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PROJECT CHECO REPORT
Contemporary Historical Evaluation of Combat Operations

COMBAT SKYSPOT

9 AUGUST 1967

HQ PACAF

Directorate, Tactical Evaluation
CHECO Division

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SE Asia Team

DTEC-67-0015

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
AUG 1967	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Combat Skyspot	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **HQ PACAF Directorate, Tactical Evaluation CHECO Division**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**SAR**	**38**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

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C ..... 1 Cy
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DI ..... 1 Cy
DO ..... 1 Cy
DM ..... 1 Cy
DPL ..... 1 Cy
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DTEC ..... 3 Cys

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COMBAT SKYSPOT

1. The Need

Migratory rains of Vietnam, low-hanging cloud cover, and the Viet Cong's exploitation of the hours of darkness have been a great hindrance to the Air Force role of harassment, interdiction, and close air support of ground troops. On clear nights, or when cloud cover is not a factor, flare-ships, in conjunction with fighters or gunships, can harass and interdict the enemy, or provide close air support to the friendly forces in contact.

When adverse weather moves in, with a ceiling of 400-500 feet, the Forward Air Controller (FAC), flying in an O-1 aircraft, can at times, drop down through a cloud-deck and maintain visual contact with the ground. The fighter pilot, flying five times as fast and with one-fourth the maneuverability, has a definite problem with low ceilings and poor visibility. Under conditions such as these, dive bombing is limited, and even shallow, angle-type deliveries, such as strafing, may not offer completely satisfactory results.

The need to support Special Forces Camps under attack during periods of inclement weather was forcibly brought out during the battle and subsequent loss of A Shau. Located in a valley in the northern section of South Vietnam, A Shau Special Forces Camp came under heavy Viet Cong

attack early in the morning on 9 March 1966.[1/]

At that time, the weather--broken to overcast--with a 300-500-foot indefinite ceiling, provided ideal working conditions for the enemy, since it prevented effective air strikes. The few air strikes managing to transit below the cloud cover were so restricted in their delivery patterns as to be ineffectual in repelling the overwhelming numbers of Communist troops.[2/]

The loss of A Shau emphasized the need for a weapons system which could support ground forces at all times. This need pointed especially to the importance of an all-weather strike capability--during the day or night, and in any kind of weather.

2. The Solution

The Strategic Air Command, to evaluate the proficiency of their aircrews, had been using a ground-based radar/computer unit designated MSQ-35. This system, called Radar Bomb Scoring or RBS, could predict the exact point of impact of a simulated bomb drop.

Using this highly accurate SAC radar system, a test was conducted in 1965 at Matagorda Proving Range, Texas, using F-100 aircraft to deliver live ordnance. Factors such as altitude, wind speed, aircraft speed, temperature, and ordnance characteristics were introduced into the computer. The pilot was given heading, altitude, and airspeed instructions as the bomb-run progressed. As the aircraft neared the point of bomb release, a

countdown was initiated and a release was accomplished on the controller's "hack." [3]

The first tests were highly successful, and as the tests progressed, the controllers and pilots' skill and coordination increased, resulting in a decrease in Circular Error Average (CEA).

3. MSQ-77 Equipment

The MSQ-77 unit consists of five vans to house all components and associated systems. They are:

- Control and Plotting Van;
- One Diesel Power Van - Primary;
- One Diesel Power Van - Secondary;
- Administration and Supply Van;
- Communications and Maintenance Van.

The Control and Plotting Van contains the X-Band radar, computer, and flight plotting board. A computer is linked between the radar and the plotting board, providing necessary signals to drive the radar in an automatic mode, and the ink plotter to trace the path of the aircraft over the ground. The computer also drives a board of instruments to display the aircraft's ground speed, true altitude and heading, thereby furnishing the ground controller information to voice-direct the bomb-run and release.

The power vans have 50-KW generators to supply the needed power for operation of the equipment. One generator is used as standby for

periodic maintenance of the main generator or, if need be, to provide emergency power in the event the main generator fails. All vans are air-conditioned to provide the most comfortable environment possible, and to produce a constant operating temperature for the computers and associated circuitry. The entire site is enclosed within a 15-foot high, revetted wall, guarded by a single sentry at the sole point of access. 4/

The MSQ-77 is a pencil beam, X-Band radar, operating most effectively in conjunction with the aircraft-installed SST-181 X-Band beacon. 5/ This beacon (measuring about four inches on each side), receives, amplifies, and returns the MSQ-77 signal. As a result, the capability and range of the Combat Skyspot system is greatly increased. Installed in the aircraft, the SST-181 beacon, in conjunction with the long-range modification on the MSQ-77 radar, increases the controlled range capability to 196 nautical miles (NM). If no beacon is in the aircraft, or if the beacon is inoperative, a skin paint method may be used as an alternate means, with an effective range of 40-50 NM. 6/

The MSQ ground components are capable of either manual tracking, automatic tracking, or utilization of the computer to drive the antenna for computer tracking. This last mode is called "rectangular coast" and is similar to dead reckoning (DR) tracking if lock is broken. Normally, the system is provided with an acquisition radar, since the main beam is quite narrow. It was felt, however, because of the close association and communication with the Control and Reporting Center/Control and Reporting Point (CRC/CRP), the acquisition radar could be eliminated at the initial sites

placed in operation. Thus, the controllers usually depended upon other installations for initial acquisition. On occasion, the nonavailability of the acquisition radar has created difficulties. 7/

4. Combat Readiness

In becoming combat ready, the Combat Skyspot (CSS) units progress through a three-phase development program. Phase One concerns preparation of the site. This requires an earth stabilization capable of supporting 8,000 pounds spot weight. Land communications must also be established at this time. When aerial transportation is required, a special C-133 aircraft with clam shell doors must be utilized, because the MSQ-77 vans are so large. On the ground, a normal fifth wheel tractor can be used. After deployment and positioning of the equipment, the last step of Phase One is preparation for initial control of the aircraft.

