track was established, the target track was occasionally lost due to the initial noisy measurement of the frequency ambiguity factor. When the PRT is abruptly changed to compensate for a changing Doppler frequency, the received ambiguous frequency is unchanged if the correct ambiguity factor is known. If it is not correct, the received ambiguous frequency occurs at another frequency. If the ambiguity factor is off by several units, then the change of the ambiguous received frequency is off by more than the MTI filter bandpass limits and it could be in the blind zone.

Once the signal was in the blind zone it was not detected and the target track was considered lost. During the Flat Trajectory tests the ARBAT System started measuring the ambiguity factor incorrectly at Doppler frequencies in the neighborhood of 45-50 kHz. Above 70 kHz Doppler frequency, the frequency ambiguity factor error was large enough to occasionally cause the received ambiguous Doppler frequency to enter the blind zone causing loss of track.

3.3 PROBLEMS AND POTENTIAL SOLUTIONS

Analysis of the Flat Trajectory Test results indicate that the primary problems are involved in the target acquisition phase. There were several types of problems which made the target acquisition difficult. These problems are listed as follow:

- 1) The acquisition gate was not centered on the target.
- 2) The rapid azimuth rate caused problems.
- 3) The clutter and multipath caused problems.

The problems involved with the acquisition gate not being centered are not unique to the acquisition of tank/antitank munitions. However, the small target elevation change with a fast low trajectory, causes the radar to be more sensitive to calibration misalignment in acquisition of the target. The acquisition gate needs to be centered on the target within 0.3 degree. Causes of the misalignment are listed below.

- a) Angular Calibration misalignment 0.5 degree
- b) Mechanical antenna tilt slippage 0.1 degree
- c) Possible calibration changes due to temperature changes 0.1 degree

All of these causes of the misalignment problems have been corrected through better operating procedures and calibration techniques. In the October 31 test, the mechanical tilt slippage was first noted during the following tests; the tilt elevation angle was verified and corrected between firings which corrected the problems during the tests. Shortly after the Flat Trajectory Tests, mechanical means were found to stabilize the tilt. There have been no further problems since then with the mechanical tilt slippage.

In December, a new procedure was implemented which greatly improved the calibration. This procedure necessitated the addition of software corrections so that differences of the measured position of calibration sources from survey position could be added to the data. This corrected the calibration to within 0.2 degree. In May, during a set of P&P tests, a new procedure was developed to improve the calibration to within 0.05 degree using actual motion of the target through the acquisition gate. This semiautomated calibration procedure will be implemented during the PEP program. It is expected that the new procedure will automatically correct for angular change due to temperature changes during the day.

Problems with clutter and multipath were introduced at the start of Section 2. Due to the limitation of not being able to set the acquisition angle at a low value (except for extremely low QE shots) because of the large azimuth rate, little test data was gathered on the effect of clutter on the acquisition of the target. As shown in Section 4 for the ARBAT System, the multipath effects start at an angle of 0.9 degree above the radar horizon which correspond to an elevation angle of 1.3 degrees above the horizontal plane at YPG. The only tests that could have been effected by multipath were those shots below a QE of 80 mils on October 31 and November 4, for the 105 mm targets and those below a QE of 50 mils for the 90 mm targets. The results of these firings, as indicated in Table 3-11, were good for acquisition angles above 1.3 degrees (excluding those initial shots used for calibrating the day of testing) and poor for acquisition angles below 1.4 degrees. At 0.9 degree above the radar horizon (surface) the lower elevation beam is set at 0.6 degree. At this angle the amount of clutter energy intercepted is about 4 dB above the minimum clutter intercept. Thus, at the angle where multipath effects begin, the clutter effects are just starting to be seen. It is impossible, at this stage, to determine whether the ARBAT System will eventually be limited by clutter or multipath effects.

To assist in reduction of problems associated with multipath and clutter, the following list of potential changes is presented.

Multipath Reduction

- a) Increase the elevation angle of the lower elevation beam by
 - 1) decreasing the separation of the two elevation lobes;
 - 2) offset the center of the elevation sequential lobe position above the expected position of the target,
- b) Raise the position of the gun and fire it so the ground surface is lower than the gun position.

Clutter Reduction

- a) Reduce the elevation angle of the lower elevation lobes as above.
- b) Start the detection process when the target is expected in the acquisition gate instead of at gunfire to be able to reduce the acquisition CFAR threshold level.
- c) Improve the MTI capability of the system by
 - 1) increasing the number pulses per frame;
 - 2) improve the phase and amplitude stability of transmitter, synthesizer, and receiver.
- d) Start acquisition in the pulse compression mode.

This set of potential solutions is discussed further in Section 4.

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Section 4

ANALYSIS

Section 4

ANALYSIS

In Section 2 the report briefly describes the radar problems present when using a radar to acquire and track a near flat trajectory close to the ground, and the methods by which the ARBAT System was originally designed to overcome these inherent problems. Section 3.2 describes some of the test results and indicates that the clutter and multipath problems were not overcome and that several other problems appeared, which are inherent in the ARBAT System when trying to track the faster tank/antitank munitions were identified.

This section describes the operation of the ARBAT Radar attempting to track tank/antitank munitions, theoretically and practically, using the test results and then, analyses of each of the recommendations presented in Section 3 for solving various problems described in the Flat Trajectory Tests.

4.1 TEST GEOMETRY

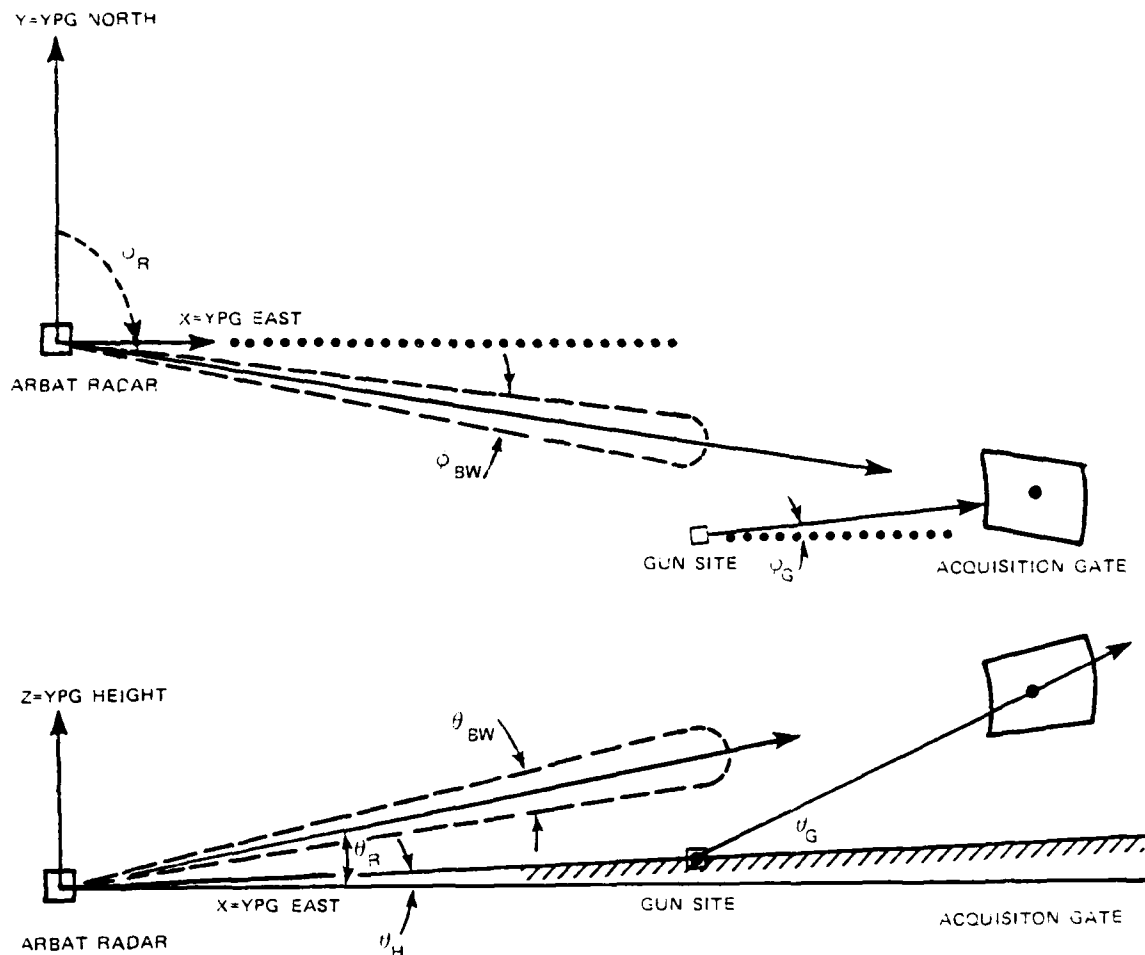
All tests were conducted with the ARBAT Radar in its fixed position and the 90 mm and 105 mm guns fixed in position at YPG gunsite no. 17. The diagram of this resulting geometry is shown in Figure 4-1. The gunsites are located approximately 680 meters from the radar at an angle of approximately 112 degrees from YPG North. The firing line-of-fire (LOF) was set by the YPG safety office at 85 degrees from YPG North. This resulted in an acquisition gate which had the target entering from the right side (southern) and traveling to the left (north). As mentioned previously, the acquisition gate was set so that the azimuth motion of the target was not greater than 12 degrees per second.

Between the Radar and the gun there is a slight dip in the surface level such that the gun height was slightly below the height of the Radar resulting in an elevation angle of approximately 0.1 degree from the horizontal plane through the radar. Beyond this dip, the ground level rises at a consistent rate such that the horizon angle as observed from the radar, is approximately 0.4 degree.

The acquisition gate size is given as the range gate size (120 meters) by the square angle produced by the azimuth and elevation beamwidths (0.5 x 0.7 degree). The linear dimensions depended upon the acquisition gate setting (range). The closest acquisition range was 1,020 meters resulting in a gate size of 120 x 10 x 14 meters³).

4.1.1 Relationship between Radar Elevation Angle and QE

The relationship between the elevation angle to set the acquisition gate and the QE angle for a given intercept time can be derived using the geometry defined in Figure 4-1. The elevation angle is given by



$$X_{RG} = \psi_G = \text{LOF} = 85^\circ$$

$$Y_{RG} = \theta_{BW} = 0.7^\circ$$

$$Z_{RG} = \psi_{BW} = 0.5^\circ$$

$$R_{RG} = 680 \text{ METERS} \quad \theta_G = \text{QE SINGLE} = \text{VARIED WITH TESTS}$$

$$\psi_{RG} = 112.0^\circ \quad \text{ACQUISITION COORDINATOR VARIED WITH TESTS}$$

$$\theta_{RG} = -0.1^\circ$$

$$\theta_H = -0.4^\circ$$

1550-7

Figure 4-1. Test Geometry

$$\theta_R = \arctangent \frac{Z_{TR}}{(X_{TR}^2 + Y_{TR}^2)^{1/2}}$$

where $Z_{TR} = VT \sin \theta_G + Z_{GR} - 1/2g T^2$

$$X_{TR} = X_{GR} + VT \cos \phi_G \cos \theta_G$$

$$Y_{TR} = Y_{GR} + VT \sin \phi_G \cos \theta_G$$

T = acquisition time

V = muzzle velocity

There are no diagonal effects

defining $W = X_{GR} [X_{GR} \cos \theta_G + Y_{GR} \sin \theta_G]$

The equation for the radar elevation angle becomes

$$\tan \theta_R = \frac{VT \sin \theta_G + Z_{GR} - 1/2g T^2}{[R_{GR}^2 + 2W VT \cos \theta_G + V^2 T^2 \cos^2 \theta_G]^{1/2}}$$

To understand this relationship, consider the normal tank/antitank munition case using the following conditions:

- 1) two-dimensional geometry $\phi_G = 90^\circ$ thus ($W = 1$)
- 2) horizon angle is zero ($Z_{GR} = 0^\circ$)

then the expression becomes

$$\tan \theta_R = \frac{\sin \theta_G VT - 1/2g T^2}{R_{RG} + VT \cos \theta_G}$$

Assume that the total time of flight (T_x) is twice the time to reach maximum altitude, then the intercept time is given by

$$T = \gamma T_x = \frac{2\gamma V \sin \theta_G}{g}$$

where

is the percentage of trajectory not tracked.

*This value of W is used for ease of reader.

and

$$\tan \theta_R = \frac{\frac{[2 V^2 \sin^2 \theta_G]}{g} \gamma [1-\gamma]}{R + \frac{V^2 2\gamma \sin^2 \theta_G}{g}} = \frac{2 V^2 \sin^2 \theta_G}{g} \gamma (1-\gamma) = \sin \theta_G \gamma (1-\gamma)$$

If we limit the conditions to low trajectories ($\theta_a < 3$ degrees) and insist upon acquiring early and tracking most of the trajectory ($\gamma \ll 1$) then

$$\theta_R = \frac{2V^2 \theta_G^2 \gamma (1-\gamma)}{g} = TV \gamma (1-\gamma) \theta_G$$

This gives the relationship as to the required radar elevation angle to be able to acquire and track 100- γ percent of a firing at a Q^E of θ_G

Using current YPG conditions

$$R = 700 \text{ meters}$$

$$V = 1000 \text{ meters per second}$$

$$\gamma = 0.1$$

then

$$\theta_G = 42.86 \theta_E^{1/2}$$

where

θ_E is in degrees

θ_G is in mils.

Typical cases of interest are

$$\theta_G = 21 \text{ mils for } \theta_E = 0.7 \text{ degree} \\ (\text{start of the multipath effects})$$

$$\theta_G = 8 \text{ mils for } \theta_E = 0.035 \text{ degree} \\ (\text{current YPG Flat Trajectory Tests})$$

This set of numbers points out two interesting items of information.

- 1) The analytical results indicate that the Flat Trajectory Test results are in the neighborhood of the theoretical limits.
- 2) To use the current ARBAT for normally Flat Trajectory Tests (QE less than 8 mils) is not feasible.

4.1.2 Radar Antenna Pattern

The effects of multipath and clutter are dependent upon radar energy being reflected from the ground and entering the main antenna beam of the radar. Figure 4-2 is a plot of the two-way antenna pattern measured at YPG using an MTI calibration reflector. The plot illustrates the relative power gain of the antenna (in dB) as a function of angle off of the mainbeam maximum. In this plot, the measured data was taken in phase command units - called beam numbers (0.0375 degree = 1 elevation beam number) centered at a beam number of 1026.5. There are several interesting items to bring to attention from this diagram

- a) 3 dB points occur at ± 4.5 beam numbers = 0.169 degree
(3 dB beamwidth = 0.338 degree)
- b) 5.5 dB points occur at ± 8 beam numbers = 0.30 degree
(lobe separation cross over)
- c) 6 dB points occur at 9.3 beam numbers = 0.35 degree
(6 dB beamwidth = 0.70 degree)
= 0.7 degree
- d) 32 dB sidelobe starts at 12.5 beam numbers = 0.656 degree
(beamwidth at sidelobe = 1.3 degrees)

4.1.3 ARBAT Sequential Lobing

The ARBAT Radar System uses sequential lobing for both azimuth and elevation target acquisition and tracking. One ARBAT measurement is called a frame and consists of 32 pulses being transmitted and processed. These 32 pulses are transmitted to two differing angles (by changing the transmitted frequency for an azimuth frame and changing the phase between arrays for an elevation frame) in an alternating manner. Figure 4-3 shows the sequential lobing for the elevation frame. If the target is expected at an elevation angle θ_R , then the two elevation lobes are placed at an equal angle of $\Delta \theta$ above and below the expected position. The signal level is observed from the target by each of the lobes. A normalized ratio is formed

$$E = \frac{S_A - S_B}{S_A + S_B}$$

and the measurement is formed

$$\theta_{\text{measured}} = \theta_R + a E$$

NUM POINTS - 2919, NUM TRUNCATED - 2288
 X RANGES FROM 949.495 TO 11/4 68
 Y RANGES FROM 24.0317 TO 62.0138
 CHANGE SCALE? (Y/N):

8/26/80 THK # 1 ELEV BEAM -- SUFO
 MEAS SIG W/O WGH

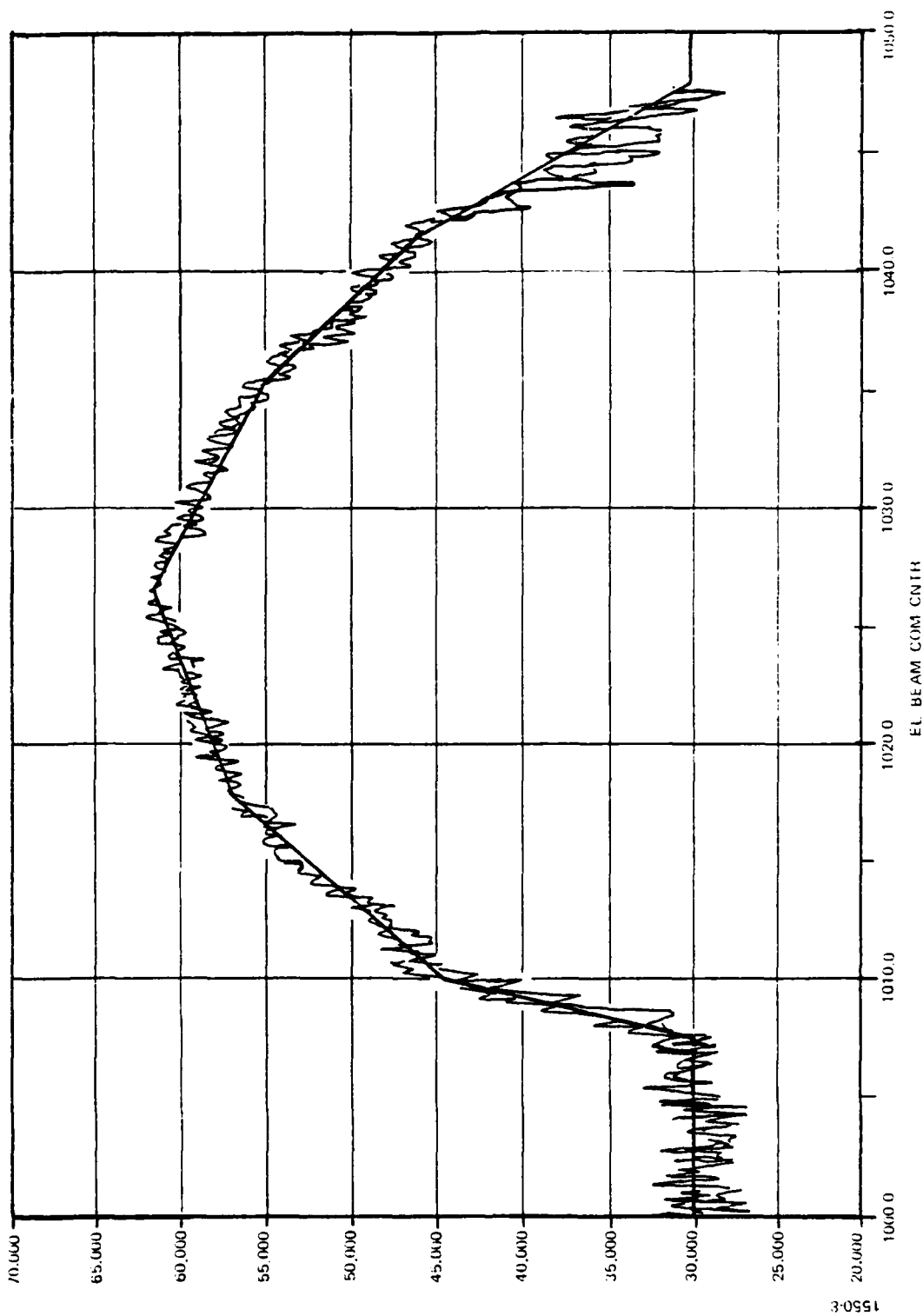
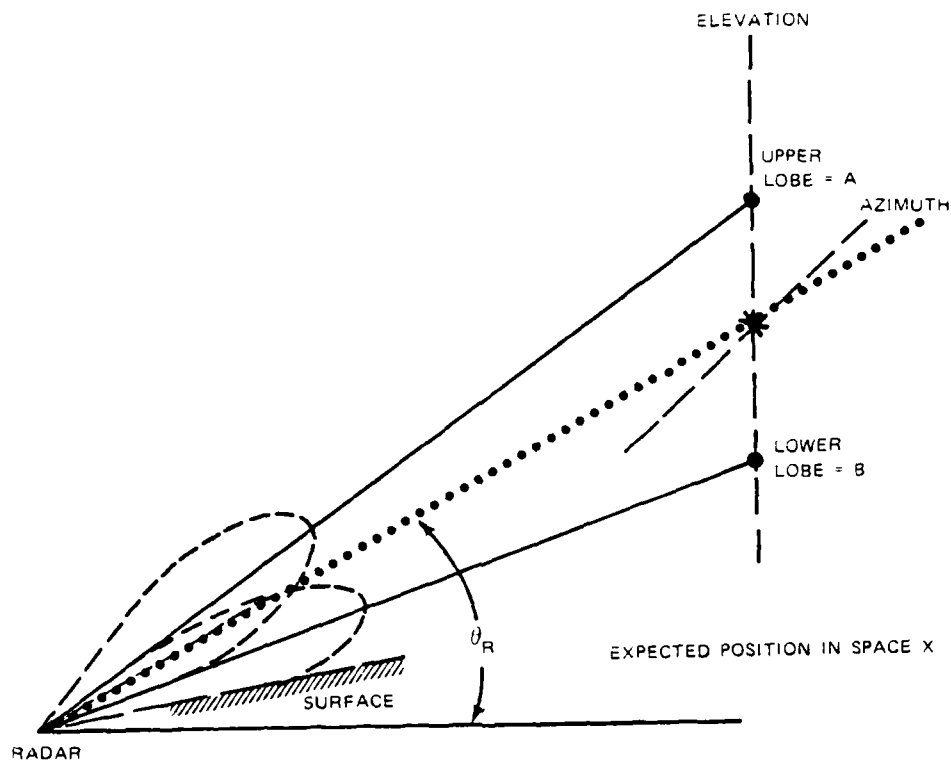


Figure 4-2. A plot of the two-way antenna pattern using an MH calibration reflector, measured at YPG



$$\theta_R = \text{EXPECTED ELEVATION ANGLE} = 0.5 (\theta_A + \theta_B)$$

$$\theta_A = \text{ELEVATION OF UPPER LOBE}$$

$$\theta_B = \text{ELEVATION OF LOWER LOBE}$$

$$\theta_A - \theta_B = \text{SEQUENTIAL LOBING SEPERATION} = 2(\Delta\theta) = 0.6 \text{ DEGREE}$$

$$G(\theta_A - \Delta\theta) = G(\Delta\theta + \theta_B) = \text{CROSSOVER POINT} = -5.5 \text{ dB}$$

$$\text{MEASUREMENT MEASURES} = E_{E1} = \frac{S_A - S_B}{S_A + S_B}$$

Figure 4-3. Sequential lobing for the elevation frame

where

E	$= +1$ for S_B approximately θ	target at θ_N
E	$= 0$ for $S_A = S_B$	target at θ_R
E	$= -1$ for S_A approximately θ	target at θ_E
α	$=$ vernier constant for the antenna and lobe separation	

At angles between θ_A , θ_R , θ_B , E is a smoothly varying single valued variable.

The vernier constant α is normally measured. For a first order approximation it is given by $\alpha = \Delta\theta$.

The accuracy of the elevation measurement just described assumes that if the antenna is pointing at the target then the amplitude of the received power is the same at all elevations. This is normally true. One situation when this is not true is when one or both beams acquire signal energy from both the direct path to the target, and one which is reflected from the surface. This is the case when acquiring or tracking a target close to the ground surface. At some elevation above the surface the lower sequential lobing beam at θ_B will start receiving this reflected energy in addition to the direct wave. This will cause an error in tracking because the measured vernier E will be modified by the reflected signal and is not be representative of the position of the target between the lobes.

To initiate a track on an acquired target, the first two measurements were used to derive the targets' initial position measurements. If the received power was dependent upon its elevation due to multipath effect, then the initial elevation rate was established not by the position of the target between the sequential lobes, but by the interference caused by the multiple path effect. Thus, the position of the initial target may not be bad, but the targets elevation rate could be in error.

Multipath Analysis - As mentioned before, multipath problems are caused by the interference of the direct return from the target with a signal from the target that is reflected off the ground. This subsection will describe analytically this interfering effect and calculate the errors caused to the elevation tracking algorithms.

Consider the geometry described in Figure 4-4. There are two signal paths between the radar and the target. Assume that path one is the direct path and the radar is centered along the proper elevation angle of the target θ_1 . The radar is also receiving signal energy along path two at an elevation of θ_2 . The amplitude of the received signal is given by

$$F = [f(\theta_1) + \rho f(\theta_2)] e^{j\alpha}$$

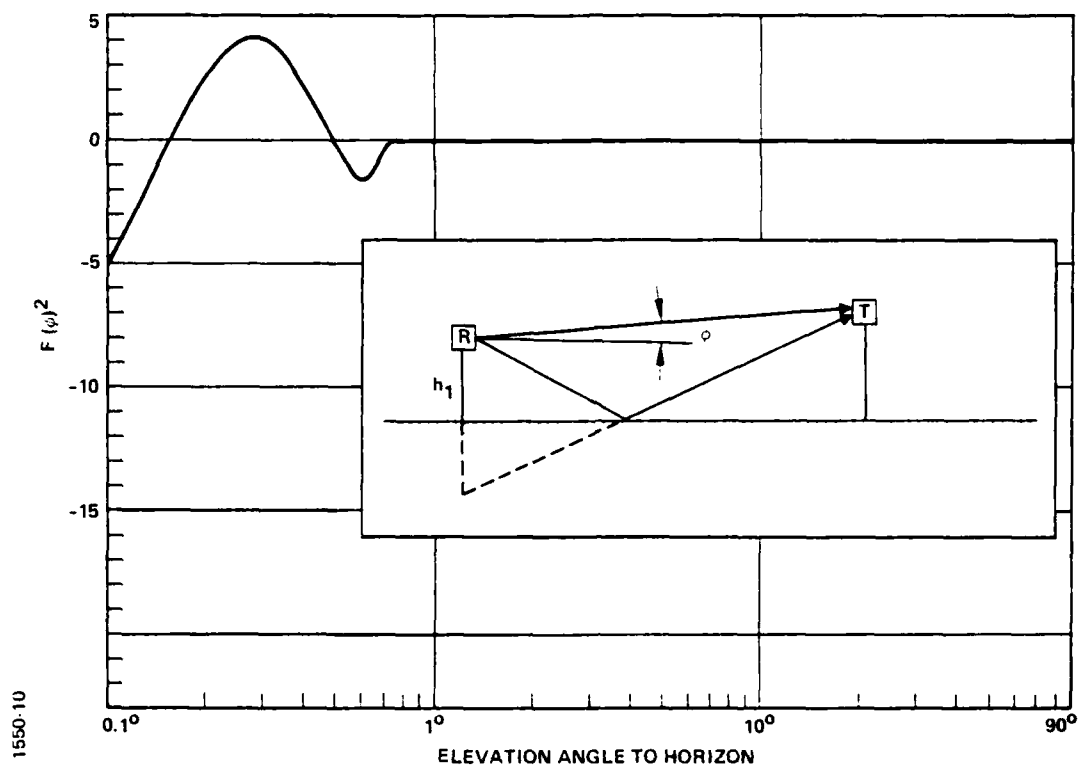


Figure 4-4. Multipath Interference Effects

where

$F(\theta_1)$ is the signal received from elevation θ_1 $g(\theta_1) = 1$ since we assume the radar elevation is directed toward the target.

$F(\theta_2)$ is the signal received from path 2 and is equal to $g(\theta_1 - \theta_2)$. when

$g(\cdot)$ is the radar two way antenna pattern (Figure 4-2)

is the amplitude of the reflected signal

σ is the phase of the reflected signal = (typed on composer)

ϕ = is a phase change caused by the reflection

δ = difference on path length between path 1 and 2.

for a low elevation angle $\delta \sim 2h_1 \sin \theta$

$$l = 1$$

$$\phi = -\pi$$

thus the signal power received as a function of elevation angle

$$F^2(\theta) = 1 - g^{1/2}(\theta) \frac{2\pi h_1}{\gamma} \sin \theta$$

For these Flat Trajectory Tests

$$\lambda = 0.0322 \text{ meters}$$

$$h_1 = 0.4 \text{ meter}$$

$$g(\theta) = \text{given in Figure 4-2}$$

The corresponding result for $F^2(\theta)$ is given in Figure 4-4 in dB versus elevation angle above the radar horizon (ground surface angle at the reflection point). This figure indicates that multipath effects did not start until the lower antenna beam was about 0.7 degree above the horizon. The signal has one minimum and maximum excursion and then rapidly decreases to zero when the target is at the same elevation as the ground surface.

The cancellation effect of the multipath did not have a serious effect until the elevation angle was close to 0.1 degree above the ground horizon. However, an analysis of the angular measurement error showed serious problems below 0.7 degree.

To calculate the measurement error, consider the normal ARBAT acquisition procedure.

- 1) Assume that the true position of the target is always midway between the sequential lobes.
- 2) The sequential lobes are ± 0.3 degree apart and the measurement is given by

$$\theta = 0.3 E$$

- 3) Then E should be equal to zero, and the error is then given by

$$\text{error} = E = \frac{S_A - S_B}{S_A + S_B}$$

- 4) S_A and S_B are given by Figure 4-4 for the various elevation angles.

The multipath angular error is given by Figure 4-5 which plots the angular elevation error in degrees versus elevation angle. Notice that the error became noticeable at an elevation angle of 1.0 degree above the horizon (1.4 degrees true elevation) and the measurement did not meet specification at elevations lower than 0.7 degree above the horizon (1.1 degrees true elevation). There is one area at about 0.45 degree above the horizon (0.85 degree true elevation) which had a small level of multipath angular error.

The elevation tracking loop will have a severe problem attempting to acquire the target at elevation angles between 0.8 and 0.55 (1.2 degrees and 0.95 degree true elevation). According to Figure 4-5, the error switches sign in this region. A trajectory, which is passed through the acquisition gate in a normal manner (increasing its elevation with time), experienced errors in measurement such that the trajectory appeared to be decreasing. The radar then predicted the next elevation position closer to the ground causing the radar to move away from, and lose the target.

