covering 93 percent of the entire offensive area of the rifle company at opening engagement ranges. (See Figure C2-l.) There is over 30 percent overlap between the minimum range of the 81mm mortar and M79 grenade launcher at initial engagement range.

(6) With a minimum of coordination through the battalion heavy mortar platoon FDC, the fires of the 81mm can be massed by battalion or they may be massed at company as required. The present organization provides the option of carrying all or one mortar and using the rest of the platoon to carry ammunition. The mortar may be employed in general support of the company or attached to the rifle platoon by mortar squad for direct support of the platoon. The battalion also has the option to task organize or cross attach within the battalion to support any scheme of maneuver.

2. (C) CONCLUSIONS.

a. The 60mm mortar with its present characteristics and with current ammunition lacks the punch and flexibility to do a job under the conditions of employment peculiar to Vietnam.

b. The range limitation of the 60mm mortar is a disadvantage in the planning of defensive fires. No firepower gap exists between the M79 grenade launcher and the 81mm mortar.

c. The primary function of the 81mm mortar is to provide direct support to the maneuver elements of the company. The 81mm mortar can best perform this mission organic to the weapons platoon of the rifle company.

EEA 29i: Are the 4.2" mortars, 106mm recoilless rifle, and the ENTAC desirable battalion weapons for this type combat?

1. (C) DISCUSSION.

a. GENERAL

(1) 4.2" Mortar. This mortar was considered a desirable battalion support weapon by 22 of 28 respondents. The maximum range of 5500 meters was said to limit the flexibility by two of them. The weight of the weapon and ammunition preclude foot mobility and restrict movement to vehicle or helicopter.

(2) 106mm Recoilless Rifle. The 106mm RR is used for base camp security, road blocks, and road clearing operations. Complete elimination of the weapon was favored by 12 of the respondents for the following reasons: no antitank applications, range not required, weapon and ammunition weight preclude foot mobility.

(3) The ENTAC is not used by any unit in Vietnam. Suitable C-2-23
b. OPERATIONAL DATA.

(1) 4.2" Mortar. Data compiled from 45 operations indicate that the 4.2" mortar was employed on 85 percent of them. Data showing the percentages of employment on operations and percentages of tubes used at base and on operations are in Figure C2-11. On the average, 75 percent of the tubes were used on operations and 25 percent for defense of the base.

(2) Recoilless Rifle, 106mm. This weapon was used on seven of 45 operations, firing a total of 24 rounds.

(3) ENTAC. All units authorized the ENTAC either have it in storage or do not have it in country. It has not been employed in Vietnam; hence, no operational data are available.

2. (c) CONCLUSIONS.

a. 4.2" Mortar. The 4.2" mortar is limited to vehicular and helicopter transport, and often has been restricted in its use by positioning problems caused by short range and security considerations. Nevertheless, the 4.2" mortar has been employed on 85 percent of the operations considered. Since this weapon has been employed a preponderant part of the time, it can be concluded that it will continue to be effective, and will actually increase in usefulness as roads are opened and vehicular mobility increases. The 4.2" mortar should be retained as a maneuver battalion weapon until it can be replaced by the 107mm mortar.

b. Recoilless Rifle, 106mm.

The 106mm recoilless rifle lacks the foot mobility required at company level. The lack of an armor threat, the limited occurrence of other suitable targets, and restricted mobility of the weapon favors its elimination at company level. The use of the 106mm on road clearing operations, the occasional hard targets that are encountered at ranges greater than the effective range of M72s and the possible development of the "Beehive", anti-personnel round, favor the retention of this weapon at battalion level.
FIGURE C2-11(C) EMPLOYMENT OF BATTALION HEAVY MORTARS

IST CAV DIV HEAVY MORTAR PLATOONS EQUIPPED WITH 81mm MORTAR IN LIEU OF 107mm MORTAR

NOTES:
- USED ON OPERATIONS
- TOTAL TUBES USED ON OPERATIONS
- TOTAL TUBES USED FOR BASE DEF

IST INF DIV
IST CAV DIV
173dABN BDE
IST BDE

(22 OPRNS) (13 OPRNS) (6 OPRNS) (4 OPRNS)
Appendix 3 to Annex C (Firepower)

EEA 30: Does the organic firepower of the maneuver battalions provide adequate terminal effects?

1. (U) INTRODUCTION

a. GENERAL The objective of this EEA is to determine if the maneuver battalion has the weapons and ammunition mixes to produce all desired terminal effects on the targets. The lethal effect of ammunition is discussed in Appendix 2 of this Annex. The other terminal effects, suppression, smoke screening and marking, and illumination, are discussed in this appendix.

b. TERMINAL EFFECTS

(1) Suppression with rifle and machine gun fire is achieved against personnel prone or standing by distributing grazing fires 12 to 60 inches over the target or target area or by placing the beaten zone on the target or distributing it over the area of the target. When the posture of the enemy is such that he is protected by foxholes, spider holes, trenches, or bunkers, grazing fires must be less than 12 inches above ground to be effective or the beaten zone must be placed on the enemy's firing position.

(2) Suppression with grenades and indirect fire weapons is achieved by placing the fragmentation and concussion effect of the munition on the target or distributing it over the target so that the casualty area coincides with the target area.

(3) Illumination to permit observation of and fire on the enemy at night is provided by mortar delivered illuminating shell.

(4) Smoke is delivered by hand grenade or mortar shell and is used to screen movement, mark positions or targets, or for signal purposes.

2. (C) EVALUATION

a. Data compiled from 41 fire fights reveal that only one was concluded exclusively through the use of rifle and machine gun fire. Thirty-eight of the fire fights required mortar or artillery fire before they were terminated, and in all but two cases, mortar and artillery fires were required in addition to hand grenades or 40mm grenade fires. The suppressive effect of rifle and machine gun fires cannot be determined from operational data since these weapons usually were used in conjunction with other weapons.
b. Discussion of enemy targets in Appendix 2 and a detailed examination of Figures C2-2, C2-4, C2-6 and C2-7 indicate that the enemy uses small arms predominantly and is concealed or has cover so that his exact position is difficult to locate. Friendly forces must therefore reinforce rifle fire with fragmentation and concussion fires from hand grenades, 40mm grenades, or mortars and provide sufficient volume of fire over an area to suppress the enemy fire. When the source of enemy fire is pinpointed, small arms fires are concentrated along with high trajectory fragmentation fires to gain fire superiority and maintain suppression.

c. Small arms fire restrict enemy movement but it does not prevent it. Opening the engagement usually has been the option of the enemy. His decision to do so is predicated on his estimated chances for success. (See Figure C2-5, Appendix 2). Enemy hit-and-run tactics include the use of intense small arms and fragmentation fires initially and he habitually disengages when loss of fire superiority is threatened. He has been repeatedly successful in breaking off under small arms fire and moving away. Figure C2-1, Appendix 2, reveals that of 63 engagements U.S. forces closed on the enemy only seven times. There is only one engagement recorded where the total enemy killed or captured represented the entire enemy force that was engaged.

d. Only two comments were received concerning ammunition mix. One respondent said that a 40mm illumination and smoke round for the M79 grenade launcher would increase the capability of the squads and platoon to mark targets for air strikes and to illuminate night operations. Marking targets for air strikes with smoke by forward elements is common practice in this theater and a smoke grenade for either the rifle or M79 grenade launcher would improve the infantry capability of accurately marking beyond the range of the hand grenade.

3. (U) CONCLUSIONS

a. The organic firepower of the maneuver battalions provides adequate terminal effects for illumination, marking suppression, and screening.

b. Illumination is available now at company and/or battalion level if required. It is not considered feasible for employment at squad and platoon level because of the requirement for close control of illumination and the need for coordination among units.
Appendix 4 to Annex C (Firepower)

EEA 31: Does the organization of the maneuver battalion provide for continuous fire support throughout the battalion's area of operations?

