ANNEX C

(U) AIRCREW BIOGRAPHICAL INFORMATION (U)

Each mission included a pilot, gunner, and crew chief. Individual pilot-gunner teams always flew together. Biographical information is included here to record the experience level and relevant personal data regarding the crew members. Data for the gunners on teams Alpha and Charlie are not available at this time.

AIRCREW BIOGRAPHICAL DATA

NAME Fenwick, Scott E. (Pilot, team Alpha)

GRADE CW2 SERIAL # 045364795

AGE 24 PRIMARY MOS 100E

DUTY MOS 100E SECONDARY MOS 100B

What aircraft are you qualified to fly? AH-1G - UH-1A, B, D, H
TH-55

Do you hold an instructor rating? No

Do you hold an instrument rating? No

About how many mock (CDEC) TOW firings did you do? 200

Indicate below flying duty assignments:

Unit Name	Location	From To	Types AH	Types Mission	Approximate Hours Logged
C Btry 2nd 20th ARTY 1st AIR CAV DIV	RVN	June 70 June 71	AH-1G	Combat Escort and Aerial Rocket Artillery	1100
155th AVN Co.	Fort Ord, Calif.	June 71 now	UH-1 AH-1G	Training R & D Combat	

Figure C-1 AIRCREW BIOGRAPHICAL DATA

AIRCREW BIOGRAPHICAL DATA

NAME Hixson, Douglas R. (Pilot, team Charlie)

GRADE CW2 SERIAL # 529603455

AGE 26 PRIMARY MOS 100E

DUTY MOS 100E SECONDARY MOS 100B

What aircraft are you qualified to fly?
OH-13 E-G UH-1 B, D, H AH-1G

Do you hold an instructor rating? Instrument I.P. (unit)

Do you hold an instrument rating? Yes

About how many mock (CDEC) TOW firings did you do? (Pilot) 150

Indicate below flying duty assignments:

Unit Name	Location	From To	Types AH	Types Mission	Approximate Hours Logged
D, Co. 158th AVN, Co. (major accident)	RVN	May 70 July 70	AH-1G	D/S	137
155th Avn. Co	Ft. Ord Calif.	Mar 71 present	UH-1 AH-1G	Training Experiments Combat	650

Figure C-1 (Continued)

DECLASSIFIED
DAIM-FAR-RR # 19-mm DATE: 17 June 1987

AIRCREW BIOGRAPHICAL DATA

NAME Smith, Edmond C. (Pilot, team Bravo)

GRADE CW2 SERIAL # 558-68-7761

AGE 26 PRIMARY MOS 100EC

DUTY MOS 100E SECONDARY MOS 100B

What aircraft are you qualified to fly? AH-1G UH-1B, C, D, H
OH-23D

Do you hold an instructor rating? Yes

Do you hold an instrument rating? Yes

About how many mock (CDEC) TOW firings did you do? 250

Indicate below flying duty assignments:

Unit Name	Location	From To	Types AH	Types Mission	Approximate Hours Logged
Flight School	Ft. Wolters Hunter Stewart	July 68 June 69	OH-23 UH-1B UH-1D	Training	230
"C" Trp 3/17 CAV	Dian & Quang Tri RVN	Sept 69 Sept 70	AH-1G	CA	1377
3rd Avn Co	Yuma and Ft. Ord	Sept 70 present	AH-1G UH-1H	Training R & D Combat	400+

Figure C-1 (Continued)

DECLASSIFIED
DAIM-FAR-RR # 19-.mm DATE: 17 June 1987

NAME Rowe, Danny G. (Gunner, team Bravo)

GRADE CW2 SERIAL # 298483006

AGE 24 PRIMARY MOS 100B

DUTY MOS 100B SECONDARY MOS

What aircraft are you qualified to fly?
UH-1A, B, D, H TH-55A

Do you hold an instructor rating? Yes

Do you hold an instrument rating? No

About how many mock (CDEC) TOW firings did you do? 200

Indicate below flying duty assignments:

Unit Name	Location	From To	Types AH	Types Mission	Approximate Hours Logged
Flight School	Ft. Wolters Ft. Rucker	June 68 Nov 68 Nov 68 Mar 60	TH-55 A ABD	Training	210
92nd Ast Hel Com	Dong Ba Thin RVN	Apr 69 Apr 70	UH-1H	Combat	1168
Ctep 8/1 Cav	Fort Knox, Ky.	May 70 Jun 72	OH-58 A UH-1H UH-1B	Training Combat Experimentation	500

Figure C-1 (Continued)

ANNEX D

(C) SLANT RANGE CALCULATIONS (U)

This table and the accompanying figure were of some use to pilots in plotting the maximum map range they could use, given the altitude of the attack above ground level. The TOW pods can swivel down a maximum of 12°, so no dive is needed until an altitude of more than 2000 feet AGL is reached.

Table F-1 (C;GDS) PILOTS MAXIMUM RANGE NOTES (U)

X (Altitude in feet)	Y (Ground Range in meters)	(Missile Angle, Degrees)	Dive Angle (Missile Angle Minus up to 12°)
1000	2970	6	0
2000	2940	12	0
3000	2850	18	6
4000	2700	25	13
5000	2570	31	19
6000	2430	38	26

ANNEX E

(C) LOGISTICS DATA (U)

1. (C) SEPARATION OF AIRCRAFT. The aircraft were kept at two different locations in the Camp Holloway Area. One was kept at Holloway Main and the other at the main Heliport (Christmas Tree). This was practiced only at night to prevent the destruction of both aircraft by a single sapper or by incoming rockets in a single area.

