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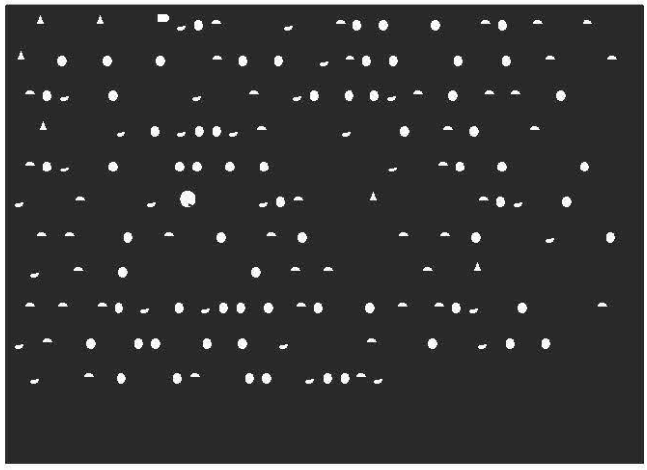

DEFENSE
INTELLIGENCE
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PROJECTED SPACE PROGRAMS—USSR (U)

PREPARED BY
U.S. AIR FORCE
AIR FORCE SYSTEMS COMMAND
FOREIGN TECHNOLOGY DIVISION

30 JULY 1982

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PROJECTED SPACE PROGRAMS—USSR (U)

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PREFACE

~~(C)~~ This study presents a 10-year projection of all Soviet space systems and then uses this projection to develop a 20-year forecast of potential high-payoff Soviet space activity. In this study three general time frames are discussed—the near, mid, and far terms. Generally, the time frames can be thought of as near term, 0-5 years; mid term, 5-10 years; and far term 10-20 years. The near and mid terms are thought to encompass a single Soviet research and development (R&D) cycle, so a program initiated at the beginning of the projection period would have its first flight before the end of the mid term. System capabilities, limitations, and improvements are discussed in terms of Key System Parameters; i.e., those mission-peculiar parameters that, when taken together, define the operational capability of the system. For easy reference and definition of area capabilities, the systems are grouped by classical military missions such as offense, defense, and surveillance, and by major interest areas such as manned and launch vehicles.

(U) This study also has two appendices. These appendices contain material of narrow interest, or experimental analysis concepts that may be incorporated into future versions of this study.

~~(C)~~ The primary purpose of this study is to provide a space systems threat model for development and long-range operational planners at OSD, Joint Agency, U&S Command, and Service Headquarters levels. The document should also be useful to planners and managers at all levels, particularly when augmented with the details on current systems provided in the standing body of DIA studies on each space mission area.

(U) The authors wish to acknowledge the following individuals who have made significant contributions to this study:

(b)(3):10 USC 424;(b)(6)

(U) Comments on improving the usefulness of this document are invited and should be forwarded to the Defense Intelligence Agency (ATTN: DT), Washington, D.C. 20301.

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SUMMARY

(U) This study presents a projection of what is expected to happen during the next 10 years for all Soviet space activity and a forecast of what could happen during the 10 to 20-year period in certain high-payoff options the Soviets may choose to develop. A brief description of the current Soviet space program, and its subelements, is given to provide a frame of reference upon which the projections are based. Projections of future programs are presented in narrative form and integrated in tabular and graphic form. Methodological considerations are provided to help in understanding the projections developed in this study.

~~(S)~~ The Soviet space program is large, active, and diverse. It has been characterized by a high level of launch activity and short payload lifetimes when contrasted to the US space program. These characteristics are expected to remain in the fore throughout the time period considered in the study.

~~(S)~~ The overall nature of the Soviet space program is not expected to change over the next 10 years. The launch rate for Soviet spacecraft is expected to remain at 90-100 launches per year. The number of different types of systems is expected to expand as the Soviets introduce new payloads for near real-time photo-reconnaissance, SIGINT surveillance, three-dimensional navigation, and others. The Soviets are also expected to introduce a reusable spacecraft. Although its announced mission will be space station support, other missions with longer term implications will also be performed.

~~(S)~~ During the 10- to 20-year period, the study forecasts the deployment and employment of directed energy devices in an ASAT role, a significant increase in the amount and type of data collected by the Soviets from Earth orbit, a significant information relay capability through space, and the development of a completely reusable space system (RSS) analogous to the US Space Shuttle.

(U) The user of this study is cautioned that many of the projections presented are subject to a high degree of time uncertainty. The nature of a new system is usually predicted with a higher level of confidence than the time when the new system will be introduced. This is because of an incomplete understanding of the Soviet's systems/technology acquisition process. There is also a strong tendency in the US to optimistically perceive the Soviets' assimilation of technology, the transition of systems development indicators, and the potential systems' first flight dates. In general, these indicators have been used to project systems introduction at a faster rate than historical data indicate.

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SECTION I

INTRODUCTION (U)

(U) This study presents a 20-year forecast of Soviet space activity. The forecast is broken into two major areas. The first area is a detailed 10-year projection covering all observed and postulated mission and high-interest areas within the Soviet space program. The second area builds upon the 10-year projection and forecasts potential high-interest or high-payoff system options the Soviets may attempt to exploit in the 10- to 20-year period. This study is organized into five major areas. The *Introduction* establishes a frame of reference within which the reader can use the projections and forecasts developed in this study. A section devoted to the *Management of the Soviet Space Program* provides an outline of the R&D base and management infrastructure associated with the Soviet space program. Several sections (III-XIII) are devoted to the *generic mission and interest areas* and present a brief historical description, some evidence and perceptions, and develop a most likely projection within a generic mission or interest area. In the section on *Projected Space Programs* these 10-year projections are consolidated into a single 10-year projection of all Soviet space activity. The section on *Forecast Options for the 20-Year Period* builds upon the 10-year projection and outlines potential high interest and/or high payoff system options the Soviets may choose to undertake in the 10- to 20-year period.

~~(S)~~ The Soviet Union, since the launch of the Earth's first artificial satellite, has developed a dynamic and expansive space program. Figure 1 is a historical representation of the Soviet space program with the number of launches used as the basis for quantification. As can be seen from Figure 1, the Soviet space program is large (between 90 and 100 launches per year) and diverse (some mission areas, like the co-orbital ASAT system, [redacted] The large number of launches results in part from the Soviets' reliance on older, proven spacecraft systems with limited orbital or mission lifetimes. The diversity within

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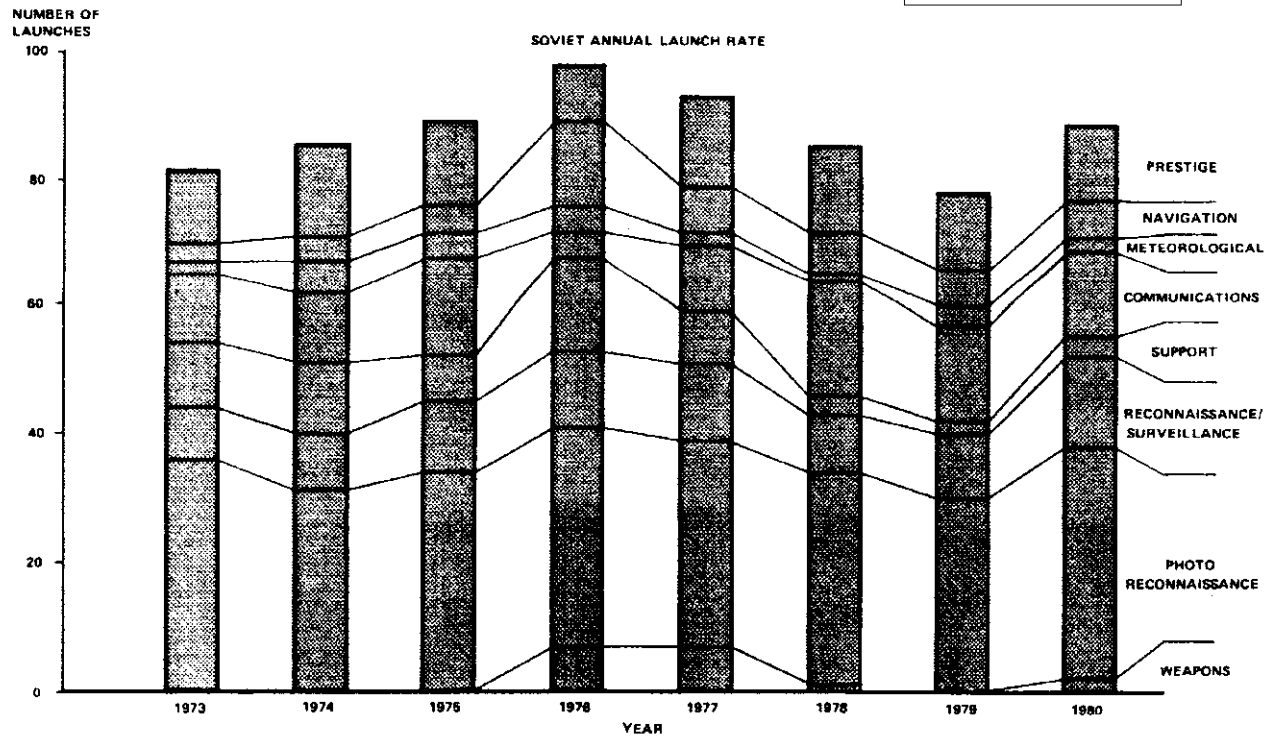

