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USIB-D-33.6/8
Final - USIB Approved
5 July 1960

UNITED STATES INTELLIGENCE BOARD

MEMORANDUM FOR THE UNITED STATES INTELLIGENCE BOARD

SUBJECT : Intelligence Requirements for Satellite Reconnaissance Systems of which SAMOS is an Example

REFERENCES : USIB-M-106, item 6
USIB-M-105, item 6
USIB-D-33.6/7, 27 June

Attached for information and appropriate action is a copy of "Intelligence Requirements for Satellite Reconnaissance Systems of Which Samos Is an Example," as approved by the United States Intelligence Board on 5 July. We are also forwarding a copy of the Board-approved letter through which Mr. Dulles subsequently transmitted these requirements to the Secretary of Defense.

JOHN HEIRES
Executive Secretary

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UNITED STATES INTELLIGENCE BOARD

Office of the Chairman

9 July 1960

The Honorable Thomas S. Gates
The Secretary of Defense
Department of Defense
Washington, D. C.

Dear Mr. Secretary:

The United States Intelligence Board has considered two major areas relating to the development and employment of the SAMOS reconnaissance system. The first of these areas is the consolidation of the general intelligence requirements of the various departments, services and agencies of the United States to serve as the overall basis for the SAMOS system development. The second of these areas is to establish priorities for the system developers and for the employment of the SAMOS system in the development stage during the 1961-1962 time period. These requirements and priorities are set forth in the attached paper entitled: "Intelligence Requirements for Satellite Reconnaissance Systems of which SAMOS is an Example".

The fulfillment of these requirements as expressed is considered critical to the security of the United States; this is also evidenced by the national priority established for SAMOS.

Sincerely,

/s/
Allen W. Dulles
Chairman

Attachment

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INTELLIGENCE REQUIREMENTS FOR SATELLITE RECONNAISSANCE SYSTEMS OF WHICH SAMOS IS AN EXAMPLE

1. The United States has, and will continue to have for the foreseeable future, a high priority requirement for photographic and electronic reconnaissance of the Soviet Union and other denied areas. In theory, it is feasible to conduct a large amount of this reconnaissance in a number of different ways, but this feasibility will be affected from time to time by technical and political considerations that might make it difficult or impossible to use all of the theoretically feasible means. Although a satellite reconnaissance system has not yet been operationally demonstrated and is not likely in the near term to produce the quality of information that can be obtained by other systems, on balance, it should be able to perform a number of reconnaissance tasks better than other systems and should be able to produce useful information on the great majority of intelligence questions against which reconnaissance systems might be employed. A satellite reconnaissance system might also be less affected by some of the political considerations affecting other reconnaissance systems. The U. S. Intelligence Board considers it essential, therefore, that the United States develop and maintain an operational satellite reconnaissance system with a wide range of capabilities.

2. The intelligence situation facing the United States will continue to be highly dynamic, influenced both by changes in Soviet capabilities and

our own intelligence assets, making it impossible to specify at any one time the precise nature of the satellite reconnaissance system that will be required in the distant future. As stated in paragraph 1 above, however, we are sure that there will exist an urgent requirement for a satellite reconnaissance system throughout the foreseeable future.

3. The photographic system must be capable of obtaining coverage of denied areas at object resolutions of approximately 20 feet, 5 feet, and ultimately 1 foot on a side. However, the 100 feet on a side programmed for R&D design objectives will be utilized and exploited for intelligence purposes to the maximum extent possible. (See Annex "A" for examples of objects that can be identified at these resolutions.) The system must provide for repeat coverage of targets at these various resolutions, depending on the nature of the target and the intelligence problem involved. The periodicity of this repeat coverage will also depend on the nature of the target and the intelligence situation, as well as on other sources that can be brought to bear on it. The anticipated frequency can be predicted more precisely as the intelligence situation develops.

