REPORT TO THE JOINT ECONOMIC COMMITTEE CONGRESS OF THE UNITED STATES

Cost And Effectiveness Of Electronic Sensor And Surveillance Systems B-163074

Department of Defense

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

JUNE 10, 1971

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-163074

Dear Mr. Chairman:

In accordance with your request, the General Accounting Office has looked into the cost and effectiveness of electronic sensor and surveillance systems in the Department of Defense. The accompanying report presents an unclassified version of the significant information developed.

Under separate cover, we are sending you a copy of a summary and compilation of Federal and State statutes relating to electronic surveillance published June 18, 1970, by the Legislative Reference Service of the Library of Congress.

We noted that your statement concerning the electronic battlefield in the Congressional Record of March 23, 1971, cited a total cost of $3.25 billion. The costs cited in our report are applicable only to the sensor and surveillance systems and related munitions developed under the auspices of the Defense Communications Planning Group for use by the military services in Southeast Asia. These costs do not include any costs applicable to tactical data systems currently under development by the military departments, such as TACFIRE, TSQ-73, and TOS, or any costs applicable to other intelligence-gathering devices, such as night observation devices developed or under development by the individual military departments.

Our observations and conclusions have not been discussed with officials of the Department of Defense. We plan no further distribution of this report unless copies are specifically requested, and then we shall distribute copies only after your agreement has been obtained or public announcement has been made by you concerning the contents of the report.

Sincerely yours,

Elmer B. Staats

Comptroller General
of the United States

The Honorable William Proxmire
Chairman, Joint Economic Committee
Congress of the United States

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D I G E S T

WHY THE REVIEW WAS MADE

At the Chairman's request, the General Accounting Office (GAO) has looked into the cost and effectiveness and certain other aspects of electronic sensor and surveillance systems in the Department of Defense (DOD). Sensors are electronic devices which detect the presence and movement of vehicles and personnel in vicinities where sensors are located.

To present an unclassified report, GAO has omitted certain detailed information such as

--operating statistics on sensor systems,
--capability of sensors and readout devices,
--location of monitoring facilities,
--available statistics on battle damage assessment, and
--design objectives and characteristics of future sensor systems.

GAO's observations and conclusions have not been discussed with officials of DOD.

The cost of the sensor and surveillance program for fiscal years 1967 through 1970 was $1.4 billion. An additional $219.7 million has been appropriated for fiscal year 1971. (See pp. 7 and 8.)

FINDINGS AND CONCLUSIONS

Management of sensor program

Until recently, the development, production, and procurement of sensor devices was centralized in the Defense Communications Planning Group (renamed the Defense Special Projects Group as of April 1, 1971). This Group was established by the Secretary of Defense in 1966 to manage development and deployment of an electronic sensor system to impede the flow of men and supplies from North Vietnam to South Vietnam. This initial mission was expanded in April 1968 to include a wide range of tactical applications of electronic sensors within South Vietnam. (See p. 6.)

The Planning Group was authorized to assign the tasks of designing and developing the equipment necessary to support its program to the military departments and other agencies. Funds for these tasks were

included in the budgets of the military departments but were controlled by the Planning Group. (See p. 6.)

The Planning Group was established hurriedly and was given an extensive program to accomplish in a very limited time. It appears that the organization succeeded in its efforts with a minimum of false starts and development of unworkable devices. (See p. 7.)

Domestic applications

The sensor and surveillance systems developed by the Planning Group would have limited applications in domestic law enforcement because of their bulk, size, and cost. These devices were developed primarily to withstand the rigors of a battlefield environment. They are used primarily in areas where any personnel or vehicle movement monitored is considered evidence of unfriendly activity. Sensors have been used by the U.S. Border Patrol to monitor selected portions of the border between the United States and Mexico. (See p. 10.)

Title III of the Omnibus Crime Control and Safe Streets Act of 1968 prohibits the manufacture, possession, sale, or transportation of devices used primarily for surreptitious interception if distribution through the mails or some aspect of interstate or foreign commerce is involved. The act does not prohibit their sale and distribution to domestic police forces and other units of local government engaged in legitimate activities. (See p. 10.)

Uses and effectiveness of sensors in Southeast Asia

Sensors have been used in Southeast Asia to

- --relieve troops from routine surveillance and guard duty,
- --monitor the movement of enemy troops and supplies in areas inaccessible to ground troops,
- --provide early warning of impending attacks by enemy troops on allied installations, and
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Officials of the military services have stated that the sensors and surveillance devices used in Southeast Asia have been effective combat tools. GAO found it impracticable to obtain a complete picture of the results of the sensor surveillance activity from a review of combat reports. (See p. 17.)

To objectively evaluate these systems from the standpoint of effectiveness, cost, and/or alternative methods is, in GAO's opinion, not feasible. (See p. 17.)

It is probable, however, that, through the use of these systems, some American lives have been saved; enemy personnel, vehicles, and supplies have been destroyed; and fewer troops have been required to accomplish combat missions. What is not clear is, how many lives have been saved, how much damage has been inflicted on the enemy, and how many fewer troops have been required. (See p. 17.)

Reliability of sensors

Sensor-aided surveillance systems have undergone a number of operational and technological changes in a relatively short period of time. A number of these changes have improved sensor performance and reliability. The newer sensors have been designed to be more able to withstand severe implant shock and changes in climatic conditions during and after implant. GAO has been informed that sensors are relatively immune to destruction from artillery and that generally a direct hit is required to render them inoperable. (See p. 18.)

From 1968 to 1970 unit costs of sensors in general have been reduced and their useful field lifetimes have been increased. The daily in-the-ground cost of a particular sensor, for example, has been reduced by 47 percent. (See p. 19.)

Use by foreign countries

Sensors have been provided to the Australian Forces in South Vietnam. The Australian Government reimburses the United States Government for the equipment provided. (See p. 20.)

Interest has been expressed by several foreign governments in sensor equipment. DOD is currently considering providing equipment similar to that used in Southeast Asia to some of these foreign governments. (See p. 20.)

Necessity for proceeding with future procurement and development of sensor systems

Purchase of newer sensors is continuing in order for DOD to provide the South Vietnamese with a detection and intelligence capability. It is impracticable, in GAO's opinion, to objectively evaluate the effectiveness of existing sensor systems. Because of this fact, it appears to be a question of policy that the executive branch and the Congress should decide on the need for newer sensors or development of more advanced models. (See p. 21.)

Tear Sheet

Manpower requirements for future sensor systems

Officials of the military departments have stated that no additional personnel will be required to operate and monitor sensor and surveillance systems in the future. Support units required to operate these systems will be provided from within the existing manpower available to the services. (See p. 24.)

