Acoubuoy, Spikebuoy, Muscle Shoals and Igloo White

Before *Pac Man*, *Pong*, or *Space Invaders*, there was *Igloo White* - the original computer video game - where the loser paid in real blood, so that the winner did not have to.

Introduction

The importance of the Ho Chi Minh Trail as the primary means of supply for prosecuting a guerrilla warfare campaign in South Vietnam has been discussed at length elsewhere. The actual method by which the United States and its Allies accomplished that is however, less detailed because of its previously highly Classified status. Thirty years after the fact, this material is now being declassified (technically called *downgrading* - to Unclassified status), and sheds a whole new light on the subject.

Where North Vietnam had no airborne delivery capability, the two options left to them that they pursued were supply by land and by water. The coastal routes of Vietnam and throughout the inland waterway and Mekong river systems were monitored and interdicted by South Vietnamese and allied U.S. Navy operations. River-watch programs by police and military authorities were implemented and land routes across the Demilitarized Zone into South Vietnam were interrupted so well that the use of other countries not originally involved with the conflict became the primary means of prosecuting the invasion. The ensuing involvement of Laos and Cambodia as delivery routes violated various international treaties and accords. It was recognized early that North Vietnam and their organized insurgency into Laos and Cambodia did not subscribe to accepted international rules. Although many supplies still got through to regular and provisional communist forces in South Vietnam, the interdiction of these supply lines saved thousands of American and Allied lives from death and injury.

Inception

In August 1966, a scientific study group (The Jason Group) was solicited to submit a proposal discussing a broad air-supported anti-personnel barrier system across Vietnam below the DMZ.

In September, Secretary of Defense McNamara established the Defense Communications Planning Group to implement the concept, and later expanded the mission scope to cover an anti-vehicle barrier system across Vietnam, Laos and Cambodia by a variety of tactical applications with a variety of sensors. Sonobuoys were already in Navy use as part of the *Jezebel* ASW (anti-submarine warfare) program - essentially a computer-aided audio spectrum analyzer. The system recorded and maintained a database of acoustic signatures of surface and submarine target vessels. Individual vessel names were routinely identified and cataloged for later recall by acoustic 'fingerprint'.

The U.S. Navy adapted the air-dropped radio sonobuoy for ground use by replacing the hydrophones with microphones and geophones, and modifying existing ASW aircraft for over-land use to accomplish the mission. The initial phase was called ALARS (Air Launched Acoustical Reconnaissance), later to become known as TRIM (Trails and Road Interdiction, Multi-sensor).

Recognition

The wide variety of code names and call-signs associated with the overall *Igloo White* program confuses the clarity of the subject, as all good security programs should. The very nature of classified operations themselves imparts information only on a 'need to know' basis regardless of the participants' clearance-level. Even the staff working inside the Task Force Alpha facility were limited on which rooms they could enter, and accessed information only necessary for their specific duties. For the sake of simplicity, they did not enquire into the nature of their associates' work off duty in too much detail, and did not customarily associate or talk with other service personnel outside of the hemisphere of their immediate shift or work crew. Additionally, the fact that most service personnel served for only one year in Southeast Asia limited knowledge to a very narrow few at a time. On the broader front, mission activities were assigned to many different specialty units of the armed services over a ten-year period. Complicating an understanding of the overall program was the fact that one organization would replace or absorb another's mission when it changed, or as one technology would supercede the other.

Identification

The overall management and prosecution of the Trail Interdiction program was the responsibility of a joint task-force of Army, Navy and Air Force commands tasked by the Department of Defense to integrate their respective intelligence gathering and targeting programs under one mission.

Operational identification was initially listed on DOD organizational charts as *Joint Task Force 728.* The initial sensor air delivery and attack portion of the program was managed by the U.S. Navy under the code-name *Dual Blade*, later changing to *Dye Marker*, and again to *Muscle Shoals*. Upon transfer of mission to the Air Force in June 1968 under the expanding umbrella of the 'air war', the ground unit identification was changed to *Task Force Alpha* and the overall electronic warfare program of dropping sensors along the Ho Chi Minh Trail was known as *Igloo White*.

The Sensors

A number of different types of detection sensors are fielded today by many nations. Some apply thermal, electromagnetic or chemical recognition techniques, reporting engine or body heat, electrical and magnetic field fluctuations from passing vehicles, machinery noises - even smell. Although some of these other detection technologies were used in Southeast Asia, seismic sensors were the most widely deployed, and were identifiable as belonging to one of two categories:

(1) GSIDs (Ground Seismic Intrusion Detector).

(2) ADSIDs (Air Delivered Seismic Intrusion Detector).

The US Navy distinguished the land sensors from their historic Sonobuoy cousins by referring to *Spikebuoy* (seismic) and *Acoubuoy* (acoustic). ADSIDs were deployed in versions I, II, and III. Audio microphone-equipped versions that allowed noises and conversations to be heard were also later referred to as ACOUSIDs.

Geophones

Seismic detectors use a transducer called a geophone to convert ground motion into an electrical signal. Widely used for underground mapping studies in oil field exploration, the geophone is a remarkable device at an inexpensive price. It consists of a magnet delicately suspended by springs and surrounded by coils of wire. When the geophone is implanted in the ground and a seismic disturbance causes ground motion, the magnet moves too. The moving magnetic field generates a voltage in the wire coil. With favorable soil conditions, the geophone and suitable electronics can easily detect the footsteps of a single person walking at a distance of thirty meters. Yet, even with that sensitivity the geophone was able to withstand shocks of up to 2000 Gs lasting several milliseconds from air-delivered sensors impacting the ground.

