# LANTIRN
# SIGNATURE FLIGHT TESTS
# DATA SUMMARY

Contract No. 7455-27

September 1981

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# LIST OF ILLUSTRATIONS

# 1.0 INTRODUCTION AND SUMMARY

A series of signature flight tests were conducted during March and June 1981 for the Low Altitude Navigation Targeting Infrared for Night pod system (LANTIRN) program. During these tests, simultaneous video data of various military vehicles were recorded with an A-6 Detection Ranging Set (DRS) FLIR and an Imaging Infrared (IIR) Maverick missile seeker. These data will be utilized to develop algorithms for the LANTIRN Target Recognizer (TR) and also to check the performance of the LANTIRN Missile Boresight Correlator (MBC). Vehicle configurations used are those agreed to between Hughes and the Martin Company. Figure 1 depicts the test setup in which a CONVAIR 240 aircraft, flying at low altitudes (500-1500 feet), records the A-6 DRS FLIR and IIR Maverick missile seeker video data of various military targets. The primary targets consisted of tanks, armored personnel carriers (APCs) and military trucks. Tests were conducted at three sites: 1) Fort Hunter-Liggett, California; 2) Fort Knox, Kentucky (simulating a

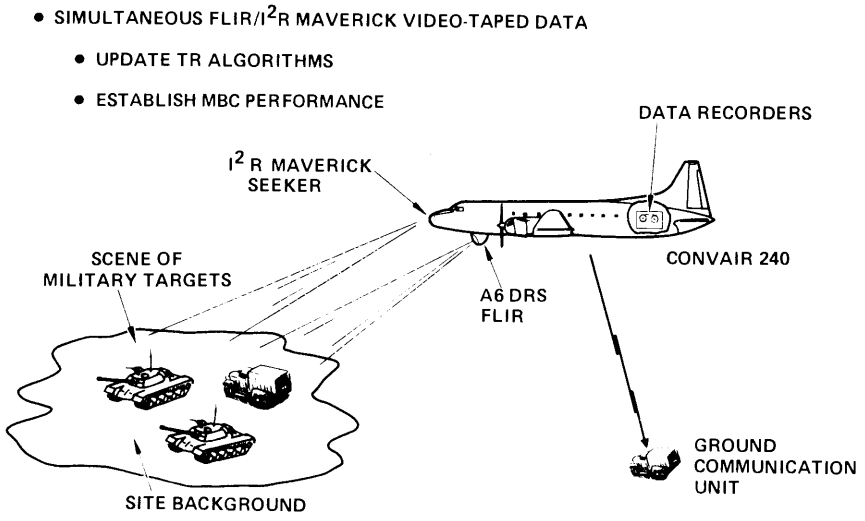



Figure 1. LANTIRN signature flight test.

## 1.2 REPORT ORGANIZATION

This report is divided into five sections. The first section, Introduction and Summary, outlines the test procedure and summarizes the data gathered. Section 2 presents the equipment configurations for the various tests, and Section 3 describes the flight tests in detail. The data summary is offered in Section 4. Conclusions are presented in Section 5.

# 2.0 EQUIPMENT CONFIGURATION

The Hughes Convair 240 aircraft shown in Figure 2 was outfitted with an A-6 DRS FLIR, an $I^2R$ Maverick seeker head, supporting electronic equipment, and recording instrumentation. The A-6 DRS FLIR was mounted under the aircraft, as shown in Figure 3, with the germanium window looking forward. The $I^2R$ Maverick seeker head was mounted in the aircraft radome as shown in Figure 4. The radome was customized to accommodate this arrangement.

The DRS used for these tests is a pre-production model which has been used before in the Convair 240. The Maverick seeker (unit GD-1) was refurbished for the Liggett tests model but was replaced with a current model for all later tests.

## 2.1 INSTRUMENTATION

Figure 5 presents the instrumentation functional block diagram. Target video data from the A6 DRS FLIR are converted to standard TV format by a modified digital scan converter, and then recorded on an IVC-1010 video recorder. The IVC-1010 is a 1-inch reel-to-reel recorder with a 10 MHz bandwidth. A vertical sync pulse is fed into a SMPTE time coder, which supplies a time signal on the audio track of the IVC recorder. Verbal information from the flight crew is also recorded. A composite video signal from the $I^2R$ Maverick seeker is sent to a TEAC V1000 video cassette recorder. Time code signals and verbal information are recorded on the audio channel.

The Mars 2000 magnetic tape recorder receives range data from the LTN-51 Inertial Navigation System (INS). This recorder also receives aircraft roll, pitch and yaw data from the INS, altitude is from the Radar Altimeter, and

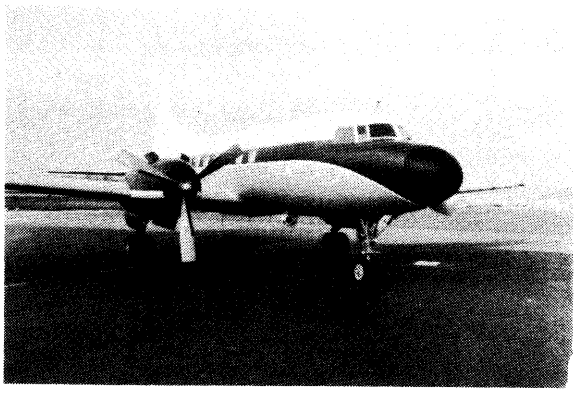


Figure 2. Hughes Convair 240.

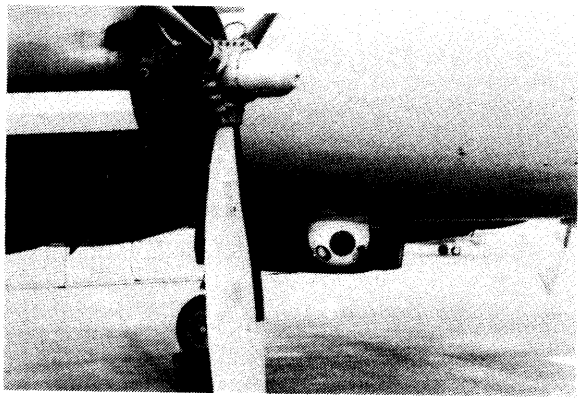


Figure 3. A6 DRS

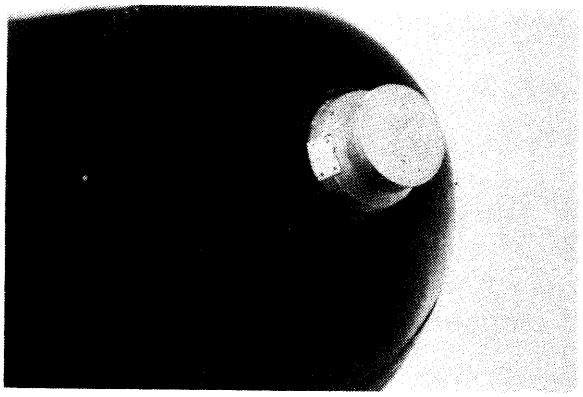


Figure 4. $I^2R$ Maverick seeker protruding from aircraft radome (with cover).

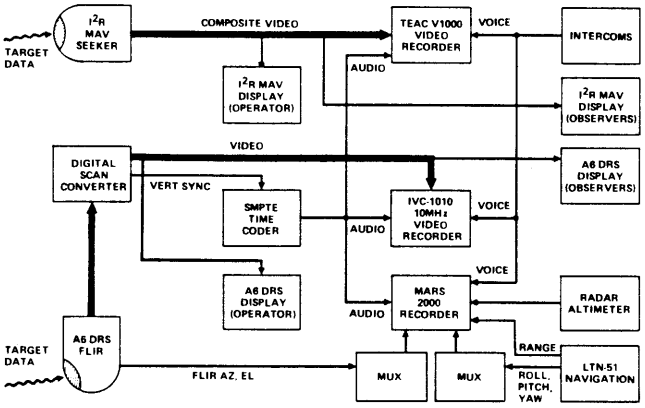



**Figure 5. Instrumentation functional block diagram.**

FLIR attitude as indicated by the gimbal angle position. These data are combined to provide another source of range. Range data will later be combined with time code information and put on printout sheets or computer tapes for the processing of the target data from the TEAC and IVC recorders.

## 2.2 CONTROL INTERFACES

The A-6 DRS FLIR operator views the target scene on a TV monitor. A hand control or "joy stick" controls the pointing direction of the DRS via the hydraulic power supply. The Maverick setup is similar. When both the DRS and Maverick are placed into the boresight mode, the Maverick can be slaved to the DRS motion. In addition, the Maverick can be switched out of the slave mode and controlled independently of the DRS.

## 2.3 EQUIPMENT PHOTOGRAPHS

Figure 6 is a photograph of the DRS test station, which includes a hand control, test panel, and display monitor (the lower monitor). The smaller monitor in the test panel is not directly functional for these tests. Actually, the small monitor verifies A-6 operation, directly bypassing the scan converter.

Figure 7 shows the Maverick test station, with its hand control and display monitor. Figure 8 shows the instrumentation rack. The IVC-1010 reel-to-reel video recorder, the TEAC V1000 cassette video recorder, and the Mars 2000 magnetic tape data recorder are shown in Figure 9. Figure 10 shows the Radar Altimeter and LTN-51 INS (inertial navigation system) mounted on the aircraft floor.

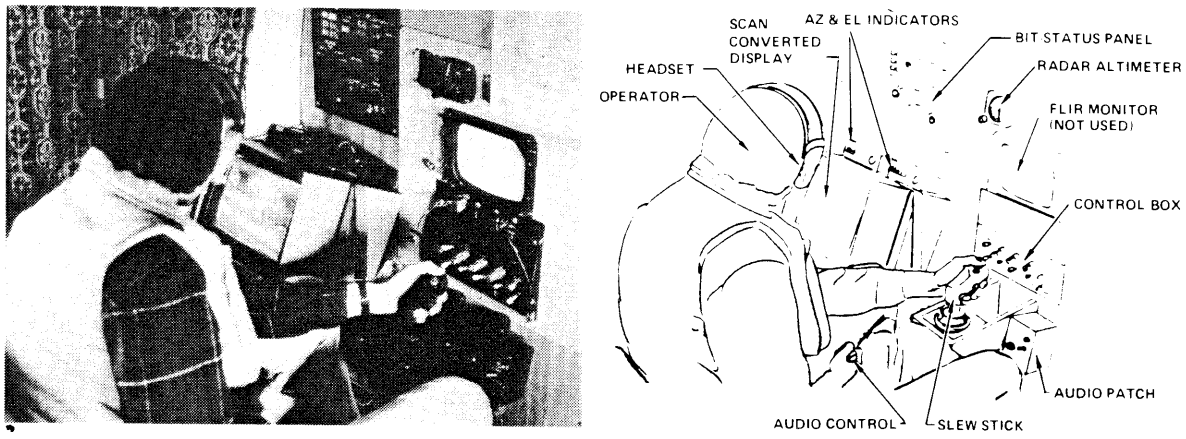



Figure 6. DRS test station.

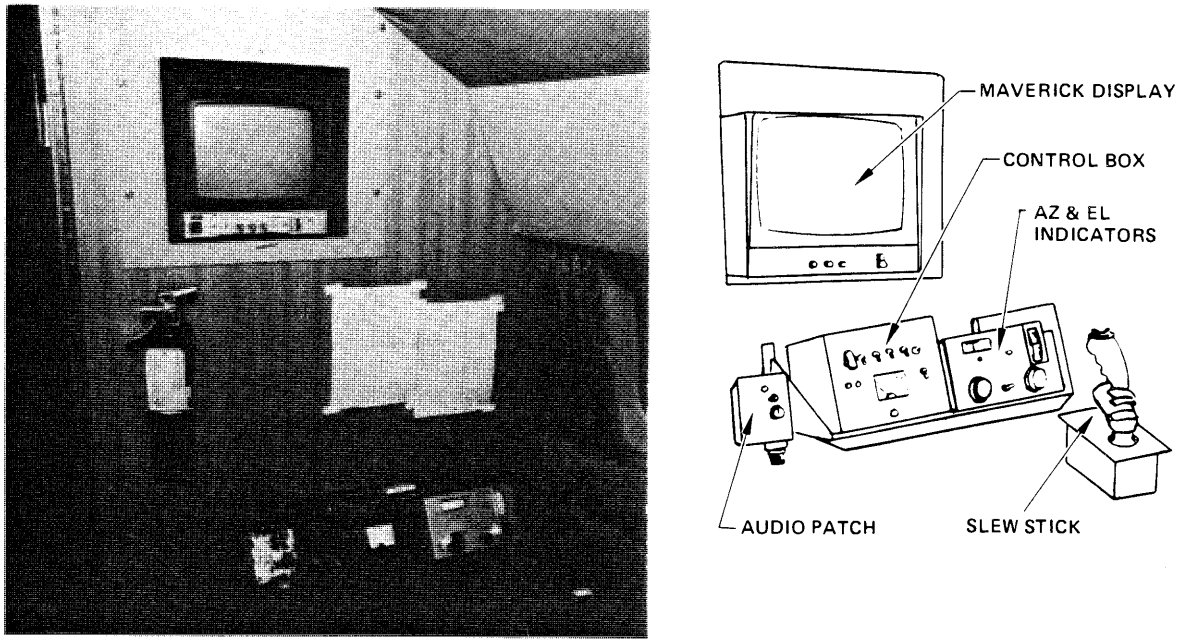



Figure 7. Maverick test station.

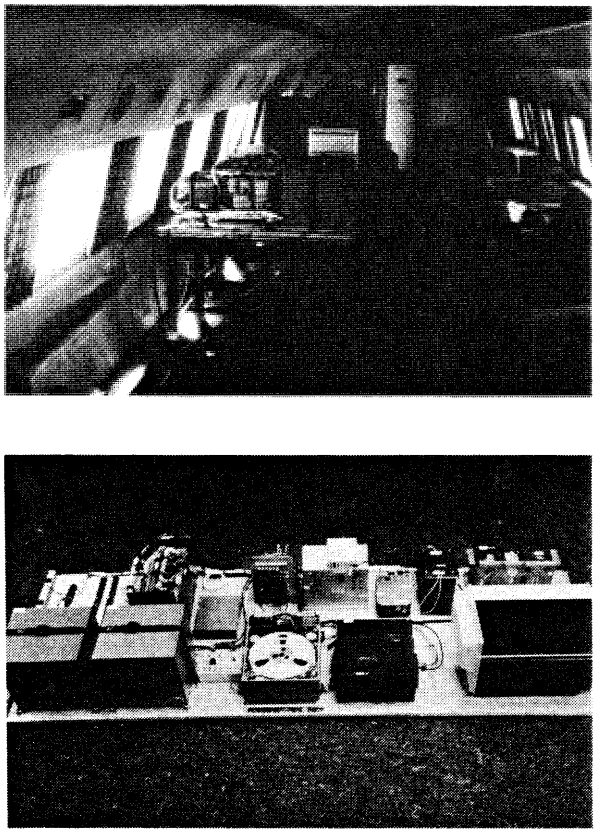



Figure 8. Instrumentation rack.