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Fig. 1 (U) Soviet Space Launches

the Soviet space program results from the use of space to support a wide variety of users in a number of different environments. Therefore, any projection of future Soviet space activity must take into account the traditional magnitude and diversity of their past and current space programs.

~~(S)~~ Projecting future Soviet activity in any area is difficult, but the complexity of the problem is multiplied because space systems support many different missions. In general, the approach taken toward space projections can be characterized as multifaceted and eclectic. First, we must recognize change is an established fact within the Soviet space program. Figure 2 presents a plot of new systems and significant system modifications as a function of time. This figure illustrates that change is recognized and accepted; the problem is to determine in what generic area the change will occur, along with the magnitude and timing of that change. Here the eclectic nature of the forecasting process comes to the forefront. Our view of the Soviet space program is characterized by various degrees of accessibility and visibility. (Accessibility relates to our ability to obtain information on Soviet programs and our understanding of that information.) Some systems, like the reconnaissance and surveillance systems, are marked by a complete lack of Soviet statements even acknowledging the existence of such a capability, while for others, like the manned and exploratory systems, the Soviets have been fairly open in discussing past and future programs. And finally, there are some areas, such as launch vehicles, where there is a mix between program visibility in the intelligence data (i.e., observation of launch facility construction and modification) and accessibility to the real meaning of the indicator (i.e., what mission will this new launch vehicle support). This degree of

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accessibility and visibility then becomes a way of characterizing the projection process used in forecasting the future course of Soviet actions.

(U) The projections process used in this study involves three phases. The first phase, which is common to space systems with high and low degrees of accessibility, involves the establishment of the forecast constraints, input information, and the forecasting basis. Typical factors considered at this phase of the forecasting process include: Soviet infrastructure; descriptions and up-to-date assessments of current space systems and their supporting systems; assessments of both the current level of systems applications of critical technologies, the proven state-of-the-art of these same technologies, and where there is a difference between these two levels of technology; planning inputs typical of those received by a Soviet planner to include perceptions of the threat the US and other countries pose to the Soviet Union; and the availability of design bureau and research institute support to aid in the development and evaluation of various future system concepts.

(U) Once the process is initialized the actual projections process is conducted using one of two interacting channels. Where there is a high degree of accessibility, the projections analyst uses an indicators-driven channel. Because of the high degree of accessibility, the analyst is able to develop indicators of system development or of system requirements.

(U) For those systems or mission areas characterized by a low degree of accessibility, the projections analyst uses a process of perception to develop systems requirements. In this channel, the analyst examines the spectrum of missions the Soviets may want to accomplish in space or use space systems to support. From this one derives system parameters and evaluates the ability of current systems to meet the parameters. Where the current systems cannot, then the analyst has a perceived requirement for a new space system.

(U) As was mentioned, the indicators and perceptions channels are interactive. This means there is no necessity to go completely through a channel to develop a system requirement. Instead, it is possible to start in the perception channel and part way through slip into the indicators channel in developing the systems requirement. This tends to blur the distinction between the two channels and make them appear as one. This channel distinction may not be apparent to the reader of this study, but in almost all cases the authors have attempted to use a dual channel process to arrive at the projections presented.

~~(C)~~ Once the system requirement is developed, the system technical requirements are defined. The required technology level is then compared with the assessed level of technology within the Soviet Union to determine the availability of required technology for system development.

~~(C)~~ Depending upon the availability of proven technology, one of two approaches can be followed. When proven technology is not assessed to be available to support the requirement, the projected space system is removed from consideration and an assessment is made as to when the technology will be available. The projected space system is reported as technology constrained. When proven technology is believed to be available, then a survey is made of the intelligence data base to determine if any ongoing programs compatible with the goal can be identified. Also, the R&D management and facilities structure is investigated to determine if development capacity is available for the proper execution of an R&D program to accomplish the perceived goal. If any or all the above factors are present, then the analyst performs a mental integration to allow him to develop what he considers to be a valid projection of a future space capability and a reasonable time for the development of a space system to exhibit that capability.

(U) Once the analyst completes this process, there are two tasks remaining. The first task is to document and report on the results of the projection process just described. This study represents the results of the first task. The second task is somewhat more difficult, but of greater, long-term importance. This task involves taking insights gained in the projections process, along with the documented forecasts, and developing intelligence collection requirements. These requirements are then used to target collection assets with the general goals of collecting more indicators to support those already available, of collecting information on those perceived requirements to verify the perceptions were valid, and of collecting information on Soviet concepts for and planned use of space to better define the spectrum of potential space mission options. The intelligence information resulting from these requirements is then used to start the forecasting process again. Figure 3 illustrates this process.

~~(C)~~ Any projection of future activity involves uncertainty, and that uncertainty by itself makes it impossible for the projection to be "correct." That is, an historical review of the projection shows no divergence between the projection and the events the projection was attempting to model—both what was to occur and what actually did occur. However, it is possible to bound the uncertainty and thereby give the decision maker a framework within which he may use the projection. The principal weakness of this study (and any other projection of Soviet space activity) is the