2. (C) SEPARATION OF MISSILES. The missiles were kept at three different locations on Camp Holloway. One was the Main Ammo Supply Point, one was a secondary ASP and, about 30 rounds were kept in a bunker on the flight line. The missiles on the flight line were modified to be used in the aircraft. Reason for separation of the missiles was the same as for the aircraft, and was practiced at all times.

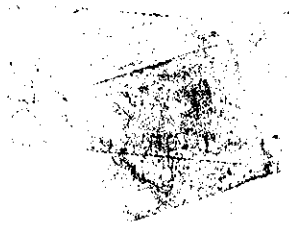
3. (U) SPARE PARTS. A "Push Package" of aircraft parts unique to the UH-1B accompanied the TOW team. All other parts for the aircraft were secured from 604th TC or 361st AHC. Parts for the XM-26 accompanied the Tech reps from Hughes Aircraft Co. These included a third complete system and test equipment. Also included from Hughes was the XM-70 trainer and related test and support equipment.

4. (C) MISSILE LOADING.

a. All loading or reloading of missiles, with the exceptions below, was done at Camp Holloway. A special rack was constructed to assist in loading the missiles. Complete re-arming of the aircraft was accomplished in three to five minutes by one or two men. Rearming was accomplished while refueling was taking place.

b. During operations in the Kontum area, four spare missiles were carried in the C & C aircraft. These were to be used for rapid re-arming of the AH as long as Kontum was used as a refueling and re-arming point.

5. (U) MAINTENANCE SUPPORT. All DS/GS maintenance was performed by the 604th TC until they left the Pleiku area. At that time the support was shifted to the 361st Maintenance Area with the help of NHA contracted personnel.



ANNEX F

(U) TRAINING (U)

1. (U) INTRODUCTION. All aircrew members were highly trained in operation of the system, with two exceptions. However, this training had been accomplished over a relatively long time, and in an unusual fashion. This annex discusses the training received by the crew members, and presents their evaluation of its usefulness.

2. (U) PRE-DEPLOYMENT TRAINING.

a. All of the pilots and two of the gunners had had experience using the XM26 system in mock firings over the previous year. One of the two crew-chiefs had some experience with the system at Fort Lewis. Some crewmembers had done literally hundreds of mock firings, on the way to experimental trials, during trials and reruns, and on the way back from trials (i.e., mock firing runs on cattle, tank-range targets, and old buildings at both HLMR and Fort Lewis). Some experiments had used these same aviators for mock firings with other systems such as XM-76 and TISEO.

b. The crewmembers were, then, experienced with the system and its peculiarities; they were also familiar with other similar systems. However, they had not fired a live missile nor had the experience of actually tracking a missile down to a target. Their performance during the Fort Lewis trials (CDEC Experiment 43.6, Phase III, Part 4) had shown that they should be able to do this without problems.

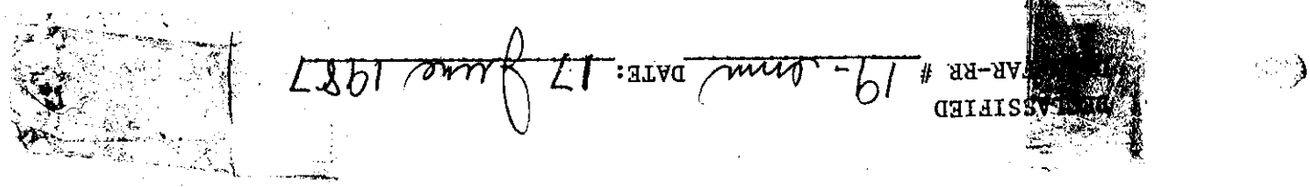
c. After arrival in Vietnam, the crews were given some tracking training by use of the XM-70 trainer, a device which yields an immediate tracking error score after each mock firing. Gunners were unanimous in praise of the effectiveness of this device in refining their tracking performance. The gunners who had previous CDEC experience, however, were very proficient and probably did not need much training. Due to the effectiveness of this device, most gunners' experience, and the relative ease of the task involved, an hour or two of actual XM-70 practice was sufficient. Practice firings were then scheduled. A large rock was selected as a target. This proved to be an unfortunate choice, as no size information was available to the gunners. Their range estimation ability had been finely developed ranging tanks; but rocks come in different sizes. All gunner's first shots at the

rock were out of range. Second shots impacted where planned. Later, some low-level practice shots were fired at oil drums at a range in excess of 2000 meters. All missiles impacted within a foot of the center of the drum, where they were aimed.

d. During combat firing, a slight misunderstanding on the part of a crew chief in use of the "missile select" switch resulted in missile failures and failure of the system to cut the guide wire. A brief instructional session eliminated this problem.

3. (U)TRAINING EVALUATION. Due to non-availability of one CDEC-trained gunner, one gunner had to be trained without the previous experiment-related mock firings. His performance could be expected to be similar to that of a well-motivated and intelligent TOW-gunner trainee of the future. For this reason, he was intensively questioned about his reactions to the training program. His overall evaluation was that the classroom, XM-70, and practice firing training was excellent and accomplished the purpose of showing someone how to use the XM-26 system. However, in actual use of the system in a tactical situation, he felt that much more emphasis would be needed on target detection and identification. The CDEC-trained gunners had many hours practice in detecting targets in a cluttered area, discriminating targets from buildings, identifying camouflaged targets, and accurately estimating the range to such targets. The non-CDEC trained gunner felt that only after 10 or more hours actual tactical flying did he become as proficient as the other gunners. This is an important point, since in future applications there might not always be a scout aircraft to locate and mark targets. This gunner felt that several hours could profitably be spent in a simulator, detecting and identifying targets. Some classroom time could also be used to explain enemy tactics and equipment.