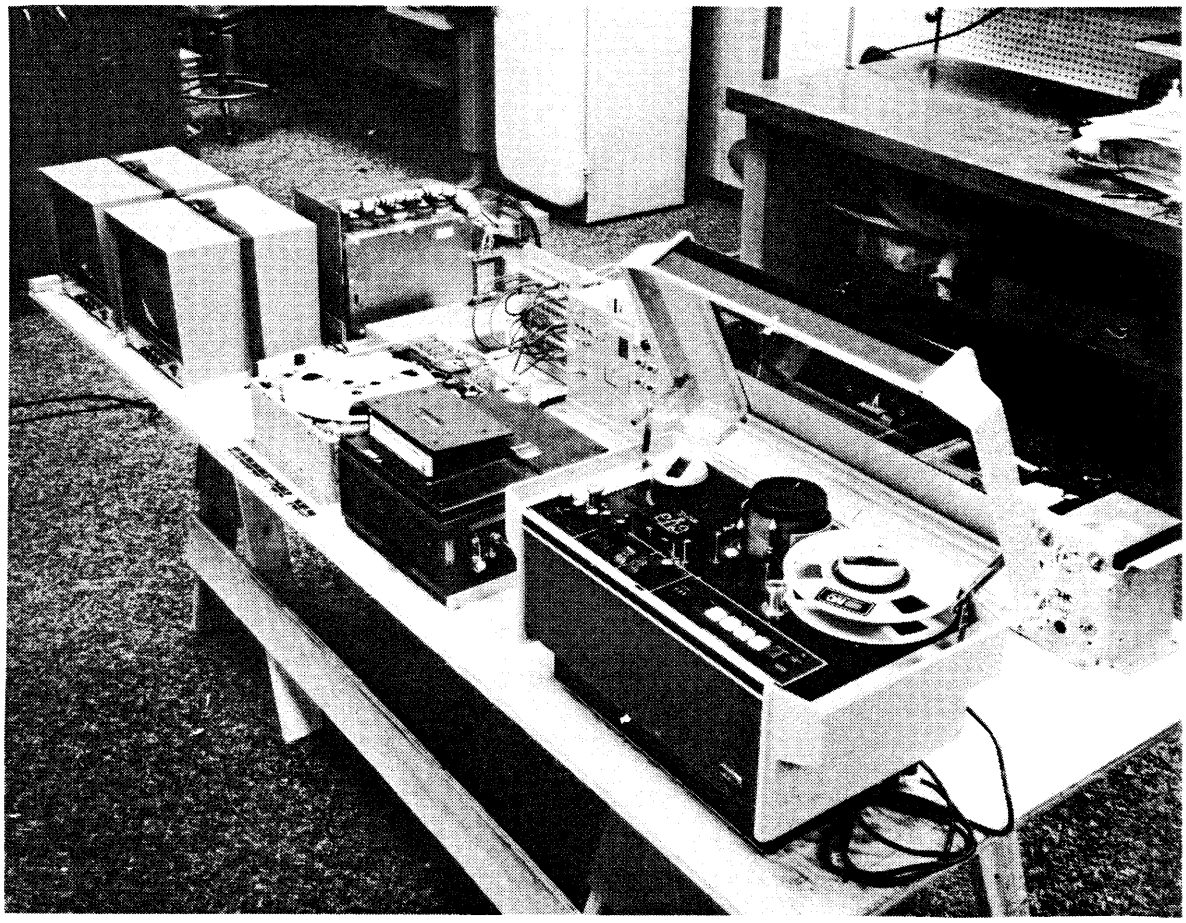
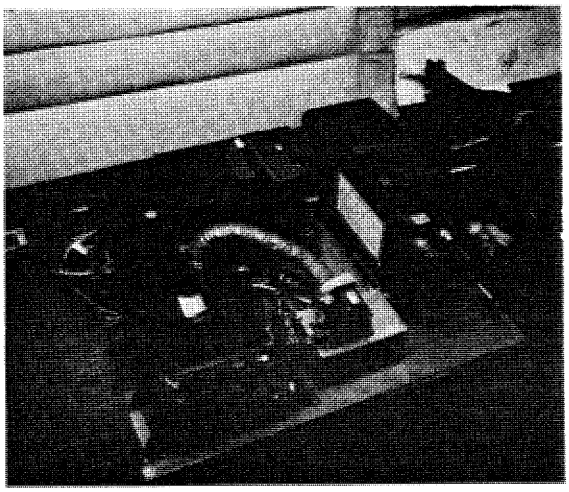


Figure 9. The IVC-1010, TEAC V1000 and Mars 2000.



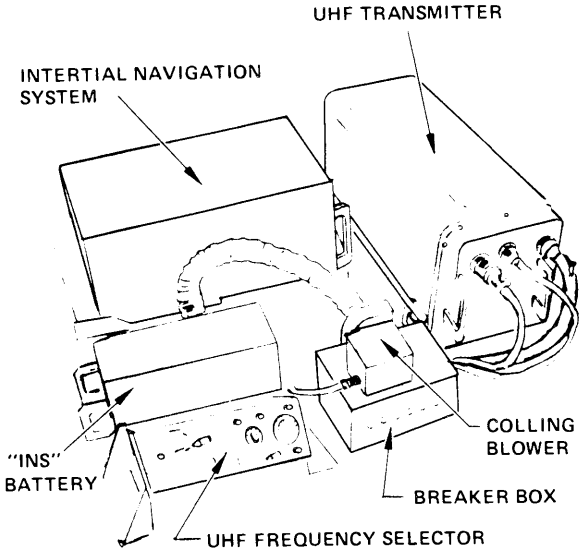



Figure 10. Radar altimeter and LTN-51 INS.

# 3.0 FLIGHT TEST DESCRIPTION

Signature flight tests were conducted at Fort Hunter-Liggett, on 12, 13, 16, 17, and 20 March 1981. Flights were conducted over Fort Irwin on 21 March 1981 and 10 and 11 August 1981 and at Fort Knox, Kentucky on 4, 8, and 9 June 1981.

## 3.1 BACKGROUND FOR FORT HUNTER-LIGGETT TESTS

Fort Hunter-Liggett is in central California, 40 miles south of Monterey and 40 miles north of Paso Robles. The test areas originally scheduled, Stoney Valley and Nacimiento Valley, were found to be unsuitable for tracked vehicles due to heavy rains. Test Area 13, shown in Figure 11, was assigned as an alternate test site. This test area has a gravel road at approximately $45^{\circ}$ to the line of flight available from Range Control. This flight path allowed for a straight low altitude approach of over eight miles to the target area. The vehicles were required to stay on the gravel road or built-up burn areas at this test site due to the condition of the ground after accumulated rainfall.

Use of four M-60 tanks, four APCs, and four trucks was planned for the tests. The number of vehicles varied from test to test due to mechanical or availability problems with the various vehicles. In addition to the target vehicles, a jeep with both a UHF and military FM radio was at the site for communication with the aircraft.

## 3.2 TESTS AT FORT HUNTER-LIGGETT

Detailed reports of each day of testing follow.

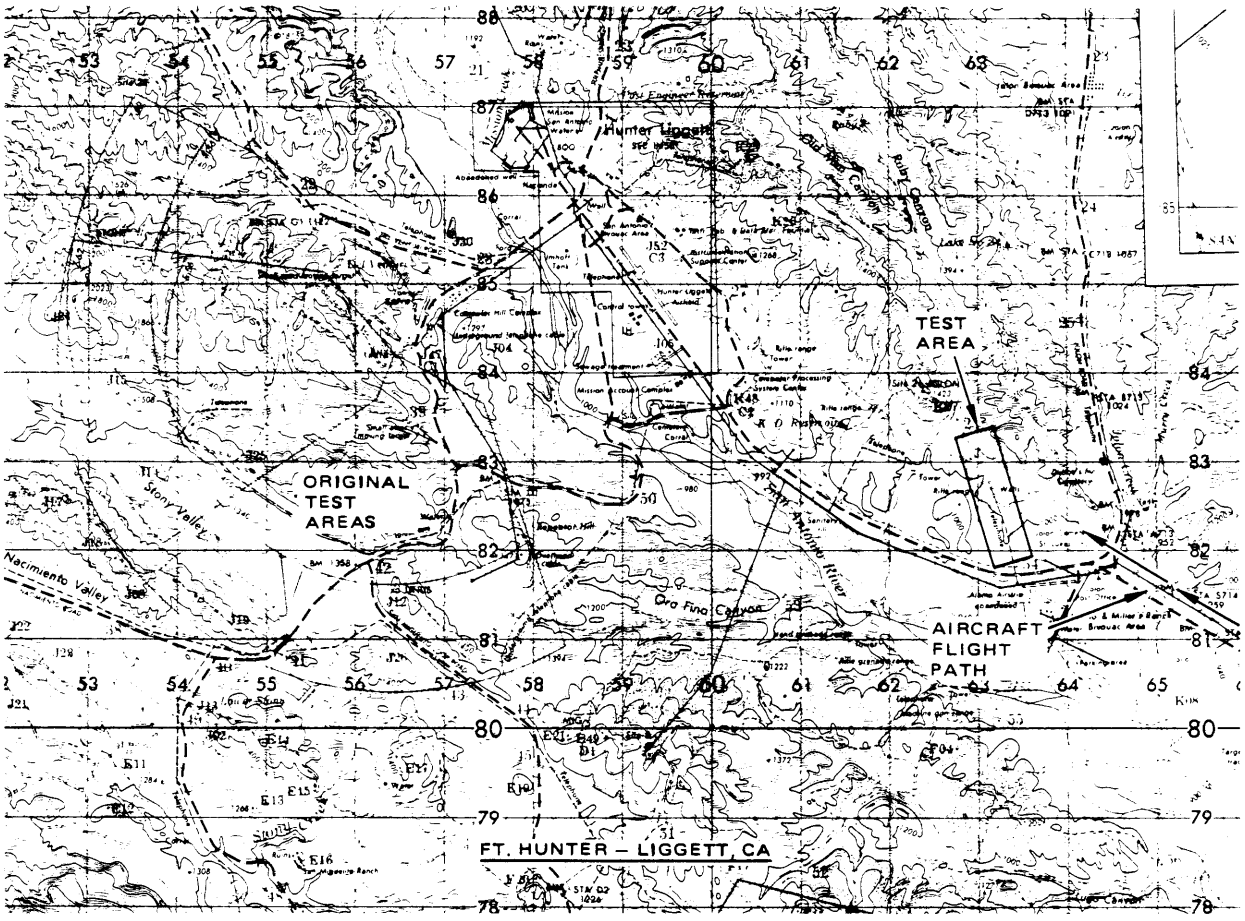



Figure 11. Fort Hunter-Liggett test area.

### 3.2.1 Thursday, 12 March 1981 Tests

The first flight tests at Fort Hunter-Liggett were held on Thursday, 12 March 1981. The test area is shown in Figure 11. The vehicles were arranged in a line on the gravel road, as shown in Figure 12. The vehicles were in groups of four, and each vehicle was separated by 100 yards. The various aspect angles of the individual vehicles were recorded by orientating the four trucks, tanks, and APCs at different angles on the road.

Eighteen data passes were made during the two afternoon missions. The first mission employed hot, running vehicles, while the second employed vehicles whose engines had cooled for two hours.

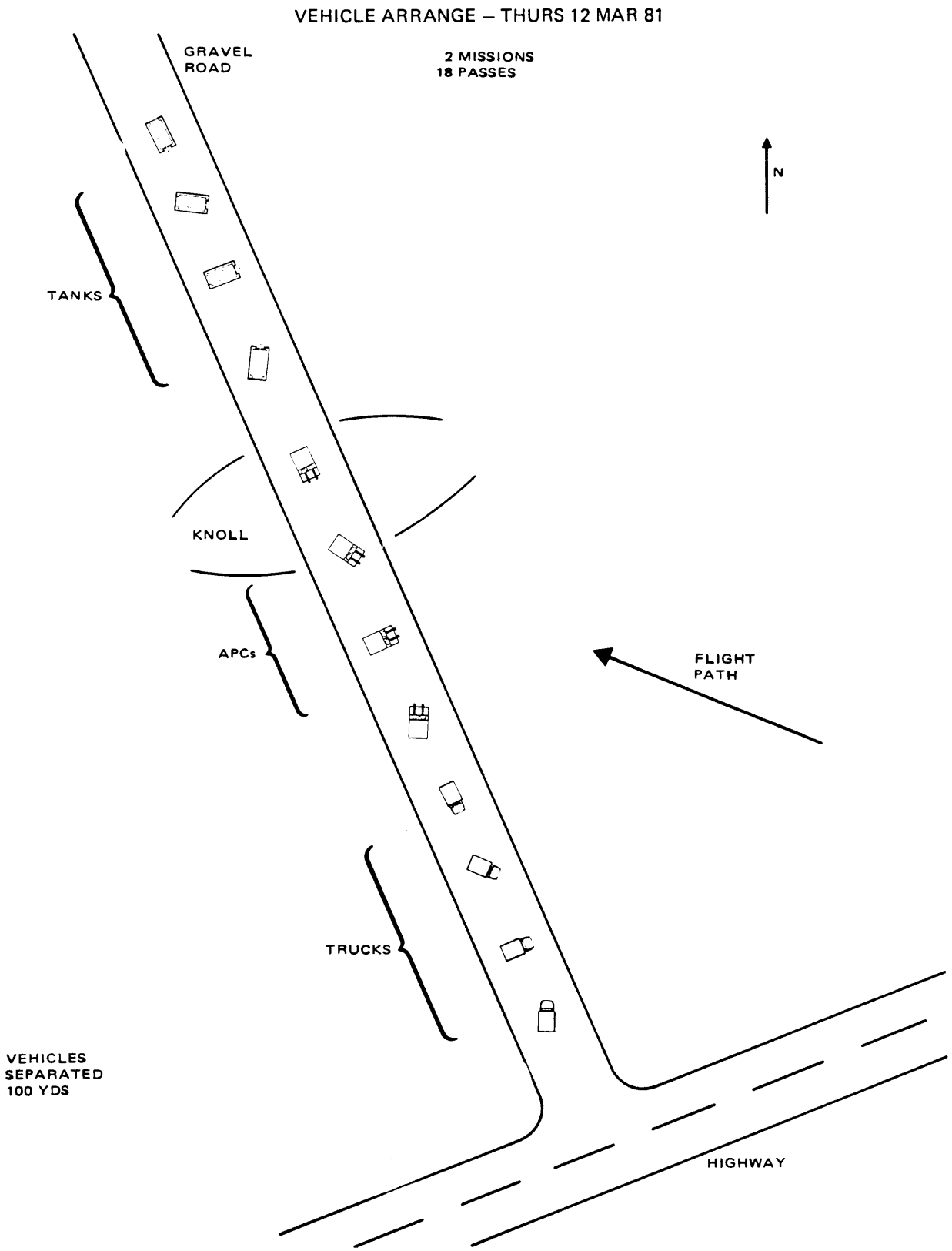



Figure 12. Vehicle arrangement, Thursday, 12 March 1981.

### 3.2.2 Friday, 13 March 1981 Tests

On Friday, 13 March 1981, the vehicles were set up on the built-up birms, as shown in Figure 13. These birms were solid enough to hold a truck or APC and thus all the vehicles were arranged in a target array. The birms were 100 yards apart and the vehicles were separated by 100 yards.

The four tanks were situated at different angles on the gravel road, 100 yards apart. On each birm was a truck 100 yards from the tanks. APCs were set another 100 yards from the trucks. The APCs were at four different angles, but the trucks are forward or backward on the birms. A 50-gallon drum, filled with wood and laced with diesel fuel, was placed on the fifth birm 300 yards from the road. This drum was ignited to simulate a burning hulk and was located near the apex of the rectangular array.

The flight path of the aircraft was at approximately $45^{\circ}$ to the array. A morning mission was performed wherein the vehicles were hot and running, while the vehicles were cooled two hours for the afternoon mission.