Sensors apparently have increased the services' ability to monitor the movement of enemy forces and to make more efficient use of military personnel in combat areas. GAO has, however, found no indications that the use of these devices will result in any reductions in overall military manpower requirements. (See p. 24.)

Contents

ABBREVIATIONS

DOD	Department of Defense
DMZ	Demilitarized Zone
GAO	General Accounting Office

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CHAPTER 1

INTRODUCTION

The Chairman, Joint Economic Committee, in a letter dated August 20, 1970, requested the General Accounting Office to make an investigation of the cost, effectiveness, and certain other aspects of the electronic battlefield program. (See app. I.) To present an unclassified report, we have omitted certain detailed information such as operating statistics, capability of sensors and readout devices, location of monitoring facilities, available statistics on battle damage assessment, and design objectives and characteristics of future sensor systems. Our observations and conclusions have not been discussed with officials of the Department of Defense.

INTEGRATED BATTLEFIELD CONTROL SYSTEM

The term "electronic battlefield" has been used in the past to describe the sensor and surveillance program in Southeast Asia. It has also been confused with the Army's future plans for the Integrated Battlefield Control System in which sensors and surveillance devices will play a major role. These devices will provide the commander with current intelligence data which, when combined with information from other intelligence sources, will assist him in making command and control decisions. The total Integrated Battlefield Control System concept envisions a future Army built around an integrated system that exploits the advanced technology of communications, sensors, fire direction, and the required automatic data processing systems and equipment.

SENSOR AND SURVEILLANCE SYSTEMS

Sensors are electronic devices which are used to detect the presence and movement of vehicles and personnel in the vicinities where sensors are implanted. A sensor-aided combat surveillance system consists basically of (1) the sensors, (2) a communications link (usually radio) from the sensor to a readout device, (3) the readout device which receives sensor transmissions, and (4) the display and processing equipment which assist in counting the sensor activations and in analyzing the data to determine the direction and rate of movement of the detected objects.

CHAPTER 2

MANAGEMENT OF SENSOR PROGRAM

ESTABLISHMENT OF THE DEFENSE COMMUNICATIONS PLANNING GROUP

Up to the present time, the management of the development, production, and procurement of sensor devices has been centralized in the Defense Communications Planning Group (redesignated the Defense Special Projects Group as of April 1, 1971). This Group was established by the Secretary of Defense in September 1966 to manage the development and deployment of an anti-infiltration system for Southeast Asia that would impede the flow of men and supplies from North Vietnam to South Vietnam. This initial mission was further expanded in April 1968 to include a wide range of tactical applications of electronic sensors within South Vietnam.

The Director of the Planning Group was authorized direct contact with the Joint Chiefs of Staff, the military departments, and theater commanders. He was instructed to report directly to the Secretary of Defense through the Director of Defense Research and Engineering for broad policy and funding decisions. He was also given the responsibility and authority, within broad DOD guidance, to make decisions pertaining to concept formulation, design, development, test, requirements analysis, procurement, and distribution of equipment.

In addition, the Secretary of Defense authorized the Director of the Planning Group to utilize the resources of the military departments and other agencies for the accomplishment of specific tasks requiring facilities and manpower resources not available within the Planning Group. These tasks included engineering design and development of sensors and related equipment and munitions, as well as the testing, production management, shipping and continued logistic support of these items. Funds to accomplish these tasks were included in the budgets of the military departments; however, they were controlled and released only upon authorization of the Planning Group.

CONTROL AND COST OF THE SENSOR PROGRAM

To ensure system integrity, the Planning Group retained management responsibility for planning, system engineering, establishment of overall schedules, evaluation and analysis of theater requirements, financial management, and identification of specific tasks to be assigned to the military departments and other agencies. (This management responsibility of sensor systems for Southeast Asia will be terminated by June 30, 1971. See p. 22.) Instructions issued to those organizations assisting in the program contained specific guidance on technical configuration, quantities required, target schedules, logistics support, funding designations, and other instructions needed to direct the effort within the parameters of the overall program.

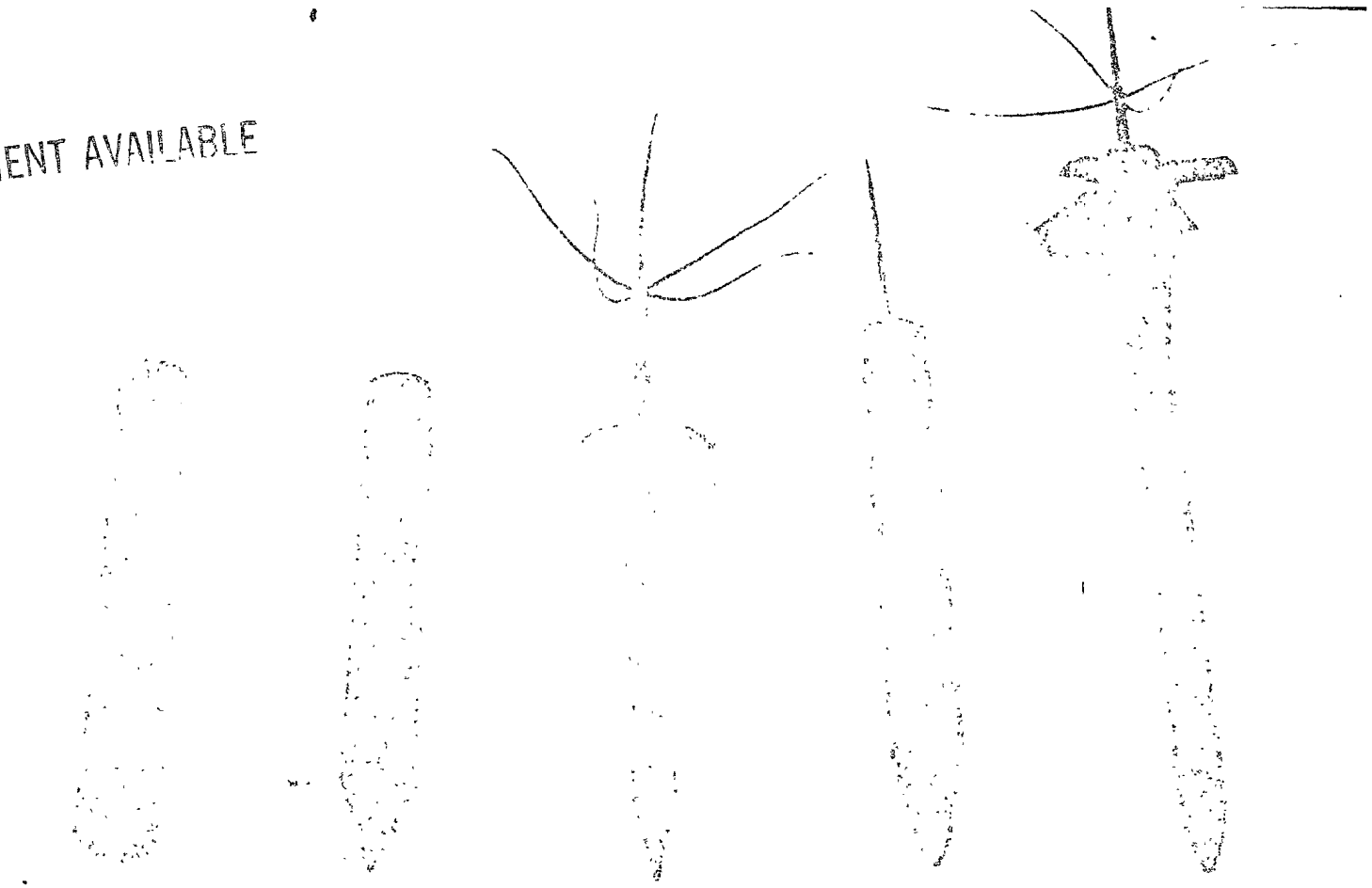
The design, development, and production of the required equipment had to be expedited because of the urgency of this program. Generally, time was not spent restudying, redesigning, or repackaging an item to determine whether a better model could be produced. As soon as an item under development demonstrated that it would work, it was put into production.