4. It is essential that the U. S. have access to information derived from electronic emissions inside of denied areas that, in the present state of the art, can be collected only by electronic reconnaissance over those denied areas. A satellite electronic reconnaissance vehicle is likely to be of great value in this reconnaissance. It is essential that such an electronic reconnaissance vehicle have a wide range of capabilities in order that it may fulfill the requirements expressed in the

National ELINT Requirements List that are appropriate to collection by a satellite. The characteristics required of these vehicles are described in Annex "B". Unfortunately, however, in the present state of the art electronic art, these capabilities are likely to be obtained only after a considerable R&D effort. We feel that the information derived from photographic reconnaissance is now, and is likely to be, of greater value and priority than that obtained by any foreseeable electronic reconnaissance system. Even in these circumstances, however, we feel that the information likely to be obtained by electronic reconnaissance would be of such value that the R&D effort to achieve this capability should be carried forward with the highest priority short of interfering with the photographic tasks outlined elsewhere in this paper. In the absence of a fully developed electronic reconnaissance system, and in view of the uncertainties as to what can be collected with interim systems, we are reluctant to specify detailed requirements for the short term that might cause serious disruptions in the R&D effort leading toward the fully developed system. There are important problems, however, toward which electronic reconnaissance could contribute critical information during the R&D phase without serious disruption to that effort. One of the most important of these is the search for emissions associated with an Anti-Ballistic Missile system. These problems are outlined in greater detail in Appendix I to Annex "B". It is probable that from time to time the intelligence situation will require that additional tasks be levied on

the satellite electronic reconnaissance system during the R&D phase. These will be communicated to the proper authorities as they arise.

5. In order for the system to move in a realistic direction and provide the maximum amount of intelligence to the country, it is essential that the R&D phase of the system be guided by and devoted to the intelligence tasks outlined below and to such additional high priority intelligence tasks as may arise from time to time. The intelligence community will review these requirements at frequent intervals as the intelligence situation develops in order that new tasks may be identified and brought to the attention of the R&D authorities at the earliest possible time.

6. At the present time, the U. S. intelligence community maintains a National Priority Reconnaissance Requirements List which identifies those specific targets in the Soviet Union against which photographic reconnaissance should be employed. This list is concerned with Soviet offensive capabilities including installations associated with the Soviet Long Range Bomber program, the Soviet Guided Missile program, the Soviet Navy especially with regard to nuclear-propelled and guided missile configured vessels and Soviet Tank, Motorized and Artillery Forces. Other targets on the list are concerned with the capabilities and strategic positioning of Soviet military forces, Soviet capabilities for defense against air and missile attack, and the Soviet power base in the form of atomic energy installations and industrial complexes. The National Priority Reconnaissance Requirements List is broken down into various categories of priority interest.

At the present time, approximately 35 objectives are considered to be of the highest priority interest. Approximately 500 objectives are of high priority interest and approximately 3,000 additional objectives are of priority interest. In addition to these specific objectives, information is required on areas that have been inaccessible to other collection systems. It is anticipated that reconnaissance of these areas may reveal the existence of important installations previously unknown.

7. The specific composition of the National Priority Reconnaissance Requirements List will change from time to time as new information is acquired from all sources and as the important intelligence problems facing the United States change. It is anticipated, however, that at any given time within the foreseeable future, our requirements for photographic reconnaissance will approximate the present list in size and variety. Complete and simultaneous coverage of the Soviet Union would not eliminate such a list, even if it were possible to achieve, because the elements of power in the Soviet Union are dynamic and new developments and additions are occurring constantly. Repeat coverage of many of the target areas in the Soviet Union will remain a requirement, therefore, although the number and periodicity of this repeat coverage will vary, depending on the nature of the target and the intelligence situation existing at the time. From an ideal point of intelligence utility, many of the high priority and highest priority targets should be covered at intervals on the order of 1 to 6 months, but the reconnaissance system should have

sufficient flexibility to permit the coverage to be timed to meet the needs of the specific intelligence situation as it develops.