1. (U) INTRODUCTION

a. GENERAL. The evaluation presented in this annex of the above element of analysis was derived from an analysis of data gathered from operations occurring prior to and during the evaluation period.

b. OBJECTIVES.

(1) To determine if the heavy mortars are properly organized within the maneuver battalion to provide continuous fire support to all maneuver elements throughout the battalion area of tactical operations.

(2) To determine if organizational changes can be made that will result in improved heavy mortar support.

c. METHODOLOGY. Several techniques were used to determine the adequacy of the battalion heavy mortar organization so checks could be made against responses. One time questions were directed to the battalion S3's of 22 maneuver battalions who were asked, based on their experience in the theater, if the number of fire direction personnel and mortar section personnel were adequate to perform specific functions under adverse circumstances. The S3's were also asked to describe the criteria used for displacing weapons during an operation or engagement. These data were compared to the operational data accumulated from 48 specific fire fights of platoon size or larger which occurred during the operations being analyzed. Consideration was given to the frequency that organic and non-organic fire support was requested, what was requested, from whom, whether it was timely, accurate and effective, and, if it was not received or available, why not?

2. (C) DISCUSSION

a. GENERAL. All heavy mortar platoons except those of the battalions of the 1st Cavalry Division are equipped with four 4.2" mortars. The battalions of the 1st Cavalry Division are equipped with six 81mm mortars in lieu of four 107mm mortars.

b. INTERVIEW RESPONSES.

(1) Adequacy of Ammunition Bearers.
(a) Twenty-two battalion commanders responded to the question, "Are there a sufficient number of ammunition bearers in the heavy mortar platoon to permit off-road employment?" Responses from the 1st Cavalry Division will be identified because of the different weapon. In the 1st Cavalry Division, out of eight responses, six stated that there was a sufficient number of ammunition bearers to permit off-road operations. Of these six, three qualified their answers by stating that "ammunition and weapons are airlifted to positions," One respondent said there were not sufficient ammunition bearers for off-road operations. Another stated the question was not applicable.

(b) From the other battalion commanders there was a total of 14 responses. Four commanders stated there were sufficient ammunition bearers for off-road operations. Of these, one explained that 4.2" mortars were not employed unless they were moved by air or ground vehicle. The weapon is considered too heavy for back-pack transport. Nine responses stated there were not sufficient ammunition bearers for off-road operations. The reason given in each of these cases was the limitation imposed by the weight of the 4.2" mortar itself, not the ammunition. This was taken to mean that the total number of crew members was not adequate to pack mortar and ammunition. The 4.2" mortar can be hand-carried for short distances but three of the five components are four-man loads (160 to 193 lbs) which preclude back-pack and off-road employment as a practical matter.

(2) Split Fire Direction Center. The capability to maintain continuous fire support throughout the battalion's area of influence often requires the operation of a split fire direction center. This is particularly true in an environment where the area of influence encompasses 360 degrees. Maneuver battalion operations officers were asked if the present organization of the heavy mortar platoons permitted such operations. The response was unanimously affirmative.

(3) Displacement.

(a) An examination of the criteria used for displacing heavy mortars by 22 maneuver battalion S3's reveals that five were guided by current doctrine. They displaced sections by bounds so that half of the mortars were always in position. Five cited availability of security at a new position, two openly rely on artillery, and three said they considered the capability to provide close in support as well as security at a new position. In addition to range and availability of positions, the other seven considered mutual support of other mortars or artillery and availability of roads and transport or lift as criteria for displacing.
(b) The battalion operations officers were also asked if the capability for continuous fire support was maintained while displacing the mortars. Of 22 maneuver battalion S3's, 15 stated that continuous fire support was maintained during displacement. Of the seven who said support was not maintained organically, more than half indicated that the gap is ordinarily filled by artillery and air support, and when feasible, with rifle company 81mm mortars. Data based on 32 operations (does not include 1st Cavalry Division operations) show that the 4.2" mortar was taken on 26 of these operations. No data exist to show how often heavy mortar support was needed, but during the 48 specific fire fights evaluated, non-organic fire support was requested on 40 occasions and organic heavy mortar support was requested only 13 times. At least on four occasions that support was required, the 4.2" mortars were known to be out of range.

3. (C) CONCLUSIONS

a. Off-road employment of battalion mortars is an established practice in this environment. It is evident from the weight of the weapon system and ammunition that the 4.2" mortar cannot be back-packed for sustained operations and that helicopters or ground vehicles are necessary for displacement. This requirement does not presently exist with the 81mm battalion mortars of the 1st Cavalry Division but will when these are replaced by 107mm mortars. The 81mm mortars in the 1st Cavalry Division are displaced by helicopter to provide larger quantities of ammunition at the mortar site. Additional ammunition bearers would not affect the capability for off-road employment since this is accomplished by helicopter.

b. The heavy mortar platoon is not capable of providing continuous fire support throughout the battalion's area of operations. This is not caused by an organizational deficiency. The unit is capable of operating a split fire direction center and has adequate personnel to employ the weapons when displaced. The deficiency is created by the lack of available firing sites in the area of operations and the inability to move with the advancing organizations (except by helicopter) when sites are available.
Appendix 5 to Annex C (Firepower)

Is the organic or attached target acquisition capability of the maneuver battalion adequate to detect and locate targets within the battalion area of operations for engagement by organic fire support and/or supporting aerial and ground based fire support?

1. (C) DISCUSSION.

a. GENERAL.

(1) Battlefield surveillance and target detection, identification, and location are serious problems in Vietnam. The terrain, dense vegetation and the ability of the enemy to use this terrain and vegetation effectively for concealment have often rendered radar equipments, AN/PPS 4 and AN/TPS 33, ineffective. In addition, the functions of surveillance and detection, identification, and location of targets may be required of units at two locations simultaneously: in the base camp area and in a forward area of operations.

(2) The radars of the surveillance section of maneuver battalions and those of supporting units are generally left for protection of the base camp area when the unit goes on operations. The equipment is bulky, delicate, and is therefore difficult to carry and to keep operational on airmobile operations.

b. TARGET LOCATION TECHNIQUES.

(1) Forward maneuver elements. The maneuver battalions depend almost entirely upon the forward maneuver elements to locate the enemy by contact. Of the 48 individual fire fights reported 46 percent were meeting engagements and 41 percent were enemy ambushes, indicating that there was no previous knowledge of the enemy's location other than that he was in the general area. In all of these 48 fire fights the initial acquisition and location of the enemy was by forward maneuver elements. However, when the units were asked what means other than forward maneuver elements and observer were used during operations, the responses shown below were received.
Target acquisition means

(2) Reconnaissance Platoon. Of 21 responses from maneuver battalion S2's, 16 stated that the reconnaissance platoon was used as a target acquisition means; however, operational data reveal that reconnaissance elements were used to locate the enemy in only 13 out of 36 operations.

(3) Surveillance Section. Of 14 maneuver battalions S2's queried, (the Ist Cavalry Division has no organic ground surveillance sections) 12 respondents reported that ground surveillance radar equipment was used. The reasons given by those responding in the negative were that the ground surveillance equipment is too heavy to back-pack and too delicate to take the rough treatment it must undergo under field use. Operational data from 36 operations revealed that radars were used on only 12 operations and were effective on 11 as shown in the table above. For additional information on equipment items and recommendations pertaining to these items, see Appendix 7, Annex A.

2. CONCLUSION.

Target detection, identification and location methods and equipment of the maneuver battalion are not adequate for operations in Vietnam.
Appendix 6 to Annex C (Firepower)

KIA 33: Does the organization of the maneuver battalion have an adequate resupply capability to sustain the required firepower for the time period necessary to accomplish the battalion's mission?

1. (U) INTRODUCTION.