In Southeast Asia, the problem with seismic sensors wasn't their sensitivity ability to pick up the soil disturbance produced by humans walking or trucks rumbling down the Ho Chi Minh trail; the problem was all the *other* noise-producing seismic signals: earth tremors, wind, thunder, rain, bombs, artillery, aircraft and especially helicopters kept the ground vibrating and created seismic sensor nuisance alarms galore. The solution came in separating the important "near-field" signal sources from the confusing "far-field" signal sources. Sometimes, seismic sensors were combined with acoustic devices to try to assess the causes of the unwanted alarms. When the alarm occurred, the listening device would turn on and transmit back to the alarm monitor. The person listening would try to determine whether or not there was a target worth going after. More commonly, seismic sensors were planted in strings along the estimated path of the target. Far-field signal sources would set off all the sensors at once and those alarms would be recognizable as such and ignored. If there was proper spacing between sensors, near-field sources (targets) would set off the sensors separately, one after the other. By knowing the sensor spacing, the alarm monitor could determine direction and speed of travel and often estimate the size of the convoy target.

SIDs

The *SID* or Seismic Intrusion Detector, was the first seismic sensor introduced in more than prototype quantities, with several hundred arriving in Viet Nam in October 1967. Up to eight SIDs were used on a single frequency and labeled A, B, C, through H. The alarms were received on either of two signal receive and display "Interrogators." One was self-contained with receiver, transmitter and eight lamps to display alarms. The other Interrogator model was built for connection to the AN/ARC-52(V) aircraft transceiver. The SID was designed without knowledge of the high background noise-levels in Viet Nam, and had the feature of being able to store alarm counts for later retrieval. Seismic events over a preset threshold level were counted, divided by 32, and each series of 32 events stored as one person walking by. It was assumed

that 32 footsteps would be detected per person passing the sensor. With the high background noise, the alarm storage feature was only useful in furnishing the knowledge that future seismic sensors would not need alarm storage capability.
In addition to seismic nuisance alarms, the simple tone modulation on high-traffic usage VHF aircraft frequencies resulted in unwanted RFI-generated alarms. In spite of these difficulties, the SID was put to good use by various artillery installations, Special Forces and the First Air Cavalry in Vietnam.

GSIDs
GSIDs, or Ground Seismic Intrusion Detectors were a hand-implanted version of the ADSID. The GSID contained the same common modules as in the ADSID, packaged in a 4.5x5x9 inch metal box and weighing about seven pounds. Switches on the panel of the GSID allowed the user to set the transmission ID code, the sensitivity of the sensor, the numbers of days for the *EOL* (End of Life) timer and to select operation in the *Real-Time* or *Inhibit* mode.
GSIDs used either an internal or an external geophone. The external geophone was deployable by means of a 12-foot cable normally stored in the case-lid. When the *EOL* function was armed, the transmitter would disable for any of four events (1) opening the lid, (2) tilting the case more than 30 degrees off vertical, (3) *EOL* time-out or (4) battery voltage dropping below 21 volts. Disabled sensors could be made operational again only by replacing the transmitter.

PSIDs
The PSID, or Patrol Seismic Intrusion Detector was built with the Grunt in mind. A PSID set consisted of four sensors and one receiver. Each sensor weighed about a pound and fitted in a BDU pocket. Nine-volt transistor radio batteries powered both sensors and receivers. New batteries lasted a minimum of eight hours under constant alarm conditions, but fifty hours of battery life was more typical. Listening to sensor alarms sounded like Morse code - the first sensor emitted one dot, the second two dots and so-on to four dots. Later models were built with sensor number four emitting six or seven dots because of the difficulty in discriminating between three and four dots. The flexible steel sensor antenna was made from the same material as a steel tape measure so that it could be wrapped around the case with the 16-foot geophone cable. The geophones fitted in a clip on the side of the case. The receiver could pick up alarm signals from the transmitter at maximum ranges of 500 to 800 meters, depending on terrain and vegetation.

HANDSIDs
The HANDSID was similar to the GSID, but manufactured by different corporation. The electronics were not at all similar to the GSID design approach and at least twice the overall size.

ADSIDs
The ADSID was a family of sensors that came in versions I, II and III as follows:

Nomenclature	Model	Variant	Type	Length	Weight
ADSID I (N)	- - - - - -	normal	seismic	31.00 ins	26.0 lbs
ADSID I (S)	MA-36	short	seismic	20.10 ins	13.7 lbs
ACOUSID II	TC-415		seismic-acoustic	53.14 ins	38.8 lbs
ACOUSID III	MA-31		seismic-acoustic	47.63 ins.	37.2 lbs
ADSID III (N)	MA-33	normal	seismic	37.66 ins.	37.2 lbs
ADSID III (S)	MA-37	short	acoustic	20.10 ins.	13.7 lbs
MODS	81 mm	mortar	seismic	33.00 ins.	9.6 lbs

It is estimated that some 36,000 air-delivered ADSID and ACOUSID sensors were produced.
Sensor design consisted of a series of common modules, using the latest integrated-circuit chip technology of the time to keep costs down. Common modules were cylindrical, sealed in hard foam potting compound, and connected to each other with circular connectors around the outer circumference at the ends of the cylinders. As with the GSID, the same adjustments - Gain, Code, Real-Time, Inhibit, and Disable could be programmed into the ADSID modules. A Common Module existed for each of the following functions; Transmitter, Encoder, Command decoder, and Command receiver.
RF alarm messages were modulated with a combination of 19kHz, 25kHz and 32 kHz pulses which

provided up to 27 codes (IDs) on a single radio channel. The transmitter radiated two watts power on one of 40 channels in the 160-175 MHz-band FM/VHF radio spectrum.

Presets

If switched to the RT (Real Time) mode, the sensor would transmit alarms at a maximum rate of 1.4 per second. If the sensor alarmed constantly in the RT mode, minimum battery life was at least 48 hours.
If switched to the INH (Inhibit) mode, the sensor would transmit alarms at a maximum rate of one per ten seconds. Minimum battery life in this mode was 45 days.
In spite of rocks, trees, rice paddies and other inhospitable impact sites, 80% of the ADSIDs were found to be operational.

