STUDY AND EVALUATION
OF COUNTERMINE ACTIVITIES
(SECMA) (U)

GROUP I
DOWNGRADED AT 3 YEAR INTERVALS
DECLASSIFIED AFTER 12 YEARS
DOD DIR 5200.10

CONFIDENTIAL
See Regrade Notice Incl.
### Request for or Notification of Rereading Action

**From:** Commanding Officer  
**To:** Commanding General  
**US Army Combat Developments Command/Experimentation Command**  
**Fort Ord, California 93941**

---

**Commanding General**

**US Army Combat Developments Command/Experimentation Command**

**Fort Ord, California 93941**

---

**To:** Commanding General  
**US Army Combat Developments Command/Experimentation Command**

---

**REQUEST FOR OR NOTIFICATION OF REREADING ACTION**

**AR 380-3**

---

**NOTICE:**


---

**REQUEST DOCUMENTS DESCRIBED BELOW ARE REVIEWED TO DETERMINE WHETHER THEY CAN BE DOWNGRADED OR DECLASSIFIED AT THIS TIME. (Include justification in the Remarks Section of this form.)**

---

**REQUEST APPROPRIATE GROUP MARKINGS FOR DOCUMENTS DESCRIBED BELOW.**

---

**DOCUMENTS DESCRIBED BELOW HAVE BEEN RECLASSIFIED IN A DIFFERENT GROUP AND WILL BE REMARKED IN ACCORDANCE WITH AN 880-S AND AN 886S.**

---

**Army Concept Team in Vietnam, 26 Sep 68, Study and Evaluation of Countermine Activities (SECMA)**

---

**The following portions of subject report are downgraded as indicated:**

**Vol I, Section II, Fig l, p5 (less data on casualties, damage, and vehicles.)**

---

**Vol II, Section II, para 5-8, p3; para 10, plO; para 22, pl3.**

---

**Vol IV, Appendix I, Fig C-l-2.**

---

**Vol VII, Section V, para 1c, 1d, le, p29.**

---

**CLASS OF SUBJ.**

---

**CLASS AND GP NO.**

---

**RE-GRADED TO CLASS & GP NO.**

---

**AUTHORITY OR COMMAND LINE (When applicable)**

---

**FOR THE COMMANDER:**

---

**NORMAN M. LEARY, CPT, AGC, Adjutant**

---

**PRINTED OR TYPED NAME AND TITLE OF OFFICER**

---

**SIGNATURE**

---

**DA FORM 1575 REPLACES EDITION OF 1 AUG 61 WHICH IS OBSOLETE.**
SUBJECT: Study and Evaluation of Countermine Activities (SECMA) Volume 1 - Basic Report

Commanding General
United States Army, Vietnam
ATTN: AVHGC-DST
APO 96375


2. In accordance with the provisions of the foregoing reference, the attached final report is forwarded for review and transmittal to Department of the Army.

3. Request one copy of the USARV and CINCUSARPAC forwarding indorsement be furnished the Commanding Officer, Army Concept Team in Vietnam (ACTIV).

FOR THE COMMANDER:

Norman M. Leary
CPT, AGC
Adjutant

REGRADED UNCLASSIFIED WHEN SEPARATED FROM CLASSIFIED INCLOSURES

CONFIDENTIAL
STUDY AND EVALUATION OF COUNTERMINE ACTIVITIES

REPORT ORGANIZATION

VOLUME 1 - BASIC REPORT

Project background, organization, and methodology. Statistical data on current enemy mine activity. Summary discussion of subtask findings, conclusions, and recommendations. Project findings, conclusions, and recommendations.

VOLUME 2 - INTELLIGENCE

Description of VC/NVA mine and mine logistics system. Evaluation of effectiveness of current intelligence system in collection and dissemination of mine data.

VOLUME 3 - MINE DETECTION EQUIPMENT

Evaluation of current hand held mine detection equipment and other mine detection systems and concepts (Infrared, photography, Geodar, and Russian detector). Evaluation of training as a countermeasure.

VOLUME 4 - MINE DETONATION EQUIPMENT

Evaluation of current mine detonation equipment and new concepts.

VOLUME 5 - PROTECTIVE EQUIPMENT

Evaluation of field protective equipment for the armored personnel carrier M-113, for blast and shock attenuation. Explosive characteristics in RVN environment.

VOLUME 6 - DENTAL OPERATIONS

Study and evaluation of methods for interdiction and/or neutralization of the VC/NVA mine logistics and emplacement system.

VOLUME 7 - BOOBY TRAP COUNTERMEASURES

Study and evaluation of the use of scout dogs, returned Viet Cong personnel, specialized training, and the Volunteer Informant Program to reduce booby trap casualties.

FILM REPORT

"THE OPERATIONAL ANTI-VEHICULAR MINE ENVIRONMENT"

Description of those environmental and operational aspects which must be visualized by participating agencies for an appreciation of the antivehicular mine problem in Vietnam.
AUTHORITY

Letter, Headquarters, United States Army, Vietnam (USARV) 8 August 1967, subject:
Study and Evaluation of Countermine Activities (SECMA)

ACKNOWLEDGEMENTS

The Army Concept Team in Vietnam is indebted to the following for their help in the study:

U.S. Army, Vietnam
The 1st Logistical Command
The Army Scientific Advisory Panel
The Army Materiel Command
The Human Resources Research Office
The First Australian Task Force
The Australian Defense Standards Laboratory

PROJECT MANAGER

Colonel Edward J. Bielecki

PROJECT ENGINEER

Mr. Joseph F. Swingle

PROJECT OFFICERS

Lieutenant Colonel Antero Aakkula
Major Thomas R. Hicklin
Major Louis J. Toupal
Captain Dennis R. Coll
Captain Robert S. Fore
Captain Joseph L. Quinta
Captain Charles J. O' Connor
Captain Eric E. Smart
Captain Lawrence A. Smith
Captain Melvin T. Starr
Captain John S. Thomas
Dr. Harold J. Matsaguna
Mr. Avery H. Fisher
ABSTRACT

Enemy mines and booby traps in RVN caused 4300 US Army casualties in 1967 and approximately 70 percent of the combat losses in tanks and armored personnel carriers. The purpose of the Study and Evaluation of Countermine Activities (SECOM) was to analyze the current countermine environment in order to identify and exploit potential countermeasures and to make specific recommendations in applicable areas for measures to minimize personnel and equipment losses from mines and booby traps.

All areas in RVN were visited by evaluator teams. The overall objective was divided into six subtasks: Intelligence, Mine Detection, Mine Detonation Equipment, Protective Equipment, Denial Operations, and Booby Trap Countermeasures. A study of CONUS training requirements was conducted by the Human Resources Research Office (HumRRO). A complete report has been written for each subtask and contains the detailed analysis, findings, conclusions, and recommendations. The HumRRO study was reported separately. A film report was prepared for the R&D community depicting the anti-vehicular mine environment.

In general it is recommended that a central staff agency be designated in USARV to continue analysis of enemy mining trends and disseminate this information expeditiously to units and agencies concerned. A USARV mine and booby trap reporting system for defining these trends and for providing data to assist the field and R&D agencies is recommended. Use should be made of the 5th Special Forces Group, Kit Carson Scouts, and available training publications to improve in-country training. Command emphasis should be placed on ammunition control and disposal to reduce the amount of abandoned ammunition, and anti-tamper fuzes should be used as back-up fuzes in aerial bombs to reduce the number of duds available for enemy use. An intensified program for locating and destroying mine factories should be pursued to eliminate this source of mines and booby traps.

In CONUS, a project manager should be designated to coordinate and control the many research and development activities relating to mine and booby trap countermeasures. Development efforts should continue on the ENSURE 202 Mine Roller and on the use of radio frequency energy and other methods for detecting or destroying electrically actuated mines. A priority effort should be given to increasing the anti-mine protection in current armored personnel carriers by improving the seam welding and hull design. Based on preliminary findings, the AN/AAE-22 aerial infrared sensor system should be further tested for its mine detection capability. Consideration should be given to modifying the current fuze-design policy and its stringent safety requirements in order to reduce the incidence of duds, which are a major material source for enemy mines. The Advanced Individual Training courses in CONUS should be modified to place greater emphasis on RVN mine and booby trap subjects. Imaginative methods should be used to keep the individual soldier informed on safeguards and countermeasures.