This essential element of analysis covers several functional areas. Appendix 1, Annex E (Service Support) contains a detailed discussion of the supply system of the individual units including resupply of Class V. Appendix 11, Annex B (Mobility) discusses the transportation problems in this environment and the individual soldier's difficulty in transporting ammunition items.

2. (C) DISCUSSION.

a. COMPANY.

(1) Battalion S3's were asked if the platoons were capable of carrying enough ammunition to conduct sustained operations using normally available resupply means. The response was unanimous in the affirmative with the proviso that normal resupply includes daily and as required resupply by helicopter. Only once during the operations evaluated was a company resupplied more often than once a day, and this was readily accomplished by helicopter.

(2) The weight of individual loads carried by the infantryman such as recoilless rifle and mortar ammunition, crew served weapons, and extra water were considered serious problems by all operations officers. To solve the problem of an adequate supply of ammunition for the platoon and company to sustain combat on search and destroy operations the 90mm recoilless rifles and some of the 81mm mortars have been left behind so that more ammunition could be carried for the weapons taken. A new platoon or company vehicle may be required to further reduce the ammunition and weapon load of the infantryman, but for this environment it would have to have the following characteristics:

(a) Light weight.

(b) Dimensions permitting lift inside a utility helicopter.

(c) Primarily maneuverable by two men but having the capability of being moved by one.

(d) Capable of negotiating the terrain of Vietnam.

For further discussion see Appendices 6 and 7, Annex B.
b. BATTALION.

(1) Ammunition resupply. Each of the 22 battalion operations officers was queried on the resupply capability of the unit from battalion to company to platoon. When asked if battalion combat operations had ever been limited by shortages of ammunition, 22 respondents provided only one affirmative reply. The reason given for the ammunition shortage was that ammunition bearers for the 120mm mortar and the 90mm recoilless rifle cannot carry sufficient ammunition to provide continuous support. The problem of the weight of ammunition for crew served weapons and the requirement for additional ammunition bearers is discussed in Appendices 1 and 2 of this annex.

(2) Basic ammunition load. When 22 operations officers were asked if the battalion was capable of maintaining an adequate Class V level for all types of operations conducted in this environment, 20 answered in the affirmative. The reasons given in negative replies were attributable to shortages of certain ammunition types in country and not deficiencies in the battalions' resources.

(3) Normal Resupply Means. The element responsible for ammunition supply to the battalion is the transportation section of the battalion support platoon. This element has an ammunition chief, ammunition specialist, and six 2½-ton trucks with drivers. It is capable of maintaining adequate Class V support to the battalion but only when routes to the Class V supply point are secure. In this environment, secure roads do not normally exist; therefore, the resupply of ammunition by organic means seldom can be made to maneuver battalions on operations. When the battalion cannot support the combat operation within its own means, the only safe and efficient means of resupply is to use helicopters which must be requested from higher headquarters either prior to or during the operation. This has proven to be an effective method of Class V resupply.

(4) Ammunition Consumption. Consumption figures are tabulated by ammunition type in Figure C3-1 in Appendix 3 of this annex.

3. (c) CONCLUSIONS.

a. Companies have the capability of transporting or carrying enough ammunition to conduct sustained operations in this environment using normally available resupply means if:

(1) They are resupplied daily during operations,

(2) Helicopters are considered a normally available resupply means;

b. The maneuver battalion does not have an adequate organic resupply capability to meet all combat conditions of this environment.
The organic capability is roadbound and many operations are conducted in areas which preclude its use. Helicopter resupply, however, has been effective in meeting all maneuver battalion requirements for resupply.
Appendix 7 to Annex C (Firepower)

EEA 34: Do the doctrine and organization of the aerial and ground based fire support units provide adequate techniques, procedures, and personnel to support the maneuver battalions' tactical employment?

1. (U) INTRODUCTION

   a. The adequacy of the doctrine and organization of the fire support units in supporting the maneuver battalions was studied in two ways. First, division and brigade commanders and operations officers of the supporting battalions were interviewed directly. Opinion was solicited on their present organization and the changes they recommended in organization and doctrine to meet the requirements of this environment. Questions were asked on the methods of employment of the units, specifically if these methods had proved effective.

   b. The second approach was to ask the maneuver battalion officers after each operation if the support received had met their requirements. Individual fire fights which occurred during the operations were also analyzed to determine the quantity, timeliness, method of control, and effectiveness of the support received. These operational data are discussed in detail in Appendix B and only a brief discussion of them will appear in this appendix.

2. (C) DISCUSSION

   a. AERIAL ARTILLERY.

   (1) General. There is one aerial artillery battalion in Vietnam and it is organic to the 1st Cavalry Division. Questions concerning employment and control were addressed to the battalion commander. The following comments reflect his views.

   (a) Employment. Aerial artillery weapons are normally employed by battery and battalion. In battalion employment, the mission is general support (GS). When batteries are employed separately, the battalion is usually assigned the mission of GS and one or more of the batteries may be given the additional mission of reinforcing (REINF), the fires of a specific direct support artillery battalion.

   (b) Control. The control of aerial artillery has been exercised satisfactorily. It can be enhanced by the addition of an O1-D aircraft with pilot and crew and one UHF (all channel) radio to be used to coordinate aerial artillery with other fire support elements. This requirement is now met by aerial artillery pilots in O1-D.
(2) Evaluation of Commander's Comments.

(a) Control. Assets are presently available within the division aviation general support company to satisfy this requirement if the division artillery or division commander considers it necessary.

(b) Employment. Major unit commanders of the 1st Cavalry Division were asked, "What methods of organization have proved most effective in supporting a battalion or a brigade with aerial artillery?" Responses received from commanders of the three brigades, division artillery, and the aerial rocket artillery battalion included the following comments.

1. Reinforcing the direct support artillery of battalion/brigade.

2. As a general rule, one battery is employed in a GS or GS-Reinforcing mission to the brigade DS artillery battalion. There has been no requirement to modify standard artillery missions.

3. In battalion operations, the aerial artillery may be attached to the DS artillery or have a GS or GS-Reinforcing mission. Aerial artillery is capable of autonomous operations and can support itself with Class V, but it is desirable to position it near DS artillery in order to minimize security and communications problems.

4. In brigade operations the aerial artillery battalion is employed in a general support role with each battery reinforcing the fires of a single direct support battalion. Normally three brigades are committed, two in AO's and one in the division TAOR. This deployment in combination with the general support mission of aerial artillery and its inherent mobility provides it with the flexibility to answer calls for fire whenever and wherever needed with all available resources. On several occasions the battalion has reinforced direct support artillery distant from the division TAOR. In these instances the aerial artillery was attached to the direct support artillery.

(c) Operational Data. Sixteen individual fire fights involving units of the 1st Cavalry Division were analyzed to determine the support received. Aerial artillery was requested seven times and was received each time. It was considered timely six times and on target five times. On all but one of the occasions where damage could be assessed, it was considered effective.
b. ARMED HELICOPTERS.

(1) Employment. Maneuver battalion commanders were asked to discuss the techniques of fire used in the preparation of landing zones in airmobile operations. The following is a description of the method unit commanders felt was most effective.

(a) The sequence of employment of fire support in preparing the landing zone is first the use of close air support followed by artillery, and finally, armed helicopters.

(b) All elements fire a preparation on the LZ and adjacent areas. Armed helicopters also fire aerial rockets along tree lines overlooking the LZ and the areas to be occupied by fire support units.

(c) Armed helicopters fire into the last mile of woodline on the approach to the LZ to cover troop carrying helicopters while slowing down for landing since during this time they are most vulnerable.

(d) Supporting fires provided during the landing are controlled and directed by one person, normally the artillery liaison officer, who is airborne while the landing of the troops takes place.

(e) Average time support is fired:
   1. Close air support, H-45 to H-20
   2. Artillery, H-20 to H-5
   3. Armed helicopters, H-5 to H-hour

(f) During extraction, suppressive fire is provided by armed helicopters.

