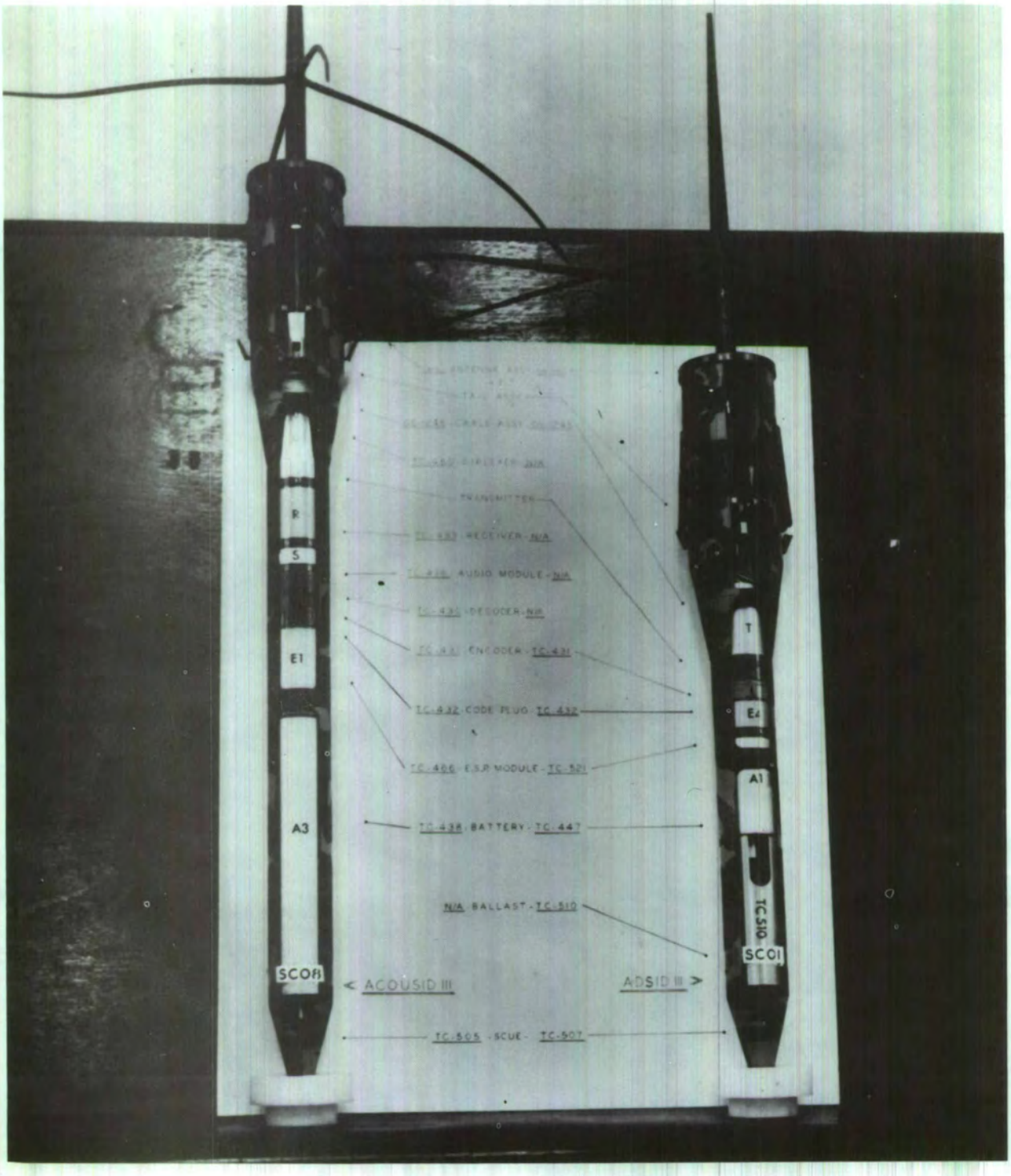
CHAPTER III

SENSORS, SENSOR-RELATED DEVICES AND SPECIAL USES

By February 1971, the last Phase I and II sensors had been retired from the IGLOO WHITE Program and entirely superseded by Phase III types. Phase I sensors consisted primarily of the Navy's SONABUOY and Air Delivered Seismic Intrusion Detectors (ADSID). The former had only an audio capability, while the latter was solely a seismic sensor. The SONABUOY was available in two versions: the CANOPY ACOUBUOY which was designed to hang in the upper layers of the jungle canopy, and the SPIKE ACOUBUOY (SPIKEBUOY) which implanted in the ground. Two other Phase I sensors used in small numbers were the Helicopter Emplaced Seismic Intrusion Detector (HELOSID) and the Hand Emplaced Seismic Intrusion Detector (HANDSID). None of these sensors were commandable, and they broadcast on 31 channels, each with 27 distinct addresses.[139/]

Phase II differed from Phase I sensors primarily in their commandability, especially the ability to command audio. These sensors could be instructed to send audio, go nonreal time (count impulses and store this information for later transmission on command), go real time (transmit impulses as they occur), and read out (transmit accumulated nonreal time impulses). ACOUBUOY and SPIKEBUOY sensors were converted to a Phase II mode, while the ADSID I was replaced by the Fighter Air Delivered Seismic Intrusion Detector (FADSID II). In addition, a combined seismic/acoustic sensor was delivered - the Acoustic-Seismic Intrusion Detector (ACOUSID II). High



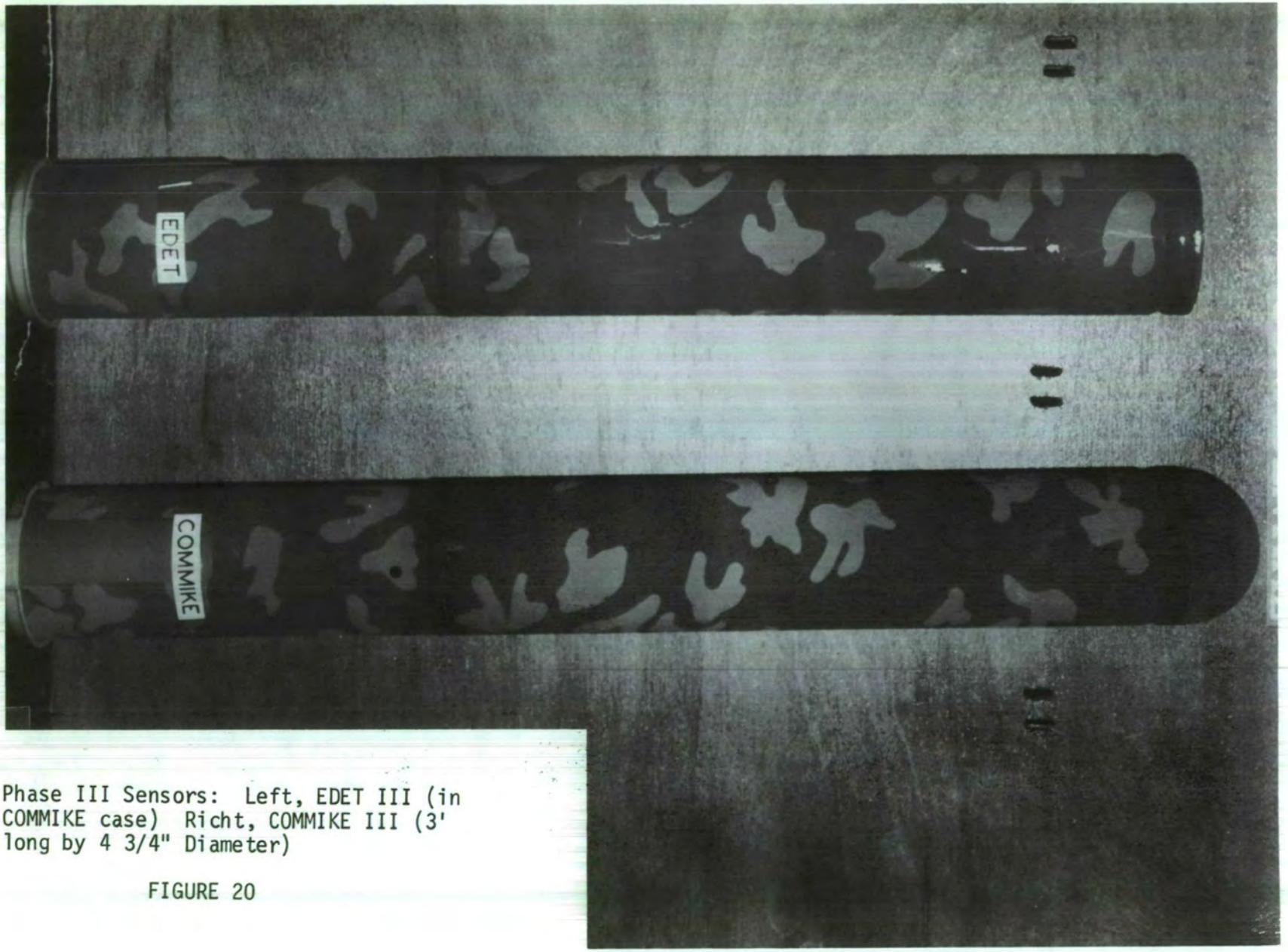
Phase III Sensors: Left, ACOUSID III
(4' long x 5" Maximum Diameter)
Right, ADSID III
(3' long x 5" Maximum Diameter)
Figure 19.

implant mortality rates for the FADSID II, however, resulted in the continued use of ADSID Is.[140] A modified SPIKEBUOY called SPIKE Seismic Intrusion Detector (SPIKESID) was used in early 1970 on a test basis. This sensor was commandable and incorporated a seismic detection circuit and a field-selectable option which made SPIKESID acoustic or seismic or both.[141]

Phase III sensors incorporated the commandable features of their predecessors, but increased the number of channels available to 32, with 64 sensor addresses each (instead of the previous 27).[142] The use of common components in Phase III devices reduced costs and logistics complexities and allowed sensors to be tailored to specific situations.[143] Sensors included Phase III versions of the ground implanted ADSID and ACOUSID, as well as the Commandable Microphone (COMMIKE III), which was suspended from jungle canopy.[144]

Engine Detection Sensor (EDET III)

EDET III was an engine-detector sensor designed to detect pulsed radio frequency energy from the unshielded system of gasoline-powered engines.[145] EDET electronic components were enclosed in standard COMMIKE III cases, restricting their use only to areas with sufficient jungle canopy to permit them to hang up. During an operational evaluation of the new sensor carried out by TFA from 27 March to 3 June 1971, 44 EDET IIIs were emplaced over existing, reliable ADSID/ACOUSID and COMMIKE strings to provide maximum verification of EDET III activations. As an LOC monitor, approximately 80 percent of the activations recorded during this test



Phase III Sensors: Left, EDET III (in COMMIKE case) Richt, COMMIKE III (3' long by 4 3/4" Diameter)

FIGURE 20

correlated directly with ADSID/ACOUSID sequences. An additional 12 percent of the sequences not detected by EDET III indicated the presence of diesel powered vehicles, demonstrating EDET's indirect capability to differentiate between different power plants.* The remaining eight percent were attributed to false alarms from weather and lightning.[146/]

EDETs were partially successful as truck park monitors, especially when emplaced in conjunction with COMMIKEs. Like seismic sensors, EDETs responded automatically to an activation which was then displayed on the GSM's IBM 2250 display console. By polling COMMIKEs collocated with EDETs only when the EDET indicated activity, the acoustic sensors confirmed the presence of trucks 50 percent of the time. The standard TFA procedure was to poll COMMIKEs at random, a method which had only a six percent rate of truck detections. Per unit of time expended by the audio technician, the COMMIKE/EDET combination produced approximately eight times greater truck identification than the COMMIKE alone, and required only one-fifth the time. A combined COMMIKE/EDET system allowed a field to be monitored which was four to five times the size of one in which COMMIKEs were polled randomly. Lightning-produced false alarms were believed to have interferred occasionally with EDET truck identification, but the total number of such activations was considered much less than for ADSID/ACOUSID sensors because of the EDET's selective nature.[147/]

* EDETs cannot detect diesel-powered vehicles--can only detect the ignition of gasoline-powered vehicles.

On 13 May 1971, TFA reported that EDETs when used in conjunction with other sensors would be most useful for truck park monitoring and for detecting special purpose vehicles such as tanks, caterpillar tractors, and those with diesel engines. TFA also considered it to be less useful as an LOC monitor in dense jungle areas;[148] earlier tests at Eglin Air Force Base, Florida, had indicated that the EDET's detection range decreased rapidly as jungle density increased.[149]

Although the utility of the EDET III had been proven operationally, the extent of its use during COMMANDO HUNT VII was uncertain at the time of this report. In May 1971, TFA had stated that approximately 826 EDETs would be used during the coming campaign if the first could be made available by October 1971.[150] By mid-August, CINCPACAF had authorized Air Force Systems Command (AFSC) to begin price negotiations for the procurement of 400 EDT IIIs, with initial delivery to be on or before 1 February 1972. Delivery rate was specified at between 20 and 35 per week.[151]

In early August 1971, the Saigon office of the Defense Special Projects Group (DSPG) responsible for the overall development of IGLOO WHITE and formerly known as the Defense Communications Planning Group reported to its Washington office that motorized sampan traffic in the Mekong Delta area of the RVN had increased significantly and inquired as to the suitability of EDET IIIs to monitor this traffic.[152] DSPG replied that the use of EDETs was feasible for this purpose as long as the rpm of the sampan's engine was high enough.[153] Possibly as an

outgrowth of this exchange was a TFA plan of mid-September to emplace a string of EDETs (with one COMMIKE) along the Se Kong River in southern STEEL TIGER south of Attopeu in an effort to detect motorized waterway traffic. This was a test plan only, with EDETs being obtained from stocks remaining after the March to June evaluation.[154/]

Commandable Audio-Engine Detector (CAEDET)

During the March to June tests EDET III modules were enclosed and emplaced in standard COMMIKE cases. Consequently, they were usable only in areas of heavy canopy. Additionally, the evaluation demonstrated that the effectiveness of the EDET/COMMIKE combination could be limited because the sensors had to be delivered in separate cases. If delivery conditions resulted in excessive distances between the final locations of the sensors, valid audio assessments and correlations between the two were impossible.[155/]

Bearing in mind these factors, TFA in June 1971 raised the possibility of combining EDET and COMMIKE components/capabilities in the same case. Also mentioned was the development of an EDET sensor either with an implant capability, or as part of existing seismic sensors. If successfully developed, EDETs could be delivered in either a ground-implant or tree hang-up mode and paired with audio or seismic capabilities with no danger of delivery dispersion limiting the effectiveness of the string.[156/] Combined sensors would also reduce the number of delivery sorties required and allow strings of only two or three sensors to be used effectively.[157/]

TFA identified two significant deficiencies in current operational capabilities which sensors combining EDET, seismic, and acoustic characteristics would help correct. First, the enemy was increasing his use of diesel-powered tracked vehicles (tanks, bulldozers) and prime movers in Laos, but TFA was unable to distinguish these from those using conventional gasoline engines. Second, TFA could not adequately monitor the vast numbers of truck park/storage areas in use (or suspected use) by the enemy, or correctly determine the most lucrative time for strikes.[158/]

In July 1971, the Chief of Staff of the Air Force (CSAF) applied the term CAEDET to the proposed ignition/commandable acoustic sensor to prevent confusion with EDET III.[159/] Electronics Systems Division at Hanscom Field, Massachusetts, directed in August that the audio-ignition detection components would be designed to fit inside a container suitable for both a canopy hang-up and ground-implant role,[160/] but delivery of sensors was not believed possible before October 1972.[161/] As of the cut off date of this report, there were no firm plans to proceed with the development of an EDET combined with seismic capabilities.

Radar Beacon Transponder (RABET II)

Not all new sensor devices and applications were successful. One notable failure was the RABET II. This consisted of a 400 watt X-Band radar beacon enclosed in an ACOUSID II case which was implanted by an F-4. The beacon was designed as a target reference marker to aid radar bombing. When interrogated by an X-Band radar, the RABET II was supposed

to transmit a response indicating its position.[162] Of six RABET II beacons test-dropped from July to October 1970, only one established contact after impact, and then only for seven or eight minutes.[163] These umpromising results led to the project's cancellation by the DCPG (now DSPG) on 24 December 1970.[164]

Acoustical Targeting

At the end of COMMANDO HUNT III, considerable doubt existed at TFA concerning the value of acoustic sensors. The presence of these sensors in LOC monitoring strings was regarded at that time as adding only insignificantly to the ability to define sequences, since three or four reliable seismic devices were believed adequate to confirm the presence of truck traffic. An acoustic capability was seen as useful only in certain special cases, such as with strings giving inadequate patterns because of ambiguity, high false alarm rates, or weak responses. Acoustic sensors were also useful at either end of COMMANDO BOLT strings to provide the maximum possible warning of approaching trucks, since acoustic detection range was approximately three times that of seismic.[165]

Acoustic sensors were considered of little value for area reconnaissance or monitoring purposes as well. From September 1968 to September 1969, 22 Reconnaissance by Acoustic (RBA) and "Occupational" (to determine enemy occupancy of an area)[166] sensor strings were in use in STEEL TIGER, but this had fallen to 16 for COMMANDO HUNT III.