4. (U) CORRELATION. It is also interesting to note that a frequent complaint of all gunners in the Cheyenne evaluation (CDEC Experiment 43.6, Phase 4) was that they had not had sufficient practice in target detection and identification. These results seem to indicate that some sort of target identification training program would be useful.



SECTION I

(U) HISTORY (U)

1.1 (U) GENERAL. The 1st Combat Aerial TOW Team, Vietnam was so named and deployed in the Republic of Vietnam on 22 April 1972. The original team was engaged in combat until 20 June 1972. The name awarded the Team by the 1st Aviation Brigade denotes its association with that unit as well as being the first time in the history of the United States Army that a heliborne TOW system was employed in combat against an armed enemy.

1.2 (U) BACKGROUND.

a. Experiment 43.6. The team was originally organized to train and participate in USACDEC Experiment 43.6 (Attack Helicopter, Daylight Defense) Phase III. The XM26 Visual Acquisition Sight System was one of three to be evaluated. Three Aircraft Commanders and two crew chiefs were selected from the 155th Aviation Compnay USACDEC Fort Ord, California, with three pilot/gunners being obtained from the 8th Squadron, 1st Cavalry Regiment (Black Hawks), Fort Knox, Kentucky. The Team OIC was assigned from within CDEC resources. Training and participation began in the third quarter of CY 1971, and continued through February 1972 at Hunter Liggett Military Reservation, California. Identified as 43.6 Side Experiment VASE (Visual Acquisition System Evaluation : a comparison of three heliborne sighting systems in target acquisition and simulated TOW firings) a total of 108 record trials were completed during this period. In February 1972 after an initial analysis of results, it was recommended that a repeat of the VASE experiment, utilizing only the XM26 TOW Sight System as integrated into the UH-1B, be conducted at another location. Sites selected included Fort Riley, Kansas; Fort Lewis, Washington, and Fort Knox, Kentucky. As a result of commitments at Fort Riley, Kansas, the decision to conduct the initial experiment at Fort Lewis, Washington was reached with subsequent trials at Fort Knox, Kentucky. Approximately 85 exploratory and record trials were conducted at Fort Lewis during the period of 6 March to 16 April 1972.

b. Vietnam Alert. On April 15, 1972 a warning order was received by the 43.6 contingent at Fort Lewis directing preparation for deployment of the entire system to RVN on 21 April 1972 to

include the two test UH-1B Aircraft. Classed as an extension of Experiment 43.6 under combat conditions, the system, to include TOW simulator trainer (XM70), launching pods, missiles, XM26 Sight, and all associated test equipment was prepared for air movement to Vietnam. Designated to accompany the equipment and the TOW team personnel were representatives from Hughes Aircraft Corporation (4), Bell Helicopter (1), and USA Missile Command MICOM (1). A last minute substitution was required for 1 pilot/gunner from Fort Knox, Kentucky. A replacement pilot/gunner was obtained from USAPNSCOM, Saint Louis, Missouri. The equipment and personnel were consolidated at McCord Air Force Base, Washington, loaded on two C141 Aircraft and departed for RVN on 22 April 1972 and arrived at Tan Son Nhut, Saigon, Vietnam on 24 April 1972.

c. Vietnam Operations. At Tan Son Nhut the reassembly of the two aircraft and the complete installation of TOW systems were expedited. The advancing enemy armored thrusts were overwhelming the ARVN defenses and the need for this new precision anti-tank fire power was needed to stem the onslaught. On 26 April the Team moved to Long Binh and was placed under the operational control of the 1st Aviation Brigade. The seriousness of the enemy armored threat in several key areas of the country was such that thought was given to the immediate commitment of the team without further training; however, in this escalated quasi-mid-intensity environment, training was recognized as the key to survivability. The period 26-29 April was utilized to conduct additional gunner tracking training, continue system checkout, and install the armored seat modification. The entire team was considered combat ready on 29 April, and with UH-1H escort was flown to Pleiku for live fire training and operational employment with the 17th Combat Aviation Group. The period 30 April to 2 May was utilized for actual live fire training in the Pleiku area. From 2 May to 12 June, the team was committed daily (weather permitting) in support of the US and ARVN defense of Kontum. During this period the dramatic success of the aerial TOW teams made a significant contribution to the successful defense of Kontum. A map of the operational area is shown in Figure 1-1; the arrows on this map depict the primary direction of the enemy armored advance. Operational summarys and results of these missions are included in subsequent paragraphs. Replacement in-country team members were trained from 12 June to 20 June, with the 1st Combat Aerial TOW Team in Vietnam returning to the CONUS 18-22 June.

1.3 (U) PURPOSE. The purpose of this report is to present the results of the deployment in Vietnam of the 1st Combat Aerial TOW Team. Conclusions reached from analyses of data and aircrew debriefings are presented, along with recommendations applicable to future operations.

1.4 (U) SCOPE. This report includes a brief overview of the operation, and a summary of findings and conclusions. Annexes provide detailed data supporting the conclusions, including: description and analysis of each mission, tracking error analysis from gun camera film, logistics, training, and biographical data.

1.5 (U) SUPPLEMENTAL REPORT. A supplement to this report will be forwarded to all addressees when additional data becomes available. These may include: battle damage, comparative tracking error analysis with implications for training, equipment and system performance reports, further debriefing conclusions and recommendations as debriefings continue, and additional biographical data. Night employment of the TOW system using new innovative techniques, if available, will also be included. Additionally, the supplement will address as much as possible who detected the target, target handoff difficulties, and response time. For instance, an excessive response time may support a concept for limited arming of the scout helicopter with one or two TOW missiles to permit engagement of fleeting targets. Other supplemental data will include: data on weather, and its effect on employment of high performance aircraft and helicopters; and local US and ARVN commanders' assessments of the impact of the aerial TOW on the initial defense of Kontum and subsequent operations.

