COMNAVFORV EVALUATION PHASES

Phase and title	Goal	Time frame
I. Training and familiarization	Train and familiarize operating personnel	July 1968.
II. Preliminary operations	Develop tactics, conduct initial evaluation	August to October 1968.
III. Expanded operations	Refine tactics, evaluate wider scope of operations.	November to December 1968.

Our amphibious forces back in the States also went to work on this program and tests were conducted to determine the immediate capabilities of on-the-shelf sensor items as related to—

A. Detection of canal traffic.
B. Enemy base area targeting.
C. Mobile riverine base defense.
D. River ambush detection.

The test results proved the existing items had direct application in all of the foregoing areas.

FIRST NAVY MONITORING SITE

The first Navy monitoring site was established in August 1968 to monitor traffic in an area contiguous to a shipping channel leading to Saigon. Others followed as assets became available.

This viewgraph illustrates the basis for Navy application of sensors in Vietnam. Sensors are placed along river banks or trails leading to them. A few are placed in water. Artillery, naval gunfire, or air strikes are used to react to those activations identified as the enemy.

NAVY SENSOR APPLICATIONS

Waterway (route) surveillance
Enemy base area targeting
Mobile riverine base defense
Ambush detection

Navy uses nearly all sensors developed by DCPG and a few we have developed on our own.

Encouraged by the potential of sensors, COMNAVFORV informally requested in early 1969 that three monitoring vans be constructed.

This is the result. The first one was delivered in August 1969. This is an exterior view of the operational van and its maintenance van. They are known as Sea Lords vans. They may be transported by boat, helicopter, or truck. Navy uses its monitoring equipment similar to antisubmarine warfare techniques to form a barrier against infiltration.

This slide shows the interior of a Sea Lords van. We placed three vans in-country during the summer of 1969. We found that the vans had a capability greater than was required. They gave us more than we needed, and certainly more than the Vietnamese Navy required. The sophisticated equipment in them was difficult to maintain in the field.

We brought them back to the United States for use in training. As can be seen by this slide, many stations can be manned at once and an instructor can conduct group training in realistic conditions. The total cost to build and field these vans was $1.3 million.

TRANSFERRING SENSORS TO VIETNAMESE NAVY

We are now transferring the sensor equipment and sites to the Vietnamese Navy. They now control about half of the Navy in-country assets. The Vietnamese like sensors and should employ them well. The Vietnamese Navy CNO, Rear Admiral Chon, in his plans to take over sensors, is establishing a sensor detachment in his navy. Present plans are that the VNN should assume all current assets.

SENSOR EFFECTIVENESS

The information I am about to relate is in the form a series of examples which will indicate their usefulness in Navy operations. The effectiveness of sensors is difficult to measure. It is not always possible to evaluate what the results of a response to sensors may have been. However, nobody who has used them, especially for defensive purposes, wants to be without them.

My first example is that of a pilot project of 6-weeks duration that was conducted to determine if the enemy could be forced off his preferred logistics routes within a particular area of operations (AO) leading to several waterways. This was done several months after the Navy began using sensors in connection with its riverine operations.

Sensors played a major role in this operation. Trails at a considerable distance from any friendly force were systematically seeded on the basis of detailed intelligence assessements. The area in question was virtually uninhabited and there were no friendly people moving through the area, which was adjacent to several enemy base areas.

The terrain in which the operation was conducted is seamed with trails and shallow canals. It included the shortest and most direct routes from the enemy's supply base to the friendly bases and cities which he was seeking to attack. We knew in general where the enemy entered the area and we knew in general where he wanted to deliver logistics, which he tried to cache at different points along the major river in the vicinity, for pickup by another logistics unit. What we did not know was which of the myriad trails and canals available to him he would be using on a given occasion. It would have been impossible to post waterborne or ground troops along each trail and canal which the enemy might be trying to steal across. Such an undertaking would also have been extremely risky for our forces, since a unit small enough to be used feasibly in an ambush position would have been highly vulnerable. It was sensors which enabled us to locate the enemy while minimizing exposure of our own men to direct engagement.

When sensor data indicated the presence of enemy forces, artillery was called in to hit the target. Backing up the artillery were naval craft positioned along the river to respond to sensor data which indicated the enemy had escaped the artillery barrage and was continuing along the route. The boats were also engaged in their normal operations on the river, preventing enemy forces in the immediate vicinity of the river from crossing.

CORROBORATE SENSOR INTELLIGENCE WITH SEAL TEAMS

To corroborate the intelligence provided by the sensors, on two occasions Navy Seal Teams (sea, air, and land) were inserted in areas where the enemy was believed to be moving. In both instances, the seals observed enemy units moving through the areas where sensor information indicated they could be expected. The seals did not attempt to take these much larger enemy forces under fire, although on the second insertion they were themselves observed and fired on fortunately were evacuated with no casualties.

We had other evidence that the data supplied by the sensors were correct. A number of visual reconnaissance flights were flown in the mornings over areas where the sensors had indicated the enemy had been moving the night before. Fresh signs of their recent passage through the area were evident. We had no doubt that the sensors were providing evidence of enemy presence.

We knew they were there and we knew that the sensors were picking them up. The question was: How could we tell if our efforts to halt them were really successful? During the time of the pilot operation, we noted that fire-fights along the river, in the area where they had previously attempted to cross, dropped off considerably. But this was a period of decreasing activity in the entire corps area. In any case, better evidence came to light when it was found that the number of logistics caches within the project's area of operations dropped sharply. At the same time, there was a distinct upsurge in the number of logistics caches located at a point much farther down the river, well away from the AO of the test operation.

As the test went on, it was clear that traffic along the shortest and most direct enemy trails across the AO, which were very heavily traveled at the beginning of this test, dropped off and, in many cases, just stopped altogether.

All of this suggested that the plan was working and that, if we were not halting the enemy, we were certainly making it extremely costly for him to try to cross that AO. As in any operation of this kind, the real evidence came in much later, through a succession of captured enemy documents over the months following the operation. They indicated that the enemy was having serious difficulties in providing enough weapons and ammunition to the units in his subregions normally served through that area. Complaints were filtering back to the enemy headquarters, saying their forces were low on weapons, low on ammo, low on medicines, and low on food. Meanwhile, several POW's captured some time after the pilot project, who had tried to transit the area where the sensors were located, told of the effect of being hit with an artillery barrage when to their best knowledge they were nowhere near any of our forces. The surprise effect of artillery attacks, by night or in daylight, when they were far from our lines had a strong inhibiting effect on those enemy troops who survived the barrages.

EPISODE IN THE DELTA

An interesting episode occurred very recently in the delta area. Two airstrikes were put in an area where a Navy team had tracked a large enemy force on sensors. Acoubuoy picked up screams and yelling during the airstrike. After the first airstrike the team monitored a VC conversation in which was discussed the life of a VC, the possibility of a second airstrike, and instructions to return home. A second airstrike resulted in the enemy apparently aborting his mission.

This is another incident related by commander, naval forces, Vietnam. A sensor monitoring team in a Sea Lords van alerted transiting patrol boats of movement ahead along the riverbank. The boats then drifed out of the area and set night defensive positions. Later, the boats were again warned by the monitoring team of movement approaching their position from both sides of the river. Using night binoculars, the boatcrews detected 10 to 12 men and a sampan approaching. The boats broke their ambush and commenced a firing run, sinking the sampan while receiving automatic weapons fire from both banks. Quick response Navy Seawolves aircraft continued reaction as the boats withdrew to evacuate one wounded crewman. Early warning by the sensor personnel prevented heavier friendly casualties. The Sea Lords van may have paid for itself in the first week of operation.

We have been able to prove that sensors can measure a difference in level in activity. A test was conducted to determine if there was a significant difference in the levels of activity in the 12-week periods prior to and following the Cambodian operation last spring. We know there was a lower level of activity following commencement of that operation and the sensors reflected this.

Captured enemy statements indicate some hints of effectiveness. In one case captured VC statements confirmed several kills in an area of sensor-directed artillery.

COSTS OF THE PROGRAM

Navy funds were applied to procure sensors in accordance with DCPG tasking. The assets shipped to theater for in-country use were utilized by all the services as needed and as approved by COM USMACV. It is therefore difficult to determine what part of the Navy budget applied to Marine usage and what part applied to Navy usage. However, on the basis of requirements submitted to DCPG by COM USMACV for fiscal year 1970 (the only year this form of detailed breakout is available), Department of the Navy requirements were divided between III MAF and COMNAVFORV with 57 percent of the requirements for the Marines and 43 percent of the requirements for COMNAVFORV. Very limited usage data from in-country indicates that actual usage was divided between III MAF and NAVFORV at very nearly similar proportions.

There are three programs in the Navy under which remote sensor development has been done. Historically, the first of these programs to do remote sensor work is the Navy Vietnam Laboratory Assistance Program (NVLAP). NVLAP is not an organization, per se; but is a system by which Navy laboratories react quickly to Vietnam needs requested by COMNAVFORV or other SEASIA naval forces. Remote sensors are a relatively small part of the overall NVLAP program. The major program in which the Navy has participated is the DCPG program. The third program is the Navy remote sensor systems effort which complements, for Navy requirements, the systems developed by DCPG and under which ongoing systems will be developed if DCPG ceases to direct the program.

The R.D.T. & E. and hardware costs for sensors developed under the NVLAP program total $945,000 through fiscal year 1970. The devices developed in this program are generally required for the protection of Navy units and are small in number.

Through fiscal year 1970 a total of $152.4 million was authorized for Navy support of the DCPG program. (This total does not include those funds returned by DCPG to Navy control.) This slide depicts the breakout. Planned funding for this program in fiscal year 1971 amounts to $25.9 million, which would appear to be an increase over the displayed 1970 funding of $22.0 million. However, the 1970 OPN funding, $13.2 million, does not accurately reflect Navy and Marine Corps sensor requirements for use incountry, which had a value of $47.0 million. This deficit in funding to meet theater requirements was and is being made up through DCPG direction by DCPG controlled assets and funds from the other services. Thus Navy requirements for funding in support of the DCPG program have actually declined from a total of $55.8 million in fiscal year 1970 to a total of $25.9 million in fiscal year 1971.

Of the originally approved DCPG program, DCPG program reductions (referred to by DCPG as funds returned to the Navy) totaled $8.1 million. This chart depicts the breakout of these funds and their application within the Navy. In addition, $8 million of Navy funds not required for the accomplishment of DCPG tasking have been reapplied to other urgent Navy programs. A breakout of these funds and their reapplication is included in the detailed classified financial information provided to the subcommittee. Net funds used have therefore been $16.1 million less than the originally approved DCPG program.

In addition to the DCPG and NVLAP programs, the Navy has invested a total of $2.08 million in Navy remote sensor systems developed to complement the DCPG program. The following viewgraph is a breakout of the funds expended by appropriation and year.

DCPG PROGRAM

DCPG NET PROGRAM[1] AND FUNDS USED

[In millions of dollars]

Fiscal year	R.D.T. & E.		PAMN		OPN		O. & M.N.		Total	
	Net program	Used	Net program	Used	Net program	Used	Net program	Used	Net program	Used
1967	16.0	16.0	24.7	18.8	19.1	19.1	5.6	5.5	65.4	59
1968	14.7	14.7	2.4	3.7	11.9	14.0	11.6	10.4	40.6	42
1969	9.7	9.7	1.0	.6	12.0	10.3	1.7	1.0	24.4	21
1970	6.5	6.3	.1	0	13.2	12.1	2.2	.8	22.0	19
1971[2]	5.0		.1		18.6		2.2			
Total (through fiscal year 1970)	46.9	46.7	28.2	23.1	56.2	55.6	21.1	17.7	152.4	143

[1] Approved DCPG program less funds returned by DCPG to the Navy.
[2] DCPG program in the fiscal year 1971 budget currently before the Congress.

DEPARTMENT OF THE NAVY

DCPG PROGRAM FUNDS RETURNED TO THE NAVY

[Amount in millions of dollars]

Fiscal year	APPN	Amount	Navy application
1967	None		
1968	None		
1969	PAMN	2.0	Applied to Navy operations and safety improvement program (OSIP).
	O. & M.N.	1.5	Reprogramed to other O. & M.N. requirements.
1970	R.D.T. & E.	3.5	2.0 applied to reductions under Project 703. 1.0 applied to air launched missiles program. .5 OSD budget reduction.
	PAMN	.9	Applied to OSIP.
	O. & M.N.	.2	Reprogramed to other O. & M.N. requirements.
Total		8.1	

DEPARTMENT OF THE NAVY

DCPG CONTROLLED NAVY FUNDS NOT USED FOR ACCOMPLISHMENT OF DCPG TASKING

[amount in millions of dollars]

Fiscal year	APPN	Amount	Navy application
1967	PAMN	5.9	Applied to Navy operations and safety improvement program (OSIP).
	O. & M.N.	.1	Reprogramed to other O. & M.N. requirements.
1968	PAMN	.1	Applied to Navy OSIP.
	O. & M.N.	1.2	Reprogramed to other O. & M.N. requirements.
1969	O. & M.N.	.7	Do.
1970	O. & M.N.	1.4	Do.
Subtotal		9.4	
Less 1968 PAMN		−1.4	Applied to DCPG program from Navy OSIP.
Total applied to Navy programs		8.0	
1970	R.D.T. & E.	.2	Balance Available to DCPG.
	PAMN	.1	Do.
	OPN	1.1	Do.

NAVY REMOTE SENSOR PROGRAM FUNDING ALLOCATIONS

	R.D.T. & E.	OPN
Fiscal year—		
1969	[1] $600,000	
1970	[2] 920,000	[3] $560,000

Note: Use of funds (planned)—(1) Riverine and special warfare; (2) riverine and special warfare (TSOR 38–17); and (3) procurement of MIDS.

PLANS FOR THE FUTURE

Navy is in the formative stages of sensor utilization. We have yet to explore all possibilities for the use of these devices. We have written three tentative specific operational requirements (TSOR's) which will eventually be translated into requirements. These TSOR's cover the areas of amphibious warfare, special warfare, and airstrike warfare. The definition of requirements which can then be priced and purchases made is 2–3 years away. The Navy is able to take this time to accurately and adequately define its specific requirements because we realize that any urgent requirements for sensor systems during that time period could be met with DCPG technology. We are making hardware purchases through DCPG, this and next year, primarily to use in training and experimentation for the Navy and Marine Corps to help develop tactics and procedures which will eventually govern requirements.

We are projecting to spend a very modest sum in our development program over the 6 years, beginning in fiscal year 1971, to expand our knowledge within the framework of the three TSOR's. Classified financial details on this program have been provided separately to the subcommittee.

Funding level is generally low. As you can derive from my briefing Navy experience with sensors in combat has been confined to air (which was assumed by the Air Force) and riverine. Consequently, we have a lot to learn before we can project larger investments. On the other hand, Navy is a staunch advocate of remote sensor systems, especially in riverine warfare. There is no question that remote sensors saved significant numbers of Navy lives and greatly reduced the numbers of wounded in action.

Thank you, sir.

P-2 PROGRAM DISCONTINUED

Senator CANNON. Thank you, Admiral, that is a very fine statement.

Getting back to the P-2 aircraft that the Navy used, you indicated that that program was a relatively short-lived program. Why were they discontinued as sensor monitors?

Admiral HOUSE. The aircraft is a slow airplane. It was designed to operate over the ocean, sir. It doesn't have a very good rate of climb. We started using them up in the hilly terrain and the first one, as I noted, we presume ran into a mountain. He just couldn't get over a hill when he came up to it. The others were shot down by flak. The plane is slow. I have flown in it. And although we put two jet engines on them some 15 years ago to give them higher performance, it still doesn't go 200 miles an hour. It is a slow, lumbering aircraft. The Air Force took over the task and they put some high-performance aircraft in it, which is the kind of aircraft that pretty well have to be applied when you are running into heavy flak situations.

Senator CANNON. What was the final disposition of the aircraft that were not lost?

Admiral HOUSE. They were brought back to the United States.

Senator CANNON. Are they still in use now?

Admiral HOUSE. Yes, sir.

(The Navy subsequently furnished the following information:)

At the time, ten aircraft remained in the squadron. All ten aircraft were stripped of useable equipment. DCPG diverted most of the equipment peculiar to the airborne sensor operation to the Air Force and Navy returned the rest to its inventory. These ten aircraft were then placed in storage at Davis Monthan AFB, Phoenix, Arizona where they remain at present.