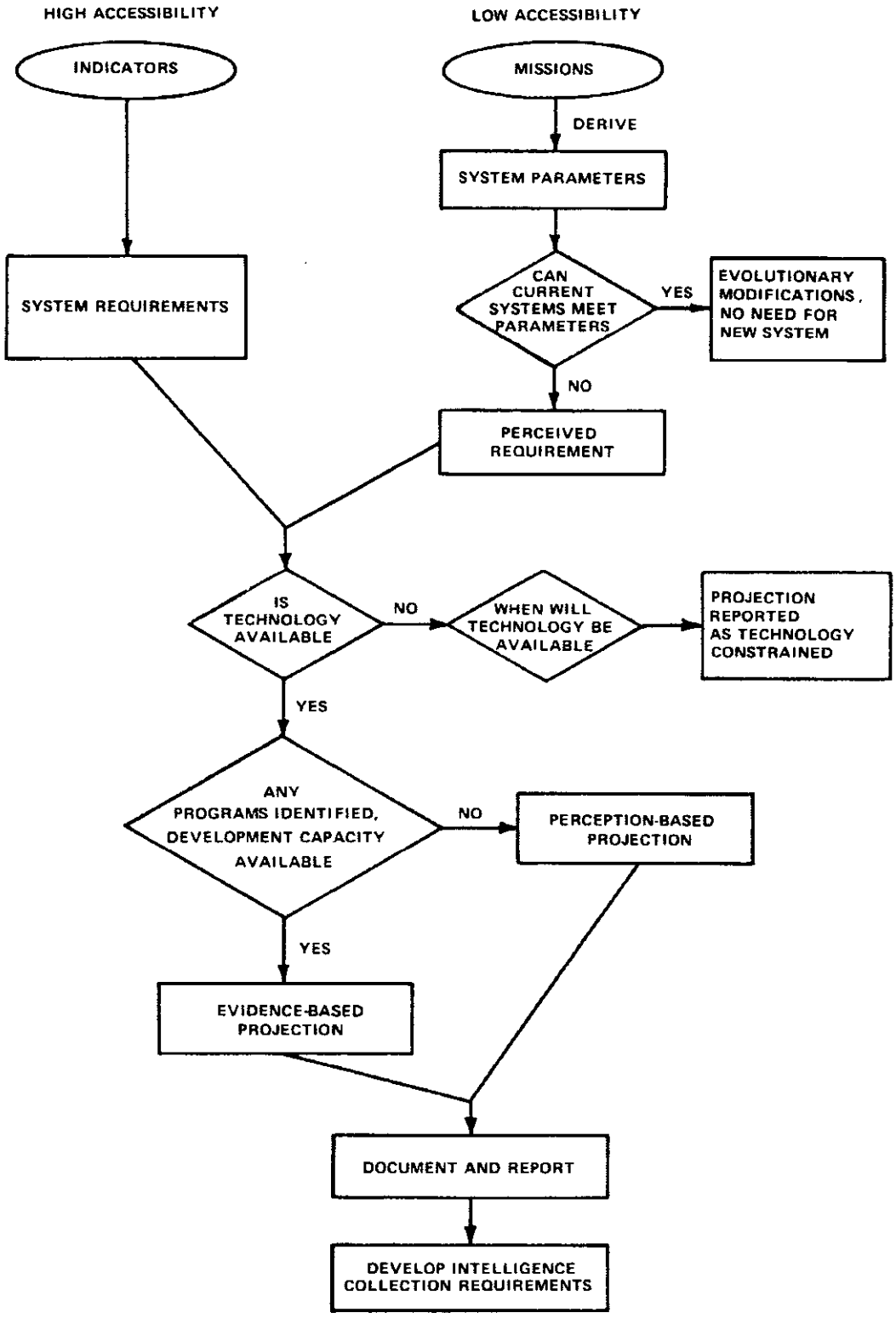

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Fig. 3 (U) Future Systems Projection Process

definable limits on the uncertainty of the projection quickly become unbounded as we go forward in time. This stems from a lack of understanding of the scope and direction of the Soviets' space program.

~~(C)~~ Of the "big three" components of the Soviet aerospace program—missiles, space, and aircraft—least is known about the Soviet space program. This is because of a number of different reasons. Some are the result of the Soviets' own modus operandi and others because the US perceives a relatively low threat from the Soviet space program resulting in a lower level of resources devoted to intelligence collection and analysis.

~~(S)~~ From the beginning the Soviets have not talked about much of their space program. They have not revealed, [redacted] some very fundamental facts about their space program:

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(b)(1);1.4 (c)

[redacted]

(b)(1);Sec. 1.4(c)

[redacted]

Soviet spacecraft are developed within the same ministry that develops liquid-propellant ballistic missiles, thus hindering interpretation of facility indicators that tend to become universally associated with the missile program unless an irrefutable space context is found.

~~(C)~~ These reasons have historically tended to fog our ability to see into the future of the Soviet space program, and the intelligence community has often been surprised by new Soviet space developments (starting with Sputnik 1). Therefore, analysis of the Soviet space program has been reactive rather than anticipatory. The reactive nature of the analysis causes a concentration on past events, not future activities, and this concentration means the uncertainty limits on future systems can be large.

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SECTION II

MANAGEMENT OF THE SOVIET SPACE PROGRAM (U)

1. Background (U)

(U) Starting with the launch of Sputnik I in 1957, the Soviet space program has developed into an expansive program encompassing all generic mission areas one would expect a super power to exploit. The Soviet space program is one of extreme diversity, ranging all the way from the Soviet ASAT weapons program to the purely scientific and exploratory lunar and planetary programs.

(S) There are lessons to be learned from an overview of the entire Soviet space program. These lessons are generally in the area of the Soviets' modus operandi in developing new space systems. As was illustrated earlier, there is little question regarding the inevitability of change in the Soviet space program. The principal questions are how and when the change will occur. Historical evidence in the Soviet space program indicates the Soviet space system designer, once the mission requirement is defined, severely limits technical risk through conservative system design. This maximizes the probability of meeting a schedule established at the start of a spacecraft development process. The minimization of technical risk usually occurs when existing systems or components are used or modified to perform a different mission or role than originally intended. The continued use of the Vostok vehicle for recoverable space payloads is an example of this approach. This is not to say the Soviets will not develop a new spacecraft when required to do so, but with such systems they tend to commit themselves to long development cycles to ensure delivery of a workable spacecraft at the end of the cycle.

(U) The research, development, testing, production, and operation of hardware for the Soviet space program are carried out by a highly integrated bureaucratic structure. As in all bureaucratic systems, functions have been delineated and assigned to various organizational entities. The three major functions associated with space systems are national program management and decision-making, development and production of the necessary hardware, and operation and exploitation of the spacecraft.

2. National Structure for Space Hardware Development (U)

(U) National decision-making is concentrated in the Communist Party and the governmental structure. The Politburo is at the apex of the party/government political and economic structure. This 22-member body has ultimate control of Soviet space program development. Major decisions involving the scope, direction, and timing of space programs are decided by the Politburo. Normally, there exists two reasons that would prompt the Politburo to decide upon the development of a new space program (a) sufficient scientific and technical progress to allow development of more sophisticated prototypes of spacecraft, and (b) substantial decrease in the effectiveness of existing space systems. In addition to these, the national economy and international prestige can be deciding factors in a Politburo decision to develop new space systems. The key performers are L. I. Brezhnev, General Secretary of the Party, President of the Supreme Soviet Presidium, and Chairman of the Defense Council; D. F. Ustinov, Minister of Defense and the former Party Secretary in charge of the defense industrial base; and N. A. Tikhonov, newly appointed Chairman of the USSR Council of Ministers, succeeding A. N. Kosygin.

(C) The Central Committee Secretary for Defense Industrial Matters is a member of the Party Secretariat. The secretary is charged by the party to monitor all matters related to the development of military weapons and space systems in specific ministries making up the military industrial sector of the national economy. The position carries a great deal of authority because (a) it carries the weight of the party behind it, (b) it reports directly to the Politburo, and (c) it commands the resources of the entire party and government hierarchy devoted to defense research, development, and production. This position has been open since Februrary 1979. The party and government weapon system/space development, infrastructure was probably so well integrated by D. F. Ustinov, when he served as the party and government czar of this infrastructure, that there is little need for a full-time decision-maker and overseer in this area. In cases of need, Ustinov is believed to make the decisions of this office.

(C) The Defense Industry Department is directly answerable to the Secretary for Defense Industrial Matters. It was headed by I. D. Serbin for over a quarter of a century until his death in February 1981. His successor has been identified as I. F. Dmitriyev, formerly deputy chief to Serbin. The main function of the department is to monitor the work of the defense industrial hierarchy. Its apparatus extends to all levels of the defense industrial ministries and is, in fact, a separate communication channel outside the normal government bureaucracy. Its feedback capability

allows local party officials direct access to top level decision-makers. Its staff represents the power of the party and is treated with respect and deference at all levels of government. It is represented at all meetings involving decisions affecting military weapons development and space programs. Within the department itself, the staff is organized with sections in the space, missile, and electronics areas. It also controls the selection of all defense industrial managerial appointees to the research institute director, designer, and plant manager levels.

~~(C)~~ The Defense Council, while not formally a party organization, provides the Politburo with military expertise and viewpoints on the operational aspects of various proposed weapon systems and space programs with military applications. The 1977 Constitution of the USSR identifies the formation of the Defense Council and approval of its membership as a function of the Presidium of the USSR Supreme Soviet. Previously, the Defense Council was assumed to act in a consultative capacity to the Politburo, on an "as-required" basis. This change in the Constitution seems to transfer the Defense Council from party control to government control. The implication being that the Defense Council has been divested of its policy-making capability and placed in a role of policy execution. Much of the significance of this transfer loses its importance because the major participants remain the same.