(2) Equipment.

(a) Major unit commanders, maneuver battalion commanders and armed helicopter platoon leaders were asked, "Has the lack of a significant speed advantage of escort helicopters over transport helicopters been a limiting factor in airmobile operations? If so, how and what is the differential required?"

(b) Of the 39 responses received, 20 considered the lack of speed differential a significant limitation. These 20 responses include the views of the commander of the 1st Cavalry Division and 16 of 17 armed helicopter platoon leaders. The one negative response from an
armed platoon leader was qualified because he already had the 540 system (a larger engine) which satisfied his requirements. The other negative responses were from Infantry commanders. The commanders felt that speed was not a limiting factor. The armed helicopter platoon leaders, on the other hand, stated that they could not break off from the formation, fire suppressive fire, and return to the formation unless their speed differential increased. To permit this mission now, the transport helicopters must slow down and wait for the escort ship. This procedure increases their vulnerability to ground fire.

(c) Speed Differential. The solutions recommended by those responding in the negative are outlined below.

1. 20 to 50 knots minimum: 9
   Cavalry Division

2. 50 knots minimum: 2 (including CG, 1st

3. 100 knots: 2

4. 540 system with increase in endurance - 2

(1) Organization. Division artillery and artillery battalion commanders were asked if six howitzers per battery for direct support units were appropriate in this environment. Nine responses were received. The TOE number of howitzers/guns per battery was considered appropriate to this environment by all respondents. Comments were added which stated that four firing units were sometimes established within the battalion from the three existing batteries to meet the diverse requirements of base camp security and support of operations. It was also stated that this is within the present capability of the artillery organizations.

(2) Employment. Maneuver battalion commanders were asked to describe the ways in which units compensate for the loss of heavy around-the-clock artillery fire support. Their responses are summarized below.

(a) Medium and heavy artillery is frequently available for operations (See Appendix 8, this Annex). Heavy artillery, 8" howitzers and 175mm gun, is seldom moved and provides mostly H&I fires and LZ preparation fires from base camp areas. It has been moved, however, when the enemy has been contacted in force.

(b) Close air support, both Air Force and Navy, has provided effective fire support on most of the operations. On only two operations of 41 was the fire support reported as inadequate because...
medium and heavy artillery was out of range and weather precluded the use of tactical aircraft. B-52's have provided the destructive effects required on enemy base camp areas and tunnel complexes.

(c) The enemy is out-gunned by the 105mm howitzer and this weapon is effective against personnel targets. A heavier high explosive capability is needed to destroy bunkers and fortifications and has been provided by tactical aircraft when medium and heavy artillery were not available. The use of heavy and medium artillery on operations will increase as roads are secured.

(3) Doctrine.

(a) Basic principles of artillery employment require the delivery of timely and accurate fire to meet the requirements of the maneuver elements. Of the 48 individual fire fights analyzed, artillery was requested 32 times. It was received in adequate quantity on all occasions and was timely 28 times. It was on targets 31 times. It was considered effective 27 times and partially effective three times, and ineffective twice.

(b) The point of artillery doctrine most difficult of achievement in this environment is that of mass. Because of the distances imposed by the requirement to provide support in all parts of the AO and TACFOR, artillery is sometimes positioned so that only one battery can be massed and is often positioned so that no more than two batteries can be massed in support of the maneuver elements. The advantages of mass can be expressed by an example: to achieve 20 percent casualties against a 120 x 150 meter target composed of troops on the defense, rear foxholes, it would require six successive volleys from two batteries of 105mm howitzers or one volley from three batteries firing 70M. This is 72 rounds as opposed to 18. One battery could never achieve more than 17 percent casualty fraction against this target. (Reference, para 497, FM6-40). The data presented in 1(a) above on specific encounters does not, however, reflect any deficiency in present artillery support.

d. FIRE SUPPORT COORDINATION. Major unit commanders, maneuver and artillery battalion commanders, and armed helicopter platoon leaders were asked if available resources were adequate for fire support coordination. If their reply was negative they were asked to state the additional resources required. A total of 52 responses was received. Resources available for fire support coordination in this environment were considered adequate by 44 respondents. There was at least one negative response from each of the four major units being evaluated. The problems outlined by those responding in the negative and the number of such responses are listed below:

C-7-5
(1) Insufficient liaison teams - 5
(2) Insufficient communications and/or personnel - 4
(3) No airborne command and control facility for DS artillery commander - 2
(4) No airborne command and control facility for maneuver battalion commander - 1
(5) Inadequate coordination of US and allied ground, air, and naval fire - 2
(6) Lack of FM communication between helicopters and artillery - 1

Additional discussion of these problems appears in Appendices 3 and 4, Annex D.

3. (C) CONCLUSIONS.

a. The doctrine of aerial and ground based fire support units provides adequate techniques and procedures to support the maneuver battalions' tactical employment. The inability to mass artillery battery fires in many situations has not yet proved a limitation in this environment. The problems encountered with metro and survey are discussed in Appendix 10 of this annex.

b. Based on the discussion in 2b(2) above and the consensus of the armed helicopter platoon leaders, a speed advantage for escort helicopters over transport helicopters is required in order that the escort mission of providing suppressive fires can be accomplished effectively. This speed differential should be on the order of 50 knots.

c. The organization of the fire support units are adequate to permit the performance of all support missions. The support provided to maneuver elements by the aerial and ground based artillery has been reported as excellent for all operations (See Appendix 10, this annex). There are no indications that the organizations' resources are inadequate.
Appendix 8 to Annex C (Firepower)

EEA 35: Are the weapon systems of the aerial and ground based fire support units adequate in terms of range, lethality, and mobility to support the maneuver battalions?

1. (C) DISCUSSION

a. GENERAL. The adequacy of the aerial and ground based weapons systems supporting the maneuver battalion in terms of range, lethality, and mobility was determined by interviewing commanders and by studying targets now being engaged to ascertain the missions assigned to these weapons in this environment. Commanders and staff officers were asked if the quantity and types of tubes available and the required stand-off range of supporting weapons were adequate. Additionally, operations officers of fire support elements were asked after each operation to describe the targets engaged, weapons used, range at which employed, and the types of ammunition expended. This information was added to an analysis of actual fire fights which occurred during the operations and which required fire from supporting weapons. A report was given each time of the quantity, timeliness, accuracy, and effectiveness of the supporting fires received.

b. RANGE.

(1) Aerial Weapons.

(a) The questions outlined in paragraph 1a above were asked of armed helicopter platoon leaders. Fourteen responses were received on targets they encountered during an operation and the engagement range and weapon system used on each. These data appear in Figures C8-1 and C8-2.
PERSONNEL TARGETS ARE ENGAGED BY ARMED HELICOPTER VERSUS RANGE.
Figure C8-2 (C), frequency material targets are engaged by armed helicopters versus range.
Their recommended stand-off ranges for helicopter mounted weapons systems are presented below.

### NUMBER OF RESPONSES FOR EACH RANGE

<table>
<thead>
<tr>
<th>STAND-OFF RANGE, METERS</th>
<th>2.75in Rkt</th>
<th>7.62mm MG</th>
<th>40mm GL</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 - 50</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>75 - 100</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>150 - 200</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>250 - 500</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>550 - 1000</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1050 - 1500</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>1550 - 2000</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2050 - 2500</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2550 - 3000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDIAN</td>
<td>500 - 1500</td>
<td>500 - 1000</td>
<td>500 - 1000</td>
</tr>
</tbody>
</table>

(b) These data indicate little uniformity of judgment on a required or desired stand-off range for helicopter mounted weapon systems. There were three major factors considered by the pilots when estimating these stand-off ranges.

1. The effective range of the weapon.
2. Avoidance of anti-aircraft fire.
3. The requirement to register, if possible, before firing for effect.