The last two are still in use by Naval Air Development Center, Warminster, Pa. for sensor test and developmental work. Present plans are to retire one OP-2E aircraft this fiscal year and the last one during fiscal year 1972. The equipment in them is old and they are too costly to maintain, especially in this limited role.

Senator CANNON. You indicated the Navy developed equipment for 30 aircraft for the Air Force. What is the status of that equipment at the present time?

Admiral HOUSE. That I do not know, sir. Perhaps the Air Force can talk to that question this afternoon.

Senator CANNON. You don't know whether they are still using that equipment in their aircraft or not?

Admiral HOUSE. No, sir; I do not.

SEA LORD VANS

Senator CANNON. If the Navy operation is transferred to the Vietnamese, will the Navy continue to use the Sea Lord vans for training in the United States?

Admiral HOUSE. Yes, sir. We are training our advisory people that are going to Vietnam. As you know, the turnover of Navy assets to the Vietnamese Navy is progressing very rapidly, but we are still training advisers to assist the Vietnamese, particularly in a tactical control of support aircraft, for example, to work with the boats is one illustration. And we want to train our advisers in the use of these devices before we actually send them to Vietnam.

Senator CANNON. You indicated these vans were overequipped and had more capability than you needed.

Did you develop a more simplified van for use by the Vietnamese?

Admiral HOUSE. We developed a more simplified read-out system for our own use primarily, sir, and that is what the Vietnamese will inherit.

Senator CANNON. That equipment will be turned over to them?

Admiral HOUSE. Yes, sir.

Senator CANNON. The fiscal 1971 budget has an item for a Sea Lord van. What is that money to be used for?

Admiral HOUSE. I will refer to my financial expert on my right, if I may—Captain Fenwick. Do you have details on that?

Captain FENWICK. Yes, sir.

Admiral HOUSE. May we provide that answer later?

Senator CANNON. You may provide that.

(The Navy subsequently furnished the following information:)

In answer to the question about the entry on the Sea Lords Vans for Fiscal Year 71, that money does not apply to the existing vans but to a second generation or third generation type van for monitoring some of the newer sensors coming along.

Senator CANNON. Senator Goldwater.

Senator GOLDWATER. I have no questions.

Senator CANNON. That is all the questions we have for the open session, then. Thank you very much.

Admiral House. Yes, sir.

Senator CANNON. The committee will now go into executive session, then.

(Whereupon, at 11:50 a.m., the committee proceeded into executive session.)

AFTERNOON SESSION

Senator CANNON. The committee will come to order.

General, you may proceed, sir.

STATEMENT OF MAJ. GEN. CARLOS MAURICE TALBOTT, DIRECTOR OF OPERATIONS, DEPARTMENT OF THE AIR FORCE

General TALBOTT. I am Major General Talbott, director of operations for Air Force Headquarters in the Pentagon. It is indeed a pleasure for me to appear before your special subcommittee, and I assure you that we are eager to assist you in any way we can to provide a better understanding of IGLOO WHITE, the Air Force portion of the DCPG anti-infiltration system, and how it fits into our overall air interdiction campaign.

In addition to General Evans, who will brief you on the IGLOO WHITE system, I have Major Anderson with me to cover the specialized areas of munitions, gunships, and other sensor systems which you have requested.

In order to place these specialized areas in a proper perspective, I would first like to explain briefly the concepts and strategies upon which our air interdiction operations in Southeast Asia are based.

You will recall that in April of 1968 we ceased bombing North Vietnam north of 19° N. The interdiction of material and troops had to be shifted further south to Mugia and Ban Karai Pass areas of North Vietnam and into southern Laos.

COMMANDO HUNT

In anticipation of further bombing limitations, Headquarters Pacific Air Forces developed a plan for intensified interdiction in Laos, South Vietnam, including the demilitarized zone, and with an option to include North Vietnam up to 19° north latitude. The plan was assigned the nickname Commando Hunt. The plan was approved by COMUSMACV, CINCPAC, and ultimately by the Joint Chiefs of Staff.

As approved, the plan called for emphasis on truck destruction during the northeast monsoon dry season by integrating the capability of the IGLOO WHITE sensor system and other available ground and air reconnaissance measures.

The basic plan, with necessary hardware, for an anti-infiltration system in Laos had already been developed, however, the TET offensive of early 1968 delayed its implementation and diverted many of the assets. [Deleted] was charged by 7th Air Force with managing the electronic detection and tracking, target designation and attack of enemy traffic through southern Laos.

Cessation of bombing in North Vietnam on November 1, 1968, forced our interdiction campaign into southern Laos and South Vietnam. The Commando Hunt interdiction plan was executed on November 15, 1968, without the North Vietnam option. The objective was to reduce the flow of supplies by destroying vehicles, and vulnerable road segments and water crossings. The nature of the terrain forced our primary operations into a small segment of eastern Laos, roughly from Mugia Pass on the north to Tchepone on the south. The emphasis was on denying the enemy free entrance to the expanding system of roads in the central area of southern Laos.

THIRD DRY SEASON

At this time we are now in the third dry season of Commando Hunt campaigns. This dry season, as you know, extends approximately from October to April. The area of operations this season includes the entire eastern half of southern Laos. The enemy has increased his efforts during these 3 years and we have found it necessary to apply pressure against his entire Laotian logistic system; not only at the entrance gates but in the central and exit areas. We search out his storage areas and truck parks—while we continue to attack the trucks on the road.

Our daylight capability has forced him to 98 percent night movement. As the ground sensor systems became more reliable we learned to better interpret this information and respond tactically. An example is the munitions package concept that is used to block key roads. That will be discussed in some detail later. Mutually supporting items of ordnance such as high explosive bombs, antivehicle and antipersonnel mines make roads and alternate trails impassible, and then inhibit the actions of enemy repair crews. The munitions packages also cause a backup of vehicles and supplies behind the choke point and provide more lucrative targets for tactical and strategic bombers. A gunship has been equipped with covert night sensors and computer-directed guns to find and kill vehicles that formerly could not be attacked. The introduction of [deleted] navigation equipment to the theater provided more accurate navigation for all-weather bombing. The fantastic accuracy of laser guided bombs ([deleted] is a common circular error probability) reduced sortie requirements for cutting roads. We have found these bombs are outstanding against antiaircraft guns.

The large bomb load of the B–52 ARC LIGHT force was exploited to attack truck parks, and vulnerable road segments and water crossings and storage areas. To illustrate the current effectiveness of ARC LIGHT, since mid-October we have been performing saturation bombing tactics along several road segments and waterways near the North Vietnam border. During this period, vehicle detections have been almost nonexistent along the roads and the waterways used to float supplies south have been disrupted by creating flow diversions and destroying portage areas. This saturation bombing in concert with tactical fighters and gunships has drastically reduced the enemy throughput of supplies into South Vietnam.

F–4'S—BACKBONE OF INTERDICTION FORCE

The backbone of our interdiction force has been tactical fighters—primarily F–4's. It has been the constant daytime presence of these aircraft that has forced the enemy to almost exclusive nighttime activity. As I mentioned earlier, about 98 percent is our current estimate.

The F–4's are being used more at night. They provide flak suppression escort for gunships, and attack all classes of targets that can be illuminated by flares or marked with ground flares. [Deleted] F–4 squadrons have been equipped with a very accurate [deleted] navigation system. [Deleted.] We recently deployed [deleted] B–57G aircraft equipped with an array of night-capable sensors similar to those on the AC–130 gunship. These sensors are integrated through computers to deliver several types of weapons including laser guided bombs.

I believe that a review of the tactics and weapons now being used, and those improvements that we expect to make will give you confidence in our ability to interdict North Vietnam's troops and supplies that move through Laos.

ESSENTIAL TO U.S. POLICY

The USAF interdiction campaign is essential to U.S. policy and objectives in South Vietnam. The enemy has less control and presence in South Vietnam and can probably be controlled by the Republic of Vietnam Armed Forces; Vietnamization is proceeding at a good pace; and the casualties of all free world forces are lower and the enemy must pay dearly for each of his less frequent incidents.

General Evans will now discuss the details of our IGLOO WHITE sensors system and he will be followed by Major Anderson.

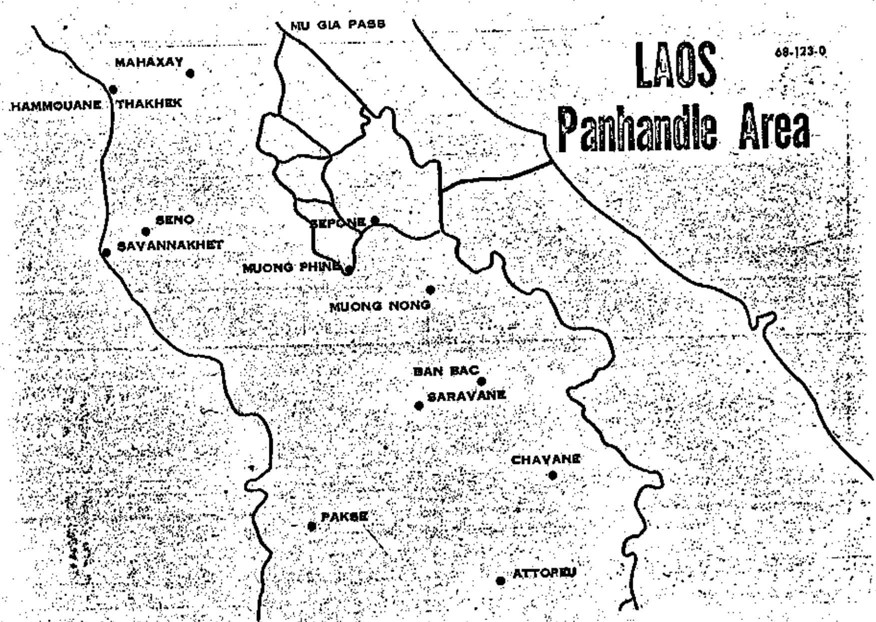
STATEMENT OF BRIG. GEN. WILLIAM JOHN EVANS, SPECIAL ASSISTANT FOR SENSOR EXPLOITATION, DEPARTMENT OF THE AIR FORCE

General EVANS. Mr. Chairman and members of the subcommittee: I am Brigadier General Evans, Special Assistant for Sensor Exploitation for the Air Force.

Earlier this week, General Deane, the Director, DCPG, briefed you on the history of his organization and explained the manner in which the DCPG anti-infiltration system was born. This morning, I would like to go into some detail in explaining the Air Force portion of that system called IGLOO WHITE. It operates in Laos, and is entirely air supported; it involves no ground forces. I will describe the munitions associated with IGLOO WHITE and also, with respect to sensors, cover airborne sensors used by our AC–130 gunships and [deleted] aircraft to acquire tactical targets in Laos today. These airborne sensors, while not a part of the IGLOO WHITE program, complement our ground sensors to enhance our overall tactical effectiveness.

IGLOO WHITE

Let me start with the IGLOO WHITE unattended ground sensor system, a detection system—and I emphasize detection—designed to find tactical targets. To set the stage, I will briefly review the threat when the system was fielded in late 1967 and compare it to the environment in which we are operating today. As we foresaw, the environment has not remained static and since the early days, many changes have taken place which make our interdiction efforts much more difficult.



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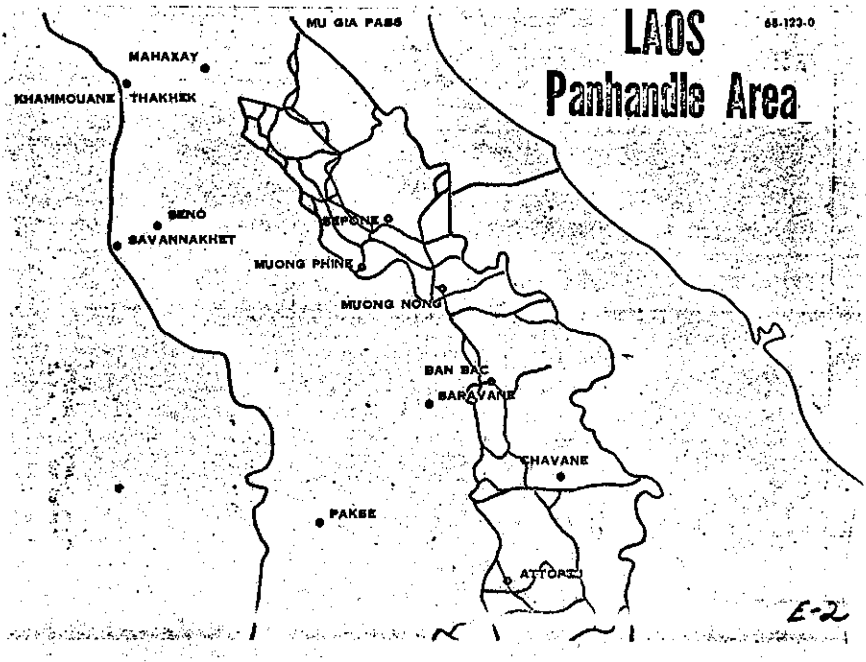
In 1967, and even until the middle of 1968, there were relatively few motorable roads in Laos. Our intelligence indicated that there were less than [deleted] kilometers of useful roadnet available to the North Vietnamese to move their supplies and equipment from North to South Vietnam. The truck fleet in those early days entered Laos through either the MuGia or Ban Karai Passes and exited Laos on Route 922.



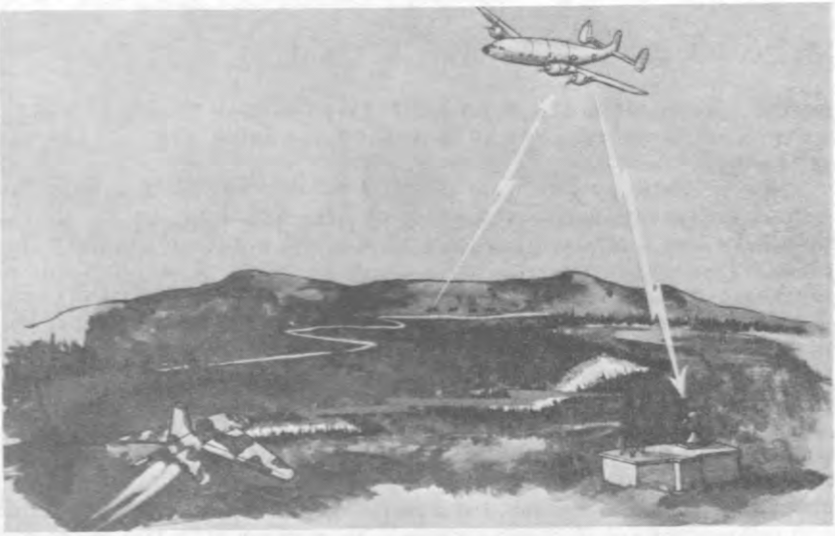
His reaction to our efforts to cut existing roads naturally was the construction of redundant lines of communications to bypass the resulting choke points. This series of actions on our part and reactions on his part has produced today an elaborate road network adding up to some [deleted] kilometers of available roadbed which provide considerable flexibility for his logistic operation. Roads following the shorter route from North to South Vietnam around the western end of the DMZ provide him another entry to Laos which is most attractive as it allows him to keep his trucks within the sanctuary of North Vietnam longer and limit their exposure to our air strikes for a much shorter period of time while traversing the Laotian roads just west of the DMZ. He has also constructed [deleted] kilometers of POL pipeline in the same area and is making extensive use of the waterways to float his supplies south.

ENEMY REACTION TO INTERDICTION CAMPAIGN

Our interdiction program not only consisted of roadcuts but also attacks on the trucks themselves. One of his reactions to this interdiction tactic is to increase the size of his truck fleet. In 1967–68, we estimated trucks in the system to number around [deleted]. Our latest intelligence estimate is almost [deleted] times that many, for a total of [deleted] trucks. As you would expect, attacks on his system naturally caused him to bring in more numerous, heavier antiaircraft defenses. Whereas only smaller caliber, sporadic antiaircraft reactions were encountered in early 1968, the enemy's antiaircraft defenses now include the full gamut of 37, 57, 85 and 100-mm. guns. These guns, which totaled [deleted] being highly mobile, provided a very flexible defense, operating from over 3,000 prepared gun emplacements in response to the tactical situation. This map, classified exhibit, shows on which areas of the roadnet these guns are concentrated.