Equipment was designed only to withstand environmental conditions existing in Southeast Asia. These limited environmental requirements contributed to a reduction in the development cycle for the introduction of new equipment from about 6 years to between 15 and 21 months for most items.

Since its inception the Planning Group has sponsored the development of several different types of sensors, associated ground and airborne relays, other ancillary equipment, and the development of related special antipersonnel and antivehicular munitions. The latter were designed to protect sensors and to interdict enemy troops and supplies infiltrating on foot and in vehicles. Illustrations of several air-delivered sensors used in Southeast Asia are on page 9.

The Planning Group was established hurriedly, and it was given an extensive program to accomplish in a very limited time. It appears that, under these circumstances, the organization succeeded in its efforts with a minimum of false starts and development of unworkable devices. The cost of

the Planning Group's program for fiscal year 1967 through 1970 was about $1.4 billion. An additional $219.7 million has been appropriated for fiscal year 1971, for a total estimated program cost from inception through fiscal year 1971 of about $1.6 billion. A breakdown of these costs by military service and type of appropriation is shown in exhibit A.



ACOUBUOY	SPIKE ACOUBUOY	ADSID	FADSID	ACOUSID
(ACCOUSTIC INTRUSION DETECTOR)	(ACOUSTIC INTRUSION DETECTOR)	(AIR DELIVERED SEISMIC INTRUSION DETECTOR)	(FIGHTER AIR DELIVERED SEISMIC INTRUSION DETECTOR)	(ACOUSTIC/SEISMIC INTRUSION DETECTOR)
LEVEL DELIVERY/635 MPH HUNG IN FOLIAGE	LEVEL DELIVERY/635 MPH BURIED IN GROUND	LEVEL DELIVERY/635 MPH BURIED IN GROUND	LEVEL DELIVERY/635 MPH BURIED IN GROUND	LEVEL DELIVERY/635 MPH BURIED IN GROUND

Approximate scale - 1 inch = 1 foot

CHAPTER 3

POTENTIAL UTILIZATION OF SENSORS BY DOMESTIC LAW ENFORCEMENT AGENCIES

The sensor and surveillance systems developed by the Defense Communications Planning Group appears to offer only limited opportunities for use by domestic law enforcement agencies because of their bulk, size, and cost. These devices were developed primarily to withstand the rigors of a battlefield environment.

The sensing devices developed by the Planning Group have application primarily in areas where any personnel or vehicle movement monitored is considered evidence of unfriendly activity. The U.S. Border Patrol has been using these devices to monitor selected portions of the border between Mexico and the United States and has been able to increase its apprehension of persons attempting to enter the country illegally.

Title III of the Omnibus Crime Control and Safe Streets Act of 1968 (18 U.S.C. 2510-2520) prohibits the manufacture, possession, sale, or transportation of any mechanical device used primarily for the purpose of surreptitious interception if their distribution involves the mails or some aspect of interstate or foreign commerce. However, the act restricts itself from applying to work done by officers, agents, employees, or persons under contract with the United States, a State, or a political subdivision of a State. Therefore, it does not prohibit distribution and sale of sensor devices to domestic police forces and other units of local government engaged in legitimate activities but does preclude such sale to other groups.

The Legislative Reference Service of the Library of Congress has prepared a compilation of the Federal and State statutes relating to electronic surveillance. This compilation, entitled "Wire Tapping and Eavesdropping," was published on June 18, 1970.

CHAPTER 4

OPERATIONAL USE AND EFFECTIVENESS OF SENSORS IN SOUTHEAST ASIA

The original mission of the Defense Communications Planning Group was to develop an infiltration and interdiction capability to impede the flow of vehicles and personnel into South Vietnam. The program was to include an air-supported, anti-infiltration system in Laos and a barrier system extending along the Demilitarized Zone (DMZ) from the Gulf of Tonkin through the road and trail network in Laos used by the infiltrators.