8. The information obtained by the satellite reconnaissance system would be of maximum use in providing strategic intelligence information. In addition to this primary mission, it should provide important by-products in the form of information bearing on indications of Soviet intentions.

9. At the present time, the U. S. Intelligence Board is faced with several outstanding problems which should be considered on a priority basis for system development and employment of the photographic satellite vehicles during the 1961-1962 time period as follows:

a. Our first and most urgent priority requirement is for a photographic reconnaissance system capable of locating suspect ICBM launch sites. It is estimated that many sites for the launching of operational Soviet ICBM's will be completed between now and the end of 1962. It is our strong belief that our best and possibly our only chance to detect these sites will be during the construction phase; once these sites are completed, we will have considerably less opportunity to detect them. It is important, therefore, that a maximum effort be made to find the Soviet operational ICBM launch sites before the end of 1962. Once any ICBM site is located, a satellite reconnaissance system with adequate ground resolution should be able to maintain surveillance and report changes in its status, but if these sites are not located before the end of the construction phase almost any reconnaissance system would be of considerably less value

against such a target. We believe that if we are to find the Soviet operational ICBM launch sites, our highest priority effort should be directed to a general search of a substantial portion of that part of the USSR covered by the rail net. Photographic resolution to accomplish this search mission would need to approach 20 feet on a side. Repetition of this general search at the rate of approximately once each month initially would give us a relatively high degree of assurance of providing the information required. Read-out of the photography on this frequency would establish trends and priorities for the programming of subsequent search missions. It is expected that the photography will also be used to supplement that obtained by other means for the improvement of mapping and more precise location of targets in the Soviet Union in response to the Emergency War Plans of the Armed Services.

b. If suspicious locations are identified which might be possible ICBM launch sites, these locations will be added to the highest priority category of the National Priority Reconnaissance Requirements List. Our second priority requirement, therefore, is for photographic coverage of the highest priority target category in the USSR, with a photographic system of sufficient resolution to supply us with descriptive information on those targets. It is believed that resolution approaching 5 feet on a side is necessary for this requirement. There should be a capability to launch and/or control these missions on-call at short notice to meet the needs of the intelligence situation as it develops.

c. Our third priority requirement is for a photographic system of sufficient resolution to supply us with the technical characteristics of the highest priority targets before the end of 1962. This will require a resolution of better than 5 feet on a side.

d. If technological development barriers preclude the design objectives for resolutions described above, the USIB will designate resolutions which are acceptable from an intelligence standpoint.

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1. Photo (Annex "A")
2. ELINT/COMINT (Annex "B")

EXAMPLES OF INTELLIGENCE TARGETS THAT MIGHT BE IDENTIFIED AT VARIOUS RESOLUTIONS

1. The following categories, although not intended to be definitive or comprehensive, are presented for the purpose of giving some idea of object size in the intelligence spectrum which might be identified at the limiting resolutions indicated. This evaluation is considered valid provided the targets are not concealed by deception or camouflage.

a. Photography with a ground resolution of objects 100 feet on a side should provide information for identification and location of cities, forests, large bodies of water, changes in rail alignments and transportation patterns, industrial complexes, CBR and nuclear R&D test facilities, major military complexes, possibly including large missile sites or related electronic facilities and patterns, air bases and large Naval and port facilities. Indications of industrial growth should be detected. Large ships (300 feet in length or more) should be detected at anchor or at sea and naval formations at sea identified. The extent of complexes, installations and sea formations should be approximately measured and some locational and topographic information should be available.

b. Photography with a ground resolution of objects 20 feet on a side should provide all the information available from that with a ground resolution of 100 feet on a side, plus intelligence information concerning

components of installations or complexes. Some air base runways, submarine bases, drydocks, piers and supporting facilities, ground forces barracks areas, equipment parks, and training centers, major or isolated surface-to-air missile sites, atomic energy installations, ballistic missile sites, and industrial installations should be detected, located, identified by type and approximately measured. Large vessels including surfaced submarines, large aircraft and missile launch pads, should be counted. Military support facilities should be identified by type. The identification and disposition of major Soviet naval forces should be determined.