I believe it important to point out these significant changes in the threat to highlight how much more difficult the interdiction problem is today than it was in the days when the anti-infiltration system was conceived.

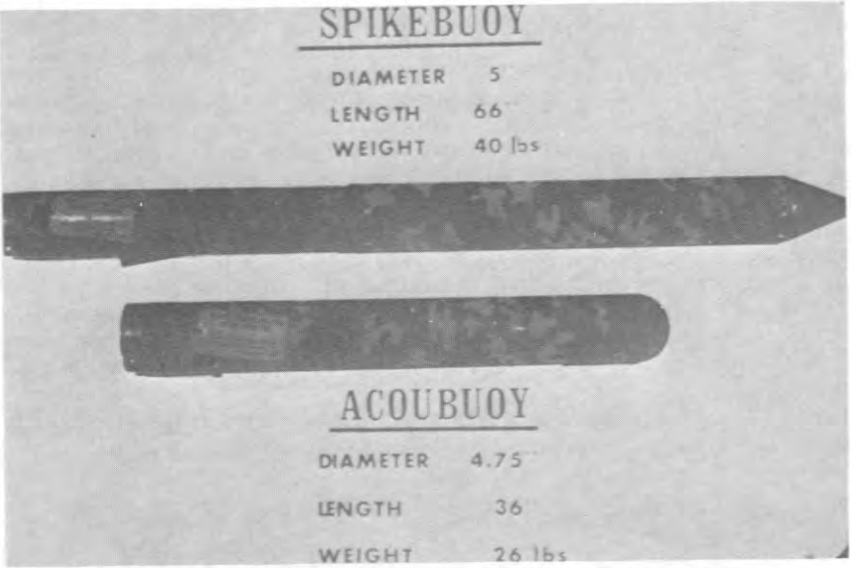
With this overview of the environment in which the IGLOO WHITE detection system operates, let us now look at the system itself.



The basic elements of the IGLOO WHITE system are the sensors themselves, a delivery vehicle, a relay aircraft, and a ground assessment facility. Its operation follows the original concept quite closely. First, the sensors are air-delivered along known or suspected infiltration routes and truck parks. Trucks moving along these roads activate the sensors and these activations are related in real time to the ground assessment facility for analysis. Once a valid target track has been produced, this information is then passed on to the appropriate controlling agency for strike response.

SENSOR—TRUE HEART OF SYSTEM

Now, let's look at each of the system's elements in more detail. First, the sensor—the true heart of the system around which all the rest is structured. Here are two acoustic sensors—one designed for



ground implantation and the other for tree hangup by use of a parachute. This latter type we have over on the table with the red cap on the top.

These acoustic sensors were inspired by the Navy's Sonobuoy, an early acoustic submarine detection device. The hydrophone of the Sonobuoy was replaced by a microphone and a long-life battery was added. Tree hangup is the most common mode of employment in Southeast Asia. As you can see, a well-delivered ACOUBUOY can be quite difficult to detect. We have a type here and I think it will be interesting to listen to some actual sounds picked up by some ACOUBUOY in Laos which are monitoring a truck park. You will listen to some typical truck park noises and then you will hear conventional as well as jet aircraft attack the truck park and the resulting antiaircraft fire that comes from the truck park.

(A tape was played.)

These are voices of some of the people in the truck park. The truck is starting up now. A typical driver. This is a conventional aircraft coming in for a bomb drop. That is a jet aircraft. This is the antiaircraft fire. You can see the fidelity of the acoustics are quite good.

the breakout. Planned funding for this program in fiscal year 1971 amounts to $25.9 million, which would appear to be an increase over the displayed 1970 funding of $22.0 million. However, the 1970 OPN funding, $13.2 million, does not accurately reflect Navy and Marine Corps sensor requirements for use incountry, which had a value of $47.0 million. This deficit in funding to meet theater requirements was and is being made up through DCPG direction by DCPG controlled assets and funds from the other services. Thus Navy requirements for funding in support of the DCPG program have actually declined from a total of $55.8 million in fiscal year 1970 to a total of $25.9 million in fiscal year 1971.

Of the originally approved DCPG program, DCPG program reductions (referred to by DCPG as funds returned to the Navy) totaled $8.1 million. This chart depicts the breakout of these funds and their application within the Navy. In addition, $8 million of Navy funds not required for the accomplishment of DCPG tasking have been reapplied to other urgent Navy programs. A breakout of these funds and their reapplication is included in the detailed classified financial information provided to the subcommittee. Net funds used have therefore been $16.1 million less than the originally approved DCPG program.

In addition to the DCPG and NVLAP programs, the Navy has invested a total of $2.08 million in Navy remote sensor systems developed to complement the DCPG program. The following viewgraph is a breakout of the funds expended by appropriation and year.

DCPG PROGRAM

DCPG NET PROGRAM[1] AND FUNDS USED

[In millions of dollars]

Fiscal year	R.D.T. & E.		PAMN		OPN		O. & M.N.		Total	
	Net program	Used	Net program	Used	Net program	Used	Net program	Used	Net program	Used
1967	16.0	16.0	24.7	18.8	19.1	19.1	5.6	5.5	65.4	59
1968	14.7	14.7	2.4	3.7	11.9	14.0	11.6	10.4	40.6	42
1969	9.7	9.7	1.0	.8	12.0	10.3	1.7	1.0	24.4	21
1970	6.5	6.3	.1	0	13.2	12.1	2.2	.8	22.0	19
1971[2]	5.0		.1		18.6		2.2			
Total (through fiscal year 1970)	46.9	46.7	28.2	23.1	56.2	55.6	21.1	17.7	152.4	143

[1] Approved DCPG program less funds returned by DCPG to the Navy.
[2] DCPG program in the fiscal year 1971 budget currently before the Congress.

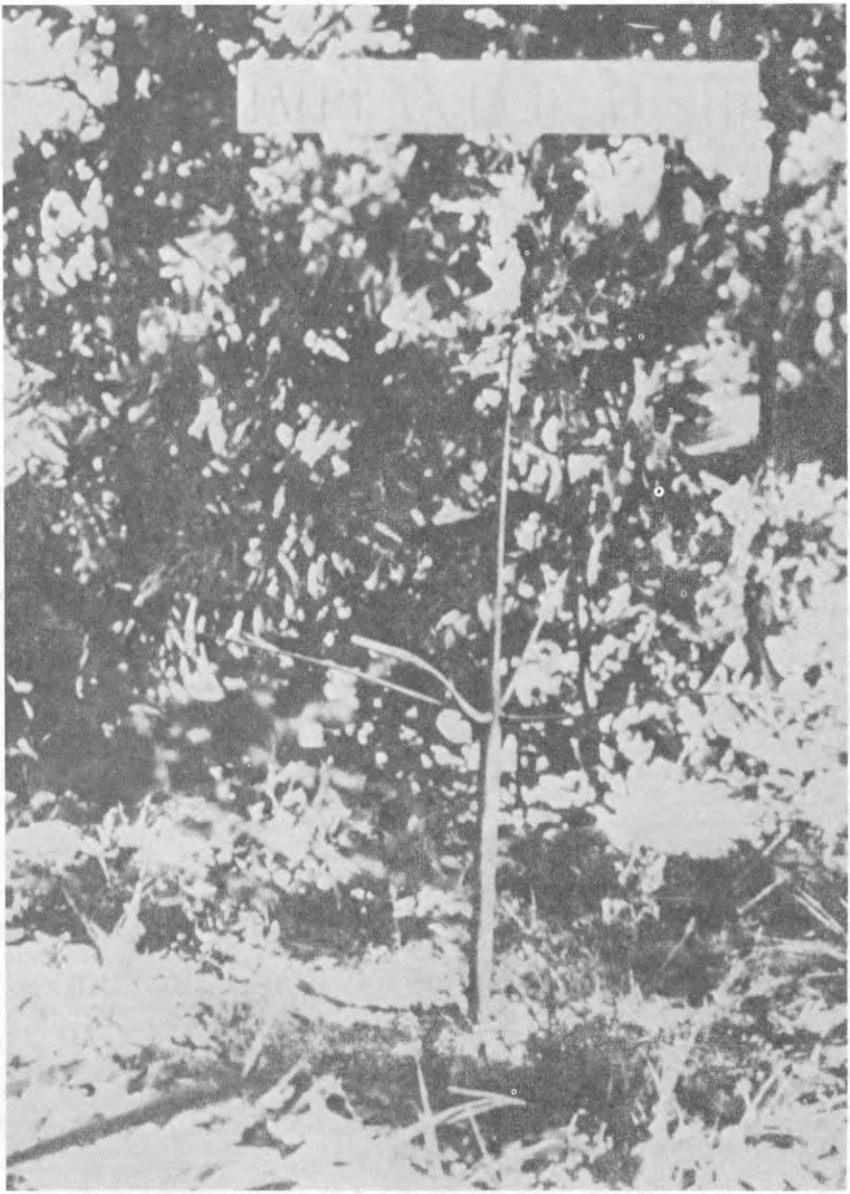
DEPARTMENT OF THE NAVY

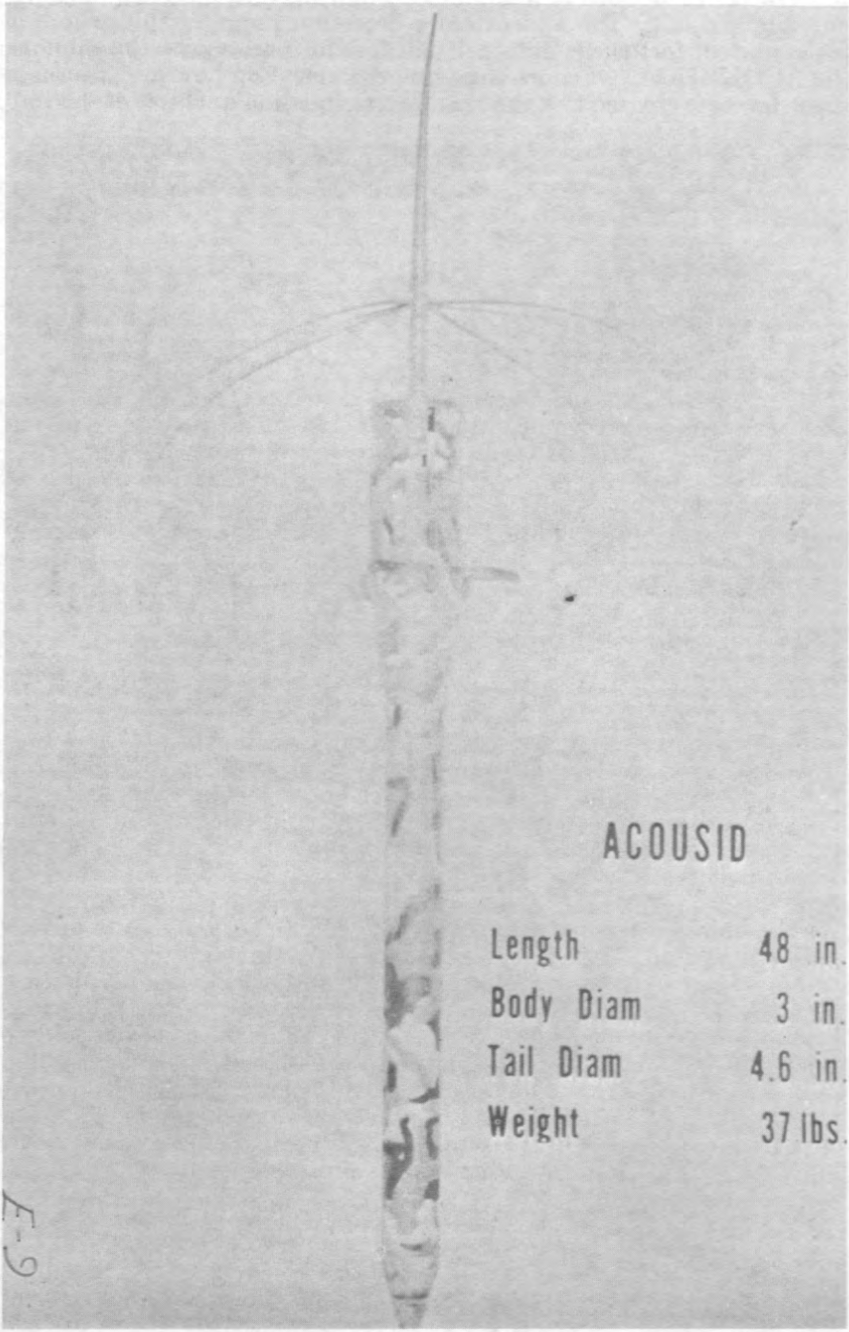
DCPG PROGRAM FUNDS RETURNED TO THE NAVY

[Amount in millions of dollars]

Fiscal year	APPN	Amount	Navy application
1967	None		
1968	None		
1969	PAMN	2.0	Applied to Navy operations and safety improvement program (OSIP).
	O. & M.N.	1.5	Reprogramed to other O. & M.N. requirements.
1970	R.D.T. & E.	3.5	2.0 applied to reductions under Project 703. 1.0 applied to air launched missiles program. .5 OSD budget reduction.
	PAMN	.9	Applied to OSIP.
	O. & M.N.	.2	Reprogramed to other O. & M.N. requirements.
Total		8.1	

which acts as a terradynamic brake, leaving only the camouflaged antenna showing. The approximate detection range of this sensor is [deleted] feet for trucks and [deleted] feet for personnel—the same as the ACOUBUOY. Of course, the ranges depend on how much seismic disturbance is created and the seismic transmission qualities of the soil.




ACOUSID
Length 48 in.
Body Diam 3 in.
Tail Diam 4.6 in.
Weight 37 lbs.
E-9

ACOUSID—ADSID

This device—the ACOUSID—is, as the name suggests, a combination acoustic and seismic sensor. It contains only seismic detection logic, but can transmit audio information gathered by a small microphone at the base of the antenna which can be turned on remotely to provide confirmation of a detection. Its detection ranges are the same as the ADSID.

These last two sensors constitute about [deleted] percent of our sensor field in Laos. The field size today numbers over [deleted]. Since the program's inception in December 1967, over [deleted] sensors of all types have been delivered. This includes those delivered in South Vietnam in support of Army operations in country. At present, we are getting on the average [deleted] days lifetime from our latest design sensors.

I have mentioned only two types of detection logic—acoustic and seismic—but we are constantly looking for better ways to find the targets we are interested in; in other words, to be more discriminating in our detection efforts. Since we are primarily looking for trucks, bulldozers, and other vehicles of that type, a [deleted] detector would be most useful. In recognition of this, we have under development the [deleted].

Senator GOLDWATER. Don't we already have that?

CURRENT SENSORS—DESIGNED FOR SOUTHEAST ASIA

General EVANS. We have an airborne version [deleted]. We do not have an air deliverable ground sensor. This is what we are looking for, basically the same type of logic with some refinements.

As previously indicated, our current family of sensors, including [deleted], was designed specifically for use in Southeast Asia. We believe the system has demonstrated significant potential for enhancing future tactical operations worldwide, and Tactical Air Command has in fact stated a requirement for integration of IGLOO WHITE technology into TAC's worldwide operational capability. To provide this capability, improvements must be made to accommodate present sensor design to the much more severe environmental conditions to be found in many other areas of the world which are of military interest. For example, a [deleted] which will work in the temperate latitudes must be developed. Considerable effort is being devoted to this problem and we think the solution is a [deleted]. The overcrowded radio frequency environment of Central Europe presents another problem; a place in the frequency spectrum must be found in which we can operate and not interfere with other communications systems and vice-versa. We are working on this problem, also.

SENSOR COST

Before we leave the sensors, I would like to say a few words about their cost. To really evaluate sensor cost, we must look not only at the basic price of the sensor, but also examine its reliability, useability, and useful life. A meaningful measurement of cost would be how much it costs us to maintain a sensor in the field for one day. I know that General Deane used this approach by illustrating the change in cost of a hand-emplaced sensor.