Phase Two confirms target coordinate accuracy, a necessary requisite, since available maps may be inaccurate. In this vital operation, beacon-equipped aircraft are site-directed over known surveyed geographical locations to validate the coordinates in the MSQ computer. If inaccuracies exist, a radar adjustment is made to correct them.

Phase Three is the operational check-out of a site, employing live ordnance under FAC control in VFR conditions. The targets selected are no closer than five kilometers from friendly forces. The FAC flies at least two kilometers on either side of the run-in line, and clears the mission aircraft for release. Results of this phase are thoroughly evaluated by the FAC to determine the operational parameters for the final phase.

Phase Four is the fully operational phase. The ultimate objective of Combat Skyspot is to attain an early capability for controlling any type of strike aircraft on a rapid-reaction basis. Combat Skyspot personnel develop and maintain a complete target folder to permit rapid diversion to requested targets. 8/

5. MSQ-77 and TPQ-10 Sites

At the time of this report, six Combat Skyspot sites were located in Southeast Asia--five in the Republic of Vietnam, and one in Thailand. The initial system was deployed to a location near Bien Hoa, becoming operational on 1 April 1966. The other five were activated as follows: Pleiku, May 1966; Nakhon Phanom, Thailand, 3 June 1966; Dong Ha, 12 June 1966; Dalat, 26 September 1966, and Binh Thuy, 3 April 1967.

In addition to these sites, the Marines are using a similar system to the MSQ-77. Known as the TPQ-10, its sites are located in I Corps area at: Quang Ngai, Chu Lai, Da Nang, Phu Bai, and Dong Ha. The TPQ-10 has a limited range of 50-NM. 9/

6. Organizational Structure

Strategic Air Command (SAC) is responsible for the MSQ-77 site determinations and geodetic surveys. SAC also provides the personnel for operation and maintenance of the MSQ-77 units. Air Force Logistics Command obtains the X-Band beacons for the aircraft and designs, develops, and installs them. Military Airlift Command provides the means of getting

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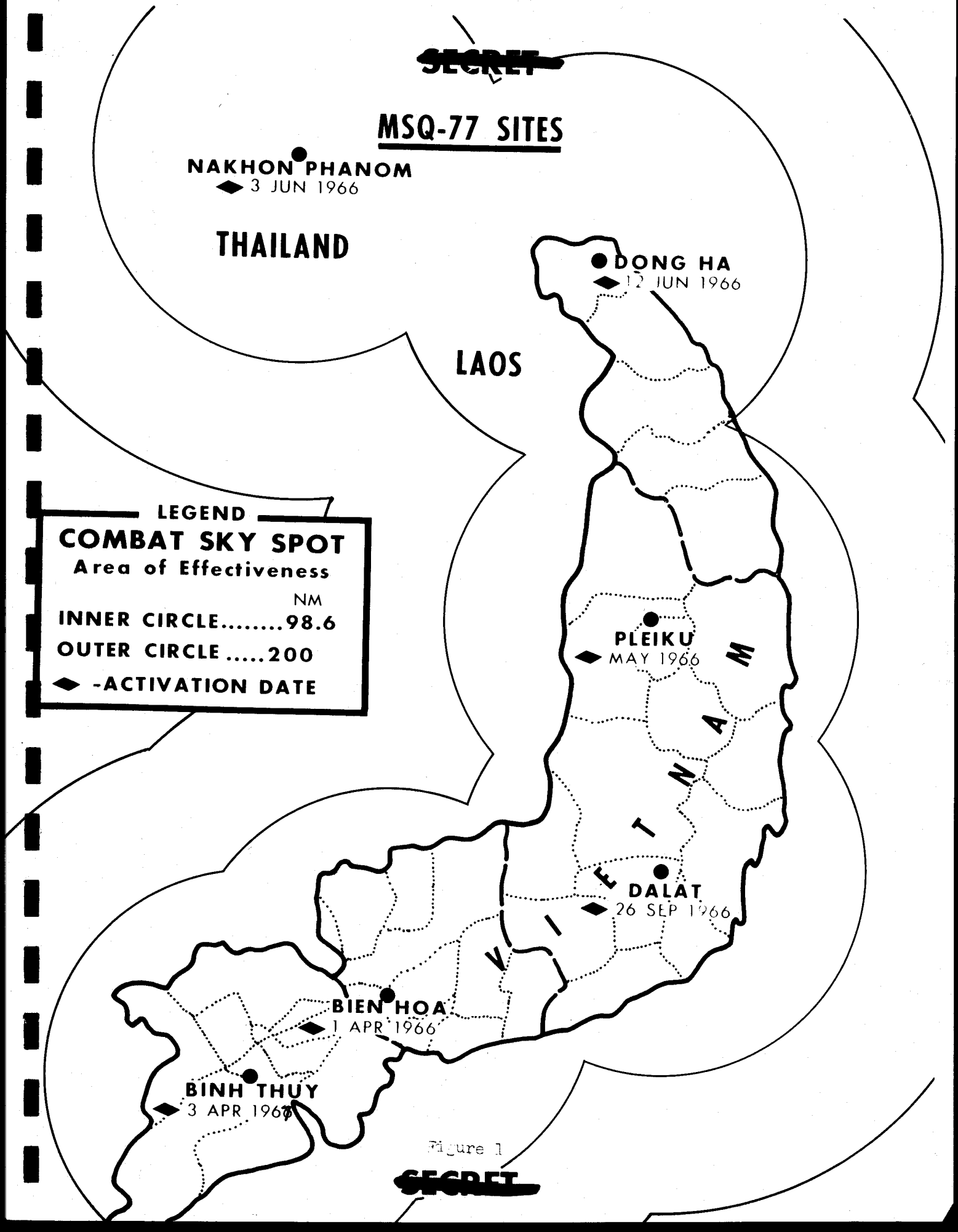