4.1.4 ARBAT Detection

The ARBAT System uses a CFAR (Constant False Alarm Rate) detector to determine whether the signal is present or not. This is accomplished by calculating an adaptive threshold value on which to base this detection criteria. In the ARBAT System, the adaptive threshold is based upon estimating the noiselike signal by averaging the spectral filters which do not contain either clutter or signal. The threshold is then set by multiplying this average residual level by a known value determined by the

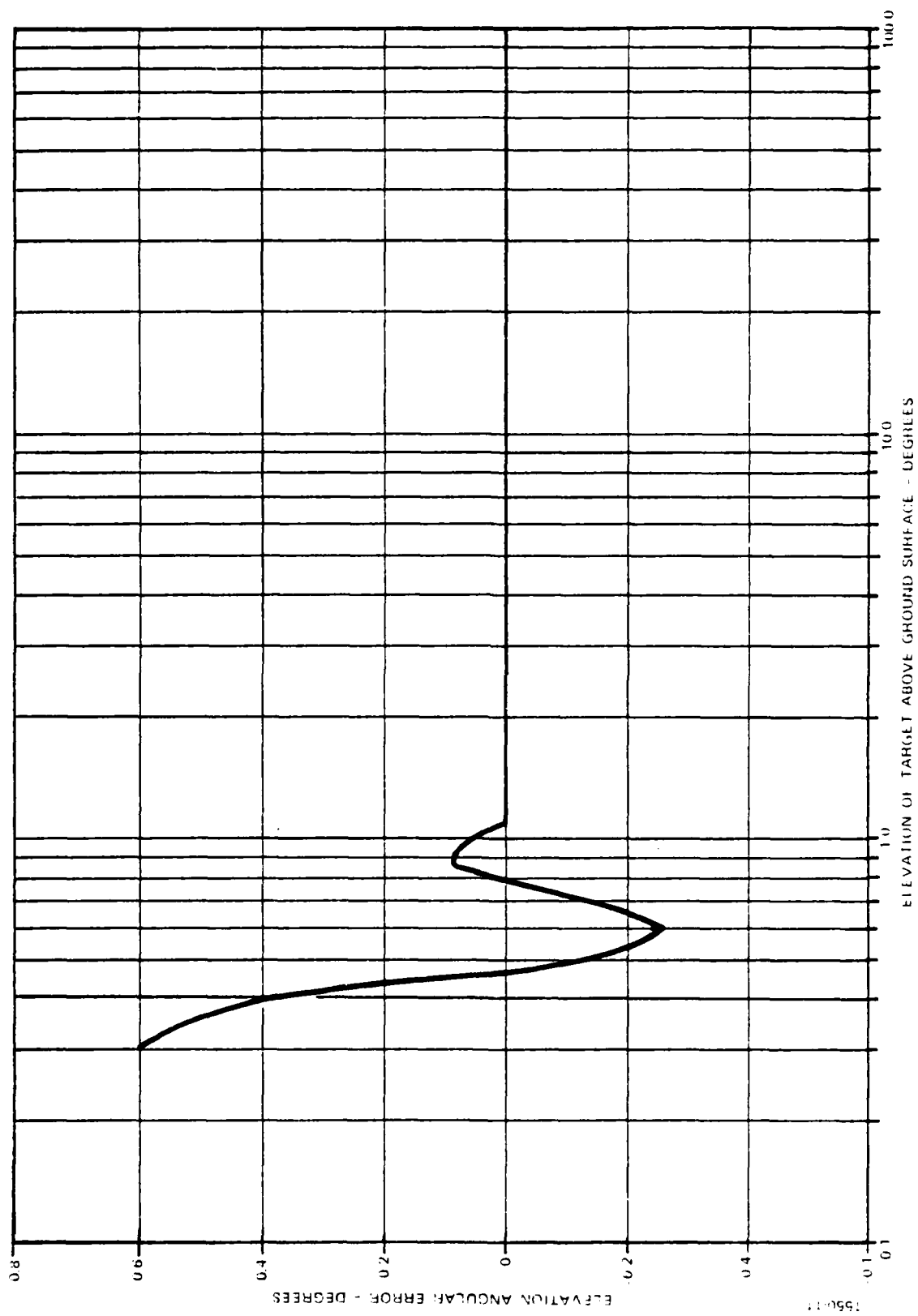


Figure 4-5. ARBAT Multipath Elevation Angular Error

requirement to maintain track and data accuracy. The scaling factor is determined by the false alarm rate required by the system to operate. The relationship is given by

$$\text{a target is present of } S > \left(\frac{S}{R}\right) \ln \frac{1}{\rho}$$

Currently, the ARBAT System uses the following threshold

acquisition	80
tracking	50.

To be able to track properly, experience has shown that the signal to residual ratio must be above 16 dB. The residual level is determined either by the convolution of the system instabilities with the largest of either the signal level or clutter level, or by the system noise level, whichever is larger. For acquisition of a low QE target, the clutter will generally set the residual level.

4.1.5 Clutter

The amount of clutter energy in the received signal is dependent upon the amount of clutter seen by the main antenna beam. Consider the antenna pattern presented in Figure 4-3. A rough indication of this clutter level is given by calculating the ratio of antenna power intercepting the surface to the power received from the target centered at the center of the antenna beam. The amount of clutter is given by

$$C(\theta) = K \int \frac{g(\theta) B(\theta) d\theta}{R(\theta)}$$

where

- $g(\theta)$ = antenna pattern of Figure 4-3
- $B(\theta)$ = 1 when θ intercepts the surface and 0 elsewhere
- R^2 = range from the radar to the point of surface interception
- K = various factors corresponding to the beamwidth and pulsewidth.

This calculation is plotted in Figure 4-6, a plot of clutter (dB) received (normalized to $\theta = 90$ degrees) as a function of elevation angle. This plot shows that the clutter effects are not noticeable until an elevation angle of 0.6-0.7 degree above the ground surface.

To take both multipath and clutter into consideration, the received signal/residual ratio becomes

Signal/residual

$$(\theta) = \frac{K F(\theta)^2 M}{C(\theta)}$$

1550-12

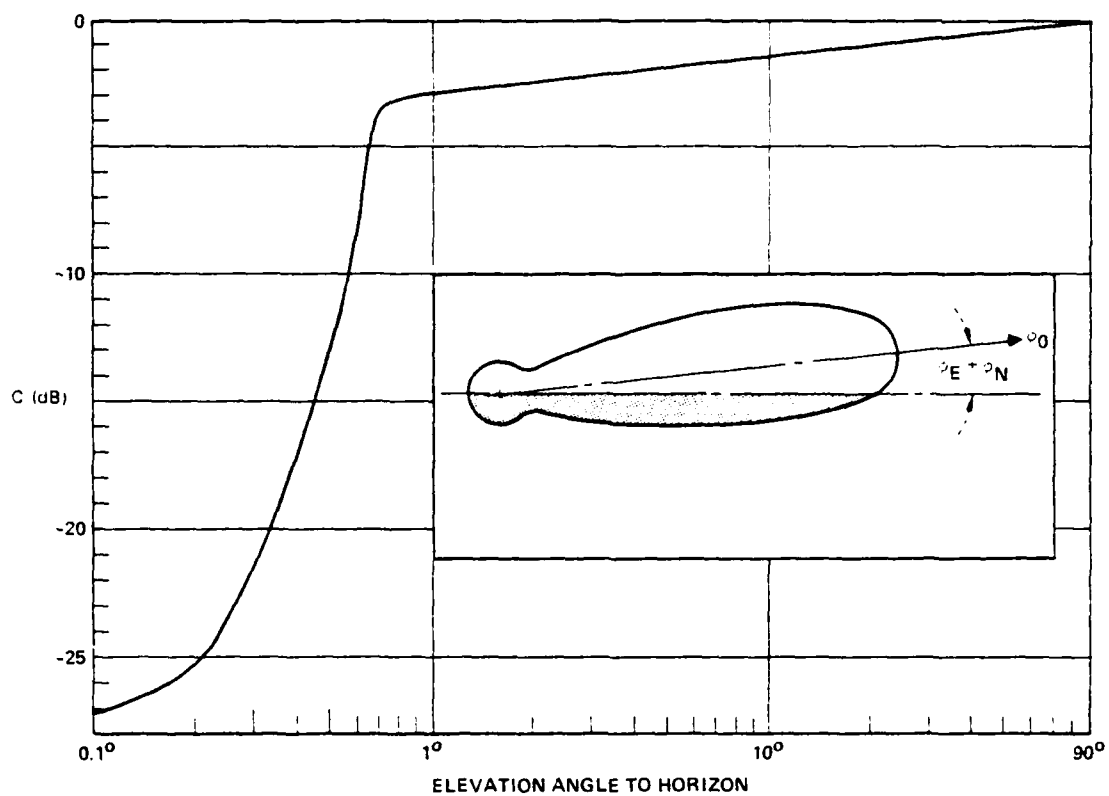


Figure 4-6. Clutter Effects

where

M = MTI improvement factor taking into account the system instabilities and processing gain.

K = Constant, taking into account the various nonchanging parameters of the radar system.

The ratio $Q(\theta)^2 F^2(\theta)/C(\theta)$ is plotted as Figure 4-7 and is a combination of Figures 4-4 and 4-6. Since this is a relative plot of dB vs elevation angle it can be used to give an indication of the effect that system changes can produce.

The best the ARBAT System was able to accomplish in the Flat Trajectory Tests, were several tracks at QEs of 35-40 mils with an acquisition angle of 0.8-0.9 degrees. This level indicates the known limits of clutter.

4.2 MULTIPATH REDUCTION TECHNIQUES

- a) Increased the elevation angle with respect to the target by decreasing the separation between the two elevation lobes.

At this time, the separation between the elevation lobes was +0.3 degree corresponding to a crossover of about 5.5 dB. It should have been possible to decrease this separation to a crossover of 3 dB. This corresponded to a separation of the elevation lobes of +0.17 degree, which corresponded to an improvement of 0.13 degree.

- b) Offset the center of the tracking lobes so that the target is closer to the lower beam.

The measurement accuracy of the sequential lobing techniques was only good to two beam numbers. Thus, one would not want to attempt to be any closer than the two beam numbers to the lower beam, and thus, this technique corresponded to an improvement of about 0.07 degree.

These two techniques should have allowed the acquisition to occur approximately 0.2 degree closer to the ground. This should have provided an improvement but it was not sufficient to eliminate the problem. If multipath is the limiting problem, these techniques would not provide sufficient improvement. In order to use the system as currently required for low QE testing (QE = 8 mils). To take part in current operations Section 4.1 indicates that the lower beam must be within 0.03 degree of the horizon. This was not possible with operation procedures at this time.

1550 13

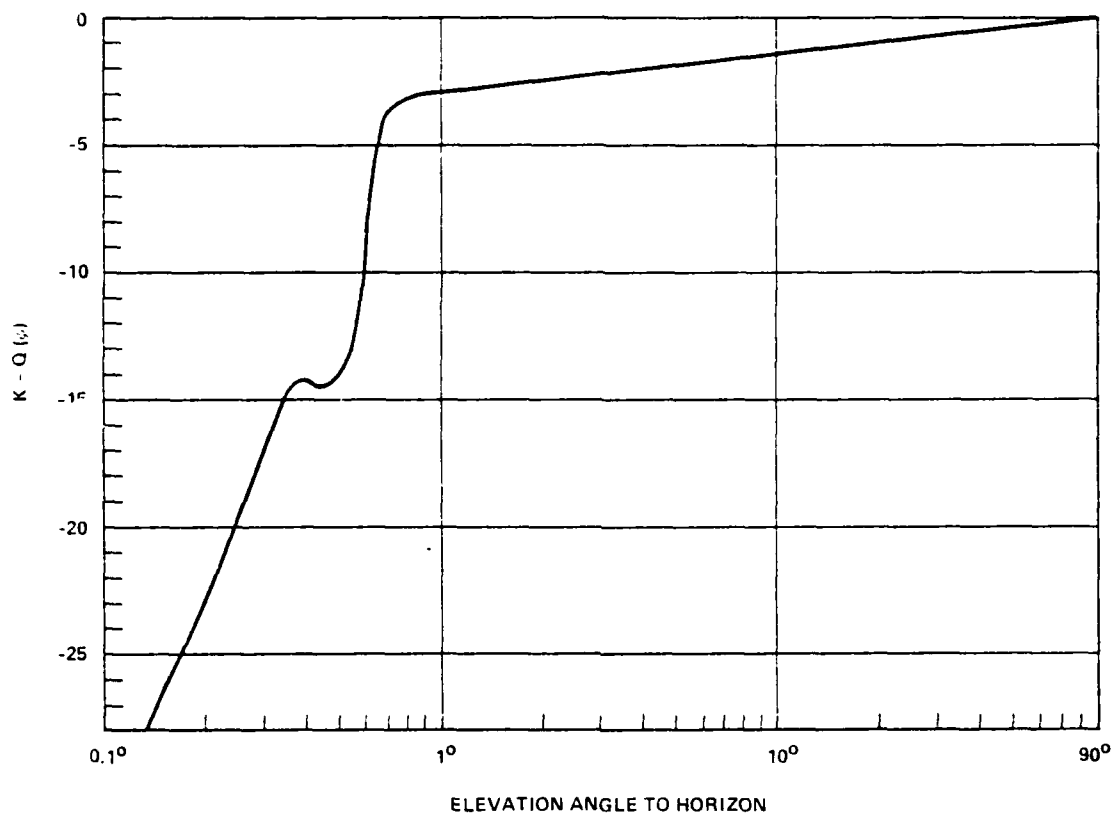


Figure 4-7. Combined Multipath and Clutter Effects

- c) Use in elevated gun position.

One solution was to remove the reflecting surface. The best method to remove surface scatters was to raise the gun to a height considerably higher than the scattering surface. This was accomplished by having a firing site on a hill or bluff firing horizontally away from them. This removed both the clutter and multipath problems. The height needed above the reflecting surface was given by

$$H = R \sin \theta_{\min} = 0.016 R$$

where

$\theta_{\min}$ = elevation above surface where multipath effects start = 0.9 degree

R = Range of Acquisition Point to Radar.

4.3 CLUTTER REDUCTION

4.3.1 Multipath Reduction Techniques

All three techniques mentioned in Section 4.2 to reduce the multipath problems reduced the clutter effect. Figure 4-7 indicates that an increase in the lower elevation beam position of 0.2 degree corresponds to the slight clutter reduction of 1.0 dB. Removal of the scattering surface by firing from a raised position removed the clutter effect.

4.3.2 Use Pulse Compression during Acquisition

The use of pulse compression during acquisition reduced the clutter by another 1-2 dB. However, this was impractical due to the small range gate size (15 meters) used in pulse compression. At a Doppler velocity of 1000 meters per second the target remained in the range gate for only 15 milliseconds. Since the acquisition algorithms need the frames (approximately 25 milliseconds) to acquire the target, there was not sufficient processing time.

4.3.3 Delay Processing until Acquisition Time

Delaying the acquisition (search) processing until approximately the time the acquisition took place allowed one to use a lower threshold value, since the false alarm rate could be higher. A change from the current acquisition threshold of 80 to a track threshold of 50 allowed detection to occur at wide beamwidths of the antenna. This allowed use of a higher elevation beam for lower clutter intake and better detection criteria. This corresponded to about 0.1 degree improvement.

4.3.4 Increase Pulses per Frame

During the PEP program, the tracking software may be changed to allow the transmission and processing of an increased number of pulses per frame. The number of pulses was doubled or quadrupled. Each doubling of the number

of processed pulses improves the MTI improvement factor by a factor of three dB. This corresponded to the clutter improvement obtained by increasing the lower beam by 0.2 degree (however, no multipath improvement occurred).

The problem with doubling the number of pulses per second during acquisition was that the target could enter and leave the acquisition gate before acquisition occurred. If the number of pulses was doubled, the PRT remained the same, and in azimuth beamwidth was 0.5 degree; then the maximum permissible azimuth rate was 10 degrees per second. This was a higher azimuth rate than the ARBAT System had. This made use of an increase in the number of pulses per frame not worthwhile unless the PRT could be increased.

4.3.5 Improve the System Stability

The current transmitter, receiver, and frequency synthesizer were designed and constructed in the late 1960's as part of the AN/TPQ-26 radar. The measured MTI improvement factor was 25 dB. These equipment elements will be reconfigured during the RETROFIT program. Normal design procedures and modern components should result in a system MTI improvement factor of 40 dB. This would reduce the effect of clutter by 15 dB which corresponded to an increase of the lower elevation beam of 0.5 degree. The clutter level will be low enough to not affect the system when compared to the multipath problems which are not affected by the system stability improvement. There are no reasons to add the additional expense to design MTI improvements better than 40 dB in the transmitter, receiver and frequency synthesizer.

The following table is a list of the changes recommended to improve the ARBAT's capability to test low trajectory tank/antitank munitions.

Table 4-1. Recommended Changes to ARBAT

<u>Change</u>	<u>Problem*</u>	<u>Type</u>	<u>Improvement</u>	<u>When</u>	<u>Cost</u>
Raise the gun position	CM	procedure	great	immediately	slight
Reduce Tracking Lobe separation	CM	software	slight	PEP	slight
Offset Tracking	CM	software	slight	PEP	slight
Increase pulses per frame	C	software	slight	PEP	moderate
Reconfigure Transmitter, RCVR, synthesizer	C	hardware	moderate	retrofit	high
Delay Time of start of processing	C	software	slight	PEP	slight

1550-14

*Problems C = Clutter
M = Multipath

Section 5

CONCLUSION

Section 5

CONCLUSIONS

The goal of the Flat Trajectory Study was to determine if the current ARBAT System could be used for tank/antitank munition testing, and if not, what changes are necessary?

The existing ARBAT Radar System can be used to track and evaluate tank/antitank ammunition at YPG if the test configuration is designed to minimize the ARBAT low coverage imitation of multipath and clutter.

The Flat Trajectory Test, its analysis, and theoretical analysis indicated that the ARBAT System is limited by azimuth tracking problems due to high azimuth rate required in the higher QE firings, and by multipath caused angular errors for near flat trajectory tests to an elevation angle of 0.9 degree above the ground surface. Theoretical considerations indicate that this limits the testing to firings with QE angles above 20 mils, which is a considerably higher QE than currently used for the standard YPG tank/antitank munition tests and shows that the ARBAT cannot be used for current tests.

Assuming that the high azimuth rate tracking problems can be resolved, the multipath angular errors are seen to be the limiting factor in using the ARBAT for tank/antitank munition testing. There are two software changes which would help lower the minimum angle by 0.2 degree to a value of 0.7 degree. These are as follow:

- 1) Reduce the separation between the elevation sequential lobes
- 2) Track in an offset mode with the target closer to the lower beam.

Both of these solutions are straightforward and should be considered when time permits.

The primary solution for use of the ARBAT System for tank/antitank munition testing is to operate the test(s) in a manner where the reflecting surface is removed. A simple method of accomplishing this at YPG would be to reverse the direction of firing. Since the horizon has a slant of 0.4 degree, this would reduce the minimum radar elevation angle from 1.3 degrees to 0.9 degree. However, this still will not solve the problem. The best solution is to fire the weapon from a raised position such that the true elevation angle of the reflecting surface is greater than $0.9 + 0.3 = 1.2$ degrees.

It was not possible to obtain a good idea of the effect of clutter on the acquisition of the target due to the high azimuth rate and multipath problems. The solutions presented in the previous paragraphs will help to reduce the clutter problem. In addition, the use of modern design techniques and components should improve the MTI improvement factor by some 10-15 dB.

Section 6

RECOMMENDATIONS

Section 6

RECOMMENDATIONS

I do not recommend making extreme and expensive changes to the new receiver, transmitter and synthesizer since acquisition and tracking of tank/antitank munitions appears to be limited by multipath and not clutter.

However, the following table is a list of recommended changes to improve the ARBAT's capability to take part in tank/antitank munitions studies.

<u>Change</u>	<u>Problem*</u>	<u>Type</u>	<u>Improvement</u>	<u>when</u>	<u>Cost</u>
Test the gun off of a bluff	CM	procedure	great	immediately	slight
Reduce taking separation	CM	software	slight	PEP	slight
Offset tracking	CM	software	slight	PEP	slight
Increase pulses per frame	C	software	slight	PEP	moderate
Reconfigure transmitter, RCVR synthesizer	C	hardware	moderate	RETROFIT	moderate
Delay time of start of processing	C	software	slight	PEP	slight

*Problems

C = Clutter
M = Multipath

Appendix A

*SCOPE OF WORK FOR AN ARBAT
RADAR SYSTEM FLAT TRAJECTORY STUDY*

CONTINUATION SHEET
PART II-THE SCHEDULE
SECTION F-DESCRIPTION/SPECIFICATION
F.1 SCOPE OF WORK

Page 1 of 3

I-OBJECTIVES

SCOPE OF WORK
FOR
AN ARBAT RADAR SYSTEM
FLAT TRAJECTORY STUDY

1. OBJECTIVES

1.1 The contractor shall devote his resources and facilities for a period not exceeding 9 months to provide the following engineering services:

a. Conduct engineering tests at Yuma Proving Ground by tracking with ARBAT radar flat trajectory projectiles fired from 105mm gun.

b. Evaluate the test data.

c. Make recommendations for the ARBAT system improvement.

1.2 The ARBAT radar system, delivered by the contractor ITT Gilfillan, Inc to the government during the previous phase of this program, will be provided for use to the contractor as a Government Furnished Equipment. Projectiles to be tracked will be provided by the government (Yuma Proving Ground).

CONTINUATION SHEET
PART II-THE SCHEDULE
SECTION F-DESCRIPTION/SPECIFICATION
F.1 SCOPE OF WORK

Page 2 of 3

II-PROCEDURE

II-PROCEDURE

1. This program will involve field testing the ARBAT prototype radar system, analyzing the test results and making recommendations.
2. Initial Test Investigation. The contractor shall conduct tests at the Yuma Proving Ground using flat trajectory weapons, to be fired in anti-tank configuration and attempt tracking with the ARBAT system in its present configuration.
3. System Study. During this phase the contractor shall study and analyze the test results and system performance.
4. System Improvement Recommendations. During this phase the improvements to the existing system shall be considered in detail and the necessary changes to the system for tracking of the anti-tank, flat trajectory ammunition will be recorded.

III-REQUIREMENTS

III-REQUIREMENTS

1. The work under this contract shall be performed in accordance with the following requirements and in accordance with any other terms, conditions and requirements as may be reflected herein:

2. Initial Test Investigations

A series of test rounds shall be fired using the flat trajectory weapons with the weapon adjusted to fire at relatively high elevation angles. After these initial rounds are fired then the weapon elevation angle would be gradually reduced and further tracking attempted as the weapon is brought closer to its normal flat trajectory firing position. The ARBAT radar system, in the present configuration shall be exercised to achieve the intercept and track of the above targets. At the end of this initial test period the results shall be reviewed and the data developed would become a basis for the next step in the overall effort.

The Government shall provide the anti-tank ammunition test firings, the timing of which shall be coordinated with the availability of the ARBAT Radar for these flat trajectory tests. The number of test round firings used for this study shall be based on the above equipment availability during the scheduled program period for these tests.

3. System Study and Analysis

During this phase of the effort the initial test data obtained in F.1.III.2 will be thoroughly evaluated with respect to characterizing the current system and to specifying improvements to the existing system through software and hardware changes.

4. System Improvement Recommendations

During this phase the improvements to the existing system will be reviewed and formally proposed. A careful attempt will be made to separate the minor/major changes in both hardware and software. These changes will become the basis of a final deliverable report at the end of this phase, stating system improvement recommendations to be incorporated in future ARBAT Systems.

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Appendix B

TEST PROGRAM PLAN

10/7/80

TEST PROGRAM PLAN

FLAT TRAJECTORY PHASE I

Test to be conducted at YPG utilizing ARBAT System. Test tentatively scheduled for the week starting October 20, 1980, this date based upon availability of ARRADCOM funding to be made available to ITTG prior to the above start date.

Gun Site #16 have been reviewed and chosen for the Flat Trajectory Study. 105MM & 90mm have selected as most applicable ammunition to be utilized.

45 round are requested for the first days firing program. Firing should begin at 8:30 a.m.

20 Rounds of 105 mm

Subject to availability

25 Rounds of 90 mm

The following firing table applies:

105mm (STD)

Warm up rounds - as prescribed by firing officer

<u># of RD's</u>	<u>Charge</u>	<u>QE</u>	<u>AZ = 90°</u>
5	#7	600	
5	#7	900	
5	#7	1200	
5	#7	300	

90mm (Anti Tank) (FTE 90-N-2)

5	300
5	250
5	200
5	175
5	150

TEST PROGRAM PLAN CONTINUED

Procedure:

1. W.E. Devereux will be the designated ITTG Test Director and responsible for Technical Direction.
ITTG personnel will start one hour early on this day and follow normal pre-fire menu and set up tables.
3. ITTG/Government personnel will insure that communication network and gun fire switching is operational.
4. Radar will be operational and tracking will be attempted on warm up rounds.
5. Firing officer should plan for five minutes between each round.
6. ITTG Test Director (W. Devereux) can specify longer or shorter intervals as firing progresses.
7. It is anticipated that if the radar is adequately tracking the first three rounds of any one (group) QE that the ITTG Test Director can communicate with the firing officer and proceed to next QE if desired.
8. In the event the radar is not tracking as anticipated, the ITTG Test Director will communicate with the firing officer and request a delay in the firing program and approximate the timing delay required to affect a software/hardware change.
9. It is expected that the firing program will proceed smoothly and without interruption barring some unforeseen catastrophe.
10. Data from this test will be analyzed by ITTG Personnel and results transmitted to the Government Representatives.
11. ITTG Test Director will communicate with YPG Personnel and schedule succeeding test for this Flat Trajectory Study.

Appendix C

ARBAT OPERATIONAL LOG BOOK

QUTP

19 OCT 80 FLAT TRAJ. F.O. F. JOHNSTON S.P. 17
 105 MM Q.E. #600M CHG. 7 L/F 90°
 DATA BASE 029.DB ANT. TILT = 20° MAG. TAPE # 29101 I.T. 75MS
 GUN X = 32116.095, Y = 35286.110, Z = 167.807
 P.E. W. DEVEREUX ITTG

TUBE #	FILE #	DESCRIPTION	ADDITIONAL INFO
576		PREMATURE INTERRUPT FROM GUN	NO DATA
577	0	GOOD TRACK	FULL
578	1	FULL TRACK	
579	2	FULL TRACK	ERROR RETURN
580	3	NOISE	NO TRACK
581	4	NOISE	NO TRACK Q.E. 700M I.T. 50MS
582	5	NO TRACK	029.A
583	6	FULL TRACK	029.B RCS 10^{-5} , D LOEF. 1035 To MATCH TIME AT TRIT. TOP
584	7	NO TRACK, NOISE	
585	0	FULL TRACK	TAPE # 29102
586	1	F.T.	QE=1100 TE=400MSEC EL=12.48° 029.C
587	2	FULL TRACK	
588	3	FULL TRACK	
589	4	FULL TRACK	ERROR RETURN
590	5	FULL TRACK	
591	6	FULL TRACK	Q.E. 300M I.T. 115MS 029.D
592	7	NO TRACK	
593	8	NO TRACK	NEW TAPE # 29103
594	9	FULL TRACK	RE-RATE 11.5 I.T. 225MS 029.E
595	10	NO TRACK	
596	11	FULL TRACK	
597	12	FULL TRACK	B.T. MALFUNCTION

LUNCH BREAK, WEAPON CHANGE

D. Rosner

RECORDED BY _____ DATE _____
 WITNESSED & UNDERSTOOD _____ DATE _____ CONTINUED
 WITNESSED & UNDERSTOOD _____ DATE _____ ON PG. _____

JOB NO.

GOVT. CLASSIF.

SUBJECT

EQUIP.

7

7 OCT 80 CONT'D 90MM Q.E. 300M, ANT. TILT 30° I.T. 400MS

DATA BASE 029.F

L/F 35°

MAG. TAPE # 29104

G. COORD. X = 32115.925, Y = 35292.437, Z 167.544

TUBE #

FILE #

1	0	NO DETECTION	
2	1	NO DETECTION	
3	2	DETECTION, NO TRACK	RCS 1×10^{-5}
4	3	DETECTION, NO TRACK	I.T. 500MS
5	4	DETECTION, NO TRACK	I.T. 600MS
6	5	DETECTED ?	400 Q.E.
7	6	" ?	
	7		NOISE RECORD
8	8	MISSSED	
9	9	DETECTED	I.T. 700MS
10	10	FULL TRACK	RCS 1×10^{-4}
11	11	DETECTED	
12	12	DETECTED	I.T. 500MS
13	13	SHORT TRACK ≈ 1 SEC	
14	14	SHORT TRACK $\approx .5$ SEC	
15	0	DETECTED, NO TRACK	NEW TAPE 29105
16	1	DETECTED	
17	2	DETECTED	
18	3	"	
19	4	"	
20	5	"	RCS INCREASED TO 1×10^{-2}

TEST HALTED.

D. Rozner

RECORDED BY _____ DATE _____

WITNESSED & UNDERSTOOD _____ DATE _____ CONTINUED

WITNESSED & UNDERSTOOD _____ DATE _____ ON PG _____

JOB NO.

GOVT. CLASSIF.

8

SUBJECT

EQUIP.