Application

The ADSID III shown above is typical of the devices dropped from US aircraft along roads, rivers and jungle trails in Southeast Asia. They were dropped in sequential 'strings' along a predetermined target line in a series of from 4, up to 10, 12, 15 or sometimes more, depending on the priority of the target area. With their flexible spring-steel antennas, they were designed to bury in the ground and blend into the surrounding foliage by resembling tree branches and plants. All devices transmitted alarm data for only a short distance. They were continuously monitored twenty-four hours a day by US Air Force crewmen flying unarmed, propeller - driven electronic surveillance aircraft orbiting overhead at 20,000ft.
Initially, Navy OP-2E *Neptune* aircraft performed sensor air deliveries at very slow speeds from altitudes as low as 500 feet, making them easy targets for enemy gunfire. The pilots of VO-67 at Nakhon Phanom knowingly expected that they would incur as high as an 85% casualty rate from such operations, but volunteered to fly them anyway, and many crewmen were lost.
During later operations, sensors were hand-dropped from CH-3 *Jolly Green Giant* helicopters of the 21st SOS *Dust Devils* (Special Operations Squadron) and later, delivered by Air Force F-4D Phantom-IIs.

In addition to air delivery operations, South Vietnamese Special Forces 'Spike' teams coordinated by MACVSOG *Heavy Hook* operations out of Nakhon Phanom, carried and hand- implanted GSIDS in Laos and Cambodia in the course of their other reconnaissance and road watch activities in the *Prairie Fire* and *Daniel Boone* operational areas. The sensors were monitored from four constantly manned aerial orbits over Southeast Asia by Lockheed EC-121R radio relay aircraft that retransmitted the data over X-band to the ground Intelligence Surveillance Center (ISC) at Nakhon Phanom Royal Thai Air Force Base, Thailand. Flight operations continued 24-hours a day from 15 February 1967 until mid 1975.

On 24 November 1970, a Senate Preparedness Investigating Subcommittee completed and published an *Investigation into the Electronic Battlefield Program*, detailing development and use of remote surveillance sensors to locate hostile forces in Vietnam.
On 21 February 1971, the Navy disclosed that that they had been using remote sensors in Vietnam since June of 1967. *Acoubuoy* and *Spikebuoy* were said to be able to transmit up to 20 miles.

OP-2E Sensor aircraft

Four Lockheed SP-2H Neptune ASW airframes were modified for Trail Interdiction in 1967 and re-designated OP-2E observation aircraft. Paint schemes varied:
(1) all black, (1) all green, (2) all gray; and all four carried the same equipment:
The fuselage underbelly ASW radome and MAD (Magnetic Anomaly Detector) tail 'stinger' assemblies were removed. A tail gunner compartment was installed with NOS (Night Observation Scope) and a twin 20mm cannon turret. The underbelly ASW radome area was enlarged to accommodate AN/APQ-92 search radar equipment. FLIR (Forward looking Infra-Red) and LLLTV (Low Light-Level Television) sensors were mounted in forward chin fairings. SLAR (Side Looking Airborne Radar) was pod-mounted either side of the fuselage aft of the wing trailing edge. Additional equipment included an Infra Red imaging sensor, airborne MTI (Moving Target Indicator), DIANE (Digital Integrated Attack and Navigation Equipment), and Black-Crow vehicle ignition detectors. Armament included:
(2) Forward-firing SUU-11/A Mini-gun pods,
(2) Mk82 500lb General Purpose bombs,
(2) Mk77 incendiary bombs mounted outboard on under-wing pylons.

Although armed with a pair of Mini-gun pods under the wings, OP-2E's were not 'gunships' in the classic sense of the term. The OP-2E mission was sensor air delivery, coordinated with AP-2H attack aircraft. OP-2E's were fitted with multiple ejector racks just outboard of the reciprocating engines, with additional sensors carried in racks in the bomb bay.
On 15 February 1967, four OP-2E's with tail identification code **MR** were assigned to Navy Observation Squadron *OBSRON Sixty Seven* (VO-67) - were operationally assigned to Nakhon Phanom AB, Thailand where they flew TRIM missions using the call sign *Sophomore* until 1 July 1968. Both reciprocating and turboprop engines were extensively muffled after the aircraft were deployed to the war zone in 1968. Missions were flown against targets inside Vietnam, Cambodia and Laos along the Ho Chi Minh Trail.

OP-2E aircraft MR-9 (131525) of VO-67

All four aircraft were returned to CONUS in 1969 where they were decommissioned at Davis-Monthan AFB. Some remain on display at the Pima Air Museum, Tucson, Arizona.
Click here to see OP-2E's at Arizona's Davis Monthan /Pima Air Museum facility

AP-2H Attack aircraft
Four Lockheed Neptune ASW aircraft were reengined to OP-2E specifications and converted to AP-2H's by E-Systems Corp. at the U.S. Naval Weapons Center. The ASW radomes and MAD stingers were also removed as with the OP-2E's. AN/ALE-29 chaff dispensers were mounted in the tails for SAM counter-measures, and a chin-mount radome housing was installed to accommodate AN/APQ-31 target acquisition radar arrays under the nose. Eight 40mm Honeywell XM-149 belt-fed automatic grenade launchers were mounted at a forward slant-angle in the bomb bay that produced a wide-area downward spray of fire. Paint schemes all followed the Navy three-tone grey camouflage pattern.
Click here to see AP-2H photos on Eric B. Shuyer's VAH-21 Page
On 31 August 1968 four AP2-H's with tail identification code **SL** were assigned to Navy Attack Squadron *HATRON Twenty One* (VAH-21) at Cam Ranh Bay. Between 1 September 1968 and 16 June 1969, Hatron Twenty One flew over 200 missions, mostly against road and river traffic in the Parrot's Beak area of the Mekong Delta.