### 3.2.3 Monday, 16 March 1981 Tests

The difficulty of acquiring vehicles at ranges of 4 to 5 miles was noted, and the problem of viewing the whole target array in the European-type background was discovered in the first series of tests. A new array was employed for the test flights of Monday, 16 March 1981, as shown in Figure 14. These tests resulted in an overall test pattern one-third size.

The four tanks were parked 33 yards apart at four different aspect angles on the gravel road between the first two birms. A truck was placed on the road at both ends of the tank configuration, 33 yards away. On the first birm, 33 yards away, two trucks were parked, one facing forward and one backward. On the second birm the APCs were parked 33 yards apart at different angles. Burning barrels were on the gravel road 100 yards away from the end vehicles.

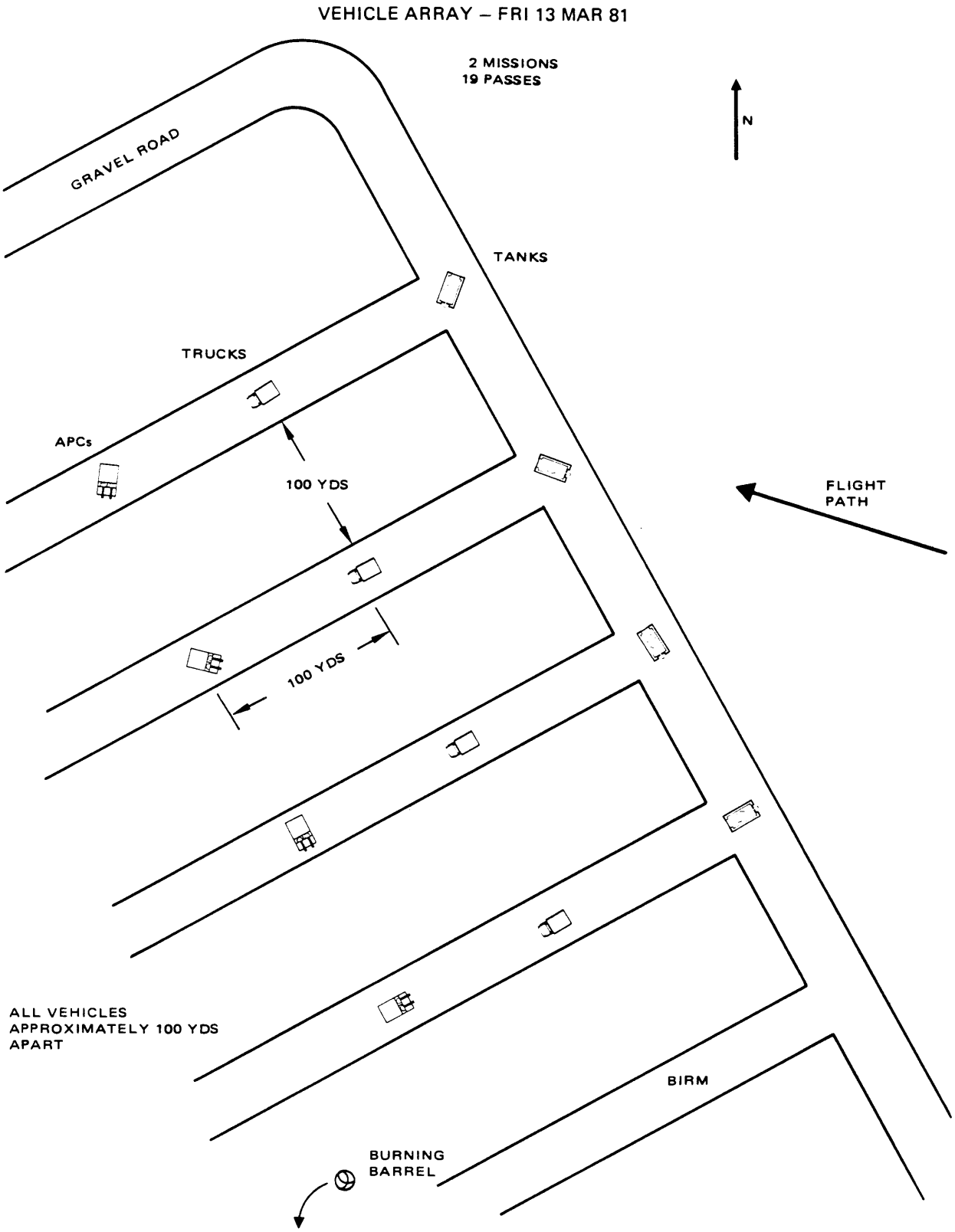



Figure 13. Vehicle array, Friday, 13 March 1981.

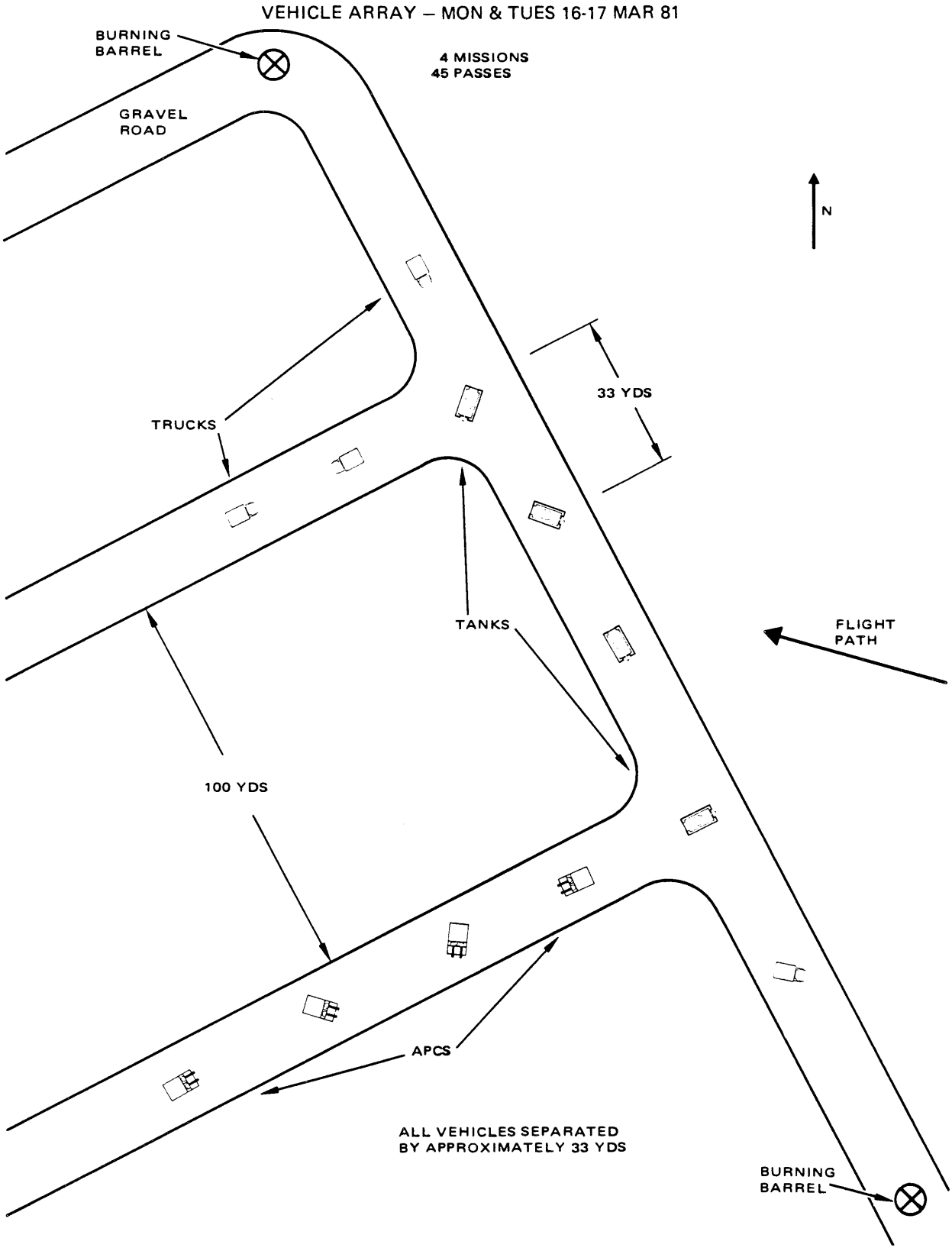



Figure 14. Vehicle array, Monday and Tuesday, 16-17 March 1981.

In this configuration the vehicles did not overlap, negating the 100 yard separation and allowing for more concentrated data accumulation per data pass. The closer array made acquisition easier, as did the burning barrels which framed the array. This was a night flight, and the barrels aided the pilot of the Convair 240 to zero in on the target area. In addition, the trucks had their headlights illuminated for this purpose.

The aircraft was flown at 1000 to 1,200 feet AGL to allow the targets to be acquired at a range of 5 miles over the tree line. In previous flights the tree line blocked the view of the target at 4 to 5 miles when the aircraft flew below these altitudes.

A mission was flown from 8:00 to 9:00 p. m. with the vehicle engines hot and running, and a mission was flown from 11:00 p. m. to 12:30 a. m. with the vehicles cooled for two hours. Additional passes were made of the vehicles leaving the test area along the gravel road.

### 3.2.4 Tuesday, 17 March 1981 Tests

Two afternoon missions were flown on Tuesday, 17 March 1981, with the same test conditions as in the flight tests of Monday, 16 March 1981 (see Figure 14).

Photographs were taken of the vehicles in the test array. A view of an M-60 tank is shown in Figure 15 while Figure 16 is an APC on one of the birms with a tank in the background. All the vehicles in the array, as seen from a nearby hilltop are shown in Figure 17. The number of each type of vehicle varied from the test plan due to Army equipment problems.

### 3.2.5 Friday, 20 March 1981 Tests

The vehicles were arranged in a line on the gravel road for the Friday, 20 March 1981 flight tests, as shown in Figure 18. The area of the gravel road used was about one-quarter mile from the birm area, between the top of a small hill and the main post highway.

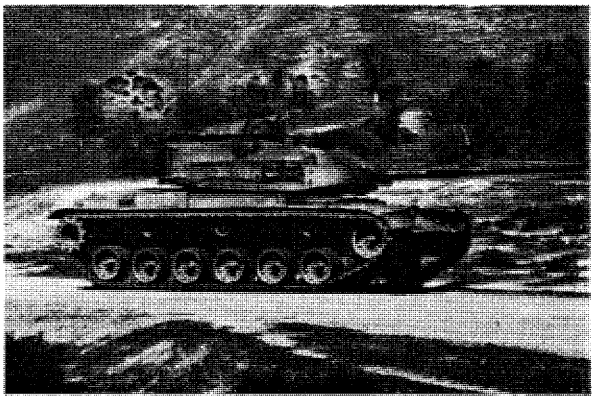


Figure 15. M-60 tank at Fort Hunter-Liggett.

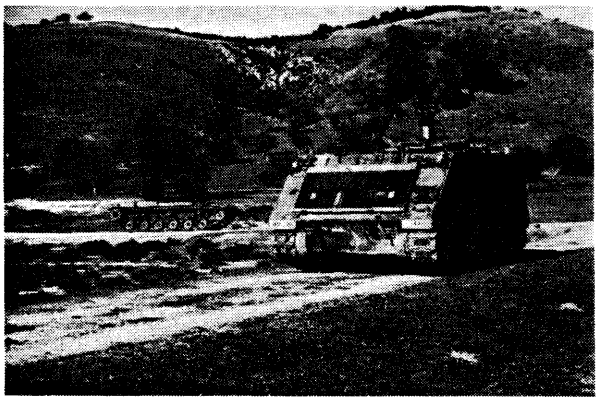


Figure 16. APC and tank.

Figure 17. Full target array.

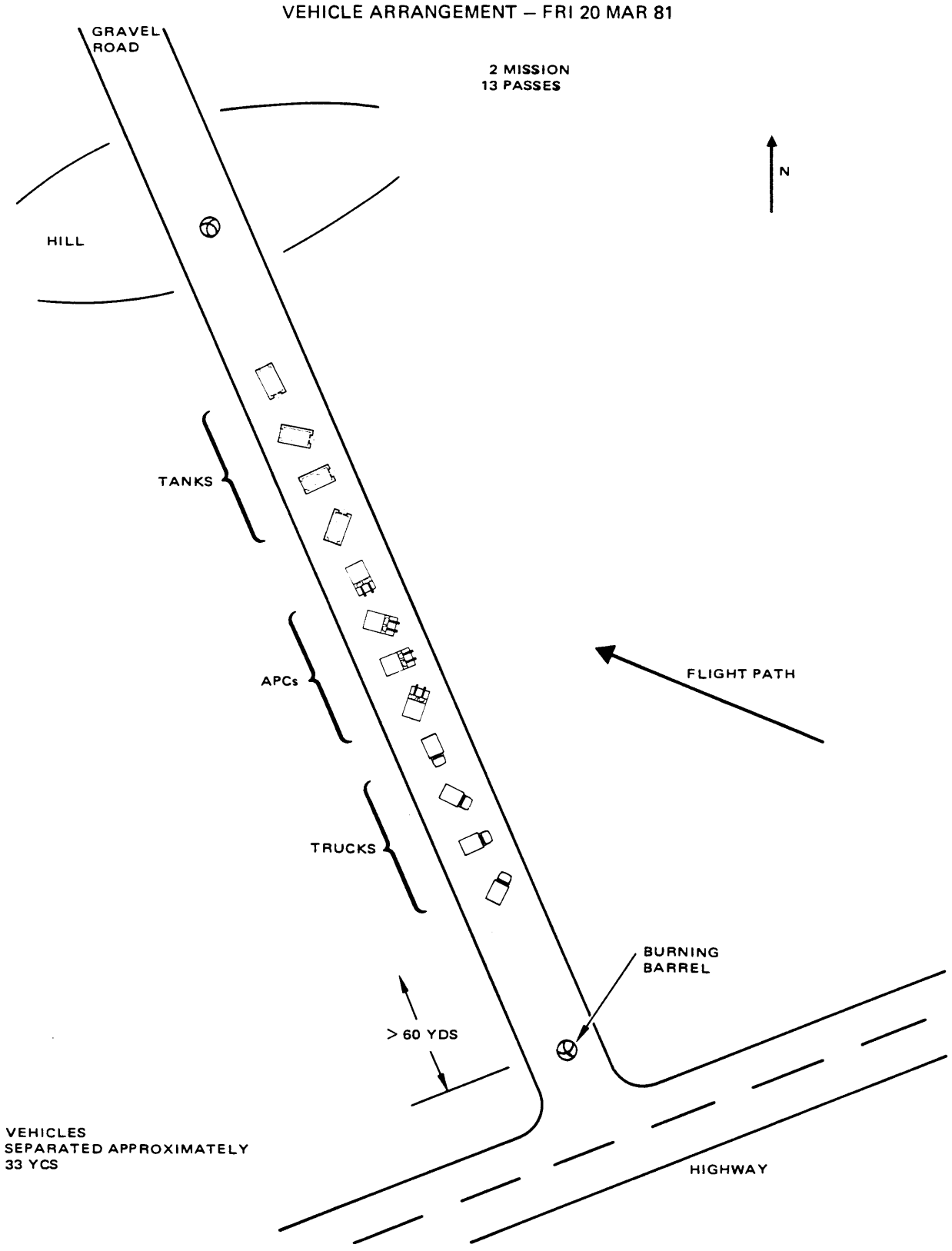



Figure 18. Vehicle arrangement, Friday, 20 March 1981.