31 OCT 80 FLAT TRAJECTORY F.O. F. JOHNSTON G.P. 17
 105 MM Q.E. 300 m CHARGE L/F 85° MV 731.5 M/S
 GUN $X = 32102.997$, $Y = 35226.318$, $Z = 167.098$
 DATA BASE 031.DB MAG. TAPE # 31101 ANTENNA TILT = 20°
 P.E. W. DEVEREUX ITTG.
 RAND B. ROSEN, RECORDER

TUBE # FILE #

101	→	PROGRAM HUNG UP, RECYCLED	
102	0	FULL TRACK	
103	1	FULL TRACK	
104	2	FULL TRACK	
105	3	FULL TRACK	Q.E. 250 m (1 LINE)
106	4	NO TRACK, DETECTED	ANT. TILT OFF SLIGHTLY
107	5	DETECTED	

GRAVHED PREVIOUS TARGETS TO DETERMINE WHY NO TRACKS. TARGET APPEARED
 TO BE ON EDGE OF AZIMUTH BEAM. TRACKED 18 REFLECTOR TO DETERMINE
 AZ. BIAS. ADJUSTED AZ BIAS. (-.58)

108	6	DETECTED	RECHECKED DATA, ADJUSTING BIAS
109	7	DETECTED	
110	8	FULL TRACK	
111	9	≈ 80% TRACK	
112	10	FULL TRACK	Q.E. 200 m
113	11	FULL TRACK	
114	12	FULL TRACK	Q.E. 175 m
115	13	DETECTED, VERY SHORT TRACK ≈ 1 SEC	
116	14	FULL TRACK	
117	15	FULL TRACK	Q.E. 150 m
118	16	FULL TRACK	Q.E. 125 m
119	17	FULL TRACK	Q.E. 100 m
120	18	FULL TRACK ?	Q.E. 75 m

END OF TEST

RECORDED BY _____ DATE _____

WITNESSED & UNDERSTOOD _____ DATE _____ CONTINUED

WITNESSED & UNDERSTOOD _____ DATE _____ ON PG. _____

JOB NO.

GOVT. CLASSIF.

SUBJECT

EQUIP.

9

G.P. 17

NOV 80 FLAT TRAJECTORY F.O. H. SMITH

105MM Q.E. 200 m L/F 85°

GUN X=32102.997, Y=35226.318, Z 167.098

DATA BASE N4.DB MAG. TAPE # 04111

ANTENNA TILT=20°

P.E. W. DEVEREUX ITTG

RECORDER: Daniel B. Rosen

TUBE #

FILE #

121

0

FULL TRACK

200 m Q.E.

122

1

FULL TRACK

123

2

DETECTION

124

3

SHORT TRACK ≈ 2 SEC.

100 m Q.E.

125

4

SHORT TRACK ≈ 2 SEC.

AZ BIAS -4.5

126

5

FULL TRACK

MAG. TAPE # 04112

Q.E. 150 m

127

1

FULL TRACK

150 m

128

2

FULL TRACK

EL LOBE (SEARCH)

129

3

DETECTED

N4A.DB

Q.E. 100 m

130

4

FULL TRACK

100 m

N4A.DB

131

5

FULL TRACK

132

6

≈ 50% TRACK

QE 80 m

133

7

DETECTED ?

134

8

DETECTED

80 m

135

9

DETECTED

N4B.DB

136

10

FULL TRACK

N4C.DB

EL BIAS -.1

137

11

DETECTED

N4D.DB

Q.E. 70 m

138

12

DETECTED

139

13

DETECTED

N4E.DB

140

14

DETECTED

END OF 105MM TEST

RECORDED BY _____ DATE _____

WITNESSED & UNDERSTOOD _____ DATE _____ CONTINUED

WITNESSED & UNDERSTOOD _____ DATE _____ ON PG. _____

JOB NO.

GOVT. CLASSIF.

10 SUBJECT

EQUIP

4 NOV 80 FLAT TRAJECTORY 90 MM G.P. 17 F.O. H. SMITH
 P.E. W. DEVEREUX ITTG DATA BASE N4F.DB L/F 85°

GUN: X = 32115.925, Y = 35292.437, Z = 167.544. ANTENNA TILT = 20°

MAG. TAPE # 04113

RECORDER: Daniel B. Rosner

TUBE # FILE #

21	0	DETECTED	Q.E. 300m
22	1	MISS PROB. DETECTION	N4G.DB
23	2	DETECTED	N4H.DB
24	3	DETECTED (NO Z.T.)	N4I.DB
25	4	DETECTED	N4J.DB

END OF TEST

RECORDED BY _____ DATE _____

REVIEWED & UNDERSTOOD _____ DATE _____ CONTINUED

REVIEWED & UNDERSTOOD _____ DATE _____ ON PG. _____

JOB NO.

GOVT. CLASSIF.

12

SUBJECT

EQUIP.

07 NOV 80 FLAT TRAJECTORY TEST F.O. H. SMITH G.P. 17

90 MM 4F 85°

P.E. W. DEVEREUX ITTG DATA BASE N7.DB

ANTENNA TILT = 20°

GUN: X = 32115.925, Y = 35292.437, Z = 167.544 MAGNETIC TAPE # 07111

RECORDER: D. ROSNER

TUBE #	FILE #	Q.E. 300 m
26	0 DETECTED	
27	1 DETECTED, D.B. = N7A.DB, RES = 10 ⁻³ , THRES = 60.50, EL = 15	
28	2 DETECTED	N7B.DB
29	3 DETECTED? NO	N7C.DB
30	4 DETECTED	N7D.DB
31	5 TRIED TO TRACK	N7E.DB
32	0 FULL TRACK NEW TAPE # 07112	N7F.DB
33	1 DROPPED TRACK	
34	2 FULL TRACK	N7G.DB
35	3 DETECTED	
36	4 DROPPED TRACK EL LOBE	N7H.DB Q.E. 200 m
37	5 FULL TRACK	N7I.DB
38	6 FULL TRACK	
39	7 FULL TRACK	N7J.DB Q.E. 100 m
40	8 FULL TRACK	~~Q.E. 50 m~~
41	9 SHORT TRACK ≈ 2 SEC	N7K.DB Q.E. 50 m
42	10 FULL TRACK	N7L.DB
43	11 SHORT TRACK ≈ 2 SEC	
44	12 DROPPED TRACK SHORTLY AFTER DETECTION.	
45	13 FULL TRACK	

END OF TEST

RECORDED BY _____ DATE _____

WITNESSED & UNDERSTOOD _____ DATE _____ CONTINUED

WITNESSED & UNDERSTOOD _____ DATE _____ ON PG. _____

Appendix D
GUNFIRE EVENT DATA

TIME OF FLIGHT:	43.533 SEC	X(CYF61)	4416.51 M	NR6(CARPA1)	1243.490 E	WZRG(CARD)	1.000 57 D
IMPACT ANGLE:	600.000 DEG	Y(CYF61)	36153.470 M	67(CARPA1)	87.756 DEG	DC11(CGORD)	10.000 61 C
IMPACT VELOCITY:	.000 M/SEC	Z(CYF61)	176.40 M	11(ALPHA1)	.000 DEG	60(CORD)	8.000 56 M
EXTRAPOLATION:	33.634 SEC						

LIVEL SUMMARY OF TUBE ROUND NUMBER 78 (MATED 08/10/80) 10:37:18

TIME: 105 FLAT

LINKING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09129121 (59361.260 Z)

TIME OF FIRE:	90.000 DEG	XCVF01	32116.07 M	HRG (ARHAT)	68.070 M	HZRRG (CUR)	000 M
QUADRANT EL:	600.000 MILES	YCVF01	35286.11 M	AZ (ARHAT)	11.050 DEG	DR31 (CUR)	000 M
MUZZLE VELOCITY:	494.000 M/SEC	ZCVF01	167.41 M	EL (ARHAT)	120 DEG	AL (CUR)	000 M

***** ACQUIRE ***** OCCURRED AT 09129121 (59361.260 Z)

TIME TO ACQUIRE:	.048 SEC	XCVF01	32142.73 M	HRG (ARHAT)	707.403 M	HZRRG (CUR)	200 M
		YCVF01	35287.57 M	AZ (ARHAT)	11.050 DEG	DR31 (CUR)	000 M
		ZCVF01	185.59 M	EL (ARHAT)	120 DEG	AL (CUR)	000 M

***** IMPACT ***** OCCURRED AT 09130104 (59404.430 Z)

TIME OF FLIGHT:	43.279 SEC	XCVF01	44652.48 M	HRG (ARHAT)	1342.170 M	HZRRG (CUR)	17776.80 M
IMPACT ANGLE:	600.000 DEG	YCVF01	36150.58 M	AZ (ARHAT)	87.410 DEG	DR31 (CUR)	806.25 M
IMPACT VELOCITY:	.000 M/SEC	ZCVF01	176.60 M	EL (ARHAT)	1001 DEG	AL (CUR)	000 M
EXTRAPOLATION:	33.331 SEC						000 M

EVENT SUMMARY OF TUBE ROUND NUMBER 79 CREATED 08/12/61 10:37:50

TITLE: 105 FLAT

FIRING DATE: 10/29/60

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:31:11 (59471.126 Z)

LINE OF FIRE:	90.000 DEG	X(YPG): 32116.09 M	NHG(CARRAT):	483.070 M	HZNRG(CORD):	.00 M
QUADRANT EL:	600.000 MILS	Y(YPG): 35286.11 M	AZ(CARRAT):	112.530 DEG	DRGT(CORD):	.00 M (0.8115)
MUZZLE VELOCITY:	494.000 M/SEC	Z(YPG): 167.61 M	IL(CARRAT):	1.129 DEG	ALT(CORD):	.00 M

***** ACQUINE ***** OCCURRED AT 09:31:11 (59471.200 Z)

TIME TO ACQUINE:	.672 SEC	X(YPG): 32137.71 M	NHG(CARRAT):	700.930 K	HZNRG(CORD):	21.12 M
		Y(YPG): 35291.25 M	AZ(CARRAT):	111.400 DEG	DRGT(CORD):	50.15 M (20.0015)
		Z(YPG): 186.30 M	IL(CARRAT):	1.392 DEG	ALT(CORD):	18.49 M

***** IMPACT ***** OCCURRED AT 09:31:53 (59513.560 Z)

LINE OF FLIGHT:	42.379 DEG	X(YPG): 44018.43 M	NHG(CARRAT):	12542.370 K	HZNRG(CORD):	1190.74 M
IMPACT ANGLE:	608.000 DEG	Y(YPG): 36136.38 M	AZ(CARRAT):	87.309 DEG	DRGT(CORD):	800.70 M (27.0000)
IMPACT VELOCITY:	.000 M/SEC	Z(YPG): 176.60 M	IL(CARRAT):	.000 DEG	ALT(CORD):	8.09 M
EXTINQUISHMENT:	32.507 SEC					

EVENT SUMMARY OF TUBE ROUND NUMBER 80 (RELATED OR/1/1/81 10:32:56)

TITLE: 105 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

**** GUNFIRE ***** OCCURRED AT 09133.10 (59550.918 Z)

TIME OF FIRE:	50.000 DEG	X (YFG): 32116.09 M	RHS (CARB):	083.070 R	HZARC (GUD):	0.00 M
QUADRANT EL:	600.000 M115	Y (YFG): 35584.11 M	RZ (CARB):	112.520 D16	DR3 (GUD):	0.00 M
MUZZLE VELOCITY:	494.000 M/SEC	Z (YFG): 167.11 M	L1 (CARB):	123 D16	AL1 (GUD):	0.00 M

**** ACQUINE ***** OCCURRED AT 09133.11 (59551.000 Z)

TIME TO ACQUINE:	.002 SEC	X (YFG): 32140.49 M	LRB (CARB):	704.739 R	HZARC (GUD):	0.00 M
		Y (YFG): 35596.13 M	RZ (CARB):	111.431 D16	DR3 (GUD):	0.00 M
		Z (YFG): 187.34 M	L1 (CARB):	1470 D16	AL1 (GUD):	0.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 81 (RELATED 08/17/81 10:38:00)

TITLE: 105 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

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##### GUNFIRE ##### OCCURRED AT 09137146 (59866.655 Z)
LINE OF FIRE: 90.000 DEG + X(VFG) 32116.09 M + RUG(ARBAT) 680.070 K + HZRG(CORD) 1.00 M + G R 11 S)
QUADRANT EL: 900.000 MILS + Y(VFG) 35386.11 M + AZ(ARBAT) 113.530 DEG + DEPT(CORD) 1.00 M + G R 11 S)
MUZZLE VELOCITY: 494.000 M/SEC + Z(VFG) 187.61 M + FI(ARBAT) 1.123 DEG + ALT(CORD) 1.00 M + G R 11 S)

##### ACQUIRE ##### OCCURRED AT 09137146 (59866.760 Z)
TIME TO ACQUIRE: .045 SEC + X(VFG) 32125.38 M + RUG(ARBAT) 690.665 K + HZRG(CORD) 9.779 M + G R 11 S)
+ Y(VFG) 35389.77 M + AZ(ARBAT) 113.592 DEG + DEPT(CORD) 5.17 M + G R 11 S)
+ Z(VFG) 185.77 M + FI(ARBAT) 1.328 DEG + ALT(CORD) 17.76 M

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EVENT SUMMARY OF TUBE ROUND NUMBER 82 (RELATED 08/17/81) 10:28:10

TIME: 105 FLAT

LOADING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:42:36 (60156.942 Z)

TIME OF FIRE:	90.000 DEG	X(VFG): 35116.09 M	ERG(CERBAT):	683.070 R	HZERG(CURD):	1.00 M
QUADRANT EL:	900.000 MILS	Y(VFG): 35284.31 M	67(CARBAT):	112.530 DEG	DELT(CURD):	1.00 M
MUZZLE VELOCITY:	494.000 M/SEC	Z(VFG): 167.41 M	11(CARBAT):	123 DEG	ALT(CURD):	1.00 M

***** ACQUIRE ***** OCCURRED AT 09:42:36 (60156.900 Z)

TIME TO ACQUIRE:	1.550 SEC	X(VFG): 35158.80 M	ERG(CERBAT):	725.746 R	HZERG(CURD):	43.71 M
		Y(VFG): 35092.22 M	67(CARBAT):	110.752 DEG	DELT(CURD):	6.11 M
		Z(VFG): 243.44 M	11(CARBAT):	5.009 DEG	ALT(CURD):	75.63 M

***** UNKNOWN ***** OCCURRED AT 09:42:38 (60157.456 Z)

TIME TO EVENT:	2.116 SEC	X(VFG): 35115.82 M	ERG(CERBAT):	686.972 R	HZERG(CURD):	3.73 M
EVENT VELOCITY:	6.992 M/SEC	Y(VFG): 35099.30 M	67(CARBAT):	111.385 DEG	DELT(CURD):	1.170 M
		Z(VFG): 236.43 M	11(CARBAT):	5.220 DEG	ALT(CURD):	65.62 M

EVENT SUMMARY OF TUBE ROUND NUMBER 83 (RELATED OR/17/8) 10:38:49

TITLE: 105 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09150146 (60646.222 Z)

LINE OF FIRE:	90.000 DEG	X(YFG)1 32116.09 M	HRG(CARHAT):	283.070 E	HRG(CARHAT):	0.00 M
QUADRANT ELI:	900.000 MILS	Y(YFG)1 35286.11 M	AZ(CARHAT):	117.530 DEG	DECI(CARHAT):	0.00 M
NOZZLE VELOCITY:	494.000 M/SEC	Z(YFG)1 167.61 M	LI(CARHAT):	1120 DEG	ALTI(CARHAT):	0.00 M

***** ACQUIRE ***** OCCURRED AT 09150146 (60646.400 Z)

TIME TO ACQUIRE:	.178 SEC	X(YFG)1 32171.79 M	HRG(CARHAT):	730.280 E	HRG(CARHAT):	50.00 M
		Y(YFG)1 35290.49 M	AZ(CARHAT):	110.540 DEG	DECI(CARHAT):	4.00 M
		Z(YFG)1 240.12 M	LI(CARHAT):	5.510 DEG	ALTI(CARHAT):	77.01 M

***** IMPACT ***** OCCURRED AT 09151128 (60646.323 Z)

TIME OF FLIGHT:	42.101 SEC	X(YFG)1 37560.14 M	HRG(CARHAT):	647.350 E	HRG(CARHAT):	5786.00 M
IMPACT ANGLE:	900.000 DEG	Y(YFG)1 35540.64 M	AZ(CARHAT):	80.450 DEG	DECI(CARHAT):	694.00 M
IMPACT VELOCITY:	8.992 M/SEC	Z(YFG)1 176.00 M	LI(CARHAT):	1000 DEG	ALTI(CARHAT):	8.79 M
EXTRAPOLATION:	32.273 SEC					

EVENT SUMMARY OF TUBE ROUND NUMBER 84 RELATED 00/17/81 10:30:56

TITLE: 105 FIAT

FIRING DATE: 10/29/80

DESCRIPTION:

11111 GUNFIRE 11111 OCCURRED AT 09:52:59 (60779.904 Z)

LINE OF FIRE:	90.000 DEG	X(VPG):	32116.09 M	RHC(ARBAT):	683.070 M	HZLRG(CORD):	0.00 M
QUADRANT FL:	900.000 M115	Y(VPG):	35286.11 M	62(ARBAT):	117.550 DEG	DETH(CORD):	0.00 M
MUZZLE VELOCITY:	494.000 M/SEC	Z(VPG):	167.81 M	11(ARBAT):	.123 DEG	ALT(CORD):	0.00 M

11111 ACQUIRE 11111 OCCURRED AT 09:53:00 (60780.100 Z)

TIME TO ACQUIRE:	.196 SEC	X(VPG):	32176.48 M	RHC(ARBAT):	735.497 M	HZLRG(CORD):	0.00 M
		Y(VPG):	35291.70 M	62(ARBAT):	110.324 DEG	DETH(CORD):	0.00 M
		Z(VPG):	240.57 M	11(ARBAT):	0.554 DEG	ALT(CORD):	0.00 M

	TIME OF FLIGHT	33.275 SEC	X(VFO1)	35846.56 M	Y(VFO1)	7473.747 M	HEIGHT(GND)	4224.06 M
	IMPACT ALTITUDE	900.000 DEG	X(VFO0)	35541.49 M	Y(VFO0)	86.978 DEG	HEIGHT(GND)	4224.06 M
	IMPACT VELOCITY	6.992 M/SEC	X(VFO1)	176.40 M	Y(VFO1)	105.6 DEG	HEIGHT(GND)	8.275 M
	EXTRAPOLATION	33.395 SEC						

EVENT SUMMARY OF TUBE ROUND NUMBER 86 CREATED 06/17/81 10140116

TITLE: 105 FIAT

FINING DATE: 10/29/80

DESCRIPTION:

111111 GUNFIRE 111111 OCCURRED AT 10:05:45 (61345.015 Z)

TIME OF FIRE: 90.000 DEG X(VFG): 32116.69 M Y(BHC(CARBA)): 682.070 M Y(HZRC(CURD)): 100 M
 QUADRANT EL: 1100.000 MILS Y(VFG): 35266.11 M Y(AZ(CARBA)): 112.230 DEG Y(DRT(CURD)): 100 M
 MUZZLE VELOCITY: 494.000 M/SEC Y(ZVFG): 167.83 M Y(L(CARBA)): 123 DEG Y(ALT(CURD)): 100 M

111111 ACQUIRE 111111 OCCURRED AT 10:05:45 (61345.400 Z)

TIME TO ACQUIRE: .381 SEC X(VFG): 32764.14 M Y(BHC(CARBA)): 781.463 L Y(HZRC(CURD)): 88.00 M
 Y(VFG): 35290.51 M Y(AZ(CARBA)): 109.707 DEG Y(DRT(CURD)): 9.00 M
 Y(ZVFG): 334.68 M Y(L(CARBA)): 12.725 DEG Y(ALT(CURD)): 107.00 M

111111 IMPACT 111111 OCCURRED AT 10:06:44 (61604.253 Z)

TIME OF FLIGHT: 58.735 SEC X(VFG): 35428.50 M Y(BHC(CARBA)): 7976.805 E Y(HZRC(CURD)): 7.50 M
 IMPACT ANGLE: 1100.000 DEG Y(VFG): 35592.07 M Y(AZ(CARBA)): 86.756 DEG Y(DRT(CURD)): 700.00 M
 IMPACT VELOCITY: 6.992 M/SEC Y(ZVFG): 176.60 M Y(L(CARBA)): 100 DEG Y(ALT(CURD)): 8.00 M
 EXTRAPOLATION: 49.854 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 87 (RELATED 08/12/01 10:41:26)

TITLE: 105 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10:08:45 (61725.689 Z)

LINE OF FIRE:	90.000 DEG	X(VPG) 32116.09 M	RNG(ARPA):	280.070 M	H/RNG(CORD):	1.00 M	G (E) (S)
QUADRANT EL:	1100.000 MILS	Y(VPG) 35286.11 M	AZ(ARPA):	112.250 DEG	DRG(CORD):	1.00 M	
MUZZLE VELOCITY:	494.000 M/SEC	Z(VPG) 167.01 M	EL(ARPA):	1.170 DEG	AL(CORD):	1.00 M	

***** ACQUINE ***** OCCURRED AT 10:08:45 (61725.400 Z)

TIME TO ACQUIRE:	.361 SEC	X(VPG) 32767.50 M	RNG(ARPA):	780.720 M	H/RNG(CORD):	91.81 M	
		Y(VPG) 35286.11 M	AZ(ARPA):	108.710 DEG	DRG(CORD):	2.75 M	
		Z(VPG) 356.57 M	EL(ARPA):	12.293 DEG	AL(CORD):	148.77 M	

***** IMPACT ***** OCCURRED AT 10:09:35 (61725.776 Z)

TIME OF FLIGHT:	50.737 SEC	X(VPG) 35562.56 M	RNG(ARPA):	8104.848 M	H/RNG(CORD):	7466.48 M	
IMPACT ANGLE:	1100.000 DEG	Y(VPG) 35656.54 M	AZ(ARPA):	87.253 DEG	DRG(CORD):	210.82 M	
IMPACT VELOCITY:	6.992 M/SEC	Z(VPG) 176.40 M	EL(ARPA):	1.057 DEG	AL(CORD):	8.79 M	
EXTRAPOLATION:	40.826 SEC						

EVENT SUMMARY OF TUBE ROUND NUMBER 88 (CREATED 08/17/61 10:42:05)

TITLE: 105 FLAT

FIRING DATE: 10/29/60

DESCRIPTION:

44444 GUNFIRE 444444 OCCURRED AT 10:10:59 (61859.665 Z)

TIME OF FIRE: 90.000 DEG X(VTG): 3216.05 M RHG(CARRAT): 483.070 M HZRRG(CUR): 1.00 M
 QUADRANT EL: 1100.000 MILS Y(VTG): 35286.11 M AZ(CARRAT): 112.530 DEG DR1(CUR): 1.00 M
 MUZZLE VELOCITY: 494.000 M/SEC Z(VTG): 167.61 M EL(CARRAT): 1173 DEG AL(CUR): 1.00 M

44444 ACQUIRE 444444 OCCURRED AT 10:11:00 (61860.080 Z)

TIME TO ACQUIRE: 1.385 SEC X(VTG): 32762.52 M RHG(CARRAT): 779.961 M HZRRG(CUR): 24.57 M
 Y(VTG): 35591.54 M AZ(CARRAT): 109.621 DEG DR1(CUR): 5.83 M
 Z(VTG): 535.45 M EL(CARRAT): 12.301 DEG AL(CUR): 167.60 M

44444 IMPACT 444444 OCCURRED AT 10:11:54 (61914.662 Z)

TIME OF FLIGHT: 54.598 SEC X(VTG): 46176.72 M RHG(CARRAT): 869.090 M HZRRG(CUR): 800.03 M
 IMPACT ANGLE: 1100.000 DEG Y(VTG): 54684.79 M AZ(CARRAT): 87.770 DEG DR1(CUR): 1.00 M
 IMPACT VELOCITY: 6.992 M/SEC Z(VTG): 176.60 M EL(CARRAT): 1.008 DEG AL(CUR): 8.72 M
 EXTRAPOLATION: 45.113 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 89 CREATED 08/17/81 10:42:49

TITLE: 105 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10:13:20 (62060.326 Z)

LINE OF FIRE: 90.000 DEG X(VPG) 32116.09 M HRS(CARRAT): 683.070 M HZ(RHG(CGND): .00 M (0 K115)
 QUADRANT EL: 1100.000 MILS Y(VPG) 35288.11 M AZ(CARRAT): 117.520 DEG DRCT(CGND): .00 M (0 K115)
 MUZZLE VELOCITY: 494.000 M/SEC Z(VPG) 167.81 M EL(CARRAT): .120 DEG ALT(CGND): .00 M

***** ACQUIRE ***** OCCURRED AT 10:13:20 (62060.700 Z)

TIME TO ACQUIRE: .374 SEC X(VPG) 35206.37 M HRS(CARRAT): 786.361 M HZ(RHG(CGND): 571.28 M (29 K115)
 Y(VPG) 35288.74 M AZ(CARRAT): 109.711 DEG DRCT(CGND): 41.43 M (29 K115)
 Z(VPG) 337.20 M EL(CARRAT): 17.350 DEG ALT(CGND): 169.39 M

***** IMPACT ***** OCCURRED AT 10:14:12 (62062.720 Z)

TIME OF FLIGHT: 52.395 SEC X(VPG) 34619.41 M HRS(CARRAT): 7041.305 M HZ(RHG(CGND): 670.332 M (88 K115)
 IMPACT ANGLE: 1100.000 DEG Y(VPG) 35821.00 M AZ(CARRAT): 81.477 DEG DRCT(CGND): 584.88 M (88 K115)
 IMPACT VELOCITY: 6.992 M/SEC Z(VPG) 176.40 M EL(CARRAT): .057 DEG ALT(CGND): 8.79 M
 EXTRAPOLATION: 42.521 SEC

FOUN SUMMARY OF TUBE ROUND NUMBER 90 (CREATED 08/10/01 10:42:00)

TITLE: 105 FLAT

FINING DATE: 10/29/86

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10:15:40 (62140.387 Z)

TIME OF FIRE: 90.000 DEG + X(YFG): 30116.09 M + RRG(CARHAT): 483.070 R + HZRRG(COHD): 1.00 M
 QUADRANT EL: 1100.000 MILS + Y(YFG): 35386.11 M + AZ(CARHAT): 112.530 DLG + DECT(COHD): 1.00 M
 MUZZLE VELOCITY: 494.000 M/SEC + Z(YFG): 147.61 M + EL(CARHAT): 123 DLG + AL(COHD): 1.00 M

***** ACQUIRE ***** OCCURRED AT 10:15:40 (62140.750 Z)

TIME TO ACQUIRE: 36.3 SEC + X(YFG): 34207.74 M + RRG(CARHAT): 783.750 R + HZRRG(COHD): 51.00 M
 + Y(YFG): 35386.95 M + AZ(CARHAT): 109.712 DLG + DECT(COHD): 2.00 M
 + Z(YFG): 334.44 M + EL(CARHAT): 12.287 DLG + AL(COHD): 148.04 M

***** IMPACT ***** OCCURRED AT 10:16:34 (62154.774 Z)

TIME OF FLIGHT: 54.388 SEC + X(YFG): 36757.38 M + RRG(CARHAT): 7763.473 R + HZRRG(COHD): 6671.30 M
 IMPACT ANGLE: 1100.000 DEG + Y(YFG): 35952.85 M + AZ(CARHAT): 86.804 DLG + DECT(COHD): 666.75 M
 IMPACT VELOCITY: 6.992 M/SEC + Z(YFG): 176.60 M + EL(CARHAT): 105B DLG + AL(COHD): 8.75 M
 EXTRAPOLATION: 44.475 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 91 CREATED 00/12/01 10:43:51

TITLE: 105 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10121129 (62489.985 Z)

LINE OF FIRE:	90.000 DEG	X (YPG) 32116.09 M	RNG (CARB) :	483.070 M	HZ (RNG-CURD) :	100 M
QUADRANT EL:	300.000 MILS	Y (YPG) 35286.11 M	AZ (CARB) :	112.500 DEG	DRCT (CURD) :	100 M
MUZZLE VELOCITY:	494.000 M/SEC	Z (YPG) 167.41 M	EL (CARB) :	112.500 DEG	ALT (CURD) :	100 M

***** ACQUIRE ***** OCCURRED AT 10121130 (62490.100 Z)

TIME TO ACQUIRE:	.115 SEC	X (YPG) 32194.68 M	RNG (CARB) :	256.048 M	HZ (RNG-CURD) :	28.75 M
		Y (YPG) 35287.58 M	AZ (CARB) :	110.143 DEG	DRCT (CURD) :	1.48 M
		Z (YPG) 196.76 M	EL (CARB) :	1.628 DEG	ALT (CURD) :	22.35 M

***** IMPACT ***** OCCURRED AT 10121133 (62513.637 Z)

TIME OF FLIGHT:	23.872 SEC	X (YPG) 36594.47 M	RNG (CARB) :	2516.403 M	HZ (RNG-CURD) :	68.75 M
IMPACT ANGLE:	300.000 DEG	Y (YPG) 35377.02 M	AZ (CARB) :	87.500 DEG	DRCT (CURD) :	483.000 M
IMPACT VELOCITY:	6.992 M/SEC	Z (YPG) 176.60 M	EL (CARB) :	1.056 DEG	ALT (CURD) :	8.75 M
EXTRAPOLATION:	13.957 SEC					

EVENT SUMMARY OF TUBE ROUND NUMBER 92 (RELATED OR/17/81 10:43:50)

TITLE: 105 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10:23:04 (62504.190 Z)

LINE OF FIRE:	90.000 DEG	X(VPG) 35116.05 M	RIG(CANBAT)	283.070 E	H/RRC(GOR)	0.00 M
GUADRANT EL:	300.000 MILS	Y(VPG) 35288.11 M	A7(CANBAT)	130.500 DEG	DIGIT(GOR)	0.00 M
MUZZLE VELOCITY:	494.000 M/SEC	Z(VPG) 167.41 M	LL(CANBAT)	123 DEG	AL(GOR)	0.00 M

***** ACQUIRE ***** OCCURRED AT 10:23:04 (62504.380 Z)

TIME TO ACQUIRE:	.155 SEC	X(VPG) 35176.42 M	RIG(CANBAT)	736.789 E	H/RRC(GOR)	40.73 M
		Y(VPG) 35294.72 M	A7(CANBAT)	130.100 DEG	DIGIT(GOR)	0.01 M
		Z(VPG) 188.53 M	LL(CANBAT)	123 DEG	AL(GOR)	21.17 M

EVENT SUMMARY OF TUBE ROUND NUMBER 93 CREATED 00/12/61 10:44:01

TITLE: 105 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10129158 (62958.852 Z)

LINE OF FIRE:	90.000 DEG	X(VPG): 32116.09 M	RHG(CARHAT):	283.070 M	12/RHG(CGR):	.00 M	0 (115)
QUADRANT EL:	300.000 MILS	Y(VPG): 35284.11 M	AZ(CARHAT):	117.130 DEG	DETH(CGR):	.00 M	
MUZZLE VELOCITY:	494.000 M/SEC	Z(VPG): 167.11 M	EL(CARHAT):	.123 DEG	ALT(CGR):	.00 M	