Figure 1

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equipment and personnel from CONUS to SEA locations. The bombing tables are developed by the Air Force Armament Laboratory. Thirteenth Air Force provides Precision Measuring Equipment Laboratory (PMEL) and logistics for Thailand and for Republic of Vietnam-based units until Seventh Air Force attains PMEL capability. 10/

7. Operations

The United States Air Force has deployed the MSQ-77 Bomb Directing Central Radar units to Southeast Asia to fulfill a continuing requirement for additional all-weather and night air support of friendly ground forces.

In SEA, the MSQ-77 system is utilized by tactical fighters, tactical bombers, and B-52 bomber aircraft for controlled release of ordnance on targets during periods of darkness and adverse weather. Some of the additional uses for the system are:

- Harassment and interdiction of enemy forces and lines of communication.
- Support Special Forces Camps and friendly outposts;

  Bombing enemy forces that attack friendly units.

  Direct resupply and air evacuation during periods of darkness or adverse weather.
- Support Land/Sea rescue by directing rescue aircraft to exact location during darkness or periods of adverse weather.
- Support paradrops.
- Assist GCA approaches of aircraft which have inoperative airspeed systems.
- Plot target areas obtained from an aircraft which is orbiting

a newly discovered target. The MSQ-77 site can mark the area and direct other flights to it.

Since deployment of the MSQ-77 system to Southeast Asia, it has been in daily use. Generally the aircraft being directed are: F-100, F-4C, F-105, A-1E, A-26, B-52, and B-57. The F-100 and B-52 aircraft use the system most frequently.

Ordnance dropped includes: leaflets, CBU clusters, incendiaries, fragmentaries, general purpose bombs, demolitions, napalm bombs, and flares.[11/] Each of these types of ordnance has its own ballistics and the bomb release systems vary among aircraft. For example, the B-52 bomb rack relies strictly on gravity to pull the ordnance away from the released bomb shackle. On the other hand, the F-100 has a thruster to push the ordnance away from the bomb rack. Each system requires different ballistics computations to be set into the MSQ-77 computer to enable it to predict most accurately, the exact release point for the ordnance.

8. Request Procedures

The Direct Air Support Center's (DASC) request for a MSQ-77 mission against a preplanned target will contain the desired axis of attack, and accurate UTM coordinates in eight digits, if possible. If troop safety is a consideration, the request will also include proximity and direction of the target from the friendly forces. A MSQ-77 unit may be requested to back up a visual FAC target, if the target is within 1,500 feet of a MSQ control point. This request is indicated by the phrase "Combat Skyspot Alternate."

The Combat Skyspot missions are fragged by the Seventh Air Force Tactical Air Control Center (TACC) or the Seventh Air Force Command Post. If an immediate/diverted mission is required this request can originate at any level of command, and it is sent by the most rapid means to the DASC. The request is monitored by each intermediate headquarters (i.e., Brigade/ Regiment, Division), which has approving authority. Radio silence at any level up to DASC is tacit approval of the request. The DASC submits the approved request to TACC to scramble strike aircraft from alert. 12/

When the TACC annotates on the daily frag: "Combat Skyspot Alt," this indicates those FAC-controlled strikes are acceptable for MSQ-77 attack, in the event adverse weather precludes visual attack. The MSQ personnel prepare a flight plan for all targets within their area of responsibility and, if necessary, are prepared to direct strikes. TACC/CP also furnishes the Combat Skyspot unit with MSQ-77 targets on a daily basis to be utilized by aircraft unable to strike their assigned targets. Where overlapping coverage exists, other MSQ units are prepared to conduct the directed mission if necessary.

Aircraft procedures on a fragged MSQ-77 mission call for the pilot to turn on aircraft beacons after engine start (Condition 2). When airborne, the lead contacts CRC/CP and receives vectors to a designated IP or hand-off point. If on an immediate/diverted mission, all aircraft turn on their beacons when advised of diversion. The CRC/CP provides the Combat Skyspot unit with weather conditions, planned release altitude, and the axis of attack. CRC/CP initiates hand-off to Combat Skyspot controllers;

close coordination exists between CRC/CRP and MSQ sites.

The flight lead assures proper IFF/SIF squawk before hand-off to the Combat Skyspot controller. When contact has been established, the lead will give the call sign, mission number, number of aircraft, and ordnance carried by type and number. 13/

9. Limitations

The MSQ-77 tracking radar has a 40-50-NM range limitation when the aircraft being controlled are not equipped with the SST-181 beacon. In this case, the site must rely on skin paint to direct the aircraft. Aircraft equipped with SST-181 beacons may be controlled to a range of approximately 196-NM owing to long range modification of the MSQ radar. The MSQ-77 radar operation is limited to line of sight, and the minimum flight altitudes are therefore limited by earth curvature and obstructions between the site and the aircraft.

Whenever possible, selection of the location of the sites to permit an obstruction-free operation in all quadrants within range limitation of the unit is attempted. The MSQ system is greatly dependent on UHF communications which also are limited to line of sight. For this reason, Skyspot missions are seldom conducted beyond 150-NM due to unreliable UHF radio communication.

Another limitation has been air mass turbulence. It affects the aircraft motion, thus destroying the stable platform vitally needed for precise bombing.