iv
The urgency of this problem, first stated in 1966, justifies priority action by all agencies concerned to act on approved recommendations of this report, and to continue to search for new solutions to the mine threat.
<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>iv</td>
</tr>
<tr>
<td>I  INTRODUCTION</td>
<td></td>
</tr>
<tr>
<td>1. Purpose</td>
<td>1</td>
</tr>
<tr>
<td>2. Objectives</td>
<td>1</td>
</tr>
<tr>
<td>3. Background</td>
<td>1</td>
</tr>
<tr>
<td>4. Scope</td>
<td>2</td>
</tr>
<tr>
<td>5. Method of Evaluation</td>
<td>2</td>
</tr>
<tr>
<td>II  MINE AND BOOBY TRAP DATA</td>
<td></td>
</tr>
<tr>
<td>6. General</td>
<td>4</td>
</tr>
<tr>
<td>7. SECON Mine and Booby Trap Report</td>
<td>4</td>
</tr>
<tr>
<td>8. Data Processing</td>
<td>6</td>
</tr>
<tr>
<td>9. Revised Mine and Booby Trap Report</td>
<td>6</td>
</tr>
<tr>
<td>10. Findings and Conclusions</td>
<td>7</td>
</tr>
<tr>
<td>III  INTELLIGENCE</td>
<td></td>
</tr>
<tr>
<td>11. General</td>
<td>8</td>
</tr>
<tr>
<td>12. Viet Cong Tactics, Techniques and Materiel</td>
<td>8</td>
</tr>
<tr>
<td>13. Mine and Booby Trap Information</td>
<td>9</td>
</tr>
<tr>
<td>14. Salient Findings and Conclusions</td>
<td>9</td>
</tr>
<tr>
<td>IV   MINE DETECTION</td>
<td></td>
</tr>
<tr>
<td>15. Background</td>
<td>10</td>
</tr>
<tr>
<td>16. General</td>
<td>10</td>
</tr>
<tr>
<td>17. Mine Detector Tests</td>
<td>10</td>
</tr>
<tr>
<td>18. Detector Test Results</td>
<td>10</td>
</tr>
<tr>
<td>19. Airborne Infrared Sensor</td>
<td>11</td>
</tr>
<tr>
<td>20. Wire Detector Concept</td>
<td>11</td>
</tr>
<tr>
<td>21. Road Clearing Procedures</td>
<td>11</td>
</tr>
<tr>
<td>22. Salient Findings and Conclusions</td>
<td>12</td>
</tr>
<tr>
<td>V    MINE DETONATION</td>
<td></td>
</tr>
<tr>
<td>23. Background</td>
<td>13</td>
</tr>
<tr>
<td>24. General</td>
<td>13</td>
</tr>
<tr>
<td>25. ENSURE 202 Mine Roller</td>
<td>13</td>
</tr>
<tr>
<td>26. Wire Detonator Concept</td>
<td>13</td>
</tr>
<tr>
<td>27. Salient Findings and Conclusions</td>
<td>14</td>
</tr>
<tr>
<td>VI</td>
<td>PROTECTIVE EQUIPMENT</td>
</tr>
<tr>
<td>----</td>
<td>----------------------</td>
</tr>
<tr>
<td>28</td>
<td>General</td>
</tr>
<tr>
<td>29</td>
<td>Armored Personnel Carrier Damage</td>
</tr>
<tr>
<td>30</td>
<td>Supplemental Armor Tests</td>
</tr>
<tr>
<td>31</td>
<td>Shock Isolation System</td>
</tr>
<tr>
<td>32</td>
<td>ENSURE 218, APC Modification Kit</td>
</tr>
<tr>
<td>33</td>
<td>Salient Findings and Conclusions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VII</th>
<th>DENIAL OPERATIONS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>General</td>
<td>18</td>
</tr>
<tr>
<td>35</td>
<td>US Abandoned Ammunition</td>
<td>18</td>
</tr>
<tr>
<td>36</td>
<td>US Dud Ordnance</td>
<td>18</td>
</tr>
<tr>
<td>37</td>
<td>Factory Location and Destruction</td>
<td>19</td>
</tr>
<tr>
<td>38</td>
<td>Area Denial and Surveillance</td>
<td>19</td>
</tr>
<tr>
<td>39</td>
<td>Road Paving</td>
<td>19</td>
</tr>
<tr>
<td>40</td>
<td>Salient Findings and Conclusions</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VIII</th>
<th>BOOBY TRAP COUNTERMEASURES</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>General</td>
<td>21</td>
</tr>
<tr>
<td>42</td>
<td>Training</td>
<td>21</td>
</tr>
<tr>
<td>43</td>
<td>Kit Carson Scouts</td>
<td>21</td>
</tr>
<tr>
<td>44</td>
<td>The Volunteer Informant Program (VIP)</td>
<td>22</td>
</tr>
<tr>
<td>45</td>
<td>Scout Dogs</td>
<td>22</td>
</tr>
<tr>
<td>46</td>
<td>Salient Findings and Conclusions</td>
<td>23</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IX</th>
<th>TRAINING IN CONUS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>Discussion Summary</td>
<td>24</td>
</tr>
<tr>
<td>48</td>
<td>Salient Findings and Conclusions</td>
<td>24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>RESEARCH AND DEVELOPMENT</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>General</td>
<td>26</td>
</tr>
<tr>
<td>50</td>
<td>The ENSURE System</td>
<td>26</td>
</tr>
<tr>
<td>51</td>
<td>User-Developer Interface</td>
<td>26</td>
</tr>
<tr>
<td>52</td>
<td>Formulation of Requirements</td>
<td>27</td>
</tr>
<tr>
<td>53</td>
<td>Centralized Direction of RDT&amp;E</td>
<td>27</td>
</tr>
<tr>
<td>54</td>
<td>Annual Seminar</td>
<td>27</td>
</tr>
<tr>
<td>55</td>
<td>Findings and Conclusions</td>
<td>28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XI</th>
<th>RECOMMENDATIONS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>Mine and Booby Trap Data</td>
<td>29</td>
</tr>
</tbody>
</table>
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>57. Intelligence</td>
<td>29</td>
</tr>
<tr>
<td>58. Mine Detection</td>
<td>29</td>
</tr>
<tr>
<td>59. Mine Detonation Equipment</td>
<td>30</td>
</tr>
<tr>
<td>60. Protective Equipment</td>
<td>30</td>
</tr>
<tr>
<td>61. Denial Operations</td>
<td>30</td>
</tr>
<tr>
<td>62. Booby Trap Countermeasures</td>
<td>31</td>
</tr>
<tr>
<td>63. Training in CONUS</td>
<td>32</td>
</tr>
<tr>
<td>64. Organization and Procedures for Research and Development</td>
<td>32</td>
</tr>
<tr>
<td>65. Priorities for Research and Development</td>
<td>33</td>
</tr>
<tr>
<td>66. Priorities for Field Commanders</td>
<td>33</td>
</tr>
</tbody>
</table>

ANNEX A BIBLIOGRAPHY .................................. A-1

ANNEX B MINE AND BOOBY TRAP DATA FORMS AND CORRELATIONS .................................. B-1

ANNEX C ROAD PAVING DATA .................................. C-1

ANNEX D DISTRIBUTION .................................. D-1
<table>
<thead>
<tr>
<th>Figures</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mine and Booby Trap Data Summary, 1 March - 10 June 1968</td>
<td>5</td>
</tr>
<tr>
<td>E-1 Original Mine and Booby Trap Report Format (Front)</td>
<td>E-1</td>
</tr>
<tr>
<td>E-2 Original Mine and Booby Trap Report Format (Back)</td>
<td>E-2</td>
</tr>
<tr>
<td>E-3 Revised Mine and Booby Trap Report Format (Front)</td>
<td>E-3</td>
</tr>
<tr>
<td>E-4 Revised Mine and Booby Trap Report Format (Back)</td>
<td>E-4</td>
</tr>
<tr>
<td>E-5 Correlation of Damage vs Charge Weight by Type of Vehicle</td>
<td>E-5</td>
</tr>
<tr>
<td>E-6 Correlation of Casualties and Damage by Type of Vehicle</td>
<td>E-6</td>
</tr>
<tr>
<td>E-7 Correlation of Casualties and Damage by Charge Weight</td>
<td>E-7</td>
</tr>
<tr>
<td>E-8 Detection Efficiency of All Mine Incidents</td>
<td>E-8</td>
</tr>
<tr>
<td>E-9 Mine Incidents - Types of Firing Devices Used and How Detected</td>
<td>E-9</td>
</tr>
<tr>
<td>E-10 Origin of Mines by Size of Charge and Type of Explosive</td>
<td>E-10</td>
</tr>
<tr>
<td>E-11 Mine Incidents - Types of Explosive Firing Device</td>
<td>E-11</td>
</tr>
<tr>
<td>E-12 Origin of Booby Traps by Size of Charge and Type of Explosion</td>
<td>E-12</td>
</tr>
<tr>
<td>E-13 Booby Trap Incidents - Types of Explosive and Firing Device</td>
<td>E-13</td>
</tr>
<tr>
<td>C-1 Paving Costs - Route 19 West, Pleiku Area (Coordinates YA996298 to AR774368)</td>
<td>C-1</td>
</tr>
<tr>
<td>C-2 Road Mine Incidents - Route 19 W</td>
<td>C-2</td>
</tr>
<tr>
<td>C-3 Damage Costs, Road Mine Incidents Route 19 W</td>
<td>C-3</td>
</tr>
</tbody>
</table>
SECTION I - INTRODUCTION

1. PURPOSE

The purpose of the Study and Evaluation of Countermine Activities (SECMA) was to analyze the mine environment, identify and exploit potential countermeasures, and make recommendations for measures to minimize personnel and equipment losses from mines and booby traps.

2. OBJECTIVES

The purpose was subdivided into major objectives:

a. To study and evaluate enemy tactics, techniques, and materiel to define the mine environment and the enemy mine and booby trap system to exploit any discerned vulnerabilities.

b. To evaluate friendly tactics, techniques, and materiel pertinent to countermine operations to determine what local and general changes are required and what new concepts and materiel should be further developed.

3. BACKGROUND

As early as November 1965, COMUSMACV at the request of MACV USARV initiated a priority request to DA, ASCW for equipment, both vehicular and man-carried, to successfully detect, locate, neutralize, or destroy enemy mines without damage to friendly equipment or personnel. As of mid-1967, no satisfactory solution had evolved. COMUSMACV cited land mines and booby trap detection/neutralization as a significant problem and stated that one third of the friendly casualties in 1966 were caused by these weapons. On 14 June 1967, the Army Concept Team in Vietnam (ACTIV) reported to CG, USARV that the mine problem in Vietnam (RVN) had never been thoroughly studied in its entirety, and no single agency had used a systematic approach to analyze the mine problem and to propose new areas of investigation. It was recommended that ACTIV be given the mission of seeking solutions to the problem. On 8 August 1967, DCGUSARV requested ACTIV to conduct a Study and Evaluation of Countermine Activities (SECMA) in RVN, for the purpose of enhancing friendly countermine tactics and techniques and improving countermine equipment in order to reduce damage and casualties from mines.