One argument against RBA stressed the relative inefficiency of the RBA method as producers of target intelligence:[167]

> *In general, by the time we go through the effort of determining by photo and visual reconnaissance whether an area would be a likely site for an RBA string, we will already know whether or not there is a target warranting strike in the area. Knowing that, there is little use in emplacing the RBA string which was intended to answer the same question.*

Other problems concerned the dispersed nature of enemy storage facilities which meant that even well-placed acoustic strings usually sensed only low levels of activity even in major complexes. RBA emplacement sorties were also difficult to obtain, since LOC monitoring strings had a higher priority.[168]

A fresh look was taken at the value of acoustic targeting during COMMANDO HUNT V. In February 1971, an RBA program was initiated using COMMIKE IIIs to ascertain enemy activity in certain enemy truck park/storage areas covered by heavy canopy. A total of 11 COMMIKE strings were implanted in areas identified as potentially lucrative by evaluation of sensor patterns and inputs from all intelligence sources. Several targets were developed from this effort. In March, EDET IIIs were combined with the COMMIKEs as part of the evaluation of the new engine ignition detectors.[169]

In July 1971, TFA inaugurated the concept of Acoustic Targeting Areas (ATA). Under this concept acoustic intelligence gathering and

analysis were done in terms of an area, which was monitored by a series of strings of two or three sensors each. Previously, RBA strings had averaged nine sensors each[170] and had functioned primarily as an intelligence collector. When RBA sensors had indicated enemy activity in an area, visual and photographic reconnaissance were used to determine a set of strike coordinates. ATAs went beyond this concept in that strikes could be called in on the basis of acoustic indications alone.[171] As of July 1971, 27 ATAs had been implanted, 40 assessments had been made in 16 of the areas, and two strikes called in with unknown results.[172]

The reemphasis of TFA from its previous role of an intelligence gatherer to that of a target developer accounted for much of the fresh attention devoted to acoustic targeting. Sorties were now available for acoustic sensor implants, since greater importance was being attached to programs with BDA potential, rather than those intended to count trucks or monitor LOCs. TFA was also considering a plan for COMMANDO HUNT VII to implant acoustic sensors in areas of heavy canopy in grid patterns, rather than the straight lines used in the past.[173]

Use of Sensors for Assessing BDA

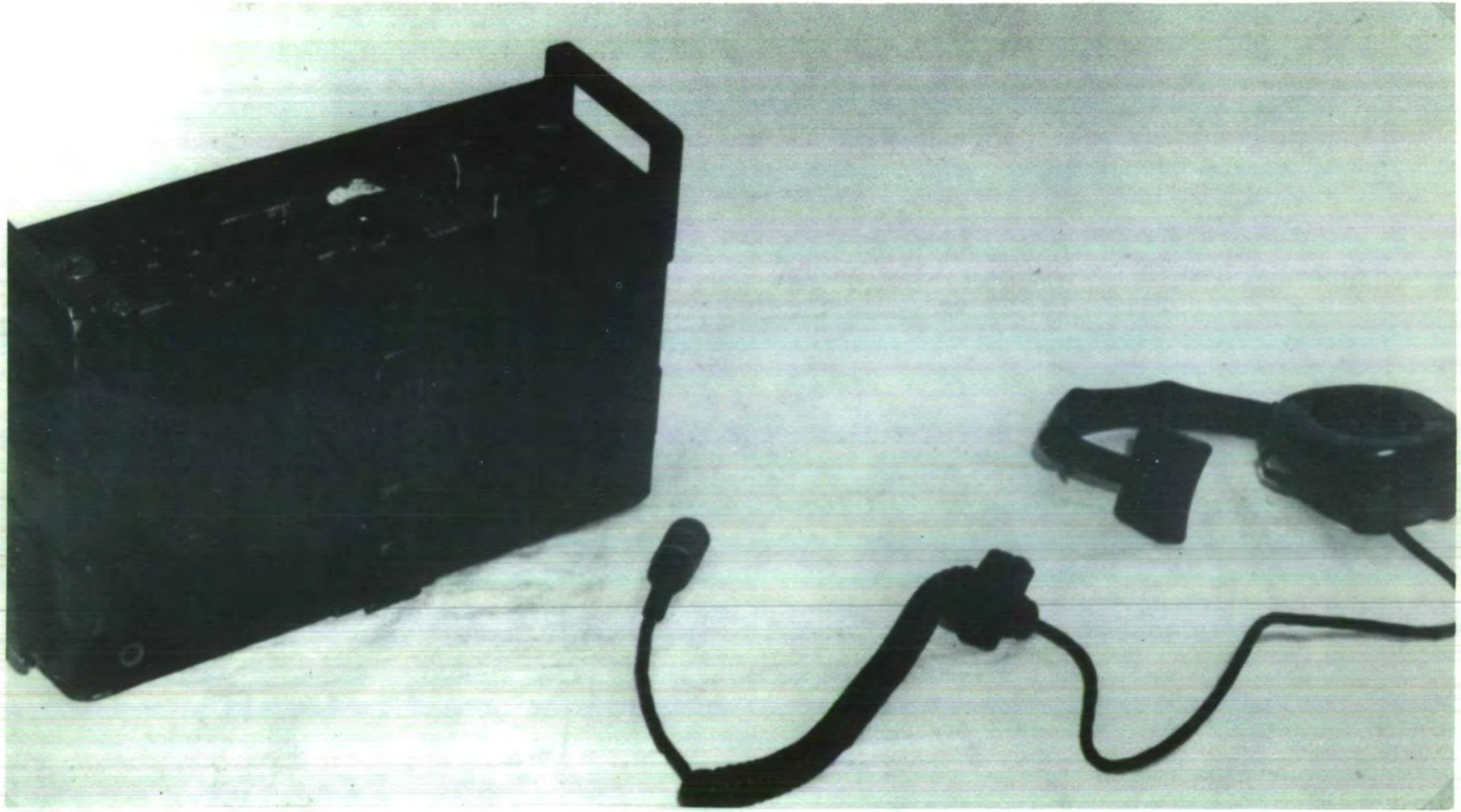
Sensors were used for determining BDA only to a limited extent. An April 1971 7th AF report pointed out that for any damage assessment to be made, the vehicles would have to be within the string at the time of the attack, and the attack coordinated with TFA. Although this was possible with COMMANDO BOLT operations, it would be extremely difficult with other fighters or gunships, especially since only 3.5 percent of

the motorable Laotian route structure was covered by sensor strings.[174/]

Sensors often recorded activations immediately following strikes, but it was difficult to determine precisely if these were caused by exploding ordnance, secondary explosions, or enemy activity. Detection of a significant amount of continuing activity after conclusion of a strike would indicate an enemy presence in the area and a response to the attack. This could be the basis for a recommendation that the target be restruck. Although sensor (especially acoustic) BDA was a factor which was taken into account by TFA, it was never considered quantifiable or capable of being entered into the TFA data base as confirmed BDA.[175/]

Portatale

In January 1970, a 10-day test/evaluation program was conducted by three OV-10s of the 23d Tactical Air Support Squadron (TASS) at Nakhon Phanom Royal Thai Air Force Base, Thailand (NKP), to determine the feasibility of adopting Portatale I Very High Frequency (VHF) receivers as an airborne aid to enable FAC aircraft to receive and display signals directs from IGLOO WHITE sensors in areas where terrain conditions masked read out by conventional monitoring and relay procedures.[176/] The Portatale was a light weight, portable device which had the capability of decoding and displaying signals from sensors on any of 31 channels, one at a time (See Figure 21). Marine OV-10 crews at Da Nang had been using the device for this purpose and reported it to be simple in



Portatale I and Headphone

FIGURE 21

operation and highly reliable. During the evaluation FACs of the 23TASS hoped to be able to conduct strikes on sensor-detected targets on a near-real time basis in areas where the use of sensors had previously been restricted, such as Rat Fink Valley and the Ban Laboy Fords, both near Ban Karai Pass.[177]

In early January 1970, the Director of Materiel Management at Kelly Air Force Base, Texas, authorized the implementation of a Class IB modification to equip Air Force OV-10s with Portatales in accordance with Naval Air Systems directives and guidance.[178] This was accomplished by Air Force Personnel at NKP assisted by advisors from the III Marine Air Wing (MAW).[179] In addition, two special strike strings consisting of four ADSIDs and one SPIKESID apiece were emplaced for the operation on 12 January in the Delta 57 area in Laos near the Xe Bang Fai River.[180] Deteriorating weather and increased enemy AAA defense had forced the test to be moved away from the preferred site, Route 912B in Rat Fink Valley.[181] All sensors except the two SPIKESIDs functioned satisfactorily, and none could be read from EC-121R orbits.[182]

The operational evaluation ran from 22-31 January 1970 and was conducted as a conventional Panther Team operation employing OV-10 FAC and A-1 strike aircraft:[183]

> *The navigator in the OV-10 used a manual "CONFIRM" sheet to record a time history of sensor activations to provide sequences which were then interpreted to indicate the presence, number and approximate location of the trucks.*

During the 10-day period, a total of 31 Portatale-detected sequences indicated truck movement. Fourteen of these were visually investigated by means of the Night Observation Device (NOD, an available-light-augmentation instrument to improve visibility during night operations) carried on participating OV-10s and a 15th sequence was checked by an O-2 FAC. Results were as follows:[184/]

Sensor Activations	402	Trucks Sighted	31
Sensor Sequences	31	Trucks Struck	13
Sequences Investigated	15	Trucks Destroyed	11

In addition, three POL fires and one medium secondary explosion were reported. During the period of the test, Panther Teams had 23 FAC confirmed truck kills, 11 of which were directly attributable to Portatale equipped aircraft.[185/]

The evaluation demonstrated that FAC aircraft with a Portatale capability could effectively read out sensor strings masked from other monitor aircraft and utilize the information to detect, acquire and destroy enemy trucks. The test also determined that normal FAC crew duties and the time required to record and interpret sensors placed a limit on the number of sensors and the extent of the area that could be monitored.[186/]

Another Portatale strike string was emplaced on Route 912B in Rat Fink Valley on 3 February 1970 to be used in conjunction with OV-10 FACs and A-6s with Airborne Moving Target Indicator (AMTI) radar

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JANUARY 1970 PORTATALE TEST

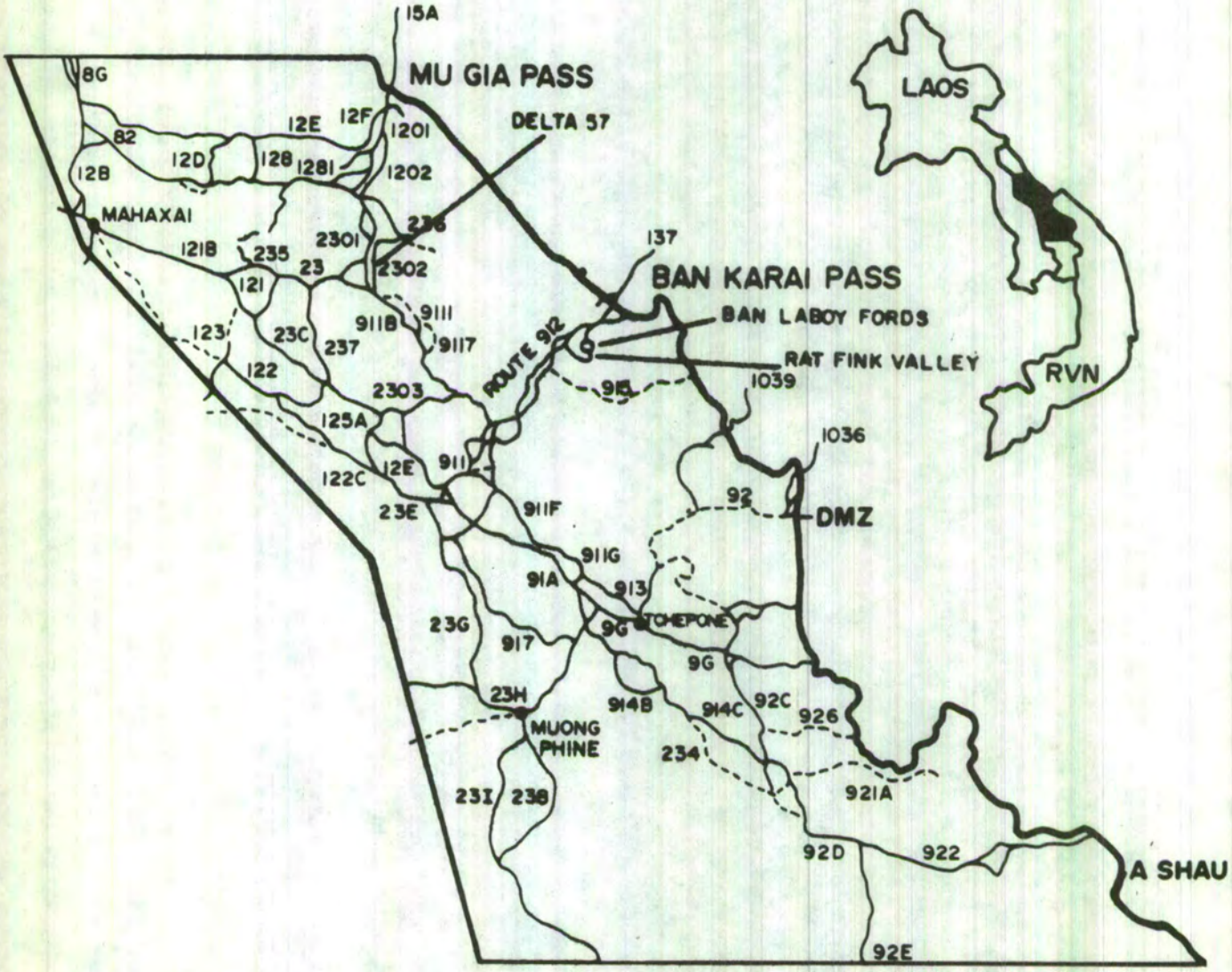

FIGURE 22

[redacted]

[redacted]

capability, but higher priority OV-10 requirements prevented this from being carried out.[187/]

Further TFA study of the widespread application of Portatale revealed numerous difficulties if gunships or even substantial numbers of FAC aircraft were to be equipped with the device on a regular basis. A 27 May 1970 study admitted the advantage in providing real time target information, but the cost of the necessary equipment and modifications (estimated at $300,000) for the FAC and gunship fleet, as well as the added burden on aircrews, were seen as serious drawbacks. The navigator's prime duty of keeping the aircraft above the LOC and searching for truck targets with the NOD would prevent him from adequately monitoring the Portatales and keeping the activation log which was necessary for determining the validity of an activation sequence, and, if valid, the direction of travel. For this reason, the Portatale might be little used or ignored completely, thus wasting the resources involved.[188/]

TFA also estimated that less than 10 percent of the sensor string location requests were refused because of terrain masking; many of these routes could be monitored just as effectively by putting the string elsewhere on the LOC. The Portatale-equipped FAC aircraft or gunship, because of its low operating altitude, would itself incur terrain masking problems more serious than those affecting EC-121Rs monitoring the sensor field from the normal orbits. Since the Portatale could receive on a small range of channels only, management of a larger

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Portatale field would be extremely difficult, and Radio Frequency Interference (RFI) problems would increase. The January 1970 test had avoided this problem by using only two strings. TFA also pointed out that subsequent use of the Portatale had resulted in unspectacular BDA.[189/]

Portatale in CREDIBLE CHASE

The use of Portatale as an airborne sensor read out device surfaced again in September 1971 in connection with the CREDIBLE CHASE program to develop a minigunship based on the Short Take Off and Landing (STOL) Turbo-porter aircraft. During a 14-16 September CREDIBLE CHASE Conference at Eglin Air Force Base, Florida, the use by this aircraft of real time sensor information to assist in the location of targets was discussed. This information was to be provided by on-board read out of sensors through Portatale III devices; the necessary electrical connections were already being installed on all aircraft under existing contracts. In addition, DSPG recommended the installation of RO-376 Event Recorders in CREDIBLE CHASE aircraft to further assist sensor interpretation. At the cut off date for this report, details of this further modification had still to be settled, and no information was available concerning the anticipated employment of airborne Portatale IIIs.[190/]

Radio Frequency Interference (RFI)

IGLOO WHITE sensors have always been considered to be extremely vulnerable to hostile jamming efforts.[191/] Studies in 1966 during the early stages of the sensor program examined IGLOO WHITE's vulnerability to enemy Electronic Countermeasures (ECM), but decided

[redacted]

that protective measures would slow program development and procurement. Consequently the risk was accepted and the project went ahead as scheduled. These studies concluded that the probable ECM target in the IGLOO WHITE system would be the sensor-to-aircraft VHF data relay.[192/]

While North Vietnamese forces failed to employ such tactics against IGLOO WHITE, RFI was noted on sensor monitoring channels on several occasions during COMMANDO HUNT V. An incident on 7 October 1970 featured severe sensor data interference lasting 90 minutes on Blue and Purple Orbits. There was no indication of the intentional introduction of non-data signals into the sensor channels, and the 553d Reconnaissance Wing speculated that it may have been a side effect of either friendly or enemy ECM/anti-ECM activities during B-52 missions.[193/] Similar incidents occurred from December 1970 to March 1971, with durations of a few minutes to nearly an hour.[194/] As predicted by the 1966 studies, the sensor to aircraft data relay proved to be highly vulnerable to RFI.

In early March 1971, the Air Force Special Communications Center at Headquarters Air Force Security Service in San Antonio, Texas, investigated 29 such incidents occurring since 25 January. A strong correlation was found was found between the interference and periods of ECM jamming performed by B-52s and their EB-66 escorts. North Vietnamese SPOON REST Surface-to-Air missile (SAM) acquisition radar frequencies operated near the IGLOO WHITE sensor-to-aircraft data relay; the necessity of jamming these radars raised the likelihood that this interference could be expected to recur in the future.[195/] Sensor data loss because of such

[redacted]

incidents was small, however, and RFI represented an inconvenience, rather than a major obstacle to the successful operation of IGLOO WHITE.

At a sensor conference at Sandia Laboratories (the firm responsible for developing much of the IGLOO WHITE technology) in Albuquerque, New Mexico, on 28-30 April 1971, 7th AF reported the jamming problems and requested that the vulnerable channels be deleted and replaced by others in another frequency range.[196/] COMUSMACV approved the change on 9 May and the seven most vulnerable sensor data channels were exchanged for seven new ones.[197/]

A September 1971 TFA message stated that there had never been an attempt by the enemy to interfere electronically with IGLOO WHITE operations, but requested that ". . . every precaution be exercised to insure that knowledge of the potential vulnerability of the IGLOO WHITE system to ECM be safeguarded." The success of enemy jamming efforts "would be a function of the approach used," the message continued, but the size of the sensor field, its dispersal, and the foliage found in STEEL TIGER were all expected to limit the success of such an attempt.[198/]

Enemy Attempts to Neutralize IGLOO WHITE Sensors

Interrogation of enemy captives and ralliers disclosed enemy awareness of sensors and countermeasures against them. Enemy personnel moving along infiltration trails in Laos received occasional briefings concerning sensors from North Vietnamese troops manning Commo-Liaison stations situated along their route. A typical briefing covered the

appearance of sensors, common locations, correct procedures upon discovering such a device, methods of rendering them ineffective and the danger they represented.