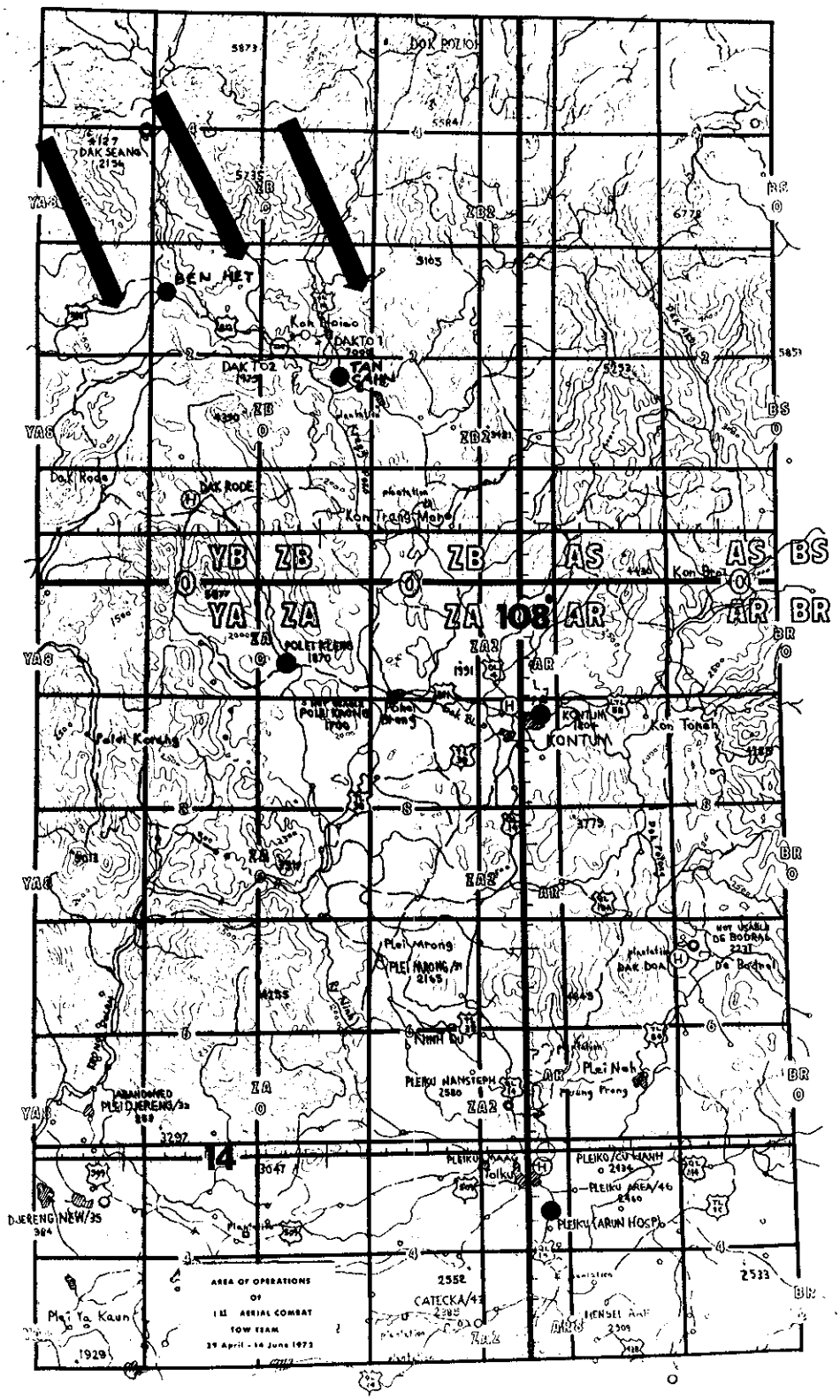


Figure 1-1 AREA OF OPERATIONS

SECTION II

(C) OPERATIONAL SUMMARY (U)

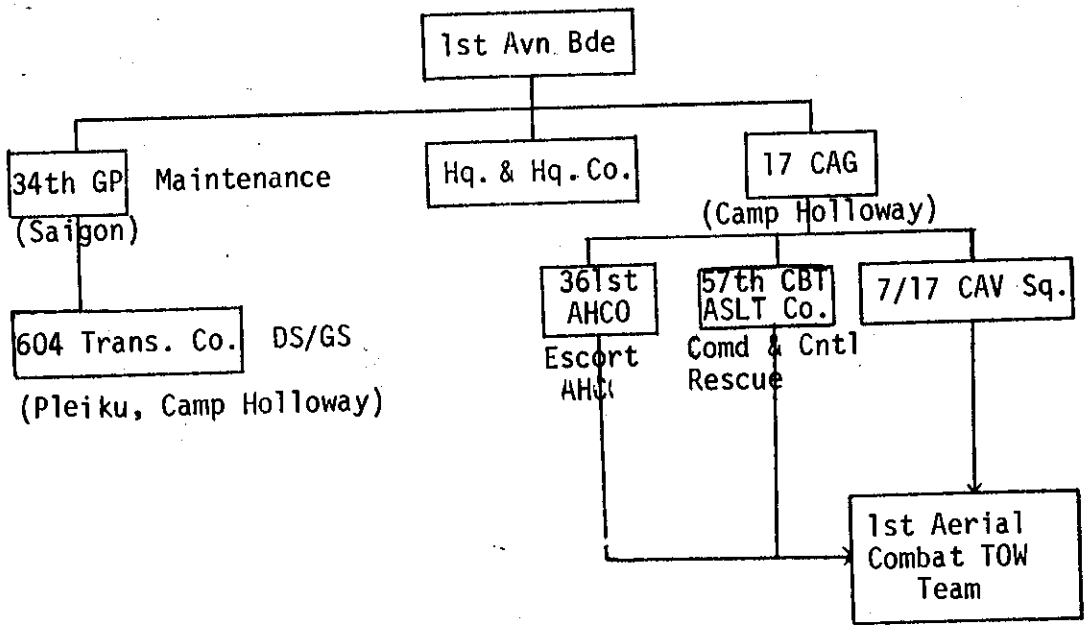
2.1. (U) PURPOSE. To determine the operational effectiveness of the helicopter-fired TOW missile system in a combat environment.