1Reference 1
2Reference 2
3Reference 3
The need for the study was reaffirmed by a review of current casualty and vehicle loss data. In 1967, the US Army mine and booby trap casualties (4,273) represented a personnel loss equivalent to five infantry battalions; 1968 casualties through May amounted to three infantry battalion equivalents (2,390).¹ Sixty-five percent of the Armored Personnel Carrier (APC) combat losses and 70 percent of the tank losses were caused by mines.² In 1968, it was found that US Army elements unintentionally activated approximately 50 percent of all of the enemy mines and booby traps which they encountered. On the average, one friendly casualty resulted from each encounter.

In August 1967, a Countermine Seminar was conducted to gather and exchange information from members of field units. Data collection was initiated in March 1968 by a team of twelve officers and two civilians, and was completed in June 1968.

4. (C) SCOPE

This study included an assessment of the enemy mine and booby trap threat and all potential countermeasures. The enemy threat was assessed in the Intelligence subtask and the countermeasures were functionally grouped into five subtasks: Mine Detection, Mine Detonation, Protective Equipment, Denial Operations, and Booby Trap Countermeasures. The scope of the study was sufficiently flexible to permit evaluation of any new concept which was suggested during the study.

5. (U) METHOD OF EVALUATION

a. Correlations of data from mine and booby trap incident reports and the Intelligence subtask were used to assess the enemy tactics, techniques, and materiel. Reports received from US Army and Army of the Republic of Vietnam (ARVN) units during a three-month period were used to analyze the sources, characteristics, and effectiveness of enemy materiel and the effectiveness of current friendly countermeasures. Elements of potential bias were introduced because all units did not report for the entire period and some reports were incomplete. The reported incidents covered all four Corps Tactical Zones in RVN. The Intelligence subtask made a qualitative and quantitative analysis of the enemy mine and booby trap system based on a comprehensive research and study of the data available in the MACV and ARVN intelligence files and an analysis of the daily interrogation and intelligence reports. Reports from all Free World Military Assistance Force (FWMAF) units and all areas in RVN were included in the data sample. Knowledgeable prisoners of war and Chieu Hoi returnees were interviewed when feasible.

¹Reference 4
²Reference 5
b. The Mine Detection, Mine Detonation, and Protective Equipment sub-tasks evaluated the effectiveness of available standard equipment and field expedients through field evaluation and controlled tests. The controlled tests, conducted at Long Binh and its environs during the dry season, included a potential bias because tests in a full range of terrain, soil, and weather conditions were precluded by the short period available for the study and limited access to other areas. To the extent feasible, a representative cross section of personnel skill was used for equipment tests, and theory of random numbers was applied to reduce personnel bias. Different groups of personnel were employed at Pleiku and at Long Binh in the controlled tests of mine detectors, but the training and skill levels of both test groups were generally equal. The feasibility of the application of radio frequency energy to the detection and detonation of mines was assessed through analytical presentations and a limited number of field tests using equipment available in-country. Further feasibility tests in this area were conducted in CONUS by the US Army Electronics Command (USAEPCOM), and the US Army Mobility Equipment Research and Development Center (USAMERDEC).

c. The Denial Operations subtask studied those concepts, tactics, techniques, and equipment which could be employed to interdict the enemy mine manufacturing, logistics, and emplacement systems. Data was gathered by literature research, staff visits, and interviews of personnel. Units and areas representative of the RVN were included in the data sample. The Delta area was not included. This element of potential bias was introduced because there were no Explosive Ordnance Disposal (EOD) or ammunition supply units, the principal data sources, operating in that area. The consistency of the data collected from units located in the other areas tends to confirm that the subtask findings are valid for all areas of RVN.

d. The Booby Trap subtask made an assessment of the FMMAF training, tactics, and techniques which could be applied as countermeasures against enemy booby traps. This evaluation was based on field visits, observations, and interviews of personnel in five US divisions and pertinent staff personnel in Field Force and higher headquarters. All areas of RVN were included in the data sample, and actual operations were feasible.

e. The Human Resources Research Office (HumRRO) conducted a study of Advanced Individual Training in CONUS with respect to the detection and avoidance of mines and booby traps in Vietnam. As a by-product of this study, HumRRO provided an evaluation of in-country training on the same subject. Training aspects which were not included in the HumRRO study were addressed in the Booby Trap Countermeasures subtask.

f. A documentary film report was prepared on the anti-vehicular mine environment. This visual presentation of the prevailing operational and environmental factors was designed to assist the research and development community in developing countermeasures applicable to RVN.

1Reference 6
SECTION II - MINE AND BOOBY TRAP DATA

6. (U) GENERAL

Department of Army Training Circular 5-31, May 1967, states the need for a uniform system of reporting data on enemy mines and booby traps, including tactics, techniques, and the types and quantities of hardware used. The need for data to define the problem and to evaluate the effectiveness of countermeasures was also stressed by the Army Scientific Advisory Panel Ad Hoc Committee on Vietnam. Investigation disclosed that no uniform mine and booby trap reporting system existed in RVN. No single agency was specifically responsible for gathering comprehensive information on enemy mines and booby traps, although many agencies and units were collecting some data. The Combined Intelligence Center, Vietnam (CICV) extracted data from intelligence summaries. This data, generally limited to the time, date, and location of the mine incident, was automated for correlation and could be displayed on map overlays. The USARV Surgeon's Office collected wound and casualty data based on causative agents. Vehicle damage data reported to a special study team in the USARV G-4 Section indicated losses by vehicle type due to various causes. The data from these three independent sources could not be correlated or reconciled. Field units collected data of varying content designed to meet their individual needs, but no correlations of this data were possible.

7. (U) SECMA MINE AND BOOBY TRAP REPORT

A SECMA mine and booby trap report format was developed in an effort to fill these data needs (Annex B), and reports were solicited from all field units. The report format was designed to facilitate conversion of data to punch cards for automatic data processing by the USARV Data Service Center. Reporting by field units was initially slow and incomplete, but most units were reporting in complete detail at the close of the three month reporting period. A total of 817 reports were received during the period 1 March to 10 June 1968. Although reports were not received from all US Army and ARVN units, the reported incidents covered all geographic areas in RVN. Correlations of this data helped to interpret field data developed in other subtasks and indicated the current trends in enemy activity (Figure 1). The US Army Combat Developments Command (USACDC) reported that the data was of great value and recommended the inclusion of additional data in the report. A correlation of vehicular casualties and damage was reported to be valuable for future studies by the Army Materiel Systems Analysis Agency. Additional correlations are presented in Annex B.

1Reference 7, page 54
2Reference 8
3Reference 9
<table>
<thead>
<tr>
<th>INCIDENTS NO.</th>
<th>MINES</th>
<th>511</th>
<th>62.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOOBY TRAPS</td>
<td>306</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>817</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

### HOW DETECTED

<table>
<thead>
<tr>
<th></th>
<th>MINES</th>
<th>%</th>
<th>BOOBY TRAPS</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Detonation</td>
<td>234</td>
<td>45.8</td>
<td>157</td>
<td>51.3</td>
</tr>
<tr>
<td>2. Visual</td>
<td>139</td>
<td>27.2</td>
<td>125</td>
<td>40.9</td>
</tr>
<tr>
<td>3. Civilian</td>
<td>3</td>
<td>0.6</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>4. FRS-4</td>
<td>26</td>
<td>5.1</td>
<td>3</td>
<td>1.0</td>
</tr>
<tr>
<td>5. FRS-3, 153</td>
<td>65</td>
<td>12.7</td>
<td>9</td>
<td>2.9</td>
</tr>
<tr>
<td>6. Probe</td>
<td>30</td>
<td>5.9</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>7. Other</td>
<td>16</td>
<td>3.2</td>
<td>10</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>511</td>
<td>100.0</td>
<td>306</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### TYPE EXPLOSIVE

<table>
<thead>
<tr>
<th></th>
<th>MINES</th>
<th>%</th>
<th>BOOBY TRAPS</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mine</td>
<td>320</td>
<td>62.6</td>
<td>5</td>
<td>1.6</td>
</tr>
<tr>
<td>2. Claymore</td>
<td>28</td>
<td>5.5</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>3. Grenade</td>
<td>3</td>
<td>0.6</td>
<td>218</td>
<td>71.3</td>
</tr>
<tr>
<td>4. Arty/Mortar</td>
<td>29</td>
<td>5.7</td>
<td>36</td>
<td>11.8</td>
</tr>
<tr>
<td>5. Bomb</td>
<td>5</td>
<td>1.0</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>6. TNT</td>
<td>64</td>
<td>12.5</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>7. Other</td>
<td>18</td>
<td>3.5</td>
<td>13</td>
<td>4.2</td>
</tr>
<tr>
<td>8. Unknown</td>
<td>44</td>
<td>8.6</td>
<td>27</td>
<td>8.9</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>511</td>
<td>100.0</td>
<td>306</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### ORIGIN OF MAN'F

<table>
<thead>
<tr>
<th></th>
<th>MINES</th>
<th>%</th>
<th>BOOBY TRAPS</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. US</td>
<td>82</td>
<td>16.1</td>
<td>120</td>
<td>39.2</td>
</tr>
<tr>
<td>2. USSR</td>
<td>9</td>
<td>1.8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3. CHICOM</td>
<td>103</td>
<td>20.1</td>
<td>80</td>
<td>26.2</td>
</tr>
<tr>
<td>4. VC Local</td>
<td>146</td>
<td>28.6</td>
<td>23</td>
<td>7.5</td>
</tr>
<tr>
<td>5. Other</td>
<td>38</td>
<td>7.6</td>
<td>8</td>
<td>2.6</td>
</tr>
<tr>
<td>6. Unknown</td>
<td>133</td>
<td>26.0</td>
<td>75</td>
<td>24.5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>511</td>
<td>100.0</td>
<td>306</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### SIZE OF CHARGE