(c) The effective range of the weapons systems is fixed and any increase through research and development would be an advantage to the pilots. Enemy anti-aircraft fire is generally .30 caliber but on numerous occasions armed helicopters have encountered .50 caliber weapons using tracers. This would make the minimum safe stand-off distance for armed helicopters about 1500 to 2000 meters. The problem of registration is the one most frequently mentioned by the pilots. It is a particular problem with the 40mm system which not only has a short effective range (1200 meters) but is also a low velocity system, (750ft/sec) which makes registration before fire for effect almost impossible.

(2) Artillery

(a) Engagement Ranges. The fire support element was asked after each operation to describe the type of targets engaged with artillery and the ranges at which they were engaged. The information provided appears in Figure C2-2 and C2-4, Appendix 2 of this annex. The engagement range of direct support artillery on targets reported for 13
operations appear in Figure C-3

(b) Stand-Off Ranges.

1. The question, "Where is direct support artillery positioned with respect to forward maneuver elements?" was asked of artillery battalion commanders and operation officers on a one time basis. Fourteen responses were received with the following variety of answers:

a. Direct support artillery is normally located between 800-11,000 meters to the rear.

b. It is located on the flank.

c. It is located in front of supported unit when a search and destroy mission is moving toward the artillery position.

d. It is located so that two-thirds of the artillery range is beyond the supported unit.

e. It is located where it can best support the mission.

f. In some instances, support has been provided from base camp.

2. These responses, except for the doctrinal statements in d. and e. indicate the limitations imposed by this environment in the positioning of artillery. In jungle and mountainous areas of Vietnam, locations suitable for artillery positions are limited, and since artillery is displaced by helicopters to these areas, full utilization of the position is imperative. This is verified by examination of Figure C-3 which shows that the percentage of targets engaged at all ranges is approximately equal except for direct fire and fire at minimum and maximum ranges.

3. The reasons given for the lack of a meaningful standoff distance for direct support artillery apply and are even more pronounced with general support artillery. Heavy artillery, 8" howitzers and 175mm guns, is seldom moved from a base camp area. Medium artillery, 155mm howitzers, is taken on operations occasionally but insufficient data were available to determine engagement ranges of targets. However, some operations are conducted within range of base camp artillery and much of the supporting fire from these weapons is in the maximum range bracket.

c. LETHALITY.

(1) Discussions of lethality aspects of serial and ground
FIGURE C8-5(c), FREQUENCY OF TARGETS ENGAGED BY DIRECT SUPPORT ARTILLERY RANGE.

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FREQUENCY OF OCCURRENCE CUMULATIVE PERCENT

RANGE, METERS

2000 4000 6000 8000 10000 12000

105mm HOWITZER
based weapons appear throughout this annex. A discussion of the improvement which could be made to the ammunition mix is presented in Appendix 9 of this annex. A discussion of the lack of organic medium artillery in the 1st Cavalry Division also appears in Appendix 9.

(2) Twenty-five battalion operations were analyzed for the type, timeliness, effectiveness, quantity, and source of the required non-organic fire support. Only two of the 25 operations did not require non-organic support at some time. Respondents described non-organic artillery fire support required during the operation as followings:

**Operations on which General Support Artillery Received**

<table>
<thead>
<tr>
<th>Caliber</th>
<th>1st Inf Div</th>
<th>1st Cav Div</th>
<th>173rd Abn Bde</th>
<th>101st Abn Bde</th>
</tr>
</thead>
<tbody>
<tr>
<td>105mm</td>
<td>7</td>
<td>12</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>155mm</td>
<td>7</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8&quot;</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>175mm</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARA</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Operations on Which General Support Artillery Received**

<table>
<thead>
<tr>
<th>Source of Artillery</th>
<th>1st Inf Div</th>
<th>1st Cav Div</th>
<th>173rd Abn Bde</th>
<th>101st Abn Bde</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Inf Div Arty</td>
<td>7</td>
<td>10</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>1st Cav Div Arty</td>
<td>6</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>IIForceV</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Royal Australian Arty</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Royal New Zealand Arty</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>RVN</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

General support artillery was considered adequate by all 23 respondents. All requests for general support missions were granted and it was considered timely and effective 100 percent of the time.

(3) One measure of the adequacy of the quantity of artillery support is whether required H&I missions can be accomplished. After each operation, the fire support element was asked what percentage of the total artillery ammunition expenditure was fired for H&I. Responses covered 25 operations; on the average 24.3 percent of all artillery ammunition fired was for H&I. The results are summarized below.

**Percentage of H&I**

<table>
<thead>
<tr>
<th>Source of Artillery</th>
<th>1st Inf Div</th>
<th>1st Cav Div</th>
<th>173rd Abn Bde</th>
<th>101st Abn Bde</th>
</tr>
</thead>
<tbody>
<tr>
<td>4%-15%</td>
<td>7</td>
<td>12</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>12%-80%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4%-27%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50%-70%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.5%</td>
<td>31.5%</td>
<td>14.1%</td>
<td></td>
<td>60%</td>
</tr>
</tbody>
</table>

C-8-7
d. MOBILITY.

(1) The discussion of the stand-off range for artillery in paragraph 1b (2)(b) above, points out the difficulties of positioning artillery in this environment. Heavy artillery is roadbound and as roads are opened up, the use of these weapons in support of tactical operations will increase. Medium artillery has been airlifted but the lift requires CH-54's for weapons and ammunition (See Appendix 1, Annex B).

(2) The recent introduction of the lightweight 105mm howitzer, M102 has improved the mobility of the direct support artillery of the 1st Cavalry Division. A discussion of the impact of this new weapon on mobility appears in Appendix 1, Annex B.

2. (c) CONCLUSIONS

a. The range, lethality, and mobility of supporting weapons are considered adequate for this environment, except for a lack of medium artillery in the 1st Cavalry Division which is discussed in Appendix 9. This does not mean, however, that improvements in any of these factors would not be beneficial to combat in this environment. The benefits which would be derived from such improvements are apparent from the discussions throughout this annex of the problems related to mobility in this environment.

b. The required stand-off range for aerial weapons is a combination of the effective range of weapon, the intensity and caliber of anti-aircraft fire, and the pilot's desire to maximize the terminal effects on the target. Consideration of these trade-offs produced various responses from individual pilots and platoon leaders and the median shown in paragraph 1b(1)(a) above is merely representative of the tactics of the majority.

c. The frequency of ranges at which direct support artillery engage targets is given in Figure C8-3. A desired or required stand-off range cannot be determined because:

(1) There is a limited number of suitable areas to position artillery in many sections of Vietnam.

(2) Maximum use of each position must be made because of the requirement to displace by helicopter.
EEA 36: Does the firepower of the aerial and ground based fire support units provide adequate terminal effects to support the maneuver battalions?

1. (U) INTRODUCTION

a. GENERAL. The discussion of terminal effects in this annex will consider only those effects listed in paragraph 23 b(2) FM6-20-2, Field Artillery Techniques. Those effects are neutralization, destruction, interdiction, and harassing fires. In the case of aerial artillery and armed helicopters, the effect of suppression is considered to be synonymous with neutralization.

b. TARGETS. The varied nature of the targets described in Appendix 2 (Figures C2-2, C2-4, C2-6, and C2-7) call for high explosive shell with impact, delay, and air burst fuze options. These shell and fuze options are available in light, heavy, and medium ground based artillery but are not all available for aerial artillery and the armed helicopters.

c. EFFECTS. While the method of attack of a target is determined largely by the type, size (dimension or scale), density (number of personnel or positions comprising the targets), attitude (posture) of personnel and cover (vegetation or protective cover), the results desired or terminal effects are a guide to the intensity of fire to be placed on the targets. (Chapter 30, FM 6-40).

d. MEASUREMENT OF EFFECTS. Since terminal effects are the results desired, their adequacy can be measured directly by determining satisfaction with results expressed by the supported unit commanders. Adequacy of terminal effects in this annex are treated in terms of:

(1) Responsiveness to the maneuver battalion request for fire.