The MSQ is also limited as to the number of aircraft it can control at one time. It can control only one flight against one target at a time. Upon completion of one bomb run, a time lag of five minutes is required prior to directing in the next sortie. If the controller must change to another target, an additional five minutes is required. 14/

10. Restrictions

Basic troop safety consideration requires Combat Skyspot strikes at least 1,000 meters from friendly forces. Strikes may be conducted in closer proximity to friendly forces, however, if the ground commander indicates specific approval. 15/

The current margin of safety for bombing in the vicinity of friendly forces is based on the accuracy of initial tests at the Matagorda Proving Range, Texas. Current accuracy is considered much improved, and the 1,000 meter margin of safety may be excessive. Studies have been initiated to justify closer limits in support of friendly troops.

In addition to the requirement of 1,000-meter safe distance to troops, Directive 95-4 (28 June 1966), Headquarters, Military Assistance Command, Vietnam, states that air strikes will be under positive control by Combat Skyspot, if targeted within 5,000 meters of the Cambodian border. This restriction provides safeguards against possible border violations, but does not apply to troops in contact, or to positions in the zone from which fire is received. 16/

11. Variables Relating to Accuracy

The accuracy and tolerances of the MSQ-77 equipment, ballistics of

ordnance, type of aircraft, bomb release system, altitude, and airspeed are known, and the wind effect can be computed accurately. Therefore, based on these factors, the bombs released from an aircraft under Combat Skyspot control should impact within a radius of approximately 300 feet from the desired point of impact. However, all bombs do not impact within this radius, because other factors not related to the MSQ-77 equipment influence the actual bomb impacts. The more significant factors are: (1) aircraft attitude at the time of bomb release; (2) bomb dispersion; (3) turbulent air mass; (4) ground controller and pilot coordination; and (5) formation releases.

The aircraft attitude at the time of release influences the path of the bomb in two ways. First, bombing from an altitude of 20,000 feet, if the aircraft heading deviates just one degree, the bomb could impact in error as much as 350 feet in the direction of the heading error. Secondly, if the wings of the aircraft are not level at the time of bomb release, deflection errors are introduced, especially if the bomb is force-ejected.

As previously mentioned, force-ejected bombs leave the bomb rack with an initial velocity perpendicular to the aircraft wings. If this velocity is directed away from the vertical because the aircraft wings are not level, the bomb will impact with an azimuth error. Using F-100 aircraft at an altitude of 20,000 feet, the error is approximately 10 feet per degree of bank per 1,000 feet of altitude. Additional errors may occur when other aircraft have multiple ejection racks (MERs) and the bombs are released with a lateral velocity.

The next factor to be considered is bomb dispersion. Bombs disperse according to the individual characteristics of each type of bomb and are particularly influenced by the center of gravity of the bombs, condition of aircraft bomb racks and the condition of the bomb fins. Statistically, a percentage of bombs released will not follow their predicted trajectory because of manufacturing tolerances, particularly in the center of gravity tolerance. Predicted trajectories are derived from statistical averages.

Turbulent air is a factor which induces random acceleration forces upon the aircraft. If the ordnance is released while these forces are acting upon the aircraft, the resultant deflection will be imparted to the ordnance causing an error at impact.

Coordination between the MSQ ground controller and the pilot is essential to prevent a gross error in bomb impact. The ground controller directs each bomb-run through voice communications with the pilot, who responds to, and closely follows instructions of the controller. This coordination is particularly critical during the countdown phase of the delivery. The controller must have established in his mind the minimum standards and tolerances for directing aircraft to the bomb release point. If the pilot cannot precisely control the heading and altitude of his aircraft to maintain the required track to bomb release, the ground controller must abort the run and either reposition the aircraft for another run, or release the particular aircraft from the Combat Skyspot sortie.

The last induced error concerns formation releases. There are

two possible means of inducing errors when releasing ordnance in formation. The first concerns a loose spacing between the lead and his wingman. As readily seen, the distance between the lead aircraft, which the ground controller is directing, and the wingman, represents the distance away from the desired point of impact (DPI). The second induced error is the movement of the wingmen in their attempt to maintain a close formation. The lead flies as smoothly as possible but should last minute corrections be issued by the ground controller, there will be a proportional state of flux in respect to the formation. This motion of the wingman attempting to hold his position can cause the bombs to be "thrown" or dropped while the aircraft is banked and off heading. 17/

12. Accuracy of Combat Skyspot

The ground director bombing system is one of a family of "range-theta" (R-θ) systems. Theoretically, the error in range (measured from the ground station), would be relatively insensitive to that range. The azimuth error (measured at right angles to the radius from the ground site), should increase with range. It is reported that the design azimuthal uncertainty is one mil (600 feet at extreme range).

The pencil line used for the graphical record of the aircraft ground track has a "width" of 100 feet. However, there are so many other sources of error, as previously discussed, that the uncertainties of range and azimuth are themselves vague. 18/

To evaluate the accuracy of Combat Skyspot, there are a number of

sources available:

- Eye witness reports of bomb impacts;
- Photographs of Combat Skyspot BDA;
- FAC BDA of Combat Skyspot missions;
- Electronic measured, bomb release miss-distance.

The eye witness reports are from ground commanders who are in a position to observe some bomb impacts. These reports are very infrequent as are photographs of bomb hits.