One North Vietnamese rallier reported that sensors were described to his group as being one meter long and 62mm in diameter, and painted in a camouflage pattern (similar to that of uniforms) to resemble tropical trees. Sensors had four antennae, two for detecting voices and two for sending signals to waiting aircraft.[199/] Most sources reported that the sensors were believed dropped by U.S. reconnaissance aircraft, although one prisoner was told that some were hand-implanted on trails by Army of the Republic of Vietnam (ARVN) Special Forces personnel.[200/]

When moving through areas where sensors were suspected, personnel were instructed to walk slowly and quietly and refrain from speaking. Important messages were to be whispered only, and sticks for fires were to be cut, not broken. Any movement which the sensors detected could result in immediate artillery or air strikes.[201/] The ground and trees in bivouac areas were always closely searched for air-dropped sensors and mines.[202/]

Upon discovery of a sensor, infiltrating personnel were instructed to inform cadre or Commo-Liaison station personnel immediately. Sensors were deactivated by burning or stabbing with bayonets,[203/] or were turned upside down and their antennae jammed into the ground. One rallier who reported that he had broken sensors open claimed that

the larger devices contained some 54 "tubes and bulbs." This individual drew two sketches, which resembled transistors, for his interrogator.[204/] None of the sources reported serious morale problems on account of sensors, although one group was said to have been nervous while passing through a suspected area.

The nature of his sensor-deactivation procedures indicates that the enemy was unaware that sensors automatically deactivated when tilted a certain angle from the vertical. The concern over limited individual conversation and movement while travelling through an area with possible sensor activity revealed that enemy forces believed sensors employed primarily acoustic, rather than seismic detection methods. Since all of the sources were infiltrating ground troops not associated with enemy trucking operations in Laos, no comment is possible about the awareness of enemy vehicle units of sensors and their seismic characteristics.

CHAPTER IV

IGLOO WHITE MONITOR AND RELAY AIRCRAFT

An essential component of the IGLOO WHITE system was the availability of a reliable airborne platform from which to read out emplaced sensors or transmit the data to the ISC. The primary relay/read out aircraft for the IGLOO WHITE program had always been former Navy EC-121Rs operated by the 553d Reconnaissance Wing at Korat Royal Thai Air Force Base, Thailand. Commencing operations in November 1967, the 553d RW eventually deployed 24 aircraft (with the call sign BATCAT) which flew 10-hour missions at altitudes of 16,000' to 18,000'. At that altitude sensor transmissions could be received for a radius of 43 nautical miles with about 90 percent accuracy.[205/]

Due to the age of the EC-121R increasing amounts of time were spent on maintenance, and spare parts were difficult to obtain. Other EC-121R shortcomings were its large crew of up to 22 men and limited altitude capabilities. IGLOO WHITE planners also believed that a higher-flying monitor relay platform would be able to cover the Laotian sensor field with fewer orbits and sorties. These considerations and the desire to reduce system costs made the early procurement of a follow-on relay aircraft a matter of great importance to IGLOO WHITE.[206/]

PAVE EAGLE I

Since early 1968, Headquarters Tactical Air Command (TAC) had sought the development of a drone ground sensor monitor which could

Lockheed EC-121R BATCAT
Figure 23.

[redacted]

operate in antiaircraft artillery (AAA) high threat areas where the vulnerable EC-121R and its large crew could not be risked. The aircraft chosen for this task was a Beechcraft Debonair modified with a turbo-super charged engine, additional fuel capacity, sensor data relay equipment and the capability to operate in a drone (or NULLO - No Live Operator Aboard) mode. This aircraft, designated YOU-22A and given the project name of PAVE EAGLE I, was expected to be suitable for orbits of 12 hours duration in a NULLO mode and six hours with a pilot aboard. PAVE EAGLE I was designed to operate solely as an airborne relay platform and even when manned had no capability to manually read out sensors or pass target advisories.[207]

Five OU-22A aircraft were in place at Nakhon Phanom Royal Thai Air Base, Thailand, by 7 December 1968 and began test and evaluation flights as part of the IGLOO WHITE program.[208] Although these test flights were conducted in the drone mode, a pilot was always aboard to prevent the loss of aircraft since radio frequency interference at NKP reduced the reliability of the drone control equipment.[209] During the evaluation (in which PAVE EAGLE Is flew one of three sensor monitoring orbits)[210] certain deficiencies were identified, such as the lack of sufficient power, deicing gear, and cabin pressurization. More serious shortcomings involving in-flight engine failures resulted in the QU-22A being restricted from flights over hostile territory on 1 July 1969.[211] QU-22A crashes in June and August prompted the return of all remaining aircraft to the United States in December 1969.[212]

[redacted]

PAVE EAGLE II

PAVE EAGLE II (QU-22B) succeeded PAVE EAGLE I. The B model was similar to its predecessor, but was based on the Beech Model 36. Cost considerations precluded the installation of certain desirable features such as cabin pressurization or a turbo-prop engine, although a larger reciprocating engine was installed.[213/] PAVE EAGLE II operated at altitudes of between 20,000' and 23,000' (6,000' higher than the EC-121R) and was normally flown in a remote control mode, although a pilot was on board in case of difficulties.[214/] A fleet of QU-22Bs was expected to perform the EC-121R mission at one-fifth the cost and one-fourth the personnel requirements of the larger aircraft.[215/]

Since the QU-22B was unable to read out sensors on board the aircraft, it was necessary that the location of the monitoring orbit for extreme southern STEEL TIGER be adjusted to permit the relay of data to TFA. EC-121R BATCATs flying Purple Orbit were able to read out sensor strings manually on board the aircraft, and conducted a traffic advisory service (FERRET III) for FACs and gunships in the area by use of X-T Plotters. The great distance of Purple Orbit from NKP, however, prevented relay of data to TFA for the accomplishment of these functions. The greater altitude capabilities of the QU-22B allowed a new orbit to be established (White Orbit) which could monitor all of Purple's sensors and at the same time effectively relay the data to TFA for read out. The optimum location for White Orbit was developed by test flying during late 1970-early 1971. Part of this program was a special STEEL TIGER test orbit designated Lavender.[216/]

Beech QU-22B

(PAVE EAGLE II)

FIGURE 24

[redacted]

The first five QU-22Bs arrived in SEA in early June 1970 to supplement the 18 remaining EC-121Rs.[217] Full coverage of Green Orbit (three sorties/12 hours a day) began on 1 October, and on 15 October QU-22Bs assumed coverage of Blue Orbit (another three sorties/12 hours per day). Rough running engines and the crash of an aircraft in Laos in late December, however, caused the temporary grounding of the entire fleet by the end of the year. By 31 January 1971, the 16 PAVE EAGLE IIs at NKP were again covering Green Orbit and had extended their flights to Blue Orbit (nine sorties/32 flying hours daily). At this time, the QU-22B was fulfilling all of its intended commitments,[218] and the 553d RW's EC-121Rs were covering Purple Orbit.

At no time during their operational evaluation had either PAVE EAGLE I or II flown missions solely in a NULLO mode. Reasoning that no mission degradation would result from operations in a manned mode only, PACAF on 8 March 1971 authorized the removal of drone equipment from all QU-22B aircraft and the disposition of the control vans and radio units. During the first 1500 hours of operation, two in-flight auto-pilot malfunctions would have resulted in loss of the aircraft if a pilot had not been aboard. PACAF concluded that the greater altitude capability of the QU-22B would allow orbits to be adjusted to avoid AAA threats without adversely affecting the quality of sensor read out.[219]

Since early December 1970, the QU-22B program had encountered increasing difficulties with the aircraft's powerplant, fuel system, maintenance and supply. In spite of these problems and the resultant

[redacted]

lost orbit time, the increase in the QU-22B's operational commitment had been necessary to allow complete coverage of the two orbits in light of the dwindling EC-121R fleet. These increasing difficulties and the 8 February 1971 crash of a QU-22B in which the pilot was lost finally led to the EC-121R having to replace PAVE EAGLE II on half of Blue Orbit.[220/] On 23 March the QU-22B was relieved of the rest of Blue Orbit and continued on Green Orbit only, at a rate of three sorties a day.[221/]

The 56th Special Operations Wing (SOW) at NKP began a graduated test program on 26 April 1971 to evaluate the QU-22B's reliability and to discover the cause of the engine difficulties which had continually plagued both PAVE EAGLES. The first stage of the program consisted of four QU-22B sorties a day to cover Green Orbit and two other sorties flying a modified Green Orbit in the vicinity of NKP for test and training purposes. The number of sorties gradually increased until by 17 May a total of nine aircraft were flying daily (six on Green Orbit and three conducting local test flying).[222/] During the 26 April-7 June evaluation, 48 incidents of engine roughness were noted, with all but 16 of these occuring in the same four aircraft.[223/]

By 10 July 1971, PAVE EAGLE II was covering Green Orbit with four sorties a day (13 flying hours) and had assumed the late afternoon/early morning portions of Blue Orbit (three sorties/nine hours).[224/] Three QU-22B crashes in August, however, resulted in an 18 August directive from 7th AF that all aircraft were to be removed from IGLOO WHITE/COMPASS FLAG support activities.[225/]

Within a week of the new restrictions, the 56SOW began a 45-day test program consisting of flights under visual conditions within gliding distance of NKP. The tests were intended to determine engine reliability and sought to duplicate operational missions. Aircraft were flown between 16,000' and 20,000' in hopes of assessing the effect of altitude on engine performance. Additionally, a copilot was added to all flights to record instrument readings, identify deficient areas and increase crew confidence.[226] A CINCPACAF message on 20 August reported that personnel and facilities at NKP were adequate for support of the program and that "additional on-site assistance may be counterproductive." The message admitted that engines were still the major cause of accidents, and that no significant trend or cause was identifiable; similar problems existed ". . . today that did a year ago."[227]

By 15 September, the QU-22B had improved to such an extent that the aircraft was again allowed to fly Green Orbit and resume COMPASS FLAG testing. This schedule was to continue until the 1 October end of the 45-day test program.[228] On that date, the QU-22B transferred Green Orbit to the Airborne Command and Control Center C-130E (ABCCC) and devoted all of its available resources to flying the more demanding (both in distance from NKP and hours of sortie time per day) Blue Orbit.[229]

[redacted]

ABCCC as IGLOO WHITE Relay Aircraft

As early as February 1971, agencies associated with IGLOO WHITE began to investigate alternate relay aircraft in case the QU-22B's difficulties proved unresolvable. On 25 February, TFA reported to 7th AF that the T-39, U-21, U-2, and C-130 had been considered as IGLOO WHITE relay aircraft, but only the C-130 had been successfully flight-tested in this role. The test had been held the previous month at Eglin Air Force Base, Florida. TFA requested that an ABCCC C-130E be sent to NKP for ground tests to determine the compatibility of IGLOO WHITE and ABCCC equipment.[230/]

Ground tests were successful and an ABCCC aircraft with IGLOO WHITE Prime Mission Equipment (PME) borrowed from a QU-22B was test-flown on Green Orbit on 18-20 June. No interference or operational degradation was noted between the two missions, and the C-130E's performance as a sensor monitor was considered identical with that of the PAVE EAGLE system. No additional personnel were required aboard the ABCCC aircraft, and the installation of the IGLOO WHITE PME and antennae could be accomplished during periodic C-130 maintenance.[231/] The ABCCC C-130E functioned solely as a monitor/relay station, and possessed no manual read out or FERRET III capability.

The 18 August decision to remove all PAVE EAGLE IIs from IGLOO WHITE orbits also accelerated the program to install QU-22B relay equipment packages in the ABCCC C-130Es. These modifications were

[redacted]

Lockheed C-130E Airborne Battlefield Command and Control Center (ABCCC).

FIGURE 25

completed by the end of September. All nine remaining EC-121Rs were ordered retained in SEA through 1 October as an additional measure to ensure mission coverage.[232] The return of the QU-22B to operations in mid-September and the success of the ABCCC C-130E, however, allowed plans to go ahead for reducing the EC-121R fleet to six in early October.[233]

During late August and much of September 1971, ABCCC C-130Es regularly monitored the IGLOO WHITE sensor field in northern STEEL TIGER and relayed the information back to TFA. The sensor field in extreme southern STEEL TIGER was monitored from White Orbit by the ABCCC aircraft on a test basis, but during most of the period this area was covered by Purple Orbit EC-121Rs. When restricted to White Orbit, ABCCC found its command and control mission degraded, since the C-130E was unable to adjust its location to enhance communications with strike aircraft and Laotian ground forces. Similar difficulties occurred on Blue Orbit. Since ABCCC could best combine both missions on Green Orbit, it began flying at this location on 1 October when QU-22B improvements allowed the smaller aircraft to assume responsibility for Blue Orbit. Southern STEEL TIGER continued to be monitored by EC-121R BATCAT on Purple Orbit.[234]

C-130B as IGLOO WHITE/COMPASS FLAG Support Aircraft

In a continuing search for additional alternate airborne platforms for IGLOO WHITE and COMPASS FLAG, a standard C-130B was fitted with PME for both of these programs and test flown during late September

from NKP.[235/] The tests were completely successful and at the time of this report, requests and proposals for acquiring and specially modifying three C-130Bs for these missions were under consideration at 7th AF.[236/]

CHAPTER V

DART I AND II AND DUFFLE BAG

Both of the Deployable Automatic Relay Terminal (DART) programs initially were deployed in support of U.S. Army operations in the RVN and were not considered part of IGLOO WHITE. They are included in this paper because they were developed and operated by the U.S. Air Force and employed IGLOO WHITE concepts and technology. DART I was transferred to TFA in July 1971 and integrated into IGLOO WHITE. DART II was terminated in September 1970, but knowledge of its difficulties and shortcomings is important for a proper appreciation of the role of sensors in Southeast Asia.

While IGLOO WHITE was directed almost exclusively against enemy vehicles and vehicle-related activities, the DART/DUFFLE BAG programs were concerned primarily with detecting the presence of enemy personnel. After its transfer to Quang Tri and subsequent move to TFA, however, DART I also played an important role in monitoring enemy vehicle activity on LOCs in northern MR I and the southern DMZ. Frequent use was made of hand-or-helicopter emplaced sensors in all these programs, although IGLOO WHITE-style F-4 sensor delivery became standard practice in both the DARTs.

DART I

DART I originally became operational at Bien Hoa Air Base, RVN, on 1 March 1969 to maintain sensor surveillance of infiltration from

[redacted]

DART I OPERATING LOCATIONS

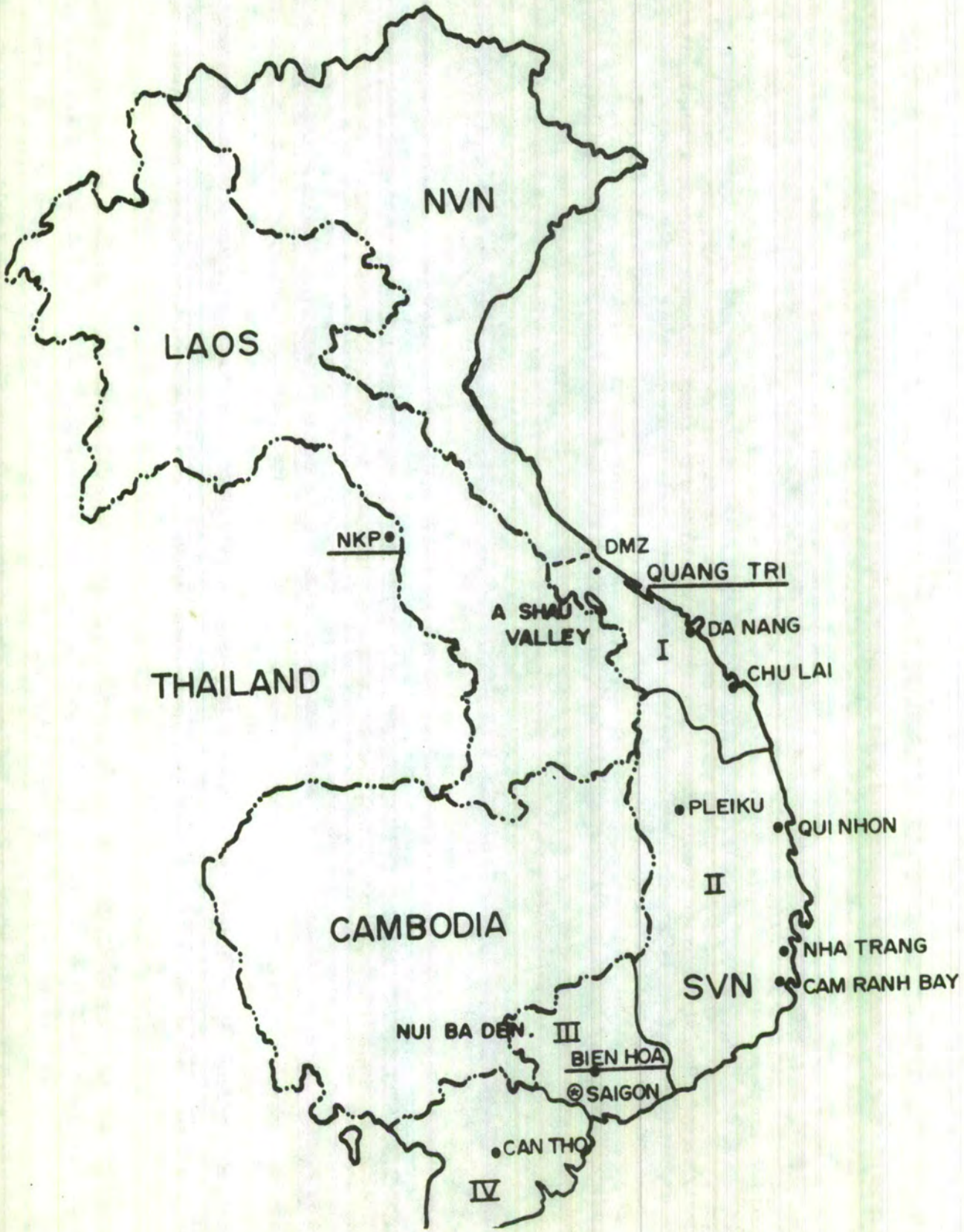


FIGURE 26

[redacted]

[redacted]

Cambodia into the RVN. It was also part of the DUFFLE BAG program of unattended ground sensors employed within Vietnam. The DART read out facility consisted of transportable components including a directional S-Band antenna atop a 60-foot relay tower. DART was designed to read out sensors, interpret the data, and relay near-real time (less than one minute old) information on enemy personnel and vehicular movements to strike agencies in much the same manner as the ISC at NKP.[237/]

The primary sensor used in DART I was the Hand Emplaced Seismic Intrusion Detector (HANDSID I). Magnetic Intrusion Detector (MAGID) or Passive Infrared Intrusion Detector (PIRID) devices could be hand-wired to HANDSID to increase its sensitivity.[238/] Because of the flat terrain in the MR III area of the RVN, sensor data was relayed to the Bien Hoa facility by means of a permanent ground relay atop a 3,235 foot mountain (Nui Ba Den). EC-121R BATCATs flying on Amber Orbit were available to automatically relay this data to Bien Hoa during periods when the ground relay was nonoperational. Both the Bien Hoa and Nui Ba Den facilities were operated by the Air Force, while the Army was responsible for emplacing sensors. Artillery fire responses to sensor activations came from the 25th Infantry, 1st Infantry and 1st Air Cavalry Divisions.[239/]

By early 1970, the Army's Battlefield Area Surveillance System (BASS) was being introduced into the DART I area. Once BASS was in

[redacted]

[redacted]

operation, II Field Force Vietnam (IIFFV) felt that a transfer of DART I to another operating area would be agreeable to the three divisions which it served.[240/] BASS employed the same sensors as DART I, and also used ground relay stations to pass the information to a read out facility.