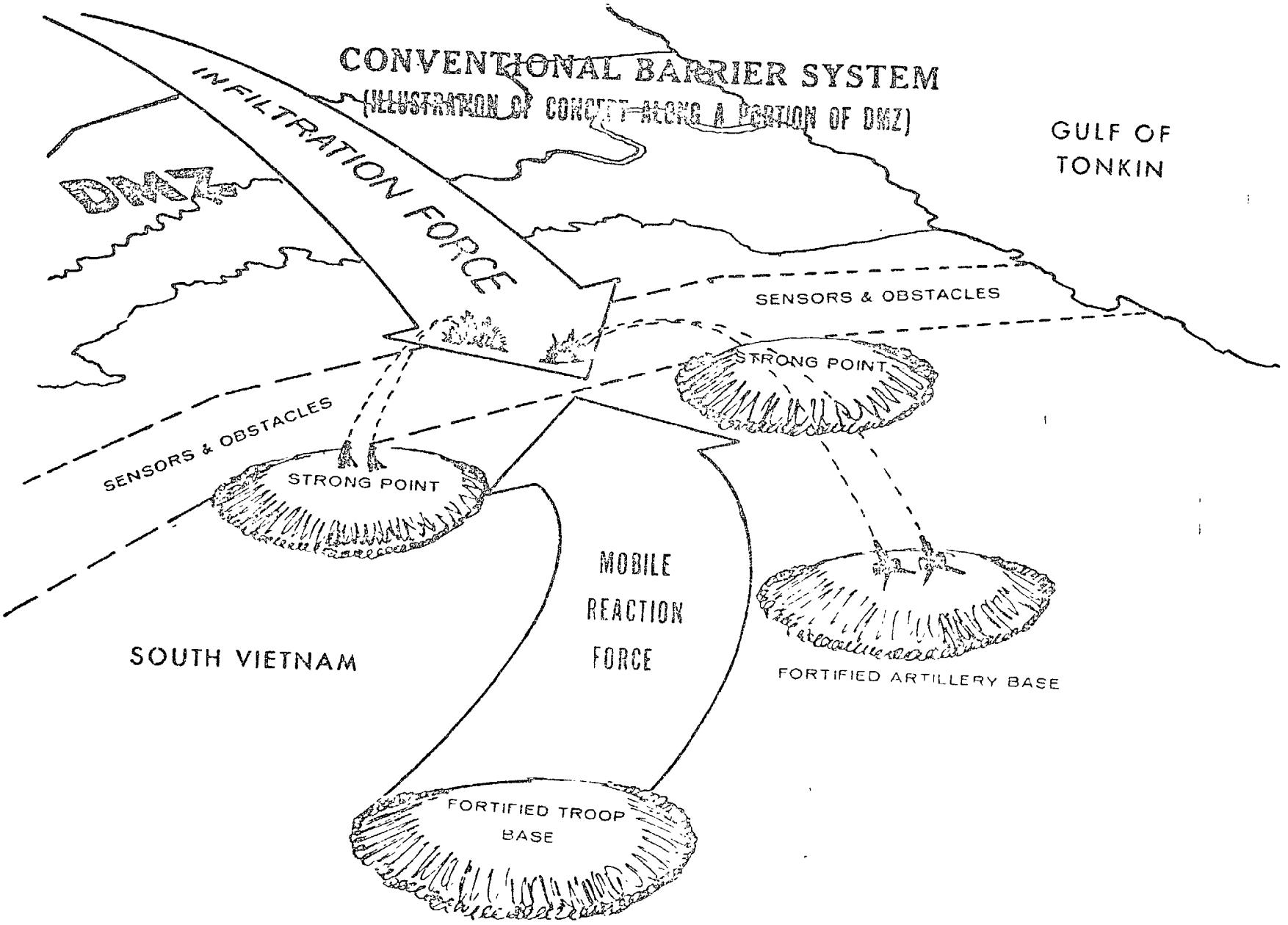
The conventional barrier system, often called the "McNamara Wall," was named "Duel Blade." The air-supported, anti-infiltration system was to consist of antivehicular and antipersonnel subsystems, collectively referred to as "Igloo White." The Planning Group's initial mission was expanded in April 1968 to include the use of electronic sensors in a wide range of tactical operations against the enemy within South Vietnam. This operation is known as "Duffel Bag."

The Duel Blade, Igloo White, and Duffel Bag operations are discussed below.

DUEL BLADE

Duel Blade was to encompass cleared areas 100 to 150 meters in depth and approximately 27 kilometers long. (See illustration on p. 12.) The sides of the cleared areas were to be enclosed with barbed wire, and the space between the wire obstacles was to be planted with antipersonnel mines. A 10-meter center strip was to contain sensors which would be monitored at the various strong points and forward operating bases.

The sensors and other equipment necessary to support the Duel Blade operation were delivered to the theater in 1967. After an area 600 meters wide and 13 kilometers long had been cleared, construction was terminated in June 1967 because of an adverse tactical situation. The fixed-barrier


CONVENTIONAL BARRIER SYSTEM
(ILLUSTRATION OF CONCEPT ALONG A PORTION OF DMZ)
DMZ
INFILTRATION FORCE
GULF OF TONKIN
SENSORS & OBSTACLES
STRONG POINT
SENSORS & OBSTACLES
STRONG POINT
MOBILE REACTION FORCE
SOUTH VIETNAM
FORTIFIED ARTILLERY BASE
FORTIFIED TROOP BASE

concept was then abandoned in favor of tactics which called for the use of mobile, quick-reacting combat units to respond to North Vietnamese infiltration in the area of the DMZ.

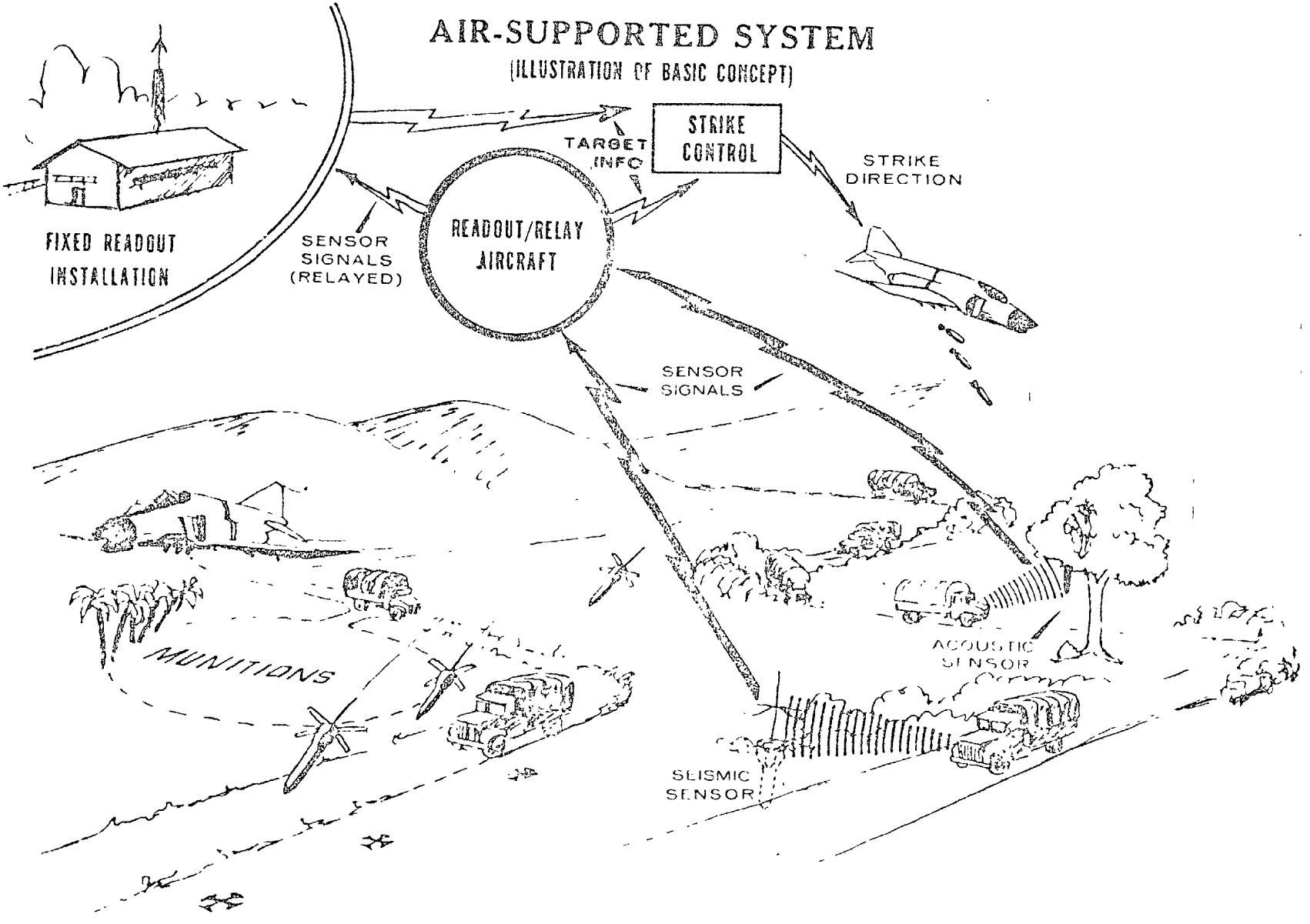
Selected operating bases of the original Duel Blade concept are currently functioning, and some hand-implanted sensors are being used in the eastern portion of the DMZ. In the western portion, air-delivered sensors have been implanted, and the sensor transmissions are being relayed by aircraft to a monitoring facility at Quang Tri.