The vehicles were parked 33 yards apart at four aspect angles. Burn barrels were set at both ends of the formation. The flight path was at approximately 45° to the road. No blocking tree line existed in this area and therefore the aircraft could approach the target area at an altitude of 500 feet with target acquisition at four miles.

Two afternoon missions were flown with hot and cooled vehicles. A pass was then made of the vehicles leaving the test area along the gravel road. After this final day of flight tests at Fort Hunter-Liggett, the aircraft returned directly to the airport at Van Nuys.

## 3.3 TESTS AT FORT IRWIN

Fort Irwin, desert terrain, is located 35 miles from Barstow, California, halfway between Los Angeles and Las Vegas. Two missions were flown at Fort Irwin on Saturday, 21 March 1981, over National Guard maneuvers. M-60 tanks, trucks, and other military vehicles were located at various undesignated locations in the test area assigned.

Efforts were made to fly over any active vehicles and maneuvers to obtain data. However, no ground communication vehicle was available and the military could not supply information on specific maneuvers or operations. This test method proved to be so unsatisfactory that the Sunday flight tests were cancelled.

On 10 and 11 August a second attempt was made to acquire desert type data. Due to much better coordination with the Army, these flights proved most successful. Tanks information, moving and random position relative to buildings, was obtained. This information afforded a more well-rounded data base upon which to draw.

## 3.4 TESTS AT FORT KNOX

Signature flights were made at Fort Knox, Kentucky to enhance the data base for European terrain under high temperature and high humidity. These conditions were satisfied and the test goals achieved. The temperature ranged from 79°F to 85°F with a relative humidity of 60 percent to 87 percent during the six missions flown. Visibility ranged from a very marginal three miles to a maximum reported visibility of six miles. On two

occasions, the Convair-240 returned for fuel under Instrument Flight Rules (IFR). A map of the test area is given in Figure 19.

The vehicles supporting the test profile at Fort Knox consisted of three M-60 tanks, three APC, one 2-1/2 truck and two jeeps. A different technique was employed at Fort Knox than during other tests: the array remained constant while the vehicle attitude, relative to flight path was rotated 45° after each successful pass. Altitude during passes ranged between 1000 and 1500 feet above ground level. The first configuration was a random positioning, as shown in Figure 20, with the vehicles spaced 50 meters apart. The vehicles then proceeded at approximately 5 mph and passes were made with the vehicles approaching and with the vehicles departing. Of the 26 passes made during two flights, eight were unsuccessful due to late acquisition of the vehicles. These flights, as well as other flights at Fort Knox were made under high humidity and adverse weather conditions. The temperature during the 4 June flight was 79 to 80°F with a relative humidity of 85 percent.

On 8 June 1981, four flights were made with a total of 35 passes. During these runs, the vehicles were configured in a column and were spaced 50 meters apart, as shown in Figure 21. Successive passes were made, rotating each tank 45° after each pass to cover all tank profiles. The vehicles were then moved into a side by side configuration, as shown in Figure 26. During the reconfiguration video tapes were made of the tanks in motion from various and random angles. The final configuration was side by side columns of tanks and of APC, separated by 50 meters.

On 9 June 1981, one flight totalling 14 passes was made. The column configuration was like that of the 8 June tests (see Figure 22). After each successful pass, the vehicles were rotated 45°. On the last four passes, as the vehicles moved in mass, two passes were taken to the south and two passes to the north.

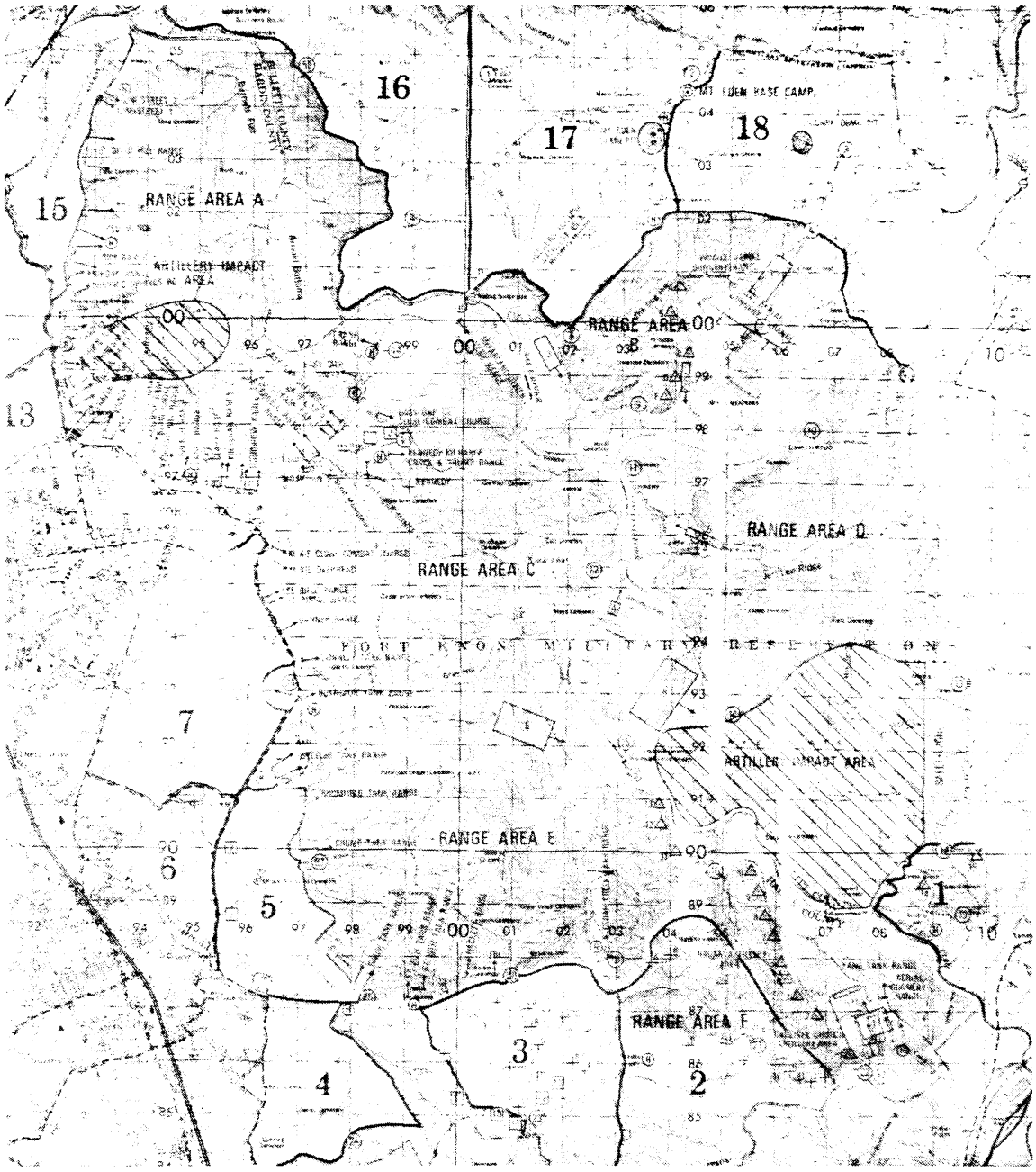



Figure 19. Fort Knox test area.

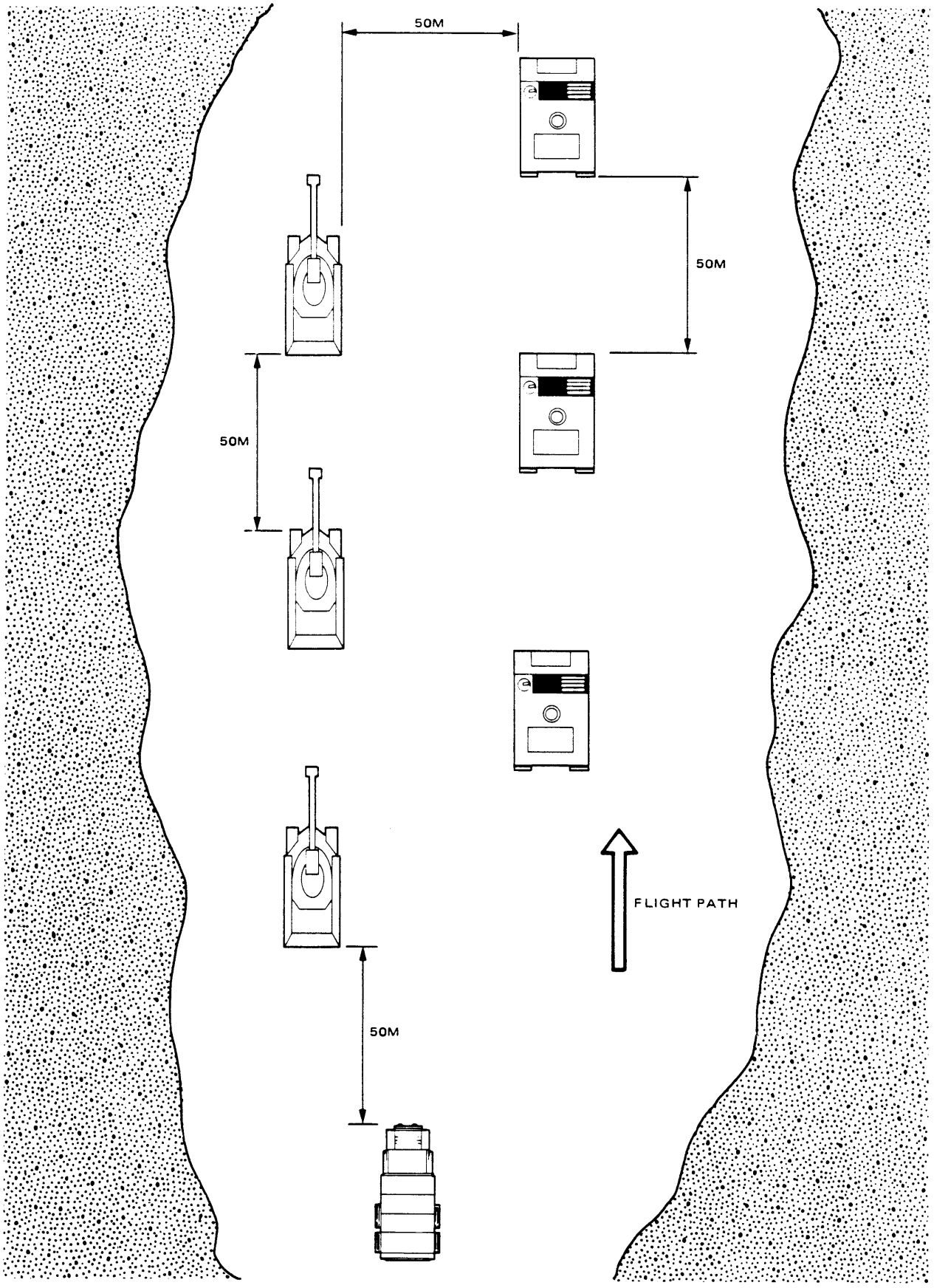



Figure 20. Vehicle arrangement, Friday, 4 June 1981.