(2) Timeliness of the fire.

(3) Effectiveness of the fire. If the requester was satisfied, the assumption is made that the desired effect was obtained.

2. (C) DISCUSSION

a. GROUND BASED ARTILLERY SUPPORT.

(1) Of nine respondents, two division artillery commanders and seven direct support artillery battalion commanders, eight considered the ground based artillery support for ground and air mobile
(2) Operational data based on responses by maneuver battalion commanders participating in 48 combat operations are shown below. They indicate that 80 percent of the ground based artillery fire delivered on target was considered effective by maneuver battalion commanders. In the cases where effect was not adequate, or partially adequate, it was attributed to lack of accuracy or timeliness.

<table>
<thead>
<tr>
<th>NUMBER OF ENGAGEMENTS</th>
<th>FREQUENCY THAT FIRE WAS:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>REQUESTED</td>
</tr>
<tr>
<td>48</td>
<td>42</td>
</tr>
</tbody>
</table>

b. AERIAL ARTILLERY SUPPORT.

(1) There is only one assigned aerial rocket artillery (ARA) battalion in Vietnam. The Commanding Officer was queried concerning the available ammunition mixes, their adequacy to support maneuver battalions, and what, if any, other types of ammunition were required. Information was also available from after action reports submitted by the ARA Commanding Officer for operations from 1 to 20 January 1966 and from 24 January to 3 February 1966. Only the artillery aspects of UH-1B armament are considered under the subject of aerial artillery.

(2) Two respondents from the 1st Cavalry Division stated a need for heavier aerial artillery support in order to obtain desired effects in airmobile operations. The 2.75" rocket does not have the capability to penetrate fortified positions or overhead cover and has no fuze option other than point detonating. A delay fuze option plus a more destructive punch is desired. Two solutions were presented. One suggested the addition of a battery of 4.5" aerial rockets (12 helicopters). The other solution recommended 4.5" aerial rockets in exchangeable clusters, so that each rocket artillery helicopter could be selectively armed.

(3) Information on the adequacy of the terminal effects of aerial and ground based fire support units, not organic to the maneuver battalions, was gained from responses by maneuver units for 48 engagements.

(a) The 48 engagements included 16 airmobile units. During these engagements aerial rocket artillery was requested seven
times. It was received six times. On these six occasions, all fires were timely, five were on target (the other time coverage was fair), half were effective, one was partially effective, and two were ineffective.

(b) These operational data, reinforced by comments from the supported units, show that aerial artillery support was not consistently effective in the 1st Cavalry division, and was considered inadequate in comparison to direct or general support artillery. This is directly attributable to the small caliber of the rocket and the lack of shell and fuze options needed to produce desired effects on the target. The data indicate that the 1st Cavalry Division has a need for aerial artillery having the terminal characteristics of medium artillery to provide general support artillery fires in airborne operation.

(4) Only 18 SS-11 anti-tank guided missiles were fired during the period 15 September 1965 to 3 February 1966. This information was obtained from ammunition expenditure records. No suitable SS-11 targets have been encountered in RVN thus far. This weapon has only limited application against hard point targets which constitute approximately 16 percent of all targets engaged by both aerial artillery and armed helicopters. (See Appendix 2, Figure C2-4.)

c. AERIAL WEAPONS OTHER THAN AERIAL ARTILLERY.

(1) The adequacy of terminal effects for aerial weapons other than aerial artillery was determined by interviews with and responses from 10 armed helicopter platoon leaders and an examination of the targets they encountered in 14 operations. Figure C2-4 shows a total of 82 percent personnel and 16 percent materiel targets were encountered.

(2) Armament Available.

(a) 2.75" rocket, high explosive round with point detonating fuze.

(b) 40mm grenade, high explosive round with point detonating fuze.

(c) 7.62mm machine gun ammunition, all standard types.

(3) Operational data did not yield specific responses from supported unit commanders or from the armed helicopter platoon commanders on the adequacy of weapons systems in producing a desired effect upon the target. Comments were made, however, concerning the adequacy of the weapons and the ammunition mix. Adequacy of effects can be deduced from the weapons and ammunition deficiencies since
characteristics of the weapon are related to volume of fire and accuracy of delivery and the burst characteristics are related to lethality. Volume of fire, accuracy, and burst characteristics are in turn all functions of effect.

(4) Comments were made concerning the adequacy of the ammunition mix as follows:

(a) 2.75" Rocket. A requirement was expressed by four of the respondents for a selective system to fire white phosphorus (WP), high explosive (HE), or high explosive anti-tank (HEAT) rounds. In addition, one respondent expressed a requirement for variable fuze options.

(b) 40mm Grenade. The range of 700 to 1200 meters and muzzle velocity of 750 feet per second were described as inadequate by eight respondents. The range is not compatible with other weapons systems and the muzzle velocity is not rapid enough to permit adjustment by burst. A requirement for a tracer type round to be used in adjustment was also expressed by eight respondents. Additionally, one respondent desired an incendiary round. Four respondents stated the hopper capacity was too small and that the capacity had been increased locally from 200 to 300 rounds.

(c) 7.62mm Machine Gun Ammunition. Six of the respondents commented about low reliability of the weapon because of weak pull motors and failure of parts. Ammunition as such was suitable.

3. (c) CONCLUSIONS

a. GROUND BASED ARTILLERY. The firepower of ground based artillery provides adequate terminal effects in support of the maneuver battalion.

b. AERIAL ARTILLERY.

(1) The 2.75" rocket is not adequate for attack of a majority of personnel targets encountered. Effective attack of personnel in trenches, foxholes, rice paddies and swamps requires an air-burst fuze. A selective system is required to fire shell HE, WP, or HEAT with fuze options to provide surface, air, or delay burst as appropriate to insure proper attack of targets.

(2) Available calibers for aerial rocket artillery are not adequate to provide effects equal to medium artillery support for airborne operations. This deficiency can be corrected by the development of the 4.5" rocket with the shell and fuze options described above.
C. AERIAL WEAPONS OTHER THAN ARTILLERY.

(1) Conclusions for the 2.75" rocket armament system in paragraph 3b (1) above apply.

(2) The 40mm grenade launched by the M5 launcher is considered effective. However, the development of a tracer round increased range and velocity, and increased hopper size will improve the capability of the delivery system and the accuracy of fire.

(3) The 7.62mm machine gun produces adequate terminal effects, however its reliability should be improved by increasing reliability of pull motors and parts.
EEA 37: Does the organization of the aerial and ground based fire support unit provide for continuous fire support throughout the supported organization's area or operation?

1. (C) INTRODUCTION

a. GENERAL.

(1) Artillery commanders were asked to comment on the adequacy of meteorological and survey resources and the capability of battery, battalion and division artillery to conduct split fire direction operations. Nine artillery battalion commanders and one division commander responded as follows:

(a) Metro adequate: 60 percent

(b) Survey adequate: 40 percent

(c) Capable of split FDC operation: 100 percent

(2) Division, brigade and division artillery commanders were asked to comment on the capability of artillery to deliver continuous fire support throughout their respective areas of influence. Ninety percent of these respondents considered the number of artillery tubes and caliber adequate to provide continuous support in all types of operations in Vietnam.

b. TAOR AND AO. The terms area of operations and tactical area of responsibility are defined in detail in paragraph 1, Section II of the ARCOV Report. In general the area of operations (AO) considered in this appendix is an area of from 37 x 26 kilometers to 40 x 40 kilometers in which a unit operates tactically for a definite period of time. A0's may be from 20 to over 280 kilometers from the tactical area of responsibility (TAOR) where the unit has certain continuing tactical responsibilities such as the defense of key installations. The important consideration is that elements of division or brigade have the requirement to conduct simultaneous operations in widely separated hostile areas.

