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AVHGC-DST ( 16 AUG 1970 ) 1st Ind  
SUBJECT: Letter Report - Land Navigation System (LNS)-102

DA Headquarters, U.S. Army Vietnam, APO San Francisco  
96375 18 AUG 1970


THRU: Commander - in - Chief, U.S. Army Pacific, APO San  
Francisco 96558

TO: Assistant Chief of Staff for Force Development,  
Department of the Army, Washington, D.C. 20310

1. Subject letter report is submitted for review and approval.
2. This headquarters concurs in the conclusions and recommendations as written.
3. Request one copy of all forwarding and approval indorsements be furnished this headquarters and all action and information addressees (See Distribution, Inclosure 1).

FOR THE COMMANDER:

1 Incl  
nc

  
R. E. THOMPSON  
CPT, AGC  
Assistant Adjutant General

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Inclosure 1)

AD873602

DEPARTMENT OF THE ARMY  
ARMY CONCEPT TEAM IN VIETNAM  
APO San Francisco 96384

AVIB-LED

16 AUG 1970

SUBJECT: Letter Report - Land Navigation System (LNS)-102

Commanding General  
United States Army, Vietnam  
APO 96375

1. REFERENCES:

a. Letter, HQ 25th Inf Div, 17 July 1967, subject: Non-Standard Required Equipment.

b. Message, COMUSMACV 26981, 13 August 1967, subject: Vehicular Mounted Land Navigation System.

c. Letter, USACDC, 27 March 1968, subject: Troop Test, Land Navigation System.

d. Disposition Form, AVHGC-DST, 17 November 1969, subject: Land Navigation System (LNS)-102.

e. Message, AMSME-RZK-KE, COUSAMERDC, 221843Z April 1970, subject: Land Navigation System.

2. PURPOSE:

The purpose of this evaluation was to determine the suitability of the Land Navigation System (LNS) for operation in the Republic of Vietnam (RVN).

3. OBJECTIVES:

The objectives of the evaluation were:

a. To document the techniques of system employment and the manner in which the information produced by the system is used to meet mission requirements.

b. To determine the acceptability of the performance of the system when employed in a variety of combat vehicles in RVN.

c. To determine the compatibility of the LNS with the combat and maintenance environment of RVN.

d. To recommend a basis of issue for each type of evaluating unit, should the requirement prove to be operationally suitable.

#### 4. BACKGROUND

Aviation Electronics Limited, a Canadian commercial corporation, developed a vehicle-mounted, magnetic navigation system believed to be adaptable for use in the M151 1/4-ton truck, the M37 3/4-ton truck, and the M113 armored personnel carrier. CG USARPV requested 25 of these systems for evaluation in April 1966. On 27 March 1968, USAOPV recommended that, when available, these be evaluated by ACTIV. The initial increment of 21 land navigation systems began arriving in RVN 11 February 1970, accompanied by a five-man New Equipment Training Team (NETT). By 7 March, sufficient equipment had been received to begin installation, successively, in the 25th Infantry Division, the 3d Brigade, 9th Infantry Division, and the 11th Armored Cavalry Regiment. Installation was completed on 31 March 1970, and was followed by approximately 2 weeks of orientation and training. A 60-day evaluation in each unit began during the period 25 March to 7 April 1970.

#### 5. DESCRIPTION

a. The Land Navigation System (LNS) is a vehicle-mounted, automatic system designed to provide the user, while the vehicle is in motion, with continuous heading and location information. Two visual indications of heading and position are provided:

(1) A dial display on which heading is indicated by an arrow against a compass rose with position expressed in eight-digit Cartesian grid coordinates.

(2) A plotter display employing a standard military map, with bearing and position indicated by a projected light arrow.

b. A scale selector switch permits setting the system to any of four map scales: 1:25,000, 1:50,000, 1:100,000, and 1:250,000.

c. The Land Navigation System is made up of five major components:

(1) Magnetic Sensor (MS): The sensor that determines vehicle heading, and transmits this information to the computer.

(2) Computer, Electromechanical (CEM): A real-time analog computer that processes heading information from the magnetic heading transmitter and distance-traveled information from the vehicle odometer. The computer output is a continuously updated estimate of vehicle location and heading. This information is transmitted to the display units.

(3) Readout, Coordinates and Heading (PCH): The dial display described in Paragraph 5a(1) above. Starting grid is inserted and plotter scale selected at this subsystem.

(4) Plotter, Map Position and Heading (PMPH): The plotter display described in Paragraph 5a(2) above. A map is placed in the display; the light bug is then placed at the starting location by means of a joy-stick control.

(5) Inverter Power Supply (IPS): The unit that converts DC current from the vehicle battery into the AC current required to drive the system.