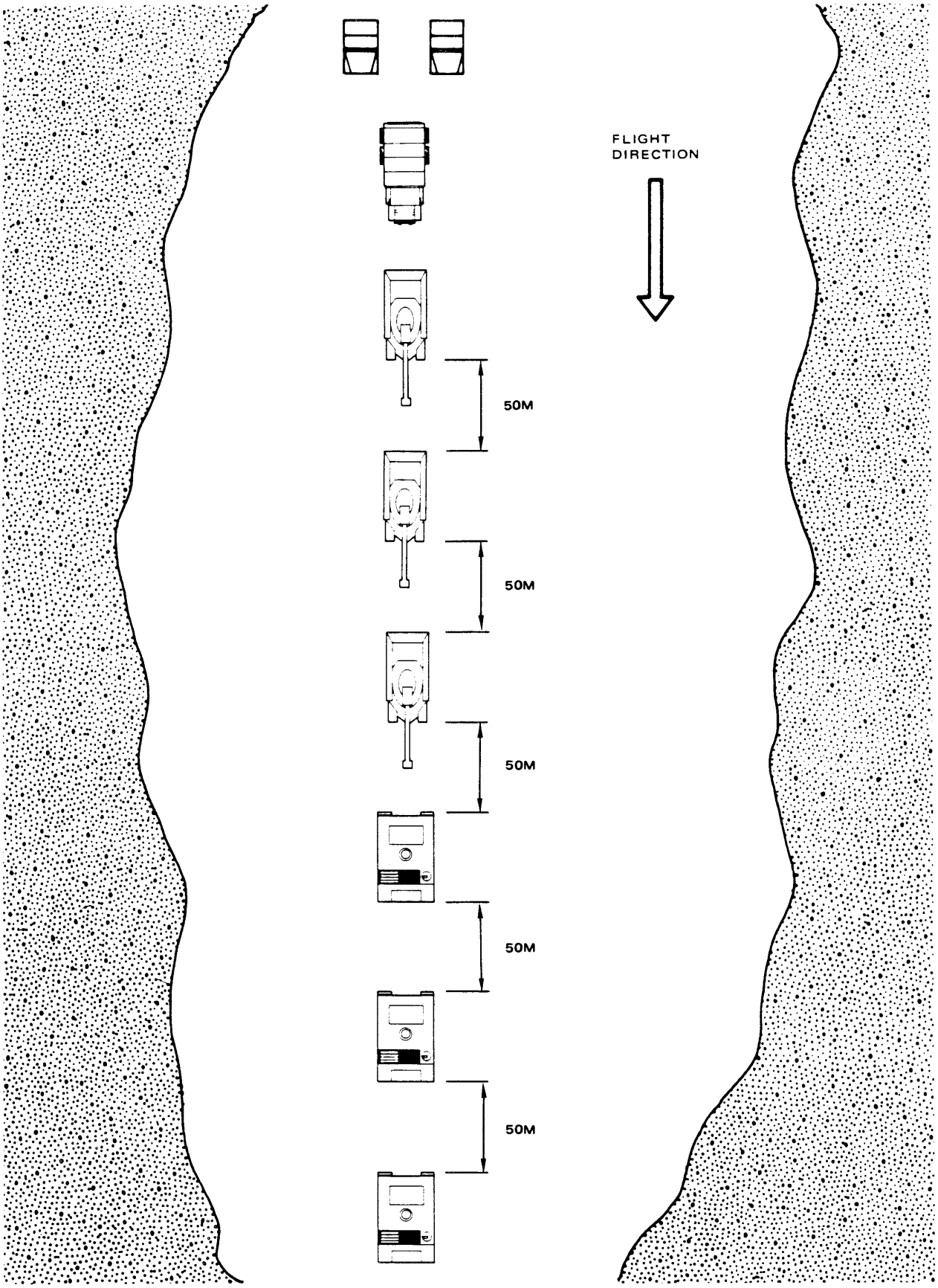



Figure 21. Vehicle arrangement, Monday morning 8 June 1981

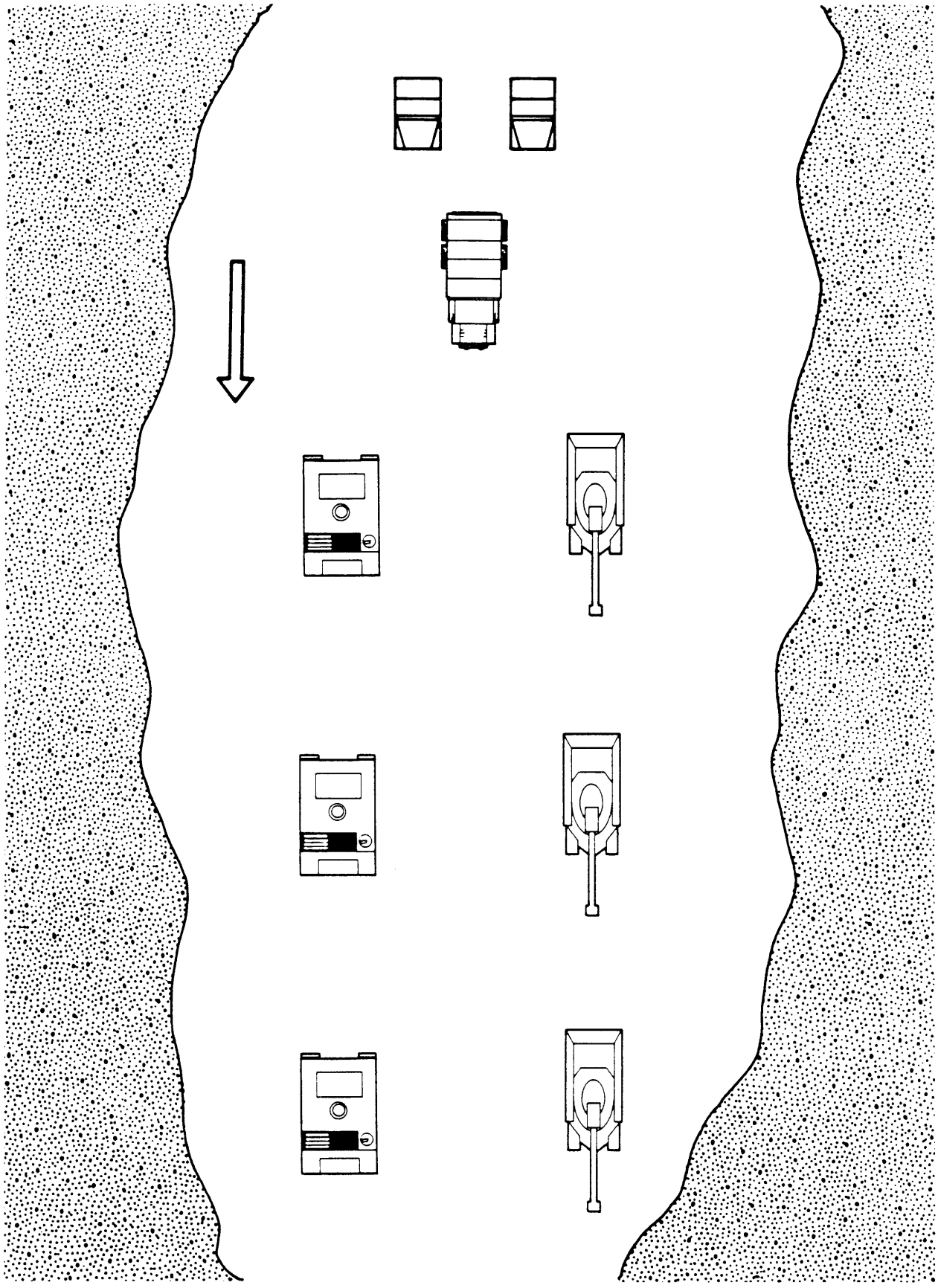


Figure 22. Vehicle arrangement, Monday afternoon 8 July 1981

# 4.0 DATA SUMMARY

This section contains a summary of the signature flight test data secured during signature flight tests. These tests consisted of 18 missions, and each mission performed several data runs. Ten of the 12 missions were flown at Fort Hunter-Liggett, two at Fort Irwin and six at Fort Knox.

## 4.1 MISSION DESCRIPTION OVERVIEWS

Overviews of the data taken on each mission follow. These sheets provide statistical data of weather and equipment. These data afford a brief, rapid review of each series of passes.

## 4.2 DATA PASS DESCRIPTIONS

The data pass description sheets allow for a rapid "look-up" of any individual pass. Information on the accomplishments and significant events of each pass is presented.

The "main" target is defined as that target which was retained in the center of the FLIR FOV throughout the pass.

LANTIRN SIGNATURE FLIGHT TEST
MISSION DESCRIPTION - OVERVIEW

Date: Thursday, 12 March 1981
Mission Number: 81-8 Total Data Passes: 11
Location: Fort Hunter-Liggett Type of Terrain: European
Time of Test: 2:20 - 3:30 pm Section of Day: Afternoon

Target Information

Set-Up: In Line Engine Temperature: Hot, Running
Total Vehicles: 12 Tanks: 4 APCs: 4 Trucks: 4
Special Comments: Vehicles 100 yards apart on road

Weather

Temperature ($^{o}$F): 55$^{o}$ Air Pressure (in Hg): 29.98
Dew Point ($^{o}$F): 51$^{o}$ Wind Direction: 250$^{o}$
Relative Humidity: 84 percent Wind Speed (Knots): 8
Visibility: (Miles): 15 Rain Comment: None
Cloud Coverage: 3000 feet broken, 20000 feet overcast

System Performance

A6 DRS: Jerking; focus usually poor; some "venetian blind" effect
$I^{2}R$ Maverick: Focus poor
DRS/Maverick Slaving: Fair. Learning problems for new procedure.
Recording Machines:
Special Comments:

General Comments: First day of data-taking. Difficult to find targets.

## LANTIRN SIGNATURE FLIGHT TEST
## MISSION DESCRIPTION - OVERVIEW

Date: Thursday, 12 March 1981

Mission Number: 81-9 Total Data Passes: 7

Location: Fort Hunter-Liggett Type of Terrain: European

Time of Test: 5:00 - 5:45 pm Section of Day: Late afternoon

### Target Information

Set-Up: In Line Engine Temperature: Cooled 2 hrs

Total Vehicles: 12 Tanks: 4 APCs: 4 Trucks: 4

Special Comments: Terrain makes it difficult to find targets.

### Weather

Temperature ($^{o}$F): 53$^{o}$ Air Pressure (in Hg): 29.98

Dew Point ($^{o}$F): 45$^{o}$ Wind Direction: 250$^{o}$

Relative Humidity: Wind Speed (Knots): 6

Visibility: (Miles): 15 Rain Comment: None

Cloud Coverage: Broken at 2500 feet, overcast at 25000 feet

### System Performance

A6 DRS: Occasional jerking problem

$I^{2}R$ Maverick: Poor video

DRS/Maverick Slaving: Improving method

Recording Machines: OK

Special Comments: I. N. S not aligned for this flight

General Comments: Second run of first day of flight tests. Some bugs in procedure still to be worked out.

# LANTIRN SIGNATURE FLIGHT TEST
# MISSION DESCRIPTION - OVERVIEW

Date: Friday, 13 March 1981

Mission Number: 81-10 Total Data Passes: 11

Location: Fort Hunter-Liggett Type of Terrain: European

Time of Test: 10:00 - 10:45 am Section of Day: Morning

## Target Information

Set-Up: Array Engine Temperature: Hot and running

Total Vehicles: Tanks: APCs: Trucks:

Special Comments: Array used is an effort to simulate our original test plan under new conditions. Burn barrels used: Oversaturation caused DC-Restoration problem across target area.

## Weather

Temperature ($^{o}$F): 49$^{o}$ Air Pressure (in Hg): 29.95

Dew Point ($^{o}$F): 41$^{o}$ Wind Direction: 300$^{o}$

Relative Humidity: 72 percent Wind Speed (Knots): 5

Visibility: (Miles): 15 Rain Comment: Light rain showers

Cloud Coverage: 3000 feet broken, 22000 feet overcast

## System Performance

A6 DRS: Very jerky at times, poor focus

$I^{2}R$ Maverick: Poor to fair focus

DRS/Maverick Slaving: Problems when aircraft banked

Recording Machines: Video rolled at times; video noisy

Special Comments: Poor DRS focus may be due to rainy conditions

General Comments: Array and flight procedure needs improvement to get maximum data per pass

# LANTIRN SIGNATURE FLIGHT TEST
# MISSION DESCRIPTION - OVERVIEW

Date: Friday, 13 March 1981

Mission Number: 81-11 Total Data Passes: 8

Location: Fort Hunter-Liggett Type of Terrain: European

Time of Test: 1:15 - 2:00 pm Section of Day: Afternoon

## Target Information

Set-Up: Array Engine Temperature: Cooled 2 hrs +

Total Vehicles: 12 Tanks: 4 APCs: 4 Trucks: 4

Special Comments: Vehicles too widespread for sufficient array data from distances

## Weather

Temperature ($^{o}$F): 54$^{o}$ Air Pressure (in Hg): 29.93

Dew Point ($^{o}$F): 44$^{o}$ Wind Direction: 010$^{o}$

Relative Humidity: 69 percent Wind Speed (Knots): 5

Visibility: (Miles): 15 Rain Comment: None

Cloud Coverage: Broken 3000 feet

## System Performance

A6 DRS: Better data than this morning. Better focus. Still jerky

$I^{2}R$ Maverick:

DRS/Maverick Slaving: OK

Recording Machines: 400 cycle noise

Special Comments:

General Comments: Sunny weather in afternoon better than rainy, hazy morning for all systems

## LANTIRN SIGNATURE FLIGHT TEST
## MISSION DESCRIPTION - OVERVIEW

Date: Monday, 16 March 1981

Mission Number: 81-13 Total Data Passes: 9

Location: Fort Hunter-Liggett Type of Terrain: European

Time of Test: 8:00 - 9:00 pm Section of Day: Night

### Target Information

Set-Up: Array Engine Temperature: Hot, running

Total Vehicles: 11 Tanks: 4 APCs: 4 Trucks: 3

Special Comments: Two burn barrels for visual and IR guidance. Two trucks also had headlights on. Vehicles much closer than before: 33 yards apart. Target Acquisition from 4 -5 miles at 1000 feet AGL

### Weather

Temperature ($^{o}$F): 47$^{o}$ Air Pressure (in Hg): 29.95

Dew Point ($^{o}$F): 37$^{o}$ Wind Direction: 350$^{o}$

Relative Humidity: Wind Speed (Knots): 1

Visibility: (Miles): 15 Rain Comment: None

Cloud Coverage: Scattered at 2500 feet, broken at 25000 feet

### System Performance

A6 DRS: Good

$I^{2}R$ Maverick: Good

DRS/Maverick Slaving: Good

Recording Machines: 400 cycle rolling noise

Special Comments: Picture quality good, except for 400~.

General Comments: New test array, with burn barrels, worked very good. Much better data than before. System worked exceptionally well. The most useful runs yet.

# LANTIRN SIGNATURE FLIGHT TEST
## MISSION DESCRIPTION - OVERVIEW

Date: Monday, 16 March 1981

Mission Number: 81-14 Total Data Passes: 15

Location: Fort Hunter-Liggett Type of Terrain: European

Time of Test: 11:00 pm-12:30 am Section of Day: Night

### Target Information

Set-Up: Array Engine Temperature: Cooled 2 hrs

Total Vehicles: 11 Tanks: 4 APCs: 4 Trucks: 3

Special Comments: Some vehicles apparently had started their engines during cool down period. Aircraft at 1200 feet AGL for better long distance target acquisition.

### Weather

Temperature ($^{o}$F): 39$^{o}$ Air Pressure (in Hg): 29.95

Dew Point ($^{o}$F): 37$^{o}$ Wind Direction: -

Relative Humidity: Wind Speed (Knots): Calm

Visibility: (Miles): 15 Rain Comment: None

Cloud Coverage: Scattered at 2500 feet, broken at 25000 feet

### System Performance

A6 DRS: Good

$I^{2}R$ Maverick: Good

DRS/Maverick Slaving: Good

Recording Machines: 400 cycle rolling noise

Special Comments: Everything seemed to work fine

General Comments: Recommend flying 1000 - 1200 feet AGL in order to see targets above tree line from 5+ miles out. Excellent data missions.

# LANTIRN SIGNATURE FLIGHT TEST
# MISSION DESCRIPTION - OVERVIEW

Date: Tuesday, 17 March 1981

Mission Number: 81-15 Total Data Passes: 12

Location: Fort Hunter-Liggett Type of Terrain: European

Time of Test: 12:45 - 2:00 pm Section of Day: Afternoon

## Target Information

Set-Up: Array Engine Temperature: Hot, running

Total Vehicles: 11 Tanks: 3 APCs: 6 Trucks: 2

Special Comments: Test array changed due to missing tanks and trucks and additional APCs. Mechanical problems given as reason for missing tanks.

## Weather

Temperature ($^{o}$F): 65$^{o}$ Air Pressure (in Hg): 29.97

Dew Point ($^{o}$F): 45$^{o}$ Wind Direction: 160$^{o}$

Relative Humidity: Wind Speed (Knots): 3

Visibility: (Miles): 15 Rain Comment: None

Cloud Coverage: 16000 feet scattered, 2500 feet broken

## System Performance

A6 DRS: Good

$I^{2}R$ Maverick: Good

DRS/Maverick Slaving: Good most of the time

Recording Machines: Tearing problem seen on DRS monitor

Special Comments: Still have 400 cycle noise from ground loop

General Comments: Good data collection day. Sun caused vehicles to be hot on one side

# LANTIRN SIGNATURE FLIGHT TEST
# MISSION DESCRIPTION - OVERVIEW

Date: Tuesday, 17 March 1981

Mission Number: 81-16 Total Data Passes: 13

Location: Fort Hunter-Liggett Type of Terrain: European

Time of Test: 4:15 - 5:30 pm Section of Day: Late Afternoon

## Target Information

Set-Up: Array Engine Temperature:

Total Vehicles: 11 Tanks: APCs: Trucks:

Special Comments: Troops started some engines during cooldown period. Some data with troops standing on APCs (against orders). Excellent data pass of tank moving through woods.

## Weather

Temperature ($^{o}$F): 68$^{o}$ Air Pressure (in Hg): 29.96

Dew Point ($^{o}$F): 45$^{o}$ Wind Direction: 180$^{o}$

Relative Humidity: Wind Speed (Knots): 4

Visibility: (Miles): 15 Rain Comment: None

Cloud Coverage: 16000 feet scattered, 2500 feet broken

## System Performance

A6 DRS: Good

$I^{2}R$ Maverick: OK

DRS/Maverick Slaving: OK

Recording Machines: Good video except for 400 cycle roll

Special Comments:

General Comments: Good data missions

## LANTIRN SIGNATURE FLIGHT TEST
## MISSION DESCRIPTION - OVERVIEW

Date: Friday, 20 March 1981

Mission Number: 81-17 Total Data Passes: 8

Location: Fort Hunter-Liggett Type of Terrain: European

Time of Test: 11:20 am-12:20 pm Section of Day: Noon

### Target Information

Set-Up: In Line Engine Temperature:

Total Vehicles: 7 Tanks: APCs: Trucks:

Special Comments: Vehicles did not arrive on time. At first only four trucks, then three trucks and three APCs. Burn barrels not provided by Army

### Weather

Temperature ($^{o}$F): 54$^{o}$ Air Pressure (in Hg): 29.97

Dew Point ($^{o}$F): 39$^{o}$ Wind Direction: 210$^{o}$

Relative Humidity: 59 percent Wind Speed (Knots): 7

Visibility: (Miles): 15 Rain Comment: None

Cloud Coverage: 3000 feet broken, 10000 feet broken/overcast

### System Performance

A6 DRS: Some jerking

$I^2R$ Maverick: Fair. Seems to be degrading

DRS/Maverick Slaving: Difficulty

Recording Machines: Good

Special Comments: New 28V power supply used to reduce 400 cycle noise problem. Data much better. Maverick seems to need extra warm-up to operate properly, expecially in poor weather

General Comments: Rainy weather seems to degrade performance of both DRS and Maverick.