The best overall on-the-spot bombing accuracy reports are from the airborne FACs. The number of missions for which FAC-scored data may be obtained are limited by such factors as weather, darkness, foliage, and previous bomb craters. Distances reported by FACs are radii from the desired point of impact within which all bombs impacted. (This means that the distance reported is not necessarily the impact distance of each bomb, but rather it is the distance of the farthest bomb from the desired point of impact.) Also, if the FAC is using a 1:50,000 scale map, he can estimate distance and locate targets to within approximately ± 50 meters. If the particular target is not a prominent landmark, but adjacent to something prominent, he has the double problem of determining the DPI and working from there to assess the bomb impact. 19/

In Phase Three, Combat Skyspot missions are conducted in day VFR with a FAC "on scene" at the DPI. In one case, 60 bomb-runs were performed with 90 bombs released. The FAC estimated the CEA as 470 feet;

photography showed the CEA to be 570 feet; and the site's electrical score had a CEA of 440 feet. The electrically-measured error is accomplished by the site using the actual release point data as shown on its computer read-outs. These are compared with the precomputed desired release point. The resultant is the error. This occurs when the majority of available data is obtained; the electrical score accuracy is ± 100 feet for each bomb run.

The ideal data needed for making an analysis of bomb impact distribution relative to DPI are the azimuth and distance of each bomb impact in relation to a DPI for an unlimited number of Combat Skyspot runs.

From such data, an accurate and complete statistical analysis of Combat Skyspot bombing could be made, and probability techniques could be applied to determine specific margins of safety for any acceptable probability of casualties to friendly forces. An exhaustive test under controlled range conditions would be required to obtain such data, and since these extensive tests have not been conducted, statistical analysis data are not available.

Combat Skyspot accuracy is obtained mainly from electronic scoring and in a few cases from FACs or ground units. Scores were extracted from the biweekly Combat Skyspot reports covering the periods from 16 November 1966 to 30 April 1967. Five sites reported from November 1966 to April 1967, as follows:

Combat Skyspot	MSQ-77 Site (Location)	CEA (Feet)
One	Bien Hoa (OL-21)	238
Two	Pleiku (OL-22)	256

Combat Skyspot	MSQ-77 Site (Location)	CEA (Feet)
Three	Nakhon Phanom (OL-23)	322
Four	Dong Ha, (OL-24)	291
Six	Binh Thuy (OL-26)	222

20/

Persons who have observed Combat Skyspot bomb impacts state that 30-40 percent of bombs released, impact on target. BDA of airborne FACs show that 20 percent impact on target, 80 percent within 300 feet, 90 percent within 600 feet, 96 percent within 1,000 feet, and 99.9 percent within 1,300 feet. The remaining 0.1 percent of the bombs impact at varying distances--as far as 3,000 feet from the DPI.

Tallying scores from a random period of 14 October 1966 to 15 January 1967, the following table summarizes the FAC BDA:

Distance within which bombs impact from target (Feet)	On Tgt	150	300	600	1,000	1,300
Portion of all bombs (Percent)	20	68	80	90	96	99.9

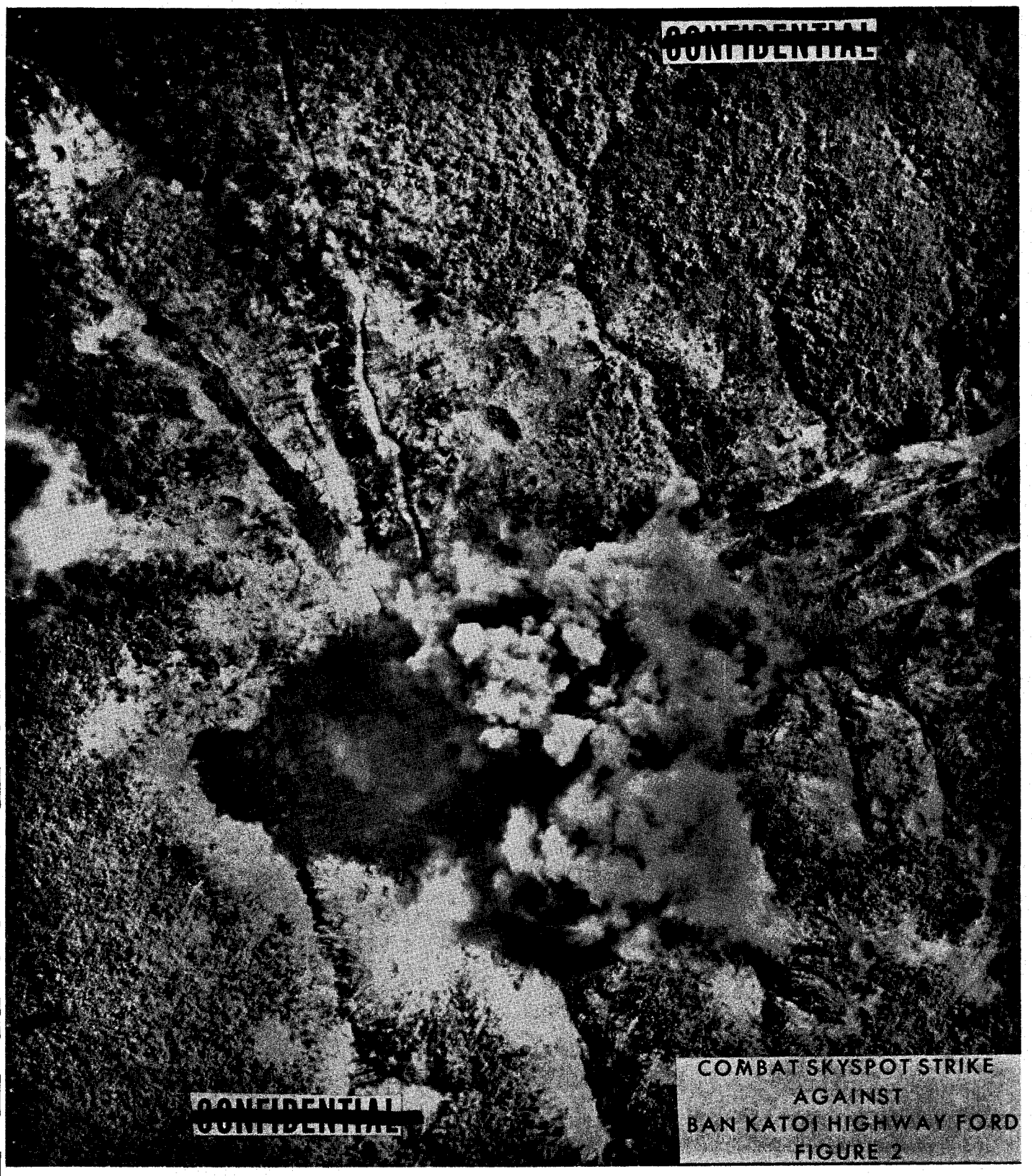
With the exception of three, all of the bombs impacted within 1,300 feet. Footage of the three bombs that impacted beyond 1,300 feet were: 1,500, 2,400, and 3,000. These distances are considered gross errors, and a possible cause for them was either operator error or releasing in turbulent air.