## 6. APPROACH

The LNS was installed in ten M151 jeeps and seven M113 APC. The participating units were offered and declined an M37 3/4-ton truck equipped with the LNS. The LNS was installed as vehicles became available. Installation and data collection did not interfere with normal combat operations.

## 7. ENVIRONMENT

The evaluation was conducted in III CTZ in widely separated areas having several types of terrain. The M151 trucks operated most of the time on asphalt and dirt roads. The M113 APC operated at high speed on dirt roads en route to their area of operation, then departed the roads and operated in rice paddies, rough open areas, and in jungle growth and rubber plantations. The weather was typical of the northeast (dry) monsoon in III CTZ.

## 8. EQUIPMENT STATUS

On 1 May 1970, the evaluation was suspended indefinitely. At that time, one complete system for the APC had become a combat loss. Of the remaining 16 systems, 10 have been recovered. Six of the 10 recovered systems were inoperative. All of the unrecovered systems are inoperative. The reasons for these system failures have not been determined.

9. TECHNIQUES OF EMPLOYMENT

a. 25th Infantry Division

(1) Eight LNS were allocated to the 25th Infantry Division. During the period 9 to 12 March 1970, three systems were installed in M113 APC and five in M151 trucks. Of the three systems installed in M113 APC, one each was assigned to the HHC 2/22 Mechanized Infantry Battalion, Co D 1/5 Mechanized Infantry Battalion, and HHC 4/23 Mechanized Infantry Battalion. The five systems installed in M151 trucks were assigned one each to HHC 2/22 Mechanized Infantry Battalion, Co D 1/5 Mechanized Infantry Battalion, HHC 4/23 Mechanized Infantry Battalion, HHC 2/14 Mechanized Infantry Battalion, and Co E 3/22 Mechanized Infantry Battalion.

(2) The M113 APC vehicles were employed for road security, sweeps of areas around permanent and temporary bases, reconnaissance, minesweeping operations, and search and destroy missions. The M151 trucks were employed for intelligence collecting operations in Vietnamese villages, road reconnaissance, and administrative transportation.

(3) The M151 trucks with the LNS were used either singly, or accompanied on a mission by one standard M37 3/4-ton truck. Individual M113 APC with LNS normally operated as elements of a small unit operation, consisting of four to five APC. Although several formations were used, the LNS-equipped APC was the lead vehicle on all operations. Vehicle separation varied from 15 to 100 meters.

b. 3d Brigade, 9th Infantry Division

(1) Five systems were allocated to the 3d Brigade, 9th Infantry Division for installation on M151 trucks. Four were installed on military police vehicles of the 483d MP Platoon. One system was installed on an M151 truck assigned to the 571st Engineer Company (CMBT). The installations were accomplished during the period 15 to 20 March 1970.

(2) The vehicles were employed for road security patrol, official transportation for the Provost Marshal, route reconnaissance, and accident investigations.

(3) The vehicles were operated independently, and remained on local roads in the vicinity of the brigade headquarters.

c. 11th Armored Cavalry Regiment (ACR)

(1) Four systems were allocated to the 11th ACR for

installation on M113 APC. The installation was accomplished during the period 22 to 31 March 1970 in APC assigned to L Troop 3d Squadron, G Troop 2d Squadron, B Troop 1st Squadron, and HH Troop (Scouts).

(2) The vehicles were employed for area reconnaissance and convoy security missions, and for security during a move of an operating base.

(3) While conducting area reconnaissance, 7 or 8 vehicles would form in double rows. The LNS-equipped APC operated in various positions in the formation. No particular position was found to be more advantageous than another.

## 10. OPERATIONAL PERFORMANCE

### a. Utilization

(1) The equipment was used whenever possible. However, equipment failures began occurring within 1 or 2 days after installation. Magnetic sensors mounted on the APC failed after a few hours of operation.

(2) Coordinate and heading information from the set was used as follows:

(a) To fix the location of a vehicle accident on a road

(b) To check a location determined by other means

(c) To locate preplanned objectives.

### b. Operability

The LNS was simple to operate, and the coordinate and heading readout was easy to interpret. The following additional observations were made during the evaluation:

(1) The coordinate and heading display unit (RCH) was located inconveniently inside the APC. In RVN, the vehicle commander and driver normally rode on the outside of the APC; therefore, the vehicle commander could not read the RCH from his usual position. When the mapboard display (PMPH) was placed on top of the APC just forward of the top center hatch, it was found to be cumbersome for the vehicle commander to use.

(2) The arrow on the PMPH display was very difficult to see in the daylight.

(3) The 1:50,000 scale map was the most common map in use. On road operations, because of the distances traveled at relatively high speeds, map sheets of this scale had to be changed frequently. This caused delays because, to maintain accuracy, the vehicle had to be stopped for each map change.