<table>
<thead>
<tr>
<th></th>
<th>MINES</th>
<th>%</th>
<th>BOOBY TRAPS</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 0-10 lb</td>
<td>147</td>
<td>28.9</td>
<td>279</td>
<td>91.3</td>
</tr>
<tr>
<td>2. 11-20 lb</td>
<td>172</td>
<td>33.8</td>
<td>13</td>
<td>4.2</td>
</tr>
<tr>
<td>3. 21-40 lb</td>
<td>157</td>
<td>30.2</td>
<td>5</td>
<td>1.6</td>
</tr>
<tr>
<td>4. Over 40 lb</td>
<td>28</td>
<td>5.7</td>
<td>5</td>
<td>1.6</td>
</tr>
<tr>
<td>5. Unknown</td>
<td>7</td>
<td>1.4</td>
<td>6</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>511</td>
<td>100.0</td>
<td>306</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### TYPE FIRING DEVICE

<table>
<thead>
<tr>
<th></th>
<th>MINES</th>
<th>%</th>
<th>BOOBY TRAPS</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pressure</td>
<td>289</td>
<td>56.5</td>
<td>36</td>
<td>11.8</td>
</tr>
<tr>
<td>2. Pressure</td>
<td>9</td>
<td>1.8</td>
<td>15</td>
<td>4.9</td>
</tr>
<tr>
<td>3. Pull</td>
<td>2</td>
<td>0.4</td>
<td>28</td>
<td>9.2</td>
</tr>
<tr>
<td>4. Pull Release</td>
<td>4</td>
<td>0.8</td>
<td>27</td>
<td>8.8</td>
</tr>
<tr>
<td>5. Command</td>
<td>45</td>
<td>8.8</td>
<td>8</td>
<td>2.6</td>
</tr>
<tr>
<td>6. Command Pull</td>
<td>6</td>
<td>1.2</td>
<td>4</td>
<td>1.3</td>
</tr>
<tr>
<td>7. Pressure/</td>
<td>77</td>
<td>15.1</td>
<td>5</td>
<td>1.6</td>
</tr>
<tr>
<td>Electric</td>
<td>4</td>
<td>0.8</td>
<td>144</td>
<td>47.1</td>
</tr>
<tr>
<td>8. Trip Wire</td>
<td>14</td>
<td>2.7</td>
<td>8</td>
<td>2.6</td>
</tr>
<tr>
<td>9. Other</td>
<td>111</td>
<td>21.9</td>
<td>31</td>
<td>10.1</td>
</tr>
<tr>
<td>10. Unknown</td>
<td>58</td>
<td>11.3</td>
<td>31</td>
<td>10.1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>511</td>
<td>100.0</td>
<td>306</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### TYPE VEHICLE

<table>
<thead>
<tr>
<th></th>
<th>MINES</th>
<th>%</th>
<th>BOOBY TRAPS</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 1/4 Ton</td>
<td>11</td>
<td>2.2</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>2. 3/4 Ton</td>
<td>7</td>
<td>1.4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3. 1/2 Ton</td>
<td>12</td>
<td>2.3</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>4. 5 Ton</td>
<td>41</td>
<td>8.0</td>
<td>2</td>
<td>0.6</td>
</tr>
<tr>
<td>5. APC</td>
<td>64</td>
<td>12.5</td>
<td>5</td>
<td>1.6</td>
</tr>
<tr>
<td>6. Tank</td>
<td>34</td>
<td>6.7</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>7. Other</td>
<td>47</td>
<td>9.2</td>
<td>6</td>
<td>2.0</td>
</tr>
<tr>
<td>8. N/A (No Vehicle)</td>
<td>295</td>
<td>57.7</td>
<td>290</td>
<td>94.9</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>511</td>
<td>100.0</td>
<td>306</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### EXTENT OF DAMAGE

<table>
<thead>
<tr>
<th></th>
<th>MINES</th>
<th>%</th>
<th>BOOBY TRAPS</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Light</td>
<td>18</td>
<td>8.3</td>
<td>5</td>
<td>31.3</td>
</tr>
<tr>
<td>2. Moderate</td>
<td>46</td>
<td>21.3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3. Heavy</td>
<td>49</td>
<td>22.7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4. Destroyed</td>
<td>85</td>
<td>39.4</td>
<td>7</td>
<td>43.7</td>
</tr>
<tr>
<td>5. Unknown</td>
<td>8</td>
<td>3.7</td>
<td>4</td>
<td>25.0</td>
</tr>
<tr>
<td>6. None</td>
<td>10</td>
<td>4.6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>216</td>
<td>100.0</td>
<td>16</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Mine and Booby Trap Reports from US Army and ARVN Units.

(C) Figure 1. Mine and Booby Trap Data Summary

C. Morgan 10 June 1969

CONFIDENTIAL
8. (c) Data Processing

The collected data was correlated by card sorting equipment. Further correlations by tactical area of operational responsibility (TAOR), types of terrain, and other area variables were not feasible since insufficient computer time was available. Such correlations would be helpful in defining the threat in the various areas and in determining what countermeasures were most appropriate. All sampled units maintained some record of mine and booby trap activities in their area. Many of the field units expressed an interest in receiving timely correlated mine and booby trap data for their TAOR on a monthly basis. The existing data processing system at the CICV is capable of correlating mine and booby trap data and of preparing map overlays of incident locations. Such overlays permitted the development of the mine density charts in Volume 2 of this study, which identified major areas of mine activity. Samples of the CICV overlays and the density charts were discussed with staff personnel of Headquarters I and II Field Forces, the 20th Engineer Brigade, and the USARV Engineer Section. The value of such displays was expressed by all personnel, particularly in the CICV type of overlays which presented incident locations for all of 1967. To meet these requirements, automatic data processing of all mine and booby trap data will be necessary.

9. (11) Revised Mine and Booby Trap Report

a. Review of the report format and data indicated that further improvements could be made. The possibility of using one USARV report to replace existing reports used by the USARV Surgeon and the 1st Logistical Command was investigated, but informal discussions revealed this was not possible. To provide more definitive data on mine and booby trap characteristics, tactics and techniques, vehicular damage, and the effectiveness of countermeasures, the format was revised (Annex B) to include the following major changes:

(1) Three new detection methods were identified (Kit Carson Scout, Scout Dog, and VC Mine Marker) and the probe method was deleted.

(2) Two distinctions were made; one between metallic and non-metallic mines, the other between the use of dud and unfired friendly munitions. These distinctions were made for better definition of the threat and of the sources of mine materials.

(3) Charge weights were further broken down to facilitate determination of the mean charge weight. The method for determining the charge weight was added to facilitate validation of the reported weights. A tendency to over-estimate weights was evident in the reports received, using the original format.
(4) Further details on the incident location and on the specific location of road mines was included to permit better definition of enemy tactics and techniques.

(5) The location of vehicular damage was added to identify specific vehicle areas which might require additional protective equipment.

(6) Detailed wound data was deleted since this is included in the USARV Surgeon's study.

b. The proposed format was forwarded to representatives of the R&D community for further comment, but none was received prior to preparation of this report.

10. (C) Findings and Conclusions

a. Adequate and comprehensive mine and booby trap data in RVN was not available because of the lack of a central collecting agency.

b. Definitive trends in enemy mining activity could be determined by a uniform reporting system.

c. The revised SECMA Mine and Booby Trap Report format (Annex B), modified to include any additional data requested by R&D agencies, will provide data which will be of value to field and R&D elements.

d. Appropriate automation of mine and booby trap data will expedite the development and distribution of data correlations and displays needed by CONUS and RVN agencies.
11. (U) General

This subtask collected information on enemy mining activities to identify vulnerabilities in the enemy's mine and booby trap system and evaluated the effectiveness of the current friendly intelligence system for the collection and dissemination of such information.

12. (C) Viet Cong Tactics, Techniques, and Materiel

a. In 1965, the Viet Cong (VC) had a limited logistic capability and were forced to use a variety of locally manufactured mines and improvised booby traps. They made imaginative and ingenious use of local materials and captured or dud munitions. A wide range of explosive charge weights was used in mines. Pressure-mechanical or pressure-electrical actuators predominated. Mines were not normally emplaced in patterned mine fields but as random, nuisance mines. Most booby traps encountered in the field prior to 1965 were of the punji stake variety and were installed along expected travel routes. Explosive booby traps were used to a limited degree.

b. By the end of 1967, an extensive organization for in-country manufacture of enemy mines and booby traps had been established consisting of workshops of varying capabilities at the different levels of command. The lower level (district and village) workshops were highly mobile, normally had 5 to 25 workers, and concentrated on the production of grenades which are often used for booby traps. The higher level (regional and provincial) workshops were less mobile and produced most of the heavier ordnance in the enemy's mine inventory. A captured enemy film revealed that such factories extracted explosives from dud US aerial bombs and collected dud BLU-3 bomblets for the manufacture of mines. In addition, a well organized supply system had been developed to support mine and booby trap activities. As the logistics system improved, the enemy arsenal had been augmented with standard Russian and Chinese Communists (CHICOM) mines and firing devices. These were issued to the Army of North Vietnam (NVA) forces initially and later to some VC elements. However, local mine factories have continued to be found throughout RVN.

c. During the period of the study, random nuisance mining prevailed and no deliberate mine field in any standard pattern was reported. Pressure-electric road mines were employed with the explosive being offset from the actuating device so it would detonate under the belly of a vehicle. Locally produced and Russian non-metallic pressure-actuated mines were reported for the first time. Previously, all mines had contained some metallic component in the firing mechanism. Some signs and other improvised marking methods were still used by the VC to
designate the presence of mines and booby traps in an area; however, no uniform marking system was evident. The use of non-explosive booby traps had diminished sharply. This type accounted for less than one percent of the 306 incidents reported during the period.