The FAC score distance is the radial distance within which all bombs impacted. The electrical score distance is the radial distance appearing on the plotting board and showing the bomb impact point in relation to

the target. These missions were flown primarily by F-100 aircraft from a release altitude of 20,000 feet. [21]

FAC SCORES VERSUS ELECTRONIC SCORES

MISS DISTANCE - FEET FAC	ELECT	DIFFERENCE FT	NR OF BOMBS	TYPE ORD
900	100	800	4	MK81
1,500	2,175	675	8	MK82
225	1,225	1,000	8	MK82
0	350	350	8	M64
0	150	150	8	M64
300	300	0	8	M64
0	0	0	8	M64
600	600	0	8	MK81
0	450	450	8	MK81
0	100	100	8	MK81
0	200	200	8	MK81
0	150	150	8	MK81
0	950	950	8	MK81
0	100	100	8	MK81
0	425	425	8	MK81
300	550	250	8	MK82
300	900	600	8	MK82
0	200	200	12	MK81
500	800	300	4	M64



COMBAT SKYSPOT STRIKE
AGAINST
BAN KATOI HIGHWAY FORD
FIGURE 2

IMPACT OF BOMBING STRIKES
AGAINST BAN KATOI HIGHWAY FORD
FIGURE 3

MISS DISTANCE - FEET FAC	ELECT	DIFFERENCE FT	NR OF BOMBS	TYPE ORD
3,000	2,000	1,000	4	M64
0	0	0	4	MK81
900	900	0	8	MK81
0	100	100	8	MK81

Several strikes were made against the Ban Katoi Highway Ford (Fig. 2 and 3) situated a few miles north of the DMZ. They were controlled from the site at Nakhon Phanom, Thailand. Forward Air Controllers were "amazed at the accuracy of these strikes."

Results of tests to date have indicated that strike aircraft releasing bombs on command from an MSQ-77 site can achieve a CEA of 330 feet. This CEA is based upon several evaluation methods, however, it is primarily determined electronically. 22/

13. Effectiveness

On a monthly basis, various units submit to their respective DASC, results of requested Combat Skyspot sorties, including their effectiveness and recommendations.

The following are comments taken from these DASC reports:

> "...The 1st Air Cavalry Division requested air support for Operation Pershing and Le Jeune. VR'd 75 missions

> of the 100 flown. CEA was 23 meters or approximately 75 feet. The computed CEA of 23 meters is much lower than in previous months. Past experience has shown Sky Spot CEA to be fairly constant at approximately 100 meters.
>
> "The recommendations are to increase the number of beacon equipped aircraft so that at least one aircraft in each flight will have an operative beacon. Because of the distance of the Pershing area of operation from Bongo (Skyspot at Pleiku), most 1st Cavalry Division Sky Spot targets can be struck only by beacon equipped aircraft. Many missions are lost which could have been completed using Sky Spot backup had the fighters been beacon equipped."

The 9th Republic of Korea (ROK) Division considered Combat Skyspot a very effective ordnance delivery system for night and inclement weather operation. From the 5th Special Forces Group, there were reports of overall accuracy within approximately 30 meters of the target with no gross errors. Their evaluation of Combat Skyspot states that it is extremely accurate and effective in destroying or damaging targets. The 1st Brigade of the 101st Airborne Division reported the CEA was approximately 10-15 meters.

Friendly ground forces' confidence in Combat Skyspot accuracy has been enhanced and strengthened considerably. Ground commanders also have great confidence in CSS, since it continues to be a most effective method of ordnance delivery. Interrogations of captured VC regularly reveal the shock effect of Combat Skyspot.[23/]

The psychological effect that Combat Skyspot bombing has on the enemy is substantial. There are many instances where returnees and prisoners have divulged the awesome mental anxieties incurred by B-52 harassment and

interdiction missions.

A notebook belonging to a Viet Cong sergeant of the 325th Division related one such B-52 strike.[24]

> "...Alas! the shower of B-52's bombs, it was terrible. At 4:15 last night, a group of B-52 aircraft dropped bombs on the Battalion, C2 was destroyed. This sight cut me to my heart. All Battalion Cadres were killed, one staff cadre was wounded. G-2 suffered more than fifty killed, and tens of C-1 were wounded. Blood ran torrents...."

On 21 July 1966, another Viet Cong soldier writes, "I was sent to Le Loi unit to fight while I was in charge of transporting ammunition and rice. We were not even half-way there when B-52 aircraft suddenly struck--men died."