(U) The USSR Council of Ministers directs the vast governmental bureaucracy including the nine defense industrial ministries, the Ministry of Defense (MO), and the various peripheral agencies supporting the space program, such as the State Committee for Science and Technology (GKNT), the Academy of Sciences of the USSR (AN SSSR), the State Planning Committee (GOSPLAN), the State Banking Committee (GOSBANK), the Ministry of the Chemical Industry (MINKHIMPROM), the Ministry of Instrument Making, Automation Equipment, and Control Systems (MINPRIBOR), and other industrial ministries supporting space contracts.

~~(C)~~ The Military Industrial Commission (VPK) is a supraministerial body providing a national level framework for overall coordination and control of all military product and space-related research, design, development, test, and production within the Soviet Union. It is directly subordinate to the Presidium of the Council of Ministers, the body responsible for day-to-day operation of government, and as such is a governmental rather than a party organization. Its chairman, L.V. Smirnov, is a Deputy Chairman of the Council of Ministers and a member of the Presidium of that body. His staff is responsible for various aspects of military and space RDT&E and production. VPK staff members expedite, negotiate, arbitrate, and solve the multitude of problems arising in the day-to-day interaction between ministries and between the ministries and the customers. (See Figure 4.)

~~(S)~~ As the final customer for new and improved weapons, including complete space systems and launch vehicles for scientific satellites, the Ministry of Defense (MO) has overall responsibility for generating requirements and monitoring the research, development, test, and production carried out by the defense industrial ministries. The detailed requirements for procuring major weapon systems peculiar to each of the Soviet Armed Forces is controlled by the individual service's main technical administrations, or "directorates," normally located within the force headquarters. The following main technical directorates have been identified within the Soviet Ministry of Defense: Ground Forces—Main Forces and Artillery Directorate (GRAU); Air Defense Forces (Voysk PVO)—Fourth Main Directorate of the Ministry of Defense (4th GUMO); Naval Forces—Directorate of Rocket and Artillery Armaments (KSIV); Air Forces—Aviation Technical Committee (ATK); Strategic Rocket Forces—Main Directorate for Rocket Armaments and Equipment, and Main Directorate for Space Systems. The Deputy Minister of Defense for Armament and the General Staff provides central guidance for the technical directorates. The relationship of the service main technical directorates within the Ministry of Defense is shown in Figure 5.

~~(S)~~ The establishment of the tasking documentation for weapon systems including the timely and accurate completion of a project are technical directorate functions. The actual research, design, test, and production fall under the role of the defense industrial ministries.

~~(S)~~ The main technical directorates of the Soviet Armed Forces having prime responsibility for space system requirements generation are those of the Strategic Rocket Forces (SRF), the Air Defense Forces (Voysk PVO) and the Navy (Morskoy Flot).

~~(S)~~ The organization which actually has control over Soviet space launches is the Main Technical Directorate of Space Systems of the Soviet Rocket Forces (SRF). The main directorate is thought to be the controlling organization for the majority of Soviet military space research, development, test evaluation, production, and quality control. It also controls the allocation of hardware to users of the specific space systems and experiments.

~~(S)~~ The Main Technical Directorate of the Voysk PVO (4th GUMO) has the responsibility for

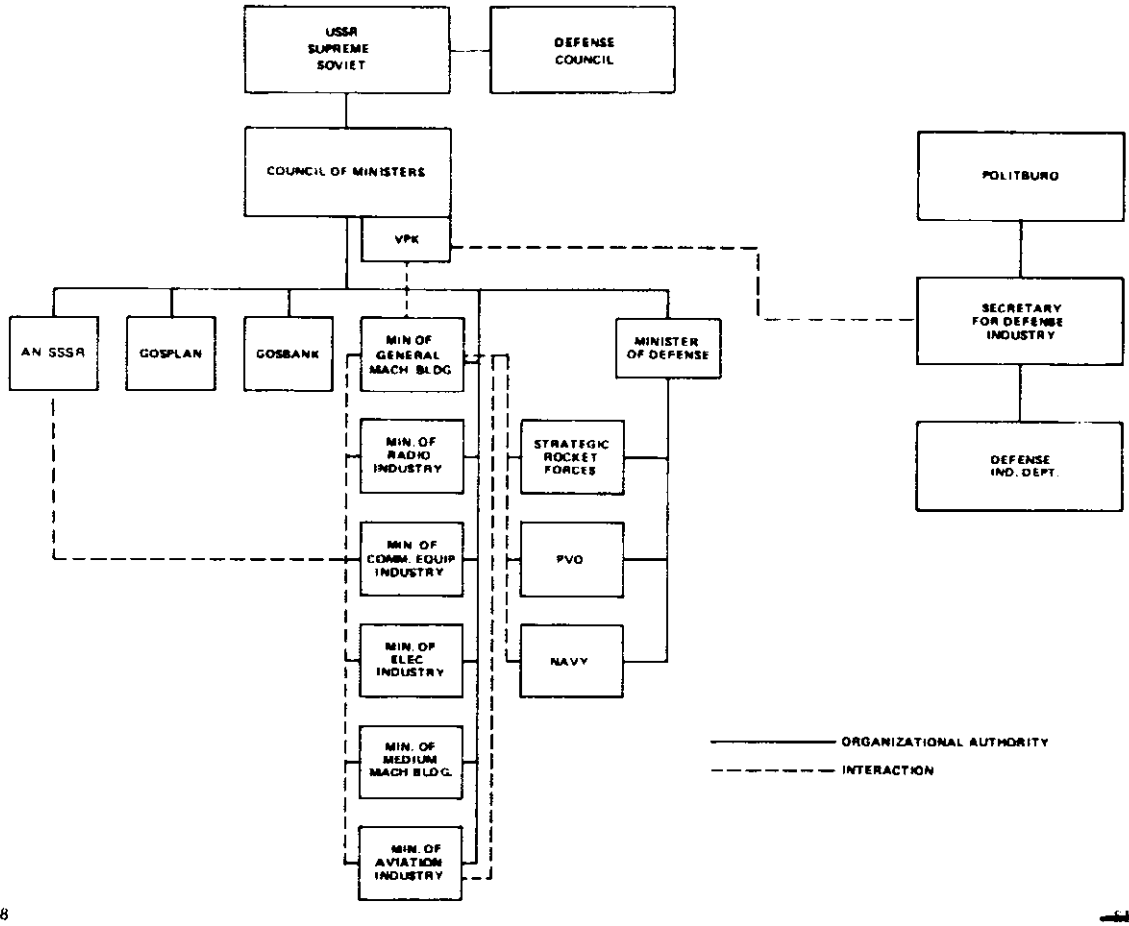

Fig. 4 (U) Organizational Interaction in the Soviet Space Program

generating requirements for such programs as antiballistic missile, antisatellite, and missile launch detection. The Naval Main Technical Directorate (KSIV) plays a similar role in the specification of requirements for programs such as the radar and ELINT ocean reconnaissance satellites.

3. Space System Hardware Acquisition Process (U)

(S) The development of all Soviet space systems, from the establishment of national goals to the eventual realization of operational hardware, involves the mutual participation of three major elements—(1) the party/government establishes national goals and policies and allocates resources, (2) the Ministry of Defense (through a service main technical directorate) generates the requirement and monitors progress and quality, and (3) the defense-industrial ministries perform the research, design, test, and series production of the space system.

(S) Over a period of years, intelligence data have been acquired from a variety of sources describing the sequence of events in new aerospace systems acquistion and the interactions of the various participating organizations. The entire process is applicable to space launch vehicles and, in particular cases, is relevant to payload development. There appears to have been little basic change during the past three decades in the underlying philosophy and procedural concepts governing the nature and characteristics of the process. Nor, for that matter, is there much variation in the overall system acquisition process when a different type of aerospace system is being acquired.