13. (c) Mine and Booby Trap Information

A study of the intelligence system with regard to mine and booby trap information showed that a vast amount of narrative information had been gathered at MACV level which was not adequately catalogued. Examination of all available mine and booby trap publications revealed that many different publications had been issued by various headquarters and field units. All of the MACV publications were at least one year old at the time of the study: many had been limited in distribution so that their existence and contents were largely unknown to field units. Unit publications were of varying types and content and in many cases duplicated material found in MACV publications. Considerable data had been collected at CTCV on workshop locations, but this information was not promptly disseminated to units that could destroy these facilities. Recurring reports revealed that some workshops were still operational and that some destroyed workshops had been reactivated.

14. (c) Salient Findings and Conclusions

a. The amount of information on mines and booby traps collected at MACV was voluminous and difficult to retrieve.

b. Mine and booby trap publications were numerous, overlapping, had limited distribution, and were out of date.
15. (C) Background

Countermine equipment used and developed during World War II was designed mainly for clearance of lanes through deliberate mine fields. The metallic mine detector and probing, both time consuming techniques, were used throughout the war. At the beginning of the US buildup in Vietnam, the US Army had two hand-held detectors, the metallic detector, AN/PRS-3, later replaced by the Polan - 153, and the non-metallic detector, AN/PRS-4. A vehicular-mounted metallic mine detector developed by the USAMERDE was type classified Standard "A" but had not been procured. A field test of this equipment with a remote control system in September 1966 indicated the need for further improvements and redesign.

16. (U) General

The mine detection subtask assessed present equipment and procedures and new equipment and concepts for their effectiveness in minimizing casualties and vehicular damage caused by enemy mines. Information was gathered by means of field trips and controlled tests, where feasible. Field trips included visits and interviews with personnel actively engaged or involved in mine detection in five US Army Divisions. The controlled tests were conducted on the AN/P153 metallic mine detector, the AN/PRS-4 non-metallic mine detector and the AN/AAS-22 airborne infrared sensor. A feasibility study was conducted on a new concept for detecting wires based on the use of radio frequency (RF) energy.

17. (C) Mine Detector Tests

a. The P153 detector was tested to determine the influence of burial depth, mine metal content, sweep rate, and high-ferrous soil on its detection effectiveness. Simulated high-metallic, medium-metallic, and low-metallic mines were buried at depths varying from two to twelve inches. Two sweep rates, approximating the sweep speed suggested for the equipment and the faster speed normally used in RVN sweeping operations, were used. Tests were conducted at Pleiku, where the soil has a high ferrous content, and at Long Binh.

b. The PRS-4 detector was tested to determine the influence of burial depth and sweep speed on its detection effectiveness. Real and simulated explosives were buried at depths of six and twelve inches in the test area. In this test, the operators set their own sweep rate.

18. (C) Detector Test Results

From field visits and controlled tests, it was determined that:

a. The AN/P153 metallic mine detector was most frequently used in RVN, and the AN/PRS-4 non-metallic mine detector was used only occasionally.
b. The P153 had structural weaknesses.

c. The effectiveness of mine sweeping operations with the P153 varied with the amount of time allotted for the operation and the amount of metallic debris in the road.

d. At the suggested sweep rate of approximately 0.75 miles per hour, the P153 was effective at depths to four inches in detecting low-metallic content mines, six inches for medium-metallic mines, and twelve inches for high-metallic content mines.

e. The P153's maximum sweep speed for total area coverage was calculated to be 0.75 miles per hour, and its effectiveness was reduced when the sweep rate exceeded 0.80 miles per hour.¹

f. The effectiveness of the P153 was reduced in high-ferrous soil areas.

g. The FRS-4 was disliked by the users because of its weight, delay after signal saturation, and lack of ability to discriminate between real and false targets.

h. The FRS-4 was capable of detecting metallic and non-metallic mines at depths of twelve inches, but it also detected many soil anomalies.

i. The FRS-4 had to be operated at a rate of approximately 0.06 miles per hour in order to be effective, during the controlled tests.

19. (C) Airborne Infrared Sensors

The feasibility of employing airborne infrared sensors to detect mine holes was tested. Mine holes varying in size from 12 inches in diameter and 12 inches in depth to 18 inches by 36 inches were dug and refilled during the night hours. Flights were made by a Mohawk OV-1 aircraft equipped with the AN/AAE-22 sensor at altitudes of 500 and 1000 feet. The sensor detected all mine holes 16 minutes after the holes were refilled, at both altitudes. Retests at times exceeding 16 minutes were negative, but the detector was not operating at maximum efficiency. Measured temperature differentials in excess of 0.25°C indicated that detection should have been possible with the AN/AAE-22. No further tests were conducted due to time limitations.

20. (C) Wire Detector Concept

A new concept for a wire detector was tested. This concept was essentially based on a change in input impedance (due to a change in mutual impedance) as detected by an antenna when another wire (antenna)...

¹For details, see Volume 3, Mine Detection, Annex C.

²For details, see Volume 3, Mine Detection, pages C8 - C12.
is placed in its proximity. In subsequent tests, USARCOM technicians were able to detect buried wires by the measurable shift in tank voltage on an end fed dipole.

21. (C) Road Clearing Procedures

It was determined that two procedures used for road mine clearing operations had proven highly successful. The first procedure entailed a maximum effort by the 1st Infantry Division to open 60 kilometers of Highway 13 for subsequent daily use. The Division used mine detectors, road plovs, mechanical ditch diggers, and day and night security measures. The clearing operation was completed in six weeks, and security measures were continued thereafter. No road mine incidents occurred in the following 115 days. The second procedure developed by the 2d Brigade, 25th Infantry Division, applied when roads were to be used on an irregular basis. Times and routines for the convoys were unannounced. On the movement date, security forces were heli-lifted along the road length to selected positions, spaced to maintain visual contact. Mine detection teams were air-lifted and spaced along the road to start simultaneous clearance. On completion of clearing operations, the move was initiated.

22. (C) Salient Findings and Conclusions

a. Although the P-153 metallic mine detector needs structural improvements, it can detect mines with a metallic content but is not being employed to its maximum effectiveness in RVN because field commanders and operators are not fully aware of its capabilities and limitations.

b. The PRS-4 non-metallic mine detector can detect all types of enemy mines to a depth of twelve inches, but it is heavy, detects many false targets, and requires excessive sweeping time.

c. The AN/AAS-22 airborne infrared sensor detected mine holes only up to 16 minutes after excavation; however, the temperature differential throughout the night between the ambient and excavated soil was within the detection capabilities of the sensor.

d. A concept for detecting buried wires by means of radio frequency energy was proven feasible.

e. The two road clearing procedures described were effective in reducing mine incidents on main supply routes.

1 For further details, see Volume 3, Mine Detection, pages 41-45.

2 For further details, see Volume 3, Mine Detection, pages 6-10.
23. (c) Background

Equipment for rapidly clearing mines by detonation, such as non-expendable mine rollers, flails, and various linear explosive devices, were developed and used in World War II. The non-expendable rollers were effective but were heavy, slow, and difficult to maneuver. Flails were effective in off-road operations but they quickly destroyed any road surface. Explosive devices were limited in effectiveness and often increased the sensitivity of the fuses of mines which were not detonated. In 1965, the US Army had several linear explosive detonators but no mechanical mine detonation equipment.

24. (c) General

The purpose of this subtask was to study and evaluate means for intentionally detonating emplaced mines and to make specific recommendations on the development and use of such devices for minimizing casualties. Initial investigations of those mine incidents where the firing device was identifiable, revealed that three types of detonating mechanisms were used in 91 percent of the enemy's mines. These types were mechanical pressure (29 percent), pressure electric (17 percent), and command electric (19 percent).

25. (c) ENSURE 202, Mine Roller

Based on a USARV request, USAMERDC developed the ENSURE 202, Expendable Mine Clearing Roller, Model 3A. The roller consisted of two sets of individually articulated road wheels designed to actuate both mechanical pressure and pressure electric mines. Three rollers were to be evaluated in RVN in April and May of 1968. Although the two rollers which were available for testing failed structurally before encountering an enemy mine, one did detonate a deliberately emplaced US M15 AT mine and, as designed, the expendable roller assembly broke clearly at the shear plane from the non-expendable portion. A new expendable roller was attached in 25 minutes. USARV requested USAMERDC to strengthen the expendable portions of the roller and to provide 30 strengthened roller assemblies for further field testing.

26. (c) Wire Detonator Concept

To counter both pressure electric and command electric mines, the use of radio frequency (RF) energy to detonate such mines was investigated. The concept was based on using the near field of a dipole to induce an electric current in the firing circuit. Enemy detonators were obtained and detonated in RVN using approximately 40 millijoules of RF energy. USARCOM adopted the concept for development and verified its feasibility. USAREC has proposed a development program requiring $830,000 and nine months to produce a prototype RF detonator for evaluation in RVN.
27. (c) **Salient Findings and Conclusions**

a. Effective mine detonation equipment was not available to field commanders for use in road clearing operations.

b. The USAMERDC Expendable Mine Clearing Roller showed potential and was worthy of further development.

c. The RF detonator was feasible, showed potential, and was worthy of further development.

d. A combination device capable of detonating pressure and electrically actuated mines with sufficient speed, maneuverability, and durability would effectively counter the three main types of detonators used in enemy road mines.
(C) SECTION VI - PROTECTIVE EQUIPMENT

28. (c) General

a. The purpose of this subtask was to study and evaluate means for providing additional protection for personnel in vehicles which are subject to mine attack and to make specific recommendations on the use of these means for minimizing casualties.

b. Initial investigations revealed that vehicles of all types were being destroyed by anti-tank mines; however, 45 percent of the total vehicular mounted personnel casualties occurred in the M113 APC. In addition, approximately 65 percent of the APC combat losses were due to mines. Experimentation with in-country resources was confined to protective measures for the APC.