IGLOO WHITE

The Igloo White system (utilized by the Air Force), as originally conceived, was to consist of both antivehicular and antipersonnel subsystems. The antivehicular subsystem was to encompass the area in Laos from the Mu Gia pass south to Tchepone and was to include 500 kilometers of roads. The antipersonnel subsystem was to encompass the trails crossing the western end of the DMZ and included the Ho Chi Minh trail in Laos. The antipersonnel subsystem, however, was never implemented because of the diversion of resources to assist in the defense of Khe Sanh in January 1968 and, subsequently, to other applications in South Vietnam.

The objective of the antivehicular subsystem is to detect and provide intelligence information for use in the interdiction of enemy truck traffic along specific road networks, in order to stop or reduce the flow of trucks carrying troops and supplies into South Vietnam. (See illustration on p. 14 for a diagram of the concept of this system.) Both acoustic and seismic sensors are used in the antivehicular subsystem and are implanted primarily by F-4D jet aircraft assigned to the Igloo White delivery mission. Selected incapacitating antipersonnel mines are also air delivered by the F-4's to cause casualties among personnel in truck parks or storage areas and to protect sensors from retrieval by the enemy.

Sensors are activated by vehicles passing within the detection range. The sensor transmissions are then transmitted to the Infiltration Surveillance Center located in Thailand where they are analyzed by intelligence specialists.


AIR-SUPPORTED SYSTEM
(ILLUSTRATION OF BASIC CONCEPT)
FIXED READOUT INSTALLATION
SENSOR SIGNALS (RELAYED)
READOUT/RELAY AIRCRAFT
TARGET INFO
STRIKE CONTROL
STRIKE DIRECTION
SENSOR SIGNALS
MUNITIONS
ACOUSTIC SENSOR
SEISMIC SENSOR

Targets identified by the Center are reported to the air control system, which controls the strike aircraft. Normally, the forward air control aircraft are then directed to the target for visual confirmation and for direction of strike aircraft.

In addition to identifying targets for immediate strikes, the Center uses sensor data to establish patterns of enemy activity. These patterns indicate the location of truck parks and storage areas which are potential targets for later air strikes.

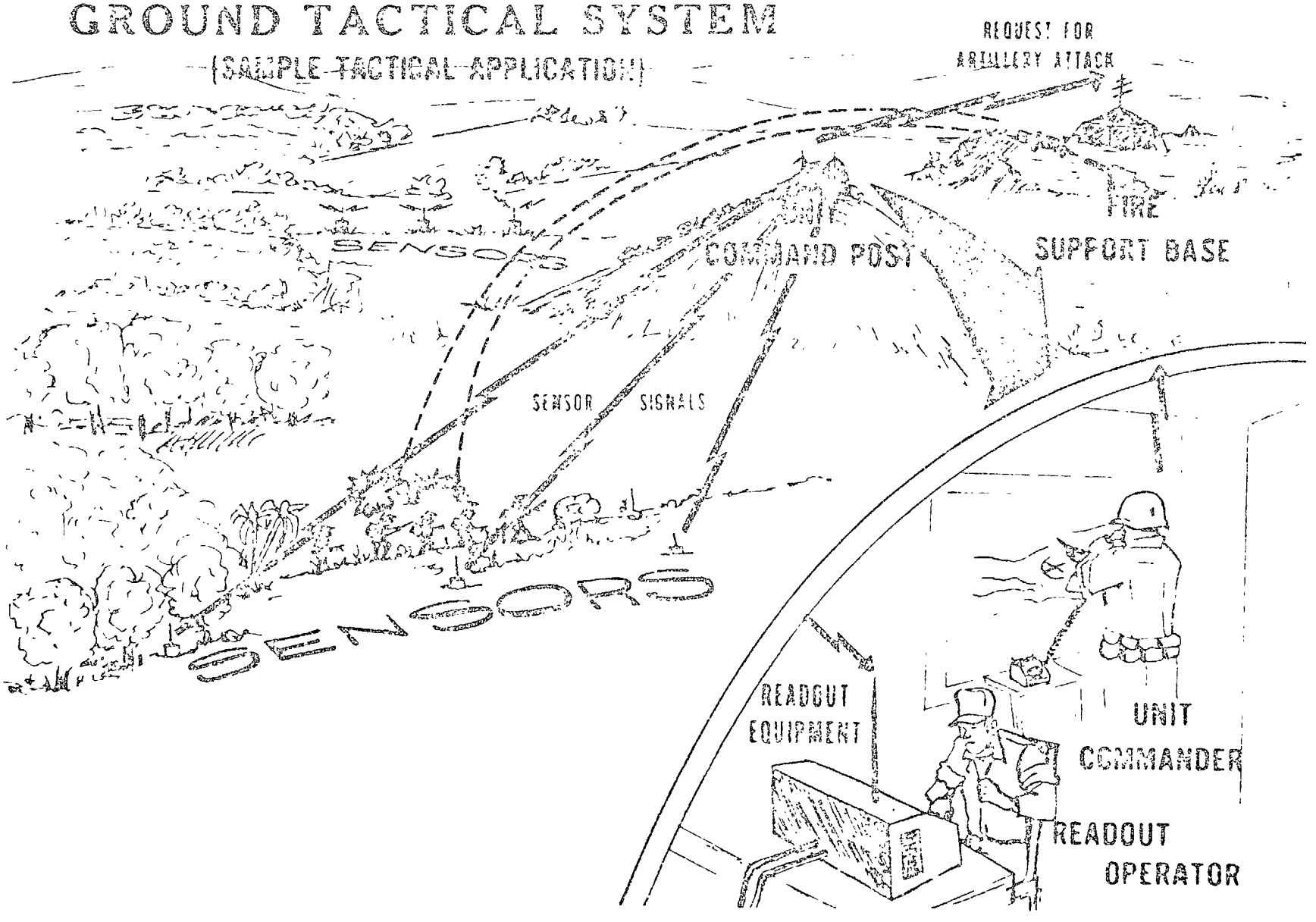
To complement the use of sensors in the Igloo White System, a specialized munitions package was developed. After roads are closed by bombing, mines are dropped along approaches to the destroyed portions of the roads to deter repair by heavy equipment and to prevent bypass. The concentration of enemy truck traffic in the area then creates targets for air attack.