***** ACQUIRE ***** OCCURRED AT 10129159 (62959.000 Z)

TIME TO ACQUIRE:	.148 SEC	X(VPG): 32180.37 M	RHG(CARHAT):	740.783 M	12/RHG(CGR):	69.76 M	
		Y(VPG): 35292.75 M	AZ(CARHAT):	110.149 DEG	DETH(CGR):	6.24 M	104 (115)
		Z(VPG): 188.17 M	EL(CARHAT):	1.497 DEG	ALT(CGR):	20.76 M	

EVENT SUMMARY OF TUBE ROUND NUMBER 94 (CREATED 08/17/81 10:44:20)

TITLE: 165 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10132145 (63165.188 Z)

TIME OF FIRE:	90.000 DEG	X(VPG): 32116.69 M	IRRG(CARBAT):	683.070 M	0.00 M
QUADRANT EL:	300.000 MILS	Y(VPG): 35287.11 M	AZ(CARBAT):	117.530 DEG	0.00 M
MUZZLE VELOCITY:	494.000 M/SEC	Z(VPG): 167.41 M	EL(CARBAT):	1.122 DEG	0.00 M

***** ACQUIRE ***** OCCURRED AT 10132145 (63165.188 Z)

TIME TO ACQUIRE:	.162 SEC	X(VPG): 32216.36 M	IRRG(CARBAT):	778.433 M	102.77 M
		Y(VPG): 35287.86 M	AZ(CARBAT):	109.523 DEG	1.76 M
		Z(VPG): 197.22 M	EL(CARBAT):	2.057 DEG	29.41 M

***** IMPACT ***** OCCURRED AT 10133108 (63168.266 Z)

TIME OF FLIGHT:	23.098 SEC	X(VPG): 36176.04 M	IRRG(CARBAT):	7396.461 M	6755.95 M
IMPACT ANGLE:	300.000 DEG	Y(VPG): 35637.15 M	AZ(CARBAT):	87.758 DEG	551.08 M
IMPACT VELOCITY:	6.992 M/SEC	Z(VPG): 176.60 M	EL(CARBAT):	1.057 DEG	3.79 M
EXTRAPOLATION:	13.186 SEC				

EVENT SUMMARY OF TUBE ROUND NUMBER 95 (CREATED 08/12/81 10:44:26)

TITLE: 105 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

GUNFIRE ##### OCCURRED AT 10134119 (63259.756 Z)

TIME OF FIRE:	90.000 DEG	X (YPG) :	32116.09 M	RUC (ARRAT) :	683.070 M	HZRRG (GUR) :	.00 M	0 K115)
QUADRANT FI :	300.000 MILS	Y (YPG) :	35286.11 M	AZ (ARRAT) :	112.520 DEG	DR31 (GUR) :	.00 M	
MUZZLE VELOCITY:	494.000 M/SEC	Z (YPG) :	167.01 M	LI (ARRAT) :	.123 DEG	AL (GUR) :	.00 M	

ACQUINE ##### OCCURRED AT 10134119 (63259.950 Z)

TIME TO ACQUIRE:	.194 SEC	X (YPG) :	32214.77 M	RUC (ARRAT) :	774.173 M	HZRRG (GUR) :	90.67 M	4.3 K115)
		Y (YPG) :	35290.36 M	AZ (ARRAT) :	109.430 DEG	DR31 (GUR) :	4.26 M	
		Z (YPG) :	196.15 M	LI (ARRAT) :	1.989 DEG	AL (GUR) :	20.34 M	

EVENT SUMMARY OF TUBE ROUND NUMBER 2 (RATED 08/17/80) 1010745

TYPE: 165 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

16555 GUNFIRE 333333 OCCURRED AT 08:40:57 (56457.564 Z)

LINE OF FIRE: 85.000 DEG
 GUARDANT EL: 300.000 MILS
 MUZZLE VELOCITY: 731.500 M/SEC

33333 ACQUIRE 333333 OCCURRED AT 08:40:58 (56458.100 Z)

TIME TO ACQUIRE: .514 SEC
 X(VFG): 37446.48 M
 Y(VFG): 35286.05 M
 Z(VFG): 271.65 M

33333 UNKNOWN 333333 OCCURRED AT 08:41:02 (56460.124 Z)

TIME TO EVENT: 4.538 SEC
 EVLUT VELOCITY: 348.842 M/SEC
 X(VFG): 34422.36 M
 Y(VFG): 35429.59 M
 Z(VFG): 771.68 M

33333 IMPACT 333333 OCCURRED AT 08:41:26 (56464.294 Z)

TIME OF FLIGHT: 28.708 SEC
 IMPACT ANGLE: 300.000 DEG
 IMPACT VELOCITY: 1000 M/SEC
 EXTRAPOLATION: 18.794 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 3 CREATED 08/12/83 10:08:07

TITLE: 105 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

11111 GUNFIRE 111111 OCCURRED AT 08143118 (56598.282 Z)

LINE OF FIRE: 85.000 DEG X (YPG) 32163.00 M X (RGCARHAT) 656.495 M Y (ZERRC-GURD) 100 M
 QUADRANT EL: 300.000 MILS Y (YPG) 38226.52 M X (ZCARHAT) 117.493 DLG Y (RCHT-GURD) 100 M
 MUZZLE VELOCITY: 731.500 M/SEC Z (YPG) 167.10 M X (LLCARHAT) 1.179 DLG Y (ALTCURD) 100 M

11111 ACQUIRE 111111 OCCURRED AT 08143118 (56598.860 Z)

TIME TO ACQUIRE: .518 SEC X (YPG) 32446.50 M X (RGCARHAT) 100.436 M Y (ZERRC-GURD) 327.13 M
 Y (YPG) 38236.70 M X (ZCARHAT) 106.837 DLG Y (RCHT-GURD) 2.84 M
 Z (YPG) 271.50 M X (LLCARHAT) 5.897 DLG Y (ALTCURD) 104.40 M

11111 UNKNOWN 111111 OCCURRED AT 08143122 (56602.875 Z)

TIME TO EVENT: 4.593 SEC X (YPG) 34457.52 M X (RGCARHAT) 303.066 M Y (ZERRC-GURD) 236.321 M
 Y (YPG) 38431.62 M X (ZCARHAT) 97.253 DLG Y (RCHT-GURD) 1.20 M
 EVENT VELOCITY: 350.457 M/SEC Z (YPG) 772.51 M X (LLCARHAT) 11.473 DLG Y (ALTCURD) 203.31 M

11111 IMPACT 111111 OCCURRED AT 08143142 (56632.387 Z)

TIME OF FLIGHT: 24.105 SEC X (YPG) 36610.50 M X (RGCARHAT) 730.883 M Y (ZERRC-GURD) 672.13 M
 IMPACT ANGLE: 300.000 DEG Y (YPG) 38717.34 M X (ZCARHAT) 88.714 DLG Y (RCHT-GURD) 100.42 M
 IMPACT VELOCITY: .000 M/SEC Z (YPG) 1.00 M X (LLCARHAT) 1.393 DLG Y (ALTCURD) 107.10 M
 EXTRACTION: 14.187 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 4 (CREATED 08/17/80) 10:08:25

TITLE: 195 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

11111 GUNFIRE 111111 OCCURRED AT 08146108 (56768.292 Z)

LINE OF FIRE: 05.000 DEG XCVG1 32103.00 M RUCARRAT1: 652.492 M HZRRG-CORD: 100 M
 QUADRANT FL: 300.000 MILS YCVG1 35224.32 M AZARRAT1: 117.493 DEG DR11-CORD: 100 M
 MUZZLE VELOCITY: 731.500 M/SEC ZCVG1 167.10 M LIARRAT1: 1179 DEG AL1-CORD: 100 M

11111 ACQUIRE 111111 OCCURRED AT 08146108 (56768.800 Z)

TIME TO ACQUIRE: .508 SEC XCVG1 32441.42 M RUCARRAT1: 1004.754 M HZRRG-CORD: 100.00 M
 YCVG1 35257.51 M AZARRAT1: 100.000 DEG DR11-CORD: 100.00 M
 ZCVG1 273.58 M LIARRAT1: 5.947 DEG AL1-CORD: 100.00 M

11111 UNKNOWN 111111 OCCURRED AT 08146112 (56772.872 Z)

TIME TO EVENT: 4.284 SEC XCVG1 34471.64 M RUCARRAT1: 3045.403 M HZRRG-CORD: 2777.77 M
 YCVG1 35432.12 M AZARRAT1: 97.519 DEG DR11-CORD: 1.44 M
 EVENT VELOCITY: 349.122 M/SEC ZCVG1 273.72 M LIARRAT1: 11.433 DEG AL1-CORD: 200.00 M

11111 IMPACT 111111 OCCURRED AT 08146139 (56753.592 Z)

TIME OF FLIGHT: 25.308 SEC XCVG1 35103.05 M RUCARRAT1: 742.500 M HZRRG-CORD: 7017.27 M
 IMPACT ANGLE: 300.000 DEG YCVG1 35756.47 M AZARRAT1: 88.432 DEG DR11-CORD: 87.00 M
 IMPACT VELOCITY: .600 M/SEC ZCVG1 .00 M LIARRAT1: 1.772 DEG AL1-CORD: 167.10 M
 EXTRAPOLATION:

EVENT SUMMARY OF TUBE ROUND NUMBER 5 CREATED 08/12/01 10:00:45

TITLE: 105 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 08150107 (57007.554 Z)

LINE OF FIRE: 85.000 DEG X(YPG) 32105.60 M X(HG-CARBA1): 656.495 E X(HRG-CGRD): 1.00 M
 QUADRANT EL: 250.000 MILS Y(YPG) 35826.50 M X(AZ-CARBA1): 117.493 DEG X(BE1-CGRD): 1.00 M
 MUZZLE VELOCITY: 731.500 M/SEC Z(YPG) 167.10 M X(L-CARBA1): 1.179 DEG X(ALT-CGRD): 1.00 M

***** ACQUIRE ***** OCCURRED AT 08150108 (57008.100 Z)

TIME TO ACQUIRE: 1.546 SEC X(YPG) 32456.10 M X(HG-CARBA1): 1017.164 E X(HRG-CGRD): 154.27 M
 Y(YPG) 35827.70 M X(AZ-CARBA1): 106.631 DEG X(BE1-CGRD): 1.45 M
 Z(YPG) 252.29 M X(L-CARBA1): 4.681 DEG X(ALT-CGRD): 85.15 M

***** IMPACT ***** OCCURRED AT 08150128 (57028.850 Z)

TIME OF FLIGHT: 21.299 SEC X(YPG) 36269.10 M X(HG-CARBA1): 6808.375 E X(HRG-CGRD): 6409.27 M
 IMPACT ANGLE: 250.000 DEG Y(YPG) 35836.05 M X(AZ-CARBA1): 88.733 DEG X(BE1-CGRD): 29.29 M
 IMPACT VELOCITY: 349.162 M/SEC Z(YPG) 1.00 M X(L-CARBA1): 1.425 DEG X(ALT-CGRD): 167.10 M
 EXTRAPOLATION: 11.463 SEC

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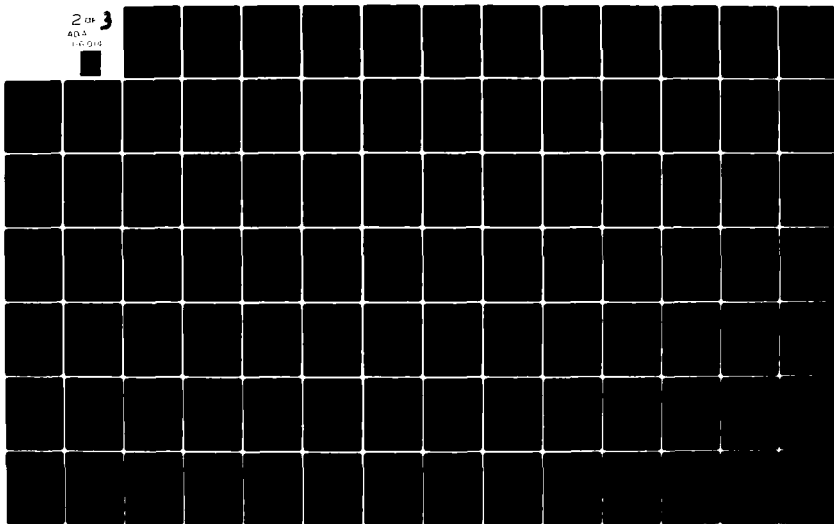
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U.S. GOVERNMENT PRINTING OFFICE: 1967

EVENT SUMMARY OF TUBE ROUND NUMBER 6 CRATED 08/12/81 10:09:00

TITLE: 105 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 08:51:57 (57117.715 Z)

LINE OF FIRE:	85.600 DEG	X(VPG):	32103.00 M	RMS(ARHAT):	656.495 K	HZ(SHG+GUR):	.00 M
QUADRANT EL:	250.000 MILS	Y(VPG):	35528.30 M	AZ(ARHAT):	117.493 DEG	DCI(1+GUR):	.00 M
MUZZLE VELOCITY:	731.500 M/SEC	Z(VPG):	167.10 M	EL(ARHAT):	1.179 DEG	ALT(GUR):	.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 7 CREATED 08/12/81 10:09:09

TITLE: 105 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 08:55:37 (57337.585 Z)

LINE OF FIRE:	85.000 DEG	X(YPG):	32163.00 M	RNG(ARBAT):	696.495 K	UZNNG(GUN):	.00 M
QUADRANT EL:	250.000 MILS	Y(YPG):	35226.32 M	AZ(ARBAT):	117.493 DEG	DRIT(GUN):	.00 M
MUZZLE VELOCITY:	731.500 M/SEC	Z(YPG):	167.10 M	EL(ARBAT):	.179 DEG	ALT(GUN):	.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 8 CREATED 08/17/81 10109117

TITLE: 105 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09115127 (58527.362 Z)

TIME OF FIRE: 85.000 DEG X(VP6): 32163.00 M RRG(ARRAT): 696.495 M HZRRG(GUN): 0.00 M (0 K115)
 QUADRANT EL: 250.000 MILS Y(VP6): 35226.32 M AZ(ARRAT): 117.493 DEG DEFT(GUN): 0.00 M (0 K115)
 MUZZLE VELOCITY: 731.500 M/SEC Z(VP6): 167.10 M EL(ARRAT): 117.493 DEG ALT(GUN): 0.00 M (0 K115)

***** ACQUIRE ***** OCCURRED AT 09115134 (58534.356 Z)

TIME TO ACQUIRE: 7.048 SEC X(VP6): 32424.58 M RRG(ARRAT): 984.297 M HZRRG(GUN): 324.38 M (41 K115)
 Y(VP6): 35267.87 M AZ(ARRAT): 106.589 DEG DEFT(GUN): 13.38 M (41 K115)
 Z(VP6): 254.08 M EL(ARRAT): 4.943 DEG ALT(GUN): 86.59 M (41 K115)

***** IMPACT ***** OCCURRED AT 09115144 (58544.326 Z)

TIME OF FLIGHT: 17.018 SEC X(VP6): 30655.02 M RRG(ARRAT): 775.465 M HZRRG(GUN): 1251.73 M (9 K115)
 IMPACT ANGLE: 250.000 DEG Y(VP6): 35126.76 M AZ(ARRAT): 123.627 DEG DEFT(GUN): 11.58 M (9 K115)
 IMPACT VELOCITY: 349.142 M/SEC Z(VP6): 0.00 M EL(ARRAT): 12.469 DEG ALT(GUN): 167.10 M (9 K115)
 EXTRAPOLATION: 9.970 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 9 CREATED 08/12/81 10:09:25

TITLE: 105 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:29:01 (59341.800 Z)

LINE OF FIRE:	85.000 DEG	X (YPS):	32163.00 M	RNG (ARBAT):	496.495 M	HZ RNG (GUN):	.00 M
QUADRANT ELI:	250.000 MILS	Y (YPS):	35226.32 M	AZ (ARBAT):	117.493 DEG	DRJ11 (GUN):	.00 M (
MUZZLE VELOCITY:	791.500 M/SEC	Z (YPS):	167.10 M	EL (ARBAT):	.179 DEG	AI1 (GUN):	.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 12 CREATED 08/12/81 10:10:32

TITLE: 105 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

***** GUNFIRE *****	OCURRED AT 09:37:36 (59856.421 Z)				
LINE OF FIRE:	85.000 DEG	X(YFG): 32103.00 M	RNG(ARBAT):	696.495 K	HZNRG(GUN):
QUADRANT ELI:	200.000 MILS	Y(YFG): 35224.32 M	AZ(ARBAT):	117.493 DEG	DRFT(GUN):
MUZZLE VELOCITY:	731.500 M/SEC	Z(YFG): 167.10 M	EL(ARBAT):	1.179 DEG	ALT(GUN):
***** ACQUIRE *****	OCURRED AT 09:37:36 (59856.460 Z)				
TIME TO ACQUIRE:	.479 SEC	X(YFG): 32442.10 M	RNG(ARBAT):	1001.654 M	HZNRG(GUN):
		Y(YFG): 35246.03 M	AZ(ARBAT):	106.739 DEG	DRFT(GUN):
		Z(YFG): 238.17 M	EL(ARBAT):	3.944 DEG	ALT(GUN):
***** IGNITION *****	OCURRED AT 09:37:39 (59859.769 Z)				
LINE TO IGNITION:	3.200 SEC	X(YFG): 34049.04 M	RNG(ARBAT):	2188.431 K	HZNRG(GUN):
JERK ANGLE:	3.244 DEG	Y(YFG): 35399.28 M	AZ(ARBAT):	93.316 DEG	DRFT(GUN):
IGNITION VELOCITY:	405.609 M/SEC	Z(YFG): 492.14 M	EL(ARBAT):	7.172 DEG	ALT(GUN):
***** REACQUIRE *****	OCURRED AT 09:37:40 (59860.850 Z)				
TIME OF REACQUIRE:	4.429 SEC	X(YFG): 34270.34 M	RNG(ARBAT):	2800.439 M	HZNRG(GUN):
		Y(YFG): 35424.71 M	AZ(ARBAT):	92.531 DEG	DRFT(GUN):
		Z(YFG): 508.52 M	EL(ARBAT):	6.934 DEG	ALT(GUN):
***** UNKNOWN *****	OCURRED AT 09:37:42 (59862.422 Z)				
TIME TO EVENT:	6.001 SEC	X(YFG): 34545.71 M	RNG(ARBAT):	3503.820 M	HZNRG(GUN):
EVENT VELOCITY:	320.169 M/SEC	Y(YFG): 35474.79 M	AZ(ARBAT):	91.202 DEG	DRFT(GUN):
		Z(YFG): 568.08 M	EL(ARBAT):	6.503 DEG	ALT(GUN):
***** IMPACT *****	OCURRED AT 09:37:54 (59874.563 Z)				
TIME OF FLIGHT:	10.142 SEC	X(YFG): 37707.39 M	RNG(ARBAT):	6226.059 K	HZNRG(GUN):
IMPACT ANGLE:	3.244 DEG	Y(YFG): 35689.21 M	AZ(ARBAT):	88.698 DEG	DRFT(GUN):
IMPACT VELOCITY:	.000 M/SEC	Z(YFG): .00 M	EL(ARBAT):	1.558 DEG	ALT(GUN):
EXTRAPOLATION:	8.263 SEC				

EVENT SUMMARY OF TUBE ROUND NUMBER 13 CREATED 08/12/81 10:10:51

TITLE: 105 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

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8888 GUNFIRE 88888 OCCURRED AT 09:39:26 (59966.219 2)
LINE OF FIRE:      85.000 DEG      X(YPG): 32103.00 M      RNG(ARRAT):
QUADRANT EL:      200.000 MILS      Y(YPG): 35226.32 M      AZ(ARRAT):
MUZZLE VELOCITY:  731.500 M/SEC      Z(YPG): 167.10 M      LL(ARRAT):
                                     696.495 M      HZRG(GUN):
                                     117.493 DEG      DRFT(GUN):
                                     -.179 DEG      ALT(GUN):
                                     -.00 M      0 K115)
                                     -.00 M
                                     -.00 M

8888 ACQUIRE 88888 OCCURRED AT 09:39:26 (59966.700 2)
TIME TO ACQUIRE:  .481 SEC      X(YPG): 32440.56 M      RNG(ARRAT):
                                     Y(YPG): 35226.23 M      AZ(ARRAT):
                                     Z(YPG): 238.05 M      LL(ARRAT):
                                     1000.501 M      HZRG(GUN):
                                     106.747 DEG      DRFT(GUN):
                                     3.941 DEG      ALT(GUN):
                                     339.64 M      0 K115)
                                     4.33 M      0 K115)
                                     70.95 M

8888 IMPACT 88888 OCCURRED AT 09:39:44 (59914.264 2)
TIME OF FLIGHT:    18.066 SEC      X(YPG): 37681.92 M      RNG(ARRAT):
IMPACT ANGLE:      200.000 DEG      Y(YPG): 35681.25 M      AZ(ARRAT):
IMPACT VELOCITY:  405.609 M/SEC      Z(YPG): .00 M      LL(ARRAT):
EXTRAPOLATION:      8.185 SEC      6200.418 M      HZRG(GUN):
                                     88.767 DEG      DRFT(GUN):
                                     -1.564 DEG      ALT(GUN):
                                     3397.35 M      0 K115)
                                     33.04 M      0 K115)
                                     167.10 M

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EVENT SUMMARY OF TURE ROUND NUMBER 14 CREATED ON/12/81 10:11:00

TITLE: 105 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

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88888 GUNFIRE 88888 OCCURRED AT 09:42:30 (60150.866 Z)
LINE OF FIRE: 85.000 DEG : X(YPG) : 32103.60 M : RHG(ARBAT) : 456.495 K : HZRRG(GUR) : .00 M : O R11.5)
QUADRANT EL: 175.000 MILS : Y(YPG) : 35228.32 M : AZ(ARBAT) : 317.493 DEG : DR11(GUR) : .00 M : O R11.5)
MUZZLE VELOCITY: 731.500 M/SEC : Z(YPG) : 167.10 M : EL(ARBAT) : .179 DEG : AL(GUR) : .00 M : O R11.5)

88888 ACQUIRE 88888 OCCURRED AT 09:42:31 (60151.400 Z)
TIME TO ACQUIRE: .534 SEC : X(YPG) : 32454.37 M : RHG(ARBAT) : 1012.454 K : HZRRG(GUR) : 352.98 M : O R11.5)
: Y(YPG) : 35260.65 M : AZ(ARBAT) : 106.530 DEG : DR11(GUR) : 27.98 M : O R11.5)
: Z(YPG) : 326.40 M : EL(ARBAT) : 3.234 DEG : AL(GUR) : 59.30 M : O R11.5)

88888 UNKNOWN 88888 OCCURRED AT 09:42:35 (60155.474 Z)
TIME TO EVENT: 4.608 SEC : X(YPG) : 34530.19 M : RHG(ARBAT) : 3062.905 K : HZRRG(GUR) : 2437.13 M : O R11.5)
EVENT VELOCITY: 347.304 M/SEC : Y(YPG) : 35430.79 M : AZ(ARBAT) : 92.020 DEG : DR11(GUR) : 27.98 M : O R11.5)
: Z(YPG) : 474.34 M : EL(ARBAT) : 3.716 DEG : AL(GUR) : 507.94 M : O R11.5)

88888 IMPACT 88888 OCCURRED AT 09:42:47 (60167.814 Z)
TIME OF FLIGHT: 16.949 SEC : X(YPG) : 37473.78 M : RHG(ARBAT) : 5992.164 K : HZRRG(GUR) : 5300.35 M : O R11.5)
IMPACT ANGLE: 175.000 DEG : Y(YPG) : 35645.70 M : AZ(ARBAT) : 80.839 DEG : DR11(GUR) : 27.98 M : O R11.5)
IMPACT VELOCITY: .000 M/SEC : Z(YPG) : .00 M : EL(ARBAT) : .169 DEG : AL(GUR) : 167.10 M : O R11.5)
EXTRAPOLATION: 7.065 SEC

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EVENT SUMMARY OF TUBE ROUND NUMBER 15 CREATED 08/12/81 10:11:14

TITLE: 108 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

88888 GUNFIRE 88888 OCCURRED AT 09:44:26 (60266.322 Z)

LINE OF FIRE:	85.000 DEG	X(YPG):	32183.00 M	RNG(CARRAT):	696.495 N	HZ(RNG(GUN)):	.00 M
QUADRANT EL:	175.000 MILS	Y(YPG):	35226.32 M	AZ(CARRAT):	117.495 DEG	DRGT(GUN):	.00 M
MUZZLE VELOCITY:	731.500 M/SEC	Z(YPG):	167.10 M	EL(CARRAT):	.179 DEG	ALT(GUN):	.00 M

88888 ACQUIRE 88888 OCCURRED AT 09:44:26 (60266.800 Z)

TIME TO ACQUIRE:	.478 SEC	X(YPG):	32445.12 M	RNG(CARRAT):	1006.719 N	HZ(RNG(GUN)):	394.54 M
		Y(YPG):	35529.83 M	AZ(CARRAT):	106.489 DEG	DRGT(GUN):	3.51 M
		Z(YPG):	229.67 M	EL(CARRAT):	3.446 DEG	ALT(GUN):	62.57 M

EVENT SUMMARY OF TUBE ROUND NUMBER 16 (CREATED 08/12/61 10:11:50)

TITLE: 105 FLAT

FIRING DATE: 10/31/60

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09147120 (60440.885 Z)

LINE OF FIRE: 85.000 DEG ; X(VPG) 32103.60 M ; RUC(ARBAT) : 690.495 M ; HZRRG(CURD) : 100 M ;
 QUADRANT EL: 175.000 MILS ; Y(VPG) 35226.32 M ; AZ(ARBAT) : 117.493 DEG ; DRG1(CURD) : 100 M ;
 MUZZLE VELOCITY: 731.500 M/SEC ; Z(VPG) 167.10 M ; LL(ARBAT) : .179 DEG ; AL1(CURD) : 100 M ;

***** ACQUIRE ***** OCCURRED AT 09147121 (60441.400 Z)

TIME TO ACQUIRE: .517 SEC ; X(VPG) 32452.07 M ; RUC(ARBAT) : 1011.522 M ; HZRRG(CURD) : 351.42 M ;
 ; Y(VPG) 35259.28 M ; AZ(ARBAT) : 106.204 DEG ; DRG1(CURD) : 7.34 M ;
 ; Z(VPG) 228.65 M ; LL(ARBAT) : 3.305 DEG ; AL1(CURD) : 61.55 M ;

***** IMPACT ***** OCCURRED AT 09147138 (60450.210 Z)

TIME OF FLIGHT: 17.327 SEC ; X(VPG) 37494.05 M ; RUC(ARBAT) : 6712.480 M ; HZRRG(CURD) : 5609.69 M ;
 IMPACT ANGLE: 175.000 DEG ; Y(VPG) 35483.75 M ; AZ(ARBAT) : 80.742 DEG ; DRG1(CURD) : 31.62 M ;
 IMPACT VELOCITY: 347.384 M/SEC ; Z(VPG) .00 M ; LL(ARBAT) : -1.561 DEG ; AL1(CURD) : 167.10 M ;
 EXTRAPOLATION: 7.410 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 17 (CREATED 08/12/81 10:11:46)

TITLE: 105 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:50:16 (60616.641 Z)

LINE OF FIRE:	85.000 DEG	X (YPG): 32103.00 M	RHC (ARRAT):	696.495 R	HZRRG (CUR):	.00 M
QUADRANT EL:	150.000 MILS	Y (YPG): 35226.52 M	AZ (ARRAT):	117.493 DEG	DR11 (CUR):	.00 M
MUZZLE VELOCITY:	731.500 M/SEC	Z (YPG): 167.10 M	LC (ARRAT):	.179 DEG	AL1 (CUR):	.00 M

***** ACQUIRE ***** OCCURRED AT 09:50:16 (60616.640 Z)

TIME TO ACQUIRE:	.559 SEC	X (YPG): 32446.36 M	RHC (ARRAT):	1073.891 R	HZRRG (CUR):	34.53 M
		Y (YPG): 35258.97 M	AZ (ARRAT):	106.404 DEG	DR11 (CUR):	.86 M
		Z (YPG): 215.65 M	LC (ARRAT):	2.596 DEG	AL1 (CUR):	48.55 M

***** IMPACT ***** OCCURRED AT 09:50:32 (60632.379 Z)

TIME OF FLIGHT:	16.339 SEC	X (YPG): 37434.67 M	RHC (ARRAT):	5943.175 R	HZRRG (CUR):	5235.50 M
IMPACT ANGLE:	150.000 DEG	Y (YPG): 35440.15 M	AZ (ARRAT):	88.910 DEG	DR11 (CUR):	30.82 M
IMPACT VELOCITY:	347.304 M/SEC	Z (YPG): .00 M	LC (ARRAT):	1.632 DEG	AL1 (CUR):	167.10 M
EXTRAPOLATION:	6.430 SEC					

EVENT SUMMARY OF TUBE ROUND NUMBER 18 CREATED 08/12/83 10112100

TITLE: 105 FLAT

FINING DATE: 10/31/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:52:16 (60736.131 Z)

LINE OF FIRE: 85.000 DEG X(YFG): 32103.60 M RRG(CARRAT): 690.495 M HZRRG(CGUR): 1.00 M
 QUADRANT EL: 125.000 MILS Y(YFG): 35226.52 M A7(CARRAT): 117.493 DEG DR11(CGUR): 1.00 M
 MUZZLE VELOCITY: 731.500 M/SEC Z(YFG): 167.10 M LL(CARRAT): 1.179 DEG AL1(CGUR): 1.00 M

***** ACQUIRE ***** OCCURRED AT 09:52:16 (60736.636 Z)

TIME TO ACQUIRE: .519 SEC X(YFG): 32454.23 M RRG(CARRAT): 1011.887 M HZRRG(CGUR): 350.75 M
 Y(YFG): 35259.44 M A7(CARRAT): 106.573 DEG DR11(CGUR): 2.359 M
 Z(YFG): 269.66 M LL(CARRAT): 2.287 DEG AL1(CGUR): 42.56 M