SENSOR COST AND PERFORMANCE (ADSID)

	Unit cost	Reliability	Useability	Lifetime (days)	Cost per day
1967	$2,145	[Deleted]	[Deleted]	[Deleted]	$100
Today	975	[Deleted]	[Deleted]	[Deleted]	15

I would like to show you a comparison of factors between 1967 and 1970 which produces a cost-per-sensor day for an air-delivered sensor, the ADSID. I have chosen the ADSID which was our most popular sensor at the start of the sensor program and which is still the mainstay of our field today, with over [deleted] of them now in the ground. The basic cost of the ADSID in 1967 was $2,145. With improvements in design and production techniques, we have reduced that basic cost to about $975. This design and production experience also has moved our reliability figure from [deleted] percent in 1967 to [deleted] percent now and, as I will point out shortly, more accurate delivery of the sensors—putting them where we intend so they can be used to full advantage—has increased their usability from [deleted] percent to [deleted] percent. Improved battery design has lengthened sensor life from [deleted] to [deleted] days. When you consider all of these factors, the cost-per-sensor day in 1967 was $100, whereas now it costs under $15.

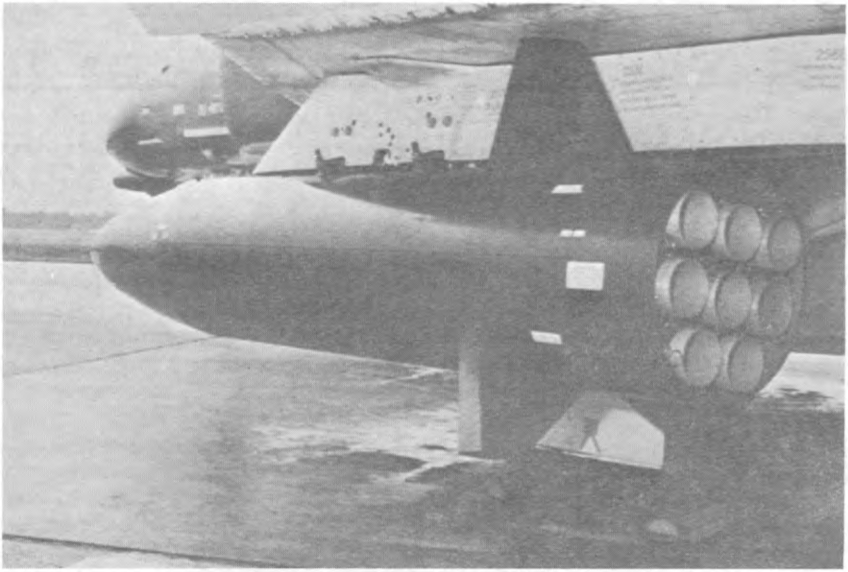
LIFE OF SENSOR

Senator CANNON. Is the life of the sensor dependent on the battery? Is that the limiting factor?

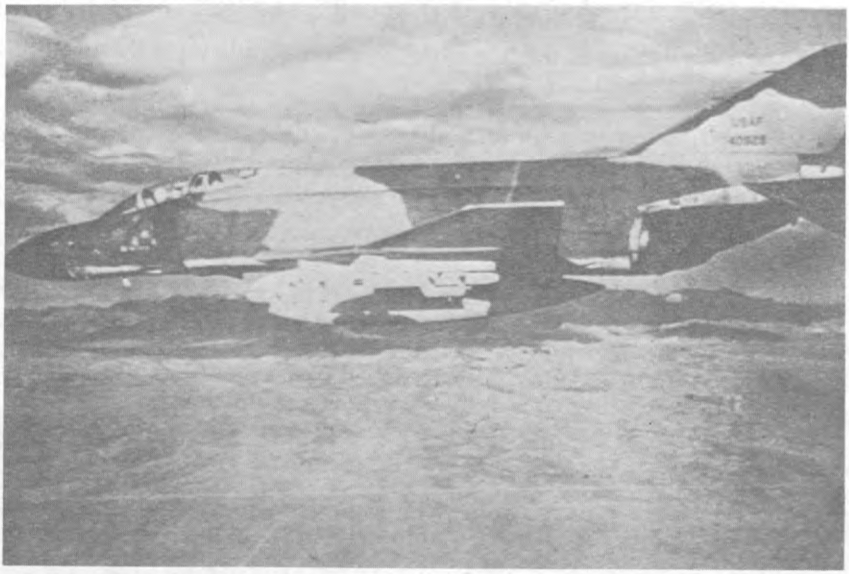
General EVANS. Yes, sir; the life of a sensor is determined by the battery and, of course, the useful battery life is determined by how many activations that sensor has to transmit. [Deleted] days is a good figure for the ADSID today whereas our acoustic sensors use more power when they transmit the type of information that we heard earlier on the tape, so their lifetime is not nearly as long as the seismic sensor.

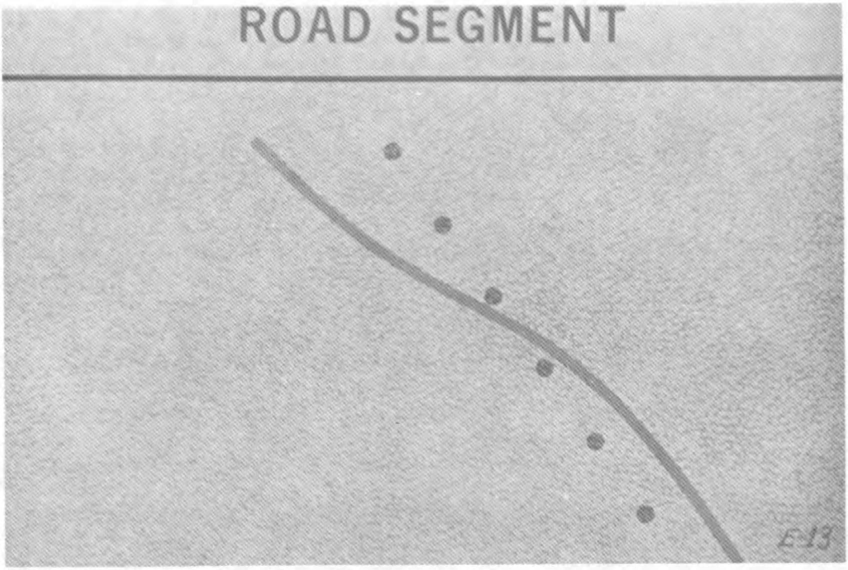
How do we deliver these sensors? At first, delivery was accomplished visually. Of course, this requires good weather and easily identifiable terrain features, conditions which frequently do not exist in Southeast Asia. Also, we did not have a high-speed capability and the vulnerability of our slower moving delivery vehicles to antiaircraft fire forced high-delivery altitudes from which large implant errors were induced, as indicated by the Navy witness this morning as far as the OP–2 was concerned.

Since those early days, we have developed a high-speed, nonvisual delivery capability in the form of [deleted]-equipped F–4 aircraft. [Deleted.] This slide shows the SUU–42 delivery pod mounted on an

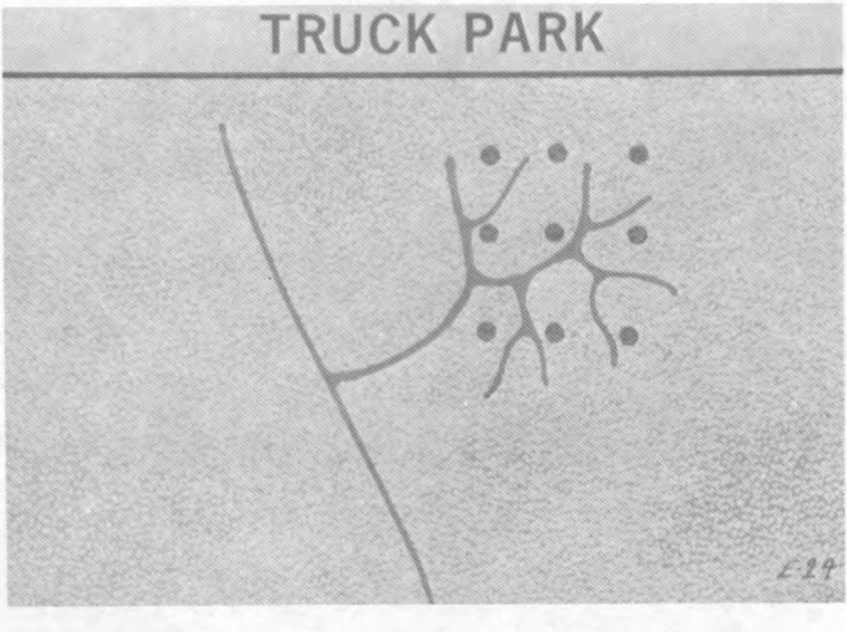


F–4. The pod can carry up to 16 sensors or two per tube. This one shows an ADSID being delivered. Normally, the sensors are delivered in strings along roads, as shown here. All of them can be the same type





devices, mixed strings of seismics and acoustics to provide an acoustic confirmation. In the case of truck parts, a typical array would be strings in parallel, consisting primarily of acoustic sensors listening for typical truck park noises, such as you heard on the tape recording. These arrays can be established by multiple passes of one aircraft or by one pass of several aircraft with lateral separation.



Only dots on these slides, these sensor locations represent considerable effort to produce an effective detection source. Planners at the ground assessment facility do exhaustive studies of available intelligence to determine which road segments and parking areas the enemy is likely to use. Once identified, photography is taken and closely examined to choose the most suitable areas for sensor implantation. The planners look for straight portions of road insofar as possible. If sufficient tree canopy is present, a hangup acoustic device may be used, or if ground implant is desired for seismic monitoring, then a certain degradation is induced, depending upon the amount of foliage to be penetrated. This must be taken into account in determining the number to be dropped. Large rock formations are avoided, as are flooded areas. Once the desired location of the string is established and the numbers, types, and interval of the sensors determined, the mission is laid on.

When we were limited to visual delivery, intricate coordination had to be established between the delivery aircraft and a forward air controller so that the aim point for the first sensor could be marked with smoke just prior to the delivery aircraft's arrival.

Now, using our [deleted] capability, we have an all-weather, self-contained, consistently accurate delivery system.

The unqualified success of [deleted] in the sensor delivery role has led to its use in delivery of ordnance, where a similar all-weather capability is needed. I'll discuss in a moment how we use these [deleted] F–4's very effectively as strike vehicles in response to sensor activations; however, to continue through the system in a logical sequence, we should look next at the relay link.

EC–121R

This is the EC–121R, currently our primary relay platform. These aircraft are stationed at [deleted]. The aircraft are wholly dedicated IGLOO WHITE resources, orbiting to provide the required line-of-sight link between the sensors and the assessment facility. The relay aircraft receives the radio frequency transmissions from the sensors, and retransmits this information to the ground facility for processing and assessment.

In addition to this data relay capability, onboard equipment provides the aircraft crew with the capability to manually assess the sensor activations, produce target information, and pass this intelligence via secure voice directly to the appropriate ground station or airborne control or strike element. This procedure is useful when the relay aircraft is out of the line-of-sight range of the automated assessment facility or when ground commanders want target information directly.

PAVE EAGLE

[Deleted] to supplement, and perhaps eventually replace our EC–121 fleet, we have developed a single-engine aircraft called Pave Eagle, shown here. It is basically a small, commercial aircraft—the Beech

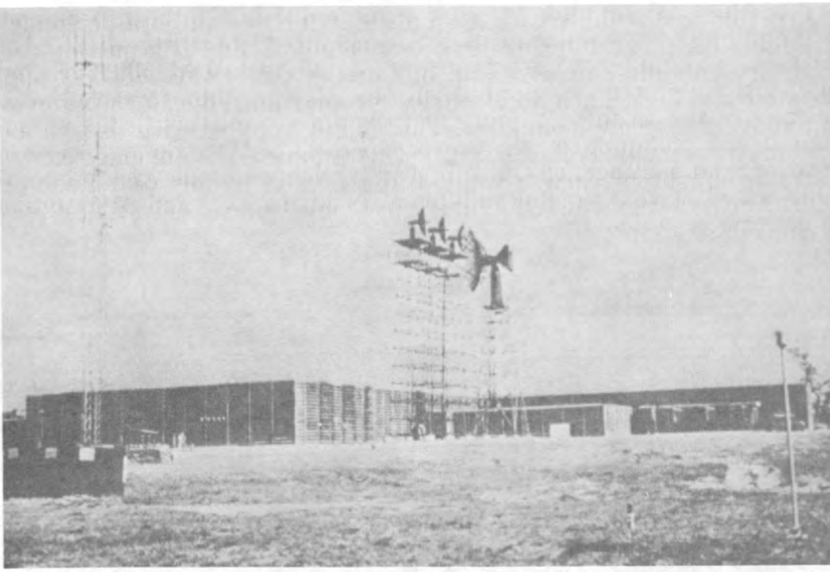
Debonair—with a larger engine and increased wingspan. It can operate in either the manned or drone mode; however, it is strictly a data relay platform; it has no airborne assessment capability. Its main advantage lies in economy of operation and the fact that it permits operation in suspected high-threat areas without exposing a large aircrew to undue risk.

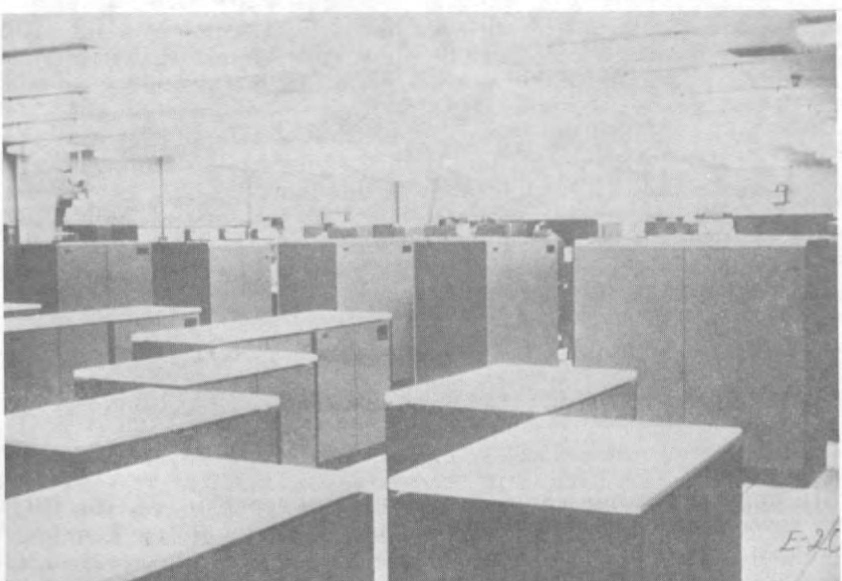
[Classified exhibit] the theater evaluation of this aircraft has been successfully completed and we are now changing the composition of our relay fleet to the mix indicated on this chart [deleted] EC–121's—[deleted] with attendant savings of almost a thousand people and over $5 million of O. & M. funds annually.

[Classified exhibit] this chart shows the location of the orbits currently being flown in Laos. [Deleted.]

INFILTRATION SURVEILLANCE CENTER

The next element is the ground assessment facility. This is an exterior view of the Infiltration Surveillance Center—or ISC. It is the nerve center of our present system. In our IGLOO WHITE operation, the size and complexity of our sensor fields make computer assistance essential to correlate the large number of activations over the wide area of operation. Sensor data from the relay aircraft automatically enter into the ISC's computer, shown here. The computer then produces a printout depicting activations of the sensors, by their individual identifiers, as a function of time. [Classified exhibit.] These printouts are analyzed and from the activation patterns information [deleted] can be derived. After this target information is developed, it is passed to the intelligence section for correlation with other source information and then to the operations section for transmission to the Airborne Battlefield Command and Control Center which allocates strike aircraft.





Besides locating targets for immediate reaction, the ground assessment facility, through analysis of enemy logistic flow patterns, also generates lucrative targets—such as truck parks and storage areas—for preplanned strikes. Additionally, sensor data, by providing a measure of system input versus output, is useful in determining the effectiveness of our interdiction efforts.

Just this past summer, we have made reductions in both personnel and equipment at the Infiltration Surveillance Center. By putting the necessary computer program on one of the two IBM 360–65's and allowing a maintenance period daily for that machine, we were able to remove the second computer. This action, coupled with the reduction in the manning of the ISC's Operations Division and certain stateside support agencies, resulted in a savings in this year's operations over last year's of 160 military personnel spaces and $4.5 million in contractor support.

ISC REDUCTIONS

[In millions of dollars]

	1969	1970	Difference
Manpower	385.0	225.0	160.0
Contractor support	8.8	4.3	4.5

DART

In order to provide an emergency backup capability for the ISC, we developed the DART—Deployable Automatic Relay Terminal. As the name implies, the DART is air-transportable, whereas the ISC obviously is not.