One instance occurred when a Viet Cong Company was lined up to hit the rear forces of the U.S. However, Combat Skyspot strikes from behind them, and all around, kept the company from striking at the U.S. troops. This company was broken up and made ineffective by the air strikes.[25]

After one B-52 air strike, 200 of 500 Viet Cong were killed. The captured Executive Officer of this outfit stated,[26] "The surviving members of the J-13 Regiment scattered after the strike. Their morale was low and many were willing to give themselves up to the GVN if afforded the opportunity."

The constant threat of all-weather harassment has played a large part in the success of the Chieu Hoi program--a program to induce Viet Cong

to defect and join the government. A more personal indication of the effects of Combat Skyspot bombing was provided in a letter written by a VC to his brother on 26 May 1967. The VC, Bay Chi, wrote of the death of three VC cadre in a night bombing conducted by Allied jets on Nhut Ninh in Tan Tru District. He disclosed that the VC in Long An Province were very afraid of Allied jets, equipped with modern devices and capable of very accurate night bombing, which cause considerable losses to the VC. 27/

14. Combat Skyspot "Short Rounds"

There have been instances of short rounds in the Combat Skyspot Program. These short round incidents range from ground commanders not knowing where all of their troops are located prior to the strike to erroneous information being fed into the computers of the MSQ-77.

On 9 March 1967, an incident occurred in which a Combat Skyspot mission dropped ordnance on friendly troops. The ground commander had requested CSS air strikes in the defensive perimeter of a heavily punji-staked, booby-trapped, and fortified area so that it could be investigated. Accordingly, the FAC was requested, and although radio contact had been established, low clouds prevented him from flying directly over the friendly ground forces' position.

The FAC returned to the TACP and requested three CSS air strikes, plus any additional resources that could be generated by DASC Alfa. In response to this request, the first CSS was dropped at 1110 hours.

Another FAC, flying in support of Project DELTA, received an

emergency call from the Maneuvering Ground Force (MGF) to cancel all CSS, as the first sortie had hit friendlies. He stopped the CSS and conducted a detailed visual aerial reconnaissance of the terrain. This revealed that bombs had, in fact, been dropped on the correct coordinates, but the friendlies had been in the target area. Their casualties amounted to 15.

Later investigation showed the cause of this incident to be a navigational error on the part of the ground forces. If a FAC had fixed the friendly forces' position, this error would probably have been discovered. The reason he had avoided overflying the target area, however, was to preclude unnecessary compromise of their position.

As a result of this incident, a policy was established that CSS missions would not be requested until a FAC had positively located the friendly elements by overflight.[28/]

There were also problems in the requesting and preplanning portion of the Combat Skyspot system. For example, on 16 April 1967, a request for an air strike was originated by the 25th Infantry Division, and sent in code to G-3 Air Headquarters II FFV. In decoding, the Assistant G-3 Air made a letter designator error. While the letter designator should have been XT, the error produced was XS.

The erroneously decoded request was delivered to III DASC for purposes of preliminary planning in the event the mission was approved and fragged. The air strike was relayed to TASE where it was decoded properly, approved and fragged, by Seventh Air Force TACC. As per SOP, the morning

of the fragged strike, the recorder on duty at the Controlling MSQ site contacted III DASC to confirm target coordinates, timing, and heading for the strike aircraft. At this time, III DASC told the MSQ site recorder the target coordinates were XS rather than XT. The site recomputing on XS target, was subsequently struck by two F-100s with 8X750-pound bombs on 16 April 1967.

These bombs struck the town of Ben Tre exactly 10,000 meters due south of the intended target. Investigators of this incident reached the conclusion that because of decoding errors, and not cross-checking the decoded requests, as well as failing to check obvious discrepancies between the DASC and the site, errors of this type could more readily occur on immediate air strike requests than on a preplanned mission such as this one.[29/]

Lastly, the MSQ operators themselves have been involved in this human error problem. One such error occurred in April 1967, when MSQ personnel were transposing UTM coordinates to compute XY coordinates from UTM tables. These X and Y coordinates are set into the MSQ computer system to give a track reference for the controller to direct the strike. Because this is such a critical computation, the procedure called for two men to compute individually, and then compare their results. Both men made the same transpositional error; in addition, one did not use the prescribed form. This occurrence resulted in a gross bombing error of about 11,000 meters from the desired target box.[30/]

The controller is now required to physically plot the X and Y range

components on a 1-to-500 scale map to compare the measurements with the information being set into the computer. This check will reveal any computation error in excess of 2,000 feet.[31]

15. Innovations

As new ideas appear on the radar bombing scene, the Air Force's goal is to make the Combat Skyspot system more portable, accurate, and versatile. One of the ideas recently effected at the Nakhon Phanom, Thailand site concerns the new TSQ-81. Similar to the MSQ-77, but placed in a 10 by 42-foot portable building, the TSQ-81 is Caribou aircraft (C-7A) portable, needs no special hardened site, and may be set up in two days. The total weight of this equipment is 7,300 pounds, which is divided into five Caribou-capable loads.[32]

Plans exist for another new system, the CL-55, incorporating a modified Nike Ajax antenna pedestal, 250 feet from the MSQ-77 Control and Maintenance Vans. The basic idea is to remote the antenna system from the area where the men are situated, thus affording personal security from attacks by airborne radar seeking offensive weapons.[33]

Because of the limited range (196-NM) of the MSQ-77 radar, Route Packages IV, V, and VI, and northern Laos have been beyond the reach of Combat Skyspot. To extend the range of the ground-directed bombing capability to vital targets in these areas, a proposal has been made to operate a MSQ-77 from ships in the Gulf of Tonkin. Testing of this program, nicknamed Combat Keel, is now under way. It serves the purpose of evaluating

the capability of a shipboard-mounted MSQ-77 to provide precise ground-directed bombing in a simulated operational environment, and to identify and measure the support requirements for such a system. 34/

These new ideas, plus those in the initial planning stages, are oriented toward a more efficient and accurate Combat Skyspot system.