***** UNKNOWN ***** OCCURRED AT 09:52:20 (60740.776 Z)

TIME TO EVENT: 4.645 SEC X(YFG): 34535.13 M RRG(CARRAT): 3037.369 M HZRRG(CGUR): 2441.48 M
 Y(YFG): 35439.72 M A7(CARRAT): 92.030 DEG DR11(CGUR): 2.65 M
 EVENT VELOCITY: 353.654 M/SEC Z(YFG): 352.75 M LL(CARRAT): 3.440 DEG AL1(CGUR): 105.65 M

***** IMPACT ***** OCCURRED AT 09:52:31 (60751.357 Z)

TIME OF FLIGHT: 15.226 SEC X(YFG): 37217.07 M RRG(CARRAT): 5733.465 M HZRRG(CGUR): 5137.37 M
 IMPACT ANGLE: 125.000 DEG Y(YFG): 35059.43 M A7(CARRAT): 80.885 DEG DR11(CGUR): 14.76 M
 IMPACT VELOCITY: .000 M/SEC Z(YFG): .00 M LL(CARRAT): 1.651 DEG AL1(CGUR): 167.10 M
 EXTRAPOLATION: 5.387 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 19 (CREATED 08/12/61 1012:16)

TITLE: 105 FLAT

FIRING DATE: 10/31/60

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09154140 (60860.124 Z)

LINE OF FIRE: 85.000 DEG ; X(YPG) 32183.60 M ; HRG(ARHAT) ; 656.495 M ; HZHRG(CUR) ; .00 M ; 0 K115)
 QUADRANT EL: 180.000 MILS ; Y(YPG) 35324.30 M ; A2(ARHAT) ; 117.493 DEG ; DRG1(CUR) ; .00 M ; 0 K115)
 MUZZLE VELOCITY: 731.500 M/SEC ; Z(YPG) 167.10 M ; L1(ARHAT) ; .179 DEG ; A1(CUR) ; .00 M ; 0 K115)

***** ACQUIRE ***** OCCURRED AT 09154140 (60860.650 Z)

TIME TO ACQUIRE: .526 SEC ; X(YPG) 32455.60 M ; HRG(ARHAT) ; 1017.483 M ; HZHRG(CUR) ; 354.775 M ; 0 K115)
 ; Y(YPG) 35324.61 M ; A2(ARHAT) ; 106.488 DEG ; DRG1(CUR) ; 17.43 M ; 0 K115)
 ; Z(YPG) 198.73 M ; L1(ARHAT) ; 1.667 DEG ; A1(CUR) ; 31.64 M ; 0 K115)

***** IGNITION ***** OCCURRED AT 09154149 (60869.526 Z)

TIME TO IGNITION: 9.402 SEC ; X(YPG) 35812.33 M ; HRG(ARHAT) ; 4477.750 M ; HZHRG(CUR) ; 3817.88 M ; 0 K115)
 JENK ANGLE: 26.011 DEG ; Y(YPG) 35490.58 M ; A2(ARHAT) ; 90.756 DEG ; DRG1(CUR) ; 28.17 M ; 0 K115)
 IGNITION VELOCITY: 361.433 M/SEC ; Z(YPG) 216.58 M ; L1(ARHAT) ; .617 DEG ; A1(CUR) ; 47.88 M ; 0 K115)

***** IMPACT ***** OCCURRED AT 09154154 (60874.426 Z)

TIME OF FLIGHT: 14.302 SEC ; X(YPG) 38140.83 M ; HRG(ARHAT) ; 6700.000 M ; HZHRG(CUR) ; 6097.07 M ; 0 K115)
 IMPACT ANGLE: 26.011 DEG ; Y(YPG) 35717.09 M ; A2(ARHAT) ; 86.552 DEG ; DRG1(CUR) ; 60.94 M ; 0 K115)
 IMPACT VELOCITY: .000 M/SEC ; Z(YPG) .00 M ; L1(ARHAT) ; 1.448 DEG ; A1(CUR) ; 167.10 M ; 0 K115)
 EXTRAPOLATION: 4.926 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 20 (CREATED 08/12/83 10:12:28)

TITLE: 105 FLAT

FIRING DATE: 10/31/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:56:39 (60959.727 Z)

LINE OF FIRE: 85.000 DEG X(YFG): 32163.00 M HIG(ARHAT): 696.495 K HZRG(CUR): 1.00 M
 QUADRANT (I): 75.000 MILS Y(YFG): 35226.32 M AZ(ARHAT): 117.493 DEG DECT(CUR): 1.00 M
 MUZZLE VELOCITY: 731.500 M/SEC Z(YFG): 167.10 M LL(ARHAT): 1.179 DEG ALT(CUR): 1.00 M

***** ACQUINE ***** OCCURRED AT 09:56:40 (61000.256 Z)

TIME TO ACQUINE: .523 SEC X(YFG): 32453.76 M HIG(ARHAT): 1012.977 K HZRG(CUR): 2.415 K
 Y(YFG): 35258.45 M AZ(ARHAT): 106.591 DEG DECT(CUR): 1.67 M
 Z(YFG): 189.64 M LL(ARHAT): 1.123 DEG ALT(CUR): 22.74 M

***** REACQUIRE ***** OCCURRED AT 09:56:47 (61067.450 Z)

TIME OF REACQUIRE: 7.723 SEC X(YFG): 35323.63 M HIG(ARHAT): 2038.590 K HZRG(CUR): 37.978 K
 Y(YFG): 35504.37 M AZ(ARHAT): 90.649 DEG DECT(CUR): 2.72 M
 Z(YFG): 185.48 M LL(ARHAT): 1.742 DEG ALT(CUR): 18.38 M

***** IMPACT ***** OCCURRED AT 09:56:54 (61014.423 Z)

TIME OF FLIGHT: 14.696 SEC X(YFG): 34526.68 M HIG(ARHAT): 3444.914 K HZRG(CUR): 4940.71 K
 IMPACT ANGLE: 75.000 DEG Y(YFG): 35639.58 M AZ(ARHAT): 85.136 DEG DECT(CUR): 18.35 K
 IMPACT VELOCITY: 1.000 M/SEC Z(YFG): .00 M LL(ARHAT): 1.782 DEG ALT(CUR): 167.10 M
 EXTRAPOLATION:

(EVENT) SUMMARY OF TUBE ROUND NUMBER 1 (CREATED ON 11/1/81 10:49:15)

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 12133139 (70419.145 Z)

LINE OF FIRE: 85.000 DEG X (VP) 32115.93 M RRG (ARRAT) 480.316 M HZRRG (GORD) 100 M
 QUADRANT EL: 300.000 MILS Y (VP) 35392.44 M A7 (ARRAT) 112.043 DEG DRIT (GORD) 100 M
 MUZZLE VELOCITY: 914.400 M/SEC Z (VP) 167.54 M LL (ARRAT) 114.146 DEG AL (GORD) 100 M

***** ACQUIRE ***** OCCURRED AT 12133146 (70426.200 Z)

TIME TO ACQUIRE: 7.055 SEC X (VP) 32456.07 M RRG (ARRAT) 967.018 M HZRRG (GORD) 309.56 M
 Y (VP) 35393.79 M A7 (ARRAT) 107.856 DEG DRIT (GORD) 14.43 M
 Z (VP) 267.44 M LL (ARRAT) 5.838 DEG AL (GORD) 100.10 M

***** UNKNOWN ***** OCCURRED AT 12133145 (70425.126 Z)

TIME TO EVENT: 5.983 SEC X (VP) 32456.07 M RRG (ARRAT) 1005.480 M HZRRG (GORD) 343.61 M
 Y (VP) 35394.10 M A7 (ARRAT) 107.951 DEG DRIT (GORD) 14.43 M
 EVENT VELOCITY: 901 M/SEC Z (VP) 271.01 M LL (ARRAT) 5.819 DEG AL (GORD) 103.67 M

***** IMPACT ***** OCCURRED AT 14100106 (76006.744 Z)

TIME OF FLIGHT: ***** SEC X (VP) 32456.08 M RRG (ARRAT) 1012.571 M HZRRG (GORD) 343.61 M
 IMPACT ANGLE: 300.000 DEG Y (VP) 35394.07 M A7 (ARRAT) 107.953 DEG DRIT (GORD) 14.43 M
 IMPACT VELOCITY: 900 M/SEC Z (VP) 267.54 M LL (ARRAT) 5.838 DEG AL (GORD) 100.10 M
 EXTRAPOLATION: ***** SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 2 (CREATED 06/11/83 10:45:27)

TITLE: 90 FIAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 12:36:53 (70613.676 Z)

LINE OF FIRE: 85.000 DEG X(VPG) 32115.93 M HRC(ARRAT): 680.512 M HZRR(GOHD): 1.00 M
 QUADRANT EL: 300.000 MILS Y(VPG) 35292.44 M AZ(ARRAT): 117.043 DEG DR311(GOHD): 1.00 M
 MUZZLE VELOCITY: 914.400 M/SEC Z(VPG) 167.54 M LI(ARRAT): 114.146 DEG 611(GOHD): 1.00 M

***** ACQUIRE ***** OCCURRED AT 12:37:00 (70620.960 Z)

TIME TO ACQUIRE: 7.224 SEC X(VPG) 32456.92 M HRC(ARRAT): 1007.248 M HZRR(GOHD): 342.49 M
 Y(VPG) 35324.50 M AZ(ARRAT): 107.944 DEG DR311(GOHD): 1.00 M
 Z(VPG) 270.77 M LI(ARRAT): 5.012 DEG 611(GOHD): 103.823 M

***** UNKNOWN ***** OCCURRED AT 12:37:00 (70620.461 Z)

TIME TO EVENT: 6.785 SEC X(VPG) 32456.02 M HRC(ARRAT): 1003.480 M HZRR(GOHD): 343.24 M
 Y(VPG) 35324.02 M AZ(ARRAT): 107.956 DEG DR311(GOHD): 1.00 M
 EVENT VELOCITY: .002 M/SEC Z(VPG) 271.37 M LI(ARRAT): 5.039 DEG 611(GOHD): 103.823 M

***** IMPACT ***** OCCURRED AT 12:37:07 (70627.344 Z)

TIME OF FLIGHT: 13.669 SEC X(VPG) 34972.05 M HRC(ARRAT): 5492.359 M HZRR(GOHD): 4475.50 M
 IMPACT ANGLE: 300.000 DEG Y(VPG) 35726.72 M AZ(ARRAT): 88.133 DEG DR311(GOHD): 9.39 M
 IMPACT VELOCITY: .000 M/SEC Z(VPG) .000 M LI(ARRAT): 1.766 DEG 611(GOHD): 167.54 M
 EXTRAPOLATION: 6.395 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 3 (CREATED 08/12/81 10:49:37)

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

00000 GUNFIRE 00000 OCCURRED AT 12:45:34 (71134.036 Z)

LINE OF FIRE:	85.000 DEG	X (YF6)	32115.93 M	RNG (ARRAT)	680.516 M	H7RRG (GUD)	.00 M
QUADRANT EL:	300.000 MILS	Y (YF6)	35592.44 M	AZ (ARRAT)	117.043 DEG	DRIFT (GUD)	.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z (YF6)	167.54 M	EL (ARRAT)	146 DEG	ALT (GUD)	.00 M

IVM) SUMMARY OF TUBE ROUND NUMBER 4 (CREATED 08/17/81 10:49:14)

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

12128 GUNFIRE 22222 OCCURRED AT 12:48:07 (71267.875 Z)

LINE OF FIRE: 85.000 DEG : X(YPG) 32115.53 M : RNS(CRBA1): 280.510 G : H/RNG(GUR): 4.00 M : 0 K115)

QUADRANT ELI: 300.000 MILS : Y(YPG) 35292.44 M : A2(CARRA1): 117.043 DEG : DR117(GUR): 2.00 M

NUZZLE VELOCITY: 914.400 M/SEC : Z(YPG) 167.54 M : EL(CARBA1): .146 DEG : A1(GUR): 2.00 M

22228 ACQUINE 22222 OCCURRED AT 12:48:10 (71269.450 Z)

TIME TO ACQUIRE: 5.577 SEC : X(YPG) 30539.54 M : RNS(CARRA1): 1003.763 M : H/RNG(GUR): 4.00 M : 0 K115)

: Y(YPG) 35331.74 M : A2(CARRA1): 101.580 DEG : DR117(GUR): 2.00 M

: Z(YPG) 296.25 M : EL(CARBA1): 6.728 DEG : A1(GUR): 128.70 M

EVENT SUMMARY OF TUBE ROUND NUMBER 5 CREATED ON/12/81 10:49:52

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 12:53:49 (71629.815 Z)

LINE OF FIRE:	85.000 DEG	X(VPG): 32115.93 M	RNG(ARBAT):	680.516 M	HZNRG(GUN):	.00 M
QUADRANT EL:	300.000 MILS	Y(VPG): 35592.44 M	A7(ARBAT):	117.043 DEG	DETH(GUN):	.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(VPG): 167.54 M	LL(ARBAT):	.146 DEG	ALT(GUN):	.00 M
***** ACQUIRE ***** OCCURRED AT 12:53:49 (71629.856 Z)						
TIME TO ACQUIRE:	.035 SEC	X(VPG): 32549.20 M	RNG(ARBAT):	1089.929 M	HZNRG(GUN):	437.23 M
		Y(VPG): 35556.71 M	A7(ARBAT):	100.183 DEG	DETH(GUN):	26.26 M
		Z(VPG): 307.52 M	LL(ARBAT):	7.308 DEG	ALT(GUN):	140.58 M

IVM1 SUMMARY OF TUBE ROUND NUMBER 6 CREATED 08/12/81 10:59:00

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

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##### GUNFIRE ##### OCCURRED AT 12:59:22 (71942.861 Z)
LINE OF FIRE: 85.000 DEG  X(VPG): 32115.53 M  RRG(ARRAT): 680.516 K  HZRRG(GUN): 400 M ( 0 KI15)
QUADRANT EL: 400.000 MILS  Y(VPG): 35392.44 M  AZ(ARRAT): 112.043 DEG  DR11(GUN): 400 M ( 0 KI15)
MUZZLE VELOCITY: 914.400 M/SEC  Z(VPG): 167.54 M  EL(ARRAT): 1146 DEG  AL1(GUN): 400 M ( 0 KI15)

##### ACQUIRE ##### OCCURRED AT 12:59:29 (71949.900 Z)
TIME TO ACQUIRE: 7.019 SEC  X(VPG): 32597.67 M  RRG(ARRAT): 1149.077 K  HZRRG(GUN): 454.176 K ( 16 KI15)
Y(VPG): 35342.29 M  AZ(ARRAT): 100.440 DEG  DR11(GUN): 262.82 M ( 16 KI15)
Z(VPG): 370.56 M  EL(ARRAT): 10.078 DEG  AL1(GUN): 262.82 M ( 16 KI15)

##### UNKNOWN ##### OCCURRED AT 12:59:28 (71948.904 Z)
TIME TO EVENT: 6.027 SEC  X(VPG): 32406.58 M  RRG(ARRAT): 1159.101 K  HZRRG(GUN): 493.271 M ( 16 KI15)
Y(VPG): 35338.52 M  AZ(ARRAT): 100.569 DEG  DR11(GUN): 262.11 M ( 16 KI15)
MUZZLE VELOCITY: .001 M/SEC  Z(VPG): 372.28 M  EL(ARRAT): 10.087 DEG  AL1(GUN): 204.73 M ( 16 KI15)

##### IMPACT ##### OCCURRED AT 12:59:46 (71964.519 Z)
TIME OF FLIGHT: 23.638 SEC  X(VPG): 30474.30 M  RRG(ARRAT): 726.163 K  HZRRG(GUN): 1745.52 M ( 7 KI15)
IMPACT ANGLE: 400.000 DEG  Y(VPG): 35193.33 M  AZ(ARRAT): 150.113 DEG  DR11(GUN): 9.71 M ( 7 KI15)
IMPACT VELOCITY: .000 M/SEC  Z(VPG): .00 M  EL(ARRAT): 13.480 DEG  AL1(GUN): 167.54 M ( 7 KI15)
EXTRAPOLATION: 16.619 SEC

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EVENT SUMMARY OF TUBE ROUND NUMBER 7 CREATED 06/12/81 10:50:10

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 131031.42 (72222.182 Z)

LINE OF FIRE:

QUADRANT ELI

MUZZLE VELOCITY:

85.000 DEG
400.000 MILS
914.400 M/SEC

X(VPG): 32115.53 M
Y(VPG): 35292.44 M
Z(VPG): 167.54 M

KG(ARRAT):
AZ(ARRAT):
EL(ARRAT):

680.516 M
112.043 DEG
-146 DEG

HZRNG(GUN):
DRKT(GUN):
ALT(GUN):

.00 M
.00 M
.00 M

0 KILLS

1 (V) SUMMARY OF TUBE MOUND NUMBER 8 (CREATED 08/12/01 10:50:24)

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 13:06:41 (72401.104 Z)

LINE OF FIRE:	85.000 DEG	X(VPG):	3015.93 M	RNG(ARRAT):	680.516 M	HZ(KRG(CUR)):	.00 M
QUADRANT EL:	400.000 MILE	Y(VPG):	3552.44 M	AZ(ARRAT):	117.043 DEG	DETH(CUR):	.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(VPG):	167.54 M	LC(ARRAT):	.146 DEG	ML(CUR):	.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 8 CREATED 08/12/81 10:50:30

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 13110157 (72657.266 Z)

LINE OF FIRE: 85.000 DEG X(YPG) 32115.93 M RUG(ARBAT) 680.516 K 07606(GUR) .00 M
 QUADRANT ELI: 400.000 MILS Y(YPG) 35292.44 M AZ(ARBAT) 112.043 DEG DR311(GUR) .00 M
 MUZZLE VELOCITY: 914.400 M/SEC Z(YPG) 167.54 M EL(ARBAT) .146 DEG ALT(GUR) .00 M

***** ACQUIRE ***** OCCURRED AT 13111106 (72666.300 Z)

TIME TO ACQUIRE: 9.094 SEC X(YPG) 32521.49 M RUG(ARBAT) 1072.068 K 07606(GUR) 402.66 M
 Y(YPG) 35331.83 M AZ(ARBAT) 101.772 DEG DR311(GUR) 5.80 M
 Z(YPG) 337.41 M EL(ARBAT) 9.023 DEG ALT(GUR) 162.86 M

***** IMPACT ***** OCCURRED AT 13111110 (72676.540 Z)

TIME OF FLIGHT: 21.240 SEC X(YPG) 32135.80 M RUG(ARBAT) 682.966 K 07606(GUR) 29.70 M
 IMPACT ANGLE: 400.000 DEG Y(YPG) 35400.24 M AZ(ARBAT) 105.612 DEG DR311(GUR) 107.54 M
 IMPACT VELOCITY: .001 M/SEC Z(YPG) .00 M EL(ARBAT) .146 DEG ALT(GUR) 162.54 M
 EXTRAPOLATION: 12.046 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 9 (CREATED 08/12/81 10150146)

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 13:13:57 (72837.222 Z)

LINE OF FIRE: 85.800 DEG X(CYPG): 32115.93 M H(RG(CARDAT): 640.516 K H(RG(CORD): 100 M
QUADRANT EL: 400.000 MILS Y(CYPG): 35392.64 M A7(CARDAT): 117.043 DEG DRT(CORD): 100 M
MUZZLE VELOCITY: 914.400 M/SEC Z(CYPG): 167.54 M LL(CARDAT): 146.016 A1(CORD): 100 M

***** ACQUIRE ***** OCCURRED AT 13:14:04 (72844.250 Z)

TIME TO ACQUIRE: 7.028 SEC X(CYPG): 32726.61 M H(RG(CARDAT): 1261.563 K H(RG(CORD): 617.66 M
Y(CYPG): 35539.46 M A7(CARDAT): 99.528 DEG DRT(CORD): 6.38 M
Z(CYPG): 409.65 M LL(CARDAT): 10.031 DEG A1(CORD): 247.10 M

***** UNKNOWN ***** OCCURRED AT 13:14:03 (72843.167 Z)

TIME TO EVENT: 5.940 SEC X(CYPG): 32485.14 M H(RG(CARDAT): 1240.457 K H(RG(CORD): 577.75 M
EVENT VELOCITY: .001 M/SEC Y(CYPG): 35384.10 M A7(CARDAT): 99.630 DEG DRT(CORD): 1.80 M
Z(CYPG): 405.66 M LL(CARDAT): 10.957 DEG A1(CORD): 237.51 M

***** IMPACT ***** OCCURRED AT 13:13:12 (74161.439 Z)

TIME OF FLIGHT: 888888 SEC X(CYPG): 32485.14 M H(RG(CARDAT): 1249.528 K H(RG(CORD): 577.75 M
IMPACT ANGLE: 400.000 DEG Y(CYPG): 35384.07 M A7(CARDAT): 99.630 DEG DRT(CORD): 1.77 M
IMPACT VELOCITY: .000 M/SEC Z(CYPG): .000 M LL(CARDAT): 7.813 DEG A1(CORD): 167.54 M
EXTRAPOLATION: 888888 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 10 CREATED 08/12/81 1015115

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 13.17.07 (73027.036 Z)

LINE OF FIRE:	85.800 DEG	X(CYF01 32115.93 M	RRC(CARRAT1):	480.516 M	H2RRRC(CGUR0):	.00 M
QUADRANT EL:	400.000 MILS	Y(CYF01 35292.44 M	A7(CARRAT1):	112.043 DEG	DR11(CGUR0):	.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(CYF01 167.54 M	11(CARRAT1):	.146 DEG	AL1(CGUR0):	.00 M

***** ACQUIRE ***** OCCURRED AT 13.17.07 (73027.736 Z)

TIME TO ACQUIRE:	.714 SEC	X(CYF01 32497.00 M	RRC(CARRAT1):	1251.725 M	H2RRRC(CGUR0):	583.50 M
		Y(CYF01 35346.51 M	A7(CARRAT1):	99.450 DEG	DR11(CGUR0):	.00 M
		Z(CYF01 406.89 M	11(CARRAT1):	10.947 DEG	AL1(CGUR0):	259.34 M

***** IMPACT ***** OCCURRED AT 13.17.141 (73061.725 Z)

TIME OF FLIGHT:	34.685 SEC	X(CYF01 35347.50 M	RRC(CARRAT1):	8065.488 M	H2RRRC(CGUR0):	7438.726 M
IMPACT ANGLE:	400.000 DEG	Y(CYF01 35701.55 M	A7(CARRAT1):	80.507 DEG	DR11(CGUR0):	.00 M
IMPACT VELOCITY:	.001 M/SEC	Z(CYF01 .00 M	11(CARRAT1):	1.403 DEG	AL1(CGUR0):	177.54 M
EXTRAPOLATION:	24.775 SEC					

EVENT SUMMARY OF TUBE ROUND NUMBER 11 (CREATED 06/17/83) 10153123

TITLE: 90 PLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 13:21:11 (75071.777 7)

LINE OF FIRE:	85.000 DEG	X (YF6): 30135.53 M	RANGE (ARBAT):	280.312 M	HYPERBOLIC CARD:	
QUADRANT EL:	400.000 MILS	Y (YF6): 38292.44 M	AZ (ARBAT):	137.043 DEG	DEUTEROCARD:	
MUZZLE VELOCITY:	914.400 M/SEC	Z (YF6): 127.54 M	EL (ARBAT):	140 DEG	ALTCARD:	
						0.00 M
						0.00 M
						0.00 M

TIME OF FLIGHT:	12.061 SEC	X (YIP6)	30445.27 M	IRBC (GRAB1)	925.138 E	IRBC (GRAB1)	147.176 M
IMPACT ANGLE:	400.000 DEG	Y (YIP6)	35156.55 M	AZ (GRAB1)	112.559 DEG	IRBC (GRAB1)	35.000 M
IMPACT VELOCITY:	.000 M/SEC	Z (YIP6)	.00 M	EL (GRAB1)	-10.543 DEG	AZ (GRAB1)	167.154 M
EXTRAPOLATION:	4.220 SEC						

EVENT SUMMARY OF TUBE ROUND NUMBER 13 CREATED ON 10/17/01 10:51:43

TITLE: 90 FLAT

TESTING DATE: 10/29/80

DESCRIPTION:

13333 GUNFIRE 33333	OCCURRED AT 13126136 (73556.966 Z)								
LINE OF FIRE:	85.000 DEG	X(VPG): 32115.53 M	RNG(CARBAT):	GR0.516 K	HZRG(CGHD):				
QUADRANT EL:	400.000 MILS	Y(VPG): 35292.44 M	AZ(CARBAT):	112.043 DEG	DRCT(CGHD):				0 E11.5
MUZZLE VELOCITY:	918.400 M/SEC	Z(VPG): 167.34 M	EL(CARBAT):	146.016 DEG	ALT(CGHD):				000 M
13333 ACQUINE 33333	OCCURRED AT 13126137 (73557.350 Z)								
TIME TO ACQUIRE:	0.582 SEC	X(VPG): 32400.47 M	RNG(CARBAT):	1150.742 K	HZRG(CGHD):				487.13 M
		Y(VPG): 35338.88 M	AZ(CARBAT):	100.208 DEG	DRCT(CGHD):				4.00 M
		Z(VPG): 370.12 M	EL(CARBAT):	10.024 DEG	ALT(CGHD):				202.58 M
13333 UNKNOWN 33333	OCCURRED AT 13126139 (73556.416 Z)								
TIME TO EVENT:	2.448 SEC	X(VPG): 33593.70 M	RNG(CARBAT):	2004.401 K	HZRG(CGHD):				1488.31 M
		Y(VPG): 35490.41 M	AZ(CARBAT):	91.563 DEG	DRCT(CGHD):				68.47 M
EVENT VELOCITY:	270.252 M/SEC	Z(VPG): 844.37 M	EL(CARBAT):	20.702 DEG	ALT(CGHD):				798.82 M

IVM) SUMMARY OF TUBE ROUND NUMBER 14 CREATED 08/12/81 10:51:50

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 13:28:32 (73712.103 Z)

LINE OF FIRE:	85.860 DEG	X(CYF61)	3213.53 M	RHG(CARRAT1)	680.516 M	HZENG(COHD)	.00 M
QUADRANT ELI	400.800 MILS	Y(CYF61)	35292.44 M	AZ(CARRAT1)	112.043 DEG	DR3T(COHD)	.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(CYF61)	167.54 M	EL(CARRAT1)	1146 DEG	ALT(COHD)	.00 M

***** ACQUIRE ***** OCCURRED AT 13:28:32 (73712.706 Z)

TIME TO ACQUIRE:	.597 SEC	X(CYF61)	32410.75 M	RHG(CARRAT1)	1162.176 M	HZENG(COHD)	496.50 M
		Y(CYF61)	35339.23 M	AZ(CARRAT1)	100.504 DEG	DR3T(COHD)	3.53 M
		Z(CYF61)	372.52 M	EL(CARRAT1)	10.072 DEG	ALT(COHD)	204.97 M

EVENT SUMMARY OF TUBE ROUND NUMBER 15 (RELATED ON/17/81 10:51:17)

TIME: 90 FLAT

ENDING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 13:31:17 (73877.160 Z)

LINE OF FIRE:	85.000 DEG	X(YFG):	32115.53 M	ORG(ARHA):	280.516 K	HZRRG(GUH):	0.00 M
QUADRANT EL:	400.000 MILS	Y(YFG):	35292.44 M	AZ(ARHA):	112.043 DEG	DR1(GUH):	0.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(YFG):	167.54 M	LL(ARHA):	1.146 DEG	AL(GUH):	0.00 M

***** ACQUIRE ***** OCCURRED AT 13:31:17 (73877.650 Z)

TIME TO ACQUIRE:	.550 SEC	X(YFG):	35595.03 M	ORG(ARHA):	114.405 K	HZRRG(GUH):	481.270 H
		Y(YFG):	35337.75 M	AZ(ARHA):	100.716 DEG	DR1(GUH):	5.36 M
		Z(YFG):	369.10 M	LL(ARHA):	10.029 DEG	AL(GUH):	201.56 M

EVENT SUMMARY OF TUBE BOUND NUMBER 16 (CREATED ON 12/7/81) 10:52:04

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

88888 GUNFIRE 88888 OCCURRED AT 13:55:31 (75331.114 Z)

LINE OF FIRE:	85.000 DEG	X (YFG)	32115.53 M	KRG (ARBAT)	680.516 M	HZRG (GUN)	0.00 M
QUADRANT EL:	400.000 MILS	Y (YFG)	35292.44 M	AZ (ARBAT)	117.043 DEG	DRFT (GUN)	0.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z (YFG)	167.54 M	EL (ARBAT)	1146 DEG	ALT (GUN)	0.00 M

88888 ACQUINE 88888 OCCURRED AT 13:55:31 (75331.700 Z)

TIME TO ACQUINE:	.586 SEC	X (YFG)	37696.58 M	KRG (ARBAT)	1158.921 M	HZRG (GUN)	492.67 M
		Y (YFG)	35336.63 M	AZ (ARBAT)	100.654 DEG	DRFT (GUN)	1.64 M
		Z (YFG)	371.67 M	EL (ARBAT)	10.058 DEG	ALT (GUN)	204.15 M

EVENT SUMMARY OF TUBE ROUND NUMBER 17 (CREATED ON 11/17/01 10:52:14)

TITLE: 90 FLAT

LINKING DATE: 10/29/00

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 13:59:45 (75505.473 Z)

LINE OF FIRE: 85.000 DEG : X(YPG): 32115.93 M : RRG(ARRAT): 600.516 M : HZNRG(GURD): .00 M :
 QUADRANT EL: 400.000 MILS : Y(YPG): 35092.44 M : A2(CARRAT): 117.043 DEG : DRIT(GURD): .00 M :
 MUZZLE VELOCITY: 914.400 M/SEC : Z(YPG): 147.54 M : EL(CARRAT): .146 DEG : ALT(GURD): .00 M :
 G B115)

***** ACQUINE ***** OCCURRED AT 13:59:52 (75502.500 Z)

TIME TO ACQUIRE: 7.627 SEC : X(YPG): 32104.62 M : RRG(ARRAT): 1152.443 M : HZNRG(GURD): 493.27 M :
 : Y(YPG): 35346.40 M : A2(CARRAT): 100.496 DEG : DRIT(GURD): 5.17 M :
 : Z(YPG): 270.56 M : EL(CARRAT): 10.044 DEG : ALT(GURD): 200.42 M :
 10 B115)