29. (c) Armored Personnel Carrier Damage

Mine-damaged APCs were examined and the following was found:

a. Failures in the hull structure:

(1) Rupture of the box beam.

(2) Separation of the hull bottom at the weld joint between the bottom plate and the lower glacis plate.

(3) Rupture of the bottom hull plate.

(4) Separation of the bottom hull plate from the box beam.

(5) Fracture or disintegration of the final drive housing.

(6) Rupture of the sponson plate.

b. Main internal damage:

(1) Power train damaged by deflection of the bottom hull plate and movement from its hold down blocks.

(2) Steering laterals broken up.

(3) Broken fuel lines and bent torsion bars caused by deformation of the bottom hull plate.

30. (c) Supplemental Armor Tests

a. Several supplemental armor systems were constructed and placed under the belly armor of test vehicles. These were tested against the blast effect of a US M35 AT mine, which was considered representative.
of enemy mines in explosive charge weight. Four to six-inch laminations of the following materials were tested:

1. Mild steel and MX-10 aluminum honeycomb airfield mat.
2. Mild steel and plywood.
3. Plywood, rubber, steel, and concrete.
4. A mild steel box filled with sand.
5. A mild steel box frame filled with empty soda cans.

b. With supplemental armor, the damage to the belly armor which was sustained by all test vehicles was greater than that experienced by an APC in a similar test without supplemental armor. Although preliminary research had indicated that many enemy mines contained 25 to 30 pounds of explosive, few vehicles were as severely damaged by enemy mines as the test vehicles which were exposed to M-15 mines containing 22 pounds of Composition B (equivalent to 29.7 pounds of TNT). The force of the explosive caused the vehicle to be violently thrown into the air, and the resulting acceleration would have caused severe casualties to all passengers even if the blast had not penetrated the hull. In subsequent tests using 10 and 15 pounds of TNT against unprotected hull bottoms, the belly armor did not rupture, but the weld joints failed.

31. (C) **Shock Isolation System**

Naval shock isolation seats, chairs mounted on collapsible columns, were mounted in several test vehicles to determine their value in attenuating impact shock effects. All columns were completely collapsed. Owing to lack of instrumentation, no conclusions could be drawn. Current literature states that these seats, when mounted on an additional shock isolation platform, will limit the shock loading from a watermine to a force of 10g, which is within human tolerance levels.

32. (C) **ENSURE 218, APC Modification Kit**

a. On a USARV request in 1966, the US Army Materiel Command (USAMC) developed the ENSURE 218 modification kit to provide protection for the APC against blast from enemy mines. The kit consists of the following items:

1. Supplemental armor for the hull bottom.
2. Modified bow vane.
3. Heavy-duty fuel line which will be moved from the location of the present lightweight line.
(4) Emergency ramp release.

(5) Aircraft safety harness for the driver.

b. Although no ENSURE 218 kits were available for evaluation by SECMA, the supplemental hull armor prevented rupture of the hull by an M-15 mine in a CONUS test.1

33. (C) SALIENT FINDINGS AND CONCLUSIONS

a. None of the armor supplements tested by SECMA offered a significant improvement in protection for the M113 APC.

b. The most promising protective equipment for the APC was the ENSURE 218 modification kit, since it should protect against major damage and severe casualties from mines containing up to 20 pounds of TNT.

c. Shock effects inside the vehicle were not significantly reduced by any protective materials tested.

d. The weld joints of the M113 are inadequate to withstand the moderate sized (10 to 15 pounds of TNT) mines used by the enemy in RVN.

e. Because of high accelerations experienced in an APC from larger mine explosive charges, hull protection against the blast effects of such charges would be of little value in reducing personnel casualties.

1 Reference 10
34. (C) General

a. The denial operations subtask studied those tactics, techniques, materiel, and concepts which could reduce the effectiveness of the enemy's mine supply, manufacturing, and emplacement system. (Currently 39 percent of their booby traps are of US origin.) Field visits, observations, and interviews in selective areas, augmented by available data, were used for this assessment.

35. (C) US Abandoned Ammunition

Since the enemy made use of US ordnance, currently 39 percent of their booby traps are of US origin, the sources of such materiel were studied. It was found that friendly forces frequently abandoned ammunition in areas accessible to the enemy. The average monthly cost of abandoned ammunition recovered by EOD units was $26,000, and the average monthly value of ammunition turned in under the Volunteer Informant Program (VIP) was $13,000. This infers an estimated annual cost of $468,000 for abandoned ammunition. Lack of accountability and facilities for accepting returned ammunition contributed to abandonment. US combat troops frequently discard ammunition once carried in a combat operation as unserviceable due to dust, dirt, mud, and similar minor imperfections. For example, one EOD detachment estimated that it destroyed 971 tons of such reclaimable ammunition in 1967. Shortcomings in ammunition packing were cited as a major factor since troops tend to discard deteriorated ammunition. The plastic container for 81mm mortar rounds was commonly cited since it failed to protect the fuze and propellant increments against moisture.

36. (C) US Dud Ordnance

Methods for minimizing duds and the enemy reuse of such items were also investigated. Assuming normal and acceptable dud rates in an average monthly expenditure of all types of ammunition, it was estimated that approximately 187 tons of high explosive became available to the enemy in the form of duds. Inadequacies in packaging and handling during field storage contributed to duds as did fuzes that deteriorate. To improve safety, fuzes incorporated many features to preclude premature detonation. The resultant complex design with a superfluity of safety features contributed to the dud problem. Based on reports, and from interviews with EOD personnel, it appeared that the percentage of duds in Russian and CHIC ammunition was lower than US dud rates. Reuse of friendly duds could be reduced by incorporating anti-tamper features. Numerous standard anti-tamper and influence fuzes were available for aerial bombs which could be used as backup fuzes for the primary fuzeing system. Such fuzes are not available for artillery and mortar projectiles.

For further details, see Volume 6, Denial Operations, pages 19-22 and 29.
37. (C) Factory Location and Destruction

Thirty percent of the mines currently encountered were reported to be of local manufacture; therefore, means of locating and destroying these manufacturing sources were studied. Based on reports, field units could not or did not give a high operation priority to factory location and destruction. Factory information was mainly obtained from Chieu Hoi returnees, prisoners, and captured documents. The clandestine Vietnamese agents working with field units were a promising source for such information, but were not being fully exploited. Chemical detection methods could be developed for identifying factory emanations. Since duds were used in manufacture, traceable devices or reactive chemicals inserted in spurious duds could be used to locate or destroy the factory. Such devices and chemical additives represent a possible long-term development.

38. (C) Area Denial and Surveillance

Enemy mine emplacement can be impeded by a variety of area-denial and surveillance methods. Various intrusion and surveillance devices were found to be available. There are 19 types of intrusion detectors which can be hand or aerially emplaced to detect areas of enemy activity. Some of these detectors are currently available for evaluation in RVN and some are in use. Suitable weapon systems combined with an emplaced intrusion detector could result in an effective area denial system. Road mining can be minimized by employing a combination of illumination, electronic and visual surveillance, and responsive fires. A silent aircraft, QT-2, was tested as an airborne platform for visual surveillance of roads and showed potential in this role.

39. (C) Road Paving

a. The use of road paving to impede mine emplacement was not reported in Volume 6, Denial Operations, because the data developed on this subject was not available prior to preparation of that report. It is generally agreed that paving will impede enemy road mining activity. Excavation through the paving for mine emplacement is more laborious and time consuming, and the emplacement can be more readily detected in the newly paved surface. However, mines can be emplaced in the unpaved shoulders at locations where vehicles will tend to leave the pavement. As the paving deteriorates, the enemy can bury mines in the potholes under the broken pavement. Paving will not preclude mine emplacement under the pavement by tunneling from the road side, a method often used in the Delta where the roadway is on an elevated fill. With this method the explosive charge is normally increased and command-detonated so the resultant blast will destroy a selected military target as well as create a large road-obstructing crater.

b. Road paving requires a major engineering effort in time, men, and materiel. Offsetting these costs are savings in casualties and vehicle damage from reduced
mining. As additional benefits, paving reduces the cost of operating and maintaining vehicles, improves military logistics, and enhances the civilian economy by facilitating the movement of local produce and commodities.

c. Since road paving was suggested by many individuals, it was considered advisable to present the data which was accumulated during the study involving one paving project in the Pleiku area (Annex C). Although this limited sample showed that paving reduced enemy mining activity during the two months after paving, the data was insufficient for a cost effectiveness analysis. Conclusive proof of the effectiveness of road paving would require further study.

40. (C) Salient Findings and Conclusions

a. Large quantities of ammunition were abandoned by friendly forces. This abandonment resulted from many factors including enemy action, incorrect assessment of serviceability, insufficient renovation facilities, and lack of accountability.

b. Some ammunition and its packaging were inadequately designed for the RVN environment. This contributed to deterioration and hence abandonment of ammunition.

c. The high incidence of dud munitions of all kinds in RVN was partly the result of fuze inadequacies.

d. The use of present standard anti-tamper and influence fuzes in bombs would be a deterrent to the reuse of duds.

e. Suitable anti-tamper and influence fuzes for artillery and mortar projectiles would reduce the enemy use of such duds.

f. Paving reduced enemy mining activity.
SECTION VIII - BOOBY TRAP COUNTERMEASURES

41. (c) General

This subtask assessed four specific areas which were considered to possess maximum potential for minimizing booby trap casualties. These areas were: in-country booby trap training, use of Kit Carson Scouts for locating booby traps, use of the VIP to recover booby traps and materiel related to their manufacture, and employment of scout dogs for detecting booby traps.