Large, fixed facilities like the ISC are not compatible with our tactical mobility concept and therefore are not being considered for future ground terminals. Though deployable, the DART has no computer capability and relies entirely on real-time operator assessment of sensor activations. We have [deleted] of these facilities in South Vietnam for receiving and assessing sensor fields within that country in support of the Army's [deleted] operation.

SENSOR REPORTING POST

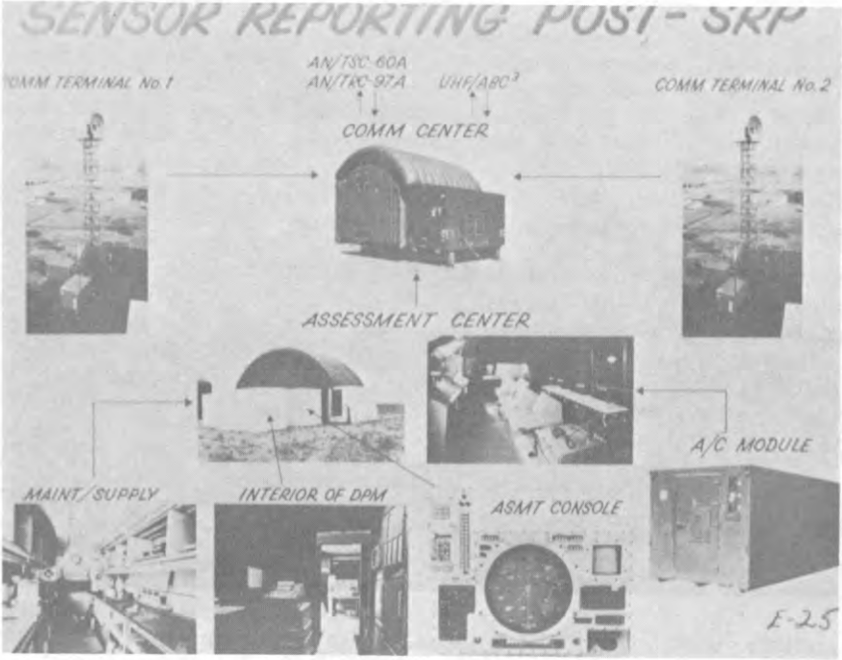
To provide a mobile facility with a computer capability, we developed the SRP—Sensor Reporting Post—shown here (p. 126).

This facility combines the transportability of the DART with some measure of the automation of the ISC. It possesses functional capabilities closely resembling those of the ISC for a sensor field of [deleted] sensors, but without data storage. The SRP is at Eglin AFB, where it is undergoing integration testing with the Tactical Air Control System to determine the interfaces necessary to optimize tactical effectiveness.

Turning to the future, there are several Air Force actions either planned or underway to improve our ground sensor surveillance system—all part of a 5-year development plan.

In the area of sensors, I have already mentioned improvements needed in battery design for operation in cold weather and the identification of a frequency band which will allow worldwide application. Also, I mentioned work going on at Rome Air Development Center on a [deleted] detector. We are also developing and plan to test a combination seismic and magnetic sensor which should be more discriminating than our current sensors.

One of the objectives of our sensor development effort is to [deleted].



IMPROVED DELIVERY ACCURACY

Additionally, improved delivery accuracy will greatly help in this area because if we can deliver the sensors closer to the road we want them to monitor, the detection range of the sensor could then be reduced, thus reducing the size of the area they are listening to. [Deleted] amount of extraneous noise is reduced and only the trucks' [deleted]. This, in conjunction with more accurate post-drop location, will allow us to more accurately pinpoint the target's location.

In the area of relay, we realize that our present relay platforms are vulnerable to enemy air action. We are studying relay platforms such as [deleted].

In the area of communications techniques, we would like to build in more protection against jamming, because against a sophisticated enemy [deleted] we must expect countermeasures. [Deleted.]

As far as assessment facilities are concerned, we are, as I pointed out, anxious to get away from a large, fixed installation such as we have at [deleted]. To enhance our tactical mobility, we built the sensor reporting post, which I showed you on a chart earlier. It is now undergoing integration testing with elements of the tactical air control system to insure its compatibility. From these tests, there will possibly be modifications to the facility, such as changes to the computer software to allow it to accommodate more than [deleted] sensors. I visualize no major changes to the facility's design, however.

I will cover the cost of these development items later when I talk about IGLOO WHITE expenditures.

VALUE OF SENSORS DURING DARKNESS

Up to now, we have only been talking about using sensors as a detection source. How effective have they been in that role? (Classified exhibit.) This chart makes an interesting and significant point. Beyond the obvious fact that ground sensor detections amount to over four times those from other sources, such as airborne sensors and visual sightings, [deleted] I would like to point out a less obvious fact which might easily be overlooked. (Classified exhibit.) If you will notice, the difference between ground sensor detections and those from other sources is insignificant during daylight hours. Note, however, that during periods of darkness, when eyeballs and other visual viewing devices are degraded, ground sensors produced the vast majority of the detections. Looked at another way, the chart points up how many potential targets would have gone undetected were it not for these "road sentinels" who remain on the job 24 hours a day, rain or shine.

COMMANDO BOLT

Although sensors have certainly proven valuable as a detection source, it is not enough merely to have the capability to sit and count trucks as they pass by; to be truly effective, an interdiction system must also have the capability to attack and destroy the detected targets. This means all-weather strike in real time. As the trucks are moving, ground sensors accomplish this for us in an operation called Commando Bolt. An assessment officer monitors sensor activations in his area of interest. When he recognizes a target signature from a (classified exhibit) particular sensor string, he calls up on his cathode ray tube a sketch of the roadnet which that string of sensors is monitoring; the computer automatically displays and updates on the CRT the movement of the target along that road [deleted]. He then can instruct one or a number of the [deleted] F-4's, which I mentioned earlier, to enter these [deleted] coordinates into the aircraft's computer. This gives the aircraft the course to steer to that point and produces an automatic release of ordnance at the proper time to hit the target. Using area-type ordnance, excellent results have been obtained with this blind-bombing method.

In addition, Navy A-6 aircraft were vectored to active areas where, with their moving target indicator radar, they could acquire the trucks as point targets for a precision bomb drop. Likewise, we will provide sensor-derived intelligence to our new B-57G squadron, which [deleted] has similar radar. As you can see, Commando Bolt accounted for [deleted] trucks destroyed or damaged, representing [deleted] percent of the total destroyed or damaged during the last dry season interdiction campaign. Further, these results were achieved with [deleted] strike sorties, representing [deleted] percent of the total number of strike sorties flown during the campaign [deleted]. Also, this mode of operation significantly decreases the vulnerability of our strike aircraft. Over [deleted] Commando Bolt sorties were flown before a hit was taken. No aircraft were lost to hostile ground fire.

Because munitions are an essential ingredient in our interdiction campaign, I thought that you would be interested in knowing more about some of this ordnance. For this portion of the presentation, I would like Major Anderson from the Air Force Directorate of Operations to describe these various munitions, their operation, and—where DCPG-controlled funds were involved—indicate how much Air Force money was spent on each.

Major Anderson.

STATEMENT OF MAJ. RAYMOND DALE ANDERSON, TACTICAL DIVISION, DIRECTORATE OF OPERATIONS, DEPARTMENT OF THE AIR FORCE

Major ANDERSON. Mr. Chairman and members of the subcommittee, I am Major Anderson from the Directorate of Operations.

This portion of the Air Force testimony will address Air Force munitions used in Southeast Asia. Some are associated and some are not associated with IGLOO WHITE. I will also describe the munitions package concept used in our air interdiction campaign in Southeast Asia to show how the various munitions complement each other.

Before getting into the details of the munitions, I would like to digress for just a moment to clarify for the subcommittee the Air Force responsibility for IGLOO WHITE munitions in response to DCPG tasking.

USAF IGLOO WHITE—MUNITION RESPONSIBILITIES

1. Certification of Button Bomb/Micro-Gravel/Gravel Systems to the A–1E Aircraft.
2. Certification of the ADSID to the F–4.
3. Certification of the HELOSID to the CH–3.
4. Development and Certification of a High Speed Dispenser (SUU–41) for Button Bomb/Micro-Gravel/Gravel to the F–4.
5. Development and Certification of a High Speed Dispenser (SUU–42) for Phase II Sensors to the F–4.
6. The Complete Dragontooth System (CBU–28).
7. The Complete Wide Area Anti-Personnel (WAAPM–CBU–42).

The Air Force was charged with the munitions responsibilities shown on this chart. The production, procurement, and logistics planning for IGLOO WHITE munitions, other than the DRAGONTOOTH and wide-area antipersonnel munition (WAAPM), were the responsibilities of other services.

(Classified exhibit.) The munitions funded by DCPG are listed on the left side of this chart. Other munitions, not funded by DCPG, which support IGLOO WHITE as well as air interdiction operations in general, are listed on the right side.

MUNITION DESIGNATORS

BOMBS

M Series—Air Force (M 117–750 pound bomb)
MK Series—Navy (MK–82 500 pound bomb)
BLU (*B*omb, *L*ive, *U*nit)

CLUSTER MUNITIONS

CBU (*C*luster *B*omb *U*nit) = SUU (*S*uspension *U*nit, *U*tility) + BLU

SYSTEM USED TO IDENTIFY MUNITIONS

Before describing the actual hardware, I would like to discuss the systems used to identify munitions. The Air Force uses a variety of munitions, some old and some new, some that we developed, and some that the Navy developed.

Bombs that were developed by the Air Force are identified by the letter "M" and a number. The M–117 general purpose bomb used extensively in Southeast Asia is an example of this system. The Navy identifies most of its munitions by a "Mark" number. The MK–82 500-pound bomb illustrates this.

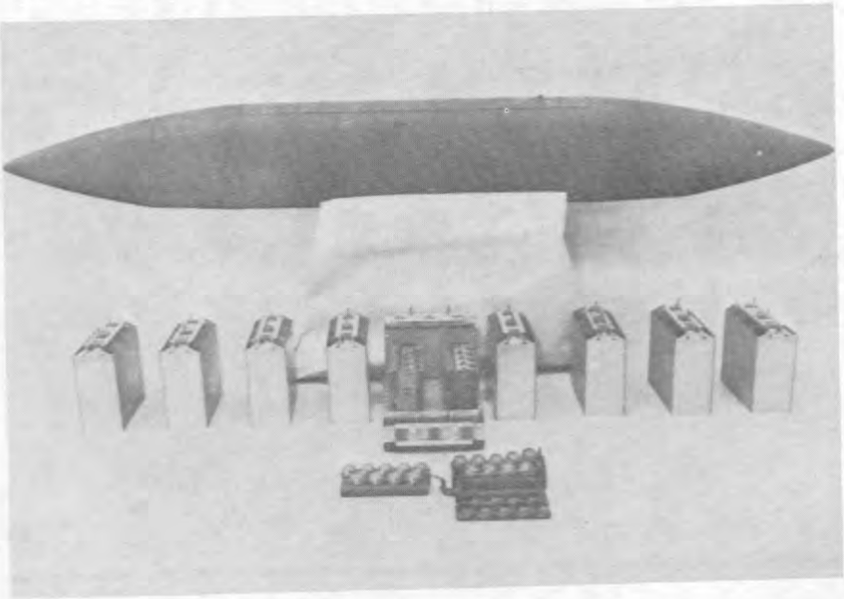
The term "BLU," which is short for "bomb, live unit" is now being used to identify the newer bombs. The common pronunciation is "BLOO." The term is used with any bomb, whether it weighs 1 pound or 1,000 pounds. Weapons that we were using before this system was initiated are still identified by their old designators. Cluster munitions have been widely used in Southeast Asia. A cluster bomb unit, or CBU, is composed of two subsystems: a dispenser and a submunition. The dispenser is designated as a "suspension unit, utility," pronounced "SOO." The submunition, or BLU, is loaded into the dispenser to give us a complete weapon, or CBU. The CBU nomenclature can be very confusing, since one dispenser can accept many different submunitions. Each time a new submunition is used, an entirely new CBU is born.

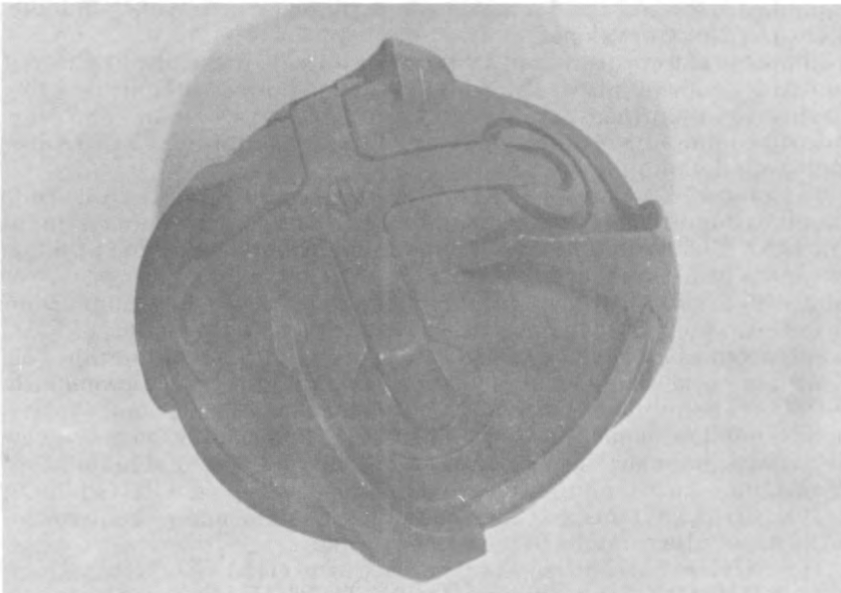
The first two items on the left-hand list are dispensers and are subsystems of other complete munitions systems.

The SUU–41 is the dispenser used with the GRAVEL system. I will discuss GRAVEL in more detail later. The SUU–42 is used only for IGLOO WHITE sensor delivery.

WAAPM

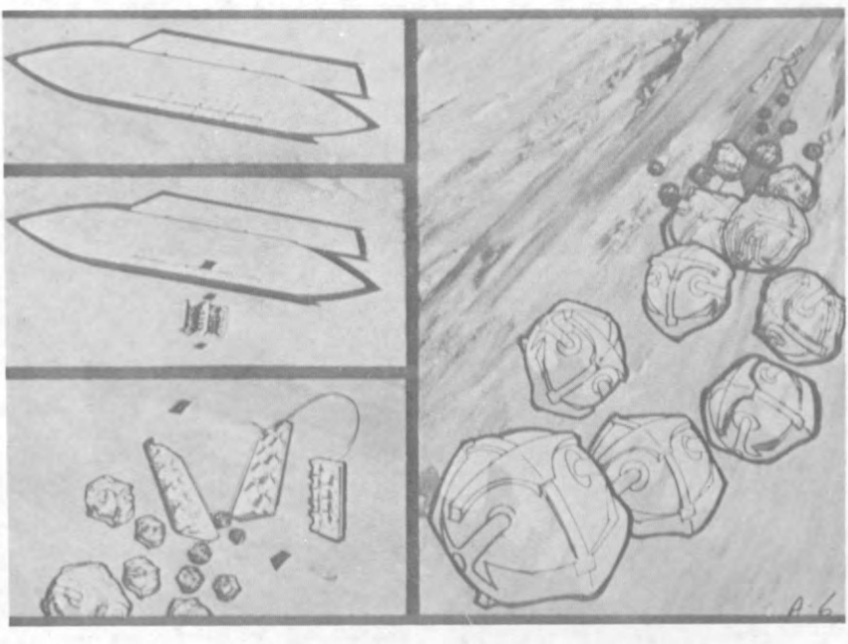
The first complete weapons system is the CBU–34 or CBU–42 wide area antipersonnel mine, hereafter referred to by its acronym WAAPM. This is a view of the munitions dispenser used for the delivery of WAAPM, showing the canisters that hold the submunitions.





This is a picture of the submunition used in WAAPM. Each bomblet contains [deleted].

This slide shows the operational sequence of WAAPM. As the delivery aircraft flies over the area to be seeded, the canisters are ejected at preselected release intervals. The canisters then open to release the



bomblets. When the bomblets are released, the airstream acting on the flutes causes the bombs to spin. This spinning action disperses the bomblets and starts the arming cycle. A [deleted] delay circuit is activated, allowing time for the mine to come to rest on the ground. When this time has elapsed, the final arming actions occur [deleted] (classified exhibit). Any disturbance of [deleted] the bomb itself will detonate the mine.