***** UNKNOWN ***** OCCURRED AT 13:59:51 (75501.419 Z)

TIME TO EVENT: 5.946 SEC : X(YPG): 32406.98 M : RRG(ARRAT): 1159.101 M : HZNRG(GURD): 493.27 M :
 : Y(YPG): 35338.52 M : A2(CARRAT): 100.569 DEG : DRIT(GURD): 5.11 M :
 : Z(YPG): 372.28 M : EL(CARRAT): 10.087 DEG : ALT(GURD): 204.73 M :
 10 B115)

***** IMPACT ***** OCCURRED AT 14:21:14 (76674.250 Z)

TIME OF FLIGHT: ***** SEC : X(YPG): 32406.98 M : RRG(ARRAT): 1159.087 M : HZNRG(GURD): 493.27 M :
 IMPACT ANGLE: 400.000 DEG : Y(YPG): 35338.45 M : A2(CARRAT): 100.571 DEG : DRIT(GURD): 5.08 M :
 IMPACT VELOCITY: .000 M/SEC : Z(YPG): .00 M : EL(CARRAT): -8.937 DEG : ALT(GURD): -127.54 M :
 ***** SEC :
 EXTRAPOLATION:

EVENT SUMMARY OF TUBE ROUND NUMBER 18 (CREATED ON 12/81 10:52:20)

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

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***** GUNFIRE ***** OCCURRED AT 14:01:55 (75715.463 Z)
LINE OF FIRE:      85.000 DEG      X(YPG): 32115.53 M      RMS(ARRAT):      480.516 M      HZRRG(GUN):      .00 M      0 K(1.5)
QUADRANT EL:      400.000 MILS      Y(YPG): 35292.44 M      AZ(ARRAT):      112.043 DEG      DEGT(GUN):      .00 M      0 K(1.5)
MUZZLE VELOCITY:  914.400 M/SEC      Z(YPG): 167.54 M      EL(ARRAT):      .146 DEG      ALT(GUN):      .00 M      0 K(1.5)

***** ACQUIRE ***** OCCURRED AT 14:02:02 (75722.856 Z)
TIME TO ACQUIRE:  7.387 SEC      X(YPG): 32603.12 M      RMS(ARRAT):      1155.032 M      HZRRG(GUN):      489.45 M      9 K(1.5)
      Y(YPG): 35339.53 M      AZ(ARRAT):      100.525 DEG      DEGT(GUN):      4.45 M      9 K(1.5)
      Z(YPG): 371.41 M      EL(ARRAT):      10.079 DEG      ALT(GUN):      203.87 M

***** IMPACT ***** OCCURRED AT 14:23:24 (77004.660 Z)
TIME OF FLIGHT:    ***** SEC      X(YPG): 32604.59 M      RMS(ARRAT):      1155.683 M      HZRRG(GUN):      493.71 M      9 K(1.5)
IMPACT ANGLE:      400.000 DEG      Y(YPG): 35338.48 M      AZ(ARRAT):      100.571 DEG      DEGT(GUN):      3.07 M      9 K(1.5)
IMPACT VELOCITY:  1000.000 M/SEC      Z(YPG): .00 M      EL(ARRAT):      -8.437 DEG      ALT(GUN):      167.54 M
EXTRAPOLATION:    ***** SEC

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(V) SUMMARY OF TUBE ROUND NUMBER 19 (RELATED OR/17/81 10152734

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

1222 GUNFIRE 83222 OCCURRED AT 14103135 (75615.474 Z)

LINE OF FIRE:	85.000 DEG	X (VPG)	32115.53 M	RUC (ARBAT)	680.516 M	H2RUC (GUR)	.00 M
QUADRANT EL:	400.000 MILE	X (VPG)	35252.44 M	A2 (ARBAT)	117.043 DEG	DK11 (GUR)	.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z (VPG)	167.34 M	L1 (ARBAT)	.196 DEG	A1 (GUR)	.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 20 (HEATED OR/12/81 10:52:47

TITLE: 90 FLAT

FIRING DATE: 10/29/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 14106115 (75975.444 Z)

LINE OF FIRE: 85.000 DEG : X(YPG): 32115.93 M : RRG(CARBAT): 680.516 M : HZRRG(GUN): :00 M :
 QUADRANT FL: 400.000 MILS : Y(YPG): 35292.44 M : AZ(CARBAT): 112.043 DEG : DRGT(GUN): :00 M :
 MUZZLE VELOCITY: 914.400 M/SEC : Z(YPG): 167.54 M : LL(CARBAT): :142 DEG : AL(GUN): :00 M :

***** ACQUIRE ***** OCCURRED AT 14106122 (75962.000 Z)

TIME TO ACQUIRE: 7.356 SEC : X(YPG): 32602.58 M : RRG(CARBAT): 1155.337 M : HZRRG(GUN): 489.07 M :
 : Y(YPG): 35336.85 M : AZ(CARBAT): 100.689 DEG : DRGT(GUN): 1.79 M :
 : Z(YPG): 371.20 M : LL(CARBAT): 10.065 DEG : AL(GUN): 203.63 M :

***** UNKNOWN ***** OCCURRED AT 14106122 (75962.000 Z)

TIME TO EVENT: 6.562 SEC : X(YPG): 32602.50 M : RRG(CARBAT): 1155.101 M : HZRRG(GUN): 492.50 M :
 EVENT VELOCITY: :002 M/SEC : Y(YPG): 35335.95 M : AZ(CARBAT): 100.701 DEG : DRGT(GUN): :59 M :
 : Z(YPG): 372.28 M : LL(CARBAT): 10.086 DEG : AL(GUN): 204.73 M :

***** IMPACT ***** OCCURRED AT 14106126 (75964.019 Z)

TIME OF FLIGHT: 10.576 SEC : X(YPG): 30674.14 M : RRG(CARBAT): 883.461 M : HZRRG(GUN): 1440.78 M :
 IMPACT ANGLE: 400.000 DEG : Y(YPG): 35341.00 M : AZ(CARBAT): 110.719 DEG : DRGT(GUN): 76.50 M :
 IMPACT VELOCITY: :000 M/SEC : Z(YPG): :00 M : LL(CARBAT): 11.047 DEG : AL(GUN): 167.54 M :
 EXTRAPOLATION: 2.970 SEC

LIVET SUMMARY OF TUBE ROUND NUMBER 21 (CREATED 06/17/81 10:55:52)

TITLE: 105 FLAT

EXPIRATION DATE: 11/04/80

DESCRIPTION:

1333 GUNFIRE 88888 OCCURRED AT 09102133 (57753.022 Z)

LINE OF FIRE:	85.000 DEG	X(VPG):	32183.00 M	NRG(CARHAT):	696.495 N	HZNRG(CURD):	100 M	
QUADRANT FI:	200.000 MILS	Y(VPG):	35286.32 M	AZ(CARHAT):	117.493 DEG	DRCT(CURD):	100 M	0.111 G
MUZZLE VELOCITY:	731.500 M/SEC	Z(VPG):	187.10 M	EL(CARHAT):	179 DEG	ALT(CURD):	100 M	

1333 ACQUIRE 88888 OCCURRED AT 09102133 (57753.550 Z)

TIME TO ACQUIRE:	.528 SEC	X(VPG):	32444.91 M	NRG(CARHAT):	1004.083 N	HZNRG(CURD):	50.000 M	
		Y(VPG):	35280.31 M	AZ(CARHAT):	106.683 DEG	DRCT(CURD):	50.000 M	0.111 G
		Z(VPG):	235.05 M	EL(CARHAT):	3.756 DEG	ALT(CURD):	50.000 M	

1333 IGNITION 88888 OCCURRED AT 09102140 (57760.157 Z)

TIME TO IGNITION:	7.135 SEC	X(VPG):	35317.26 M	NRG(CARHAT):	3853.356 N	HZNRG(CURD):	20.000 M	
BURST ANGLE:	.590 DEG	Y(VPG):	35451.46 M	AZ(CARHAT):	90.893 DEG	DRCT(CURD):	20.000 M	0.111 G
IGNITION VELOCITY:	304.609 M/SEC	Z(VPG):	571.67 M	EL(CARHAT):	5.994 DEG	ALT(CURD):	400.000 M	

1333 IMPACT 88888 OCCURRED AT 09102152 (57772.210 Z)

TIME OF FLIGHT:	15.189 SEC	X(VPG):	37569.60 M	NRG(CARHAT):	6428.305 N	HZNRG(CURD):	5.000 M	
IMPACT ANGLE:	.590 DEG	Y(VPG):	35685.67 M	AZ(CARHAT):	88.771 DEG	DRCT(CURD):	40.000 M	0.111 G
IMPACT VELOCITY:	.600 M/SEC	Z(VPG):	.00 M	EL(CARHAT):	1.509 DEG	ALT(CURD):	100.000 M	
EXTRAPOLATION:	9.311 SEC							

IVM1 SUMMARY OF TUBE ROUND NUMBER 22 CREATED 06/17/81 10:56:10

TITLE: 105 FLAT

FIRING DATE: 11/64/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09100120 (50100.335 Z)

LINE OF FIRE: 85.000 DEG X (YFG) 32103.00 M RUG (ARBAT) 696.495 K HZ (HUG) 0.00 M
 QUADRANT FL: 200.000 MILS Y (YFG) 35226.32 M AZ (ARBAT) 117.493 DEG DR (DUG) 0.00 M
 MUZZLE VELOCITY: 731.500 M/SEC Z (YFG) 167.10 M EL (ARBAT) 1.179 DEG AL (LUG) 0.00 M

***** ACQUIRE ***** OCCURRED AT 09100120 (50100.850 Z)

TIME TO ACQUIRE: .511 SEC X (YFG) 39451.55 M RUG (ARBAT) 1011.611 K HZ (HUG) 349.50 M
 Y (YFG) 35256.90 M AZ (ARBAT) 106.755 DEG DR (DUG) 0.09 M
 Z (YFG) 238.51 M EL (ARBAT) 3.924 DEG AL (LUG) 71.41 M

***** IMPACT ***** OCCURRED AT 09100138 (50118.065 Z)

TIME OF FLIGHT: 17.730 SEC X (YFG) 37620.10 M RUG (ARBAT) 633.375 K HZ (HUG) 5760.41 M
 IMPACT ANGLE: 200.000 DEG Y (YFG) 35578.77 M AZ (ARBAT) 86.183 DEG DR (DUG) 245.30 M
 IMPACT VELOCITY: 304.409 M/SEC Z (YFG) 1.00 M EL (ARBAT) 1.527 DEG AL (LUG) 167.10 M
 EXTRAPOLATION: 7.819 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 23 (FATED 08/12/81 10:56:14

TITLE: 105 FLAT

LINKING DATE: 11/04/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:11:24 (58284.361 Z)

LINE OF FIRE:	85.800 DEG	X(YFG): 32163.60 M	RHS(ARBAT):	696.495 K	HZ(RSG(GND):	.00 M	0 K(11.5)
QUADRANT EL:	100.000 MILS	Y(YFG): 35228.32 M	AZ(ARBAT):	112.493 DEG	DRJ1(GND):	.00 M	
MUZZLE VELOCITY:	731.500 M/SEC	Z(YFG): 167.10 M	EL(ARBAT):	.179 DEG	AL(GND):	.00 M	

***** ACQUIRE ***** OCCURRED AT 09:11:24 (58284.850 Z)

TIME TO ACQUIRE:	.489 SEC	X(YFG): 32433.54 M	RHS(ARBAT):	991.306 K	HZ(RSG(GND):	332.54 M	
		Y(YFG): 35228.18 M	AZ(ARBAT):	102.732 DEG	DRJ1(GND):	6.88 M	0 K(11.5)
		Z(YFG): 199.23 M	EL(ARBAT):	1.731 DEG	AL(GND):	32.13 M	

EVENT SUMMARY OF TUBE ROUND NUMBER 24 (RELATED 00/12/6) 10156.15

TIME: 105 PLAT

TRAINING DATE: 11/04/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:13:45 (50425.14/ 2)

LINE OF FIRE:	85.000 DEG	X (CPG) 37103.00 M	NRG (ARBAT):	496.493 N	1/2 NRG (CURD):	1.00 M	0 ELLS)
QUADRANT EL:	100.000 M/LS	Y (CPG) 35326.32 M	AZ (ARBAT):	117.493 DEG	1/2 DRIT (CURD):	1.00 M	
MUZZLE VELOCITY:	731.500 M/SEC	Z (CPG) 167.10 M	EL (ARBAT):	1.179 DEG	1/2 ALT (CURD):	1.00 M	

***** ACQUIRE ***** OCCURRED AT 09:13:45 (50425.450 2)

TIME TO ACQUIRE:	.503 SEC	X (CPG) 32427.72 M	NRG (ARBAT):	983.801 N	1/2 NRG (CURD):	346.40 M	34 ELLS)
		Y (CPG) 35326.53 M	AZ (ARBAT):	106.659 DEG	1/2 DRIT (CURD):	11.70 M	
		Z (CPG) 197.53 M	EL (ARBAT):	1.646 DEG	1/2 ALT (CURD):	50.64 M	

EVENT SUMMARY OF TUBE ROUND NUMBER 25 CREATED ON 12/01 10:26:31

TITLE: 105 FLAT

FIRING DATE: 11/04/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:21:54 (58914.648 Z)

LINE OF FIRE: 85.000 DEG X(VPG) 32103.00 M HIG(CARBAT) 296.495 M HZRRG(CURD) 1.00 M
 QUADRANT EL: 100.000 MILS Y(VPG) 35260.01 M AZ(CARBAT) 117.493 DEG DRCT(CURD) 1.00 M
 MUZZLE VELOCITY: 791.500 M/SEC Z(VPG) 167.10 M LI(CARBAT) .179 DEG AL(CURD) 1.00 M

***** ACQUIRE ***** OCCURRED AT 09:21:54 (58914.900 Z)

TIME TO ACQUIRE: 1.230 SEC X(VPG) 32430.55 M HIG(CARBAT) 1008.105 M HZRRG(CURD) 249.627 M
 Y(VPG) 35260.01 M AZ(CARBAT) 106.563 DEG DRCT(CURD) 1.00 M
 Z(VPG) 201.29 M LI(CARBAT) 1.020 DEG AL(CURD) 34.39 M

***** UNKNOWN ***** OCCURRED AT 09:21:59 (58919.475 Z)

TIME TO EVENT: 4.807 SEC X(VPG) 33028.20 M HIG(CARBAT) 2997.289 M HZRRG(CURD) 174.09 M
 EVENT VELOCITY: 3.769 M/SEC Y(VPG) 34701.58 M AZ(CARBAT) 117.493 DEG DRCT(CURD) 1.00 M
 Z(VPG) 436.32 M LI(CARBAT) 6.086 DEG AL(CURD) 209.127 M

***** IMPACT ***** OCCURRED AT 09:22:06 (58944.079 Z)

TIME OF FLIGHT: 31.817 SEC X(VPG) 36021.07 M HIG(CARBAT) 1533.196 M HZRRG(CURD) 1671.68 M
 IMPACT ANGLE: 100.000 DEG Y(VPG) 34578.21 M AZ(CARBAT) 120.846 DEG DRCT(CURD) 486.05 M
 IMPACT VELOCITY: 1.000 M/SEC Z(VPG) 6.749 DEG AL(CURD) 167.10 M
 EXTRAPOLATION:

EVENT SUMMARY OF TUBE ROUND NUMBER 26 CRATED 08/17/81 10:58:53

TTTT: 105 FLAT

FIRING DATE: 11/04/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:32:54 (59574.606 Z)

TIME OF FIRE: 85.000 DEG X(VPG) 32183.60 M RRG(ARBAT) 696.495 M HZRR(CUR) 100 M
 QUADRANT EL: 150.000 MILS Y(VPG) 35226.32 M A7(ARBAT) 117.493 DLG DRLL(CUR) 100 M
 MUZZLE VLOCITY: 731.500 M/SEC Z(VPG) 167.10 M LL(ARBAT) 1179 DLG AL(CUR) 100 M

***** ACQUIRE ***** OCCURRED AT 09:32:54 (59574.556 Z)

TIME TO ACQUIRE: .548 SEC X(VPG) 32462.62 M RRG(ARBAT) 1020.417 M HZRR(CUR) 301.35 M
 Y(VPG) 35259.50 M A7(ARBAT) 106.432 DLG DRLL(CUR) 170 M
 Z(VPG) 217.05 M LL(ARBAT) 2.283 DLG AL(CUR) 49.35 M

***** UNKNOWN ***** OCCURRED AT 09:32:58 (59578.746 Z)

TIME TO EVENT: 4.746 SEC X(VPG) 34586.16 M RRG(ARBAT) 3115.841 M HZRR(CUR) 2494.52 M
 Y(VPG) 35433.49 M A7(ARBAT) 92.103 DLG DRLL(CUR) 9.86 M
 EVENT VLOCITY: 350.731 M/SEC Z(VPG) 419.75 M LL(ARBAT) 4.611 DLG AL(CUR) 252.66 M

***** IMPACT ***** OCCURRED AT 09:33:10 (59580.606 Z)

TIME OF FLIGHT: 16.004 SEC X(VPG) 37504.76 M RRG(ARBAT) 6107.660 M HZRR(CUR) 5477.62 M
 IMPACT ANGLE: 150.000 DEG Y(VPG) 35245.25 M A7(ARBAT) 85.083 DLG DRLL(CUR) 60.23 M
 IMPACT VLOCITY: .000 M/SEC Z(VPG) .000 M LL(ARBAT) 1.569 DLG AL(CUR) 107.10 M
 EXTRAPOLATION:

TIME OF FLIGHT:	16.352 SEC	X(VPG):	37714.21 M	R(RC/ARPA):	6.557 DEG	R:	0.1436 GROUND	56.48.01 M
IMPACT ANGLE:	150.000 DEG	Y(VPG):	35444.05 M	AZ(CARPA):	88.931 DEG	DIG:	0.031 GROUND	56.49.59 M (9.4315)
IMPACT VELOCITY:	.0000 M/SEC	Z(VPG):	.00 M	LI(CARPA):	1.1556 DEG		0.1 GROUND	167.10 M
EXTRAPOLATION:	6.414 SEC							

EVENT SUMMARY OF TUBE ROUND NUMBER 20 (CREATED 06/12/81 10:59:25)

TITLE: 105 FIAT

FIRING DATE: 11/04/80

DESCRIPTION:

11111 GUNFIRE 11111 OCCURRED AT 09153113 (60793.592 Z)

LINE OF FIRE: 85.000 DEG X (VP6) 34103.00 M RRG (ARRAT) 696.495 M HZRRG (GUR) 0.00 M
 QUADRANT EL: 150.000 MILS Y (VP6) 35226.32 M A7 (ARRAT) 117.493 DEG DR311 (GUR) 0.00 M
 MUZZLE VELOCITY: 731.500 M/SEC Z (VP6) 167.10 M LL (ARRAT) 1.179 DEG AL1 (GUR) 0.00 M

11111 ACQUIRE 11111 OCCURRED AT 09153114 (60794.150 Z)

TIME TO ACQUIRE: .558 SEC X (VP6) 32462.26 M RRG (ARRAT) 1015.474 M HZRRG (GUR) 300.92 M
 Y (VP6) 35240.91 M A7 (ARRAT) 106.365 DEG DR311 (GUR) 13.15 M
 Z (VP6) 216.91 M LL (ARRAT) 2.678 DEG AL1 (GUR) 49.81 M

11111 UNKNOWN 11111 OCCURRED AT 09153118 (60798.320 Z)

TIME TO EVENT: 4.728 SEC X (VP6) 34572.54 M RRG (ARRAT) 3099.500 M HZRRG (GUR) 1477.59 M
 Y (VP6) 35430.98 M A7 (ARRAT) 92.148 DEG DR311 (GUR) 11.35 M
 EVENT VELOCITY: 353.217 M/SEC Z (VP6) 417.25 M LL (ARRAT) 4.589 DEG AL1 (GUR) 250.15 M

11111 IMPACT 11111 OCCURRED AT 09153130 (60810.679 Z)

TIME OF FLIGHT: 17.258 SEC X (VP6) 37467.53 M RRG (ARRAT) 6381.727 M HZRRG (GUR) 1761.54 M
 IMPACT ANGLE: 150.000 DEG Y (VP6) 35671.98 M A7 (ARRAT) 88.884 DEG DR311 (GUR) 18.65 M
 IMPACT VELOCITY: 1000 M/SEC Z (VP6) 500 M LL (ARRAT) 1.519 DEG AL1 (GUR) 107.10 M
 EXTRAPOLATION:

VIEW SUMMARY OF TUBE ROUND NUMBER 29 (RATED 08/12/81 10159134

11111: 105 FLAT

FIRING DATE: 11/64/80

DESCRIPTION:

11111 GUNFIRE 33333 OCCURRED AT 09159148 (61118.999 2)

LINE OF FIRE:	85.000 DEG	X (YPS)	32103.00 M	NRG (ARHAT)	656.495 M	07860 (GUND)	.00 M
QUADRANT EPI	100.000 MILS	Y (YPS)	35526.32 M	A2 (ARHAT)	117.493 DEG	DR31 (GUND)	.00 M
MUZZLE VELOCITY:	731.500 M/SEC	Z (YPS)	167.10 M	A1 (ARHAT)	.179 DEG	A1 (GUND)	.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 38 (RELATED OR/12/81 10:59:46)

11111 105 FLAT

FIRING DATE: 11/06/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10103143 (61429.311 Z)

LINE OF FIRE: 85.000 DEG X(VPG1) 32103.60 M RHG(CARHAT) 696.495 M HZRHG(COHD) .00 M
 QUADRANT EL: 100.000 MILS Y(VPG1) 35226.32 M A7(CARHAT) 117.493 DEG DEJ1(COHD) .00 M
 MUZZLE VELOCITY: 731.500 M/SEC Z(VPG1) 167.10 M LL(CARHAT) .179 DEG AL1(COHD) .00 M

***** ACQUIRE ***** OCCURRED AT 10103143 (61429.800 Z)

TIME TO ACQUIRE: .489 SEC X(VPG1) 32452.69 M RHG(CARHAT) 1005.670 M HZRHG(COHD) 351.39 M
 Y(VPG1) 35240.99 M A7(CARHAT) 106.514 DEG DEJ1(COHD) 4.06 M
 Z(VPG1) 201.32 M LL(CARHAT) 1.019 DEG AL1(COHD) 34.72 M

***** UNKNOWN ***** OCCURRED AT 10103146 (61426.567 Z)

TIME TO EVENT: 3.256 SEC X(VPG1) 34070.18 M RHG(CARHAT) 2590.853 M HZRHG(COHD) 1974.10 M
 Y(VPG1) 35391.55 M A7(CARHAT) 93.460 DEG DEJ1(COHD) 6.85 M
 EVENT VELOCITY: 400.756 M/SEC Z(VPG1) 294.28 M LL(CARHAT) 2.808 DEG AL1(COHD) 109.18 M

***** IMPACT ***** OCCURRED AT 10103156 (61436.537 Z)

TIME OF FLIGHT: 13.227 SEC X(VPG1) 37623.30 M RHG(CARHAT) 5540.973 M HZRHG(COHD) 4507.70 M
 IMPACT ANGLE: 100.000 DEG Y(VPG1) 35600.46 M A7(CARHAT) 85.456 DEG DEJ1(COHD) 16.17 M
 IMPACT VELOCITY: .000 M/SEC Z(VPG1) .00 M LL(CARHAT) 1.703 DEG AL1(COHD) 167.10 M
 EXTRAPOLATION: 3.688 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 31 CREATED 08/12/81 10:59:59

TITLE: 105 FLAT

FIRING DATE: 11/04/80

DESCRIPTION:

12224 GUNFIRE 22222 OCCURRED AT 10:06:08 (01568.503 Z)

LINE OF FIRE: 85.000 DEG X(VFG): 32103.60 M RRG(ARRAT): 696.495 M HZRRG(GHH): .00 M
 GUARDANT EL: 160.000 MILS Y(VFG): 35226.32 M AZ(ARRAT): 117.493 DEG DRJ1(GHH): .00 M
 MUZZLE VELOCITY: 731.500 M/SEC Z(VFG): 167.10 M LL(ARRAT): .179 DEG AL1(GHH): .00 M

12222 ACQUIRE 22222 OCCURRED AT 10:06:09 (01569.000 Z)

TIME TO ACQUIRE: .497 SEC X(VFG): 32449.90 M RRG(ARRAT): 1006.841 M HZRRG(GHH): 348.65 M
 Y(VFG): 35261.48 M AZ(ARRAT): 106.532 DEG DRJ1(GHH): 4.79 M
 Z(VFG): 206.96 M LL(ARRAT): 1.803 DEG AL1(GHH): 33.86 M

12223 IMPACT 22222 OCCURRED AT 10:06:21 (01581.031 Z)

TIME OF FLIGHT: 12.529 SEC X(VFG): 32651.71 M RRG(ARRAT): 8418.910 M HZRRG(GHH): 7829.16 M
 IMPACT ANGLE: 100.000 DEG Y(VFG): 35972.95 M AZ(ARRAT): 82.105 DEG DRJ1(GHH): 64.95 M
 IMPACT VELOCITY: 490.756 M/SEC Z(VFG): .00 M LL(ARRAT): -1.152 DEG AL1(GHH): 167.10 M
 EXTRAPOLATION: 2.832 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 32 (RELATED 08/12/81 11:00:08)

TITLE: 105 FLAT

FIRING DATE: 11/04/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10:08:30 (61718.643 Z)

LINE OF FIRE: 85.000 DEG ; X(CPG) 32103.00 M ; HUB(CARAT) : 696.493 K ; HZRRG(CURD) : .00 M ; 0 MILS)
 QUADRANT EL: 80.000 MILS ; Y(CPG) 35226.32 M ; A7(CARAT) : 117.493 DEG ; DRJT(CURD) : .00 M
 MUZZLE VELOCITY: 731.500 M/SEC ; Z(CPG) 167.10 M ; E1(CARAT) : .179 DEG ; A1(CURD) : .00 M

***** ACQUIRE ***** OCCURRED AT 10:08:30 (61718.550 Z)

TIME TO ACQUIRE: 507 SEC ; X(CPG) 32441.64 M ; HUB(CARAT) : 998.130 K ; HZRRG(CURD) : 340.84 M
 ; Y(CPG) 35224.05 M ; A7(CARAT) : 106.550 DEG ; DRJT(CURD) : 8.06 M ; 24 MILS)
 ; Z(CPG) 191.04 M ; E1(CARAT) : 1.295 DEG ; A1(CURD) : 24.74 M

***** UNKNOWN ***** OCCURRED AT 10:08:14 (61721.115 Z)

TIME TO EVENT: 3.076 SEC ; X(CPG) 33447.11 M ; HUB(CARAT) : 2409.020 K ; HZRRG(CURD) : 1730.82 M ; 0 MILS)
 ; Y(CPG) 35381.10 M ; A7(CARAT) : 93.971 DEG ; DRJT(CURD) : 1.30 M
 ; Z(CPG) 248.24 M ; E1(CARAT) : 1.878 DEG ; A1(CURD) : 81.14 M

(VEN) SUMMARY OF TUBE ROUND NUMBER 33 (CREATED ON/17/81 11:00:16)

TITLE: 105 FLAT

FIRING DATE: 11/04/80

DESCRIPTION:

14423 GUNFIRE ***** OCCURRED AT 10110128 (61828.253 Z)

LINE OF FIRE:	05.800 DEG	X(VPG):	32103.00 M	ENG(CRAT):	696.493 R	HZRG(CUR):	0.00 M
QUADRANT EL:	80.800 MILS	Y(VPG):	38226.32 M	AZ(CRAT):	117.493 DEG	DETT(CUR):	0.00 M
MUZZLE VELOCITY:	731.508 M/SEC	Z(VPG):	167.10 M	EL(CRAT):	1179 DEG	MLT(CUR):	0.00 M

EVENT SUMMARY OF TUBE MOUND NUMBER 34 (RELATED OR/12/81 11:00:15)

TITLE: 105 FLAT

LINKING DATE: 11/04/80

DESCRIPTION:

8888 GUNFIRE 88888 OCCURRED AT 10:13:48 (62026.176 Z)

LINE OF FIRE:	85.000 DEG	X (VP6):	32163.00 M	RNG (ARRAT):	696.495 M	HZRRG (GUR):	.00 M
QUADRANT EL:	86.000 MILS	Y (VP6):	35226.32 M	AZ (ARRAT):	117.493 DEG	DETT (GUR):	.00 M
MUZZLE VELOCITY:	731.500 M/SEC	Z (VP6):	167.10 M	EL (ARRAT):	1.179 DEG	ALT (GUR):	.00 M

8888 ACQUIRE 88888 OCCURRED AT 10:13:48 (62026.450 Z)

TIME TO ACQUIRE:	.474 SEC	X (VP6):	32443.66 M	RNG (ARRAT):	1001.121 M	HZRRG (GUR):	34.755 M
		Y (VP6):	35226.31 M	AZ (ARRAT):	106.684 DEG	DETT (GUR):	4.36 M
		Z (VP6):	193.34 M	EL (ARRAT):	1.377 DEG	ALT (GUR):	26.274 M

EVENT SUMMARY OF TUBE ROUND NUMBER 35 CREATED 08/17/81 11:00:24

TITLE: 105 FLAT

FIRING DATE: 11/04/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10:17:38 (62258.123 Z)

LINE OF FIRE:	85.000 DEG	X (Y)G1	37103.00 M	RRC (ARRAT):	690.493 M	HZ (RRC (GURD):	100 M
QUADRANT EL:	80.000 MILS	Y (X)G1	35266.30 M	AZ (ARRAT):	117.493 DEG	DRD (T (GURD):	100 M
MUZZLE VELOCITY:	731.500 M/SEC	Z (Y)G1	167.10 M	EL (ARRAT):	1.179 DEG	AL (T (GURD):	100 M

***** ACQUIRE ***** OCCURRED AT 10:17:38 (62258.600 Z)

TIME TO ACQUIRE:	.479 SEC	X (Y)G1	37441.70 M	RRC (ARRAT):	998.773 M	HZ (RRC (GURD):	340.38 M
		Y (X)G1	35261.46 M	AZ (ARRAT):	100.667 DEG	DRD (T (GURD):	100 M
		Z (Y)G1	193.09 M	EL (ARRAT):	1.366 DEG	AL (T (GURD):	25.35 M