# LANTIRN SIGNATURE FLIGHT TEST
# MISSION DESCRIPTION - OVERVIEW

Date: Friday, 20 March 1981

Mission Number: 81-18 Total Data Passes: 5

Location: Fort Hunter-Liggett Type of Terrain: European

Time of Test: 2:30 - 3:00 pm Section of Day: Afternoon

## Target Information

Set-Up: In Line Engine Temperature: Hot

Total Vehicles: 10 Tanks: 2 APCs: 4 Trucks: 4

Special Comments: No burn barrels supplied.

## Weather

Temperature ($^{o}$F): 53$^{o}$ Air Pressure (in Hg): 29.76

Dew Point ($^{o}$F): 40$^{o}$ Wind Direction: 230$^{o}$

Relative Humidity: Wind Speed (Knots): 8

Visibility: (Miles): 15 Rain Comment: Fine rain showers

Cloud Coverage: Broken at 2500 feet, overcast at 10000 feet

## System Performance

A6 DRS: OK

$I^{2}R$ Maverick: Degraded

DRS/Maverick Slaving: Fair

Recording Machines: OK

Special Comments: Was able to fly at 500 feet AGL and acquire vehicles at 5 miles in this teat area. No tree line to block view.

## General Comments:

## LANTIRN SIGNATURE FLIGHT TEST
## MISSION DESCRIPTION - OVERVIEW

Date: Saturday, 21 March 1981

Mission Number: 81-19 Total Data Passes: 11

Location: Fort Irwin, California Type of Terrain: Desert

Time of Test: 10:50 am-12:30 pm Section of Day: Morning

### Target Information

Set-Up: Random Engine Temperature: Mostly cold, few Hot

Total Vehicles: Various Tanks: - APCs: - Trucks: -

Special Comments: Flights over national guard maneuvers. Instructed to look for dust clouds, indicating activity, but most vehicles just parked and cold.

### Weather

Temperature ($^{o}$F): 68$^{o}$ Air Pressure (in Hg): 30.05

Dew Point ($^{o}$F): 40$^{o}$ Wind Direction: 280$^{o}$

Relative Humidity: Wind Speed (Knots): 18

Visibility: (Miles): 35 Rain Comment: None

Cloud Coverage: Scattered at 7000 feet

### System Performance

A6 DRS: Good

$I^{2}R$ Maverick: Fair

DRS/Maverick Slaving: None

Recording Machines: Some 400 cycle noise. Not bad.

Special Comments: Unable to slave DRS/MAV due to constant searching for targets

General Comments: Very difficult to find targets with desert clutter at day, and because few hot vehicles. Test would work better if we had specific locations designated.

# LANTIRN SIGNATURE FLIGHT TEST
# MISSION DESCRIPTION - OVERVIEW

Date: 6-4-81

Mission Number: 01-36 Total Data Passes: 9

Location: Fort Knox Type of Terrain: European

Time of Test: 10:30-11:34 Section of Day: Morning

## Target Information

Set-Up: Scenario 5 Engine Temperature: Warm

Total Vehicles: 7 Tanks: 3 APCs: 3 Trucks: 1 2-1/2 ton

Special Comments: Engines warm

## Weather

Temperature ($^{o}$F): 75$^{o}$ Air Pressure (in Hg): 29.99

Dew Point ($^{o}$F): 70$^{o}$ Wind Direction: 250$^{o}$

Relative Humidity: 85 percent Wind Speed (Knots): 8

Visibility: (Miles): Rain Comment:

Cloud Coverage: 1800 overcast

## System Performance

A6 DRS: Fair

$I^{2}R$ Maverick: Good

DRS/Maverick Slaving: None

Recording Machines: Ok

Special Comments: Normal runs, problems acquiring vehicles

## General Comments:

# LANTIRN SIGNATURE FLIGHT TEST
## MISSION DESCRIPTION - OVERVIEW

Date: 6-4-81

Mission Number: 81-38 Total Data Passes: 17

Location: Fort Knox Type of Terrain: European

Time of Test: 2:40 - 4:24 Section of Day: Afternoon

### Target Information

Set-Up: Scenario 5 Engine Temperature:

Total Vehicles: 7 Tanks: 3 APCs: 3 Trucks: 1

Special Comments:

### Weather

Temperature ($^{o}$F): 79$^{o}$ Air Pressure (in Hg):

Dew Point ($^{o}$F): 69$^{o}$ Wind Direction: 260$^{o}$

Relative Humidity: 85/71 percent at 3:40, 69 percent at 4:00 Wind Speed (Knots): 10

Visibility: (Miles): 2500 broken Rain Comment:

Cloud Coverage: 10$^{k}$ overcast

### System Performance

A6 DRS: Fair

$I^{2}R$ Maverick: Good

DRS/Maverick Slaving:

Recording Machines: OK

Special Comments: Normal runs - problem acquiring improving

General Comments: DRS went off the air during 17th pass, overheated

# LANTIRN SIGNATURE FLIGHT TEST
# MISSION DESCRIPTION - OVERVIEW

Date: 6-8-81

Mission Number: 81-40 Total Data Passes: 9

Location: Fort Knox Type of Terrain: European

Time of Test: 9:11 - 11:24 Section of Day: Morning

## Target Information

Set-Up:

Total Vehicles:

Special Comments:

Engine Temperature:

Tanks: 3 APCs: 3 Trucks: 1 2-1/2 ton

1. Tank - D. north
2. Tank - 45° E
3. Tank - 90° E

Over

## Weather

Temperature (°F): 67° - 69°

Dew Point (°F): 61° - 64°

Relative Humidity: 84 percent

Visibility: (Miles): 15*

Cloud Coverage: 10K scattered, 25K broken, very hazy

Air Pressure (in Hg):

Wind Direction:

Wind Speed (Knots):

Rain Comment: None

## System Performance

A6 DRS: Good

$I^2R$ Maverick: Good

DRS/Maverick Slaving: Good

Recording Machines: Good

Special Comments: Vehicles late arriving at target area (3/4 hour) but time was well spent making dry run to orientate ourselves with target area in a very hazy background

General Comments: *Visibility 6 miles hazy smoke by the end of this mission FLIR focus was poor all middle of Flt. 81-41. FLIR temp 97° all data on this is with DRS in narrow view.

## LANTIRN SIGNATURE FLIGHT TEST
## MISSION DESCRIPTION - OVERVIEW

Date: 6-8-81

Mission Number: 81-41 Total Data Passes: 9

Location: Fort Knox Type of Terrain: European

Time of Test: 12:44 - 2:21 Section of Day: Midday

### Target Information

Set-Up: Side-by-side Engine Temperature:

Total Vehicles: 7 Tanks: 3 APCs: 3 Trucks: 1 2-1/2 ton

Special Comments:

| Weather | | Mid Mission | | | Mid Mission |
|---|---|---|---|---|---|
| Temperature ($^{o}$F): | 81$^{o}$ | 80$^{o}$ | Air Pressure (in Hg): | | |
| Dew Point ($^{o}$F): | 71$^{o}$ | 70$^{o}$ | Wind Direction: | 200$^{o}$ | 230$^{o}$ |
| Relative Humidity: | 72 percent | 67 per | Wind Speed (Knots): | 12 | 10 |
| Visibility: (Miles): | 3 | 3* cent | Rain Comment: | | |
| Cloud Coverage: | 4K scatter 25 broken | | | | |

### System Performance

A6 DRS: Poor/Good

$I^{2}R$ Maverick: Good

DRS/Maverick Slaving: Good

Recording Machines: Good

Special Comments: Second flight of day. *Visibility very hazy no better than first flight.

General Comments: FLIR focus was poor till pass 7. Corrected starting pass 8. FLIR temp 97$^{o}$. Mission scrubbed after 9 passes due to DRS over temp light on.

# LANTIRN SIGNATURE FLIGHT TEST
## MISSION DESCRIPTION - OVERVIEW

Date: 6-8-81

Mission Number: 81-42 Total Data Passes: 15

Location: Fort Knox Type of Terrain: European

Time of Test: 4:26-6:30 Section of Day: Afternoon

### Target Information

Set-Up: See Data Sheets Engine Temperature: Hot

Total Vehicles: 7 Tanks: 3 APCs: 3 Trucks: 1 2-1/2 ton

Special Comments:

### Weather

Temperature ($^{o}$F): 87$^{o}$ Air Pressure (in Hg):

Dew Point ($^{o}$F): 61$^{o}$ Wind Direction: 230$^{o}$

Relative Humidity: 59 percent Wind Speed (Knots): 10

Visibility: (Miles): 3 miles Rain Comment: None

Cloud Coverage: 4K scattered

### System Performance

A6 DRS: Good

$I^{2}R$ Maverick: Good

DRS/Maverick Slaving: Good

Recording Machines: Good

Special Comments: 3rd flight of the day very hazy, good data flight

General Comments: All data is with DRS in narrow view

## LANTIRN SIGNATURE FLIGHT TEST
## MISSION DESCRIPTION - OVERVIEW

Date: 6-8-81

Mission Number: 81-43 Total Data Passes: 2

Location: Fort Knox Type of Terrain: European

Time of Test: 7:46 - 8:20 Section of Day: Evening

### Target Information

Set-Up: In Motion Engine Temperature: Hot

Total Vehicles: 7 Tanks: 3 APCs: 3 Trucks: 1

Special Comments:

### Weather

Temperature ($^{o}$F): 81$^{o}$ Air Pressure (in Hg):

Dew Point ($^{o}$F): 69$^{o}$ Wind Direction: 210$^{o}$

Relative Humidity: 67 percent Wind Speed (Knots): 10

Visibility: (Miles): Rain Comment: None

Cloud Coverage: 2K scattered

### System Performance

A6 DRS: Overheated

$I^2R$ Maverick: Good

DRS/Maverick Slaving: None

Recording Machines: Good

Special Comments: Very hazy flight scrubbed due to overheating of DRS (only 2 passes made 1 good)

General Comments: All data is with DRS in narrow view

## LANTIRN SIGNATURE FLIGHT TEST
## MISSION DESCRIPTION - OVERVIEW

Date: 6-9-81

Mission Number: 81-44 Total Data Passes: 14

Location: Fort Knox Type of Terrain: European

Time of Test: 8:27 - 10:30 Section of Day: Morning

### Target Information

Set-Up: 2 by 2 in a row Engine Temperature: Hot

Total Vehicles: Tanks: 3 APCs: 3 Trucks: 1

Special Comments:

### Weather

| | 10 a. m. | | | 10 a. m. |
|---|---|---|---|---|
| Temperature ($^{o}$F): | 77$^{o}$ | 80$^{o}$ | Air Pressure (in Hg): | |
| Dew Point ($^{o}$F): | 72$^{o}$ | 75$^{o}$ | Wind Direction: | 270$^{o}$ 210$^{o}$ |
| Relative Humidity: | 87 percent | 84 percent | Wind Speed (Knots): | 10 2 |
| Visibility: (Miles): | 5 | | Rain Comment: | 16K scattered 25K broken |
| Cloud Coverage: | 4K scattered 12K overcast | | | |

### System Performance

A6 DRS:

$I^{2}R$ Maverick: Good

DRS/Maverick Slaving: Good

Recording Machines: Good

Special Comments: DRS video started out poor due to high humidity and poor visibility, improved as humidity dropped and visibility improved. Some due to sun try to break through as we neared end of mission visibility began to degrade.

General Comments: All data is with DRS in narrow view

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: Thursday, 12 March 1981 Mission Number: 81-8

Location: Fort Hunter-Liggett Time of Test: Afternoon

Target Set-Up: In Line Engine Temp: Hot, Running

| Page No. | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1 | 2:24 pm | 2:30 | 500 feet | - | DRS very unstable - jerking. Zoomed in on dark object (cold roof of house). Video Rolling. Cows. |
| 2 | 2:41 | 2:43 | | Cows | Cows mistaken for tanks. Tank finally seen. |
| 3 | 2:47 | 2:49 | 1000 feet | Tank | DRS still jerky. Only one tank at a time possible. DRS blurry. |
| 4 | 2:53 | 2:55 | | Tank | Vehicles in better position on road. Still difficult to find vehicles. |
| 5 | 2:58 | 3:06 | | Tank | Venetian blind effect all runs. Jeep driving on road. |
| 6 | 3:10 | 3:12 | | | Video poor for both DRS and Maverick. |
| 7 | 3:17 | 3:18 | | | Fuel truck on highway |
| 8 | 3:22 | 3:24 | | | MAV video poor. DRS improved |
| 9 | 3:29 | 3:30 | | | (Note: Data not completely reviewed. To be supplied later.) |
| 10 | 3:34 | 3:37 | | | |
| 11 | 3:41 | 3:43 | | | Signal given to shut off engines |
| | | | | | Aircraft refueled in Paso Robles |

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: Thursday, 12 March 1981 Mission Number: 81-9

Location: Fort Hunter-Liggett Time of Test: Late Afternoon

Target Set-Up: In Line Engine Temp: Cooled 2 hours

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1 | 5:08 pm | 5:11 | 1000 feet | | (Note: Data not completely reviewed yet. To be supplied later.) |
| 2 | 5:15 | 5:18 | 500 feet | | |
| 3 | 5:22 | 5:23 | | | |
| 4 | 5:27 | 5:29 | | | |
| 5 | 5:32 | 5:34 | | | |
| 6 | 5:37 | 5:39 | | | |
| 7 | 5:41 | 5:43 | | Moving Tanks | |
| | | | | | Aircraft returned to Paso Robles |

LANTIRN SIGNATURE FLIGHT TEST
DATA PASS DESCRIPTIONS

Date: Friday, 13 March 1981 Mission Number: 81-10

Location: Fort Hunter-Liggett Time of Test: Morning

Target Set-Up: Array Engine Temp: Hot, Running

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1 | 9:51 am | 9:53 | 1500 feet | - | DRS video jerky. Searching for targets |
| 2 | 9:56 | 9:58 | | Truck | DRS blurry. Picture Rolling |
| 3 | 10:02 | 10:03 | | Tank | Venetian Blind Effect |
| 4 | 10:06 | 10:09 | 500 feet | Truck | - |
| 5 | 10:12 | 10:14 | | APC | Picture rolling. DRS jerking. Burn barrel saturating picture. |
| 6 | 10:17 | 10:19 | | Tank | Blurry Pictures |
| 7 | 10:23 | 10:24 | | APC | Acquire only one vehicle at a time |
| 8 | 10:27 | 10:29 | | Tank | Pictures improving |
| 9 | 10:33 | 10:34 | | Tank | Rain let up a little. Good pass |
| 10 | 10:38 | 10:39 | | Tank | Men standing on tank |
| 11 | 10:43 | 10:45 | | Tanks | Got several vehicles. Better data. Bumpy air ride. Signal given to shut off engines for cool down period.<br><br>Aircraft refueled in Paso Robles |

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: Friday, 13 March 1981 Mission Number: 81-11

Location: Fort Hunter-Liggett Time of Test: Afternoon

Target Set-Up: Array Engine Temp: Cooled 2 hours

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1 | 1:14 pm | 1:15 | 2000 feet | - | DRS still jerks somewhat. Test run over target area |
| 2 | 1:19 | 1:20 | 500 feet | APC | Quality of video looks better |
| 3 | 1:24 | 1:26 | | Tank (1) | Cows acquired first. |
| 4 | 1:29 | 1:31 | | Truck (4) | Video Roll due to DRS jerking. Good data. |
| 5 | 1:34 | 1:36 | | APC (3) | Good pass |
| 6 | 1:39 | 1:40 | 1000 feet | APC | Acquire targets at 3 miles |
| 7 | 1:44 | 1:46 | | APC (4) | 400 cycle noise. DRS has better focus. Man standing on APC |
| 8 | 1:49 | 1:51 | | Truck/ APC | Tanks hard to see because of trees. |
| | | | | | End of test mission. Aircraft returned to Paso Robles |