BATCAT Radio Relay aircraft
The 553rd Reconnaissance Wing was assigned with aircraft to Korat AB, Thailand and flew airborne signals relay missions with a crew manifest of seventeen on four color-coded orbits around the clock for every day of operations in Southeast Asia.
The aircraft were four-engined Lockheed 1049 Super-Constellation airframes upgraded from similar EC-121K and -121P models similar to those used by *College Eye* at the 552nd AEW&C Wing at Korat. Aircraft had the upper aerial height-finder radar and lower search radar domes removed from the dorsal and ventral positions and special electronics, wingtip, and fuselage blade antennae were installed. The aircraft carried 13 multichannel communications transceivers:

(5) UHF/AM band; AN/ARC-27
(2) UHF/AM band; AN/ARC-51BX
(2) VHF/AM band; Wilcox model 807B
(2) VHF/FM band; AN/VRC-46
(2) HF /SSB band; Collins 618T

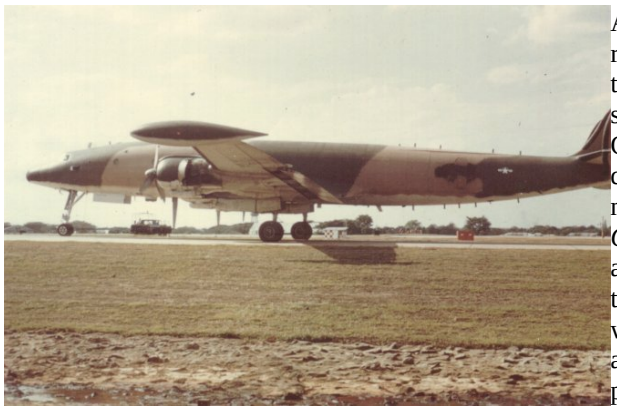
Batcat was the call-sign used, overland and off the coast of Vietnam, over Laos and Cambodia, monitoring and retransmitting the low-power sensor signals. Low power served a number of purposes - low current drain meant low battery weight and a reasonably long sensor life. Signal reception laterally across terrain was very poor unless the receiver was close, so the best reception was from an aircraft overhead. Since North Vietnam used the resources of the Soviet, Chinese and North Korean electronics intelligence community, it was important to obscure the sensor locations from radio direction finding (RDF) capability, and also important to obscure the function of the ISC at Nakhon Phanom from targeting by the NVA.

The typical Batcat mission profile usually tasked aircrews for more than eighteen hours at a time:

- Mission briefing: ½ hr.
- Standby alert: 4hrs.
- Transit flight to station: 2-¼ hrs.
- On-station signals intercept/relay operations: 8 hrs.
- Return to base: 2-¼ hrs.
- Mission debriefing: 1 to 1-½ hrs.

Flight crews reported to pre-flight briefing to get the daily information for their assigned orbit and to also get briefed on the day's activities on the other three stations. The flight crew would then sit a four-hour alert in case one of the on-station *Batcats* had to abort and return to base. Under normal conditions they would take off at their regularly scheduled time and fly to their assigned station.

The aircraft carried a crew of five radio operators - a 'flight boss', or CICO (Combat Information Control Officer), and four CIMs (Combat Information Monitors) connected to him via intercom. Each console held eight AN/ARR-52(V) sonobuoy receiver sets - four mounted high and four mounted lower down in front of the operators. The CICO operated the HF radios and the ARC-51 /ARC-109 with voice encryption. Datalink equipment for retransmission to Task Force Alpha consisted of an X-band AN/ARC-89 using a pod antenna located under the left fuselage wing root.



EC-121R at Udorn AB

All aircraft were equipped with AN/ APR-25, -26 radar homing and warning (RHAW) ground-threat receiver systems, but only a few aircraft had substantial, active ECM suites. COM/NAV consisted of dual TACAN, dual VOR, dual ADF, a LORAN system and standard nose-mounted airborne aviation search radar. While the *College Eye* aircraft of 552 AEW&C Wing had the anti-flash white paint scheme on top, Batcat had the SEA jungle green- and- tan camouflage pattern with light gray underneath. Flight crews affectionally refered to it as the *Speckled BUFF* - a play on the 'BUFF' nickname of the B-52 (G-Rating: *Big Ugly Fat Fellow*).

Sensors dropped in each area of operations were factory-built with a fixed frequency channel on which they transmitted. For any of the area designated frequencies, they had to be ordered by unique FSN (Federal Stock Number) to match the assigned frequencies. The four monitoring orbits over those areas were color coded. Up until September 1968 Batcat orbit codes were as follows:

Blue Orbit	E/W track south of the DMZ over Khe San - primary during the Tet of '68.
Purple Orbit	N/S track 20m. E of the Mu Gia /Ban Karai 'chokepoints'.
Black Orbit	E/W track just south of the DMZ over Dong Ha and Con Thien.

Pink Orbit	N/S track 20m. E of the N. Vietnamese coastline, just above the DMZ.

Later, the orbits were changed:

Blue Orbit	N/S track over the PDJ (Plaine Des Jarres).
Purple Orbit	N/S track 20m. E of the Mu Gia /Ban Karai 'chokepoints'.
Green Orbit	E/W track just south of the DMZ.
???? Orbit	N/S track between Pleiku and the Cambodian border.

While enroute, each CIM would set their R-1170/ARR receivers to the pre-assigned frequencies of whichever of the four orbits they were to work. 27 individual sensor addresses could be received on any one of the 40 designated radio channels in the 160-175 MHz VHF radio band. Sensors radiated a two watt FM alarm that illuminated a numbered light on the CIM console, and identified itself every few seconds while they picked up activity.
Spikebuoy seismic sensors were activated by ground vibrations. *Acoubuoy* acoustic sensors were activated by ambient noise, and a 'press-to-activate' green light would illuminate on the CIM console. Pressing it would allow the radio operator to listen in and record whatever sound was being made around the sensor.
The receiver 'sensor active' display lamp-field consisted of a plastic honeycomb lamp holder of with 27 bulbs arrayed in three rows:

01	02	03	04	05	06	07	08	09
11	12	13	14	15	16	17	18	19
21	22	23	24	25	26	27	28	29

The black screen lamp cover had the numerals etched in, and each indicator on the lamp field had a small spring-loaded toggle switch. Upon illuminating, the CIMs would mark 'X's on a spreadsheet log, then quickly toggle the lamp switch to clear the illuminated lights on each of the eight ARR-52s.
The CIMCO position (Combat Information Control Officer) had a Plexiglas plotting board across the aisle from him, pre-configured to display the day's assigned geographic and operational information. The roads and positions of the sensors were plotted on the board and when movement was detected, it was added to the board. Batcat was a radio relay aircraft, and the X-band repeater automatically scanned the 40 ARR-52 receivers, passing the tone codes along on datalink to the ISC ground station.