FOOTNOTES

1. (C) Msg, I DASC, Da Nang Air Field, to 2d AD, TSN, RVN, 00451, subj: A Shau Special Forces Camp Attack, 091015Z Mar 66, Doc. 1.

2. (S) OPLAN, 7AF, OPORD, 439-67, Combat Sky Spot, 10 Mar 67, Doc. 2. (Hereafter cited: OPORD 439-67.)

3. (C) Rpt, Hq TAC, subj: Fighter Delivered Munitions and their Effects, Mar 67, Doc. 3.

4. (S) Working Paper, DOA, Hq 7AF, subj: Accuracy of MSQ-77 Bombing System, 3 Sep 66, Doc. 4. (Hereafter cited: Working Paper.)

5. (C) Interview, Motorola Tech Rep, Mr. Bayless, subj: SST-181 Equipment, 24 May 67, Doc. 5.

6. (C) Rpt, Hq TAC, subj: Fighter Delivered Munitions and their Effects, Mar 67, Doc. 3.

7. (S) OPORD 439-67, Doc. 2.

8. Ibid.

9. Ibid.

10. Ibid.

11. Ibid.

12. (S) OPORD, VNAF/7AF, Joint OPORD 456-67, Undated, Doc. 6.

13. Ibid.

14. Ibid.

15. Ibid.

16. (C) Excerpts, Directive, MACV, Nr 95-4, 28 Jun 66, Doc. 7.

17. (S) Staff Study, Hq 7AF, Maj William J. Watson, subj: Combat Skyspot Bombing Margin of Safety, Undated, Doc. 8. (Hereafter cited: Staff Study by Maj William J. Watson.)

18. (S) Working Paper, Doc. 4.

19. (S) Staff Study by Maj William J. Watson, Doc. 8.

20. (S) Extract of Rpts, 7AF, Biweekly Combat Skyspot, Undated, Doc. 9.

21. (S) Staff Study by Maj William J. Watson, Doc. 8.

22. (S) WAIS, Nr 25, Vol II, subj: The MSQ-77, 25 Jun 66, Doc. 10.

23. (S) Ltr, DASC Alpha, subj: Combat Skyspot Rpt, 1-30 Apr 67, 13 May 67, Doc. 11.

24. (C) KIN Rpt, USMACV, Nr 01-0761-67, subj: Captured Documents, 15 May 67, Doc. 12.

25. (C) Ibid; Interview, Maj James Ryan, ALO, 1st Bde, ACD, by Kenneth Sams and Capt James G. Bruce, Jr., subj: Uses of Air Operation in IRVING, Bien Hoa, 8 Nov 66, Doc. 13.

26. (C) Msg, MACJ 236-1 (CICV) to JCS, 01955, subj: ARC LIGHT Strike Results 765, 170559Z Jan 67, Doc. 14.

27. (C) KIN Rpt, USMACV, Nr 5557, subj: Enemy Documents, 20 Jun 67, Doc. 15.

28. (C) Msg, ALO, 5th SF Gp to IFFV ALO, After Action Rpt, Black Jack 23, 18 Apr 67, Doc. 16.

29. (C) SO, Hq 7AF, Nr A-69, 16 Apr 67 w/Rpt, Investigation, 7AF, subj: Report of Investigation, 19 Apr 67, Doc. 17.

30. (S) Msg, CINCPACAF to RUHL Hq/CINCPAC, 31900, subj: ARC LIGHT MSQ Incident, 150049Z Apr 67, Doc. 18.

31. (S) Msg, COMUSMACV to CINCPAC 12152, subj: ARC LIGHT MSQ Incident, 121434Z Apr 66, Doc. 19.

32. (S) Special Study, Reeves Instrument Co, subj: Repackaging of Radar Bomb Directing Control AN/MSQ-77, Antenna Remoting Study, 29 Aug 66, Doc. 20.

GLOSSARY

AA	Antiaircraft
ACD	Air Cavalry Division
ADF	Automatic Direction Finder
ALO	Air Liaison Officer
AO	Area of Operation
ARA	Aerial Rocket Artillery
ARVN	Army of the Republic of Vietnam
AW	Automatic Weapons
BDA	Bomb Damage Assessment
Bn	Battalion
Cav	Cavalry
CBU	Cluster Bomb Unit
CIDG	Civilian Irregular Defense Group
Click	Kilometer
CP	Command Post
DAS	Direct Air Support
DASC	Direct Air Support Center
DF	Direction Finder
Div	Division
DPI	Desired Point of Impact
FAC	Forward Air Controller
Frag	Fragmented Operations Order
FSB	Fire Support Base
FWMAF	Free World Military Armed Forces
GM	Gravel Mine
GP	General Purpose
Inf	Infantry
KBA	Killed by Air
KIA	Killed in Action
KM	Kilometer
LOC	Line of Communication
LZ	Landing Zone
MG	Machine Gun
MIA	Missing in Action
MN	Millimeter
NVA	North Vietnamese Army

OPCON	Operational Control
PIO	Public Information Office
PMEL	Precision Maintenance Equipment Laboratory
POW	Prisoner of War
Prep	Preparation
Recon	Reconnaissance
Regt	Regiment
ROK	Republic of Korea
SF	Special Forces
TAC	Tactical Air Command
TACP	Tactical Air Control Party
TAOR	Tactical Area of Responsibility
TFW	Tactical Fighter Wing
USAF	U.S. Air Force
USSF	U.S. Special Forces
VHF	Very High Frequency
VR	Visual Reconnaissance
WIA	Wounded in Action
Willie Pete	White Phosphorous