c. Photography with a ground resolution of objects 10 feet on a side should provide a capability to identify large aircraft and known missile carrying submarine and ship types, determine base utilization, locate special weapons and CBR facilities, limited map and chart revision could be accomplished, and analyze base support facilities. A general functional analysis of industrial, military and transportation facilities should be completed. Above ground ICBM and IRBM facilities such as launch pads, stands and some support equipment should be accurately measured. The capacity of military storage facilities, the general level of military activity, military transportation capabilities and indications of security should be determined. Naval ships and units should be identified by type.

d. Photography with a ground resolution of objects 5 feet on a side should provide relatively detailed intelligence information concerning

most military and industrial installations. All aircraft, except model improvements, ground forces disposition and equipment to include tanks and artillery, some large missiles, early warning sites, AAA sites, atomic energy materials production, except weapons, structural shipboard configurations for missile handling, and special weapons storage, loading and handling should be identified, measured and analyzed. A level of military activity and type of training should be discernible.

e. Photography with a ground resolution of objects 1 foot on a side should provide detailed technical intelligence concerning air, naval or ground force equipment and industrial production processes.

REQUIREMENTS FOR ELINT/COMINT CAPABILITY

1. GENERAL

a. The ELINT/COMINT reconnaissance system must provide the ability to intercept electromagnetic emissions from the Sino-Soviet Bloc, to return the intercepted information in a secure manner to appropriate locations, and to record against an accurate time base this information in a form suitable for other processing.

b. Development of electronic reconnaissance satellites will involve maximum equipment progression, utilizing state-of-the-art equipment without inhibitions of past techniques and custom in intercept, recording and processing. The most advanced equipment possible must be employed as early in the program as is permissible within operational considerations and equipment availability. No individual vehicle will necessarily have all of the characteristics and capabilities required for the sub-system as a whole.

c. As SAMOS reaches the operational stage, intelligence information received from the project or other sources may indicate the need for additional types of directed intercept systems capable of receiving, recognizing and recording specific types of signals. As more is learned of the technical capabilities of the system, operational requirements will be revised. Provisions should be made to procure

such equipment as might be required by Quick Reaction Capabilities. A close working relationship between the R&D organization and the intelligence community is required.

d. The ELINT targets for the system will be drawn from the National ELINT Requirements List and the COMINT targets from the National COMINT Requirements List. It is not intended that collection by satellites will replace other means of ELINT/COMINT collection. It is important that the effort be concentrated on obtaining signals inaccessible by other means of collection.

e. Facilities should be provided to allow programming of the collection systems from the ground for specific targets, by changing the system directivity, radio frequency and bandwidth vs time.

f. The read-out and data processing capability for intercepted signals must be as effective as the capability for collection so as to provide a means of rapid processing and dissemination of the products to producers and users. Every effort should be made to insure that any machineable output of the system be in a form compatible with the input capabilities of the users.

g. The objective is to have an operational system as soon as possible. However, during the R&D phase, flights are required for R&D purposes, during which time it is recognized that intelligence priorities may be of a secondary consideration.

2. OPERATIONAL CHARACTERISTICS: The following characteristics represent the ultimate in the system. Appendix "I" to this Annex which shows the specific requirements for selected priority targets demonstrates that not all of the operational characteristics given below are needed for each requirement.

a. The system should provide receiving and recording equipment capable of intercepting land based, shipborne and airborne electronic emissions between 10 mcs and 50 kmcs and at lower and higher frequencies, if propagation will permit. Equipments covering specific bands within this range should be in easily substituted modular form.

b. The receiving and recording equipment should be of high sensitivity, low noise, high fidelity and most modern design in keeping with the latest developments within the state-of-the-art.

c. Receivers covering specific RF bands should be capable of receiving, recognizing, and providing outputs for the recording of all known types of modulation within their specified bands.