Upon arrival, the relief bird would contact the flight on-station via secure voice and then join them in orbit. They would then advise TFA, who would set one of the four X-band dish antennas into search mode. During a coordinated ten count-down the on-station Batcat would terminate transmission while the relief bird switched on. After TFA reported lock-on, the on-station Batcat would be relieved from their 8-hour watch, depart the orbit pattern, and fly the two-plus hours back to Korat, where they would be debriefed and stand down until their next scheduled watch.
During debrief, they would get the chance to tell what had been heard on the acoustic sensors and what had been picked up from any air-war radio chatter.
The increasing intensity of AAA and SAM activity over the trails jeopardized Batcat flights, but none were lost to hostile fire. Two EC-121R's crashed at Korat AB during operations. The entire crew of eighteen was lost on April 25, 1969, and four fatalities occurred during a crash on Sept. 6, 1969.
Their names are to be found on the Vietnam Memorial, Washington, D.C.

In July/August 1970 the 553rd Tactical Reconnaissance Wing was deactivated - reduced in size down to 553rd Tactical Reconnaissance Squadron, and transferred on paper subordinate to the 388th Tactical Fighter Wing, Korat, Thailand.
Click here to see Larry Westin's 553 TRW (BATCAT) Page

Donald Born (*Bat Cat Task Force*) referred to the Batcat aircraft with an 'AC' not the 'EC' prefix, and mentioned that the 'AC-121s' were painted all-black. The *AC*-prefix designated combat attack aircraft, and gunships like the AC-47 *Spooky* had the same camouflage scheme as the EC-121R *Batcat* above. Some AC-130 *Spectre* gunships were painted Night-Ops black. Some other types of Navy and USAF reconnaissance aircraft (not discussed here) also used all-black paint schemes, but no Lockheed Super-Constellations were modified into night operations gunships.

Quacker

Batcat flights were replaced by a joint USAF/DARPA program code-named *Pave Eagle* that was phased in for operational field trials in 1970. Under the program, six Beech A-36 *Debonaire* airframes were modified as YQU-22A development aircraft. Later, one was designated as YAU-22A, and twenty seven were produced as QU-22B aircraft, intended to be operated as pilotless drones. A Detachment of 554th Reconnaissance Wing, Udorn flew the airborne signals reception missions out of both Udorn and Nakhon Phanom RTAFB . Between 1970 and 1972, six aircraft were lost through mechanical failure, and one from pilot hypoxia. Records indicate that when the program closed, QU-22 'Quackers' never flew operationally as pilotless drones as initially programmed. Reliable eyewitness accounts indicate that they were seen flying pilotless on occasion, but other information indicates that the Commander at NKP issued a standing order that none were to be flown operationally without a pilot.

Note the distinct generator cowling bulge on the front that satisfied the heavy power requirements. It is indicated (but unconfirmed) that it incorporated a prop speed-reduction gear system for silent 'stealth' night observation operation over the HCM. Some QU-22 aircraft are still to be found at the DMAFB /Pima Air Museum, Tucson Arizona.
[Note: The code name *Silent Sam* was also associated (unknown at this time) with initial USAF/DARPA development of the *Pave Eagle* and Lockheed /Schweitzer QT-1 and -2 programs. To see the relevance, read the children's book *'Tom Swift and His Air Scout, or Uncle Sam's Mastery of the Sky*' by Victor Appleton - Ed.]
Click here to see Jack Hallett's QU-22B Page

QU-22B drone

Igloo White

Isolated on the East side of Nakhon Phanom RTAFB stood a facility only originally referred to as 'The Project'. In 1968 it was the largest single building in Southeast Asia, built and later maintained by the construction company of Parsons, Inc. under the supervision of the U.S. Army Corps of Engineers.

The air-conditioned ISC was protected from rocket attack by earth-filled ARMCO corrugated steel revetments. It was guarded by security teams, dual - perimeter cyclone fencing and razor wire.
Most of the facility was located below-ground under thick concrete roofing that also contained the backup diesel power generators. Janitorial and housekeeping work was done only by off-duty staff ranking E-5 and above.

The men and women who worked in the ISC (Infiltration Surveillance Center) known as *Task Force Alpha* were tasked with analyzing raw sensor intelligence data, determining the nature of activity on the Trail. They then directed the destruction of combat equipment, supplies, NVA troops, truck convoys, truck parks and marshalling areas. *Igloo White* was possibly one of the most important classified operations of the Vietnam war.

Access to the environmentally controlled building was afforded via the main security lobby that also doubled as an airlock entrance and changing room, where twelve inch-square pigeon-hole bins stored individually name-labeled white *KEDS* sneakers for all TFA personnel. As with any comparable data processing facility of that era, positive pressurization was necessary to prevent contamination and corrosion of sensitive electro-mechanical data processing equipment. Reel-to-reel tape drives, removable hard-disk drives, storage vaults, punch-card readers, and innumerable relays in 1960's-era computers made for high-maintenance systems, and paper chaff from fan-fold printers and the teletypes in the communications vault produced a lot of contamination. The super-fine red clay dust and humidity of northeast Thailand made it even more important to maintain a well-controlled environment.
Maintenance of air-conditioning filters and chiller pumps was always a high-priority for the facility Central Plant, but because of the 24-hour nature of operations, some important systems were run to failure rather than taken off-line to meet scheduled preventative maintenance requirements. For security reasons, only off-duty TFA personnel of rank E-5 and above were allowed to perform the housekeeping in the facility, where they constantly mopped floors and cleaned the consoles and work areas. Contract civilian IBM computer maintenance staff were constantly accessing the computer sub-floor area for equipment maintenance or cable routing, and the underfloor plenum areas remained much cleaner than the average data processing facility. Poisonous snakes still found a way in, causing some excitement, and staff were occasionally reprimanded for shooting rubber bands at the flies during the moments of boredom that is every soldier's fate. Consuming beverages, food or smoking was not allowed on the computer floors, but only in the break area outside. Staff seldom left the compound for lunch. Most either ate C rations, boxed lunches assembled and delivered from the base chow hall, or sandwiches purchased from a small snack bar installed in later years.