42. (c) Training

a. In-country booby trap training was given to newly arrived soldiers as part of each division's orientation program. All courses followed the same pattern with class instruction followed by practical work in a booby trap area containing simulated devices commonly employed by the enemy. The courses varied in length from two to six hours and in the types of booby traps covered. Non-explosive booby traps were overemphasized in several divisions, despite evidence that such devices were seldom encountered. Programs of instruction varied. They were normally developed by the NCO instructors, based on the instructor's own experience, and were not truly representative of booby trap activity in the division's TAOR. Instructors acknowledged the need for training publications but, in general, they were not aware of all MACV booby trap publications which were available to the divisions. The few publications that were used were generally outdated and overstressed non-explosive devices.

b. It was noted that the 5th Special Forces Group was uniquely qualified in booby trap warfare throughout RVN. This resulted from extensive CONUS training, intimate knowledge of local developments, and continual consolidation of booby trap data from all sections of RVN. This experience and knowledge would be invaluable in providing effective training for new personnel on arrival.

43. (c) Kit Carson Scouts

a. Kit Carson Scouts (KCS) are former VC/NVA soldiers who have rallied to the GVN under the Chieu Ho (Open Arms) Program. After rallying, the Ho Chanh (returnee) undergoes an eight-week political reindoctrination course at a GVN Chieu Ho Center. During this time US tactical unit representatives visit the center and conduct a screening process to obtain qualified volunteers. Upon completion of the course, the individual is hired by the US unit. The scouts are selected for their knowledge of enemy tactics and techniques, the indigenous population, and the countryside. The scouts have continually proven their value during combat operations. In April 1968, for instance, the KCS in the 9th Infantry Division detected 33 booby traps and three command-detonation mines.
b. Since each returnee must complete an eight-week indoctrination course prior to release from the Chieu Hoi center, his knowledge of current enemy operations is lost. However, if he has perishable information of value to a US tactical unit, arrangements can be made to have him released from the Chieu Hoi center, during the eight-week period, for the duration of an operation designed to exploit the perishable information. After release, he must be trained by the acquiring unit before he can be effectively employed. The training includes basic English, US tactics, and familiarization with US weapons and equipment. During operations, the scouts informally teach other unit personnel booby trap detection techniques. If selected scouts were used as instructors in the division schools, their knowledge would be exploited to the maximum.

c. The scout's monthly pay of 5,000 VN$ is equal to that of an ARVN staff sergeant, but problems could arise because the scouts cannot be rewarded under the VIP for any enemy arms caches they locate. Some units have paid bonuses "out of pocket" for such discoveries.

44. (C) The Volunteer Informant Program

a. Although originally conceived to gain information of enemy activities through cash or material rewards, the VIP also provides for payment of rewards for the turn-in of enemy material, particularly weapons and explosives. The success of the program is dependent on psychological operations support and flexibility in the use of funds. Current governing directives on the disbursement of funds did not permit distribution of funds to non-intelligence troops in the field, however, a recent DA exception to policy authorizes funds to be disbursed to units S-2s. The exception to policy provides for greater flexibility in distribution of funds in support of the VIP. Non-divisional USARV units use Assistance in Kind (AIK) funds. Under USARV Directive 37-25, funds can be made available at the lowest possible organizational level to permit prompt on the spot payments of the reward. An equal degree of fund flexibility is desirable for the VIP.

b. Variations exist in the rewards paid for individual items, and some units have found that payment "in kind" is preferred by the Vietnamese in certain areas. Most of the volunteer informants are children, and a majority of the material recovered is of US manufacture. In one area, 98 percent of 190 equipment turn-ins included explosives and ammunition which are commonly used in manufacture of booby traps.

45. (C) Scout Dogs

The performance of scout dogs in RVN to date has proven that they possess the ability to detect booby traps. They discovered 175 booby trap
devices during the first five months of 1968, and, reportedly, only two dogs became booby trap casualties. The ability of the scout dog to detect booby traps is directly proportional to the amount of training he receives. The dogs must be continually retrained in a secure but operationally realistic training area. In many instances, scout dog platoons did not have access to such training areas in their base camp. The Limited Warfare Laboratory is currently studying improved dog training procedures specifically addressed to the detection of mines and booby traps.

46. (C) Salient Findings and Conclusions

a. Divisional in-country training varied and did not make maximum use of publications or special knowledge of the 5th Special Forces Group personnel.

b. Kit Carson Scouts are effective in detecting enemy booby traps.

c. The Volunteer Informant Program is effective in securing the turn-in of mines, booby traps, and related explosive material.

d. Scout dogs, if properly trained, can detect booby traps.
(c) SECTION IX - TRAINING IN CONUS

47. (c) Discussion Summary

a. The basic purpose of the independently conducted HumRRO study was to determine what changes were needed in CONUS training on mines and booby traps to meet counterinsurgency requirements. To make this assessment, one civilian technician visited five CONUS training centers to observe and discuss training. For an evaluation of enemy mine and booby trap employment, visits and interviews were conducted in five Infantry Division areas in RVN. After field data collection, the study was completed in CONUS and presented in a consulting report issued in June 1968.

b. Eight hours on landmine warfare and one hour on VC booby traps were included in the Infantry Advanced Individual Training (AIT) courses. Considerable time was devoted to conventional mine warfare; the P-153 detector was briefly discussed and demonstrated, but little attention was given to visual detection. In January 1968, the training for light weapons infantrymen (MOS 11B10) was increased. Two hours on use, installation, and breaching of booby traps, and two hours on night breaching operations were added. Other infantry courses remained unchanged. The Engineer AIT provided 23 hours for landmine warfare with two hours for VC mines and booby traps, 50 minutes for explanation and demonstration of the P-153, and 36 minutes for practical work with the mine detector. Instructors expressed a need for more instruction oriented to RVN requirements. The Armor Crewman AIT included only four hours on US mine warfare with no time devoted to RVN mine warfare.

c. Interviews with personnel in RVN revealed a general opinion that CONUS training concentrated too heavily on conventional mines, and not enough time was given to RVN problems. Most units cited a need for more instruction on detection and avoidance of mines and booby traps at the expense of conventional warfare training. Cavalry units stressed the need for mine detector training. Engineers wanted more realistic mine detector training with additional practical work, particularly on the low-metallic mines found in RVN. They also asked for more instruction on detector maintenance.

48. (c) Salient Findings and Conclusions

a. CONUS training on mines and booby traps needed reorientation with additional emphasis given to RVN operations.

b. Additional training on VC mines and tactics and a substantial increase in realistic practical training with mine detectors was required in the Engineer AIT.

c. The Armor Crewman AIT needed more mine detector training, additional instruction on enemy tactics and techniques, and familiarization with countermeasures used by armored elements in RVN.

d. Twelve hours of mine and booby trap training was suggested for the Infantry AIT, giving emphasis to problems in Vietnam. (Details are presented in Reference 6.)
49. (C) General

Since the expeditious development of effective countermeasures bears on the ability of the FWMAF to reduce their casualties, the development cycle for urgent countermine requirements was studied. A review of ENSURE developments and R&D efforts with respect to countermine activities and discussions with all R&D personnel who visited or worked with the SECMA Project formed the basis for this assessment.

50. (C) The ENSURE System

The major R&D effort is addressed to the many general needs of the US Army and involves a complex system which establishes requirements and priorities and allocates appropriate funds and resources. The system normally requires four years or more to develop a standard item of equipment which will fulfill a stated Qualitative Materiel Requirement (QMR) and two years to fulfill a Small Development Requirement (SDR). The Expedited Non-Standard Urgent Requirement for Equipment (ENSURE) System was designed to minimize the development time for items needed in RVN. In RVN, requests for ENSURE items may originate with any unit and are processed by G3, USARV. Once validated and funded by DA, development is expedited. However, improvements in the current system are possible which will insure that an operationally acceptable item of countermine equipment arrives in RVN at the earliest possible date. Areas of possible improvement are discussed in the following paragraphs.

51. (C) User - Developer Interface

a. Information on operational factors and design developments is not freely exchanged between the field and the development elements and among the R&D agencies. For example, USAMERDC proceeded on development of a wire detector without complete knowledge of the prevailing operational conditions in RVN. USAECOM similarly lacked data for their wire detonator development. There is no central source available in RVN which could provide such field data to the R&D agencies, although SECMA acted in this capacity to the extent of its capability.

b. Development personnel lack first-hand knowledge of the environmental factors in RVN which must be considered in equipment development. The

1Reference 11
2Reference 12
3Reference 13
ENSURE 202 Mine Roller was tested twice in RVN and each time revealed design deficiencies that had not been detected during extensive tests in CONUS. Redesign of the mine roller should be facilitated if the knowledge gained by the project technician who was present in RVN during the field tests is properly applied. The SECOMA Film Report attempts to fill this need, in part, with regard to the critical problem of road mining. The R&D personnel directly involved in developing and testing of any countermine equipment for RVN should visit the country to gain first-hand knowledge of the operating conditions that must be met before development or testing is started.

52. (C) Formulation of Requirements

Field units are prone to overstate their requirements and hence unnecessarily create design difficulties. Non-technical field personnel tend to expect the immediate development of a solution for all possible conditions, whereas only a partial solution may be immediately possible. One example of this was reflected in a unit evaluation report on the ENSURE 202 Mine Roller. The equipment showed definite potential when used on dry roads and trails, yet the unit reported the roller was unacceptable because it could not operate in muddy soil. Since no operational mine roller was available and field units were forced to use expedient measures such as tanks and trucks, this design should be expeditiously pursued to obtain at least a partial countermeasure instead of redesigning the equipment for an all-weather capability. Direct discussions should be held in RVN between USARV and development personnel at the initiation of any urgent project so that competitive factors, such as operational requirements, state of the art, and development time, can be weighed and an agreed course of action can be established. This will assure that equipment of optimum effectiveness will be available in RVN in the shortest time frame.