(S) The Soviet system acquisition process generally originates at the party/government level where broad national policies and goals are established. These national goals serve as the point of origin of space systems requirements. The requirements are usually developed by the individual military services or an element

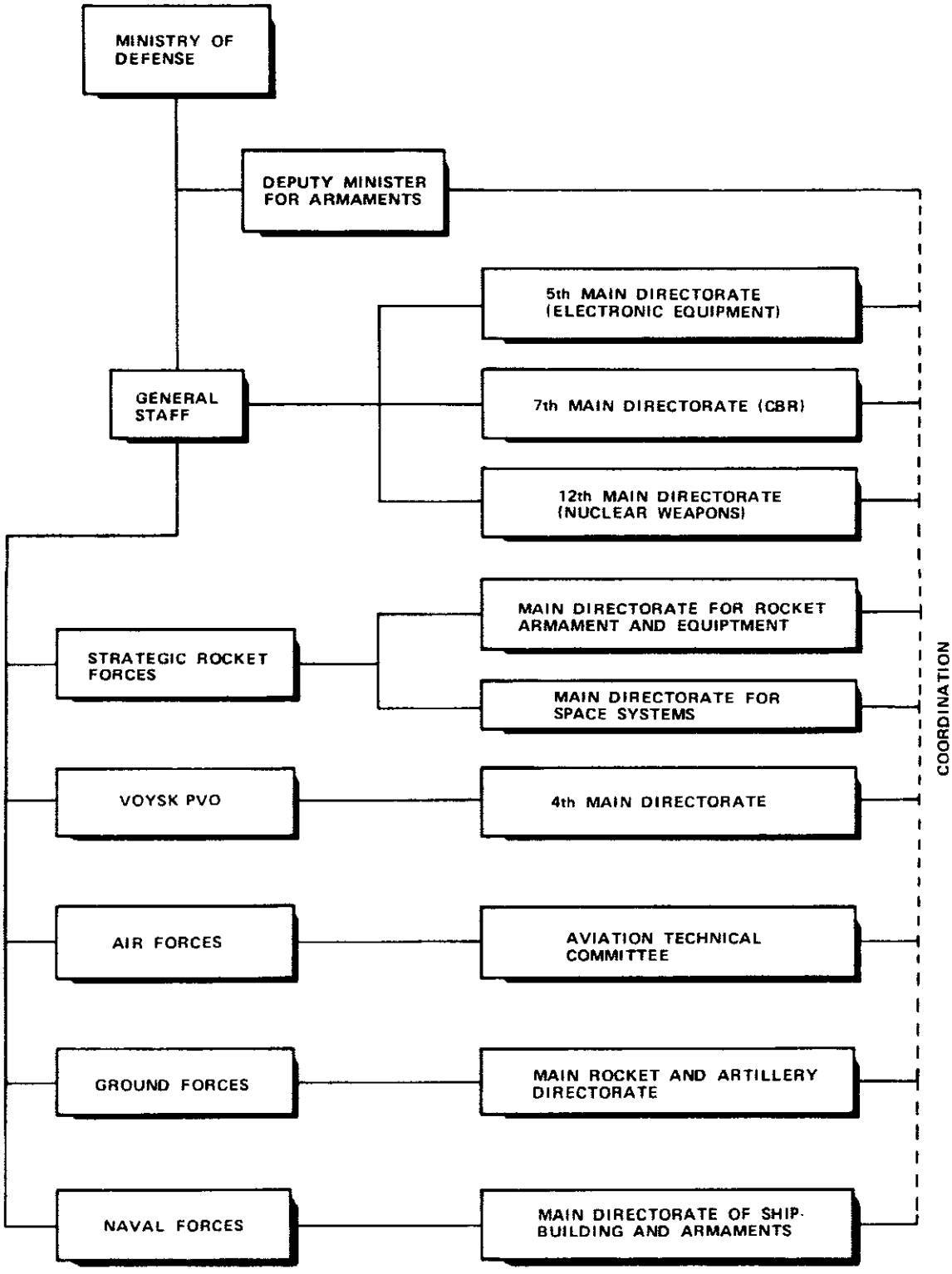

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Fig. 5 (U) Ministry of Defense Technical Directorate Organizational Subordination

of the General Staff of the Ministry of Defense. However, ideas can be initiated by a member of the political hierarchy, by the designers from the defense-industrial ministries, or by the various technical directorates of the services.

(b)(1);1.4 (c) (S) the design and development segment of the Soviet weapon system procurement program is performed in accordance with specific national rules governing development for all branches of Soviet industry. These documentation standards are defined in a series of State Standards (GOSTs) under the heading of the "Unified System of Design Documentation (*Yedinaya Sistema Konstruktorskoy Dokumentatsii*—YeSKD)."

(S) The formal acquisition process for Soviet space systems is controlled by the management procedures described in the YeSKD. These management procedures are concentrated within a single organization, a design bureau of the Ministry of General Machine Building, designated as the focal point for integration of all subsystems in a space system. This arrangement follows the typical Soviet practice of specifying a lead organization (*golovnaya organizatsiya*) to coordinate efforts dictating involvement of organizations subordinate to other than the ministry controlling the integration focal point organization. Further, required subsystems to the space system itself are developed under contract following these management procedures. The process described below represents the requirement generation/satisfaction process as we understand it. This process holds for launch vehicles, as well as for space systems.

(S) Scientific space payloads, primarily for space exploration are attributed to work performed by the USSR Academy of Sciences. The instrumentation of these payloads is developed either within the Academy of Sciences or in conjunction with Eastern European satellite country scientific organizations under the "INTERKOSMOS" program. The scientific payload is incorporated into an existing launch system, which is controlled by the military. The INTERKOSMOS program is headed by V.A. Kotelnikov, a vice president of the Soviet Academy of Sciences.

(S) Because of the unique, limited production nature of scientific instrumentation payloads, the procedure most likely employed is the one used in the Soviet Union for development of experimental devices. These procedures are identified in Soviet literature and encompass the application of fundamental scientific knowledge to development of a laboratory verification device. The procedure is known as scientific research work or NIR. (See Table I.)

(S) Military-related payloads, as a subsystem to military-related space systems, and the military-related space systems are developed under the management procedures expressed in the YeSKD. The process normally begins with the generation of the Tactical Technical Requirement (TTT) by the individual armed service technical directorate. The TTT, based upon analysis of new or potential missions, outlines general requirements for space systems to accomplish these missions. They could be a general description of the mission and the mission environment. The TTT is then submitted through the parent armed service and Ministry of Defense command channels for approval. After approval is obtained, the TTT is levied through the parent defense-industrial ministry, either the Ministry of General Machine Building (MOM) or the Ministry of Defense Industry (MOP), to a major space systems design bureau.

(S) Using the TTT as a guide, the design bureau formulates the "Initial Technical Assignment" defining the general task governing the development and testing of the space system. The design bureau also prepares a document identified as the "Draft Decision" specifying the participants (subcontractors), defining the task, and containing preliminary schedules and cost estimates. Upon its completion, the "Draft Decision" (including the Initial Technical Assignment) is circulated to all participating defense-industrial ministries for signatures of the Minister and responsible Deputy Minister. This coordination will also include the Ministry of Defense as they must provide flight-test facilities.

(S) Once coordination is completed within the appropriate defense-industrial ministry, the "Draft Decision" is forwarded to the Military Industrial Commission (VPK), which holds a session for review and approval. Once the "Draft Decision" is signed by the Chairman of the VPK, it is forwarded to the Politburo and the Council of Ministers for approval and signature.

(S) After all signatures are obtained, the "Draft Decision" officially becomes a "Decision of the VPK." For major space systems, the "Decision of the VPK" is reviewed for approval by the Defense Council and signed by L. I. Brezhnev and the Chairman of the Council of Ministers. This step involves the attachment of a "Decree" of the Central Committee of the Communist Party and the Council of Ministers. The "Decree" is also sometimes referred to as a "Government Decision." The "Decision" and "Decree" package provides formal justification for funding requests and for the inclusion of development and production schedules in economic plans coordinated by the State Planning Committee (GOSPLAN).