DART I terminated operations at Bien Hoa on 18 March 1970 and began preparations for moving the sensor read out equipment and the 73 Air Force officers and enlisted men to the new operating location at Quang Tri in RVN MR I. The relay equipment situated on Nui Ba Den was also removed, with only the monitor antenna left behind to support the BASS system.[241/] Upon arrival at Quang Tri DART I began monitoring sensor strings located in or near the Demilitarized Zone (DMZ) and in the northwestern portion of the XXIV Corps area, including the A Shau Valley.[242/]

Due to the mountainous and rugged terrain in MR I and the presence of enemy controlled high threat areas which restricted the implant of sensors by hand or helicopter, certain features of the relocated DART I operation differed from those followed in MR III. In addition to HANDSID sensors and the previous emplacement techniques increasing use was made of F-4 delivered ADSID, ACOUSID, and COMMIKE sensors identical to those employed by IGLOO WHITE. While some sections of the DART I field were read out by BASS and hand-carried Portatale units, the primary monitoring was done by an EC-121R BATCAT flying Blue Orbit for 18-24 hours a day. XXIV Corps at Da Nang

[redacted]

determined desired sensor locations based on inputs from field units and then forwarded the requests to TFA. TFA managed the sensor field (plotted implant locations, prepared sensor addresses, and resolved terrain-masking problems) and arranged for F-4 implant sorties. Target data was relayed from Blue Orbit to the DART I facility at Quang Tri where it was read out on four 120-pin X-T Plotters (See Figure 27) and sent directly to an Army Tactical Operations Center (TOC) which determined the type of response.[243] Primary Army users were the TOCs of the 1st Brigade of the 5th Infantry Division at Quang Tri and the 101st Airborne Division at Camp Eagle.[244]

The DART I report for 1-31 October 1970 reflected typical activities of the system after its move to Quang Tri. During this period, the DART I sensor field established an enemy pattern of movement into and out of the RVN along Route 9. Based on this analysis an infantry force was able to establish contact to engage the enemy, killing five North Vietnamese soldiers and capturing three AK-47 rifles. Other infantry engagement and Cobra helicopter gunship strikes based on sensor activations resulted in an additional 29 enemy KIA and 36 bunkers destroyed. The 1st Brigade, 5th Infantry Division and the 101st Airborne Division recorded 1,048 sensor activations during the month and responded with 238 artillery fire missions which expended 1,296 rounds.[245]

The DART I sensor field originally consisted of Phase I and II sensors like its IGLOO WHITE counterpart in Laos. During the 1970-71 campaign (COMMANDO HUNT V) the DART field as well as that in Laos

[redacted]

was converted to Phase III sensors. The DART I field was scheduled to convert fully to Phase III by 15 December, the date that the QU-22B aircraft would begin to monitor half of Blue Orbit.[246] Since the QU-22B was equipped to monitor and relay data only from Phase III devices, no more Phase I/II sensors were implanted after 1 October. Those remaining were not monitored after 15 December and gradually died out.[247]

The use of OV-10 aircraft to implant sensors was first mentioned in a November 1970 memorandum from a 7th AF staff officer. He reported that the Marines were using this method and recommended that it be seriously investigated by the Air Force on a selective basis.[248] A 7th AF feasibility study of the suggestion in early December revealed that Military Assistance Command Vietnam (MACV) also had requested an investigation of this delivery method to support Army sensor implants in MR I and possibly replace F-4 implants. The 7th AF study determined that the AAA threat level in the DMZ, Western Reconnaissance Zone (WRZ) and A Shau Valley still required F-4s and that the Portable Multiple Bomb Rack (PMBR) utilized by Marine OV-10s for sensor implants was not available in Air Force supply channels and would take a year to procure, flight test, and install operationally.[249] During the Dewey Canyon II phase of Lam Son 719 in early 1971, Marine OV-10s continued sensor implants and emplaced 41 ADSID strings in support of Route 9/Khe Sanh security.[250]

The area monitored by DART was temporarily expanded during Lam Son 719 to include 19 selected strings in STEEL TIGER.[251] Information

[redacted]

obtained on movers was passed through XXIV Corps Forward Headquarters to ARVN commanders and provided valuable information on enemy truck and personnel movements.[252] TFA was called upon to monitor the DART field during Lam Son 719 from 7-13 and 14-24 March when the DART facility at Quang Tri was down for maintenance. Since the DART field was monitored by the Blue Orbit BATCAT, the activations were transmitted to TFA and read out on the newly installed X-T Plotter. Although TFA possessed the capability of backing up DART for short periods of time without additional manning, four DART personnel were sent TDY to the ISC to provide assistance during the March difficulties. Activations were called directly to Army units from TFA by landline.[253]

On 5 July 1971, 7th AF proposals of the previous month to close down the DART I facility and transfer it to TFA were put into effect. Seventh Air Force justified the move for three reasons:[254]

a. The transfer of DART I would be consistent with programs for the future utilization of TFA and would provide a fifth antenna for IGLOO WHITE and COMPASS FLAG.

b. A combination of the DART and STEEL TIGER sensor read outs during future campaigns would provide real time target correlation and strike capability against enemy infiltration through the DMZ and along the Laos/RVN border.

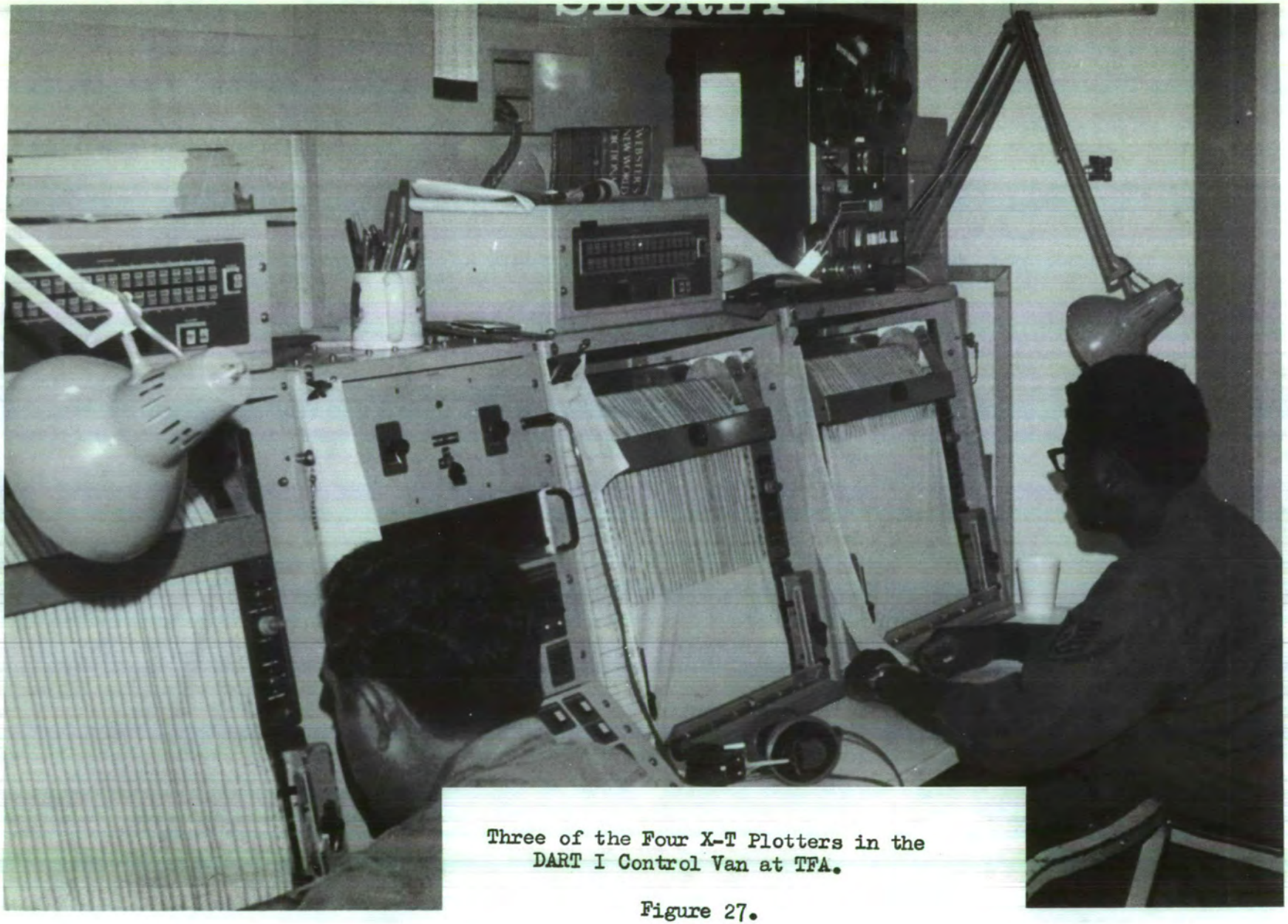
c. The anticipated withdrawal of U.S. Army forces from the Quang Tri area in the near future raised concern for the security of the DART facility and personnel.

In preparation for the move TFA began to monitor the DART field on 11 May be means of the ISC computer during normal computer duty hours and by the X-T Plotter at all other times, for a total of 19 hours daily. Upon completion of equipment installations on 1 August, the DART Plotter took over from the TFA Plotter, although the computer still monitored both the DART and IGLOO WHITE sensor fields from 1700-0600 hours daily.[255/]

DART activation sequences (relayed to TFA by Blue Orbit) were called by TFA in near-real time to the 1/5th and the 101st TOCs. From the TOC, mover information was passed to air strike forces (particularly AC-119G Stinger gunships) through the Tactical Air Control Party (TACP) at the TOC or the I Direct Air Support Center (I DASC).[256/] TFA also issued the DART daily intelligence summaries which had formerly originated from Quang Tri.[257/] A total of 18 DART personnel were transferred to TFA to operate the equipment, and the remaining 34 DART manning positions were deleted.[258/]

DART II

DART II was built originally as a backup for DART I or the ISC, or for use as a training facility in the CONUS. With the success of DART I in 1969, DART II was deployed to SEA in September 1969 to assist in antiinfiltration surveillance along the Cambodian border,[259/] with primary areas of interest being the tri-border area and the Plei Trap Valley.[260/] The system became operational at Pleiku on 28 September 1969 in support of I Field Force Vietnam (IFFV). Sensor read outs



Three of the Four X-T Plotters in the
DART I Control Van at TFA.

Figure 27.

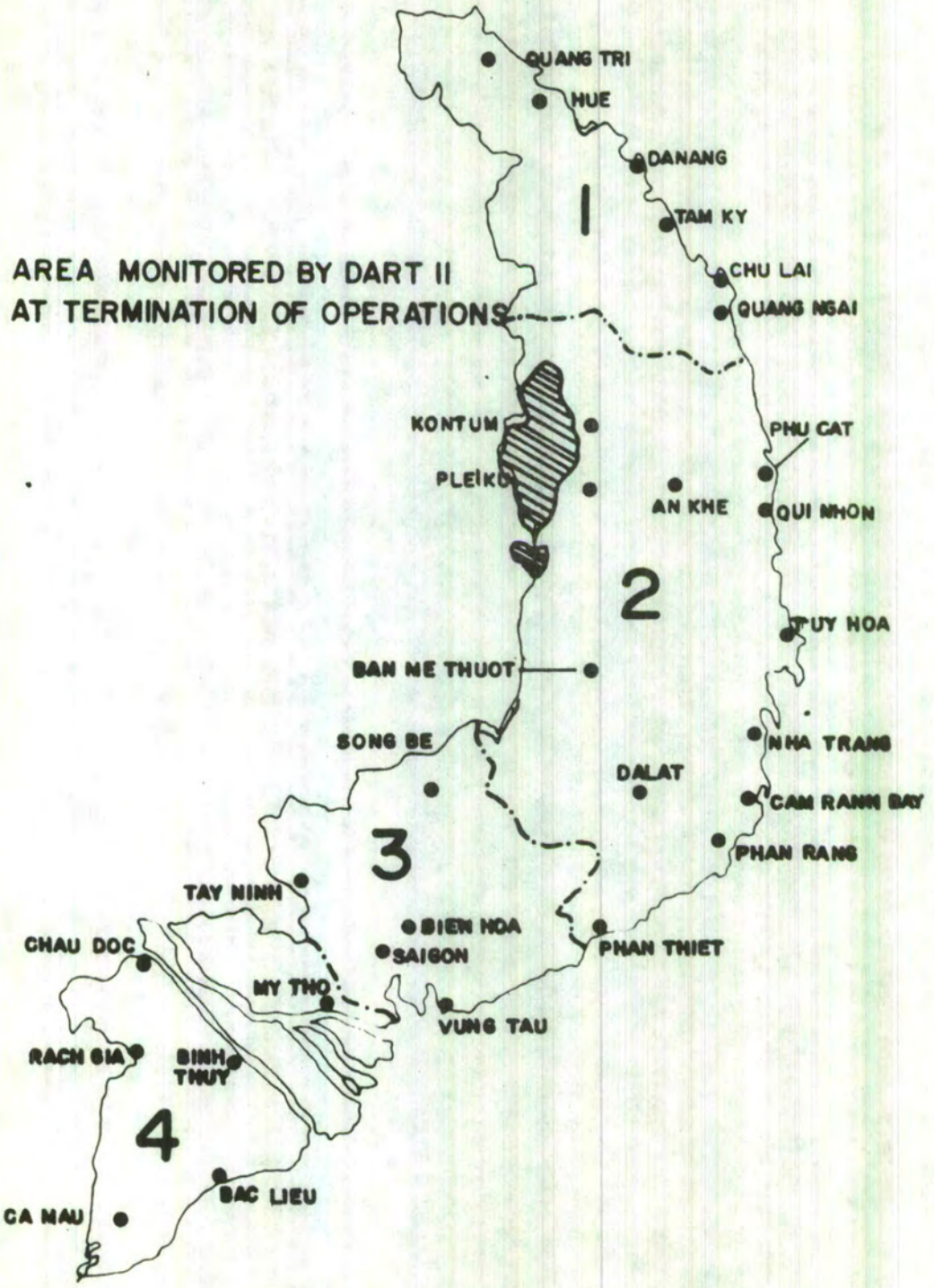

AREA MONITORED BY DART II
AT TERMINATION OF OPERATIONS
QUANG TRI
HUE
DANANG
TAM KY
CHU LAI
QUANG NGAI
KONTUM
PLEIKU
PHU CAT
AN KHE
QUI NHON
TUY HOA
BAN ME THUOT
SONG BE
NHA TRANG
DALAT
CAM RANH BAY
PHAN RANG
TAY NINH
BIEN HOA
SAIGON
PHAN THIET
CHAU DOC
MY THO
VUNG TAU
RACH GIA
BINH THUY
BAC LIEU
CA MAU
1
2
3
4

FIGURE 28

were relayed from DART II to the 52d Artillery Group where the type and extent of response were determined.[261/]

DART II differed from DART I in three ways. While DART I did not employ an airborne sensor read out until it moved to Quang Tri, from the beginning DART II utilized EC-121R BATCATs flying Orange Orbit to transmit sensor data to Pleiku. Second, DART II always employed IGLOO WHITE ADSIDs and Phase I/II HELOSIDs and ACOUBUOYs implanted by Army helicopters. Terrain and enemy activity precluded the use of hand-emplaced sensors. Third, 22 Vietnamese Air Force (VNAF) personnel were integrated into the operation in late 1969.[262/]

By early 1970, both 7th AF and IFFV began to express dissatisfaction with DART II and question its effectiveness as a real time targeting system. A 28 March message from the Vice Commander, 7th AF to MACV/J3 (responsible for the DART program) recalled that during January and February there had been an average of six fire support missions a day in support DART II. A 27 February order from the Commanding General, IFFV, however, had directed that artillery fire in support of DART II would be limited only to selected targets, such as those indicating movement. For the previous 30 days, 7th AF complained, there had been only three artillery fire missions against DART II targets. The Army had also recently relocated the 175mm guns covering the DART field in the southern Plei Trap Valley out of range of the sensors. A further shortcoming was that only six air strikes, resulting in one

confirmed enemy killed in action (KIA), had been directed against DART II derived targets since the system began operations in September 1969. Seventh Air Force felt that these results and the apparently diminishing Army interest hardly justified the continued commitment to the program of 380 Air Force personnel and six EC-121Rs.[263/]

A second "hard look" was taken at DART II in August. At that time, 7th AF pointed out to MACV/J3 the low number of Army and Air Force strike responses to DART II and the almost total absence of confirmed BDA, as well as the lack of significant intelligence. Other factors cited included:[264/]

a. The difficulties of maintaining the DART II field in light of the continuing U.S. withdrawal from western MR II.

b. Eighty-five percent of DART II Air Force personnel were scheduled to rotate at mid-September.

c. The tri-border sensor field would expire around mid-September and require re-seeding.

d. The impending introduction of the QU-22B relay aircraft on Orange Orbit would require converting all DART II sensors and facilities to Phase III equipment.