WAAPM COSTS

The CBU–34 was developed by the Air Force and had an [deleted]-day life span before it self-destructed. DCPG wanted a version with a [deleted]-day life span to use in their barrier concept. DCPG provided $83.6 million to procure the [deleted]-day version, which was designated CBU–42.

Mr. GILLEAS. Was that all R. & D. money?

Major ANDERSON. Some was R. & D. and some was procurement money, I don't have the exact breakout.

Senator GOLDWATER. Can you tell me how that is carried in the budget?

Major ANDERSON. As CBU–34/42.

Senator GOLDWATER. Is that DCPG money?

General EVANS. It varies, sir, with the object, the class of money. In the case of the 3080 money, procurement money, with the exception of munitions, is all carried under DCPG. 3020 money is missile money, classified drones for such things as the PAVE EAGLE money.

Senator GOLDWATER. Pardon?

General EVANS. Such things as PAVE EAGLE money is carried as classified drone, 3020 money.

Senator GOLDWATER. I can't recall having heard it discussed in authorization.

General EVANS. 28012 F is the program element which is listed as DCPG.

Senator GOLDWATER. Has it been so listed in all of the appropriations?

Captain WALLACE. Senator, I am Captain Wallace of the Air Force. The 3080 Other Procurement money is broken out into two segments: munitions money, as well as nonmunitions. Nonmunitions, which is generally communications and electronics money, is carried in the procurement document as "Defense Communications Planning Group." In the munitions area, the money is not identified as Defense Communications Planning Group, per se; it is carried in the individual munitions line item and does not provide any identity to DCPG.

General EVANS. R.D.T. & E. money is also listed as Defense Communication Planning Group money.

WHERE ARE DCPG FUNDS IN BUDGET?

Senator GOLDWATER. The reason I asked that question is, we got into this general subject on the floor as to the source of the funds and whether the funds had been discussed and justified. I can't recall myself having heard them discussed in authorization or appropriation hearings. I am asking these questions so we can have the answers.

General EVANS. They are listed as Captain Wallace and I have indicated.

Senator GOLDWATER. If you would submit that for the record it would be helpful.

General EVANS. Yes, sir, I think we have already supplied the chief counsel with funding information and we will be happy to augment that.

Mr. GILLEAS. I think part of the answer, too, is the fact that in the authorization bill you justify your research and development money. The production money is handled by the Appropriation Committee and generally with certain exceptions we do not pass on the validity of this type procurement because it doesn't fall within our purview, i.e., it is not a ship, missile, tank, et cetera.

Would somebody please comment on whether that is correct or not?

General DEANE. I would like to ask Mr. Detweiler who is our comptroller.

Mr. DETWEILER. In the authorization bills that have come up, as you have indicated, the R.D.T. & E. money has been passed. Also the APAF money, which is your 3010 appropriation, is included in the authorization bills, and your 3020 money which is your missile money, is also in the authorization. But the communications and electronics items, which covers the actual procurement of the sensor items and the munitions items are not. But we have submitted to you a complete list of all the appropriations where our money is by line items by appropriations and those which have been submitted to the authorization committees and those which have not.

DCPG R.D.T. & E. AND PROCUREMENT—FISCAL YEAR 1971 BUDGET REQUEST IDENTIFIED BY LINE ITEM AND APPROPRIATION

FISCAL YEAR 1971 PRESIDENT'S BUDGET

[Dollars in millions]

Line item number and title	Total of line	DCPG, fiscal year 1971	Clearly identified in P-1 documents as DCPG program	Review for authorization
PEMA—ARMY				
245 DCPG project	$78.0	$78.0	Yes	No.
PAMN—NAVY				
63 Various	3.8	.1	No	Yes.
OPN—(act. 3)				
106 DCPG program	18.6	18.6	Yes	No.
MPAF—AIR FORCE				
26 Classified drones	14.0	4.0	No	Yes.
APAF				
59 Additional SEA requirements	17.0	17.0	No	Yes.
OPAF				
34 CBU-34/42	$63.6	$26.2	No	No.
41 Cluster M-36	21.8	10.0	No	No.
42 Bomb GP-M-117	124.2	4.5	No	No.
48 Laser bomb kit	15.9	4.5	No	No.
50 Kit MK 75	7.6	4.8	No	No.
230 DCPG	36.0	36.0	Yes	No.
Total OPAF		86.0		

Note: Information provided is for the R.D.T. & E. and Procurement only. Operation and Maintenance funds amounting to $53.2 million are comingled with regular O & M funding requests in several accounts.

RESEARCH, DEVELOPMENT, TRAINING, AND EVALUATION

Service	Budget account	Program element	Line amount	DCPG amount	Review for authorization
Army	7	28012A	$12	$12	Yes.
Navy	7	28012N	5	5	Yes.
Air Force	7	28012F	14	14	Yes.
DCPG	7	28012K	14	14	Yes.

Note: As outlined above only $66,100,000 of the total DCPG fiscal year 1971 budget request for $301,900,000 is reviewed by the Senate and House Armed Services Committees for authorization.

Mr. GILLEAS. The figure you are presenting shows you have in fiscal year 1971 appeared before the Armed Services Committee and requested $66.1 million for this particular program. Most of it is research and development funds; but the question we desire answered is whether or not that money is identifiable with DCPG, recognizing they ask the services to include the funds in their budget. Is the committee informed that this money is for or on behalf of DCPG?

General EVANS. Well, we will get those answers to those specific questions, sir; and submit them.

(The information requested follows:)

IGLOO WHITE MONEY CONTAINED IN THE FISCAL YEAR 1971 PRESIDENT'S BUDGET

P-1 line No.	Appropriation	Identity	Amount (in millions)[1]
59	3010—Aircraft procurement, Air Force	Modification of inservice aircraft additional SEA requirement.	$17.0 ($17.0)
26	3020—Missile procurement, Air Force	Classified drones	14.0 (4.0)
230	3080—Other procurement, Air Force non-munitions.	Defense Communication Planning Group	36.0 (36.0)
34	Munitions	Dispenser and bomb CBU-34/42	63.8 (26.2)
41		Incendiary cluster, 750-lb. M-36	21.8 (10.0)
50		Kit MK 75 mod 0/1 w/cable (MK 36 dest)	7.6 (4.8)
42		Bomb, Group 750-lb. M-117	124.2 (4.5)
48		Laser bomb guidance kit	15.9 (4.5)
	3600—R.D.T. & E	Defense Communications Planning Group	14.0 (14.0)

[1] Only the amounts in parentheses apply to support of Igloo White.

Senator GOLDWATER. Is it correct that there is no single place in the authorization or appropriation bill that lists the total for DCPG?

Mr. DETWEILER. Yes, sir; you are. Because our moneys, they are spread over the Army, Navy, and Air Force, and you do not find them correlated for you in one particular spot. But, however, we have briefed the various appropriation committees almost every year and at that point we have done this to bring them into view as to the entire amounts by appropriations.

Senator GOLDWATER. Thank you.

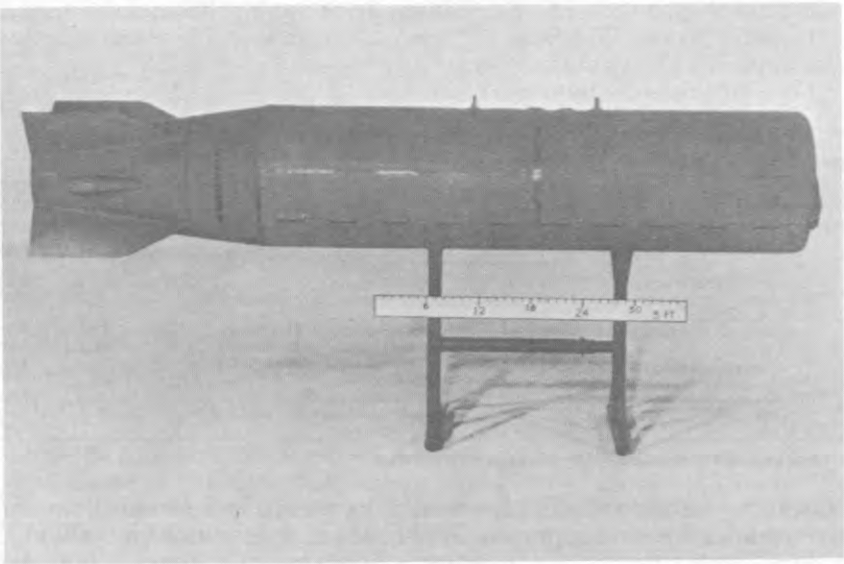
M-36 INCENDIARY CLUSTER

Major ANDERSON. This is the M-36 incendiary cluster. It weighs approximately 800 pounds. Inside the cluster are 182 M-126 incendiary bombs. We have a sample for your inspection. This is a WW-II magnesium incendiary bomb that was designed to penetrate the roofs of industrial buildings and start fires inside there. There was a sizable quantity of these bombs available at the beginning of the Southeast

Asian hostilities. They could be carried externally only on slower aircraft such as the A–1 and A–26. The B–57, having a bomb bay, could carry it internally. The stockpile was depleted by the spring of 1968. Production was reinitiated in 1969 with DCPG assistance. It still is suitable for external carriage only on slower aircraft. However, A–1 truck killing effectiveness was increased by a factor of [deleted] when this weapon became available. This weapon is being modified for high-speed carriage by the F–4. The modified version is being tested on the F–4 now and, if successful, will be available for combat by [deleted].

Senator GOLDWATER. What will be the general change in the aerodynamics of the bomb?

Major ANDERSON. Externally there will be no change. It will be exactly the same configuration. The high-speed version has the front end rounded off just a little bit.



BLU–31 LAND MINE

This is the BLU–31 land mine. It is in the 750-pound class of weapons. The blunt nose keeps the mine from burying too deep and expending all of its energy underground.

The heart of the BLU–31 is the [deleted] fuze. This is a [deleted] fuze which detects [deleted] approaching heavy targets, such as locomotives and tanks. It is designed to delay mine functioning until the target is within the lethal radius of the weapon. [Deleted.]

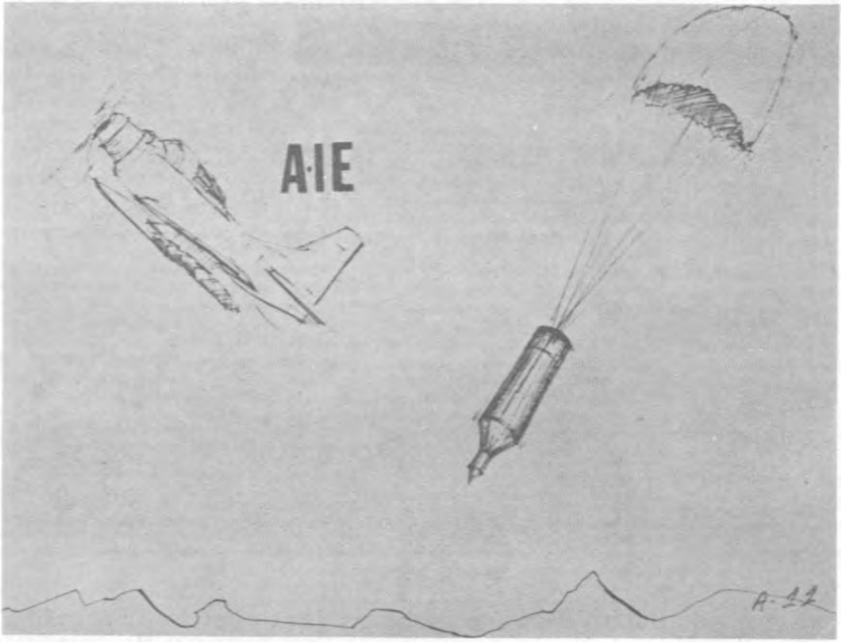
Senator GOLDWATER. [Deleted.] When the bomb hits the ground it doesn't set it off?

Major ANDERSON. No, sir. The initial impact on the ground? No, it doesn't go off then. It doesn't complete all of its arming action until it is in the ground. Then when it is fully armed then it becomes sensitive [deleted].

Senator GOLDWATER. When did you come up with that one?

PAVE PAT

Major ANDERSON. This fuze has been under development since 1963 at least that I know of.



Pave Pat is the name given to the program that is developing the fuel air explosive munition.

Pave Pat I was the first try at this concept and was limited to slow-speed aircraft. It was originally employed in Southeast Asia in the fall of 1968. Only 52 weapons were built and expended in an R. & D. effort.

Pave Pat I was actually a commercial propane tank equipped with suspension lugs.

This shows the A–1E releasing Pave Pat I. The parachute is required to reduce penetration and prevent the bomb from breaking up on ground impact. [Deleted.]

(Classified exhibit.) When the bomb functioned properly, overpressures of [deleted] pounds per square inch were measured [deleted] feet away from the impact point. [Deleted.]

This is a photograph of a forested area cleared out by a Pave Pat weapon during test. Pave Pat I was not very successful in Southeast Asia. [Deleted.]

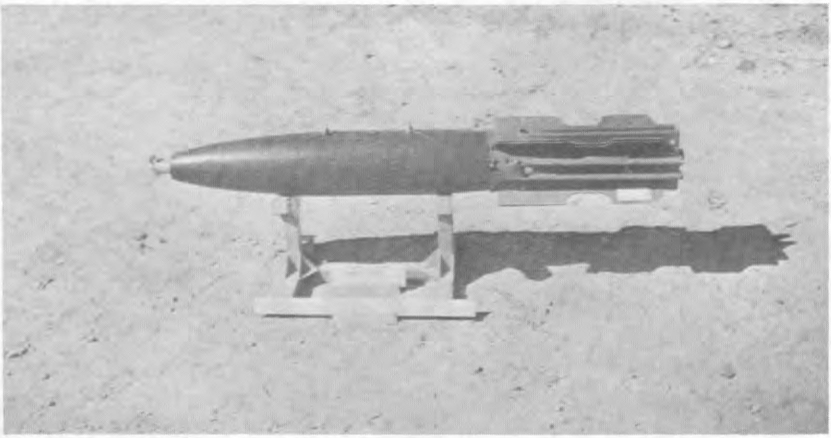
PAVE PAT II

(Classified exhibit.) This is a drawing of Pave Pat II. It is similar to Pave Pat I in size, weight, and general appearance. The Pave Pat II exterior has been cleaned up and the weapon is much more streamlined. It is designed for employment by high-speed aircraft. [Deleted.]

Senator GOLDWATER. What does it weigh?

Major ANDERSON. Approximately 2,500 pounds, sir. It is a big bomb.

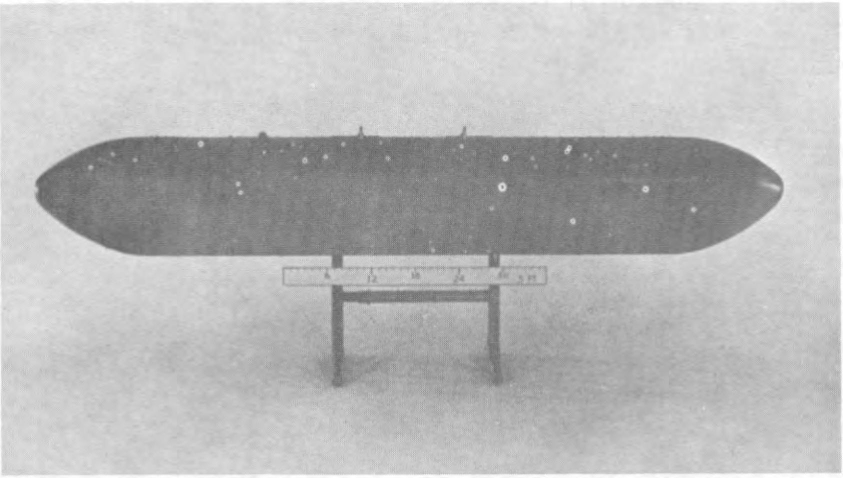
(Classified exhibit.) This is a picture of three Pave Pat II weapons loaded on an F–4. Pave Pat II is now undergoing operational test and evaluations, and combat evaluation is scheduled for [deleted].