2.2. (C) ORGANIZATION.

a. The 1st Aerial Combat TOW team was comprised of:

OIC
3 Crews - 6 pilots and 2 crew chiefs
Technical representatives - USAMICOM, Bell Aircraft, and Hughes Aircraft.
2 UH-1B helicopters with XM26 subsystems.

b. The team was attached to the 1st Aviation Brigade. The organizational chart below depicts the administrative and logistical support provided to the Team, and the operational control under which it was employed.



2.3. (C) OPERATIONS. The team arrived Camp Holloway, Pleiku, Vietnam 29 April and departed 14 June 1972. The first three days were spent checking equipment and retraining of crew personnel.

a. Training. Prior to arrival in the combat zone the crews had flown the same two UH-1B helicopters extensively in conduct of CDCEC experiments at Hunter Liggett Military Reservation in California; they were completely familiar with the XM26 Subsystem however they had never fired a TOW missile. Each pilot/gunner was trained on the XM70 TOW simulator to orient him with the operation of the guidance system. On 30 April - 1 May each crew fired live missiles in a daylight environment at known targets. Night operations training was also initiated during this period, since the team was to be employed on a 24 hour basis, and night attacks by enemy armor were considered imminent. This training, which continued throughout the employment period, met with limited success because of several factors:

(1) The high rate of dud flares (in one case 32 out of 40).

(2) The unavailability of flare ships on scheduled training night because of other combat commitments.

(3) The glare of the flares temporarily blinding the gunner causing him to lose the target and missile. A red filter was later used to minimize the glare but it reduced the illumination available to the gunner and his ability to spot and track the target. Only three night training missions were flown, and the results were poor because of the gunners' inability to accurately estimate ranges, and the glare of flares interfered with his ability to guide the missile to target. One night combat mission was flown, (see Mission Summary on page A-21).

b. Equipment. Equipment problems were experienced with both the helicopters and the subsystems. These problems were solved successfully and rapidly. The two helicopters were available 100% of the time when missions were assigned.

c. Operational Procedures. Initially, each TOW system was employed with a UH-1H Command and Control (C&C) ship provided by 7/17 Cavalry Squadron and two AH-1G gunships from the 361st AH Co. The gunships were employed until enemy pressure necessitated use of them on other combat missions. However, they were made available to the TOW system for specific missions on a top priority basis. The TOW ships were laagered at Camp Holloway on strip alert. The fire mission orders were initiated by Group Operations Center, 17th Combat Aviation Group (CAG), and sent to the C&C ship which controlled the mission and coordinated the fire clearances. Upon notification of a target, the TOW ship, weather permitting,

normally flew at 3000 feet AGL and engaged the target at approximately 3000 meters slant range. The spotting of the targets was accomplished by C&C ship and other army aircraft operating in the target area. The C&C ship was also responsible for air rescue.

d. Enemy Air Defense Activity. Enemy air defense capabilities in the area included .51 caliber machine gun, 23mm and 57mm AA weapons. No enemy heat-seeking missile air defense capability was identified in the Kontum area of operation during the period. The enemy air defense fires were active and were primarily directed at other aircraft, i.e., air cavalry scout and attack helicopters, USAF FAC and TAC aircraft, flying in closer proximity to the targets. The TOW aircraft was never taken under fire by the targets engaged except in one instance when light ground fire was received from the general area of the target. This lack of enemy air defense influence on engagements by the airborne TOW was similar to that experienced in Experiment 43.6 Phase II conducted at Hunter Liggett Military Reservation, California. This is attributable to the long standoff range and altitude maintained by the aerial TOW teams and the disciplined training and experience in these tactics gained by the crews while participating in 43.6 trials. These results should not be construed to demean the enemy air defense capability, as other scout and attack helicopters operating closer to the target and at lower altitudes received heavy fire and several were shot down. Although the TOW teams operated at an average altitude of 2500' AGL as compared to nap of the earth in Experiment 43.6, this was deemed appropriate in the absence of an enemy heat seeking missile (SAM) AD capability combined with the small arms ground fire threat at lower altitudes. The presence of an enemy SAM capability would have forced the TOW teams to risk the ground fire at NOE as opposed to a SAM at altitude.

e. Enemy Reaction.

(1) The enemy reaction to the TOW missile attacks was strangely passive. The enemy tanks engaged were in each instance stationary and did not take evasive action or return fire. The enemy AD in the areas of attack was more concerned with engaging other aircraft in closer proximity to them, and paid little attention to the TOW missile ship which was employing the standoff tactics suitable to the AD environment. It can be assumed the introduction of this new weapon system into the battle situation surprised the enemy with his intelligence down.