Operational ground-to-air communications were accomplished with a suite of secure VHF and UHF radio transceivers using KY-8 and KY-28 *NESTOR* voice-encryption systems. Remote sensor information was received from relay aircraft by means of the four tower-mounted, black X-Band satellite dish antennas. Their odd habit of being constantly oriented horizontally, pointing East (instead of pointing up into the sky for assumed satellites) solicited the code name of 'Dutch Mill'. Each dish would lock onto the datalink signals being transmitted from the four Batcat aircraft flying simultaneously on all four orbits.

On duty, Intelligence Officers and Specialists scrutinized consoles and rows of video displays - part of a sophisticated dual IBM 360 /Model 65 computer system. Data was stored and retrieved from free-standing Model 2400, 9-track reel-to-reel tape drives and DASD removable hard-disk drives. Disks were installed and removed in stacked disk carriers with clear Lexan dust covers that looked like wedding cake covers. One of the two computers was usually used to collate and process electronic intelligence and status reports for various commands around the world while serving as 'hot back-up' for the primary computer that constantly recorded and processed the trail sensor activation data relayed from aircraft. The System 360 computers at TFA were not used to perform direct data analysis at that time, but stored and printed out the information fed to them manually by Enlisted computer operations staff working in the Computer Room.


IBM 2250 display console (photo not from inside TFA)

The environment of the separate War Room was reminiscent of, and modeled upon the dimmed operations darkrooms of the Air Defense Command BMEWS (Ballistic Missile Early Warning) SAGE system centers in the United States. The same gray IBM 2250 display scopes were arranged in rows with their pistol-grip light guns, adjustable console lamping and desktop illumination. Sitting at the consoles with headsets clamped to their ears, faces lit by the glow of the displays, the enlisted CIM-G's (Combat Information Monitor - Ground) monitored real-time alarms relayed from sensors that triggered by activity on the ground. The sequentially-tripped sensors would appear on the CRT's as moving white snail-trails, superimposed on coordinate map grids.

Other enlisted staff reproduced this information on a 24-foot high, 9-foot wide Plexiglas 'Big Board' map of the slowly growing Ho Chi Minh and Sihanouk Trail complex leading to South Vietnam. It was a misnomer to speak of 'the Trail' when in fact, it was a web of roads, trail paths and waterways. There were literally thousands of small byways that comprised the 'Ho Chi Minh Trail', as if in imitation of the meandering backwaters of the riverine Mekong delta.

Although sensor alarm data was being relayed from Batcat in real-time, CIM-Gs could not punch in and listen directly to sensor microphones. Batcat flights recorded all audio on tape at 15/16 ips then shipped some of them to TFA for analysis by the Intelligence group after landing.
Under the TRIM program, not only could the ISC certainly differentiate between civilian and military vehicles, but experienced personnel could acoustically identify the exact vehicle, by type, make and model. Individual vehicles were identified repeatedly traveling up and down the Trail if they had some unique, acoustically descriptive loose part on them. Sometimes the condition of the engines was noted. Each vehicle and engine had a distinct signature on the scope.
Task Force Alpha owned a captured ZIL-157, a heavy-duty Soviet military truck. It was employed in making runs past deployed sensor strings off-base on unimproved roads to refine and hone ISC surveillance staff skills on Soviet and Chinese-manufactured vehicle signature recognition.

It is reported that response times between sensor activity and mission strike could occur in as little as five minutes, but it would not have been considered prudent to so precisely 'telegraph' the sensor locations to enemy intelligence by such cause-and-effect activity. Although it did happen on occasion, in reality, politics and painstaking - some assert 'overly cautious' - analysis played a larger hand in governing those technically accurate claims.
As soon as the mainframe had calculated the vehicles' speed and direction of travel past the sensors, they ran a forecasting subroutine for predicting target location in the near future (referred to as 'Time and Distance'). Intelligence officers would then submit their analysis to the FACLO (Forward Air Control Liaison Officer) for communication (called *Spotlight Reports*) to Headquarters, 7th AF and MACV in Saigon for buy-in, final approval, and mission tasking back down the chain of command via *PIACCS* and

CREST data networks (see *Other High Technology Assets*, below).
When combined with other (Special) Intelligence and scoured again by national policy directives originating in real-time from Washington D.C., the strike missions would eventually be authorized.
It is not an exaggeration of fact that every service member in Southeast Asia heard the complaint; *"...Helluva way to run a War!..."*
For circumstances demanding immediate response (requiring heavy post-strike justification by the TFA shift OIC), the FACLO would authorize a strike mission directly from the ISC, and target grid coordinates would be given to attack aircraft patrolling the night over Laos, Cambodia, and Vietnam.

It is reported that Batcat mission flight officers had occasionally directly vectored successful strikes on targets considered inconclusive at the time by TFA Intelligence analysts, causing much political controversy between Task Force Alpha, headquarters 7th AF and 553rd Reconnaissance Wing (Batcat) . But success has its own rewards, and the politics, outside the scope of this paper. It is noted however, that TFA Intelligence analysis was mistaken in some of their logistical expectations of the NVA effort. They were confused when vehicles acoustically identified at certain sensor-monitored points would disappear before arriving at the next predicted sensor monitor point. They had made the erroneous assumption that the NVA transport procedures were like American orthodoxy - that cargo and supplies would form up in truck convoys in Hanoi or Haiphong and drive uninterrupted, straight down to Saigon. Due to the success of Trail interdiction however, bridges at rivers, and roads through mountain passes had been made thoroughly un-navigable by wheeled vehicles, and cargo had to be hand- or bicycle-carried to truck convoys marshalled on the other side of the given 'choke' point. This resulted in what was at best, a truck shuttle system, with many byways, side trails, and truck parks performing cargo 'shuttles' from one convoy to the other.