2. (C) DISCUSSION

a. METEOROLOGICAL SUPPORT.

(1) Out of 10 artillery battalion S3's addressed, six considered that the meteorological information provided was adequate to produce accurate and timely ballistic data. One battalion commander believes erroneously that atmospheric conditions were so uniform
throughout the day that meteorological data was not necessary.

(2) Two of the four negative responses were from the direct support battalions of the airborne brigades. These do not have organic meteorological sections and receive meteorological support from external sources. Two additional negative responses were received from the 1st Cavalry Division. All negative responses stated, in essence, that atmospheric conditions are not sufficiently homogenous to provide valid data throughout the area of all subscribers with the great distance between batteries and meteorological stations.

(3) The chart below shows the ballistic effects caused by atmospheric variations during one 18 hour period in March in the Phu Loi area. The maximum variation in effects (105 HOW, Ch 7, range 7500 meters) is four probable errors in range and two probable errors in deflection. This variation is sufficient to establish a need for meteorological data.

**BALLISTICS EFFECTS DUE TO ATMOSPHERIC VARIATIONS - PHU LOI, VIETNAM**

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME</th>
<th>DEPOLCTION, MILS</th>
<th>RANGE, METERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 March</td>
<td>1218</td>
<td>R 10</td>
<td>+ 185</td>
</tr>
<tr>
<td>19 March</td>
<td>1821</td>
<td>R 18</td>
<td>+ 156</td>
</tr>
<tr>
<td>20 March</td>
<td>0612</td>
<td>R 12</td>
<td>+ 210</td>
</tr>
</tbody>
</table>

(4) No data are available in Vietnam concerning the homogeneity of atmospheric conditions in any of the areas where US troops are now operating. No judgment can be made of how distant or how great an area one meteorological station can service. It is clear, however, when division artillery units operate in widely separated areas, such as those described in paragraph 1b above, obviously effecting homogeneity of the weather, the meteorological section cannot reasonably service both areas. In this event the unit should be given meteorological assistance by detachments from higher headquarters.

b. SURVEY SUPPORT.

(1) Six of 10 respondents stated that resources normally available to division artillery and brigade artillery are not adequate to provide survey in Vietnam.

(2) The norm in this environment is for artillery batteries and battalions to operate without survey control using map data and observed fire techniques. Because of the extended distances between batteries and battalions, (See para 1b) it is beyond
the capability of the battalion and division artillery survey sections to tape, and it is impossible to use the telurometer in areas covered with jungle and dense underbrush.

(3) Survey sections cannot operate in the hostile environment without the commitment of additional security for their protection. Battalions organic to or in direct support of separate brigades have these same limitations to a greater degree because they do not have the brigade slice of a division artillery survey capability.

c. CONTINUOUS FIRE SUPPORT TO MANEUVER ELEMENTS.

(1) Eleven one-time responses were obtained from eight brigade commanders, two division artillery commanders and one division commander. Ten of the 11 considered the artillery capable of providing continuous support under all conditions of combat in Vietnam.

(2) Data from 48 operations indicates that artillery support was requested 41 times and the artillery could not provide support only once because it was not in position to fire.

3. (c) CONCLUSIONS.

Organization of the aerial and ground based artillery units provides for continuous fire support throughout the supported unit area of operations. However, the following problem areas have been defined:

a. METEOROLOGICAL SECTIONS.

(1) Artillery fire in this environment is adversely affected without accurate and timely meteorological data.

(2) Operations in Vietnam require artillery battalions and batteries to operate at considerable distances from meteorological sections. When artillery fire units operate in areas separated from a meteorological station by great distance or by terrain or other physical conditions which may influence the homogeneity of atmospheric temperature, density and wind velocity, the meteorological section cannot reasonably service these units. In this event, they should be reinforced with a meteorological section from higher headquarters.

b. SURVEY.

(1) Personnel and equipment normally available to division artillery or artillery battalions and brigade artillery battalions cannot provide survey control in Vietnam. Augmenting existing survey sections with additional personnel and presently available survey equipment will not solve the problem.
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(2) It is not practical to commit maneuver units to protect survey parties operating through enemy controlled territory.

(3) The line of sight limitations of the telurometer prevent obtaining accurate distance measurement without traversing the ground.

(4) A requirement exists for a distance and azimuth measuring system that is not line of sight and does not require physically traversing the distance measured. This system should be capable of obtaining accuracies similar to those obtained with the telurometer with angular values executed to 5th order accuracy.
Appendix II to Annex C (Firepower)

EEA 38: Is the capability to detect, identify, and locate targets throughout the division or brigade area of operations adequate in terms of the maneuver battalions' requirements for timeliness and response?

1. (U) INTRODUCTION

The maneuver battalion receives target information from forward observers of the fire support units, from radar equipment within the division/brigade and from non-organic sources such as infrared, side looking airborne radar, and aerial photography. Information was solicited from battalion intelligence offices on their experience in obtaining useful information from these sources. They were also asked after each operation to state the target acquisition means used and those which proved effective.

2. (C) DISCUSSION

a. FORWARD OBSERVERS.

(1) Maneuver battalion S2's were asked after each operation if there were sufficient observers, ground and aerial, to maintain adequate surveillance of the battle area. Fifty-five responses were obtained from 22 maneuver battalions S2's covering a total 31 operations. Of these operations, 27 were reported to have had a sufficient number of observers on hand. One respondent said he could have used more aerial observers on four separate operations. Aerial observers were on call when needed, but this S2 felt one of them should have been airborne over the battalion during daylight hours.

(2) During the 48 specific fire fights outlined in Appendix 2, of this Annex, artillery was requested and controlled by the forward observer 32 times. Artillery support was received every time it was requested and was timely 29 of the 32 times. In the other 16 engagements, aerial support controlled by aerial observers (FAC's) was requested and received 14 times. Only two engagements did not receive it, and neither of these situations was created by the lack of aerial or ground observers.

b. ORGANIC EQUIPMENT.

(1) Artillery battalion S2's, were queried on the adequacy of their equipment in acquiring and locating targets and performing required counter mortar/battery missions. Nine responses were received concerning the AN MPQ-4 radar and a summary of opinion appears below.

C-11-1
(2) Main problem areas cited by the respondents were:

(a) Excessive requirement for maintenance, lack of back-up capability.

(b) Difficulty in employing the equipment in this environment.

The first problem area can be alleviated by improving reliability and maintenance of existing equipment and by establishing a high priority for the supply of replacement parts. The second problem area can be resolved only by development of more rugged equipment with vastly increased coverage capability.

(3) As previously discussed in this Annex and in Section II, Volume I, the units being evaluated operate from base camps. These bases are subject to mortar attacks at any time from any direction. Additionally, units are periodically committed to areas of operations where forward bases and artillery positions have to be established. These positions, too, are vulnerable to mortar attack and must be secured. To compound the surveillance problem, the artillery battalion is consistently split into three widely separated battery positions to allow the greatest artillery coverage of the area of operations. This type of deployment generates the following requirements:

(a) A need for 64,000 mil coverage of key bases and facilities.

(b) A target location and surveillance system which can operate at the TAOR or accompany units to an AO.

(c) A range capability that would cover, at the minimum, the range of enemy medium mortars. Consideration should also be given to the recent introduction of 120mm mortars by the enemy and his possible use of artillery.

EEA 38 C-11-2
(4) The present system of AN/MPQ-4 radars and forward observers is grossly inadequate to meet the above requirements. Even augmented by the continuous use of small patrols, the system has been only marginally effective. Since the weight and bulk of the AN/MPQ-4 are excessive for air assault operations, the artillery relies solely on ground and air observers for target location. Even if the AN/MPQ-4 were taken on operations it would only be available to a limited number of batteries and be of limited value because of the 44.5-mil scan limitation.