DUFFEL BAG

In January 1968 the Commander of U.S. Forces in South Vietnam directed that the sensors and related equipment earmarked for the Igloo White antipersonnel subsystem be used in the defense of Khe Sanh. These sensors were dropped from aircraft among the North Vietnamese troops and along the trails and routes leading to Khe Sanh. The data derived from the sensors, combined with information received from other intelligence-gathering devices, such as night observation systems and aerial photography, provided the basis for directing artillery fire and air strikes against the enemy.

The reportedly successful use of sensors in the defense of Khe Sanh indicated that they could be used in support of ground combat operations. As a result the Planning Group was directed by the Deputy Secretary of Defense in April 1968 to support plans to use sensors in a wide range of tactical operations against the enemy within South Vietnam.

A sample of the use of sensors in the ground tactical system is illustrated on page 16.


GROUND TACTICAL SYSTEM
(SAMPLE TACTICAL APPLICATION)
REQUEST FOR
ARTILLERY ATTACK
FIRE
SUPPORT BASE
COMMAND POST
SENSORS
SENSOR SIGNALS
SENSORS
READOUT
EQUIPMENT
UNIT
COMMANDER
READOUT
OPERATOR

The acoustic and seismic sensors initially used in Duffel Bag were those designed for delivery by fixed-wing aircraft in the Igloo White system. These sensors proved to be too heavy, too large, and too costly for use by ground forces. As experience was acquired, smaller and lighter sensors more suitable for hand emplacement by ground troops were developed. In addition, readout equipment for use in a ground environment was developed to receive data from the sensors.

EFFECTIVENESS OF SENSOR SYSTEMS IN SOUTHEAST ASIA

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Officials of the military services have stated that the sensors and surveillance devices used in Southeast Asia have been effective combat tools. However, to objectively evaluate these systems from the standpoint of effectiveness, cost and/or alternative methods is, in our opinion, not feasible. It is probable that, through the use of these systems, some American lives have been saved; enemy personnel, vehicles, and supplies have been destroyed; and fewer troops have been needed to accomplish combat missions. What is not clear is how many lives have been saved, how much damage has been inflicted on the enemy, and how many fewer troops have been required as a direct result of the use of sensor surveillance systems.

In reviewing combat reports, we found that it was impracticable to obtain a complete picture of the results of the sensor surveillance activities. When a series of sensor activations results in artillery fire, aircraft strike, etc., there must be almost instantaneous battle damage assessment if a commander is to have positive confirmation of the results of the action taken. Frequently this is impossible because weather conditions are not suitable; troops

for performing the assessment are lacking; or the area is not secure, and sending troops in would expose them to danger unnecessarily. The reports did indicate, however, that some positive results were being obtained.

The estimated costs for sensor and surveillance systems and associated munitions (see p. 8) do not include military personnel costs. Officials of the Military Assistance Command and the 7th Air Force estimated that about 2,325 American military personnel were required in the various activities and organizations directly related to the operations of the sensor programs in Southeast Asia as of October 1, 1970. This estimate included personnel involved in the managing, maintaining, implanting, and monitoring of sensors and the training of personnel in Southeast Asia. We were informed that no additional troops were provided to the theater commanders in Vietnam for implanting and monitoring sensors.

RELIABILITY OF SENSORS

The equipment used in the Southeast Asia sensor-aided surveillance systems has undergone several operational and technological changes in a relatively short period of time. A number of these changes improved sensor performance and reliability. When the number of sensors needed is being computed, a relatively small quantity is added because some sensors do not operate after being implanted. This quantity was small in relation to the total Southeast Asia sensor requirements and indicated an apparently high level of reliability.

The newer phase III sensors have been designed to be more able to withstand severe implant shock, temperature, humidity, and rainfall during and after implant. In addition, officials of the Planning Group and the military departments informed us that the sensors are relatively immune to destruction from artillery fire. They stated that generally it requires a direct hit to render the sensors inoperable.

Not only have the capabilities of sensors been improved, but their unit costs have been reduced and their useful field lifetimes have been increased. By increasing the useful life, the requirement for new sensors decreases and the operating cost of sensors in the ground decreases. For example, in 1968 a hand-emplaced seismic detector cost $1,165 and had a useful lifetime of 45 days. Its cost per sensor-day in the ground was about $26. The unit production cost of an improved model of this sensor in 1969-70 was $825, and it had a life of 60 days. This resulted in a cost per sensor-day of about $14, or a reduction of 47 percent.

The following table illustrates the reduction in unit operating costs achieved during the period 1968 to 1970. The two types listed account for approximately 67 percent of the sensors in use in Southeast Asia at the time of our review.

Hand-Emplaced Seismic Sensors

Sensor	Unit cost per day 1968	1970
Miniature Seismic Intrusion Detector	$25.90	$13.75
Ground Emplaced Seismic Intrusion Detector	15.60	7.80

Air-Delivered Seismic Sensors

Sensor	Unit cost per day 1968	1970
Helicopter-Delivered Seismic Intrusion Detector	$70.00	$15.70
Air Delivered Seismic Intrusion Detector	32.20	16.10

UTILIZATION BY FOREIGN COUNTRIES

Sensors have been provided to the Australian Forces in South Vietnam by the Commander, Military Assistance Command, Vietnam. The Australian Government reimburses the United States Government for the sensors and related equipment provided.