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: Monday, 16 March 1981 Mission Number: 81-13

Location: Fort Hunter-Liggett Time of Test: Night

Target Set-Up: Array Engine Temp: Hot, running

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1 | 7:59 pm | 8:00 | 1500 feet | - | Trouble acquiring targets at night. Burn barrels not lit yet. |
| 2 | 8:06 | 8:08 | | - | As above |
| 3 | 8:13 | 8:15 | 1000 feet | Tank (2) | Burn barrels now on. Good pass. Acquisition of targets at 2 miles |
| 4 | 8:20 | 8:23 | | Tank (2) | Acquire limitation of 4 miles due to tree line. Tank (4) obscured by tree |
| 5 | 8:27 | 8:30 | 1200 feet | Tank (3) | New altitude to acquire targets from further out - 5 mi. Good data |
| 6 | 8:34 | 8:37 | | APC (1) | Good data run |
| 7 | 8:40 | 8:43 | | Tank (1) | APC (2) in wrong direction. Moved APCs in closer. Not at correct distances |
| 8 | 8:47 | 8:50 | | Tank (3) | Acquisition at 6 miles out due to burn barrels. |
| 9 | 8:55 | 8:57 | | Tank (1) | Signal given to turn off engines for cool down period. |
| | | | | | Aircraft refueled in Paso Robles |

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: Monday, 16 March 1981 Mission Number: 81-14

Location: Fort Hunter-Liggett Time of Test: Night

Target Set-Up: Array Engine Temp: Cooled 2 hours

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1 | 10:51 pm | 10:54 | 1200 feet | Tank (2) | Good data |
| 2 | 10:58 | 11:01 | 1150 feet | Tank (3) | Tank seems too hot. Must have left engine on. Men standing on tanks. Reported this to ground unit. |
| 3 | 11:05 | 11:08 | 1200 feet | APC (3) | Can visually identify targets at 3 miles |
| 4 | 11:12 | 11:15 | | APC (2) | Some interference from audio |
| 5 | 11:18 | 11:21 | | Tank (1) | Good data |
| 6 | 11:25 | 11:28 | | Tank (4) | Some engines running against our wishes |
| 7 | 11:31 | 11:34 | | Tank (1) | Good data |
| 8 | 11:39 | 11:41 | | APC (4) | Good data |
| 9 | 11:45 | 11:47 | | Truck (3) | Good data |
| 10 | 11:51 | 11:53 | | Truck (1) | After pass, instructed vehicles to depart |
| 11 | 11:58 | 12:00M | | Tanks | Troops trying to start vehicles |
| 12 | 12:04 am | 12:06 | | Truck | Moving Truck. Good data |
| 13 | 12:09 | 12:11 | | Tank | Vehicles ready to leave |
| 14 | 12:14 | 12:15 | | Tank | Tanks can not get engines started |

LANTIRN SIGNATURE FLIGHT TEST
DATA PASS DESCRIPTIONS

Date: Monday, 16 March 1981 Mission Number: 81-14

Location: Fort Hunter-Liggett Time of Test: Night

Target Set-Up: Array Engine Temp: Cooled 2 hours

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 15 | 12:21 | 12:22 | | Tank | Tanks can not leave yet. Returned aircraft to base. |

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: Tuesday, 17 March 1981 Mission Number: 81-15

Location: Fort Hunter-Liggett Time of Test: Afternoon

Target Set-Up: Array Engine Temp: Hot, running

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1 | 12:46pm | 12:49 | 1000 feet | | (Note: Tape sent to IVC to study recording problem Data to be supplied when tape is reviewed) |
| 2 | 12:53 | 12:56 | | | |
| 3 | 1:00 | 1:02 | | | |
| 4 | 1:07 | 1:09 | | | |
| 5 | 1:15 | 1:17 | | | |
| 6 | 1:23 | 1:25 | | | |
| 7 | 1:30 | 1:32 | | | |
| 8 | 1:32 | 1:39 | | | |
| 9 | 1:45 | 1:47 | | | |
| 10 | 1:52 | 1:54 | | | |
| 11 | 1:59 | 2:00 | | | |
| 12 | 2:06 | 2:08 | | | Aircraft refueled in Paso Robles |

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: Tuesday, 17 March 1981 Mission Number: 81-16

Location: Fort Hunter-Liggett Time of Test: Late Afternoon

Target Set-Up: Array Engine Temp: Cooled 2 hours

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1<br>2<br>3 | | | | | Accidentally erased during trouble-shooting Wednesday evening in aircraft |
| 4 | 4:16 pm | 4:18 | 1000 feet | Tank (1) | Partially erased. 400 cycle noise |
| 5 | 4:24 | 4:26 | | APC (2) | APC (1) obscured by trees |
| 6 | 4:30 | 4:32 | | APC 3 | Good pictures except for 400 cycle. Warmth from sun apparent on targets |
| 7 | 4:38 | 4:40 | | APC (4) | Good data |
| 8 | 4:45 | 4:47 | | APC (1) | Recorders turned on late |
| 9 | 4:52 | 4:54 | | APC (1) | Army personnel by vehicles. DRS chiller circuit breaker out on this pass, affecting video quality |
| 10 | 4:58 | 5:01 | | Truck (2) | OK |
| 11 | 5:06 | 5:08 | | Truck (3) | Vehicles acquired 4.5 miles |
| 12 | 5:12 | 5:14 | | Tank (1) | Vehicles ready to disperse |
| 13 | 5:17 | 5:20 | | Moving Tank | Good data of moving tank through cluttered terrain.<br><br>End of test missions. Aircraft returned to Paso Robles |

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: Friday, 20 March 1981 Mission Number: 81-17

Location: Fort Hunter-Liggett Time of Test: Afternoon

Target Set-Up: In Line Engine Temp: Hot

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1 | 11:22 am | 11:24 | 1500 feet | Truck (4) | DRS gain too low. Poor video contrast only 4 trucks. Much tearing of video on left side. |
| 2 | 11:30 | 11:31 | 500 feet | Truck (3) | As above |
| 3 | 11:36 | 11:38 | | Truck (1) | Light Rain. Cows in foreground. DRS jerking. Tearing. Low contrast |
| 4 | 11:43 | 11:45 | 1500 feet | Truck and Motor Pool | Now only 3 trucks. Video now good. Acquisition 5 miles out. Light rain |
| 5 | 11:52 | 11:59 | | Motor Pool | Cold targets in motor pool. Some DRS jerking. Background clutter pictures searching for vehicles coming into area. |
| 6 | 12:03 | 12:06 | 500 feet | APC (1) | 3 trucks and 2 APCs |
| 7 | 12:10 | 12:12 | | APC (2) | Acquisition >5 miles. Good shots. Men on APCs. 3 trucks, 4 APCs |
| 8 | 12:18 | 12:20 | | APC (3) | Vehicles on road. Aircraft refueled in Paso Robles |

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: Friday, 20 March 1981 Mission Number: 81-18

Location: Fort Hunter-Liggett Time of Test: Afternoon

Target Set-Up: In Line Engine Temp: Hot, running

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1 | 2:31 | 2:38 | 500 feet | APC (1) | Line of vehicles. Cows |
| 2 | 2:38 | 2:40 | | Tank (1) | Centered on cows in foreground. Moving jeep near targets |
| 3 | 2:44 | 2:47 | | Tank (2) | Line of vehicles. Cows |
| 4 | 2:51 | 2:56 | | Tank (2) | Line of vehicles. |
| 5 | 2:56 | 2:58 | | Moving APC | Tanks moving away from test area. APC moving away. |
| | | | | | Aircraft then flew directly to Van Nuys for weekend. |

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: Saturday, 21 March 1981 Mission Number: 81-19

Location: Fort Irwin Time of Test: Morning/Noon

Target Set-Up: Random Engine Temp: Mostly Cold

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1 | 11:57 am | 11:58 | 2000 feet | Cold Tank | Good data, except tank cold |
| 2 | 12:00N | 12:01pm | 1500 feet | Tanks | Camouflaged tanks |
| 3 | 12:02 pm | 12:03 | | Hot Tank | Rear view. Difficult to find targets in desert from distance |
| 4 | 12:04 | 12:05 | | Misc | Tents, parked trucks |
| 5 | 12:07 | 12:08 | | Hot Tank | |
| 6 | 12:09 | 12:10 | | Misc | Truck on road moving toward aircraft. Jeep driving away. Searching for targets. |
| 7 | 12:11 | 12:12 | | Hot Tank | Formation. Same hot tank as above rear view. |
| 8 | 12:13 | 12:14 | | Truck | Good shot of truck driving away |
| 9 | 12:17 | 12:18 | | Hot Tank | Array as above w/hot tank and cold tanks |
| 10 | 12:22 | 12:23 | | Misc | Tents, trucks |
| 11 | 12:26 | 12:27 | | - | Cannot find any targets. |
| | | | | | Refuled at Dagget |

LANTIRN SIGNATURE FLIGHT TEST
DATA PASS DESCRIPTIONS

Date: Saturday, 21 March 1981 Mission Number: 81-20

Location: Fort Irwin Time of Test: Afternoon

Target Set-Up: Random Engine Temp: Mostly Cold

| Page No | Start Time | End Time | Approx Altit. | Main Target | Comments |
|---|---|---|---|---|---|
| 1 | 2:18 pm | 2:19 | 5000 feet | Moving Tank | Good data of tank with dust clouds |
| 2 | 2:19 | 2:20 | | -- | Ground clutter test in NFOV |
| 3 | 2:21 | 2:28 | 2000 feet | | Searching for targets. Very difficult to find. Views of clouds. |
| | | | | Tank | Finally spotted single hot tank |
| 4 | 2:31 | 2:34 | | - | Hard to find any viable targets |
| 5 | 2:36 | 2:37 | | - | Searching for targets |
| 6 | 2:40 | 2:41 | | - | Searching for targets |
| 7 | 2:50 | 2:55 | | Moving Truck | Good data of truck on dirt road |
| | | | | | Returned to Van Nuys |

## LANTIRN SIGNATURE FLIGHT TEST
## DATA PASS DESCRIPTIONS

Date: 6-4-81 Temperature: 75°

Location: Louisville/Fort Knox DP: 70

Mission No.: 81-36 Humidity: 85 Percent

Takeoff: 10:30 Landing: _____ Condition: 1800 Overcast

| Pass No. | Start Time | End Time | Comments |
|---|---|---|---|
| 1 | 10:46 | | On Over tank park no pickup |
| | | 10:48 | Off |
| 2 | 10:51 | | On Intermittent rain |
| | | 10:53 | Off |
| 3 | 10:56 | | On No pickup |
| | | 10:58 | Off |
| 4 | 11:02 | | On Tank moving |
| | | 11:03 | Off |
| 5 | 11:06 | | On No pickup |
| | | 11:08 50 | Off |
| 6 | 11:12 | | On No pickup |
| | | 11:14 57 | Off |
| 7 | 11:19 | | On Tank pickup |
| | | 11:21 | Off |
| 8 | 11:26 | | On Scanario 5 vehicles pickup up |
| | | 11:28 59 | Off |
| 9 | 11:31 | | Landing at Fort Knox DRS "on" |
| | | 11:32 | DRS off |
| | | | Note: INS setup good WP right on. |

## LANTIRN SIGNATURE FLIGHT TEST
## DATA PASS DESCRIPTIONS

Date: 6-4-81 Temperature: 75°

Location: Louisville/Fort Knox DP: 69

Mission No.: 81-38 Humidity: 85 Percent

Takeoff: 2:40 Landing: _____ Condition: 25 Broken, 10K Overcast

| | Pass No. | Start Time | End Time | Comments | |
|---|---|---|---|---|---|
| * | 1 | 2:47 | | All Rec's On | Picked up tanks and truck approx 2 miles |
| | | | 2:50 | All Rec's Off | |
| | 2 | 2:54 | | All Rec's On | No pick up |
| | | | 2:57 | All Rec's Off | |
| * | 3 | 3:02:45 | | All Rec's On | Good tank Pickup |
| | | | 3:04 | All Rec's Off | |
| | 4 | 3:08 | | All Rec's On | No pickup |
| | | | 3:09 | All Rec's Off | |
| | 5 | 3:12 | | On | No pickup |
| | | | 3:14 | Off | |
| * | 6 | 3:18 | | On | Good tank pickup |
| | | | 3:20 | Off | |
| * | 7 | 3:23 | | On | *3.69 Field of View |
| | | | 3:25 | Off | Good tank pickup |
| | 8 | 3:25 | | DRS Only | |
| | | | 3:26 | No good | |
| | 9 | 3:29 | | On | No pickup |
| | | | 3:31 | Off | |
| * | 10 | 3:34 | | On | Scenerio 5 |
| | | | 3:36 | Off | Good tank pickup |
| * | 11 | 3:40 | | On | Scenerio 5 in motion |
| | | | 3:42 | Off | Good pickup |
| * | 12 | 3:45 | | On | Good pickup (short) |
| | | | 3:47 | Off | Scenerio 5 in motion |

(Continued)

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: 6-4-81 Temperature: 75°

Location: Louisville/Fort Knox DP: 69

Mission No.: 81-38 Humidity: 85 Percent

Takeoff: 2:40 Landing: _____ Condition: 25 Broken, 10K Overcast

| | Pass No. | Start Time | End Time | Comments | |
|---|---|---|---|---|---|
| * | 13 | 3:50 | | On | 1 Mile pickup in motion |
| | | | 3:52 | Off | |
| * | 14 | 3:55 | | On | 1 mile pickup in motion |
| | | | 3:57 | Off | |
| * | 15 | 4:00 | | On | Good tank pickup<br>3:71V field of view at 1 mile -<br>3:85V field of view |
| * | 16 | 4:06 | | New mav. tape<br>Good pickup 2 miles | |
| | | | 4:07 | Off | |
| | 17 | 4:11 | | On | |
| | | | 4:12 | DRS rec off DRS dropped out | |
| | | | 4:13 | Mav. and Mar Rec's off | |

## LANTIRN SIGNATURE FLIGHT TEST
## DATA PASS DESCRIPTIONS

Date: 6-8-81 Monday Morning  Temperature: $67^0$

Location: Louisville/Fort Knox  DP: $61^o$ (all passes)

Mission No.: 81-40  Humidity: Very Hazy Day

Takeoff: 9:11  Landing: 11:24  Condition:

| | Pass No. | Start Time | End Time | Comments | |
|---|---|---|---|---|---|
| | 1 | 10:01 | | All Rec's | |
| | | | 10:04 | Off | Tanks picked up moving in |
| | 2 | 10:09 | | On | Did not (1st tank $45^o$) Did pickup |
| | | | | | pickup (2nd tank $90^o$) farmer (3rd tank $120^o$) plowing |
| | | | 10:11 | Off | |
| | 3 | 10:17 | | On | No pickup |
| | | | 10:19 | Off | |
| * | 4 | 10:27 | | On | Good |
| | | | 10:28 | OK | Good pickup 2 miles |
| * | 5 | 10:35 | | On | |
| | | | 10:39 | Off | Video camera view of tank area |
| * | 6 | 10:45 | | On | Good pickup - 2 miles |
| | | | 10:47 | Off | |
| * | 7 | 10:54 | | On | Good pickup 3-1/2 miles |
| | | | 10:56 | Off | |
| * | 8 | 11:03 | | On | Good pickup 4 miles |
| | | | 11:05 | Off | |
| * | 9 | 11:12 | | On | Good pickup 2-1/2 miles |
| | | | 11:14 | Mars off Mav. off | |
| | | | 11:16 | Video camera view of tank area DRS off | |
| | | | | Visibility - 6 miles hazy smoke at end of mission | |