(5) The AN/MPQ-4 is generally left at base camp in support of the division. There are four such sets, one per artillery battalion. This in itself creates a problem since the 1st Infantry Division is split into five areas (two division areas and three brigade areas). The radars are left at the division main area to protect priority equipment; therefore, the artillery at brigade base area must rely on infantry target acquisition means such as the AN/PPS-4 and the AN/TPS-33, whose deficiencies are pointed out in Appendix 5 of this Annex.

c. NON-ORGANIC SOURCES

(1) Maneuver battalion S2's were asked after each operation, "What means were used other than observers for battlefield surveillance and target acquisition?" The responses for organic battalion means are tabulated in Appendix 5 of the Annex. Thirty-six responses covering 32 operations were received and the results are summarized below:

<table>
<thead>
<tr>
<th>Means</th>
<th>Number of Times Used</th>
<th>Number of Times Considered Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrared</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Aerial Photography</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>SLAR</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Radio Reconnaissance</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Unit and Special Agent Reports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Cavalry Troops</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

* Some units reported more than one means used during an operation.

(2) Target detection and location is accomplished almost entirely by front line units and observers. This is evident from Figure C2-6. Information received from non-organic sources consists mainly of general locations of enemy concentrations and specific locations for H&I fires. These non-organic means were considered effective 70 percent.
of the time when used on operations.

3. (C) CONCLUSIONS

a. The data and the responses to interviews indicate that there are sufficient personnel and equipment to perform the observer mission and there is no evidence that existing resources are excessive.

b. There is a need for an improved target acquisition/surveillance system in Vietnam. This system should include a countermortar/battery detection capability which meets the requirement stated in paragraph 2b(3).

c. An increased number of the AN/MPS-4's within the artillery battalions would improve the existing capability but it would require an exorbitant number to provide the necessary coverage in its present configuration alone.
ERA 39: In terms of firepower requirements, does the organization of the supporting fire support units provide an adequate, responsive re-supply capability?

1. (c) DISCUSSION

a. Operations officers of nine ground fire support units reported that battalion combat operations had never been limited by shortages of ammunition. The same officers also stated that the units were capable of maintaining an adequate Class V level for all types of operations conducted in this environment. Even when asked if ammunition resupply means had been adequate to meet periods of high ammunition consumption without a decrease in the fire support available to the maneuver battalions, the answers were unanimously affirmative from all nine fire support battalions.

b. Accurate data on total ammunition expenditure for aerial artillery were obtained only one time. However, 23 responses were received from ground based artillery battalion S4's on ammunition consumption. From these responses, complete information was available on 13 operations and results are shown in Figure C12-1. Additional information on a monthly consumption basis was available from the 173d Airborne Brigade and these rates are included below. Since 155mm, 8", and 175mm pieces are not normally used as direct support weapons (See Figure C12-2), sufficient data were not available for the computation of combat rates. These weapons are usually assigned general support, reinforcing roles where the majority of their fires are harassing and interdiction.

c. AMMUNITION CONSUMPTION RATES.

(1) 105mm Howitzer

(a) 42 rounds per tube per day (Figure C12-1)

(b) 16 rounds per tube per day (173d Airborne Brigade three month expenditure).

(c) 24 rounds per tube per day (173d Airborne Brigade required supply rate (RST) for next three months).

(2) 2.75 Inch Rocket. In Operation Masher, which lasted 10 days and Operation Matador, which lasted 20, the aerial artillery battalion of the Ist Cavalry Division expended 10.1 rounds per aerial weapon per day.
<table>
<thead>
<tr>
<th>NAME OF UNIT OPERATION</th>
<th>TYPE OF OPERATION</th>
<th>DURATION</th>
<th>AMMUNITION CONSUMPTION</th>
<th>NUMBER OF TUBES</th>
<th>RDS/TUBE/DAY</th>
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<tbody>
<tr>
<td></td>
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<td>TOTAL EXPENDED</td>
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<td>S&amp;D</td>
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<td>-</td>
<td>14408 - - -</td>
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<td>-</td>
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### Figure C12-1, Ammunition Consumption by Operation (Cont'd)

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<tr>
<th>NAME OF UNIT OPERATION</th>
<th>TYPE OPERATION</th>
<th>DURATION</th>
<th>AMMUNITION</th>
<th>NUMBER OF TUBES</th>
<th>RDS/TUBE/DAY</th>
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<td>5978 - - -</td>
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<td><strong>MEAN AVERAGE</strong></td>
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<td>12 7.85 4900</td>
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</table>

1/ 1st Inf Div = A, 173d Abn Bde = B, 1st Cav Div = C, 1st Bde, 101st Abn = D.
2/ Average taken from sample of 13 operations where number of days, ammunition and number of tubes were known.
FIGURE C12-2(U) MISSION OF HEAVY & MEDIUM ARTILLERY
The organization of the supporting fire support unit provides an adequate, responsive resupply capability to meet the fire power requirements of the maneuver elements.
Appendix 13 to Annex C (Firepower)

EEA 40: Do the doctrine and organization for use of non-organic aerial and ground based fire support elements provide the techniques, procedures, personnel, and equipment required to support the division or brigade operations?

1. (U) INTRODUCTION

Maneuver battalion operations officers were interviewed on a one time basis on the requirements for forward air controllers (FAC), how they were used, and if they were effective in exploiting the full firepower potential of the supporting aircraft. They were also asked if adequate close air support sorties were available to support all maneuver battalion employments. This information was added to an analysis by operation of the availability and usage of aerial and ground based fire support to provide an answer to this EEA. The adequacy of non-organic ground based fire support is discussed in conjunction with division artillery in Appendix 5, Annex C and the problems pertaining to tactical aircraft are addressed below.

2. (U) DISCUSSION

a. AVAILABILITY. The question, "Were adequate close air support sorties available during the operation?" was asked of battalion operations officers. Responses were received from 21 battalion 3's participating in 45 different operations. Responses indicated that close air support was available in 43 of these 45 operations. On the two occasions when it was not available, weather precluded its use.

b. CONTROL

(1) Immediate requests for close air support are usually initiated by the unit on the ground to the battalion Forward Air Controller (FAC) who calls for and controls the strike aircraft. When an airborne FAC discovers targets of opportunity he coordinates with the ground unit prior to the strike. During active periods, strike aircraft are maintained on combat air patrol (CAP) awaiting targets in areas previously coordinated with the airborne FAC by the unit on the ground. The number of aircraft sorties is coordinated between the battalion FAC's and the battalion or brigade Air Liaison Officer.

(2) Requests for pre-planned close air support missions are submitted by 1100 hours the day before the support is required. Such requests may be submitted by commanders of companies, battalions or brigades through the Air Liaison Officer (ALO) to the Tactical Air Control Center (TACC). Again, actual direction of the strike aircraft is by the FAC.
(3) Battalion S3's were asked if present procedures for obtaining and controlling close air support is effective. The question was answered by 22 officers, 19 of whom considered present procedures effective. Specific comments of those dissatisfied with these procedures are listed below:

(a) More than one FAC per battalion is needed because the demand for air firepower increases as the supported unit gains confidence in close air support.

(b) When an airborne FAC is employed a ground FAC is needed for closer coordination with the airborne FAC. This will provide greater accuracy and increased troop safety during friendly air strikes.

(c) One respondent said that the effectiveness of the FAC is often reduced because of inadequate communications. For discussion of communications see Appendix 9, Annex D.

3. (U) CONCLUSIONS

a. Doctrine and organization for use and employment of close air support does provide adequate techniques, procedures, personnel and equipment to support battalion, brigade or division operations.

b. Conditions of visibility rather than tactics are the determining factors in the number of FAC's required.