(4) Mounting the PMPH in the M was considered unnecessary. Maps were carried in the vehicle, and, in conjunction with the RCH display, could have been used to determine location.

c. Accuracy

Due to inherent defects in the magnetic sensor, no conclusive data were available.

11. COMPATIBILITY WITH RVH ENVIRONMENT

a. Installation and Calibration

Approximately four man-hours were required to install the equipment, and four man-hours to calibrate it. No significant problems were encountered. One magnetic sensor and one odometer cable failed on APC during initial road tests.

b. Reliability

Due to inherent defects in the magnetic sensor, no conclusive data were available.

c. Maintenance

Little maintenance was performed on the LNS components. As individual components failed, exchange was made with a like item from maintenance float stock; however, the exchange of components was limited due to a lack of spare parts. In three cases, the power cable leading from the power source to the computer was repaired.

d. Equipment Loss and Failures

(1) One magnetic sensor on an APC was destroyed by a mine.

(2) One magnetic sensor was torn from an APC during an engagement.

(3) At least seven additional magnetic sensors failed.

(4) One IPS, one PMPH, and one RCH failed.

e. Other Problems

(1) After the LNS was installed, speedometers of six of the M151 trucks became very erratic, fluctuating between 0 and 60 mph, thus making it impossible to determine actual speed. The cause of this problem was tentatively attributed to a failure in the cable connecting the CEM and vehicle speedometer. A final determination was not made.

(2) The LNS could not be installed on M151 vehicles equipped with machinegun mounts. Many of the units, especially the MP units, expressed the desire to install the system on gun jeeps used for convoy protection and for road reconnaissance. However, because the magnetic sensor was designed to be installed in the position occupied by the pedestal for the M60, the system could not be installed on the gun jeep. Consequently, most of the systems were installed on administrative M151 vehicles that used only the major roads, where there was little or no requirement for the LNS.

12. BASIS OF ISSUE

No recommendation can be made at this time because of the limited and inconclusive data obtained.

13. FINDINGS

a. The LNS was used primarily to check vehicle or unit location after it had been determined by conventional means.

b. The Plotter, Map Position and Heading (PMPH) was unnecessary in the M151.

c. Sixty percent of the M151 truck speedometers functioned erratically when the LNS was installed.

d. There was no requirement for the LNS on M151 vehicles used in administrative roles. It could not be evaluated on gun jeeps because the LNS, as configured, could not be installed in a 1/4-ton vehicle with a pintle weapon mount.

e. The magnetic sensor lasted no more than a few hours in the APC.

14. CONCLUSIONS

It is concluded that:

a. In its present configuration, there is little or no

requirement for the LNS in M151 vehicles in the RVN combat environment.

- b. The PMPH is not required in the M151 truck.
- c. The greatest potential use for the LNS in RVN is in the APC.
- d. The magnetic sensor failure rate is unacceptable.

15. RECOMMENDATIONS

It is recommended that:

- a. Work on the LNS be continued in CONUS to correct deficiencies related to equipment reliability and failure rates.
- b. The LNS not be considered for further evaluation in RVN until compatible designs for each application are proven suitable for deployment based on CONUS testing

1 Incl  
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13. ABSTRACT In order to determine the suitability of the Land Navigation System (LNS) for operation in RVN, the Army Concept Team in Vietnam conducted an operational evaluation of the Land Navigation System (LNS) developed by Aviation Electronics Limited. The LNS is a vehicle-mounted, automatic system designed to provide the user, while the vehicle is in motion, with continuous heading and location information. Two visual indications of heading and position are provided: (1) a dial display on which heading is indicated by an arrow against a compass rose; position is expressed by eight-digit Cartesian grid coordinates, (2) a plotter display employing a standard military map, with position shown by a projected light bug, and heading indicated by a projected arrow. The LNS was evaluated in M151 1/4-ton trucks and M113 APC of the 25th Infantry Division, 3d Brigade of the 9th Infantry Division, and the 11th Armored Cavalry Regiment. The evaluation was initiated on 7 April 1970 and was suspended indefinitely on 1 May 1970 due to equipment failures. The evaluation was conducted throughout the III CTZ. It was concluded that (1) In its present configuration, there is little or no requirement for the LNS in M151 vehicles in the RVN combat environment, (2) The greatest potential use for the LNS in Vietnam is in the APC, (3) The DUCH is not required in the M151 truck, and (4) The magnetic sensor failure rate is unacceptable. It is recommended that (1) Work on the LNS be continued in COMUS to correct deficiencies related to equipment reliability and failure rates, and (2) The LNS not be considered for further evaluation in RVN until compatible designs for each application are proven suitable for deployment based on COMUS testing.			

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