EVENT SUMMARY OF TUBE ROUND NUMBER 36 (RELATED OR/12/81 11:00:44

TITLE: 105 FLAT

FIRING DATE: 11/04/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10130127 (63027.748 Z)

LINE OF FIRE: 85.000 DEG X(VFG): 32105.00 M X(RRG(CORD): 650.495 M X(000 M
QUADRANT ELI: 80.000 MILS Y(VFG): 35284.32 M X(AZ(CORR): 117.493 DEG X(000 M
MUZZLE VELOCITY: 731.500 M/SEC Z(VFG): 167.10 M X(EL(CORR): .179 DEG X(000 M

***** ACQUIRE ***** OCCURRED AT 10130128 (63028.250 Z)

TIME TO ACQUIRE: .502 SEC X(VFG): 32744.18 M X(RRG(CORR): 1000.975 M X(000 M
X(VFG): 35242.20 M X(AZ(CORR): 100.503 DEG X(000 M
Z(VFG): 193.45 M X(EL(CORR): 1.395 DEG X(000 M

***** UNKNOWN ***** OCCURRED AT 10130131 (63031.777 Z)

TIME TO EVENT: 4.029 SEC X(VFG): 34346.08 M X(RRG(CORR): 2805.549 M X(000 M
X(VFG): 35412.25 M X(AZ(CORR): 92.703 DEG X(000 M
EVENT VELOCITY: 379.264 M/SEC Z(VFG): 246.16 M X(EL(CORR): 1.631 DEG X(000 M

***** IMPACT ***** OCCURRED AT 10130137 (63037.621 Z)

TIME OF FLIGHT: 9.874 SEC X(VFG): 36171.25 M X(RRG(CORR): 4685.191 M X(000 M
IMPACT ANGLE: 80.000 DEG Y(VFG): 33575.10 M X(AZ(CORR): 89.491 DEG X(000 M
IMPACT VELOCITY: .000 M/SEC Z(VFG): .000 M X(EL(CORR): 2.009 DEG X(000 M
EXTRAPOLATION: 2.622 SEC

JOINT SUMMARY OF TUBE ROUND NUMBER 37 (CREATED ON/3/78) 11:00:50

FILE: 105.F1AT

FIRING DATE: 11/04/80

DESCRIPTION:

11111 GUNFIRE 11111 OCCURRED AT 10133152 (63252.767 Z)

LINE OF FIRE:	85.000 DEG	X(VPG):	32105.00 M	RNG(ARBAT):	696.495 M	HZRG(CORD):	100 M	0.0115
QUADRANT EL:	70.000 MFLS	Y(VPG):	35256.33 M	AZ(ARBAT):	117.493 DEG	DRGT(CORD):	100 M	0.0115
MUZZLE VELOCITY:	731.500 M/SEC	Z(VPG):	167.10 M	EL(ARBAT):	179 DEG	ALT(CORD):	100 M	0.0115

11111 ACQUIRE 11111 OCCURRED AT 10133153 (63253.250 Z)

TIME TO ACQUIRE:	.463 SEC	X(VPG):	32450.25 M	RNG(ARBAT):	1007.808 M	HZRG(CORD):	100 M	0.0115
		Y(VPG):	35256.33 M	AZ(ARBAT):	100.898 DEG	DRGT(CORD):	100 M	0.0115
		Z(VPG):	190.41 M	EL(ARBAT):	1224 DEG	ALT(CORD):	100 M	0.0115

EVENT SUMMARY OF TUBE ROUND NUMBER 30 CREATED 00/12/83 1100156

TITLE: 105 FLAT

FIRING DATE: 11/04/80

DESCRIPTION:

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#### GUNFIRE ##### OCCURRED AT 10:35:52 (63352.399 Z)
LINE OF FIRE: 85.000 DEG 1 X(YPG) 32103.00 M 1 NR(CARBA) 696.495 M 1 H/RG(CUR) 1.00 M 0 K115)
QUADRANT EL: 70.000 MILS 1 Y(YPG) 35226.32 M 1 AZ(CARBA) 117.493 DEG 1 DR11(CUR) 1.00 M 0 K115)
MUZZLE VELOCITY: 791.500 M/SEC 1 Z(YPG) 167.10 M 1 EI(CARBA) 1.179 DEG 1 AI(CUR) 1.00 M

#### ACQUIRE ##### OCCURRED AT 10:35:52 (63352.900 Z)
TIME TO ACQUIRE: .501 SEC 1 X(YPG) 32442.76 M 1 NR(CARBA) 999.361 M 1 H/RG(CUR) 1.00 M 0 K115)
1 Y(YPG) 35226.75 M 1 AZ(CARBA) 100.379 DEG 1 DR11(CUR) 1.00 M 0 K115)
1 Z(YPG) 190.32 M 1 EI(CARBA) 1.207 DEG 1 AI(CUR) 1.00 M

#### UNKNOWN ##### OCCURRED AT 10:35:57 (63357.070 Z)
TIME TO EVENT: 4.679 SEC 1 X(YPG) 32708.04 M 1 NR(CARBA) 1407.092 M 1 H/RG(CUR) 1.00 M 0 K115)
1 Y(YPG) 30584.45 M 1 AZ(CARBA) 45.712 DEG 1 DR11(CUR) 1.00 M 0 K115)
EVENT VELOCITY: 10.790 M/SEC 1 Z(YPG) 261.43 M 1 EI(CARBA) 4.016 DEG 1 AI(CUR) 1.00 M 0 K115)

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EVENT SUMMARY OF TUBE ROUND NUMBER 39 CREATED 08/17/81 11:01:00

TITLE: 105 FLAT

FIRING DATE: 11/04/80

DESCRIPTION:

***** GUN FIRE ***** OCCURRED AT 10143147 (63827.620 Z)

LINE OF FIRE:	85.000 DEG	X (YFG): 32103.60 M	RK (CARBAT):	896.493 M	H (RRG-CORD):	100 M	0 E (H)
QUADRANT EL:	70.000 MILS	Y (YFG): 35226.30 M	AZ (CARBAT):	117.493 DEG	BR1 (CORD):	100 M	0 E (H)
MUZZLE VELOCITY:	731.500 M/SEC	Z (YFG): 167.10 M	EL (CARBAT):	1.179 DEG	AL (CORD):	100 M	

***** ACQUIRE ***** OCCURRED AT 10143148 (63828.360 Z)

TIME TO ACQUIRE:	.480 SEC	X (YFG): 32442.68 M	RK (CARBAT):	995.500 M	H (RRG-CORD):	100 M	0 E (H)
		Y (YFG): 35261.97 M	AZ (CARBAT):	106.673 DEG	BR1 (CORD):	100 M	0 E (H)
		Z (YFG): 190.22 M	EL (CARBAT):	1.200 DEG	AL (CORD):	100 M	0 E (H)

EVENT SUMMARY OF TUBE ROUND NUMBER 40 (CREATED ON 12/81 11:01:05)

TITLE: 105 FLAT

FIRING DATE: 11/04/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10:47:02 (64022.125 Z)

LINE OF FIRE:	85.000 DEG	X (YPG): 32103.00 M	NRG (AKHAT): 696.495 M	H/ERG (GUR):	.00 M
QUADRANT EL:	70.000 MILS	Y (YPG): 35224.32 M	AZ (AKHAT): 117.493 DEG	DRIT (GUR):	.00 M
MUZZLE VELOCITY:	731.500 M/SEC	Z (YPG): 167.10 M	EL (AKHAT): 179 DEG	ALT (GUR):	.00 M

LVTNF SUMMARY OF TUBE ROUND NUMBER 26 CREATED 08/12/81 11:03:59

TITLE: 90 FLAT

FIKING DATE: 11/07/80

DESCRIPTION:

11111 GUNFIRE 111111 OCCURRED AT 08:50:07 (57007.584 Z)

LINE OF FIRE:	85.000 DEG	X(CYPC): 32115.93 M	HUB(CARBAT):	680.516 M	HZRG(CORD):	100 M
QUADRANT ELEV:	308.800 MILS	Y(CYPC): 35292.44 M	AZ(CARBAT):	113.043 DEG	DRGT(CORD):	100 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(CYPC): 167.54 M	EL(CARBAT):	146 DEG	ALT(CORD):	100 M

EVENT SUMMARY OF TUBE ROUND NUMBER 27 CREATED 08/12/81 11:04:00

TITLE: 90 FLAT

FIRING DATE: 11/07/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:06:06 (57966.356 Z)

LINE OF FIRE: 85.000 DEG X(YPG): 32135.53 M RHC(CARBAT): 480.112 K HZRRG(CURD): 100 M
 QUADRANT EL: 300.000 MILS Y(YPG): 35092.44 M AZ(CARBAT): 112.043 DEG DRD(CURD): 100 M
 MUZZLE VELOCITY: 914.400 M/SEC Z(YPG): 167.54 M EL(CARBAT): 1146 DEG ALT(CURD): 100 M

***** ACQUIRE ***** OCCURRED AT 09:06:13 (57973.460 Z)

TIME TO ACQUIRE: 7.042 SEC X(YPG): 32613.69 M RHC(CARBAT): 1127.488 K HZRRG(CURD): 500.14 M
 Y(YPG): 35539.13 M AZ(CARBAT): 100.476 DEG DRD(CURD): 3.11 M
 Z(YPG): 319.75 M EL(CARBAT): 7.428 DEG ALT(CURD): 152.50 M

***** IMPACT ***** OCCURRED AT 09:06:19 (57979.574 Z)

LINE OF FLIGHT: 13.216 SEC X(YPG): 31306.45 M RHC(CARBAT): 382.502 K HZRRG(CURD): 805.99 M
 IMPACT ANGLE: 300.000 DEG Y(YPG): 38251.15 M AZ(CARBAT): 148.938 DEG DRD(CURD): 29.63 M
 IMPACT VELOCITY: 1000 M/SEC Z(YPG): 100 M EL(CARBAT): 22.047 DEG ALT(CURD): 167.54 M
 EXTRAPOLATION: 6.024 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 28 (CREATED 08/12/01 11:04:16)

TITLE: 90 FLAT

FIRING DATE: 11/07/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 09:34:35 (59675.738 Z)

LINE OF FIRE:	85.000 DEG	X(YPG):	32115.93 M	RNG(ARRAT):	280.316 K	HZRRG(CURD):	.00 M
QUADRANT ELI:	300.000 MILS	Y(YPG):	35492.44 M	RZ(ARRAT):	112.043 DEG	DEFT(CURD):	.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(YPG):	167.04 M	LL(ARRAT):	1142 DEG	BL(CURD):	.00 M

EVENT SUMMARY OF TURE ROUND NUMBER 29 (RELATED ON 12/01 11:04:24)

TITLE: 90 FLAT

FIRING DATE: 11/07/80

DESCRIPTION:

33333 GUNFIRE 33333 OCCURRED AT 10:02:55 (61375.832 2)

LINE OF FIRE:	85.000 DEG	X (YFG) 52115.53 M	HUG (ARBAT)	680.316 N	1 HZNRG (CUR)	0.00 M
QUADRANT EL:	300.000 MILS	Y (YFG) 35592.44 M	A7 (ARBAT)	117.003 DEG	1 DEFT (CUR)	0.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z (YFG) 167.54 M	L1 (ARBAT)	114.146 DEG	1 GFT (CUR)	0.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 30 CREATED 08/12/81 11:04:50

TITLE: 90 FLAT

FIRING DATE: 11/07/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10:15:30 (62130.479 Z)

LINE OF FIRE:	85.000 DEG	X(YFG):	3215.93 M	RNG(ARRAT):	680.516 M	UZRNG(CUR):	.00 M
QUADRANT EL:	300.000 MILS	Y(YFG):	35592.44 M	AZ(ARRAT):	117.043 DEG	DELT(CUR):	.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(YFG):	167.54 M	EL(ARRAT):	.146 DEG	DLT(CUR):	.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 31 (CREATED 06/17/81 11:04:30)

TYPE: 90 FLAT

FIRING DATE: 11/07/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 17:00:20 (20.065 2)

LINE OF FIRE
QUADRANT ELI
MUZZLE VELOCITY:

85.000 DEG
300.000 MILS
914.400 M/SEC

X(YPG) 32115.53 M
Y(YPG) 35292.44 M
Z(YPG) 147.54 M

RIG(CARBAT)
A7(CARBAT)
L1(CARBAT)

680.516 K
112.043 DEG
1146 DEG

HYPERG GURD
DECT GURD
AT GURD

00 M
00 M
00 M

0 01150
0 01150
0 01150

EVENT SUMMARY OF TUBE ROUND NUMBER 31 (CREATED 08/15/81 11:04:40)

TITLE: 90 FLAT

LINKING DATE: 11/07/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10132140 (63161.460 Z)

LINE OF FIRE:	85.900 DEG	X (YFG): 32115.93 M	RNG (ARBAT): 600.514 M	HZ (RNG (GUND):	0.00 M
QUADRANT EL:	300.000 MILS	Y (YFG): 35292.44 M	AZ (ARBAT): 112.043 DEG	DRIT (GUND):	0.00 M
MUZZLE VELOCITY:	919.400 M/SEC	Z (YFG): 167.54 M	EL (ARBAT): 0.146 DEG	ALT (GUND):	0.00 M

***** ACQUIRE ***** OCCURRED AT 10132141 (63161.460 Z)

TIME TO ACQUIRE:	.792 SEC	X (YFG): 32769.48 M	RNG (ARBAT): 1300.883 M	HZ (RNG (GUND):	676.35 M
		Y (YFG): 35353.60 M	AZ (ARBAT): 98.462 DEG	DRIT (GUND):	0.00 M
		Z (YFG): 370.10 M	EL (ARBAT): 0.659 DEG	ALT (GUND):	202.35 M

IVEN) SUMMARY OF TUBE ROUND NUMBER 32 (CREATED ON 11/7/83) 11:08:00

TYPE: 90 FLAT

TESTING DATE: 11/07/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10141150 (63710.633 Z)

TIME OF FIRE:

QUADRANT ELI

MUZZLE VELOCITY:

85.000 DEG

300.000 MILS

914.400 M/SEC

X(VPG) 32315.53 M

Y(VPG) 35292.44 M

Z(VPG) 167.54 M

ANG(CORR) :

AZ(CORR) :

EL(CORR) :

680.516 IN

117.043 DEG

146 DEG

0.00 M

0.00 M

0.00 M

0.00 M

0.00 M

0.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 30 (RELATED 00/11/81 11:08:07)

TITLE: 90 FLAT

FIRING DATE: 11/07/80

DESCRIPTION:

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##### GUNFIRE ##### OCCURRED AT 10:50:55 (64255.322 Z)
LINE OF FIRE: 85.000 DEG + X(VFG) 32115.93 M + BRG(CARBAT) 680.516 M + HZERG(CUR) 1.00 M
GUARDANT EL: 300.000 MILS + Y(VFG) 35295.44 M + AZ(CARBAT) 112.043 DEG + DEGT(CUR) 1.00 M
MUZZLE VELOCITY: 914.400 M/SEC + Z(VFG) 127.54 M + EL(CARBAT) 1.142 DEG + ADT(CUR) 1.00 M

##### ACQUIRE ##### OCCURRED AT 10:50:56 (64256.300 Z)
TIME TO ACQUIRE: .978 SEC + X(VFG) 32942.54 M + BRG(CARBAT) 1480.795 M + HZERG(CUR) 630.50 M
+ Y(VFG) 35370.84 M + AZ(CARBAT) 96.925 DEG + DEGT(CUR) 6.00 M
+ Z(VFG) 413.71 M + EL(CARBAT) 5.423 DEG + ADT(CUR) 242.16 M

##### REACQUIRE ##### OCCURRED AT 10:50:57 (64257.750 Z)
TIME OF REACQUIRE: 2.428 SEC + X(VFG) 33848.37 M + BRG(CARBAT) 5571.998 M + HZERG(CUR) 1555.55 M
+ Y(VFG) 35624.30 M + AZ(CARBAT) 87.574 DEG + DEGT(CUR) 197.10 M
+ Z(VFG) 471.19 M + EL(CARBAT) 13.055 DEG + ADT(CUR) 503.65 M
  
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EVENT SUMMARY OF TUBE ROUND NUMBER 34 CREATED 06/12/81 11:08:33

TITLE: 90 FLAT

FINISH DATE: 11/07/80

DESCRIPTION:

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##### GUNFIRE ##### OCCURRED AT 10158115 (64655.645 Z)
TIME OF FIRE: 85.000 DEG + X(VPG) 32115.53 M + RRG(CARDAT) 640.516 M + HZRRG(CORD) 1.00 M
QUADRANT ELI: 300.000 MILS + Y(VPG) 35292.44 M + AZ(CARDAT) 112.043 DEG + DRRT(CORD) 1.00 M
MUZZLE VELOCITY: 914.400 M/SEC + Z(VPG) 167.54 M + LL(CARDAT) 1.142 DEG + ALT(CORD) 1.00 M

##### ACQUIRE ##### OCCURRED AT 10158117 (64657.600 Z)
TIME TO ACQUIRE: 1.155 SEC + X(VPG) 35072.58 M + RRG(CARDAT) 1621.330 M + HZRRG(CORD) 261.06 M
+ Y(VPG) 35384.81 M + AZ(CARDAT) 95.864 DEG + DRRT(CORD) 8.64 M
+ Z(VPG) 456.06 M + LL(CARDAT) 10.180 DEG + ALT(CORD) 268.51 M

##### UNKNOWN ##### OCCURRED AT 10158124 (64704.775 Z)
TIME TO EVENT: 8.930 SEC + X(VPG) 37515.23 M + RRG(CARDAT) 6408.684 M + HZRRG(CORD) 5826.73 M
+ Y(VPG) 35826.07 M + AZ(CARDAT) 87.523 DEG + DRRT(CORD) 25.69 M
+ Z(VPG) 1565.74 M + LL(CARDAT) 12.237 DEG + ALT(CORD) 1378.13 M

##### IMPACT ##### OCCURRED AT 10158153 (64753.665 Z)
TIME OF FLIGHT: 37.821 SEC + X(VPG) 37036.17 M + RRG(CARDAT) 5558.456 M + HZRRG(CORD) 4791.60 M
+ Y(VPG) 35729.68 M + AZ(CARDAT) 88.327 DEG + DRRT(CORD) 6.77 M
+ Z(VPG) 1.000 M/SEC + LL(CARDAT) 1.745 DEG + ALT(CORD) 167.54 M
+ EXTRAPOLATION: 27.916 SEC

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00006 UNKNOWNH 00000 OCCURRED AT 1103117 (64987.144 Z)
TIME TO EVENT:          9.988 SEC      X(VPG)= 33102.48 M
EVENT VELOCITY:         .001 M/SEC     Y(VPG)= 30379.65 M
                                Z(VPG)= 469.05 M

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TO THE

EVENT SUMMARY OF TUBE ROUND NUMBER 36 (CREATED 08/12/81 11:08:52)

TITLE: 90 FLAT

FIRING DATE: 11/07/80

DESCRIPTION:

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##### GUNFIRE ##### OCCURRED AT 11:19:59 (65959.841 Z)
LINE OF FIRE: 85.000 DEG + X(YPG) 32135.93 M + RRG(CARRAT): 680.516 M + HZNRG(CURD): 100 M + 0 K11.5)
QUADRANT EL: 200.000 MILS + Y(YPG) 35052.44 M + AZ(CARRAT): 112.043 DEG + DIST(CURD): 100 M + 0 K11.5)
MUZZLE VELOCITY: 914.400 M/SEC + Z(YPG) 167.54 M + FL(CARRAT): 142 DEG + ALT(CURD): 100 M + 0 K11.5)

##### ACQUIRE ##### OCCURRED AT 11:20:01 (66001.056 Z)
TIME TO ACQUIRE: 1.209 SEC + X(YPG) 35129.56 M + RRG(CARRAT): 1663.399 M + HZNRG(CURD): 1017.80 M + 0 K11.5)
+ Y(YPG) 35384.48 M + AZ(CARRAT): 95.673 DEG + DIST(CURD): 100 M + 0 K11.5)
+ Z(YPG) 358.75 M + FL(CARRAT): 6.541 DEG + ALT(CURD): 191.51 M + 0 K11.5)

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EVENT SUMMARY OF TUBE ROUND NUMBER 38 (CREATED 08/12/81 11:09:31)

TITLE: 90 FLAT

FIRING DATE: 11/07/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 11:31:59 (66719.643 Z)

TIME OF FIRE:	85.000 DEG	X(VPG): 32115.93 M	RHG(CARHAT):	680.516 M	HZRR(CGRH):	
QUADRANT EL:	200.000 MILS	Y(VPG): 35262.44 M	AZ(CARHAT):	157.043 DEG	DR31(CGRH):	0.00 M C
MUZZLE VELOCITY:	914.400 M/SEC	Z(VPG): 167.54 M	LI(CARHAT):	146.016	AL1(CGRH):	0.00 M C

***** ACQUIRE ***** OCCURRED AT 11:32:01 (66721.200 Z)

TIME TO ACQUIRE:	1.557 SEC	X(VPG): 33381.27 M	RHG(CARHAT):	1916.758 M	HZRR(CGRH):	1270.20 M
		Y(VPG): 35407.91 M	AZ(CARHAT):	94.251 DEG	DR31(CGRH):	4.75 M C
		Z(VPG): 412.49 M	LI(CARHAT):	7.990 DEG	AL1(CGRH):	249.24 M

EVENT SUMMARY OF TUBE ROUND NUMBER 40 CREATED ON 12/81 11110104

TITLE: 90 FLAT

FIRING DATE: 11/07/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 11:40:08 (67208.954 Z)

LINE OF FIRE: 85.000 DEG X (YFG) 32115.93 M RRG (ARRAT) 480.516 E H HZRRG (GUR) 1.00 M C
 QUADRANT EL: 100.000 MILS Y (YFG) 35592.44 M A7 (ARRAT) 112.043 DEG BKJ1 (GUR) 1.00 M C
 MUZZLE VELOCITY: 914.400 M/SEC Z (YFG) 167.94 M LL (ARRAT) 1.146 DEG AL1 (GUR) 1.00 M C

***** ACQUIRE ***** OCCURRED AT 11:40:10 (67210.300 Z)

TIME TO ACQUIRE: 1.346 SEC X (YFG) 33335.94 M RRG (ARRAT) 1863.870 E H HZRRG (GUR) 1.00 M C
 Y (YFG) 35401.61 M A7 (ARRAT) 94.108 DEG BKJ1 (GUR) 2.07 M C
 Z (YFG) 280.69 M LL (ARRAT) 3.427 DEG AL1 (GUR) 112.14 M C

***** IMPACT ***** OCCURRED AT 11:40:25 (67225.256 Z)

TIME OF FLIGHT: 16.303 SEC X (YFG) 46548.73 M RRG (ARRAT) 8777.150 E H HZRRG (GUR) 8164.18 M C
 IMPACT ANGLE: 100.000 DEG Y (YFG) 36607.48 M A7 (ARRAT) 86.998 DEG BKJ1 (GUR) 3.49 M C
 IMPACT VELOCITY: 424.539 M/SEC Z (YFG) 1.105 DEG AL1 (GUR) 1677.54 M C
 EXTRAPOLATION: 6.407 SEC

LIVE SUMMARY OF TUBE ROUND NUMBER 41 CREATED 08/12/81 11:10:11

TIME: 90 F1AT

FIRING DATE: 11/07/80

DESCRIPTION:

1333 GUNFIRE 33333	OCCURRED AT	11144110 (67450.161 Z)					
TIME OF FIRE:	85.000 DLG	X(VP6): 32115.93 M	RUG(CARHAT):	680.516 M	HZNR(CGUR):	0.00 M	
QUADRANT ELEV:	50.000 MILS	Y(VP6): 35292.44 M	AZ(CARHAT):	117.045 DLG	DETH(CGUR):	0.00 M	0.1115
MUZZLE VELOCITY:	914.400 M/SEC	Z(VP6): 167.54 M	EL(CARHAT):	1.142 DEG	ALT(CGUR):	0.00 M	
1433 ACQUIRE 33333	OCCURRED AT	11144111 (67451.556 Z)					
TIME TO ACQUIRE:	1.389 SEC	X(VP6): 33347.77 M	RUG(CARHAT):	1848.264 M	HZNR(CGUR):	1736.57 M	
		Y(VP6): 35404.40 M	AZ(CARHAT):	94.405 DLG	DETH(CGUR):	0.00 M	0.1115
		Z(VP6): 216.08 M	EL(CARHAT):	1.497 DEG	ALT(CGUR):	0.00 M	
1533 UNKNOWN 33333	OCCURRED AT	11144112 (67452.469 Z)					
TIME TO EVENT:	2.248 SEC	X(VP6): 34763.16 M	RUG(CARHAT):	3280.354 M	HZNR(CGUR):	1736.57 M	0.471115
EVENT VELOCITY:	587.453 M/SEC	Y(VP6): 35447.92 M	AZ(CARHAT):	88.251 DLG	DETH(CGUR):	1736.57 M	
		Z(VP6): 197.24 M	EL(CARHAT):	1.560 DEG	ALT(CGUR):	0.00 M	

EVENT SUMMARY OF TUBE ROUND NUMBER 42 (CREATED ON: 11/07/81 11:10:21)

TITLE: 90 FLAT

FIRING DATE: 11/07/80

DESCRIPTION:

OCCURRED AT 11:47:34 (67654.263 Z)

LINE OF FIRE: 85.000 DEG XVP61 32115.93 M HIG(CARHAT) 680.516 K HZRRG(CURD) 1.00 M
 QUADRANT EL: 50.000 MILS YVP61 35392.44 M AZ(CARHAT) 117.043 DEG DEFT(CURD) 1.00 M
 MUZZLE VELOCITY: 914.400 M/SEC ZVP61 167.54 M LL(CARHAT) 1.146 DEG AL(CURD) 1.00 M

OCCURRED AT 11:47:35 (67655.550 Z)

TIME TO ACQUIRE: 1.347 SEC XVP61 33354.02 M HIG(CARHAT) 1875.189 K HZRRG(CURD) 1.747 SEC M
 YVP61 35402.97 M AZ(CARHAT) 94.451 DEG DEFT(CURD) 1.71 M
 ZVP61 219.60 M LL(CARHAT) 1.544 DEG AL(CURD) 52.776 M

OCCURRED AT 11:47:37 (67657.546 Z)

TIME TO IGNITION: 3.357 SEC XVP61 35159.76 M HIG(CARHAT) 3674.885 K HZRRG(CURD) 3075.075 M
 JUNK ANGLE: 3.581 DEG YVP61 35259.64 M AZ(CARHAT) 89.816 DEG DEFT(CURD) 3.54 M
 IGNITION VELOCITY: 600.107 M/SEC ZVP61 246.18 M LL(CARHAT) 1.199 DEG AL(CURD) 78.64 M

OCCURRED AT 11:47:40 (67660.600 Z)

TIME OF REACQUIRE: 6.397 SEC XVP61 36443.16 M HIG(CARHAT) 5155.867 K HZRRG(CURD) 5546.276 M
 YVP61 35485.73 M AZ(CARHAT) 80.469 DEG DEFT(CURD) 5.76 M
 ZVP61 198.50 M LL(CARHAT) 1.359 DEG AL(CURD) 31.7 M

OCCURRED AT 11:47:43 (67663.365 Z)

TIME OF FLIGHT: 9.106 SEC XVP61 37619.55 M HIG(CARHAT) 6441.715 K HZRRG(CURD) 6175.17 M
 IMPACT ANGLE: 3.581 DEG YVP61 35792.38 M AZ(CARHAT) 84.833 DEG DEFT(CURD) 3.54 M
 IMPACT VELOCITY: 1.000 M/SEC ZVP61 1.00 M LL(CARHAT) 1.500 DEG AL(CURD) 10.54 M
 EXTRAPOLATION: 1.959 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 43 (RELATED OR/17/81 11:10:50)

1111: 90 11AT

FIRING DATE: 11/6//80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 11:52:19 (67939.27) Z)

LINE OF FIRE:	85.000 DEG	X(VPG): 32115.93 M	RIG(CARBAT):	CR0.516 M	HZRG(CORD):	0.00 M
QUADRANT EL:	50.000 MILS	Y(VPG): 35052.44 M	AZ(CARBAT):	117.045 DEG	DRFT(CORD):	0.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(VPG): 167.54 M	LI(CARBAT):	1.146 DEG	ALTCORD):	0.00 M

***** ACQUIRE ***** OCCURRED AT 11:52:20 (67940.650) Z)

TIME TO ACQUIRE:	1.379 SEC	X(VPG): 35344.93 M	RIG(CARBAT):	1825.529 M	HZRG(CORD):	17.50 DEG
		Y(VPG): 35402.54 M	AZ(CARBAT):	94.469 DEG	DRFT(CORD):	2.62 M
		Z(VPG): 219.41 M	LI(CARBAT):	1.552 DEG	ALTCORD):	52.27 M

***** UNKNOWN ***** OCCURRED AT 11:52:22 (67942.37) Z)

TIME TO EVENT:	3.100 SEC	X(VPG): 39450.78 M	RIG(CARBAT):	3085.449 M	HZRG(CORD):	25.28 DEG
		Y(VPG): 35140.07 M	AZ(CARBAT):	84.777 DEG	DRFT(CORD):	5.28 M
EVENT VELOCITY:	18.756 M/SEC	Z(VPG): 122.41 M	LI(CARBAT):	1.043 DEG	ALTCORD):	45.13 M

EVENT SUMMARY OF TUBE ROUND NUMBER 44 (RELATED 00/12/81) 1110136

TITLE: 90 FLAT

FIRING DATE: 11/07/80

DESCRIPTION:

1110136 SUNFIRE 1110136 OCCURRED AT 11:55:18 (68119.342 Z)

LINE OF FIRE: 85.000 DEG X (YPR) 32115.93 M RUC (ARRAT): 680.516 M HZ (HRC (GUR): 1.00 M (0 KILS)
 QUADRANT EL: 50.000 MILS Y (YPR) 35292.44 M A7 (ARRAT): 112.093 DEG PR (T (GUR): 1.00 M
 MUZZLE VELOCITY: 914.400 M/SEC Z (YPR) 167.04 M LL (ARRAT): 1.146 DEG AL (T (GUR): 1.00 M