The Commander, U.S. Military Assistance Command, Vietnam (COMUSMACV) and 7th AF also determined that cessation of DART II operations would not significantly affect tactical operations and that DART II did not meet the desired criteria for Vietnamization.[265/] Based on these considerations, DART II was terminated and Orange Orbit cancelled on 29 September 1970, exactly one year after the program originally became

operational.[266]

The DART II end of tour report, dated 12 October 1970, listed a number of factors which had limited the effectiveness of the program:[267]

a. Real time target acquisition and effective BDA were limited by the small size of enemy personnel concentrations, his ability to rapidly redeploy and practice concealment, and the large number of trails available for his use.

b. Repeated reactions by Tac Air and artillery compromised sensor locations, resulting in use of alternate trails by the enemy.

c. Terrain and the presence of triple canopy jungle limited the availability of collateral intelligence to assist in planning sensor emplacements. Enemy control of the sensor area prevented friendly reconnaissance teams or an agent network from assessing lucrative target areas. Canopy also hindered the accurate placement of sensors in close proximity to specific trails.

d. The DART II field was limited to an average of 200 sensors because of the need to share channels and addresses with TFA and DUFFLE BAG.

e. Phase I sensors could not be shut down and continued to broadcast until the end of their 180-day life span. Once strike reactions compromised their locations, enemy forces moved to an alternate area, but the sensor continued to broadcast and prevented the use of that address in a more lucrative area.

f. The average reaction time of artillery was 20 minutes. Tac Air responded only 11 times and usually involved long delays before a FAC arrived and then more time for strike aircraft to appear. These delays rendered reactions ineffective against an elusive, mobile enemy.

g. Triple canopy jungle, terrain, and the absence of friendly forces prevented accurate assessment of reaction results.

Table 8 sums up the results of DART II's year of operation.

[redacted]

TABLE 8

DART II RESULTS[268]

28 September 1969 - 29 September 1970

Total Operationally Valid Targets Detected:	4178
Total Artillery Fire Missions:	938
Total Rounds of Artillery Expended:	7469
Total TAC Air Strikes:	11
Total Number of Sensor Strings:	155
Total Number of Sensors Implanted:	607

Damage Inflicted on Communist Forces
by Actions Based on DART II Reports

Killed in Action:	6
Bunkers Destroyed:	2
Secondary Explosions:	2
Sustained Fires:	2
Captured Equipment:	One AK-47 Rifle Two Grenades One Rucksack with Documents

The final paragraph of the DART II Weekly Activity Report for 23-29 September 1970 appropriately marked the close of the program:[269]

In keeping with MACV. . .and 7AF. . .DART II ceased operations. So, as the sun slowly sank in the western sky, DART II bid a fond AMF

[redacted]

(Adios, my friends) as it sadly swung shut its doors to the ghastly background cry of a dying SPIKESID pleading, "Tac Air, Artillery, Car 54- Where are you-u-u-u-u-u-u-u-u?"

U.S. Air Force Support of DUFFLE BAG

The transfer of DART I to TFA and the cancellation of DART II did not terminate the Air Force's role in the RVN sensor program (designated DUFFLE BAG). MACV priorities for supporting DUFFLE BAG emphasized coverage of the DMZ and areas in the RVN adjacent to the Laos/Cambodian borders. In practice, this placed the majority of the DUFFLE BAG effort in northern RVN within the area controlled by XXIV Corps.[270/]

Seventh Air Force responsibilities in DUFFLE BAG included providing the capability to monitor a maximum of 400 sensors in the DMZ, WRZ, and A Shau Valley for 19 hours a day (this was the DART I program). Activation sequences would be called within one minute of validation to Army TOCs for possible fire response. Seventh Air Force provided F-4 implant sorties adequate to maintain a maximum of 40 sensor strings, with XXIV Corps retaining the option to implant or re-seed any of the 40 strings. Three IGLOO WHITE channels were made available to DUFFLE BAG for relay purposes on aircraft covering Blue or any follow-on orbit,[271/] in addition to the five channels permanently assigned to the program. All eight were read out by TFA.[272/]

Twenty-fourth Corps in turn was responsible for managing sensor addresses on its eight channels and for providing the Air Force with

a continuously updated listing of the 40 strings eligible for F-4 implant. Twenty-fourth Corps also provided a liaison officer to TFA on a TDY basis to coordinate sensor management, implant and monitoring requirements.[273/]

DUEL BLADE

DUEL BLADE was another term associated with the DUFFLE BAG program. DUEL BLADE originally referred to a Strong-Point Obstacle Subsystem (SPOS) along the northeastern RVN border and had previously carried the name DYE MARKER.[274/] By late 1968, the SPOS had evolved into a program in which friendly maneuver forces used mobile tactics with air, artillery, and naval gunfire support to respond to targets detected by ground sensor devices (this was known as DUEL BLADE II). The DUEL BLADE II area included all territory in the RVN south of the Provisional Military Demarcation Line (PMDL) and north of Route 9. By early 1971, the term DUEL BLADE II had been terminated and absorbed into DUFFLE BAG. In its last year, DUEL BLADE II referred more to a geographical area than a program or concept.[275/]

BASS

Occasional references have been made in this report to the Army's Battlefield Area Surveillance System (BASS). BASS was different from the DARTs in that it did not consist of a specific, relatively fixed set of components or hardware. Rather, BASS was a concept which covered a variety of different sensors and read out facilities, as well as applications and uses.[276/] BASS systems were often local

in nature and involved the monitoring of approaches to defended villages and fixed military installations. The system was capable, however, of covering a larger area, as occurred when DART I was replaced by BASS in MR III. Airborne read out of BASS fields or air emplacement of sensors by other than Army organic aviation generally was not practiced, although instances occurred in northern RVN, where Air Force F-4s and Marine OV-10s occasionally delivered sensors in support of Army requirements and read outs were available from Blue Orbit. No major USAF role was anticipated in the development and future use of BASS.

Vietnamization of Sensor Programs (TIGHT JAW)

On 19 March 1969, the U.S. Joint Chiefs of Staff directed that the in-country sensor program be expanded to include Republic of Vietnam Armed Forces (RVNAF) personnel. These efforts to provide the Vietnamese with their own sensor capabilities were known as Project TIGHT JAW. On 15 June 1969, COMUSMACV Operations Plan 103-69 provided for a combined US/RVNAF border surveillance and anti-infiltration program covering selected western border areas of the RVN from the DMZ to the Gulf of Thailand and an expansion of existing sensor missions throughout the RVN. Eventual Vietnamese unilateral operation of this program was envisioned.[277/]

A July 1970 examination of northern MR I revealed the requirement for Vietnamese-operated sensor fields in this area. At this time, MACV proposed eventual Vietnamese Air Force (VNAF) operation of

DART I (Quang Tri) and DART II (Pleiku), each with a 476 sensor capacity. The VNAF would have the ability to implant sensors and monitor them with an airborne platform dedicated solely to sensor read out. Although a particular aircraft was not specified, PAVE EAGLE II was indicated elsewhere.[278/]

PACAF, 7th AF and the USAF Advisory Group agreed that the VNAF should have a capability to implant sensors, but opposed Vietnamizing the DARTs and giving VNAF an additional aircraft to operate. Instead, a simple air relay-monitoring system compatible with BASS was proposed, since personnel resources, and budgetary limitations precluded any VNAF effort approaching even a modest IGLOO WHITE concept. It was also believed likely that any VNAF role in future Vietnamese sensor programs would be that of a support role responsive to ARVN through direction of the RVNAF Joint General Staff (JGS).[279/]

By October 1970, COMUSMACV agreed that Vietnamization of PAVE EAGLE II and the remaining DART was impractical. Instead of a specialized aircraft dedicated solely to airborne sensor read out, emphasis was placed on the development of an unsophisticated Palletized Airborne Relay (PAR) system which would interface with BASS equipment already programmed for the RVNAF.[280/] By September 1971, the USAF was in the process of procuring PAR packages which would initially be fitted in VNAF C-47s and be available for installation in C-7s when these aircraft entered the VNAF inventory in 1973. If necessary PARs could also be

[redacted]

in C-119s and C-123s.[281] Upon introduction of PARs, the VNAF was expected to be fully capable of relaying sensor data to ground stations from C-47s. However, RVNAF JGS would first have to authorize VNAF to utilize aircraft for this purpose in competition with other requirements (such as airlift). The USAF was expected to have no major role in the introduction of the PAR when the time came, and advisors were expected to be drawn from ARVN personnel familiar with sensors.[282]

[redacted]

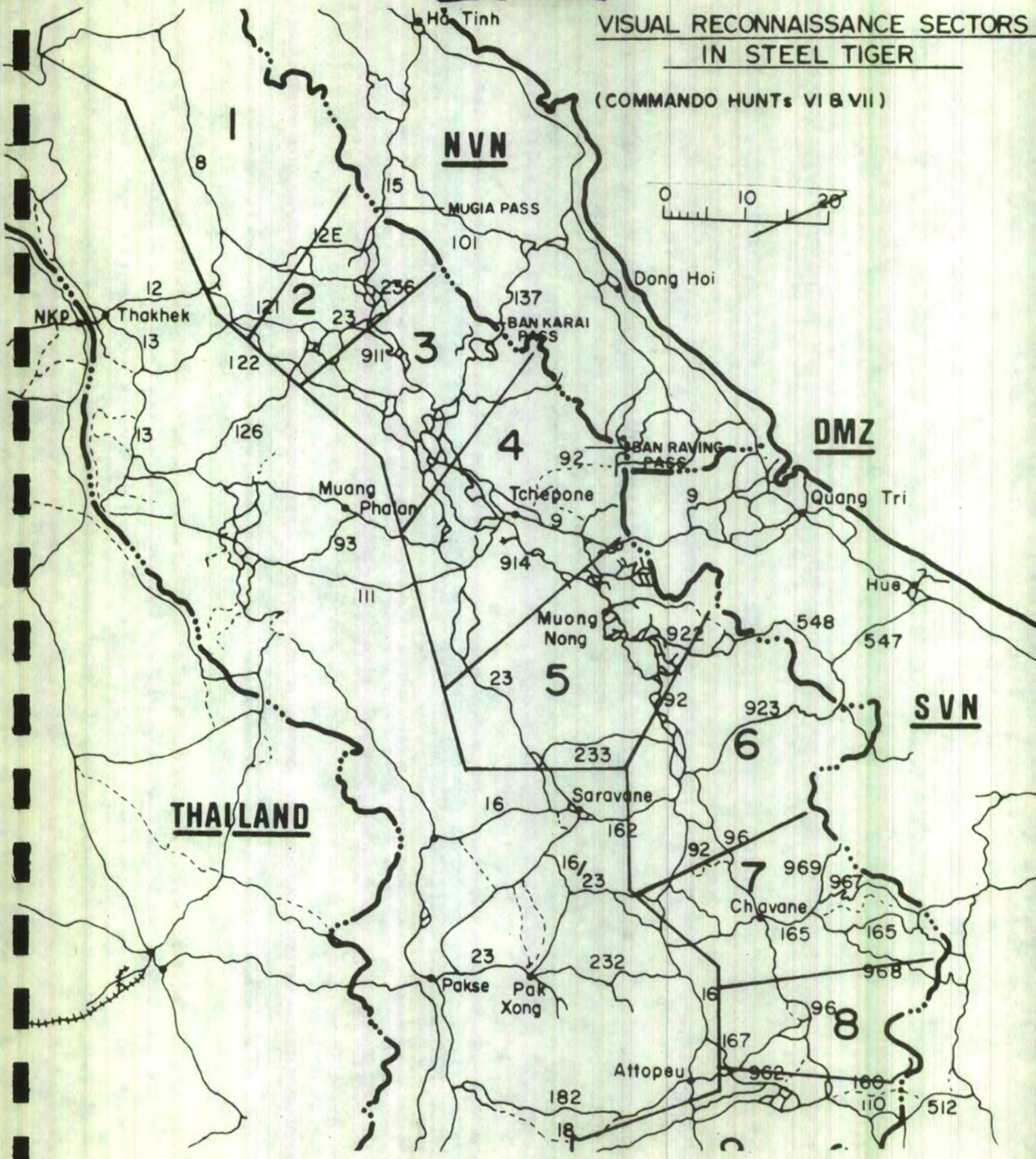

VISUAL RECONNAISSANCE SECTORS
IN STEEL TIGER
(COMMANDO HUNTs VI & VII)
Ha Tinh
NVN
MUGIA PASS
Dong Hoi
BAN KARAI PASS
BAN RAVING PASS
DMZ
Quang Tri
Hue
Thakhek
NKP
Muang Phalan
Tchepone
Muong Nong
Saravane
Pakse
Pak Xong
Attopeu
Chavane
SVN
THAILAND
1
2
3
4
5
6
7
8
0
10
20

FIGURE 29

CHAPTER VI

THE FUTURE OF IGLOO WHITE: COMMANDO HUNT VII AND BEYOND

Planning for COMMANDO HUNT VII

The COMMANDO HUNT VII campaign was just beginning as this report was going to press. The most significant change planned for IGLOO WHITE for this campaign was TFA's resumption of operational control of strike aircraft operating as part of the STEEL TIGER interdiction program. The actual details of the new procedures were still being developed at the cut off date of this report, but certain features promised to be different from the SYCAMORE Control operation of COMMANDO HUNT I.

Early planning for TFA's new function envisioned the ISC operating as an extension of the 7th AF Combat Operations Center (COC, call sign BLUE CHIP) and utilizing near-real time sensor information to direct strike aircraft (including gunships) to lucrative truck-killing areas. Ideally, the process would be a complete cycle through to damage assessment, with a restrike capability if any lucrative targets remained. 283/

One proposed form of the new procedures under consideration involved the division of the nine VR sectors into three groups (possibly sectors 1-3, 4-5, and 6-9). Aircraft operating over each set of VR sectors would be under the control of a sector operator "station" each of which would include strike control, radio communications and intelligence personnel. Like the COMMANDO BOLT system, strike nominators would closely monitor sensor strings in their assigned area by use of

IBM 2250 and 2260 display consoles. Specific coordinates of developing targets would then be passed by radio to FAC and strike aircraft in the area. In the majority of cases, moving vehicle targets would be acquired by the aircraft either visually or by radar before strike, rather than struck on the basis of predetermined LORAN coordinates. Under this proposal, a Chief Controller would supervise the "stations" and have the authority to divert strike resources from one set of VR sectors to another in which the number of strikeable targets exceeded the aircraft available to send against them.[284/] EC-121R BATCATs most likely would continue on-board sensor read out and FERRET III operations on Purple Orbit (covering sensor strings in the VR sector 6-9 area), since the distance precluded data relay to TFA without expanded communications facilities.

The intelligence section of the "station" would be composed of personnel knowledgeable of the local route structure, enemy activity patterns and the results of recent FAC and photographic reconnaissance of their assigned geographic area, as well as its target/BDA history. Based on developing sensor patterns and utilizing techniques similar to those of the Night Fixed Targeting Program, perishable semifixed targets would be located with varying degrees of precision and passed to the strike nominator for immediate FAC reconnaissance or strike. Working with the "stations" would be weather and communications-maintenance personnel, as well as another intelligence targets team responsible for combining previous target intelligence with inputs

from the "stations" to develop fixed-area targets throughout STEEL TIGER.[285/] The use of Special Intelligence (SI) would be an essential part of all target development functions, with much of this material being made available to IGLOO WHITE through the COMPASS FLAG program.

Questions unsettled at the end of this reporting period included the number of "stations" to be established, the final breakdown of VR sector responsibilities, whether all or only some strike aircraft would be assigned to TFA, and the number of hours a day the system would operate. This last question was of considerable importance, since a round-the-clock interdiction operation at TFA based on IGLOO WHITE infomation would require 24-hour a day coverage of the sensor-monitoring orbits with the resultant increased demands on manpower, aircraft, and material in all phases of the program.

Other changes anticipated for COMMANDO HUNT VII included the expansion of the KEYWORD File from its current approximately 24,000 entries to almost 100,000. This was to be accomplished by adding the 7th AF computerized intelligence data base to KEYWORD, and would expand the STEEL TIGER data base as well as introduce information from northern Laos (BARREL ROLL), Cambodia, and the RVN. In addition, the 7th AF AAA file and its BDA listing were also to be added to KEYWORD. Also available for target development purposes (although not a part of KEYWORD) was an SI collection of 10,000 cross-indexed file cards along with specialized supporting material.

Upon successful conclusion of the KEYWORD expansion, TFA would combine a variety of intelligence resources at one location: sensor information; KEYWORD File; access to FACs and their reports; Airborne Radio-Direction Finding (ARDF) capabilities; opportunities to coordinate with Controlled American Source offices; and SI programs (including COMPASS FLAG). In addition, TFA possessed the only Air Force map-making facility in SEA. By assuming operational control of strike aircraft during COMMANDO HUNT VII, TFA hoped to make direct real time use of its concentration of intelligence/targeting resources.[286]

TFA also anticipated that the COMMANDO HUNT VII IGLOO WHITE sensor field would be larger than any of its predecessors, because of extension to the WRZ of the RVN and certain LOCs in STEEL TIGER west.[287] Another proposal under consideration was to reduce the maximum number of sensors for certain strings from eight to four or five,[288] which would allow an increase in the number of sensor strings from the approximately 185 possible with eight sensors per string. The 185 string figure had been made possible by the addition of eight more IGLOO WHITE sensor frequencies during COMMANDO HUNT VI.

Remote Ground Sensor Planning and Programming Objectives (REGSENSPO)

In December 1970, Headquarters USAF issued a document entitled REGSENSPO which sought to provide ". . . guidance for coordinated midrange and long-range U.S. Air Force planning and programming of remote ground sensors and associated resources."[289] REGSENSPO envisioned

[redacted]

the "integration of ground-based surveillance capabilities and the resultant intelligence data into tactical networks for use by air base defense components and the Tactical Air Control System for the attack of ground targets in day, night and all-weather conditions." Tactical Air Command (TAC) was then in the process of coordinating with Air Force Systems Command (AFSC) and the Air Staff to incorporate sensor technology into contingency forces.

United States Air Forces Europe (USAFE) were asked in this document to consider remote ground sensors as a means of providing surveillance of forces hostile to NATO, especially their probable airfield, missile, AAA, and truck park/storage sites. Other factors to be considered by USAFE were the emplacing and airborne monitoring of sensors in hostile air environments and their use in a stay-behind role by retreating friendly forces.