53. (C) Centralized Direction of Countermine RDT&E

There is no single agency or individual in CONUS with overall responsibility for countermine equipment. This lack was noted by the Army Scientific Advisory Panel on 15 October 1967. The compendium of all projects having potential application to mine and booby trap countermeasures, revealed that 16 agencies are working on 93 projects. It is evident that centralized direction is necessary to assure that the countermine RDT&E effort is effectively coordinated and responsive to field requirements.

54. (C) Annual Seminar

A periodic review of the threat and of recent technological advancements, similar to the SECOMA discussion with the Army Scientific Advisory Panel

---

1Reference 7, pages 37 - 42

2Reference 14
should be conducted. The latter discussion reactivated the concept of
an RF wire detonator which heretofore had been considered infeasible. An
annual seminar of outstanding scientists in pertinent disciplines should assure
that all appropriate concepts are considered and evaluated by the R&D community.

55. (C) Findings and Conclusions

a. The ENSURE program can be made more responsive to US Army requirements
   in RVN by establishing a direct means of communication for improved coordination
   between USARV and the CONUS R&D community.

b. There was no single agency in USARV designated for coordinating the
   countermine activities in RVN and for providing a point of contact with the
   CONUS R&D community.

c. There was no staff agency in CONUS designated for coordinating all
   of the RDT&E activities pertinent to mine and booby trap countermeasures
   and for ensuring the RDT&E effort is responsive to USARV requirements.

d. Changes in technology may evolve new concepts applicable to counter-
   mine equipment.
56. (C) Mine and Booby Trap Data

It is recommended that:

a. USARV designate a staff agency for establishing and maintaining a Mine and Booby Trap Reporting System (Paragraphs 10a & b).

b. The designated staff agency be furnished automatic data processing support by CICV and provisions be made for expedited distribution of pertinent correlations and displays to interested units and agencies (Paragraph 10d).

57. (C) Intelligence

It is recommended that:

a. Information on mine and booby trap workshop locations be disseminated promptly to units capable of reacting (Paragraph 13).

b. Mine and booby trap publications be updated and include the following (Paragraph 14b):

(1) An extensive volume for reference use for staff studies and research groups, containing all known material on enemy mines and booby traps.

(2) A sturdily constructed, pocket size pamphlet for small unit leaders containing data needed at the tactical level.

58. (C) Mine Detection

It is recommended that:

a. Operators and field commanders be advised of the capabilities and limitations of the AN/P153 and AN/PRS-4 detectors as determined by this study (Paragraph 18).

b. The R&D agencies review the report findings with a view to improving the design of the AN/P153 and AN/PRS-4.¹

c. The two successful Standing Operating Procedures for road-clearing operations be made known to other field commanders through appropriate training publications.²

d. Continued testing be conducted to establish the capability of the AN/AAS-22 airborne infrared sensor for detecting newly emplaced mines (Paragraph 22c).

¹Volume 3, Mine Detection, para 7 & 8b.
²Ibid, pages 41-45.
e. Development continue on the radio frequency wire detector concept (Paragraph 22d).

59. (C) **Mine Detonation Equipment**  
It is recommended that:  
   a. Development and field evaluation of the ENSURE 202 Mine Clearing Roller, Model 1A, proceed on a priority basis (Paragraph 25).  
   b. That development and field evaluation of the RF detonator proceed on a priority basis (Paragraph 26).  
   c. A combination device capable of detonating both pressure and electrically actuated mines be developed (Paragraph 27d).  

60. (C) **Protective Equipment**  
It is recommended that:  
   a. The floor and lower glacis plate of the M113 APC be manufactured in one piece, and the weld joint design be changed from partial to full penetration joints (Paragraph 33d).  
   b. More emphasis be placed on protection against land mines in determining the military characteristics of future light combat vehicles (Paragraph 26).  
   c. Efforts be directed toward the development of energy absorbing materials or systems to reduce the impact shock effects from mine detonations (Paragraph 33c).  
   d. Tests be initiated to determine the threshold in mine charge weight where vehicle acceleration becomes the primary casualty-producing effect, and results be considered in hull armor design (Paragraph 33e).  

61. (C) **Denial Operations**  
It is recommended that:  
   a. Increased command emphasis be placed on enforcing the existing regulations for control, issuance, and handling of ammunition (Paragraph 40a).  
   b. Ammunition Supply Points be provided the additional personnel and facilities which will permit their acceptance and processing of unwanted ammunition (Paragraph 40b).  
   c. Ammunition and its packing be improved for RVN use (Paragraph 40b).  
   d. Increased emphasis be placed on fuse reliability, and any useful CHICOM and USSR design concepts be exploited in future US fuse designs (Paragraph 36).
e. Anti-tamper and influence fuzes be used as backup fuzes on all aerial bombs (Paragraph 40d).

f. A study be made of the requirements for anti-tamper and influence fuzes for artillery and mortar projectiles (Paragraph 40a).

g. A study be made of the desirability of incorporating incapacitating or detectable chemicals in munitions to prevent tampering with duds (Paragraph 37).

h. R&D studies on chemical munition detectors for RVN be actively pursued (Paragraph 37).

i. Increased command emphasis be placed on the location and destruction of enemy mine factories (Paragraph 37).

j. The suitability of radio frequency beacons and traceable or reactive materials in simulated duds for factory location and destruction be studied (Paragraph 38).

k. The suitability of intrusion detectors for countermine activities be evaluated in RVN (Paragraph 38).

l. Continued emphasis be placed on the development of effective night vision devices for use in countermine operations (Paragraph 38).

m. The USARV Engineer conduct a study of the cost-effectiveness of road paving as a mine countermeasure (Paragraph 39).

62. (C) Booby Trap Countermeasures

It is recommended that:

a. Booby trap training in RVN be more extensive and comprehensive (Paragraph 42).

b. USARV set guidelines for divisional booby trap training Programs of Instruction and monitor the courses of instruction to assure that content is current (Paragraph 42).

c. The 5th Special Forces Group train instructors, provided by the divisions, for divisional schools and provide technical advice (Paragraph 42).

d. Methods used in presenting booby trap publications and information to individual soldiers be improved, to include:

(1) Dynamic and imaginative techniques utilizing all information disseminating media, e.g., special publications similar to PS (Preventative Maintenance) Magazine, cartoons, TV, radio, and newspapers.

(2) A fully publicized drive for suggestions from the field on booby trap countermeasures using the Incentive Awards Program.
e. MACV review the Kit Carson Scout Program with the goal of standardizing its implementation (Paragraph 43).

f. USARV train selected highly competent Kit Carson Scouts to instruct US personnel (Paragraph 43).

g. MACV establish an adequate and flexible funding system for the Volunteer Informant Program (Paragraph 44).

h. USARV direct scout dog platoons to increase emphasis on booby trap detection training and assure that adequate training areas are available to all platoons (Paragraph 45).

64. (c) Training in CONUS

It is recommended that the changes to Advanced Individual Training (AIT) courses proposed by HumRRO be implemented, as follows:

a. Engineer AIT: Additional training on VC mines and tactics and a substantial increase in hands-on equipment training in a realistic environment (Paragraph 47).

b. Armor Crewman AIT: More training on mine detectors, enemy mine tactics and techniques, and the countermine methods used by armor elements in RVN (Paragraph 47).

c. Infantry AIT: Additional training on enemy tactics and techniques, installation, detection, and neutralization of booby traps, and mine detector operations (Paragraph 47).

64. (c) Organization and Procedures for Research and Development

It is recommended that:

a. DCG USARV designate a central staff agency to be responsible for coordinating all countermine activities in RVN and for establishing a more effective interface with the R&D community which will assure development of operationally suitable countermine equipment in the shortest time (Paragraph 51).

b. CG USAMC designate a Project Manager for Mine and Booby Trap Countermeasures to assure that the RDT&E activities are coordinated and responsive to USARV needs (Paragraph 53).

c. A seminar for RDT&E personnel be conducted at least once a year in CONUS on countermine activities with USARV participation (Paragraph 54).

1For further details, see Reference 6, pages 63-71.
65. (C) **Priorities for Research and Development**

It is recommended that among the items listed above for further research and development, highest priority be given to those which offer promise of placing effective equipment in the hands of troops in the near future, specifically:


b. The radio frequency detonator (Paragraph 26).

c. Improved mine detectors.¹

d. Improved welding techniques for manufacturing the M113 APC.²

66. (C) **Priorities for Field Commanders**

It is recommended that, for immediate improvement in operational countermine activities, field commanders give priority attention and command emphasis to the following:

a. Enforcing the existing regulations for control, issuance, and handling of ammunition (Paragraph 61a).

b. Locating and destroying enemy mine factories (Paragraph 61i).

c. Assuring that available mine detection equipment is effectively employed in accordance with its capabilities and limitations (Paragraph 19).

d. Implementation of those actions within their capability for improving training in booby trap countermeasures, the Volunteer Informant Program, and the use of Kit Carson Scouts and scout dogs (Paragraphs 42 to 45).³

e. Application where appropriate of the operational system described in paragraphs 21 and 38.

¹For further details, see Volume 3, Mine Detection, paragraphs 7 and 8.

²For further details, see Volume 5, Protective Equipment, paragraphs 6a & d.

³For further details, see Volume 7, Booby Trap Countermeasures.
THIS PAGE NOT USED

2. MACV letter, MACJ342, Subject: "Significant Problem Areas (U) (CINCPAC RCS 3960-2)," 5 December 1967 with enclosure.


5. Reports on Combat Operations Loss and Expenditive Data (COLED-V) from the COLED-V Data Collection Center, USARV for the period 1 April 1967 to 29 February 1968.


THIS PAGE NOT USED
Figure B-1. Original Mine and Booby Trap Report Format (Front)