(2) The most dramatic impact of the heliborne TOW system was demonstrated in the battle of Kontum 26-27 May. After several days of softening up the city with artillery, the enemy launched an all out offensive on Kontum on the night of 25 May. As the aerial TOW teams were committed to the battle at first light of the morning of 26 May, approximately 4000 NVA troops accompanied by 10-12 tanks had penetrated the defenses of the city. The TOW teams destroyed 10 enemy tanks within the first few hours. Relieving each other on station throughout the morning, the TOW teams tallied 10 tanks, one bunker, one truck, and destroyed two enemy machine gun crews which had been pinning down friendly troops from water towers, (see Mission Summary on pages A-33 and A-34). The following morning, 27 May, an aerial TOW team returned and destroyed the only two tanks known to be still in the area (see Mission Summary, page A-35). With the enemy armor threat eliminated, ARVN forces counter attacked and re-established control of Kontum. USAF TAC air responded to this mission, but when it arrived on station it was unable to execute the mission because of the weather conditions - cloud ceiling about 5,000 feet. It is significant to note, that in this instance, the Battle of Kontum, the USAF tactical bombers could not have accomplished the anti-tank job wihtout severe collateral damage to friendly troops and civilians in the area, and the city itself. With the enemy troops and armor having penetrated the defenses and intermingled with the allied forces, the aerial TOW teams were able to destroy tank after tank in the built up areas of Kontum with almost surgical precision, while avoiding friendly casualties and destruction to the city itself. It is also significant to point out that the enemy has been unable or unwilling to mass an armor threat in the Kontum area since this battle.

(3) Another example of the enemy reaction occurred on 14 May as two T-54 tanks were crossing a river 5 km NW of Kontum. One enemy tank was in the middle of a river, and the other was behind it preparing to cross. As the aerial TOW team rolled in and destroyed the tank in the middle of a river, the C&C aircraft reported that the crew of the second tank was abandoning their vehicle. The second tank was subsequently destroyed by the aerial TOW.

(4) On 18 May, the aerial TOW team was diverted from a search for enemy artillery and requested to aid TAC Air aircraft which were taking heavy 23mm fire during bombing runs on suspected enemy artillery positions. The aerial TOW team made its initial engagement at approximately 3150 meters and missed. The enemy AD crews continued to direct their fire solely at the USAF TAC Air, even as the aerial TOW team rolled in for a second missile launch which

destroyed the 23mm gun, (see Mission Summary, page A-25). Throughout these and other engagements, the enemy air defense reaction remained passive with respect to the TOW aircraft which were never fired upon by the target they were attacking. Air crews reported receiving primarily small arms and .51 cal fire in general target areas, with only isolated instances of 23mm and 57mm fire. (See Enemy Air Defense, para 2.3d). Only speculation can be made to explain these circumstances. Although some targets were moving when detected, all were stationary at time of TOW impact. This may have been an enemy tactic to halt, when the TOW team was spotted, to eliminate movement and dust signatures (detection cues) in hopes they had not yet been detected. The absence of AD reaction lends credence to another thought that the enemy disregarded the TOW aircraft in ignorance, mistaking it for another C&C aircraft, while they engaged more immediate dangers. This appears particularily true in the previously discussed instance with the enemy Twin 23mm.

f. Combat Constraints. In order to save on blade and operational time required to fly from Camp Holloway to the target areas, (approximately by 30 minutes), the TOW aircraft frequently used the Kontum strip as a rearm and refuel point. The C&C ship carried four missiles to Kontum. Between missions the TOW ship rearmed and hot fueled itself. This shortened the mission reaction time of the TOW ship. This practice continued until enemy shells damaged one aircraft. Each night the TOW ships, upon return to Camp Holloway, were given necessary maintenance, refueled, and rearmed and then parked at two separate airstrips to minimize the loss of both aircraft in case of attack.

SECTION III

(C) SUMMARY OF RESULTS (U)

3.1 (U) SYSTEM OPERATION. The airborne TOW concept proved to be highly adaptable to combat operations. Through installed in an overage aircraft, the TOW stabilized optical tracking system proved to be simple in operation and capable of achieving a very high percentage of first round hits. It demonstrated its capability to track easily and to destroy targets with surgical precision and with no collateral damage. It was employed effectively during periods of marginal weather. The XM-26/TOW system performed very well. The technical problems which did occur were minor and were handled by Hughes technicians.

3.2 (U) CREW PERFORMANCE. Crews were very enthusiastic about the system's performance and extremely proud of their accomplishments with it. Morale was uniformly high, and crews responded well to the demanding task of flying over-age helicopters in a combat zone. All crew members were able to learn rapidly and accomplish their assigned tasks efficiently.

3.3 (U) DAYLIGHT OPERATIONS. The results in terms of combat kills are shown in Table 3-1. Daylight combat operations were characterized by the standoff tactics which were so successful in CDEC Experiment 43.6. As crews gained more expertise with the system, they were able to further innovate, i.e., able to make multiple missile launches on the same target run if the first missile malfunctioned. When engaging multiple targets, it was possible to engage the second target a few seconds after impact of the first missile. This demonstrated the capability of the system to exploit opportunities in which multiple targets appear. Crews experienced no difficulty in acquiring and identifying targets at ranges of 3000 meters and greater.