Over time, enemy counter-intelligence activities against the Igloo White Trail-watch and interdiction program involved disabling - but more frequently - 'spoofing' sensors into producing false alarms in continued efforts to misguide Intelligence analysts and obscure NVA convoy activities. The role of allied counter-counter-intelligence against such activities thus led to endless permutations of corroboration or rebuttal of information by alternate supporting intelligence-gathering methods that is the real nature of 'military intelligence' as it is commonly known to people not inside the job.

Attack operations were not limited to just the aircraft identified in this narrative. Numerous other types of Navy and Air Force aircraft were involved in bombing operations, with the ISC fielding a bewildering array of call-signs and code names.
Navy 'carrier-based A-6C's for instance, contacted the ISC under the call-sign '*Copperhead*'. Another call-sign was *'Moonbeam'*.
When USAF assumed responsibility for the TRIM program, the Navy *AP-2H* aircraft were supplemented and eventually replaced by Air Force A-26 *INVADER*'s. Still later on into the '70's, AC-119 *'Shadow'*, AC-47 *'Spooky'*, AC-130 *'Spectre'* gunships and F-4D *'PAVE Phantom II*'s using the new '*TOWEL RACK*' LORAN navigation system were implemented as the technology progressed.
Targeting was also accomplished using radar-assisted bombing navigation systems located in various locations in Southeast Asia.

Tactical Radar Bombing Systems

AN/MSQ-77: Managed by detachments of the 1st CEVG (SAC) under the program codename *Combat Skyspot*, a number of MSQ-77s, a TSQ-81 and the radically upgraded TSQ-96 auto-track radar bombing systems provided the ability to accurately bomb targets at night or during inclement weather over Southeast Asia.

AN/TSQ-96 inside the INVERT compound at NKP (*BROMO*)

Vietnam:
Bien Hua - (*MACON*)
Binh Thuy - (*GAP* *)
Da Lat - (*CONGO*)
Dong Ha, Huế & Phu Bai - (*MILKY*)
Pleiku (*LID* **- orig. NKP)
Quang Tri - (*TEE-PEE*)
Thailand:
Nakhon Phanom - Det. 15 (*BROMO*)
Udorn - Det. 24 (*LID* **- orig. Pleiku)
Ubon - Det. 25 (*GAP* *- orig. Binh Thuy)
Mukdahan - (*Det. /Callsign unknown*)
Laos:
LS-85 - (*COMMANDO CLUB*)

AN/MSQ-77 at Huế (*MILKY*) [photo source unknown]

In the Fall of 1967 the only tactically mobile AN/MSQ-77 system (designated AN/TSQ-81) was air-lifted by CH-47 helicopter to the ridge of a 5,580-ft. mountain called Phou-Pa-Thi (N 20º 26' 42", E 103º 43'05") in *Sam Neua* province, Northern Laos, where a TACAN navigation site was already located. Mission performance was highly successful until attacked by NVA sappers, and almost all personnel were killed.
For details on *Operation Heavy Green* and the loss of USAF personnel there, search on *Lima Site 85*, - or -
Click here to see Ron Haden's LS-85 Home Page

The MSQ-77 radar was a SAC system used originally for radar bomb-*scoring*. Ground-based SAC bombing range facilities would supervise and QC aircraft bombing reports for their training program. Results from the essentially manually voice-command guided MSQ-77 and TSQ-81 operations in their radar-*directed* bombing role were in fact good, but many ground and air limitations underscored the need for a system specifically engineered to perform the developing radar bombing mission.
The TSQ-96 system was custom-built exclusively for that mission.
The optically calibrated, narrow-beam I-band radar would perform a search pattern at a predetermined acquisition point where the aircraft would arrive for target guidance. Once locked on, command guidance was accomplished by either the Ops Officer or Crew Chief giving voice corrections to the lead aircraft in the cell, left or right of track , with an eventual ordnance release count down of , "...three, two, one - hack!" The Skyspot crew plotted the inbound track on the computer's plotting board, along with the VIP (vacuum impact point - a theoretical trajectory exclusive of air /wind resistance factors) and the RP (release point).

With radar and target latitude, longitude and altitude programmed into the 50's era vacuum-tube computer, the TSQ-96 compensated for Coriolis' force at that Parallel, and factored in the inertial flight characteristics of the type of ordnance in use. Theoretically, all the pilot had to do otherwise was watch for SAMs and AAA and observe the target activity below. In practice though, flying straight and level in zero-zero visibility at low altitude for seemingly interminable amounts of time under AAA fire in karst mountain terrain naturally made pilots extremely uncomfortable with the process. Prior to the development and acceptance of of TRF (terrain following radar) in later years, it took nerves of steel for a pilot to relinquish that much command and control of the aircraft. Generally, no one clearly saw the target; just secondary explosions of ammunition and fuel.
Combat Skyspot systems were managed by the 1CEVG (Combat Evaluation Group) from SAC. Mission-tailored radar bombing units were later developed from 1CEVG experience in SEA, called Air Support Radar Teams (ASRT's - pronounced *"As-rat* "). Later versions of the TSQ-96 system, known as the

AN/TPB-1 (Tactical Pilotage Bombing) series contained resultingly more sophisticated electronics, and provided upgraded digital computer systems with expanded ordnance flight specifications, TACAN guidance, and ordnance release tones in addition to navigational support for any TACAN-equipped aircraft for bombing, tactical airlift cargo delivery or reconnaissance missions.
The later development of more sophisticated aircraft Inertial Navigation and GPS Navstar guidance systems spelled the end of ground radar-assisted missions for US Air Force operations, although it is still believed to be in use by USMC and other countries today.

Other High Technology Assets
Separate from Igloo White operations, USAF IBM Model 1050 data terminals communicated immediate tactical, strategic, logistical and administrative information over 1200- and 2400-bps lines 24 hours a day to every air base, worldwide. The USAF Directorate of Automated Systems at Tan Son Nhut AB, Vietnam had started in 1967 with a single IBM System 1410/1401, some Model 729 tape drives and a 1301 RAM storage unit to manage 7th AF air targeting data and mission tasking needs. By 1973, this had grown in complexity and capability to two System 360/ Model 50 computers, Model 2305 DASD storage, Model 2400 tape drives, and numerous System 1130/2250 communications terminals which were linked via satellite to identical dual System 360's at HQ PACAF, Hickham AFB, Hawaii.