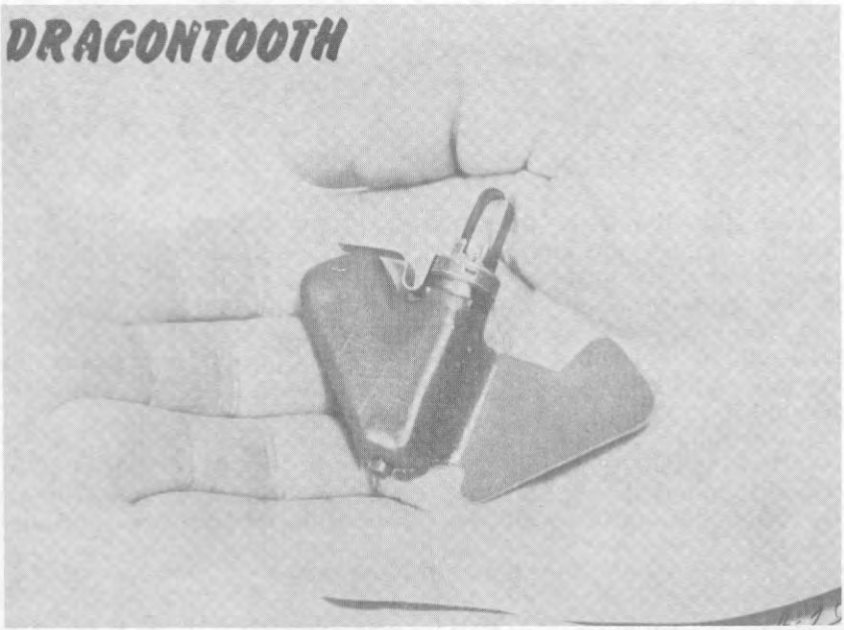
MK–36 DESTRUCTOR

The MK–36 destructor is composed of a retarded general purpose bomb with a [deleted] fuze kit. The destructor kit senses the disturbance [deleted] caused by a moving [deleted] target.

[Deleted.]



This is the dispenser used in the DRAGONTOOTH antipersonnel mine system. Each dispenser holds [deleted] mines. This is a picture



of the individual mine and we have a sample for your inspection.

DRAGONTOOTH

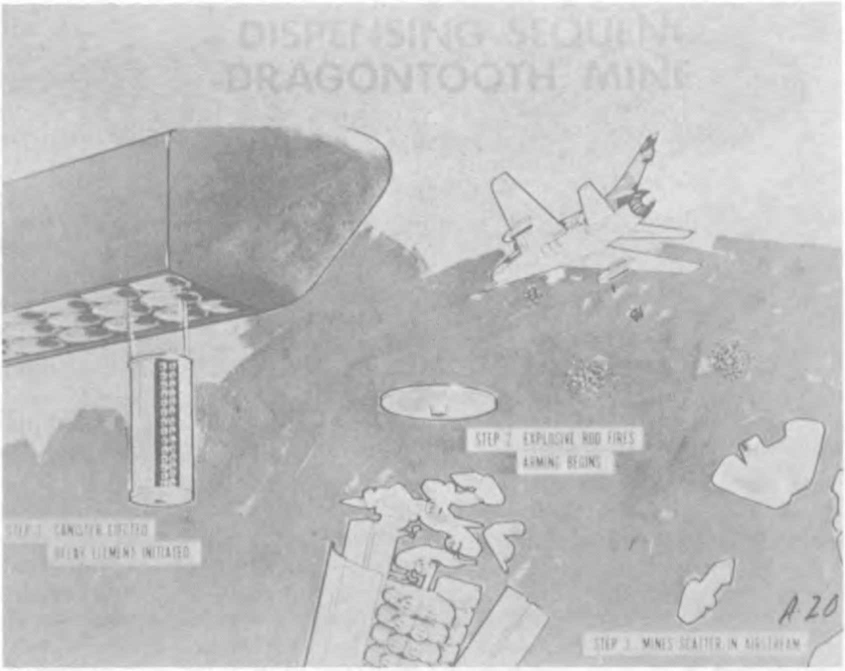
DRAGONTOOTH is a [deleted] mine, with the [deleted] being the explosive.

Senator GOLDWATER. How much damage can it do?

Major ANDERSON. How much damage, sir?

Senator GOLDWATER. Yes.

Major ANDERSON. It is purely antipersonnel. If a person steps on it, it could blow his foot off. If a truck rolls over it, it won't blow the tire.



This slide shows the operational concept of DRAGONTOOTH. The first step is canister ejection, followed by release of the individual mines from the canister. The mines disperse as they flutter to the ground. Application of sufficient external force, such as a foot step, activates the mine. DRAGONTOOTH has a [deleted] feature. [Deleted.] A [deleted] version of DRAGONTOOTH was under development, but because of technical problems, this effort was discontinued.

[Deleted.]

[Deleted.] There were only [deleted] dispensers of DRAGONTOOTH munitions in the inventory as of September 30, 1970. At the current rate of expenditure, these should be consumed in about a year.

LASER GUIDED BOMB

(Classified exhibit.) This is the Laser-guided bomb. It is a 2,000-pound general purpose bomb modified with a Laser guidance kit and oversize fins. The device on the very end of the guidance section is the Laser seeker, or detector. Immediately behind is the electronic section which also contains the guidance controls which move the fins as necessary to fly the bomb to the target.

(Classified exhibit.) This slide shows the method of operation. [Deleted.] This has been a very successful system. The average miss distance in Southeast Asia has been approximately [deleted] feet. The system was developed using Air Force funds. DCPG provided funds to procure the target designators.

USE AGAINST SOPHISTICATED ENEMY

Senator GOLDWATER. Let me ask you a question. In the opinion of you people who plan operations of this type, how successful would it be against a sophisticated enemy? If you had doubtful air superiority, could you use this successfully?

General TALBOTT. Yes, sir; by expanding on the principle I think quite effectively, if you can develop a standoff capability with it, which we are presently working on.

Senator GOLDWATER. The [deleted] has to fly a pretty steady pattern, doesn't it? He can't be evading anything [deleted].

General TALBOTT. I think the ones he is talking about, those in the initial deployment, have [deleted] so he could do some maneuvering or turning.

Major ANDERSON. He could do some mild maneuvering.

Senator GOLDWATER. Would it be effective against an enemy who had equal air superiority?

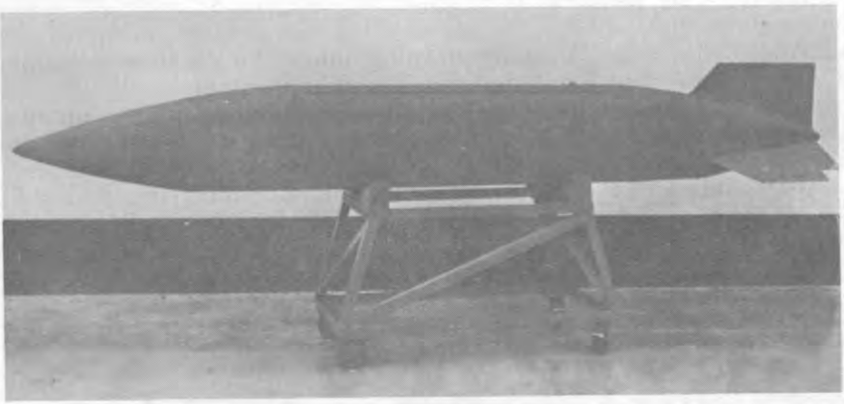
General TALBOTT. I am sorry, would you say that again?

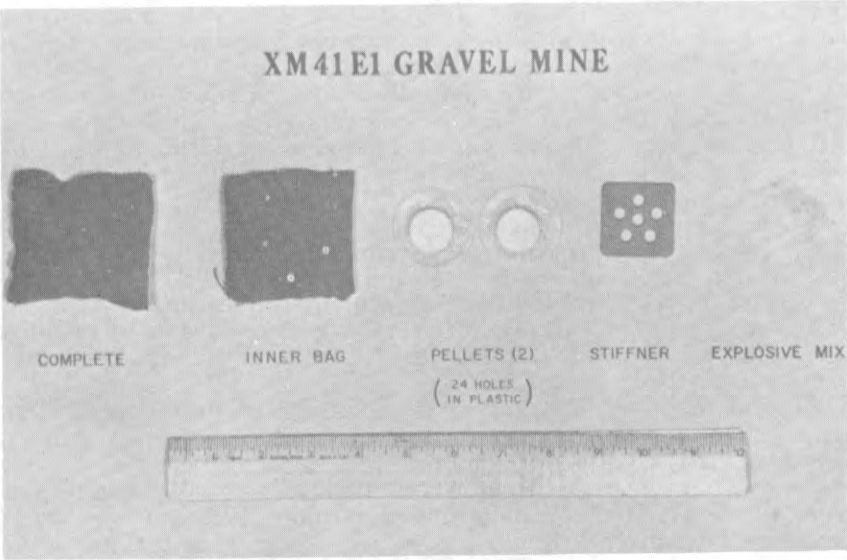
Senator GOLDWATER. Take the Soviet Union, would this bomb be effective with the type of interceptor resistance we could expect from them assuming we don't have complete air superiority?

General TALBOTT. Well, I don't think the risk delivering this bomb would be appreciably greater than in any other type of an air-to-ground attack. When you were operating in an environment where the enemy had superiority, I think you have problems regardless of what your delivery.

Major ANDERSON. There is a follow-on to the LASER guidance system [deleted].

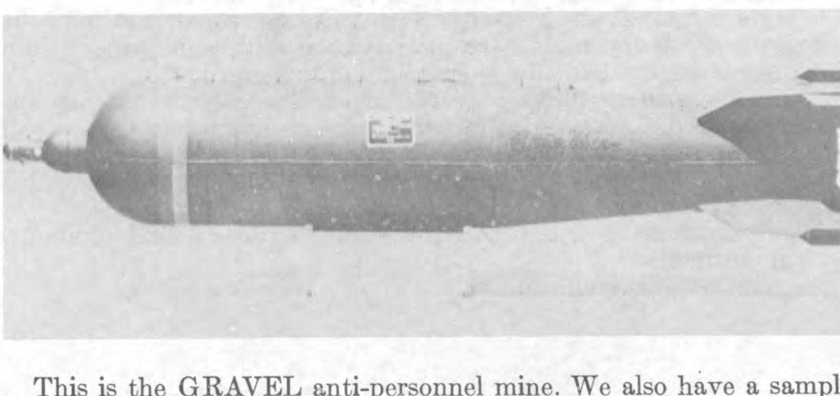
Senator GOLDWATER. All right.





GRAVEL ANTI-PERSONNEL MINE

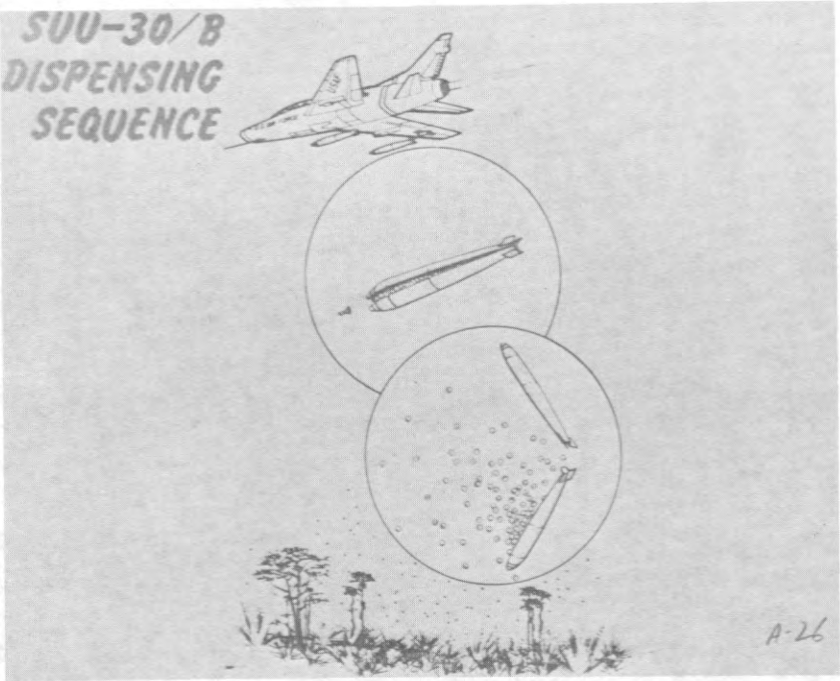
Major ANDERSON. This is the SUU-41 dispenser used in the GRAVEL anti-personnel mine system.



This is the GRAVEL anti-personnel mine. We also have a sample for your inspection. Each mine consists of a [deleted].

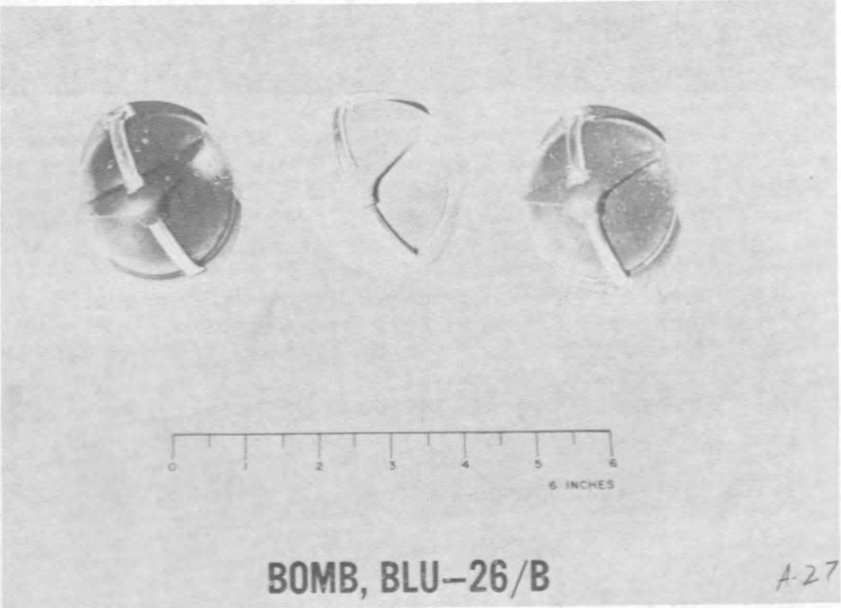
GRAVEL was originally procured by DCPG* to be used as an anti-personnel area-denial munition in the anti-personnel portion of the barrier concept. The only kill mechanism is blast, GRAVEL will blow a man's foot off but it will not blow a hole in a truck tire. [Deleted.]

* Defense Communications Planning Group.

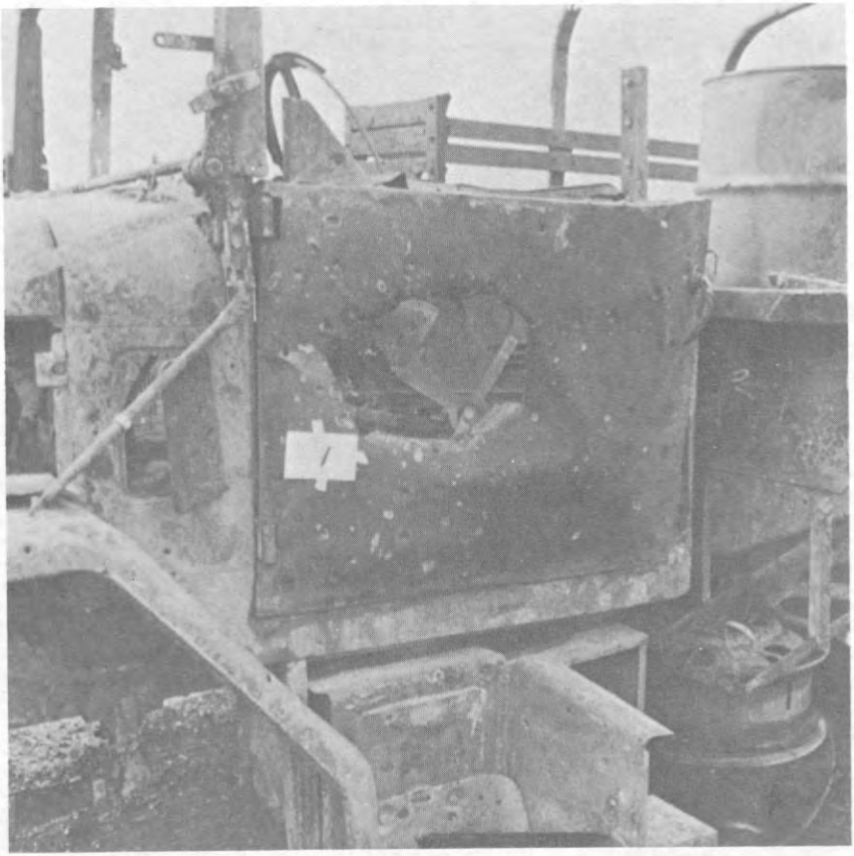


CBU–24 MUNITION

This is the clamshell dispenser used in the CBU–24 anti-personnel and anti-light material munition.