LANTIRN SIGNATURE FLIGHT TEST
DATA PASS DESCRIPTIONS

Date: 6-8-81 Temperature: 81°

Location: Louisville/Fort Knox DP: 71

Mission No.: 81-41 Humidity: 67 Percent

Takeoff: 12:44 Landing: 2:21 Condition:

| | Pass No. | Start Time | End Time | Comments |
|---|---|---|---|---|
| | 1 | 12:55 | | On Vehicles in a row 50 meter sep. Vehicles pickup late approx. 1 mile |
| | | | 12:58 | Off |
| | 2 | 1:02 | | On No pickup |
| | | | 1:03 | Off |
| | 3 | 1:09 | | On Good pickup |
| | | | 1:11 | Off |
| | | RESET TIME GEN. IT WAS ABOUT 9 MIN OFF STOW | | |
| * | 4 | 1:18 | | On Good pickup 2 miles |
| | | | 1:20 | Mav. Off |
| | | | 1:20:37 | DRS Off |
| * | 5 | 1:27 | | On Good pickup (Grnd tank command) (Description of vehicles) |
| | | | 1:29:50 | Off Alignment |
| | 6 | 1:36:40 | | On Late Pickup (In recalibrated at end of this run) |
| | | | 1:38:40 | of this run) |
| * | 7 | 1:46:06 | | On Pickup at 2 miles |
| | | | 1:48:38 | Off |
| * | 8 | 1:55:40 | | On Pickup at 3 miles |
| | | | 1:58:10 | Off |
| | 9 | 2:05:13 | | Mav. ON Tank Moving |
| | | 2:05:33 | | DRS and Mar On DRS Over temp lite on |
| | | | 2:06:30 | All Rec's Off No pickup |
| | 2:09:40 ALL PWR SHUT DOWN DRS STILL HAS OVER TEMP LITE ON | | | |
| | | | | MISSION SCRUBBED DUR TO ABOVE PROBLEM DRS TEMP. 97° |

## LANTIRN SIGNATURE FLIGHT TEST
## DATA PASS DESCRIPTIONS

Date: 6-8-81 Temperature: 87°

Location: Louisville/Fort Knox DP: 67

Mission No.: 81-42 Humidity: 59 Percent

Takeoff: 4:26 Landing: 6:30 Condition: 4K Scattered

| | Pass No. | Start Time | End Time | Comments |
|---|---|---|---|---|
| * | 1 | 4:35:32 | | On — We believe this run is scenario 2 4 mile pickup |
| | | | 4:38 | |
| | 2 | 4:40 | | Mav. calibration run Vis = 3 miles |
| | | | 4:41 | Off |
| * | 3 | 4:44:50 | | On — 2 mile pickup |
| | | | 4:47:18 | Off |
| | 4 | 4:48 | | This pass was video camera shot out window of aircraft |
| | | | 4:50:20 | into hazy |
| * | 5 | 4:54:30 | | On — 5 mile pickup (Gnd command |
| | | | 4:56:50 | Off — alignment of vehicles) |
| | 6 | 4:58:20 | | Mav and DRS calibration run |
| | | | 5:00 | Off |
| * | 7 | 5:03:07 | | On — 4-1/2 mile pickup |
| | | | 5:06:02 | Off |
| * | 8 | 5:12:20 | | On — 6 mile pickup |
| | | | 5:15:15 | Off |
| * | 9 | 5:21:34 | | On — 6 mile pickup (Ins reset) |
| | | | 5:24:20 | Off |
| * | 10 | 5:27:40 | | On — Mav and DRS calibration run |
| | | | 5:28:40 | Off |
| * | 11 | 5:30:45 | | On — 6 mile pickup |
| | | | 5:33:30 | Off |
| * | 12 | 5:39:25 | | On — 3 mile pickup tank in motion setting |
| | | | 5:42:10 | Off — Up for Scenario 1 |
| * | 13 | 5:48:29 | | On — 6 mile plous pickup tank are moving forward slowly |

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: 6-8-81 Temperature: 87°

Location: Louisville/Fort Knox DP: 67

Mission No.: 81-42 Humidity: 59 Percent

Takeoff: 4:26 Landing: 6:30 Condition: 4K Scattered

| | Pass No. | Start Time | End Time | Comments | |
|---|---|---|---|---|---|
| | | | 5:50:00 | Off | |
| | 14 | 5:58:00 | | On | 4-1/2 mile pickup (Gnd command alignment of vehicles (approx) |
| | | | 6:00:40 | Off | |
| * | 15 | 6:06:36 | | On | 5 mile pickup |
| | | 6:09:25 | | Off | "At this time we are below VFR" |
| | | | | END OF MISSION | |

## LANTIRN SIGNATURE FLIGHT TEST
## DATA PASS DESCRIPTIONS

Date: 6-8-81 Temperature: 81°

Location: Louisville/Fort Knox DP: 69

Mission No.: 81-43 Humidity: 67 Percent

Takeoff: 7:46 Landing: 8:20 Condition: Very Hazy

| Pass No. | Start Time | End Time | Comments | |
|---|---|---|---|---|
| * 1 | 7:58:50 | | On | 3 mile pickup moving vehicles |
| | | 8:00:50 | Off | |
| 2 | 8:08:50 | | On | No pickup - DRS poor video overheating |
| | | 8:10:30 | Off | |
| | | | FLIGHT SCRUBBED DRS OVERHEATED | |

# LANTIRN SIGNATURE FLIGHT TEST
# DATA PASS DESCRIPTIONS

Date: 6-9-81 Temperature: 77°

Location: Louisville/Fort Knox DP: 75

Mission No.: 81-44 Humidity: 34 Percent

Takeoff: 8:27 Landing: 10:30 Condition: Hazy - overcast

| | Pass No. | Start Time | End Time | | Comments |
|---|---|---|---|---|---|
| | 1 | 8:36 | | On | Late pickup 1 mile |
| | | | 8:38:40 | Off | 2 by 2 in a row |
| * | 2 | 8:45:50 | | On | 3-1/2 mile pickup |
| | | | 8:47:48 | Off | |
| | 3 | 8:54:54 | | On | 1 mile pickup |
| | | | 8:57:15 | Off | |
| * | 4 | 9:04:12 | | On | 3-1/2 mile pickup |
| | | | 9:06:50 | Off | |
| | 5 | 9:13:30 | | On | Recalibrated INS |
| | | | 9:15:40 | Off | This pass vehicles +5° shift |
| * | 6 | 9:20:30 | | On | 3-1/2 mile pickup |
| | | | 9:22:26 | Off | |
| | 7 | 9:28:07 | | On | This pass vehicles 45° shift |
| | | | 9:30:19 | Off | No pickup |
| * | 8 | 9:36:07 | | On | 4 mile pickup |
| | | | 9:38:12 | Off | |
| * | 9 | 9:43:50 | | On | 4-1/2 mile pickup. This pass vehicles another 45° shift INS recalibrated |
| | | | 9:45:41 | Off | |
| * | 10 | 9:51:08 | | On | 3 mile pickup. This pass another 45° shift |
| | | | 9:53:08 | Off | |
| | 11 | 9:55:23 | | On | Mav and DRS interface pass |
| | | | 9:57:16 | Off | No data back leg of pass |
| | 12 | 9:58:50 | | On | APU pickup 2 miles no shift |
| | | | 10:00:45 | Off | |
| * | 13 | 10:06 | | On | 3 mile pickup Tanks in one column moving south |
| | | | 10:08:16 | Off | APU in another column, moving south |
| * | 14 | 10:13:50 | | On | 4 mile pickup Same except heading north |
| | | | 10:15:45 | Off | |
| | | | | END | |

LANTIRN SIGNATURE FLIGHT TEST
DATA PASS DESCRIPTIONS

Date: 8-10-81 Temperature: _____

Location: Fort Irwin DP: _____

Mission No.: 81-62 Humidity: _____

Takeoff: 3:12 Landing: 5:25 Condition: Clear and Sunny

| Pass No. | Start Time | End Time | Comments | |
|---|---|---|---|---|
| 1 | 3:57:34 | | Ft. Irwin tank park all REOs on | |
| | | 3:58:04 | MAV off (Alt 3500 AGL) | |
| | | 3:59:07 | REOs off | |
| 2 | 4:04:04 | | All RECs on | 1 mile east WP #2 Truck moving |
| | | 4:05:48 | All RECs off | |
| 3 | 4:08:04 | | All RECs on | Tank head on, both systems |
| | | 4:10:40 | All RECs off | Also picked up reflector |
| 4 | 4:12:56 | | All RECs on | 1200 AGL |
| | | | | Stationary Tank<br>Cam. Tanks<br>Truck and Trailer |
| | | 4:15:56 | All RECs off | Alt 1200 AGL |
| 5 | 4:18:13 | | All RECs on | 4 mile pickup group tanks<br>1 mile pickup cam. tanks<br>1 mile pickup group tanks |
| | | 4:21:27 | All RECs off | |
| 6 | 4:23:25 | | All RECs on | Alt 1200 AGL |
| | | | | Moving PC rear |
| | | 4:25:02 | MAV off | |
| | 4:25:22 | | MAV on | Cam tanks and other vehicles |
| | | 4:27:00 | All RECs off | |
| 7 | 4:27:50 | | All RECs on | Tent - Small Building |
| | | 4:30:14 | All RECs off | |
| 8 | 4:32:20 | | All RECs on | Truck moving |
| | | 4:37:45 | All RECs off | |
| | | | MISSION SCRUBBED AT THIS POINT DUE TO OVERTEMP WARNING LIGHT ON. | |

LANTIRN SIGNATURE FLIGHT TEST
DATA PASS DESCRIPTIONS

Date: 8-11-81 Temperature: 80°

Location: Fort Irwin DP:

Mission No.: 81-63 Humidity:

Takeoff: 8:00 Landing: 10:25 Condition: Sunny/Clear

| Pass No. | Start Time | End Time | Comments | |
|---|---|---|---|---|
| 1 | 8:42:45 | | All RECs on | Trucks 1200 AGL<br>Group of Stationary Tanks |
| | | 8:44:12 | REC's off | |
| 2 | 8:47:24 | | All RECs on | 5 miles Buildings<br>Cam Group of Truck<br>1/2 mile PU Cam<br>Tanks |
| | | 8:50:34 | All RECs off | |
| 3 | 8:51:30 | | All RECs on | Cam Tanks, 2 mile PU tank and Stationary |
| | | 8:55:44 | All RECs off | (Holding about 1000 AGL) |
| 4 | 8:59:30 | | All RECs on | 4 miles PU Stationary Tank<br>1/2 miles PU Cam Tanks |
| | | 9:03:05 | RECs off | |
| 5 | 9:05:55 | | All RECs on | 1-1/2 miles PU Cam Tanks |
| | | 9:10:44 | All RECs off | |
| 6 | 9:12:54 | | All RECs on | Moving 155 Knots<br>1/2 miles PU 3 Tanks - 3 more Tanks, Cam Tanks, 2nd group of Cam. Tanks, Jeep |
| | | 9:16:53 | All RECs off | |
| 7 | 9:18:50 | | All RECs on | 1 Moving Truck<br>Moving Tank Broadside |
| | | 9:22:10 | RECs off | |
| 8 | 9:25:25 | | RECs on | Tank Compound, Group Cam. Tanks, etc., 1-1/2 miles |
| | | 9:28:38 | All RECs off | |
| 9 | 9:31:34 | | All RECs on | Group of Tanks and Trucks |
| | | 9:34:48 | RECs off | |

(Continued)

LANTIRN SIGNATURE FLIGHT TEST
DATA PASS DESCRIPTIONS

Date: 8-11-81 Temperature: 80°

Location: Fort Irwin DP:

Mission No.: 81-63 Humidity:

Takeoff: 8:00 Landing: 10:25 Condition: Sunny/Clear

| Pass No. | Start Time | End Time | Comments |
|---|---|---|---|
| 10 | 9:38:40 | | 4 mile PU Tank Compound<br>5 mile PU Tanks |
| | | 9:41:50 | MAV REC off |
| | 9:43:06 | | Changed MAV Tape REC on |
| | | | Tank Park 4-1/2 miles |
| | | 9:44:40 | RECs off |
| 11 | 9:52:38 | | All RECs on Barstow & Trains Yard |
| | | 9:54:58 | MAV off |
| | | 9:56:09 | All RECs off |
| | | | Waypoints |
| | | | 1 = Bike Lake 3517 |
| | | | 11638 |
| | | | 2 = Road 3521 |
| | | | x 155M 11636.5 |

# 5.0 CONCLUSIONS

This gathering of Infrared signature data for the LANTIRN Program has resulted in a greatly increased IR data base. The spread of these tests in the European environment has given new perspectives of IR imagery in high humidity and under adverse conditions of weather. Acquisition of targets at ranges of more than 4 miles was possible but quite difficult under the environmental conditions encountered.

The experiences gained in desert environment were also educational. Targets that were not internally warm (hot engines) melded very easily into desert shrubs under some conditions but were quite visible under others. Standard camouflage was almost completely useless in the desert environment. Dust patterns and moving vehicle depiction was most enlightning and should prove most beneficial to future development.

The signature flights fulfilled their purpose. While more data are always desirable to support a statistical solution to a problem, the signature flights produced adequate data to support the development program.

# 6.0 PERSONNEL

## 6.1 EQUIPMENT CONFIGURATION PERSONNEL

The following personnel were responsible for putting together the test system.

Sam Feinstein, Program Manager, Div. 71, El Segundo South
Ron Standel, Project Manager, Div. 71, El Segundo South
Ron Kurtus, Project Systems Engineer, Div. 71, El Segundo South
Jay Utech, Equipment Systems Engineer, Div. 71, El Segundo South
Chris Smith, Flight Test, Div. 24, Culver City
Richard Ollis, Instrumentation, Div. 24, Culver City
Steve Lutton, TR Development, Div. 72, Culver City
Len Hall, MBC Development, Div. 57, Canoga Park
Warren Doty, $I^2R$ Maverick, Div. 56, Canoga Park
Phil Massie, A-6 DRS, Div. 71, El Segundo North

## 6.2 FLIGHT TEST PERSONNEL

The following team actively participated in the Signature Flight Tests at Ft. Hunter-Liggett and Ft. Irwin.

Ron Kurtus, Project System Engineer, Div. 71, El Segundo South
Mel Krone, Operations Coordinator, Div. 24, Pt. Magu
Mark Hanson, Ground Control, Div. 24, Pt. Magu
Chuck Graffey, Pilot, Div. 24, Van Nuys
Charlie Stender, Co-Pilot, Div. 24, Van Nuys
Charlie Blake, Co-Pilot, Div. 24, Van Nuys
Jay Utech, DRS Operator, Div. 71, El Segundo South
Tex Cochrum, Maverick Operator, Div. 56, Canoga Park
Bob Martin, Instrumentation Operator, Div. 24, Culver City
Diamond Sloan, Crew Chief, Div. 24, Van Nuys
Homer Johnson, Mechanic, Div. 24, Van Nuys
Bill Cornelius, Security, Div. 50, Van Nuys