PACAF's tasking letter which accompanied the basic REGSENSPO document to its subordinate numbered Air Forces (5th AF, 7th AF, 13th AF, and 7/13th AF) requested comments concerning organizational relationships of future sensor operations. For example, at what level of assignment could sensor resources be most effectively utilized; should they be aligned with the intelligence or the command/control function; and should all components (emplacement vehicles, read out equipment, required facilities) be centrally controlled?290/

[redacted]

The 7th AF reply to PACAF (dated 16 January 1970) concerned the SEA area during the 1974-78 timeframe when it was assumed that all U.S. forces supporting IGLOO WHITE would have been withdrawn. The most useful sensor types were seen as ADSIDs, ACOUSIDs, and possibly EDETs (this was before the EDET test of March-June 1971). To establish a minimal 40-string field for six months (with a 60-day average life per sensor), approximately 1600 sensors would have to be on hand or procurable on a short-term basis. A steady supply of new sensors would be necessary if either the 40 string or the six-month figure were exceeded. Sensor implant missions would almost certainly have to be performed by LORAN-equipped F-4D aircraft, although OV-10s possibly could be used for visual delivery in AAA low-threat areas.[291/]

The use of an airborne read out of sensors was seen as providing maximum felxibility for sensor field location and configuration, although 7th AF felt that there were no systems available at that time (March 1971) which could adequately perform this task. Even FERRET III operations with the X-T Plotter were viewed as ". . . only marginally adequate for even the less demanding applications."[292/] For relaying sensor activations to a ground read out terminal, 7th AF discussed both the QU-22B and a Palletized Airborne Relay (PAR) which was being developed for installation aboard various VNAF cargo aircraft. PAR was seen as offering maximum flexibility at the least cost for a contingency sensor system, and was recommended as the best choice for monitoring any future fields.

Further, 7th AF suggested that the ground terminal facility for interpreting sensor activations probably would be similar to DART I or the more sophisticated Sensor Reporting Post (SRP, this was an air-transportable, mobile ISC which featured a small digital computer and could monitor a field of 400 sensors. It was under development at Eglin AFB, Florida).[293/] This terminal would necessarily be readily deployable to SEA and reasonably mobile once it had arrived in theater. Given the geography of SEA and the PACAF area of operations, 7th AF suggested that the potential of a shipboard SRP-type facility should be investigated as a means of providing maximum deployment flexibility.[294/]

Finally, 7th AF answered PACAF's questions on who should control a sensor system, and to what degree it should be centralized. Management and control of the system should be within the operations rather than the intelligence function, 7th AF stated, although a close operations-intelligence relationship was necessary to its successful operation. In addition, central management of all system components was seen as necessary to insure proper coordination of sensor logistics, field location and configuration, sensor implant, airborne relay schedules, and ground terminal operations. The 7th AF reply concluded with a comment on the resource competition between a sensor system and strike forces:[295/]

The competitive priority of a contingency sensor system should be low compared to the priority of strike forces in a reduced budget environment. However, a minimal system could be maintained with little impact on strike force capability, considering the relative costs of a minimal sensor system versus the costs of strike aircraft, associated equipment and facilities.

PACAF's 15 March 1971 response to the original Headquarters USAF REGSENSPO document repeated many of 7th AF's ideas. The primary use of ground sensor technology to the Air Force in the future was seen by PACAF to be target development on a real time basis, with intelligence collecting being secondary. This technology could be best exploited in PACAF's opinion, by integrating the capabilities of the SRP or similar facility in a manual mode with the Combat Reporting Center (CRC) and then including both functions in the Tactical Air Control System (TACS).[296/]

Like 7th AF, PACAF recommended the use of ADSID/ACOUSID sensors against vehicles, but stressed the need for an antipersonnel capability as well. F-4 sensor implants also were seen as necessary, and airborne data relay requirements could be best satisfied by use of the PAR. Deployment mobility was regarded as vital for the ground read out facility, which would utilize either a DART type facility or the SRP. The PACAF letter also mentioned the use of sensors to augment existing Air Control and Warning (AC&W) systems by providing a capability for detecting low-flying aircraft. This capability would be most useful in Korea, but should also be deployable throughout the Pacific area. PACAF also drew attention to the vulnerability of sensors to hostile ECM, and stressed

that efforts should continue to develop protection against this threat in future applications.[297/]

In an article appearing in the June 1971 issue of The Air Force Magazine, Major General William J. Evans, former Deputy to the Director of the DCPG/DSPG, discussed areas in which sensor research and development were continuing. Development of longer-life batteries was a prime item of interest, as were sensors which would properly implant and operate in terrain in cold-climate parts of the world. Sensor cases were desired which would blend with different types of topography and vegetation. The General also mentioned the need for new types of detectors with better target discrimination (a possible reference to EDET III), and sensor frequency bands suitable for worldwide use. Also required were sensor transmitters less vulnerable to jamming, as well as an airborne monitor/relay platform able to operate in hostile air environments. Finally, Major General Evans expressed hopes that the accuracy of sensor implants could be improved by different sensor configurations and the development of more precise navigation systems for delivery aircraft. Sensors placed closer to the roads which they monitored would require less detection range and lower battery power, thus resulting in smaller, lighter, and cheaper sensors.[298/]

MYSTIC MISSION

On 4 March 1971, the DSPG assigned the name MYSTIC MISSION to a project to develop a Phase III sensor system for use in Europe. On

9 August, DSPG activated Detachment 1 of Joint Task Force 728 to test and evaluate the new sensor program. To control the CONUS phase of the evaluation, Detachment 1 became operational on 13 September 1971 at Field 2, Eglin Air Force Base, Florida. This was a joint services project, with a U.S. Army commander, an Air Force vice commander, and a Marine Corps chief of staff.[299]

Conclusion

In October 1971, IGLOO WHITE stood at a crossroads. For the past four years, various sensor applications and uses had been proposed and tested operationally in SEA under combat conditions. For the COMMANDO HUNT VII campaign, the most successful of these programs apparently were to be combined with the authority to control directly a substantial portion of the Air Force's interdiction resources in STEEL TIGER. Although a number of separate and distinct agencies and operations were necessary to the success of the new system, the real time target detection capability of IGLOO WHITE was to be the center of the 1971-72 interdiction effort. Since both 7th AF and PACAF saw the ability of IGLOO WHITE to detect lucrative targets, direct strike aircraft against them on a real time basis, and restrike if necessary , to be the principal justification for such systems in the Air Force inventory, the results of COMMANDO HUNT VII promised to have a decisive impact on the future role of remote ground sensor technology in the U.S. Air Force.

APPENDIX I

Instructions for use of CONFIRM sheet readouts on pages 109 and 110.

SECTION 1 - Sensor String Number. The first two digits (01-09) identified in which the Visual Reconnaissance (VR) sectors of STEEL TIGER the string was located. There were nine VR sectors for the 1971-72 campaign. The notation at the extreme left identified the Ground Surveillance Monitor (GSM) responsible for monitoring the particular set of strings.

SECTION 2 - Distance Between Sensors. This figure was read from top to bottom in tenths of a kilometer. Thus, 0.26 would equal 260 meters. In certain cases the distance was given between the adjoining strings along the same LOC. For example, the last sensor in string 08-220 and the first in string 08-221 were 140 meters apart along the same road. The figures at the far left represented the year and the Julian (Zulu) date.

SECTION 3 - Individual Sensors in String. Sensor strings normally had a maximum of eight sensors, with additional strings being implanted if more sensors were desired. Since only currently active sensors were listed on the CONFIRM sheets, gaps frequently appeared in the enumeration. The sensors were always numbered from north to south, with the highest number being the southernmost sensor in the string. Strings with only one active sensor were not normally monitored.

SECTION 4 - Listing of Activations by Minute. The CONFIRM sheet displayed 40 minutes of Zulu time, with the most recent period being at the bottom of the sheet.

a. Since seismic sensors could activate for six 10-second periods each minute, the total number of those periods for which the sensor was activated was displayed in this section. This was updated at the end of each minute when all activations for that period had been received by the computer. Thus, the higher the number (up to six), the more activity was occurring within range of the sensor. Hyper-active sensors displayed continual activations and were regarded as unreliable.

b. The sample sheets illustrate patterns displayed by various activation sources. Vehicular traffic generally displayed a diagonal "step" pattern, starting with the first sensor in the string. Southbound vehicles would begin with low numbered sensors, while northbound trucks would first activate the higher numbered ones. Aircraft, ordnance and localized activity displayed distinctive patterns which a trained operator could easily distinguish from trucks.

c. Acoustic sensors were "polled" (commanded to transmit audio) when a nearby seismic or ignition sensor revealed activity. The resulting audio assessment by the Radio Operator helped determine the nature of the activation. In addition, COMMIKEs were polled at random throughout the night for any indication of enemy activity. In either case, the Radio Operator upon detecting positive signals entered his assessment of the sounds into the computer (and hence onto the GSM's IBM 2250 CONFIRM display) according to the following letter code:

AB	Tracked vehicles and motorcycles
AC	Motorcycles and aircraft
AF	Trucks and motorcycles
AK	Tracked vehicles and aircraft
AT	Trucks and aircraft
AV	Tracked vehicles and trucks
AZ	Trucks closest to sensor
B	Background noise
CA	Motorcycles
CM	Motorcycles and motion
CO	Motorcycles and ordnance
CS	Motorcycles and small arms
CV	Motorcycles and voices
G	Small arms
HA	Helicopter
JA	Jet Aircraft
KA	Tracked vehicles
KM	Tracked vehicles and motion
KO	Tracked vehicles and ordnance
KS	Tracked vehicles and small arms
KV	Tracked vehicles and voices
M	Motion
MO	Motion and ordnance
MP	Motion and aircraft
MS	Motion and small arms
O	Ordnance
OP	Ordnance and aircraft
OS	Ordnance and small arms
PA	Prop aircraft
SP	Small arms and aircraft
TA	Trucks
TM	Trucks and motion
TO	Trucks and ordnance
TS	Trucks and small arms
TV	Trucks and voices
U	Unassessable
V	Voices
VM	Voices and motion
VO	Voices and ordnance
VP	Voices and aircraft
VS	Voices and small arms
W	Weather

SECTION 5 - Mode. Indicates whether the sensor is being read out in a real time (R) basis with activations being passes as they occur, or non-real time (N), in which information is stored by the sensor for transmission at a later time upon command.

SECTION 6 - Type of Sensor. Sensors were identified by means of the following letter codes:

W - ADSID (Seismic only)
N - ACOUSID (Seismic and acoustic)
E - EDET (Ignition only)
Y - COMMIKE (Acoustic only)
Q - COMMIKE/EDET (Acoustic and ignition)

SECTION 7 - Sensitivity. Refers to sensor detection range and strength of activations. The sensitivity of sensors can be adjusted to eliminate extraneous stimuli which could cause false activations. This also allows adjustments to be made to individual sensors in a string in relation to their distance from the LOC which they are monitoring, so that a uniform pattern is presented on the CONFIRM display.

SECTION 8 - Bit Rate. Refers to the rate at which sensor-transmitted data is received by the computer. This is usually at 300 pieces of information (or "bits") per minute, although it can be reduced to 75. The lower rate is used to reduce the effect of various forms of radio. Frequency Interference (RFI).

SECTION 9 - Reliability. Sensors were rated according to the following code:

1. Unknown reliability. Given to all newly-implanted sensors.

2. A 2, 3 or 4-rated sensor which has had no activations for three days.

3. Audio sensors. COMMIKEs or ACOUSIDS which have lost their seismic capability but still retain audio.

4. Sensors that activate for weather, aircraft or random activations only. Does not participate in truck sequences.

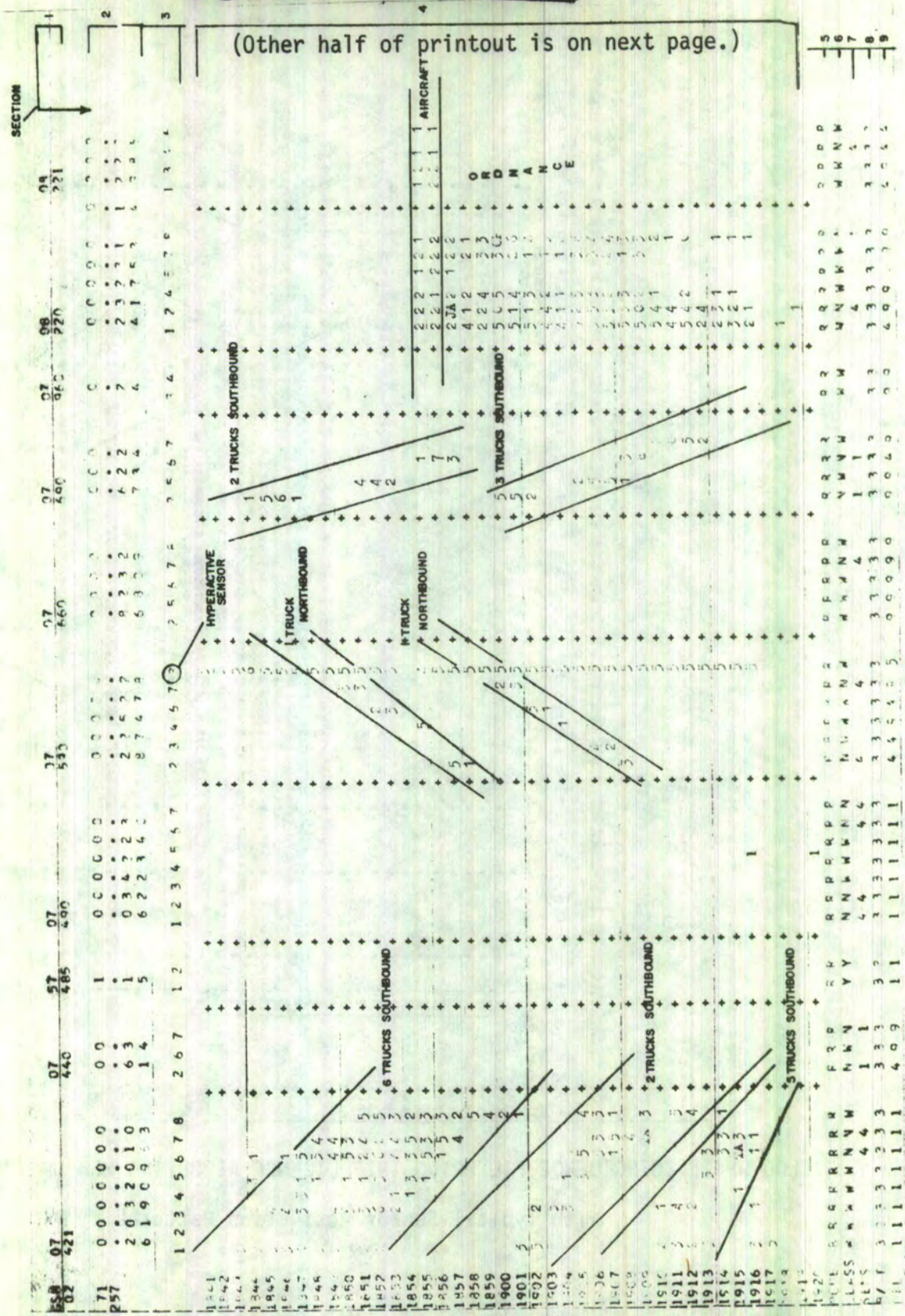
5. Hyperactive sensors. Activates for long periods of time for apparent reason.

6. A sensor previously rated 7, 8 or 9 but which has had no activations for a minimum of three days.

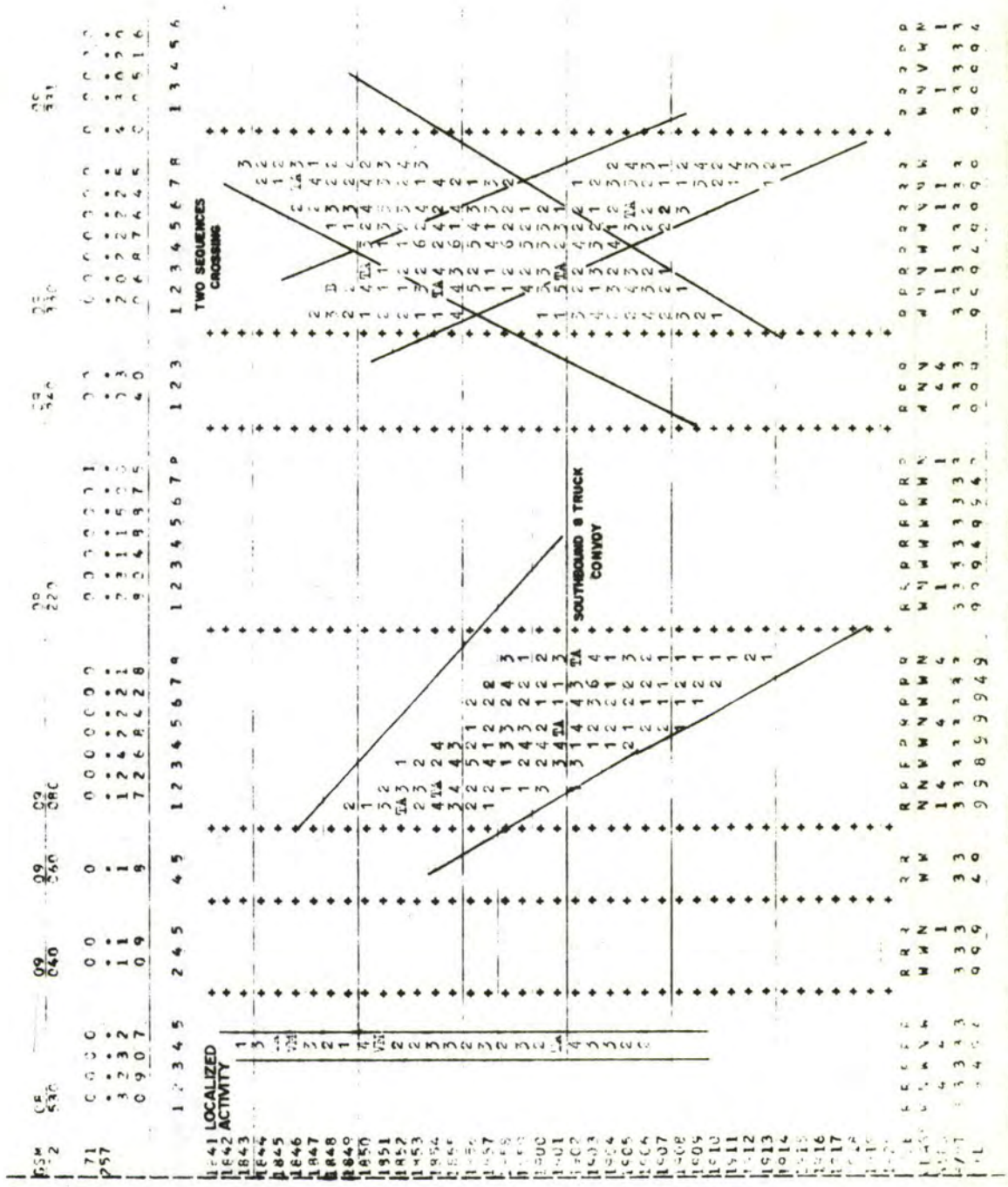
7. A useful but not reliable sensor. Activates for less than 40 percent of truck sequences, or gives unusual activations during sequences. Occasionally helps 8 or 9-rates sensors call sequences.