TABLE I

(U) STAGES OF SCIENTIFIC RESEARCH WORK

STAGES OF NIR	PHASES OF WORK
Develop the Technical Task (*Tekhicheskoye Zadaniye*) to conduct NIR	Analyze initial information sources. Develop the Technical Task for research. Coordinate and approve the research Technical Task.
Develop the Technical Proposal (*Tekhnicheskoye Predlozheniye*)	Collect and analyze the sources of S&T information. Develop the Technical Proposal according to the results of analysis of the Technical Task and sources of S&T information. Coordinate and approve the Technical Proposal for research.
Conduct Theoretical and Experimental Research	Develop initial methodological documentation for conducting research. Develop the experimental model or test article. Plan, design, and prepare the experimental models, test articles and equipment for research. Conduct experimental research. Correct the technical documentation according to the results of theoretical and experiemental research.
Formulate the Results of NIR	Develop summary scientific and technical documentation. Review of the summary S&T documentation by the Scientific Technical Council or its sections and approval.
Accept the NIR	Review and accept the NIR. Transfer documentation to interested organizations or enterprises for use or assimilation.

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~~(S)~~ The major design bureaus are essentially system integrators who are, in turn, supported by major subsystems and component design bureaus. The receipt of the "Decision of the VPK" (and "Government Decision" if applicable) by the integrating design bureau initiates the space system design and development (prototype production) phase. The phase is subdivided into the following stages:

• **Technical Assignment**—The initial "Technical Assignment" contained in the "Decision of the VPK" is studied in the design bureau long-range planning department and further defined.

• **Technical Proposal**—On the basis of the defined "Technical Assignment" a "Technical Proposal" is prepared. It will contain the space system basic characteristics, general sketches, and costing data envisioned by the major design bureau. Network schedules are also included within the "Technical Proposal."

• **Draft Design**—The "Draft Design" stage follows the acceptance of the "Technical Proposal." Included in the "Draft Design" formulation are data defining the purpose and basic parameters, and general outline drawings of the space system. The most important documents developed during this stage are the "Technical Specifications" for planning. These documents include information concerning labor intensity, cost of manufacture, and operation of the specific product. Also prepared during this stage is the "Inter-departmental Operational Technical Specifications (MRTU)," which is only in effect as long as inter-organizational activity exists. Conceptual drawings and brief descriptions are prepared for each component part, and structural materials are selected. Breadboard mockups are fabricated and tested during this stage. The "Draft Design" is reviewed by a Scientific Technical Council (NTS) and by the chief designer of the space system. The findings of the "Draft Design" and its explanatory notes are then sent by the chief

designer to the Ministry of Scientific Research Institute (NII), which attaches any technological recommendations it deems appropriate and necessary. After all concerned parties have fully coordinated, the "Draft Design" serves as the basis for development of the "Technical Design" stage. Also at this point, it is believed that another management system identified as the Unified System for Technological Preparation of Production (YeSTPP) is implemented. The purpose of this system is to identify the production plant, provide for acquiring long lead time production equipment, plan the production process, and coordinate work of the design bureau experimental plant and the series production plant.

• **Technical Design**—Design documents produced during the "Technical Design" contain the technical decision and detailed product data necessary for the creation of "working drawings" during the prototype development stage. The most important documents describe in detail the design and structural characteristics of the product and are called "Explanatory Notes." Also during this stage, detailed subcomponent reports are drawn up and full scale mockups of the space system are built. After the mockup has been approved by the general or chief designer and by a "Mockup Commission" and after the schematics and explanatory notes have been coordinated with the designer and with the Scientific Technical Council, the project moves to the "Pilot Model Production" stage.

~~(S)~~ During the "Pilot Model Production" stage, the design documents developed during the "Technical Design" stage form the basis for developing "working" documentation. Available documents are transferred from the design bureau to the experimental production plant so this plant can gear up for prototype production or in some cases "series" production. A series of tests is usually conducted by the Interdepartmental Commission. The Interdepartmental Commission first comes into play in the Soviet space system R&D cycle at the end of the "Pilot Model Production" stage. The Interdepartmental Commission, consisting of represen tatives of the military customer, the NII, the design bureau, and the production plant, is a testing and verification organ that oversees the transition of documentation, technical processes, etc., from the design bureau to the experimental or series production plant. In doing so, the Interdepartmental Commission verifies the standards and reliability of the pilot models, allowing the initiation of "Pilot Lot Production." Static tests are performed by the experimental production plant in conjunction with the Interdepartmental Commission. After these tests are completed, the results are compiled into a report that serves as the basis for R&D flight tests.

~~(S)~~ The prescribed R&D flight tests are carried out in the presence of, and under the guidance of, a "State Testing Commission," which includes the military customer. At the conclusion of the R&D flight testing, a determination of the space systems operational suitability is made by the military customer. If the space system's performance requirements have been met and the operational need is still valid, the customer through the Ministry of Defense will recommend approval for operational use and request initiation of series production. The State Commission then standardizes the technical documentation necessary for space system production.

~~(S)~~ Documentation authorizing series production and requesting necessary funding is submitted to the party/government structure for review and approval. Priorities are allocated and assigned by a special defense section of the State Planning Committee to meet the program schedule and operational quantities stipulated by the military customer.

(U) The space system acquisition process is shown in Figure 6.

4. Soviet Space System Resources (U)

4.a. Introduction (U)

~~(S)~~ The nine industrial ministries forming the defense industrial resources base are the developers and producers of space hardware. They are supported as required by other industrial ministries and various research institutes of the USSR Academy of Sciences and the Ministry of Higher and Secondary Specialized Education (MVSSO). The system integrator for spacecraft, space launch vehicles, and liquid-propellant missiles is the Ministry of General Machine Building (MOM). This ministry calls upon various other defense-industrial ministries for support in component development. Among the most important are the Ministry of the Radio Industry (MRP)—guidance and control packages and lasers; the Ministry of Communications Equipment Industry (MPSS)—satellite communications network; the Ministry of Electronics Industry (MEP)—components for telemetry systems and ascent, descent, control, and guidance mechanisms for space vehicles; the Ministry of Aviation Industry (MAP) and the Ministry of Medium Machine Building (MSM)—nuclear weapons and nuclear propulsion systems. Within each ministry, specialized research institutes, design bureaus, and production plants interact to develop the required booster/payload.

~~(S)~~ Formal contractual arrangement can be instituted between defense-industrial ministries and