After release from the aircraft, the dispenser splits longitudinally, releasing [deleted] submunitions.



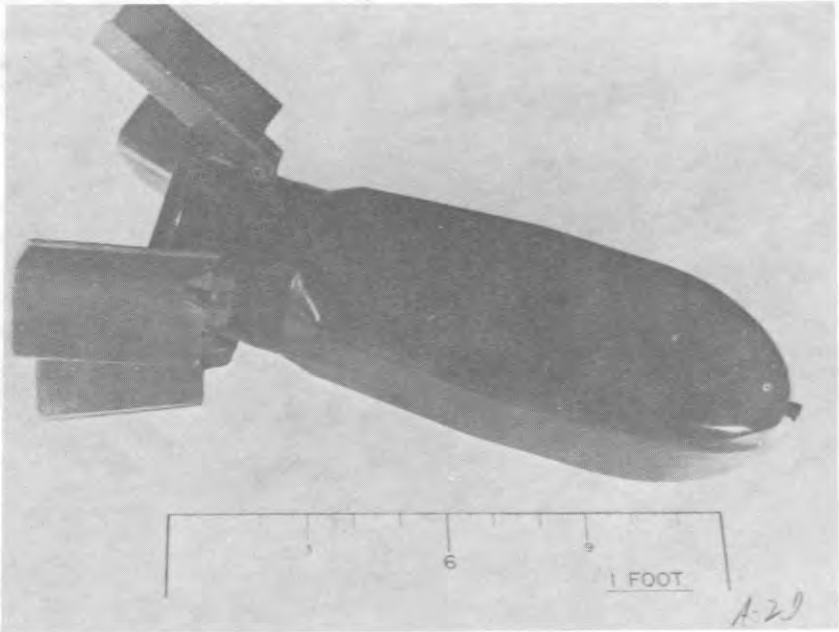
This is a slide of the submunition and we have a sample for your inspection. The primary kill mechanism is fragmentation from the [deleted] imbedded in the bomblet body. The fuze is mounted in the center of the bomblet. We also have a fuze sample. The flutes on the bomb body cause the bomb to spin, for arming and dispersion, after it is ejected into the airstream.

Senator GOLDWATER. Has this been extremely successful?

Major ANDERSON. Yes, sir, a very good weapon.

Senator GOLDWATER. I have seen the tests on it. Do they detonate on impact or just above the ground?

Major ANDERSON. They detonate on impact, sir.



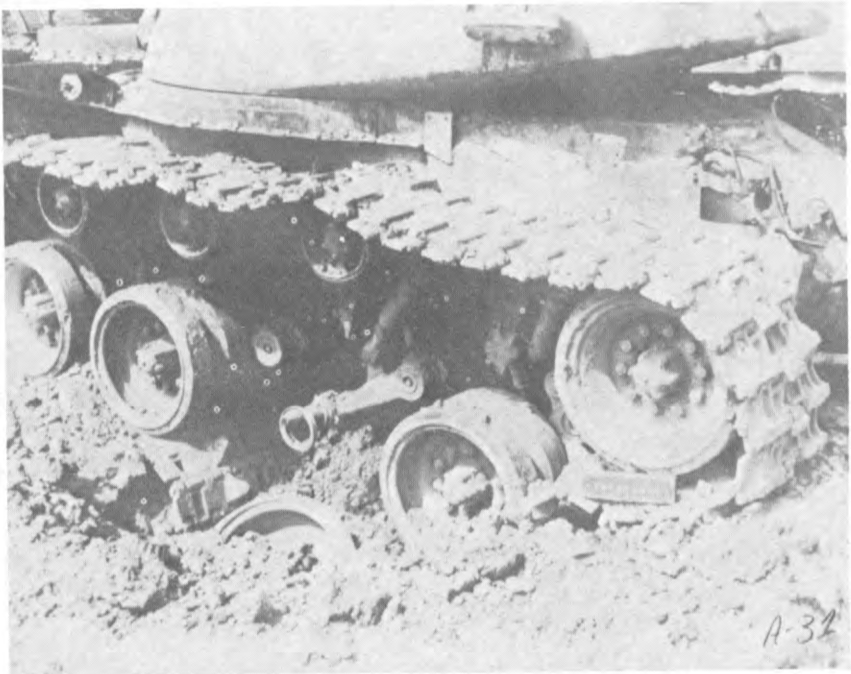
The CBU–24 is one of the most effective and widely used anti-truck munitions used in Southeast Asia. This slide shows typical CBU–14 damage to a truck. The CBU–24 fragments puncture tires, gas tanks, radiators, and kill or wound the drivers. When a truck takes a good solid hit from a bomblet, this is the type of damage that results. The CBU–24 was developed and procured exclusively with Air Force funds.

There is another version of the CBU–24 called the CBU–49. A different fuze in the same bomblet is used to give it a random time delay of up to [deleted]. This adds a harassment feature, since it is difficult for the enemy to do such things as put out fires while these delayed action bomblets are going off.

CBU–33 ANTI-VEHICULAR LAND MINE

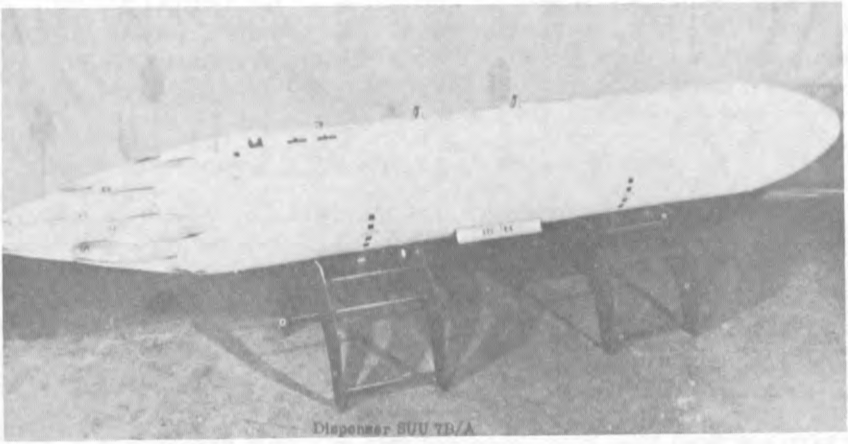
The CBU–33 is an anti-vehicular land mine optimized to destroy tanks. This is a picture of the submunition and we have a sample for your inspection. The mine weighs approximately 20 pounds. It has a shaped charge at the rear that is optimized to defeat armored track vehicles. Vehicles are detected by means of a [deleted] sensor which is designed to delay mine function until the vehicle is within the lethal kill radius. The mine has a selectable self-destruct time of [deleted].

[Classified exhibit.] This slide shows the operational concept of the CBU–33. As the delivery aircraft flies over the target area, mines are released to seed the area on and around roads.

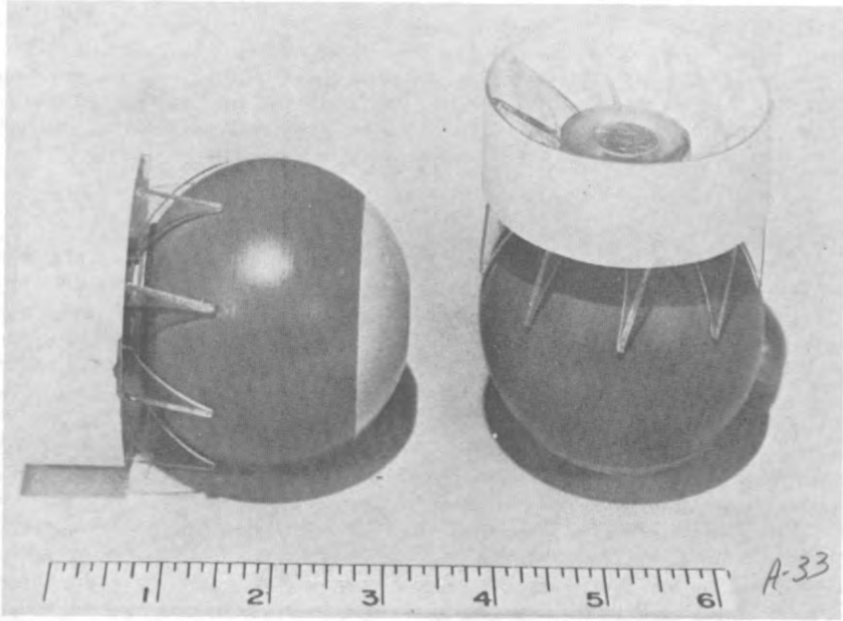


This slide shows CBU–33 damage sustained by a tank during effectiveness testing. Had the tank passed directly over the mine the [deleted].

The CBU–33 has seen limited combat use [deleted]. Production was terminated after approximately 600 units had been built. The CBU–33 was developed and procured exclusively with Air Force funds.

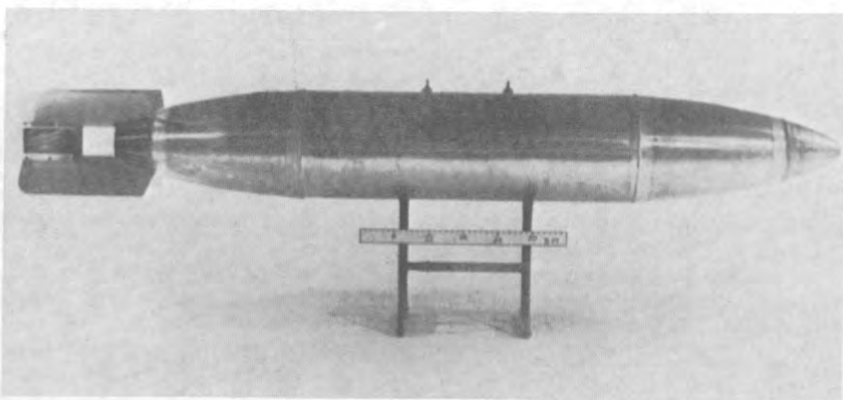


This is the 19-tube SUU–7 dispenser used in the CBU–46. The submunitions are ejected rearward from this dispenser.



This is the BLU–66 used in the CBU–46. It is an antipersonnel bomblet with the primary kill mechanism being fragmentation. Seventh Air Force has not employed this weapon very extensively because the emphasis has been on truck-killing munitions.

We are phasing the CBU–46 out of our inventory because of its limited antimateriel capabilities. The CBU–46 was procured exclusively with Air Force funds.



BLU–52 CHEMICAL BOMB

This is the BLU–52 chemical bomb. It is a standard firebomb case. It becomes a BLU–52 when filled with 270 pounds of CS–1 or CS–2 riot control agent. Its operation is quite simple. After the bomb is released, the thinskinned bomb case breaks open on impact with the ground, spreading its contents over a wide area. The persistency of the agent varies, depending on weather conditions. CS–1 will last for 3 to 5 days and CS–2 will last for 30 to 45 days. Riot control agents are nonhazardous. Their effects are nausea, choking, and copious weeping. They have been employed to a very limited degree in South Vietnam on carefully selected targets. [Deleted.]

EO GUIDED BOMB

(Classified exhibit.) This is a view of the highly-accurate electro-optical, or EO-guided bomb loaded on an F–4. It uses the same warhead as the laser bomb. It is a self-contained unit that does not require any other aircraft for its operation [deleted], Visual daylight conditions with some contrast between the target and its background environment are required. In operation, the pilot rolls in on the target in a standard dive-bomb maneuver and the small TV camera in the bomb transmits the picture it sees to a display in both cockpits of the F–4. The aircrew then locks the bomb on the desired target image and releases.

The EO bomb was first employed in Southeast Asia in February 1969. It has been used primarily on bridges, fiords, and caves, in additions to roads. The average miss distance has been approximately [deleted] feet. A bridge target [deleted] is an example of EO bomb accuracy. Five EO bombs were dropped on the bridge, dropping four of the spans.

GRASSHOPPER

(Classified exhibit.) The GRASSHOPPER is an advanced target activated munition which utilizes [deleted]. It will have [deleted] making the munition useful against both personnel and materiel (vehicles) targets. A low-level engineering development program was started in 1968 to demonstrate feasibility of [deleted]. A follow-on development program, of approximately 30 months duration, will be iniated in early 1971.

HOW VARIOUS MUNITIONS COMPLEMENT EACH OTHER

Now for a brief description of how these various munitions complement one another in our interdiction campaign.

The munitions package concept was developed to cut the enemy's lines of communications and keep them cut for extended periods of time. Three types of munitions are involved.

(Classified exhibit.) First, the road is cut at a point difficult to bypass, using highly accurate guided weapons. Laser-guided bombs have been performing most of this function.

(Classified exhibit.) Next, antimateriel landmines are emplaced. These mines will destroy a truck if one enters the mined areas.

(Classified exhibit.) Third, antipersonnel landmines are emplaced over the antimateriel mines to deter the enemy's mine-clearing operations. WAAPM has been used in this role.

(Classified exhibit.) Fourth, sensors on both sides of the munitions package determine if truck traffic is getting through the package. Sensors in other locations are used to determine other routes taken by the enemy if he cannot get through the munitions package. By creating a difficult-to-bypass chokepoint, munitions packages can also result in a concentration of enemy vehicles. These can them be attacked using CBU–24 and general-purpose bombs.

This concludes the statement on munitions.

General Evans will now resume his statement on IGLOO WHITE.

IGLOO WHITE

General EVANS. To close out the IGLOO WHITE portion of this briefing, I would like to cover the Air Force funds involved. On the first chart, the first column shows the preliminary budget estimates. These figures are arrived at by DCPG and the services jointly and represent the best estimate of what funds will be required to support the individual service programs for the fiscal year indicated. The next column shows the amount actually spent. As you can see, more often than not, the original estimates were high—less money was required than anticipated and, as a result, funds were returned to the services to be allocated against other priority programs. These figures at the bottom indicate the total amount each year turned back to the Air Force.

This is our fiscal year 1971 program, and I have broken out the expenditures by line item to give you a better understanding of how we are currently applying our money.

FUND SUMMARY, FISCAL YEAR 1971 PROGRAM

[In millions of dollars]

Aircraft procurement (3010)	17.0
Airborne relay	1.0
[Deleted]	5.5
Phase III MOD	4.0
Automatic target system	6.5
Missile procurement (3020) (Pave Eagle) (Pave Eagle II MODS and attrition replacement)	4.0
Other procurement (3080)	86.0
Nonmunitions	36.0
Command Mike III	4.6
ADSID III (N)	3.5
ACOUSID III	5.0
Common modules	12.4
Miscellaneous (test equipment, SRP O/R and MODS, ADR, etc.)	10.5
Munitions	50.0
WAAPM	26.2
M–36	10.0
MK–75 destructor	4.8
M–117D	4.5
Laser kits	4.5
R.D.T. & E. (3600)	14.0
Sensors	1.5
Navigation/delivery	.5
Data collection	3.0
Data processing	1.5
Testing	5.5
Other contractor support	2.0
Operations and maintenance (3400)	40.0
Military personnel (3500)	31.6
Total	192.6

IGLOO WHITE FUNDING

[In millions of dollars]

	Fiscal year 1967		Fiscal year 1968		Fiscal year 1969		Fiscal year 1970	
	Programed	Expended	Programed	Expended	Programed	Expended	Programed	Expended
3400 O. & M.	2.3	3.5	21.6	21.6	24.5	32.9	47.4	43.2
3100 Aircraft procurement	33.3	33.6	30.4	30.4	35.1	24.5	15.0	8.5
3020 Missile procurement			7.0	7.0	30.0	29.6	14.0	12.0
3080 Other procurement	76.1	27.9	104.4	57.8	202.2	103.1	116.7	40.8
3600 R.D.T. & E.	9.0	9.0	24.2	23.5	20.0	20.0	19.0	12.5
3300 Military construction	20.1	17.7						
Total	140.8	91.7	197.6	140.3	311.8	210.1	212.1	117.0
Difference, programed expended	49.1		57.3		101.7		95.1	