8. Activates for 40-95 percent of truck sequences.

9. Activates for more than 95 percent of truck sequences.



IGLOO WHITE COINCIDENCE FILTERING INTELLIGENCE REPORTING MEDIUM (CONFIRM) Sheet
With Typical Sensor Activation Patterns
(Numbers along right side are keyed to the explanatory text in Appendix I)



IGLOO WHITE COINCIDENCE FILTERING INTELLIGENCE REPORTING MEDIUM (CONFIRM) Sheet With Typical Sensor Activation Patterns

APPENDIX II

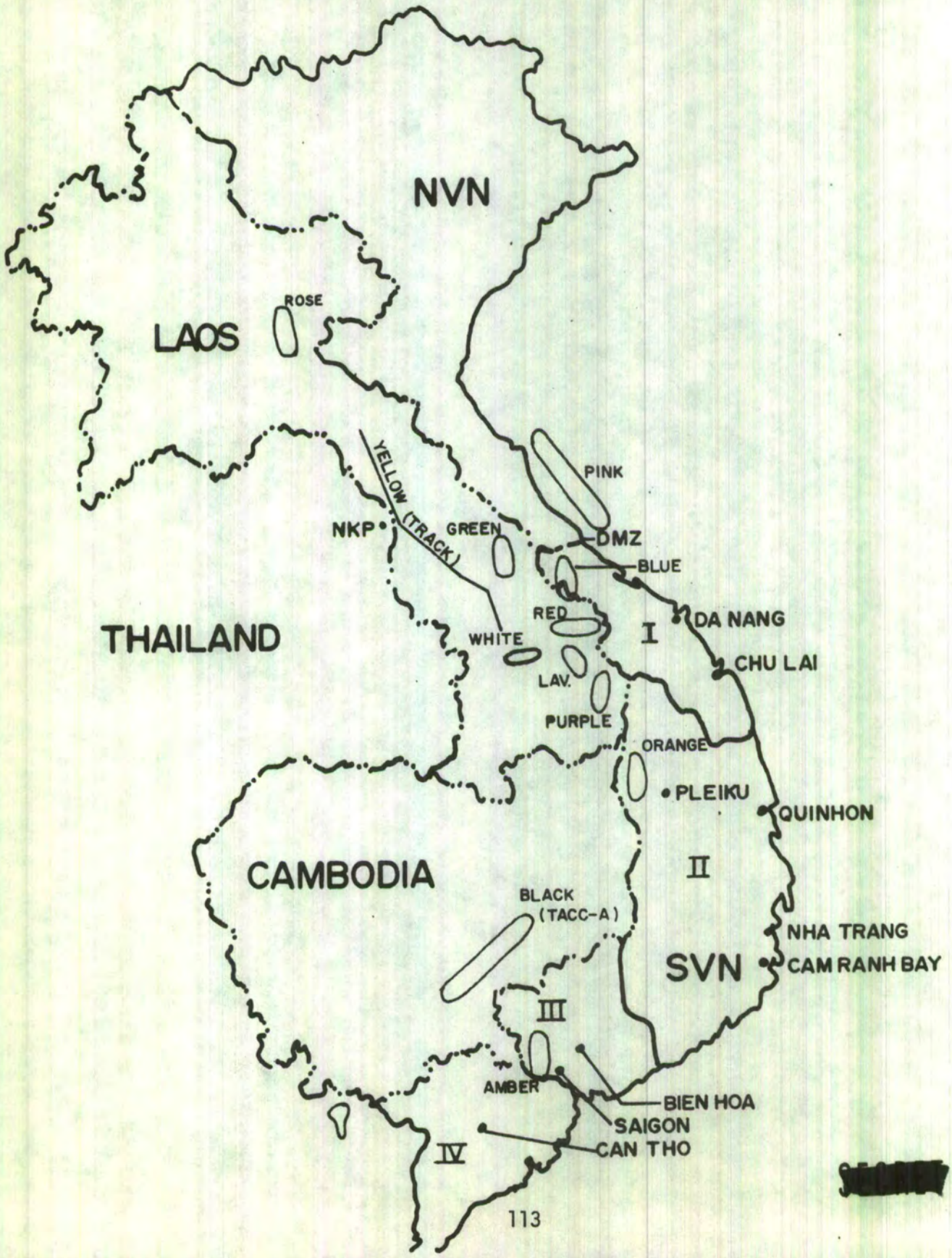
This list of aircraft orbits associated with IGLOO WHITE includes all those mentioned in this report.

ORBIT	AIRCRAFT	PROGRAM SUPPORTED	NO. OF HOURS DAILY	DATE FLOWN OR SEPTEMBER 1971 STATUS
Amber	EC-121R	DART I at Pleiku (Backup)	As required	May 1969 - March 1970
Black (TACC-A)	EC-121R	Cambodian strings (Use of Cambodian ABCCC to monitor sensors)	18	December 1970 - February 1971 (as sensor monitor)
Blue	EC-121R QU-22B C-130 (ABCCC)	DART I, IGLOO WHITE	18-24	Flown daily
Green	EC-121R QU-22B C-130 (ABCCC)	IGLOO WHITE	21	Flown daily
Lavender	EC-121R QU-22B	A test orbit flown to determine feasibility of White Orbit		Late 1970 - early 1971
Orange	EC-121R QU-22B	DART II	10 (Night)	September 1969 - September 1970
Pink	EC-121R	Sensors in NVN	Unknown	3-26 November 1968
Purple	EC-121R	IGLOO WHITE. Distance precluded relay of data to TFA	10 (Night)	Flown when C-130B not available for White Orbit

Red	C-130 (ABCCC)	Test orbit flown to assess quality of data read out from ABCCC C-130 compared with Blue Orbit		July 1971
Rose	EC-121R	Sensors along Route 7 in BARREL ROLL	10.0	August 1969 - January 1970
White	C-130B	Monitors Purple Orbit, but positioned so that higher altitude allows relay of data to TFA for read out	10.5	Flown daily
Yellow	QU-22B C-130	COMPASS FLAG (flies a track rather than an orbit)	10-12	Test stage

[redacted]

AIRCRAFT ORBITS ASSOCIATED WITH IGLOO WHITE



[redacted]

APPENDIX III

SEQUENCES PASSED, SEQUENCES NOT PASSED, AND BDA FOR HEADSHED NIGHT TRAFFIC ADVISORY SERVICE
24 October 1970 - 31 August 1971 (Based on OPREP-4 Data) 300/

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
Sequences processed	15	3501	9103	15,721	17,732	18,841	17,988	13,034	3804	1137
Movers processed	22	6190	13,781	26,913	31,471	34,337	26,892	18,483	4966	1436
Sequences passed	4	1652	2836	5690	4793	5221	5843	4441	1506	508
Sequences not passed	11	1849	6267	10,031	12,939	13,620	12,154	8593	2298	629
No aircraft available	7	1154	3157	3530	4249	5607	3562	4745	1600	339
Unable to contact aircraft	0	162	758	1586	1632	1436	1588	1123	170	78
Aircraft working strike or busy	0	373	2025	3891	5412	5052	6441	2208	377	139
Communications difficulties made information untimely	0	7	45	63	203	54	48	41	4	7
Weather precluded use of advisory	0	68	229	946	191	971	249	384	139	62
Below filter level	1	45	5	15	0	0	0	0	0	0
Other	3	39	48	0	0	500	257	92	8	3

Trucks destroyed	0	0	17	350	426	873	1012	134	15	11
Trucks damaged	0	0	4	76	105	233	165	142	32	15
Secondary Explosions	0	0	26	375	275	795	479	160	168	93
Secondary Fires	0	0	23	267	277	494	348	108	74	79
Sequences passed to:										
COMMANDO BOLT	2	729	1014	2299	2658	1996	814	301	99	20
MOONBEAM	0	286	293	721	471	714	1148	823	417	131
FACs	2	313	709	1157	672	707	1400	1474	516	135
Gunships	0	135	502	948	733	1165	2037	1517	346	182
BLUE CHIP (7AF COC)	0	0	3	10	0	0	0	0	0	1
Armed Recce	0	189	315	555	259	639	444	326	128	40

FOOTNOTES

CHAPTER I

1. (S) CHECO Report IGLOO WHITE, July 1968 - December 1969, Hq PACAF, 10 January 1970, p. 1 (Hereafter cited as CHECO IGLOO WHITE II).

2. (TS) CHECO Report IGLOO WHITE, (Initial Phase), Hq PACAF, 31 July 1968, p. 1 (Hereafter cited as CHECO IGLOO WHITE I).

3. (S) Ibid, p. 3

4. (S) Ibid, p. 5

5. (S) Ibid, p. 6

6. (S) Ibid

7. (S) Ibid, pp. 30-31

8. (S) Ibid, p. 10

9. (S) Briefing, subject: "TFA Command Briefing," presented to Colonel D. L. Flowers, Director of Command and Control, Hq 7AF, 18 September 1971 at TFA, NKP RTAB, Thailand. (Hereafter cited as TFA Briefing.)

10. (C) Message, TFA to 7DCOP, subject: Phase III Sensor Frequencies, 200220Z June 1971.

(S) Interview, topic: IGLOO WHITE. With Lieutenant Colonel Gean G. Kowalski, Chief, Surveillance Systems Branch, Tactical Air Control/Surveillance Division, Directorate of Command and Control, DCS/Operations, Hq 7AF, by Captain Henry S. Shields, Project CHECO at Tan Son Nhut AB, RVN, 12 October 1971. (Hereafter cited as Kowalski Interview.)

11. (S) Kowalski Interview.

12. (S) TFA Briefing

13. (S) Ibid, and conversation with Colonel R. Rumney, former Director of Technical Operations, TFA, at Tan Son Nhut AB, RVN, 14 December 1971

14. (S) Report (Staff Summary Sheet), subject: EDET Sensor Test, 23 June 1971, by 7DOCPS.

CHAPTER II

15. (S) CHECO IGLOO WHITE II, pp. 5-6

16. (S) Report, subject: Commando Hunt, 20 May 1971, by 7AF, p. 215 (Hereafter cited as Commando Hunt I)

17. (S) Ibid, pp. 28-29

18. (S) Ibid, p. 29

19. (S) Ibid, p. 214

20. (S) Ibid, p. 239

21. (S) Ibid, p. 214

22. (S) Ibid, p. 43

23. (S) Ibid, p. 215

24. (S) Ibid, p. 214

25. (S) Ibid, p. 43

26. (S) Ibid, p. 234

27. (S) Ibid, pp. 43-44

28. (S) Ibid, p. 68

29. (S) Ibid, p. 161

30. (S) Ibid, p. 71

31. (S) Ibid, p. xix

32. (S) CHECO IGLOO WHITE II, pp. 12-13

33. (S) Report, subject: "History of TFA, 1 January - 30 June 1970," 10 July 1970, by TFA, p. 4. (Hereafter cited as TFA History, 1 Jan-30 June 70.)

34. (S) CHECO IGLOO WHITE II, p. 13

35. (S) Report, subject: "History of TFA, 1 January-31 March 1971," 10 April 1971, by TFA.

36. (S) Interview, topic: KEYWORD File. With Captain Susan L. LaFontaine, Targets Analysis Officer, TFA, by Captain Henry S. Shields, 17 September 1971.

37. (S) CHECO IGLOO WHITE II, p. 15

38. (S) TFA History, 1 January-30 June 1970, p. 4.

39. (S) Report, subject: COMMANDO HUNT III, May 1970, by 7AF, p. 167 (Hereafter cited as COMMANDO HUNT III.)

40. (S) CHECO IGLOO WHITE II, p. 11

41. (S) Ibid, p. 17

42. (S) COMMANDO HUNT III, pp. 168-169

43. (S) Ibid, p. 169

44. (S) Ibid, pp. 172-174

45. (S) Ibid, p. 173

46. (S) Ibid, p. 171; pp. 174-176

47. (S) Ibid, p. 174

48. (S) Ibid, p. 176

49. (S) Ibid, p. 175

50. (S) Ibid

51. (S) Ibid, p. 176

52. (S) Ibid, p. 171; pp. 174-176

53. (S) Ibid, p. 177

54. (S) Ibid.

55. (S) Ibid, p. 178

56. (S) Interviews, topic: COLOSSYS and the Role of Computers in IGLOO WHITE. With TFA personnel, including Captain Ray E. Ruprecht, Duty Director, Directorate of Engineering TFA, and Captain Clifford C. Chastain, Chief, Infiltration Surveillance Division, TFA, by Captain Henry S. Shields, at TFA, NKP RTAB, Thailand, 12-19 September 1971. Also personal observations by the author.

57. (S) Msg, 553RW Korat RTAB, Thailand to 7DOT, Tan Son Nhut AB, RVN, subject: FERRET III Operations, 120955Z Mar 70 (CHECO Microfilm S435, FR 214.)

58. (S) COMMANDO HUNT III, p. 158.

59. (C) Report (Staff Summary Sheet), subject: "X-T Plotter Sensor Read Out in EC-121R," 11 December 1970, by 7DOPTS (CHECO Microfilm S437, FR 188).

60. (S) COMMANDO HUNT III, p. 158

61. (S) Briefing Notes, subject: FERRET III Operations, 18 February 1970 (Hereafter cited as FERRET III Briefing). (CHECO Microfilm S435, FR 213)

62. (S/NF) Memo for Record, "Methods of Providing Target Information to FACs and Gunships," by TFA/TOA, 27 May 1970, Appendix I: Evaluation of Spotlight and FERRET III. (CHECO Microfilm S420, FRs 175-176)

63. (S/NF) Ibid

64. (S/NF) Ibid

65. (S) FERRET III Briefing

66. (S) Interview, topic: DART, X-T Plotter, FERRET III. With Captain Clifford C. Chastain, Chief, Infiltration Surveillance Division, TFA, by Captain Henry S. Shields, at TFA, NKP RTAFB, Thailand, 15 September 1971.

67. (S) Report, subject: "Ban Raving Operations," part of TFA COMMANDO HUNT III Input to 7AF DOAC, 6 April 1970 (CHECO Microfilm S341, FR 193); TFA History, 6 April - 30 June 1970, pp. 49050; Memo to General Buckner, "Commando Bolt, 15 April - 15 June 1970," from 7AF Tactics and Combat Systems Directorate, 16 August 1970 (CHECO Microfilms S346, FR 47)

68. (S) TFA History, 1 January-30 June 1970, p. 7

69. (S) Report, subject: COMMANDO HUNT V, May 1971, by Hq 7AF p. 210 (Hereafter cited as COMMANDO HUNT V)

70. (S) TFA History, 1 January-30 June 1970, p. 13

71. (S/NF) Msg, TFA to 7DO, subject: Expanded COMMANDO BOLT Operations, 141010Z August 1970 (CHECO Microfilms S436, FR 47)

72. (S) Interview, topic: COMMANDO BOLT Operations. With Major Eric J. Brister, Staff Operations Officer, TFA, by Captain Henry S. Shields, at TFA, NKP RTAFB, Thailand, 14 September 1971, and conversations, same subject, with Colonel Ben A. Barone, Director of Operations, TFA, 18 September 1971

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77. (S) Msg, 7DOC to TFA, subject: COMMANDO BOLT Operating Areas, 060200Z March 1971

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81. (S) Msg, TFA to CSAF/XOOG, subject: Request for Sensor Information, 0210102Z August 1971

82. (S) COMMANDO HUNT III, p. 160

83. (S) Ltr, TFA/INAA to TFA/IN, subject: Band Concept, Commando Hunt V. 20 March 1971 (Hereafter cited as TFA 20 Mar 71 letter)

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86. (S) COMMANDO HUNT V, p. 211

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88. (S) Ibid.

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91. (S) Report, subject: "History of TFA, 1 January-31 March 1971," 10 April 1971, by TFA. (Hereafter cited as TFA History, 1 January-31 March 1971)

92. (S) Interview, topic: "Night Fixed Targeting Program." With Captain Susan L. LaFontaine, Targets Analysis Officer, TFA, and conversations with Major Barry W. Hubbard, Chief, Targets Branch, TFA, by Captain Henery S. Shields, at TFA, NKP RTAB, Thailand, 17-18 September 1971

93. (S) Data obtained from TFA/INT files by Captain LaFontaine

94. (S) CHECO IGLOO WHITE, p. 29

(C) Report (Staff Summary Sheet), subject: "X-T Plotter Sensor Read Out in EC-121R," 11 December 1970, by 7DOPTS.

95. (C) Report (Staff Summary Sheet), subject: "X-T Plotter Sensor Read Out in EC-121R," 11 December 1970, by 7DOPTS

96. (S) COMMANDO HUNT V, p. 210

97. (S) Report (Staff Summary Sheet), subject: "Sensor Support Lam Son 719 and 720," 29 April 1971, by 7DOCPS (Hereafter cited as 29 April 1971/DOCPS Report)

98. (S) Message, Commanding General XXIV Corps to COMUSMACV, subject: Lam Son 719 After Action Report, 260722Z April 1971 (Hereafter cited as 260722Z April 1971/XXIV Corps message).