d. The system should be capable of recognizing and recording new and unusual signals. The original modulation of intercepted signals should be preserved to the greatest degree possible.

e. The system should incorporate a direction finding capability that will permit location of electronic emitters within a five mile CEP; however, achieving this capability should not preclude attaining a high order technical collection capability within the system.

f. If feasible, receiver outputs are required that will allow determination of scan rate and polarization of intercepted signals.

g. The system should be capable of storing and discriminating between intercepted data from several orbits, at least until readout has been accomplished.

h. The system should also provide calibration data to the ground-space communications and to the data processing sub-systems adequate for the production of the most reliable intelligence information.

3. GENERAL TECHNICAL CHARACTERISTICS:

a. The receiver dynamic range requirements should be maximized to preserve pulse amplitude modulations that occur in telemetry, missile guidance, etc.

b. Receiver sensitivities should be a maximum consistent with intercept requirement. RF accuracy should be the best attainable.

c. Rapid automatic spectrum coverage is required with a high probability of intercept.

d. Image and spurious response interference should be a minimum.

e. The system should be capable of determining the synchronization of several different signals simultaneously.

4. SPECIFIC ELINT COLLECTION: The foregoing characteristics represent the ultimate in the system as we now see it. Specific requirements will change during the development phase and will be subject to

continuing revision by the Intelligence Community in accordance with the priorities established by the National ELINT Requirements List. Examples of targets of current importance and considered to be obtainable by the system are listed in Appendix "I", Section A. The technical parameters desired and the accuracies needed are added. Section B lists examples of specific targets which will become progressively attainable with development of the system. These will be moved to Section A when appropriate.

5. COMINT COLLECTION:

a. COMINT requirements for SAMOS are of lower priority than the ELINT requirements. Development of COMINT collection devices will be dependent upon empirical data acquired by the ELINT system.

b. The frequency spectrum of interest ranges from below ten megacycles per second to ten thousand megacycles per second.

c. The estimated radiated power of the transmitters to be intercepted is tabulated below:

FREQUENCY	MINIMUM POWER	SIGNAL BANDWIDTH
HF	1.0 watts	1 kc min to 10 kc max
VHF	10 watts	5 kc min to 100 kc max
UHF	3 watts	30 kc min to 1 megacycle

d. The recorder will provide for storage of video signals and will have a bandwidth capability of one megacycle.

e. The minimum sub-system (antenna, receiver, recording and playback) signal to noise ratio should be of the order of ten decibels.

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Appendix I

SPECIFIC ELINT REQUIREMENTS FOR SAMOS

SECTION A

TYPE	FREQ.	DESIRED ACCURACIES
ABM Radar	130 - 225 mc 375 - 425 mc 800 - 900 mc	RF 1% - PRF 1% - PW 5% and scan rate 5%
	1200- 1300 mc	DF 25 nm CEP
Missile Telemetry (against VTMTR)	60 - 80 mc	Analog Recording 1 mc DF 25 nm CEP
Earth to Satellite TX and Command TX	130 - 1000 mc	RF 1% - PRF 5% - scan rate 5% DF 25 nm CEP

SECTION B

GCI Radar	560 - 575 mc 2700 - 3200 mc	See SPECOR or superseding document.
HF Radar	2600 - 2640 mc	"
EW Radar	80 - 95 mc	"
GCA Radar	9300 - 9400 mc	"
SHORAN	200 - 350 mc	"
Shell Tracker	9300 - 9450 mc	"
Tactical AAA	2700 - 2800 mc	"
Tactical Acquisition	2700 - 2800 mc	"
Beacon Interrogator and Tracking Radars	2600 - 2800 mc	"
SAM Radars	2900 - 3100 mc	"
AAA	2600 - 2800 mc	"
SAM	2950 - 3100 mc	"
AAA Acq.	150 - 160 mc	"
Eq operating outside normal freq bands	900 - 2500 mc 3500 - 9000 mc 9500 - up	" " "