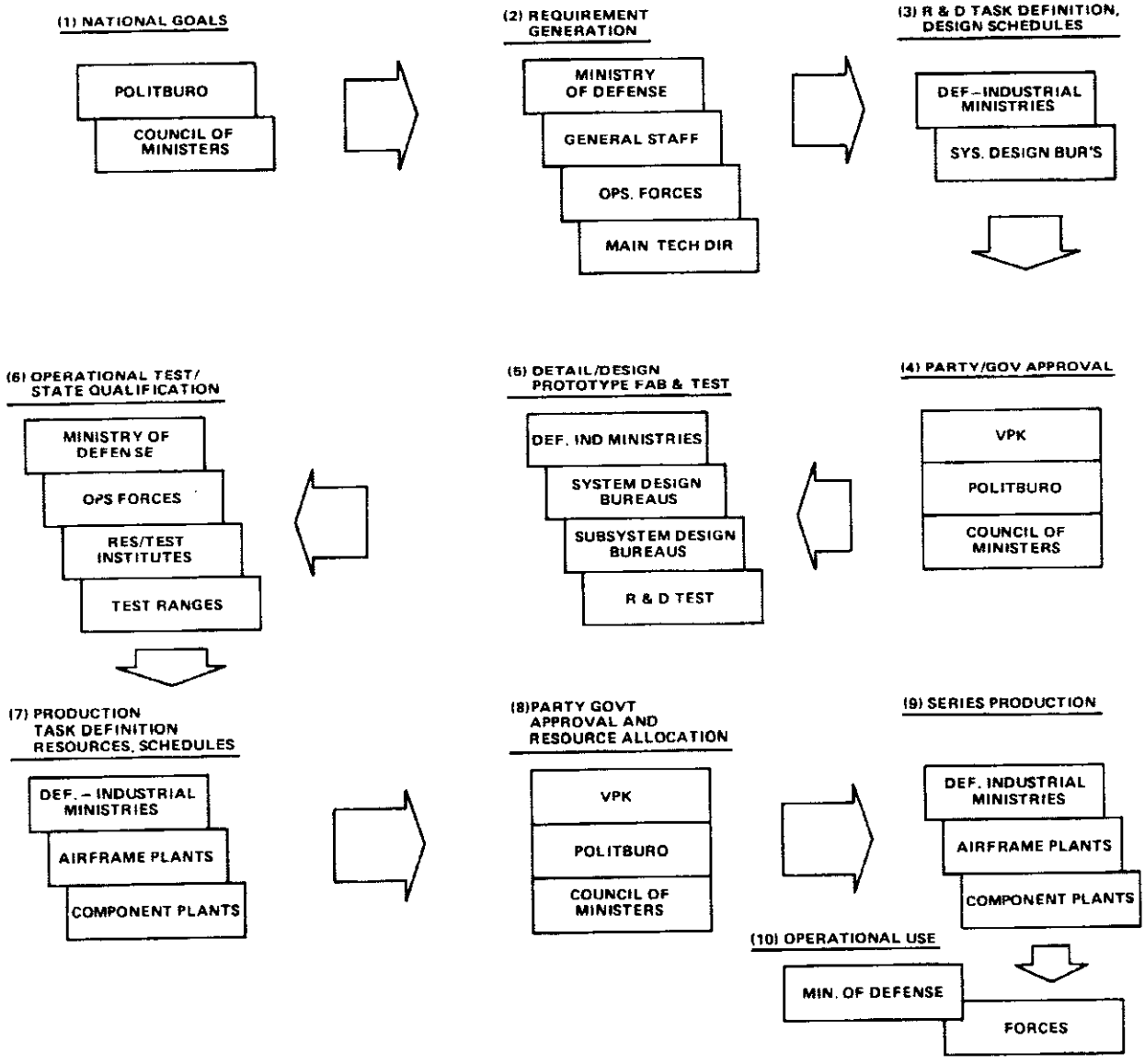

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Fig. 6 (U) Space System Acquisition Process

research institutes of the Academy of Sciences if the need arises. However, for the most part, military-related research on space systems is contained within the defense-industrial ministries. Academy cooperation in military-related space system development most likely occurs when new concepts or innovative approaches to problem-solving are involved (e.g. laser communications and weapon research) instead of the Soviet practice of incremental, evolutionary progression of existing technology. In this area, the Academy serves as the vehicle to verify new concepts incorporated in an experimental device. Further research to verify production attainability and sustainability is the responsibility of industrial NIIs and design bureaus.

4.b. Scientific Research Institutes (U) (b)(1);1.4 (c)

~~(S)~~ A number of scientific research institutes from three different industrial ministries—i.e. MAP, MOM, and MRP—have been identified as being associated with the Soviet space program. (b)(1);1.4 (c)

(U) A prime facility in the latter grouping is the Institute of Space Research (IKI), which is subordinate to the General Physics and Astronomy Sector of the USSR Academy of Sciences. Founded in 1965, IKI employs around 1,200 persons and has an annual budget of approximately 25 million rubles. The institute is organized into four research departments—astrophysics, plasma, planetology, and earth resources. The institute has a two-fold mission. First, in its capacity as a research institute of the Academy of Sciences, IKI analyzes proposals for space experiments and accomplishes extensive research for scientific instrumentation for future Soviet space efforts. Second, and probably most significant, IKI is chartered to act as the administrative and coordination head of all civilian space-related scientific efforts being worked on at the various academic research institutes within the USSR.

~~(S)~~ IKI is directed by R. Z. Sagdeyev. Sagdeyev is a strong-willed scientist who supports the fundamental research charter of IKI. (b)(1);1.4 (c)

Sagdeyev, a first-class scientist, is also an experienced politician. During his years as head of IKI, he has become an influential participant in the planning and execution of the Soviet scientific space program. Although IKI is supposedly the coordinating head of the Soviet space exploration program, and Sagdeyev a strong and influential individual in the Soviet space research effort, it is believed that IKI has little actual authority over the determination of which experiments will ultimately be incorporated into a space flight, how that space flight will be conducted, or how the data from any particular space flight will be analyzed.

has narrowed IKI's actual responsibilities to fundamental research for space experimentation. (b)(1);1.4 (c)

~~(C)~~ provided considerable data on the function and operation agenda of IKI. The verified that the facility was both a planning body for all Soviet research on space sciences and a theoretical space science research organization in its own right. The also reported the Soviet military, and not IKI, controlled the actual launch of spacecraft and the detailed design of satellites and spacecraft. (b)(1);1.4 (c) (b)(1);1.4 (c)

4.c. Design Bureaus (U)

~~(S)~~ The number and the product charters of the identified Soviet space system design bureaus are presented in the following paragraphs. The organizations covered are the Glushko, Feoktistov, Chelomey, Kryukov, Utkin, and Reshetnev Design Bureaus.

4.c.(1) Glushko Design Bureau (U)

~~(S)~~ Chief Designer V. P. Glushko is director of a massive design complex (consisting of a design bureau and experimental production plant) at the Moscow Missile and Space Development Center Kaliningrad 88. The Glushko Design Bureau is the descendant of the original Soviet space design bureau, which was headed by Sergi P. Korolev. This organization is suspected to have originally had total responsibility for all facets of the Soviet space program; but, as the number and complexity of spacecraft payloads increased, the scope of this responsibility decreased. This design bureau is believed to be responsible for the SL-3, SL-4, and SL-6 space launch vehicles, and was the lead design organization in the development of the aborted SL-X space launch vehicle. The design bureau is currently heavily involved in the design and development of the successor to the SL-X and the SL-W. (For more detail on the SL-W, see Section XIII.)

TABLE II

(U) SOVIET SPACE SYSTEM RESOURCES

SCIENTIFIC RESEARCH INSTITUTE (NIIs)

Defense Industrial Ministries

Ministry of Aviation Industry (MAP)

Central Aerohydrodynamic Institute (TsAGI), Moscow	Applied research in aerodynamics and structures; also has environmental test facilities (e.g., wind tunnels and flight simulators).
Central Institute for Aviation Motor Building (TsIAM), Moscow	Applied research in field of propulsion; also has environmental test facilities (e.g., sea level and altitude propulsion test cells).
All-Union Institute for Aviation Material (VISM), Moscow	Airframe and propulsion materials research.
Scientific Research Institute for Aviation Technology and Organization of Production (NIAT), Moscow	Fabrication and production related research, including the development and application of manufacturer method.
(b)(1);1.4 (c)	(b)(1);1.4 (c)

Ministry of General Machine Building (MOM)

Scientific Research Institute 88 (NII-88), Moscow/Kaliningrad	Basic and applied research on propellants, materials, and manufacturing.
Scientific Research Institute (NIITP/NII-1) (Scientific Research Institute of Thermo Processing), Moscow	Basic and applied research on propulsion, aerodynamics, and power systems.
Scientific Research Institute 4 (NII-4), Moscow	Guidance-related
(b)(1);1.4 (c)	(b)(1);1.4 (c)
(b)(1);1.4 (c)	

Ministry of Radio Industry (MRP)

Central Scientific Research Institute of Radio Engineering (TsNIIRT/TsNII-108)	Radar and antenna R&D, (b)(1);1.4 (c)
Scientific Institute of Automatic Instruments (NIAP), Moscow	Tracking (b)(1);1.4 (c) systems for long-range ballistic missile and space systems.

Academy of Sciences, MO, and other NIIs

Institute for the Study of Cosmic Emissions (IIKI)	(b)(1);1.4 (c)
Institute of Space Research (IKI)	Integration of nonmilitary space payloads.

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TABLE II (Cont)

SYSTEM DESIGN BUREAUS

Glushko Design Bureau (Kaliningrad 88)	SLV development.
Feoktistov Design Bureau (Kaliningrad 88)	Manned spacecraft development.
Kryukov Design Bureau (Moscow GM R&D Plant, Khimki 301)	Unmanned spacecraft development.
Chelomey Design Bureau (Moscow Missile Production Plant, Fili 23; Moscow GM and Space Research Center, Reutov)	SLVs and spacecraft development.
Utkin Design Bureau (Dnepropetrovsk Missile Development and Production Center)	SLV development. SLV/spacecraft integration.
(b)(1);1.4 (c) Reshetnev Design Bureau	Unmanned spacecraft development.