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103. (S) 260722Z April 1971/XXIV Corps message

104. (S) TFA 20 March 1971 letter, p. 2

105. (S) TFA History, 1 January - 31 March 1971

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107. (C) Message, TFA to 7DOCP, Daily Sensor Activity Report, 030940Z October 1971

108. (S/NF) Message, Commander, 7AF to CINCPACAF, subject: Transfer of DART, 140005Z June 1971

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110. (C) Message, TFA to 7DOCP, subject: Phase III Sensor Frequencies, 200220Z June 1971; Msg, Director MAT MGT, Kelly AFB, Texas to 7DOCP, subject: IGLOO WHITE Phase III Sensor Frequencies, 132100Z July 1971

111. (C) 200220Z June 1971 message

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113. (S) Message, 7DOCP to 56SOW, NKP RTAB, Thailand, subject: COMPASS FLAG Orbit Tracks, 032130Z August 1971

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115. (S) Message, 6908SS, NKP RTAB, Thailand, to 13AF, Clark AB, PI, subject: IGLOO WHITE/COMPASS FLAG, 130730Z September 1971

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123. (S) Secret Working Paper, subject: Cambodian Sensor Field Plan and Impact on Sensor Requirements, 30 July 1970 (CHECO Microfilm S436, FR 98)

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126. (S) Report (Command Correspondence Staff Summary Sheet), subject: "Analysis: Cambodian Sensor Field Evaluation," by 7DOPTS, 2 November 1970 (CHECO Microfilm S435, FR 140)

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128. (S/NF) Message, 6INT to TFA, subject: Cambodian Sensor Field Plan, 301039Z October 1970 (CHECO Microfilm S435, FR 141)

129. (S) Message, 7DOP to 388TFW, 553RW, Info: COMUSMACV, CINCPACAF, 7/13AF, Udorn RTAB, Thailand, TFA, subject: Sensor Monitor on EC-121R TACC-A Mission, 190350Z December 1970 (CHECO Microfilm S435, FR 140)

130. (S) Message, 7DOCPto 388TFW, subject: Sensor Monitoring on EC-121R TACC-A Mission, 070830Z February 1971

131. (S/NF) Report (Staff Summary Sheet), subject: "Cambodian Sensors Monitored by TACC-A," by 7DOCPS, 10 February 1971

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133. (S) COMMANDO HUNT III, p. 159

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139. (S) CHECO IGLOO WHITE II, p. 22

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141. (S) COMMANDO HUNT III, p. 159

142. (S) COMMANDO HUNT V, p. 205

143. (S) CHECO IGLOO WHITE II, p. 24

144. (S) COMMANDO HUNT V, p. 205

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(S) Hq PACAF DOOCS Review

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150. (C) Message, TFA to 7DOCP, subject: Production Requirements for EDET Sensor, 131040Z May 1971

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161. (C) Message Hq ESD, L G Hanscom Field, Mass to Det 6, ASD, Tan Son Nhut AB, RVN, subject: EDET III and IV, 012141Z July 1971

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163. (S) Report, subject: "RAVET III History," 4 November 1970 (CHECO Microfilm S436, FR 193)

164. (S) Message, DCPG to CSAF, subject: Radar Beacon Transponder - RABET, 241902Z December 1970 (CHECO Microfilm S436, FR 193)

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167. (S) Lillethum 30 June 1970 Memorandum

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171. (S) Interview, topic: Acoustic Targeting. With Captain Harry C. Harrison, OIC, Targets Operations Section, TFA, by Captain Henry S. Shields, at TFA, NKP RTAB, Thailand, 14 September 1971. (Hereafter cited as Harrison Interview)

172. (S) Report (Staff Summary Sheet), subject: "Present Status of Acoustic Targeting Areas (ATA) Program," 28 July 1971, by 7DOCPS.

173. (S) Harrison Interview

174. (S) Report (Staff Summary Sheet), subject: "Use of Sensors for BDA," 23 April 1971, by 7DOCPS.

175. (S) Interview, topic: "Use of Sensors for BDA." With Lieutenant Colonel Theodore E. Hurt, Chief, Air Operations Division, TFA, by Captain Henry S. Shields, at TFA, NKP RTAB, Thailand, 15 September 1971

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177. (S) Talking Paper, subject: "OV-10 Portatale in COMMANDO BOLT," approximately January 1970 (CHECO Microfilm S437, FR 200)

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194. (S) Memo for Record, "TFA Sensor Data Link Jamming," from 7DOPT to 7INTSM, 8 March 1971

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199. (C) Interrogation Report #1516-0146-71, subject: "Sensors Briefing to an Infiltration Group," 11 March 1971, by 1021st USAF Fld Activity Squadron

200. (C) Interrogation Report #1516-0289-71, subject: "NVA Briefing on Sensors," 14 May 1971, by 1021st USAF Fld Activity Sq.

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201. (C) Interrogation Report #1516-0138-71, subject: "NVA Briefing on Sensors in Laos," 9 March 1971, by 1021st USAF Fld Activity Sq.

202. (C) Interrogation Report #1516-0226-71, subject: "NVA Reaction to Sensoring Devices," 4 May 1971, by 1021st USAF Fld Activity Sq.

203. (C) Interrogation Report #1516-0289-71

204. (C) Interrogation Report #1516-0226-71

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206. (S) Ibid, pp. 29-30

207. (S) Ibid, p. 30

208. (S) QU-22B Chronology, August 1971, in 7DOCPS file. (Hereafter cited as QU-22B Chronology)

209. (S) CHECO IGLOO WHITE II, p. 31

(S) Hq PACAF DOOCS Review

210. (S) COMMANDO HUNT I, p. 237

211. (S) CHECO IGLOO WHITE II, p. 31

212. (S) QU-22B Chronology

213. (S) CHECO IGLOO WHITE II, p. 31

214. (S) COMMANDO HUNT V, p. 208

(S) Hq PACAF DOCCS Review

215. (S/NF) Report (Command Correspondence Staff Summary Sheet), subject: "IGLOO WHITE Forces," 28 January 1970, by Lieutenant Colonel Arthur C. Lehrman, Chief, Systems and Resources Branch, 7AF (CHECO Microfilm S436, FR 233)

216. (S) Interview, topic: IGLOO WHITE Orbits and Use of Sensors. With Captain Ray E. Ruprecht, Duty Director, Directorate of Engineering, TFA, by Captain Henry S. Shields at TFA, NKP RTAB, Thailand, 13 September 1971.

217. (S) QU-22B Chronology

(S) Report (Command Correspondence Staff Summary Sheet), subject: "553 Recon Wing C-121G Aircraft," 1 May 1970, by Lieutenant Colonel Edwin J Hatzenbuehler, Jr., Surveillance Division, 7AF.

218. (S) QU-22B Chronology

(S) COMMANDO HUNT V, p. 208

219. (S) Message, CINCPACAF to AFSC, subject: Deletion of PAVE EAGLE II Drone Capability, 082316Z March 1971.

220. (S) QU-22B Chronology

(S) COMMANDO HUNT V, p. 210

221. (S) COMMANDO HUNT V, p. 210

222. (S) Message, 56SOW to 7DO, subject: QU-22B Operations, 220700Z April 1971

223. (S) Report (Staff Summary Sheet), subject: "IGLOO WHITE Orbits," 7 June 1971, by 7DOCPS.

224. (S) QU-22B Chronology

225. (S) Message 7DOC to 56SOW, subject: "IGLOO WHITE Orbits," 180850Z August 1971

226. (S) Message CINCPACAF to CSAF, subject: "QU-22B," 202135Z August 1971

227. (S) Ibid

228. (S) Message CINCPACAF to CINCPAC, subject: "IGLOO WHITE Orbit Requirements," 180135Z September 1971

229. (S) Kowalski Interview

230. (S) Message TFA to 7DOCP, subject: "Relay Aircraft," 250255Z February 1971

231. (S) Report, subject: "CROC-C-130/ABCCC/IGLOO WHITE," in 7DOCPS files

(S) Report (Staff Summary Sheet), subject: "ABCCC/ADR, 12 August 1971, by 7DOCPS

232. (S) Message Commander 7AF to CINCPACAF, subject: "QU-22B Get Well Program," 18 August 1971 (No DTG)

233. (S) Kowalski Interview

234. (S) Ibid

235. (S) Message 13AF to CINCPACAF, subject: "IGLOO WHITE/COMPASS FLAG," 090820Z September 1971

(S) Message CINCPACAF to AFLC, subject: "IGLOO WHITE/COMPASS FLAG," 091905Z September 1971

236. (S) Kowalski Interview

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237. (S) CHECO IGLOO WHITE II, p. 44

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240. (S) Report (Command Correspondence Staff Summary Sheet), subject: "DART Status," 6 January 1970, by 7DPTS (CHECO Microfilm S437, FR 55)

241. (S) Report (Command Correspondence Staff Summary Sheet), subject: "Termination of DART I Operations in III CTZ," 12 March 1970, by 7DOTS (CHECO Microfilm S437, FR 42).

242. (C) Letter, 553RW (DCOOT) to 7DOT, subject: "Conference on 6-8 July to Discuss Standardized Reporting Procedures by the 553RW and DART I to Army Commanders in I Corps," 17 July 1970 (CHECO Microfilm S437, FR 72)

243. (S) Fact Sheet, "Sensors in SEA, Army, DUFFLE BAG (South Vietnam Only)," 27 October 1970 (CHECO Microfilm TS98, FR 019)

244. (C) Report (Command Correspondence Staff Summary Sheet), subject: "DART I (Deployable Automatic Relay Terminal)," 21 November 1970, by 7DOPTS (CHECO Microfilm S437, FR 55).

245. (S) Report, subject: "DART Statistical Report of Sensor Activations, 1-31 October 1970," by Det 2, 505 TAC Control Group (CHECO Microfilm S437, FR 60)

246. (C) Report (Command Correspondence Staff Summary Sheet), subject: "DART I (Deployable Automatic Relay Terminal)," 21 November 1970 by 7DOPTS (CHECO Microfilm S437, FR 55).

247. (C) Message 7DOP to CINCPAC, subject: "Disposition, Phase I/II Assessment Van, DART I," 241045Z December 1970 (CHECO Microfilm S437, FR 51).

248. (S) Memo for Record, "Trip Report for DART I Operations," by Major Alvin L. Pavik, 7DOPTS, 13 November 1970 (CHECO Microfilm S437, FR 56).

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252. (S) Report (Staff Summary Sheet), subject: "Sensor Support for Lam Son 719 and 720," 29 April 1971 by 7DOCPS.

253. (C) 22 March 1971 Staff Summary Sheet

254. (S/NF) Message Commander 7AF to CINCPACAF, subject: "Transfer of DART," 140005Z June 1971.

255. (S) Message 7DO to TFA, subject: "DART Transfer," 060430Z July 1971

256. (S) Report (Staff Summary Sheet), subject: "DART Reporting," 7 July 1971 by 7DOCPS

257. (S) Message 7DO to TFA, subject: "DART Transfer," 060430Z July 1971

258. (S/NF) Message 7DO to COMUSMACV (J3), subject: "Transfer of DART I Function to TFA," 111000Z May 1971

259. (S) CHECO IGLOO WHITE II, p. 47

260. (S) DART II End of Tour Report, 12 October 1970 (CHECO Microfilm S437, FRs 84-86).

261. (S) CHECO IGLOO WHITE II, p. 47

262. (S) Ibid, p. 48

263. (S) Message Vice Commander 7AF to MACV (J3), no subject, 28 March 1970 (No DTG), (CHECO Microfilm S437, FR 29)

264. (S) Letter, 7DO to COMUSMACV (J3) (Major General Cowles), subject: DART II, 20 August 1970 (CHECO Microfilm S437, FR 81).

265. (C) Message CINCPACAF to 7AF, subject: "DART II Redeployment," 090350Z October 1970 (CHECO Microfilm S437, FR 79).

266. (C) Message 7DO to CINCPACAF, subject: "DART II," 011130Z October 1970 (CHECO Microfilm S437, FR 80).

267. (S) DART II End of Tour Report, 12 October 1970 (CHECO Microfilm S437, FR 84-86)

268. (S) Ibid

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271. (C) Ibid.

272. (S) Kowalski Interview

273. (C) 3 August 1971 Memo

274. (S) CHECO Report SEA Glossary 1961-1970, Hq PACAF, 1 January 1970, p. 59

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276. (S) Interview, topic: DUFFLE BAG Program and USAF Participation. With Major Robert E. Davis, Communications Systems Officer, Special Operations Branch, Surface Operations Division, ACS/Operations, MACV, by Captain Henry S. Shields at Hq MACV Saigon, RVN, 6 September 1971 (Hereafter cited as Davis Interview).

277. (S) Report, subject: "Minutes, DUFFLE BAG/TIGHT JAW Conference, 16-17 April 1970," 5 June 1970 by MACV J3-04 (CHECO Microfilm S437, FR 212).

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279. (S) Ibid

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281. (S) Report (Staff Summary Sheet), subject" "PAR Relay," 3 July 1971 by 7DOCPS in 7DOCPS files.

282. (S) Davis Interview

283. (S) Briefing/Conference, subject: "TFA Operations in COMMANDO HUNT VII," presented by Colonel Ben A. Barone, Director of Operations, TFA and Major Eric J. Brister, COMMANDO BOLT Operations Shop, TFA, to Colonel D. L. Flowers, Director of Command and Control, Hq 7AF, 18 September 1971

284. (S) Ibid

285. (S) Ibid

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287. (S) Report, subject: "Appendix IX to Annex EE (Anti-infiltration/ IGLOO WHITE)," to COMMANDO HUNT VII Plan, 5 July 1971 by TFA. In 7DOCPS file.

288. (S) Conversations with Colonel Ben A. Barone, Director of Operations, TFA by Captain Henry S. Shields, Project CHECO, 18 September 1971 at TFA, NKP RTAB, Thailand.

289. (S) Study, subject: "Remote Ground Sensor Planning and Programming Objectives (REGSENSPO)," no date, by Hq USAF (CHECO Microfilm S442, FRs 142-143).

290. (S) Letter Hq PACAF/XP to 7AF, 5AF, 13AF, 7/13AF, subject: "Ground Sensor Capabilities and Employment," 16 December 1970. Cover letter to Hq USAF REGSENSPO Document.

291. (S) Message 7XP to PACAF/XP, subject: "Ground Sensor Capabilities and Employment," 160702Z January 1971 (CHECO Microfilm S442, FRs 141-142). (Hereafter cited as 7AF Sensor Capabilities 160702Z January 1971 message).

292. (S) Ibid

293. (S) TFA History, 1 January-30 June 1970, p. 5

294. (S) 7AF Sensor Capabilities 160702Z January 1971 message.

295. (S) Ibid

296. (S) Letter, Hq PACAF/XPX to Hq USAF (XOXFT), subject: "Remote Ground Sensor Planning/Programming," 15 March 1971.

297. (S) Ibid

298. (U) John L. Frisbee, "IGLOO WHITE," Air Force Magazine, Vol 54, #6 (June 1971), pp. 48-53.

299. (C) Message, Det Eglin AFB, Florida to JCS/Sec Def Wash DC, subject: "CONUS Plan for Demonstration of a Ph IIIE System in Europe (MYSTIC MISSION)," 131230Z September 1971.

300. (S) Gathered from records on file in office of the Air Operations Division, Directorate of Operations, TFA, NKP RTAB, Thailand. Obtained 16 September 1971.

GLOSSARY

AAA	Antiaircraft Artillery
ABCCC	Airborne Battlefield Command and Control Center
ACOUSID	Acoustic Seismic Intrusion Detector
AC&W	Aircraft Control and Warning
ADSID	Air Delivered Seismic Intrusion Detector
AFSC	Air Force Systems Command
AMTI	Airborne Moving Target Indicator
ARDF	Airborne Radio Direction Finding
ARVN	Army of the Republic of Vietnam
ASR	Automatic Sequence Routing
ATA	Acoustic Targeting Area
BASS	Battlefield Area Surveillance System
BDA	Bomb Damage Assessment
CAEDET	Commandable Audio Engine Detector
CAP	Combat Air Patrol
CAS	Controlled American Source
COC	Combat Operations Center
COLOSSYS	Coordinated LORAN Sensor Strike System
COMMIKE	Commandable Microphone
COMUSMACV	Commander, United States Military Assistance Command, Vietnam
CONFIRM	Coincidence Filtering Intelligence Reporting Medium
CRC	Combat Reporting Center
DART	Deployable Automatic Relay Terminal
DASC	Direct Air Support Center
DCPG	Defense Communications Planning Group
DMPI	Desired Mean Point of Impact
DMZ	Demilitarized Zone
DO	Directorate of Operations (TFA)
DSPG	Defense Special Projects Group
ECM	Electronic Countermeasures
EDET	Engine Detector
ETA	Estimated Time of Arrival
FAC	Forward Air Controller
FADSID	Fighter Air-Delivered Seismic Intrusion Detector
FFV	Field Force Vietnam
GSM	Ground Surveillance Monitor

HANDSID	Hand-emplaced Seismic Intrusion Detector
HELOSID	Helicopters-emplaced Seismic Intrusion Detector
IN	Directorate of Intelligence (TFA)
ISC	Infiltration Surveillance Center
JGS	Joint General Staff
KIA	Killed in Action
LOC	Line of Communication
LORAN	Long Range Navigation
MACV	Military Assistance Command Vietnam
MAGID	Magnetic Intrusion Detector
MAW	Marine Air Wing
NOD	Night Observation Device
NULLO	No Live Operator Aboard
PAR	Palletized Airborne Relay
PIRID	Passive Intra-red Intrusion Detector
PMBR	Portable Multiple Bomb Rack
PMDL	Provisional Military Demarcation Line
PME	Prime Mission Equipment
RBA	Reconnaissance by Acoustic
REGSENSPO	Remote Ground Sensor Planning Objectives
RFI	Radio Frequency Interference
RTAFB	Royal Thai Air Force Base
RVN	Republic of Vietnam
RVNAF	Republic of Vietnam Armed Forces
RW	Reconnaissance Wing
SAM	Surface to Air Missile
SAR	Search and Rescue
SEA	Southeast Asia
SI	Special Intelligence
SOW	Special Operations Wing
SPIKEBUOY	Spike Acoubuoy
SPIKESID	Spike Seismic Intrusion Detector
SPOS	Strong Point Obstacle System
SRP	Sensor Reporting Post
SS	Security Squadron
SSS	Special Strike String
SSZ	Special Strike Zone
STOL	Short Take-off and Landing

TAC	Tactical Air Command
TACAIR	Tactical Air
TACP	Tactical Air Control Party
TAO	Traffic Assessment Officer
TFA	Task Force Alpha
TFS	Tactical Fighter Squadron
TIO	Targets Intelligence Officer
TO	Directorate of Engineering (TFA)
TOC	Tactical Operations Center
TOT	Time on Target
USAFE	United States Air Forces Europe
USAFSS	United States Air Force Security Service
VHF	Very High Frequency
VR	Visual Reconnaissance
WRZ	Western Reconnaissance Zone

RESEARCH NOTE

The period before 31 December 1970 covered in this report was largely based on the COMMANDO HUNT I, III, and V reports, the two previous CHECO IGLOO WHITE studies and material found in CHECO TOP SECRET Microfilm 98 and SECRET Microfilms 341, 346, 420, 435, 436, 437, and 442. Material for the period after 1 January 1971 was obtained from an examination of current files at TFA and the Surveillance Systems Branch, Tactical Air Control/Surveillance Division, Directorate of Command and Control, DCS/Operations (DOCPS) at Headquarters, Seventh Air Force, Tan Son Nhut Air Base, Republic of Vietnam. Interviews and conversations with TFA and DOCPS personnel were also used, as were the author's personal observations at TFA.