3.4 (C) NIGHT OPERATIONS. Night operations were training flights with two exceptions. Early night firings failed due to the gunners being blinded, first by the bright IR source, and then by flares. When a red filter was retrofitted to the sight, it lowered the light transmission ability of the sight and altered the clarity of the reticle, making operation more difficult. The filter did enable night firings without blinding the gunner. However, it was nearly impossible for even these very experienced gunners to locate the range of the targets at night. Several misses also occurred due to the

gunners' inability to see the target at night while guiding the missile. Flares entering the field of view of the 13-power sight cause both missile guidance problems and danger to the gunner's eyesight. It was concluded that the system as it presently exists, does not have a significant night capability. In addition, target detection and range estimation during darkness, even with flare illumination, is extremely difficult for the most experienced crews. The flares also cause an extraneous IR source which results in missile guidance problems. Some sort of passive night vision system for target detection and tracking will be required before an effective night capability will exist.

3.5 (C) TOW PACKAGE RESULTS. The dramatic success of daylight TOW operations has already been highlighted in Section II. A summary of these results is shown in Table 3-1.

Table 3-1 (C GDS) TOW FIRINGS (U)
(As of 1200 hrs, 12 Jun 72)

COMBINED KILLS

24 Tanks (10 T54, 6 PT 76, 8 M-41)
4 A.P.C. (Believed to be AA I CVM-1967)
2 Artillery pieces (1 105mm, 1 unknown)
7 Trucks (6 2-1/2 ton, 1-3/4 ton)
1 Antiaircraft position (Twin 23mm)
2 Machinegun positions (1 12.7mm, 1 30 cal)
1 Wooden bridge
1 Hut with small arms ammunitions
1 Small arms ammo dump at abandoned fire base
1 122mm rocket launching position
3 Bunkers
47 TOTAL KILLS

SYSTEM PERFORMANCE

21		Practice Firings
85		Combat Firings
106		TOTAL FIRINGS
	10	Combat Firing Failures
		3 Missile failures (2 no IR source, 1 no flight motor)
		1 System Failure (power supply shut off at firing)
		3 Failures to Capture (could have been system, missile, or crew - unknown)
96		TOTAL GUIDED FLIGHTS
	11	Missed Target
		3 Known Misses (gunner tracking error)
		8 Out of Range (2 of these were at night)
85		TOTAL TARGET HITS

SECTION IV

(C) CONCLUSIONS AND RECOMMENDATIONS (U)

4.1 (C) OPERATIONS/COMMAND/CONTROL.

a. The accuracy of the TOW missile/XM26 system, under daylight combat conditions, is extremely good. (See Annex B, Tracking Error Analysis). Gunners were consistently able to hit pinpoint targets such as a MG crew on top of a water tower, tank cupolas, and the breech of an artillery piece at 3000 meters range, using the 13x sight.

b. The aerial TOW system is able to destroy point targets in built up areas with surgical precision with little danger of friendly casualties or collateral damage. (See Mission Analysis, page A-22, and pages A-33 through A-35.)

c. The TOW missile system was cited as having a very good effect on ARVN morale. This is probably due to the visible nature of this form of close support and its dramatic results against armor.

d. Several firings were aborted due to the presence of other aircraft in the line of fire.

4.2. (C) NIGHT OPERATIONS.

a. The aerial TOW System has limited usefulness at night due to the inherent problems associated with flares or other illumination when using an optical guidance system.

RECOMMENDATION: That some type of night vision system be developed for use in firing the TOW or other missiles at night.

b. Flare effectiveness is limited for illuminating targets at night. (See Mission Analysis for 12 June).

c. The missile IR source interferes with gunner's tracking at night.

RECOMMENDATION: That an IR filter be used on the sight when conducting night firings.

d. The IR filter fitted to the sight effectively removes the red color from the IR source at night, but reduces the intensity of the visible light. It also alters the reticle image which makes focusing the target tracking difficult.

e. The TOW team had little success in employing the TOW system at night using standard night lighting techniques.

RECOMMENDATION: That the TOW team in Vietnam continue innovations for the use of the TOW at night. Lessons learned from night operations will be incorporated into training for CDEC Experiment 43.7.

4.3. (U) TRAINING.

a. Training in operation of the system was considered adequate. More training in target detection would be helpful, especially for those follow-on crews who did not have the training and experience gained in CDEC Experiment 43.6.

RECOMMENDATION: That a simulator or training course for visual target detection be developed. This does not need to be unique to the XM-26/TOW system, but could simply be used to train pilots and gunners in the detection of concealed targets.

b. Gunners can be trained to use the system very quickly, if necessary. (See Mission Analysis for 21 May).

4.4 (C) EQUIPMENT. The equipment provided the team functioned well, and few combat missions were aborted because of defective equipment.

a. The UH-1B helicopter lacks sufficient power for many desirable combat maneuvers. This experience in Vietnam firmly supports the need for a more advanced and more powerful aerial platform for the TOW system.

RECOMMENDATION: That this advanced system have greater speed, maneuverability, range, missile capacity; and that it also have a range finder, counter-radar equipment, and present a small head-on target.

b. The sight head is not comfortable for the gunners to use. It is recommended that better adjustments be provided for sight head position, gunners' armor seat, or both.

c. Heat affects the electronic components of the system.

RECOMMENDATION: That on future systems, the electronic equipment associated with the TOW system, be installed so as to provide a suitable ambient temperature. (See Mission Summary, page A-2).

d. The type of camera presently fitted to the XM-26 sight is obsolete and yields extremely poor pictures, especially in conditions of low light.

RECOMMENDATION: That currently available state-of-the-art cameras be installed with automatic light setting and faster color film.

e. Even for crews highly trained and experienced in range estimation, ranging of unfamiliar targets (unknown size) was difficult, especially at night. (See Mission Summary, page A-3). In addition, 8 of 11 guided flights missed the target due to being slightly out of range. These data verify the findings in Experiment 43.6 where 15% of the aerial TOW firings were out of range with an error of less than 200 meters.