Canada, The United Kingdom, and other NATO countries have been briefed by the Planning Group on the sensor and surveillance equipment developed and their tactical applications. Because of the interest expressed by several foreign governments in this equipment, DOD is currently considering selling equipment similar to that used in Southeast Asia to some of these governments. At the time of our inquiry, a policy had not been established regarding restrictions on the use of sensors that might be sold to other countries. The identification of the governments being considered and the intended use of the devices by these governments are classified information.

CHAPTER 5

NEED FOR FUTURE SENSOR AND SURVEILLANCE SYSTEMS

NECESSITY FOR PROCEEDING WITH FUTURE PROCUREMENT AND DEVELOPMENT OF SENSOR SYSTEMS

As pointed out previously (see p. 17), we cannot objectively evaluate the effectiveness of sensor devices. Because of this fact, the need for continued procurement of phase III sensors and the development of more advanced models for the future appears to be a question of policy for the executive branch and the Congress to decide. Currently procurement of newer sensors is continuing in order for DOD to provide the South Vietnamese forces with a detection and intelligence capability. In addition to their use in Vietnam, the phase III sensor systems also may have applications in other areas of the world. The use of sensors by the Vietnamese and the need for procurement of sensor systems in the future are discussed below.

Use of sensors by South Vietnamese forces

In March 1969 the Deputy Secretary of Defense directed that a plan be developed to train the South Vietnamese in the use of sensors as part of the Vietnamization Program. Training of the Vietnamese began in August 1969 and is continuing. Special training teams are assigned in each division, and a central training course is conducted at Vung Tau, South Vietnam.

The South Vietnamese have employed sensors to perform several missions since the Vietnamization Program has been established. These missions include (1) interdiction of enemy infiltration and resupply routes, (2) surveillance over areas otherwise requiring reconnaissance by ground troops (economy of force), (3) surveillance of known enemy mortar and rocket-firing sites, (4) base camp and fire support base defense, and (5) collection of intelligence. At the time of our review, the South Vietnamese forces had assumed responsibility for emplacing and monitoring about 45 percent of the sensors used in South Vietnam. DOD plans to continue to provide sensors to the South Vietnamese under the Vietnamization Program.

Management and cost of sensor systems in the future

On August 8, 1968, the Director, Defense Research and Engineering, formed a committee composed of senior scientific and military personnel to evaluate the present and future programs of the Planning Group. During its investigation, this committee recognized that improved sensor systems could be applied in other areas of the world and in a range of battlefield situations beyond those encountered in Southeast Asia.

As a result of the apparent successes achieved in the use of sensors and surveillance devices in Southeast Asia, the Army, Navy, and Air Force have each established organizations to study and manage future uses of sensor systems. These staffs are to be responsible for exploiting the existing sensor technology and for developing new technology, equipment, and operational concepts which can be used for worldwide combat surveillance and target acquisition missions in any type of conflict.

On September 26, 1970, the Deputy Secretary of Defense directed that full responsibility for operational sensor systems in Southeast Asia be transferred to the Army and Air Force by June 30, 1971. Currently, the Planning Group is coordinating the transfer of these operational systems with the Departments of the Army and Air Force.

On December 12, 1970, the Deputy Secretary of Defense assigned to the Director, Defense Communications Planning Group, the mission of coordinating the future sensor programs of each of the military departments. At the time of our review, procedures for accomplishing this new mission had not been established.

During our inquiry Air Force officials informed us that they were proposing a 5-year development program to improve the Air Force ground sensor surveillance system. The total cost of this program will be about $20 million over the 5-year period. At the time of our review, the Army, Navy, and Marine Corps were in the process of definitizing their long-range development programs. The specific amounts of funds being proposed for these programs are classified.

We were informed that no estimated procurement costs were available for future sensor systems beyond those in the proposed budget for fiscal year 1972. Procurement funds programmed for future sensor systems during the next 10 years will depend on the results of each service's research and development programs and the number and types of systems selected to be added to the inventory. At the time of our review, specific quantitative requirements for future sensor systems had not been developed.

CHAPTER 6

MANPOWER REQUIREMENT FOR FUTURE SENSOR SYSTEMS

We have been informed by officials of the military departments that no additional personnel will be required to operate and monitor sensor and surveillance systems in the future. Support units required to operate these systems will be provided from within the existing manpower available to the services.

Currently the Navy has a "Sensor Application Team" on each coast with its Amphibious Forces to provide the expertise for other Navy organizations less knowledgeable in sensor uses. The Marine Corps has programmed three sensor support units, one per division. These units are scheduled to become operational on July 1, 1971. Each unit will consist of one officer and 39 enlisted men. At the time of our review, the Army and Air Force had not identified the type of support units that will be required to operate and monitor sensor systems.

The use of sensors has apparently increased the ability to monitor the movement of enemy forces and to make more efficient use of military personnel in combat areas. We have, however, found no indications that the use of these devices will result in any reductions in overall military manpower requirements.

Each of the military services have added courses in the concepts of employment of sensor systems to the curriculum of their existing service schools. In addition, the Army has added to the curriculum of its school at Fort Huachuca, Arizona, new courses of instruction on the installment and use of specific sensor systems. The Marine Corps also sends its personnel to Fort Huachuca for training in the use of specific sensor systems. The Air Force conducts its specialized training on the use of sensors at Eglin Air Force Base, Florida. The Navy trains its personnel in the use of sensors for riverine and special warfare applications at Mare Island, Vallejo, California.

The Army has established Project MASSTER (Mobile Army Sensor System Test, Evaluation and Review) at Fort Hood, Texas, which is to be the Army's test facility for intelligence-gathering systems and devices under development and the related military doctrines, organizations, and tactical concepts for the Army's future use of these systems and devices. All testing at MASSTER is performed from the user's or soldier's point of view. The intelligence-gathering-type systems and devices tested at MASSTER include devices employing the unattended ground sensors discussed in this report, as well as devices and systems employing low-light-level television; radars; optics; chemical, aural, radioactive, magnetic, and biochemical detection; thermal imagery; and image intensification. The systems tested successfully at Project MASSTER will eventually become a part of the Army's Integrated Battlefield Control System.

Currently, Project MASSTER conducts three types of tests.

1. Material field test--field testing of equipment that has been developed or is being developed in which a high level of confidence exists.

2. System field test--field testing of various organizational concepts involving battalion and larger forces.

3. Material-system field test--field testing of various arrangements of equipment and personnel (organizational concepts) at platoon or company echelons to determine optimum organizational structure and equipment requirements.