1110136 ACQUIRE 1110136 OCCURRED AT 11:55:19 (68119.450 Z)

TIME TO ACQUIRE: 1.308 SEC X (YPR) 33371.72 M RUC (ARRAT): 1897.268 M HZ (HRC (GUR): 1.00 M (0 KILS)
 Y (YPR) 35403.07 M A7 (ARRAT): 94.389 DEG PR (T (GUR): 1.00 M
 Z (YPR) 219.33 M LL (ARRAT): 1.516 DEG AL (T (GUR): 1.00 M

10.384 SEC	X (VTG)	34.513.57 M	RIG (AREA)	68.76.37 E	RZRG (COORD)	6.77.18 W
4.272 DEG	Z (VTG)	35.53.00 M	AL (AREA)	87.609 DEG	RLT1 (COORD)	1.77.16 W
0.900 M/SEC	Z (VTG)	.00 M	LL (AREA)	1.419 DEG	RLT2 (COORD)	12.7.54 W

EVENT SUMMARY OF TUBE ROUND NUMBER 46 CREATED 06/17/83 11:16:59

TITLE: 90MPLAT

FIRING DATE: 11/21/80

DESCRIPTION:

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##### GUNFIRE ##### OCCURRED AT 09138.20 (59960.745 2)
LINE OF FIRE: 85.600 DEG X (VPG) 32115.93 M RRG (ARRAT) 680.513 M HZRRG (GUR) 1.00 M
QUADRANT EL: 200.000 MILS Y (VPG) 35292.44 M A7 (ARRAT) 117.045 DEG DRHT (GUR) 1.00 M
MUZZLE VELOCITY: 914.400 M/SEC Z (VPG) 167.54 M LI (ARRAT) 1.001 DEG ALT (GUR) 1.00 M

##### ACQUINE ##### OCCURRED AT 09138.21 (59961.366 7)
TIME TO ACQUIRE: .555 SEC X (VPG) 32230.72 M RRG (ARRAT) 1164.953 H HZRRG (GUR) 512.91 M
Y (VPG) 35339.16 M A7 (ARRAT) 100.325 DEG DRHT (GUR) 1.40 M
Z (VPG) 270.51 M LI (ARRAT) 5.025 DEG ALT (GUR) 102.57 M
  
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EVENT SUMMARY OF TUBE ROUND NUMBER 47 CREATED 00/12/81 11:17:20

TITLE: 90MFLAT

WORKING DATE: 11/21/80

DESCRIPTION:

12333 GUNFIRE 33333	OCURRED AT	09147144 (00464.58) 2)				
TIME OF FIRE:	85.000 DEG	X(VPG) 32115.93 M	IRG(CARHAT):	680.513 M	HZRG(CGR):	.00 M
QUADRANT EL:	200.000 MILS	Y(VPG) 35292.44 M	A7(CARHAT):	117.043 DEG	DR31(CGR):	.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(VPG) 167.54 M	IL(CARHAT):	.001 DEG	AL1(CGR):	.00 M
12333 ACQUIRE 33333	OCURRED AT	09147145 (00465.200) 2)				
TIME TO ACQUIRE:	.619 SEC	X(VPG) 32649.34 M	IRG(CARHAT):	1187.470 M	HZRG(CGR):	5.35.27 M
		Y(VPG) 35334.76 M	A7(CARHAT):	100.200 DEG	DR31(CGR):	.00 M
		Z(VPG) 271.21 M	IL(CARHAT):	5.010 DEG	AL1(CGR):	10.3.67 M

EVENT SUMMARY OF TUBE ROUND NUMBER 48 (CREATED 08/12/81 11113433)

TITLE: 90RMFLAT

FIRING DATE: 11/21/80

DESCRIPTION:

11113 GUNFIRE 11113 OCCURRED AT 09154.115 (60855.396 Z)

TIME OF FIRE:	85.000 DEG	X(CYPG) 32115.53 M	NRG(CARDA1):	680.513 K	HZ(RNG-CURD):	100 M	0.00 M	0.00 M
QUADRANT ELI:	200.000 MILS	Y(CYPG) 35592.44 M	AZ(CARDA1):	117.045 DEG	DRGT(CURD):	100 M	0.00 M	0.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(CYPG) 167.54 M	EL(CARDA1):	1.001 DEG	ALT(CURD):	100 M	0.00 M	0.00 M

11113 ACQUINE 11113 OCCURRED AT 09154.115 (60855.950 Z)

TIME TO ACQUIRE:	15.4 SEC	X(CYPG) 32614.48 M	NRG(CARDA1):	1152.453 K	HZ(RNG-CURD):	100.01 M	0.00 M	0.00 M
		Y(CYPG) 35346.05 M	AZ(CARDA1):	100.477 DEG	DRGT(CURD):	100.01 M	0.00 M	0.00 M
		Z(CYPG) 267.19 M	EL(CARDA1):	4.995 DEG	ALT(CURD):	100.01 M	0.00 M	0.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 50 (CREATED 08/27/83) 11:14:00

TITLE: 90 FLAT

FIRING DATE: 11/21/80

DESCRIPTION:

11111 GUNFIRE 111111 OCCURRED AT 10:17:45 (62245.541 Z)

TIME OF FIRE: 85.600 DEG X(YFG) 3213.53 M HZRG(COR): 490.516 R 1.00 M
 QUADRANT ELI: 200.000 MILS Y(YFG) 35292.44 M DRFT(COR): 112.043 DEG 1.00 M
 MUZZLE VLOCITY: 914.400 M/SEC Z(YFG) 167.54 M LT(COR): 142.016 1.00 M

11111 ACQUIRE 111111 OCCURRED AT 10:17:46 (62246.100 Z)

TIME TO ACQUIRE: .359 SEC X(YFG) 32609.50 M HZRG(COR): 1147.434 R 492.54 M
 Y(YFG) 35340.01 M DRFT(COR): 100.473 DEG 4.22 M
 Z(YFG) 265.54 M LT(COR): 4.812 DEG 97.55 M

11111 IMPACT 111111 OCCURRED AT 10:18:07 (62247.514 Z)

TIME OF FLIGHT: 21.977 SEC X(YFG) 40726.41 M HZRG(COR): 9297.873 R 8640.52 M
 IMPACT ARGEL: 200.000 DEG Y(YFG) 35501.75 M DRFT(COR): 67.652 DEG 149.22 M
 IMPACT VLOCITY: 7.475 M/SEC Z(YFG) 177.100 M LT(COR): 1.048 DEG 2.50 M
 EXHAUSTION: 12.068 SEC

OVER SUMMARY OF TUBE ROUND NUMBER 51 (DATED 00/1/83) 11:14:13

TYPE: 70 FLAT

FIRING DATE: 11/21/80

DESCRIPTION:

11111 GUNFIRE ##### OCCURRED AT 101201.8V (62039.663 1)

TIME OF FIRE:	85.000 DEG	X (YF6):	35115.53 M	RUG (GRAT):	GRG. 516 E	Y (Z/IR) (CODE):	0.00 H
QUADRANT (F):	200.000 MILS	Y (YF6):	35292.44 M	67 (GRAT):	112.003 DEG	Y (D/IR) (CODE):	0.00 H
MUZZLE VELOCITY:	914.400 M/SEC	Z (YF6):	167.34 M	11 (GRAT):	1342 DEG	Y (D/IR) (CODE):	0.00 H

EVENT SUMMARY OF TUBE ROUND NUMBER 52 (RELATED OR/1,7/8) 11:14:18

TITLE: 90 FLAT

FIRING DATE: 11/21/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 14134146 (77666.649 Z)

LINE OF FIRE:	85.000 DEG	X(YF6): 32115.53 M	RHB(CARHAT):	680.516 M	HZ(RHG(CUR)):	.00 M
QUADRANT EL:	200.000 MILS	Y(YF6): 35282.44 M	A7(CARHAT):	117.043 DEG	DR11(CUR):	.00 M C
MUZZLE VELOCITY:	914.400 M/SEC	Z(YF6): 167.54 M	LI(CARHAT):	.146 DEG	AL1(CUR):	.00 M

***** ACQUIRE ***** OCCURRED AT 14134146 (77666.649 Z)

TIME TO ACQUIRE:	.000 SEC	X(YF6): 32115.53 M	RHB(CARHAT):	680.516 M	HZ(RHG(CUR)):	.00 M
		Y(YF6): 35282.44 M	A7(CARHAT):	117.043 DEG	DR11(CUR):	.00 M C
		Z(YF6): 167.54 M	LI(CARHAT):	.146 DEG	AL1(CUR):	.00 M

1000 SUMMARY OF TONE ROUND NUMBER 52 (CREATED 08/12/81 11:14:39)

TIME: 90 FLAT

ENDING DATE: 11/21/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 10135158 (63558.141 Z)

TIME OF FIRE:	85.000 DEG	X(VPG): 32115.53 M	RHG-CARBAT):	480.516 E	H/RKG-CURD):	100 M
QUADRANT EL:	200.000 MILS	Y(VPG): 35292.44 M	AZ-CARBAT):	117.003 DEG	HRTT-CURD):	100 M
NOZZLE VELOCITY:	914.400 M/SEC	Z(VPG): 167.14 M	EL-CARBAT):	1342 DEG	AL-CURD):	100 M

***** ACQUIRE ***** OCCURRED AT 10135158 (63558.700 Z)

TIME TO ACQUIRE:	1.359 SEC	X(VPG): 32419.50 M	RHG-CARBAT):	1157.457 E	H/RKG-CURD):	100.00 M
		Y(VPG): 35346.19 M	AZ-CARBAT):	100.370 DEG	HRTT-CURD):	100.00 M
		Z(VPG): 264.29 M	EL-CARBAT):	4.802 DEG	AL-CURD):	98.73 M

***** IMPACT ***** OCCURRED AT 10136123 (63563.664 Z)

TIME OF FLIGHT:	25.524 SEC	X(VPG): 41001.32 M	RHG-CARBAT):	95.30477 E	H/RKG-CURD):	8915.28 M
IMPACT ANGLE:	200.000 DEG	Y(VPG): 35570.71 M	AZ-CARBAT):	87.457 DEG	HRTT-CURD):	99.17 M
IMPACT VELOCITY:	7.475 M/SEC	Z(VPG): 177.00 M	EL-CARBAT):	1.042 DEG	AL-CURD):	9.46 M
EXTRAPOLATION:	15.615 SEC					

EVENT SUMMARY OF TUBE ROUND NUMBER 53 (RELATED 00/12/81 11:14:51)

TITLE: 90 FLAT

FIRING DATE: 11/21/80

DESCRIPTION:

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##### GUNFIRE ##### OCCURRED AT 10:40:19 (63619.047 Z)
  TIME OF FIRE:      85.000 DEG      X(YFG): 32115.93 M      RHC(ARHAT):      680.516 M      HZ/RHC-(GUR):      1.00 M
  QUADRANT EL:      100.000 MILS      Y(YFG): 35592.44 M      AZ(ARHAT):      112.043 DEG      DR11-(GUR):      1.00 M
  MUZZLE VELOCITY:  914.400 M/SEC      Z(YFG): 167.54 M      EL(ARHAT):      -146 DEG      AL1-(GUR):      1.00 M

##### ACQUIRE ##### OCCURRED AT 10:40:19 (63619.600 Z)
  TIME TO ACQUIRE:  .550 SEC      X(YFG): 32641.75 M      RHC(ARHAT):      1145.593 M      HZ/RHC-(GUR):      5.00 M
      Y(YFG): 35340.45 M      AZ(ARHAT):      100.122 DEG      DR11-(GUR):      2.00 M
      Z(YFG): 216.66 M      EL(ARHAT):      2.309 DEG      AL1-(GUR):      49.11 M
  
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EVENT SUMMARY OF TURE ROUND NUMBER 54 CREATED ON 11/21/80 111210Z

11111 90 11AT

FIRING DATE: 11/21/80

DESCRIPTION:

11111 GUNFIRE 11111 OCCURRED AT 10142117 (63737.931 Z)

TIME OF FIRE: 85.000 DEG X (XVP61) 32115.93 M X (NR6CARB11) 280.512 E X (H2RRC-CGURD) 1.00 M
 QUADRAWN FL: 100.000 MILES Y (YVP61) 35292.44 M Y (A2CARB11) 117.043 DE G Y (DE11-CGURD) 1.00 M
 MUZZLE VELOCITY: 914.400 M/SEC Z (ZVP61) 167.54 M Z (L1CARB11) 146 DE G Z (A1-CGURD) 1.00 M

11111 ACQUINE 11111 OCCURRED AT 10142118 (63738.550 Z)

TIME TO ACQUIRE: .619 SEC X (XVP61) 32115.93 M X (NR6CARB11) 1189.417 E X (H2RRC-CGURD) 241.76 M
 Y (YVP61) 35292.44 M Y (A2CARB11) 100.001 DE G Y (DE11-CGURD) 1.00 M
 Z (ZVP61) 213.73 M Z (L1CARB11) 2.142 DE G Z (A1-CGURD) 46.19 M

11111 UNKNOWN 11111 OCCURRED AT 10142127 (63747.119 Z)

TIME TO EVENT: 9.188 SEC X (XVP61) 36145.26 M X (NR6CARB11) 6667.507 E X (H2RRC-CGURD) 1.00 M
 Y (YVP61) 35785.66 M Y (A2CARB11) 87.535 DE G Y (DE11-CGURD) 24.16 M
 EVENT VELOCITY: 419.478 M/SEC Z (ZVP61) 376.66 M Z (L1CARB11) 1.787 DE G Z (A1-CGURD) 209.11 M

11111 IMPACT 11111 OCCURRED AT 10142132 (63752.646 Z)

TIME OF FLIGHT: 14.718 SEC X (XVP61) 35770.06 M X (NR6CARB11) 8592.184 E X (H2RRC-CGURD) 2677.28 M
 IMPACT ANGLE: 100.000 DEG Y (YVP61) 35156.70 M Y (A2CARB11) 87.189 DE G Y (DE11-CGURD) 65.17 M
 IMPACT VELOCITY: 600 M/SEC Z (ZVP61) 177.00 M Z (L1CARB11) 1.053 DE G Z (A1-CGURD) 9.46 M
 EXTRAPOLATION: 4.749 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 55 (CREATED 08/19/81 11:15:21)

TITLE: 90 FLAT

FIRING DATE: 11/21/80

DESCRIPTION:

8888 GUNFIRE 88888 OCCURRED AT 10:47:16 (64036.206 Z)

LINE OF FIRE:	85.000 DEG	X (YFG): 32115.93 M	RNG (ARRHAT):	680.516 M	1/2 RNG (CURF):	.00 M
QUADRANT ELI	60.000 MILS	Y (YFG): 38592.44 M	AZ (ARRHAT):	117.043 DEG	DEFL (CURF):	.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z (YFG): 167.54 M	EL (ARRHAT):	.146 DEG	ALT (CURF):	.00 M

[illegible]

EVENT SUMMARY OF TUBE ROUND NUMBER 57 CREATED 08/17/81 11:15:28

TITLE: 94 FLAT

FIRING DATE: 11/21/80

DESCRIPTION:

OCCURRED AT 10:51:37 (64297.577 Z)

LINE OF FIRE: 85.000 DEG X(YPG): 32115.93 M RRG(CARDAT): 680.516 R HZ(RG(CORD): .00 M
 QUADRANT ELV: 60.000 MILS Y(YPG): 35292.44 M AZ(CARDAT): 112.043 DEG DRCT(CORD): .00 M C
 MUZZLE VELOCITY: 914.400 M/SEC Z(YPG): 167.54 M E(CARDAT): .146 DEG ALT(CORD): .00 M

IMPACT ##### OCCURRED AT 10:58:44 (64724.720 Z)

TIME OF FLIGHT: 427.143 SEC X(YPG): 32783.45 M RRG(CARDAT): 1283.862 R HZ(RG(CORD): 640.00 M
 IMPACT ANGLE: 60.000 DEG Y(YPG): 35346.24 M AZ(CARDAT): 98.976 DEG DRCT(CORD): .63 M C
 IMPACT VELOCITY: .000 M/SEC Z(YPG): 177.00 M E(CARDAT): .343 DEG ALT(CORD): 9.46 M
 EXTRAPOLATION: 419.570 SEC

FORM SUMMARY OF TUBE ROUND NUMBER 28 (KIATD 06/17/83) 11:35:48

TIME: 90 FLAT

FIRING DATE: 11/23/80

DISCHARGE

***** GUNFIRE ***** OCCURRED AT 10:54:01 (6441.691 7)

TIME OF FIRE:	85.800 DEG	X (YF61)	32175.53 M	BRG (ARHAT):	480.516 R	RYER (CUR):	0.00 M
ROUNDANT EL:	60.000 MILES	Y (YF61)	35592.44 M	AZ (ARHAT):	112.043 DEG	DELT (CUR):	0.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z (YF61)	167.54 M	EL (ARHAT):	1142 DEG	ALT (CUR):	0.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 59 CREATED 08/12/81 11:15:57

TITLE: 90 FLAT

FIRING DATE: 11/21/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 11:16:19 (65779.419 Z)

LINE OF FIRE: 85.000 DEG X(YPG): 32115.93 M RRG(CARHAT): 680.516 M HZRRG(GOOR): 1.00 M (0 K115)
 QUADRANT ELI: 60.000 MILS Y(YPG): 35292.44 M AZ(CARHAT): 112.043 DEG DRIT(GOOR): 1.00 M
 MUZZLE VELOCITY: 914.400 M/SEC Z(YPG): 167.54 M EL(CARHAT): 1.146 DEG ALT(GOOR): 1.00 M

***** ACQUIRE ***** OCCURRED AT 11:16:20 (65780.600 Z)

TIME TO ACQUIRE: 1.181 SEC X(YPG): 33364.41 M RRG(CARHAT): 1885.872 M HZRRG(GOOR): 1.00 M (0 K115)
 Y(YPG): 35401.26 M AZ(CARHAT): 94.460 DEG DRIT(GOOR): 1.00 M
 Z(YPG): 228.05 M EL(CARHAT): 1.786 DEG ALT(GOOR): 1.00 M

***** IGNITION ***** OCCURRED AT 11:16:23 (65783.272 Z)

TIME TO IGNITION: 3.853 SEC X(YPG): 35614.79 M RRG(CARHAT): 4130.910 M HZRRG(GOOR): 1.00 M (0 K115)
 DRK ANGLE: 4.331 DEG Y(YPG): 35586.00 M AZ(CARHAT): 89.554 DEG DRIT(GOOR): 1.00 M
 IGNITION VELOCITY: 626.751 M/SEC Z(YPG): 266.59 M EL(CARHAT): 1.083 DEG ALT(GOOR): 1.00 M

***** UNKNOWN ***** OCCURRED AT 11:16:24 (65784.254 Z)

TIME TO EVENT: 5.337 SEC X(YPG): 35366.77 M RRG(CARHAT): 4880.359 M HZRRG(GOOR): 1.00 M (0 K115)
 Y(YPG): 35645.62 M AZ(CARHAT): 88.820 DEG DRIT(GOOR): 1.00 M
 EVENT VELOCITY: 563.735 M/SEC Z(YPG): 261.46 M EL(CARHAT): 1.082 DEG ALT(GOOR): 1.00 M

EVENT SUMMARY OF TUBE ROUND NUMBER 60 (DATED 08/12/81 11:16:09)

TITLE: 90 FLAT

FIRING DATE: 11/21/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 11:20:25 (66025.85 Z)

LINE OF FIRE: 85.800 DEG : X(YPG) 32115.53 M : HUB(CARVAT) : 680.516 K : HZRG(CORD) : 1.00 M (0 KILLS)
 GUADRANT EL: 60.800 MILES : Y(YPG) 35292.44 M : AZ(CARVAT) : 117.043 DEG : DRGT(CORD) : 1.00 M (0 KILLS)
 MUZLE VELOCITY: 914.400 M/SEC : Z(YPG) 167.54 M : LL(CARVAT) : 1.142 DEG : ALT(CORD) : 1.00 M (0 KILLS)

***** ACQUIRE ***** OCCURRED AT 11:20:26 (66026.55 Z)

TIME TO ACQUIRE: 1.499 SEC : X(YPG) 33381.71 M : HUB(CARVAT) : 1910.073 K : HZRG(CORD) : 1277.68 M (1 KILLS)
 : Y(YPG) 35401.51 M : AZ(CARVAT) : 94.384 DEG : DRGT(CORD) : 1.88 M (1 KILLS)
 : Z(YPG) 229.24 M : LL(CARVAT) : 1.799 DEG : ALT(CORD) : 61.70 M (1 KILLS)

***** UNKNOWN ***** OCCURRED AT 11:20:27 (66027.52 Z)

TIME TO EVENT: 2.469 SEC : X(YPG) 34515.08 M : HUB(CARVAT) : 3031.773 K : HZRG(CORD) : 2407.50 M (3 KILLS)
 : Y(YPG) 35452.53 M : AZ(CARVAT) : 91.038 DEG : DRGT(CORD) : 7.37 M (3 KILLS)
 EVENT VELOCITY: 719.344 M/SEC : Z(YPG) 266.44 M : LL(CARVAT) : 1.729 DEG : ALT(CORD) : 92.89 M (3 KILLS)

***** IMPACT ***** OCCURRED AT 11:20:33 (66033.954 Z)

TIME OF FIIGHT: 8.903 SEC : X(YPG) 37762.49 M : HUB(CARVAT) : 6301.180 M : HZRG(CORD) : 5685.93 M (5 KILLS)
 IMPACT ANGLE: 60.800 DEG : Y(YPG) 35757.48 M : AZ(CARVAT) : 88.092 DEG : DRGT(CORD) : 30.54 M (5 KILLS)
 IMPACT VELOCITY: 563.735 M/SEC : Z(YPG) 177.60 M : LL(CARVAT) : 1.070 DEG : ALT(CORD) : 9.46 M (5 KILLS)
 EXTRAPOLATION: .434 SEC

EVENT SUMMARY OF TUBE ROUND NUMBER 61 (CREATED 08/12/81) 11:16:16

TITLE: 90 FLAT

FIRING DATE: 11/21/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 11:23:27 (66207.609 Z)

LINE OF FIRE:	85.000 DEG	X(YPG): 32115.93 M	RNG(ARRAT):	680.512 M	HZRN6(GUN):	.00 M
QUADRANT ELI:	40.000 MILS	Y(YPG): 35292.44 M	AZ(ARRAT):	112.043 DEG	DRIFT(GUN):	.00 M
NOZZLE VELOCITY:	914.400 M/SEC	Z(YPG): 167.54 M	EL(ARRAT):	.146 DEG	ALT(GUN):	.00 M

***** ACQUIRE ***** OCCURRED AT 11:23:28 (66208.800 Z)

TIME TO ACQUIRE:	1.791 SEC	X(YPG): 33364.52 M	RNG(ARRAT):	1885.278 M	HZRN6(GUN):	1253.87 M
		Y(YPG): 35401.63 M	AZ(ARRAT):	94.448 DEG	DRIFT(GUN):	.04 M
		Z(YPG): 199.20 M	EL(ARRAT):	.909 DEG	ALT(GUN):	31.65 M

***** UNKNOWN ***** OCCURRED AT 11:23:29 (66209.474 Z)

TIME TO EVENT:	2.465 SEC	X(YPG): 34098.34 M	RNG(ARRAT):	2614.886 M	HZRN6(GUN):	1982.70 M
EVENT VELOCITY:	621.276 M/SEC	Y(YPG): 35457.70 M	AZ(ARRAT):	91.976 DEG	DRIFT(GUN):	8.15 M
		Z(YPG): 197.20 M	EL(ARRAT):	.812 DEG	ALT(GUN):	25.66 M

EVENT SUMMARY OF TUNE ROUND NUMBER 62 CREATED 08/12/81 11116127

TITLE: 90 FLAT

FIRING DATE: 11/21/80

DRICKS LOG

***** OCCURRED AT 11126156 (66416.516 Z)

TIME OF EVENT: 07.000 DEG X (VEG): 37115.53 M Y (VEG): 680.516 M HZRRG (GUR): 1.00 M C
 GROUND ALT: 400.000 MILE Y (VEG): 35555.44 M Z (VEG): 172.043 DEG HZRRG (GUR): 1.00 M C
 MUZZLE VELOCITY: 215.400 M/SEC Y (VEG): 167.54 M Z (VEG): 114.043 DEG HZRRG (GUR): 1.00 M C

***** OCCURRED AT 11126158 (66416.256 Z)

TIME TO ALIGHT: 1.722 SEC X (VEG): 35575.73 M Y (VEG): 1890.434 M HZRRG (GUR): 1764.66 M C
 Y (VEG): 35465.26 M Z (VEG): 94.573 DEG HZRRG (GUR): 1.00 M C
 Z (VEG): 205.24 M HZRRG (GUR): 27.69 M C

***** OCCURRED AT 11126158 (66416.665 Z)

TIME TO EVENT: 2.351 SEC X (VEG): 34693.62 M Y (VEG): 2610.102 M HZRRG (GUR): 1589.74 M C
 Y (VEG): 34459.44 M Z (VEG): 91.937 DEG HZRRG (GUR): 1.00 M C
 EVENT VELOCITY: 622.045 M/SEC Y (VEG): 197.53 M Z (VEG): 120.045 DEG HZRRG (GUR): 27.50 M C

EVENT SUMMARY OF TUBE ROUND NUMBER 63 CREATED 08/12/81 11:16:34

TITLE: 90 FLAT

FIRING DATE: 11/21/80

DESCRIPTION:

***** GUNFIRE ***** OCCURRED AT 11:30:36 (66636.616 Z)

LINE OF FIRE: 85.000 DEG X(YPG): 32115.93 M RRG(ARBAT): 680.516 M HZRG(GUR): 100 M
 QUADRANT EL: 35.000 MILS Y(YPG): 35392.44 M AZ(ARBAT): 117.043 DEG DRIT(GUR): 100 M
 MUZZLE VELOCITY: 914.400 M/SEC Z(YPG): 167.54 M LL(ARBAT): 114.146 DEG ALT(GUR): 100 M

***** ACQUIRE ***** OCCURRED AT 11:30:38 (66638.300 Z)

TIME TO ACQUIRE: 1.684 SEC X(YPG): 33375.57 M RRG(ARBAT): 1896.386 M HZRG(GUR): 1264.27 M
 Y(YPG): 35400.39 M AZ(ARBAT): 94.470 DEG DRIT(GUR): 2.74 M
 Z(YPG): 198.78 M LL(ARBAT): 89.1 DEG ALT(GUR): 31.24 M

***** UNKNOWN ***** OCCURRED AT 11:30:39 (66639.070 Z)

TIME TO EVENT: 2.454 SEC X(YPG): 33951.14 M RRG(ARBAT): 2467.998 M HZRG(GUR): 1841.53 M
 Y(YPG): 35449.46 M AZ(ARBAT): 97.285 DEG DRIT(GUR): 3.50 M
 EVENT VELOCITY: 637.832 M/SEC Z(YPG): 187.14 M LL(ARBAT): 41.5 DEG ALT(GUR): 15.60 M

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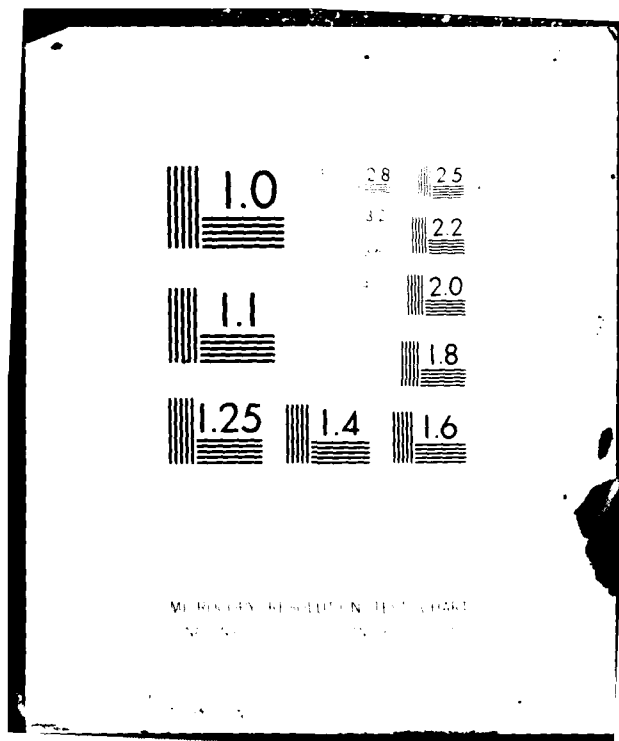
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(VIN) SUMMARY OF TUBE ROUND NUMBER 64 (CREATED ON/12/01 11:16:43)

TITLE: 90 FLAT

FIRING DATE: 11/21/80

DESCRIPTION:

12222 SUMFIRE 22222 OCCURRED AT 11:32:01 (66751.065 Z)

TIME OF FIRE:	85.000 DEG	X(VPG): 32115.93 M	NRG(ARBAT):	690.516 M	HZNRG(GUN):	.00 M
QUADRANT EL:	35.000 MILS	Y(VPG): 35095.44 M	AZ(ARBAT):	112.043 DEG	DRJ1(GUN):	.00 M
MUZZLE VELOCITY:	914.400 M/SEC	Z(VPG): 167.54 M	EL(ARBAT):	.146 DEG	AT(GUN):	.00 M

12222 ACQUINE 22222 OCCURRED AT 11:32:03 (66753.450 Z)

TIME TO ACQUINE:	1.701 SEC	X(VPG): 33347.64 M	NRG(ARBAT):	188.189 M	HZNRG(GUN):	1756.63 M
		Y(VPG): 35403.44 M	AZ(ARBAT):	94.386 DEG	DRJ1(GUN):	1.49 M
		Z(VPG): 195.50 M	EL(ARBAT):	.796 DEG	AT(GUN):	27.56 M

22222 UNKNOWN 22222 OCCURRED AT 11:32:04 (66754.323 Z)

TIME TO EVENT:	2.454 SEC	X(VPG): 33036.27 M	NRG(ARBAT):	2353.302 M	HZNRG(GUN):	1727.24 M
EVENT VELOCITY:	649.762 M/SEC	Y(VPG): 35446.61 M	AZ(ARBAT):	97.466 DEG	DRJ1(GUN):	3.64 M
		Z(VPG): 178.59 M	EL(ARBAT):	.557 DEG	AT(GUN):	11.05 M