Although now sounding less sophisticated than today's small office needs, the equipment was the best, state-of-the-art, leading edge processing technology available. This combination of hardware - and software written by IBM, Control Data Corporation, and USAF - composed the *Seek Data II*, *CREST*, and *PIACCS* systems (Pacific Interim Air Force Command and Control). Towards the end of hostilities in Vietnam, 7th AF transferred most of it to allied forces of the Republic of Vietnam (ARVN).
In October 1975 all of 7/13th AF Task Force Alpha IBM System 360/65 computer mainframes and equipment at Nakhon Phanom were shipped back to CONUS (Continental United States).

Sources estimate that the TRIM project cost nearly $1 billion a year to operate. Active air combat interdiction and later, passive surveillance operations that included the use of RPV drones (Remotely Piloted Vehicles) continued until the fall of Saigon.

* *

Public Benefit vs. Private Image

One member of Task Force Alpha was reported to have said *'...We wired the Ho Chi Minh Trail like a drugstore pinball machine, and we plugged in to it every night.'*

The credibility of Task Force Alpha was often brought into question when they identified targets where other Intelligence resources claimed nothing existed. In a number of examples, targets identified inside the Laotian border near the DMZ were identified. Flight crews bombing the designated target coordinates joked about attacking vicious banana trees, but 'non-existent' fuel drums and ammunition caches produced secondary explosions for days afterward.
The USAF claimed Igloo White to be responsible for destroying over 35,000 trucks, each carrying an average of 2.5 tons of supplies bound for South Vietnam. Official estimates were probably exaggerated by overzealous public relations. A U.S. Senate report from 1971 (considering the unsupportive nature of the Capitol Hill leadership for the Armed Services), was not above using hyperbole, noting that figures for *'...truck kills claimed by the Air Force last year...greatly exceeds the number of trucks believed by the Embassy to be in all of North Vietnam.'*

That only hints at the nature of political in-fighting occurring between the State and Defense Departments at the time. Daytime BDA (bomb damage assessment) flights rarely located the destroyed vehicles. Traffic down the Ho Chi Minh Trail continued as the NVA developed sensor decoy countermeasures and increased anti-aircraft weapons deployment.

It is politically incorrect in academic circles - and not much acceptable elsewhere - to recognize or acknowledge the benefits derived by millions of people strongly employed and heavily invested here; that our wealth derives from the blood of others. Warfare and Commerce are brother and sister to our house, and whether or not the human predilection to warfare is natural or unnatural is a philosophical discussion best left to others. What can be understood though, is that it is an insult to the aspirations and memories of those who fought and died on both sides of military conflict to overlook our inheritance at the price of so many tears across the centuries.

Commerce has historically developed out of a perceived need for war-fighting technology, and once declassified, transfers to the marketplace. Consider maritime shipping, the wheel, walkie-talkies, radar, transistors, fiber optics, satellite communications, encryption, spread-spectrum cell phones; - the Internet itself.
All were the result of initially military needs. Taxpayers financed Government- sponsored developments in computer science originally for the purposes of deciphering enemy codes, and it now contributes to the general privacy and security of commerce on the web today.

The joint-venture of military and industry about which Eisenhower gave us warning was the birthplace of the commercial video-game market of today. These technologies have since produced a wealth of economic returns far in excess of the initial seed money levied under taxation.

The schizophrenia in academic thinking between the immense cultural and financial benefits derived from Government-funded research and development versus the dire warnings of a burgeoning Big Brother atmosphere must be considered either unreasoning paranoia or pure Kant: publishing polemics by poorly-researched academics looking for tenure.

If there is a misuse of power, it will develop due to efforts on the part of *Little* Brother - the commercial marketplace itself. Viewed from either perspective, the historical facts do not seem to square with the recrudescence of neo-Luddite behavior and it's doctrine of Political Correctness, which commands obeyance - not analysis - in the finest of didactic traditions.
Eric Blair (George Orwell) would have loved it.
* *

Notes:
Information in this document was found in archives, newsgroups, narratives, journals, emails from individuals, conversations, and through various personal military experiences. Data was collected, collated and re-written to provide a comprehensive view of one specific program that occurred over a period of ten years (1965 to 1975) in Southeast Asia during the time of the Vietnam conflict.
Unofficial, official and personal web pages on the www were researched for any and all information pertinent to the subject. At this date, no web pages have been dedicated to Igloo White but it is hoped that one will soon surface for a better account by those who worked in *Task Force Alpha*.
For comments, corrections, or complaints, please contact the author.

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Photographs:

Batcat;	Courtesy of Larry Westin http://www.tdstelme.net/~westin/ec121r_4.jpg
QU-22B;	Courtesy of Larry Westin http://www.smartlink.net/~westin/batcat/YQU-22B.jpg
MSQ-77 at Hue;	Courtesy of Carl Kalie http://www.geocities.com/Pentagon/Quarters/3996/
Technical help:	The TLC (Thailand/Laos/Cambodia) Brotherhood http://TLC-Brotherhood.org
	Les (Robbie) Robbins, 554th Recon Sq., Korat RTAFB
	Larry Westin, 553rd Recon Sq., Korat RTAFB
	Ken Griswold, Analyst, Task Force Alpha, NKP RTAFB
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	'Brother' Susan, Analyst, Task Force Alpha, NKP RTAFB
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	Ron Haden, 1MOB, *Heavy Green* and *member, Circuit Rider* installation team, Lima Site 85
	Bill Person, 553rd Recon Sq., Korat RTAFB
	Thanks to sources at the *Bangkok Yacht Club* who wish to remain anonymous.
Miscellaneous:	The Autotrack Club, http://clubs.yahoo.com/clubs/combatevaluationgroup
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