This project had 282 personnel assigned to it in September 1970 and is expected to have more than 500 assigned during 1971.

EXHIBITS

EXHIBIT A

ESTIMATED DEFENSE COMMUNICATIONS PLANNING GROUP

PROGRAM COST FROM INCEPTION THROUGH FISCAL YEAR 1971

Appropriation	Fiscal year 1967	1968	1969	1970	1971	Total Program
	(millions)					
ARMY	$165.6	$222.4	$160.7	$ 52.2	$ 68.3	$ 669.2
Operations and maintenance	-	-	7.5	7.6	9.3	24.4
Strong point/obstacle maintenance	-	-	.9	-	.3	1.2
Spares, repair, school	-	-	.5	1.3	4.2	6.0
Transportation	-	-	6.1	6.3	4.8	17.2
Procurement of equipment and missiles	144.9	192.4	131.4	35.4	53.0	557.1
Communications and electronics	-	4.1	32.6	12.3	26.7	76.0
Munitions	77.1	138.2	-	-	-	215.3
Production base support	62.0	5.6	-	-	-	67.6
Boobytrap seismics	-	2.7	-	-	-	2.7
Sensors	5.8	41.8	98.8	22.8	26.3	195.5
Research, development, test, and evaluation	20.7	30.0	21.8	9.2	6.0	87.7
NAVY	$ 65.4	$ 40.6	$ 24.4	$ 22.0	$ 17.9	$ 170.3
Operations and maintenance	5.6	11.6	1.7	2.2	2.2	23.3
Strong point/obstacle maintenance	2.3	7.0	-	-	-	9.3
OP-2E aircraft detachment	3.3	2.0	-	-	-	5.3
Special operations group team supp[illegible], other	-	2.6	1.7	2.2	2.2	8.7
Procurement	43.8	14.3	13.0	13.3	10.7	95.1
Aircraft modification	16.6	2.4	1.0	.1	.1	20.4
Sensor-monitoring equipment	7.9	-	-	-	-	7.9
Acoustic sensors and related items	9.2	9.7	12.0	13.2	10.6	54.7
Strong point/obstacle material	9.9	2.2	-	-	-	12.1
Research, development, test, and evaluation	16.0	14.7	9.7	6.5	5.0	51.9
AIR FORCE	$ 91.7	$138.6	$210.1	$174.3	$117.8	$ 682.5
Operations and maintenance	3.5	21.6	32.9	43.2	40.0	141.2
EC-121/F-4 aircraft	3.4	15.8	20.8	25.2	20.5	85.7
Infiltration Surveillance Center, Deployable Automatic Relay Terminal, Sensor Reporting Post	-	4.2	10.6	11.1	11.1	37.0
Long-Range Navigation, CH-3 helicopter, POT LID test site	-	.5	.5	1.2	1.1	3.3
Drones	-	-	.4	2.6	4.3	7.3
Transportation and other	.1	1.1	.6	3.1	3.0	7.9
Procurement	61.5	93.5	157.2	68.6	63.6	444.6
Aircraft modification	33.6	29.7	16.6	8.5	14.0	102.4
Spares and repair parts	-	.7	7.9	-	-	8.6
Classified drones	-	7.0	29.6	12.0	4.0	52.6
Communications and electronics equipment	7.2	5.7	44.4	8.9	22.0	88.2
Dragontooth mines, Cluster bomb unit 28/37	-	9.3	-	-	-	9.3
Wide area antipersonnel mine, Cluster bomb unit 34/42	2.0	17.0	40.6	30.0	-	89.6
M-36 Cluster bomb	-	-	12.0	9.2	10.0	31.2
Other munitions	-	5.0	6.1	-	13.8	24.9
Tactical Fighter Dispenser, SUU-41 Aircraft mine dispenser	1.7	1.0	-	-	-	2.7
SUU-42 Aircraft sensor dispenser	17.0	18.1	-	-	-	35.1
Military construction program	17.7	-	-	-	-	17.7
Research, development, test, and evaluation	9.0	23.5	20.0	12.5	14.0	79.0
DEFENSE COMMUNICATIONS PLANNING GROUP	$ 7.3	$ 22.4	$ 16.5	$ 14.5	$ 15.7	$ 76.4
Operations and maintenance, Defense agencies	1.4	1.8	1.5	1.5	1.7	7.9
Research, development, test, and evaluation, Defense agencies	5.9	20.6	15.0	13.0	14.0	68.5
TOTAL PROGRAM COST	$330.0	$424.0	$411.7	$213.0	$219.7	$1,598.4

APPENDIX

Congress of the United States

JOINT ECONOMIC COMMITTEE

(CREATED PURSUANT TO SEC. 5(a) OF PUBLIC LAW 304, 79TH CONGRESS)

WASHINGTON, D.C. 20510

August 20, 1970

Mr. Elmer Staats
Comptroller General of the United States
General Accounting Office
Washington, D. C.

Dear Mr. Staats:

Recently I have been raising questions and requesting information about a new program known as the electronic or integrated battlefield. This system is composed of various sensors backed by computers which are designed to provide field commanders with general battlefield intelligence. In the course of my inquiries about the program, a number of questions have been raised which deserve detailed study before the Congress proceeds with its further development. Therefore, I would like to request that you undertake an investigation of cost and effectiveness of the program centered around the following questions:

1. To what extent have the three branches of the armed forces coordinated their efforts in the development of electronic battlefield devices and what action, if any, has been taken to avoid duplication?

2. How effective have these devices been in combat in Vietnam? Have they contributed to improved combat capability and how reliable have they proven in actual combat?

3. Is it necessary, in view of the Vietnamization program, to proceed with the procurement of so-called phase III sensors and with the development of more advanced sensors for 1972 and 1975?

4. Does the Department of Defense plan to make these devices and related equipment available to foreign countries under the Foreign Military Sales Act or other foreign assistance programs, and if so, what restrictions, if any, will be placed on their use?

5. What kind of support units will be necessary to operate and monitor such devices and to what extent will the use of such devices permit a reduction in military manpower?

6. What are the potential applications of these devices in domestic law enforcement? What restrictions, if any, could be placed on their distribution and sale to domestic police forces and other groups?

7. What long range plans, if any, does the Department of Defense have concerning the development and procurement of these devices during the next ten years? What are the project costs of any long range programs?

I do not accept classified information and I therefore ask that your report to me be unclassified. I would hope that you could have this report completed by March 31, 1971.

If you have any questions, please do not hesitate to call me. Thank you for your cooperation in this matter.

Sincerely,

William Proxmire, U.S.S.

WP:rra