RECOMMENDATION: That a laser rangefinder be provided on future aerial TOW systems.

f. The TOW crews used the XM-26 Stabilized Sight extensively at 13x in target acquisition and identification. However, air crews reported the lower power of the sight, 1.5x, to be of little value. The sight should have a zoom capability, as crews reported that 4.5x would have been more useful for search tasks.

RECOMMENDATION: That a stabilized sight of approximately 13x capability, with a zoom capability, be integrated on future airborne TOW systems.

g. The present automatic wire-cut system is not entirely satisfactory. (See Mission Summary, page A-2).

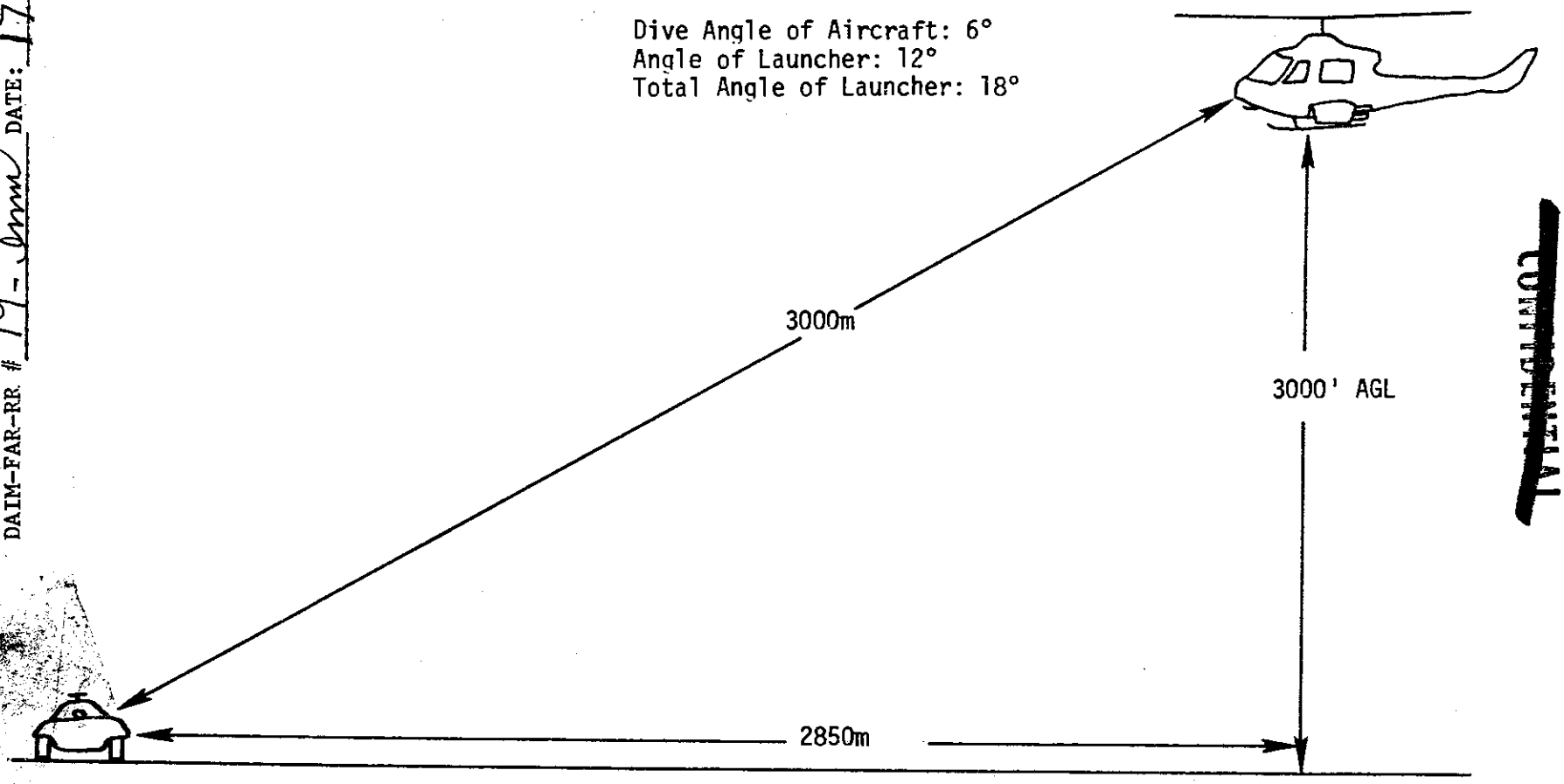
RECOMMENDATION: That the present wire-cut system be redesigned.

h. Present target designation systems (i.e., smoke, WP, FACs) are adequate for saturation type bombing operations. But, target designation for the TOW missile must be precise because of the capability of the missile to accurately hit a small target, e.g., tank turrets, open APC doors.

RECOMMENDATION: That some point target type designator system be considered for this handoff task. Further operational testing and evaluation is required in this area. This is particularly important in avoiding friendly casualties and collateral damage during combat in built up areas.

i. Survivability. The survivability of these two UH-1B TOW missile ships may be attributed to the element of surprise and the stand-off tactics of the air crews. However, employed against an enemy force with better intelligence information, from which to determine target priorities, the survivability of these two TOW aircraft might be questionable, especially had the enemy employed a heat seeking SAM.

j. There is a need for continuing monitoring of the TOW teams' activities in Vietnam, to include a revisit for on-the-spot data collection prior to publishing the supplemental report.



Typical Engagement Profile
43.6 Phase I, Vietnam

Figure (C;GDS) RANGE GEOMETRY (U)