SPACE SYSTEM PRODUCTION PLANTS

Kuybyshev Aerospace Production Plant 1	SLV and spacecraft production.
Dnepropetrovsk Missile Development and Production Center	SLV production.
Moscow Missile Production Plant, Fili 23	SLV and possible spacecraft production.
Krasnoyarsk Arms Plant 4	Spacecraft associated production.
Moscow GM Research and Development Plant, Khimki 301	Unmanned spacecraft production.

PROPULSION SYSTEMS DESIGN BUREAUS

Glushko Propulsion Design Bureau (Moscow Missile and Space Propulsion Development Center, Khimki 456)	SLV propulsion system design.
(b)(1);1.4 (c)	(b)(1);1.4 (c)
Isayev Design Bureau (NII-88, Kaliningrad)	Small SLV motor design.

~~SECRET NOFORN WNINTEL~~

4.c.(2) Feoktistov Design Bureau (U)

~~(S)~~ The Feoktistov Design Bureau (headed by former Cosmonaut K. P. Feoktistov) is also a descendant of the Korolev organization. Its physical location is next to the Glushko organization in the Kaliningrad suburb of Moscow. The Feoktistov Design Bureau appears to have assumed the responsibility for most of the manned and man-related spacecraft in the Soviet Union, including the Soyuz T, Progress, and Salyut R vehicles. Initially Feoktistov was subordinated to Korolev's successor Mishin. As the Mishin organization became more heavily involved with the SL-X launch vehicle and the manned vehicles designed by Feoktistov demonstrated their merit, Feoktistov appears to have gained considerable independence. Open source statements during the early-1970's seem to confirm this. Feoktistov was identified both as a cosmonaut and as a member of a group of designers responsible for a particular manned spacecraft. During the 1970's, his status has apparently steadily increased, and press statements associated with Salyut 6 identify him as the designer of Salyut 6, or a chief designer of the space station. Therefore, Feoktistov is now thought to function as an independent designer, although he may report to Glushko, in Glushko's capacity as head of the Kaliningrad Complex.

(b)(1);1.4 (c)

4.c.(3) Chelomey Design Bureau ~~(S)~~

(b)(1);1.4 (c)

~~(S)~~

Chelomey's responsibilities cover a wide range of system types including the simultaneous development of ballistic missiles, space launch

(b)(1);1.4 (c)

(b)(1);1.4 (c)

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(b)(3):10 USC 424

Fig. 7 (b)(1);1.4 (c)

(b)(1);1.4 (c)

vehicles, and spacecraft. In the space area, he developed the Proton family of launch vehicles—the SL-9/SL-12/SL-13. He may have responsibility for all or some portion of the Salyut space station program. Recent reporting indicates he is responsible for the Soviet's antisatellite vehicles. The overall involvement of Chelomey and his organization in the space program is obscure.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

Thus, it appears the Kryukov Design Bureau could have the responsibility for the lunar and planetary spacecraft.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

4.c.(4) Kryukov Design Bureau (U)

(b)(3):10 USC 424

~~(S~~ The Kryukov Design Bureau (formerly headed by G. N. Babakin) in the Khimki section of Moscow has the product charter for the current series of lunar and planetary payloads and satellites. The Korolev Design Bureau had the original charter for the lunar and planetary payloads; but responsibility was transferred to the Kryukov organization when the payloads transitioned from the SL-6 to the SL-12.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

4.c.(5) Utkin Design Bureau (U)

(b)(3):10 USC 424

~~(S~~ Chief Designer V. F. Utkin, successor to M. K. Yangel, is director of a large design entity located at the Dnepropetrovsk Missile Development and Production Center (DMDPC). DMDPC is probably responsible for the SL-7, SL-8, SL-11, and SL-14 launch vehicles, since the Utkin Design Bureau is responsible for the ballistic missile precursors to these space launch vehicles.

(b)(1);1.4 (c)

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(b)(1):(b)(3):10 USC 424:1.4 (c)

of the Freedom of Information and Privacy Act

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(b)(1):(b)(3):10 USC 424:1.4 (c)

of the Freedom of Information and Privacy Act

4.c.(6) Reshetnev Design Bureau (U)

(U) The Soviets have announced that M. F. Reshetnev is the chief designer of their communications, navigation, and geodetic spacecraft. Aside from that, they have said nothing about Reshetnev, his facility, or location.

(b)(1);1.4 (c)

(b)(1);(b)(3):10 USC 424;1.4 (c)

(b)(1);(b)(3):10 USC 424;1.4 (c)

(b)(1);1.4 (c)

(U) Table III summarizes the Soviet spacecraft design bureaus and their product charters.

4.d. Space Systems Production Facilities (U)

~~(S)~~ A number of production facilities have been identified as supporting the Soviet space program. The following facilities have been identified in space launch vehicle production:

(1) Kuybyshev Aerospace Production Plant 1—SL-3, SL-4, SL-6, and previously the SL-X.

(2) DMDPC—SL-7, SL-8, SL-11, and SL-14.

(3) Moscow Missile Production Plant—Fili 23: SL-9, SL12, and SL13.

(b)(3):10 USC 424

~~(S~~ ~~WNINTEL~~) Spacecraft production locations are not as well defined.

(b)(1);1.4 (c)

(b)(1);(b)(3):10 USC 424;1.4 (c)

TABLE III

(U) SOVIET SPACECRAFT DESIGN BUREAUS

CHIEF DESIGNER	LOCATION	PRODUCT LINE
V. P. Glushko	Moscow, Kaliningrad	Space Launch Vehicles, Spacecraft SL-3, 4, 6 SL-X SL-W
K. P. Feoktistov[1]	Moscow, Kaliningrad	Manned and Unmanned Spacecraft Soyuz T Progress Salyut[2] [redacted] (b)(1);1.4 (c)
FNU Kryukov	Moscow, Khimki	Unmanned Spacecraft Lunar Planetary Prognoz[2] [redacted] (b)(1);1.4 (c)
V. N. Chelomey	Moscow, Reutov	Space Launch Vehicles and Spacecraft SL-12, 13 Salyut[2] [redacted] (b)(1);1.4 (c) ASAT Radar Ocean Reconnaissance[4] ELINT Ocean Reconnaissance[4]
V. F. Utkin	Dnepropetrovsk	Space Launch Vehicles[3] SL-8 SL-11 SL-14 [redacted] (b)(1);1.4 (c)
M. F. Reshetnev	Krasnovarsk	Spacecraft [redacted] (b)(1);1.4 (c) Naval Support [redacted] (b)(1);1.4 (c) Naval Support Geodetic Intercosmos Single Payload COMSAT[2] Multiple Payload COMSATs[2] Geostationary COMSATs [redacted] (b)(1);1.4 (c) Molniya COMSATs Ocean[4]

(b)(1);1.4 (c) [redacted]

[3](U) Tentative association.

(b)(1);1.4 (c) [redacted]

[4](U) Tenuous Association.

~~SECRET~~

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SECTION III

OFFENSIVE WEAPON SYSTEMS (U)

1. General (U)

~~(S)~~ The SS-9 Mod 3, the Soviet fractional orbit bombardment system (FOBS), is a first-generation orbital weapon system developed by the Soviet Union for first-strike attacks against soft, time-sensitive targets.

(b)(1);1.4 (c)

No tests have been conducted on this system since 1971. Based on the discussions in the following paragraphs, the system is being maintained but is expected to be eventually phased-out.

(b)(1);(b)(3):10 USC 424;1.4 (c)

(b)(1);(b)(3):10 USC 424;1.4 (c)

(b)(1);(b)(3):42 USC 2162 (a) (RD);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

2. Projection Rationale (U)

~~(S)~~ In the Second Common Understanding relating to Article VII, paragraph 2 of the treaty between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Strategic Offensive Arms (SALT II Treaty), the Soviet Union agrees to dismantle and destroy 12 of the 18 launchers associated with the fractional orbital missiles at Tyuratam, and the remaining six launchers shall be modified to support testing of missiles undergoing modernization and shall be maintained strictly as test launchers. In all 18 launchers, the missiles shall be

removed and destroyed under procedures agreed upon in the Standing Consultative Commission.

(U) Also Article IX, paragraph 1(c) prohibits any new development of fractional orbital missiles.

(b)(1);(b)(3):10 USC 424;1.4 (c)

(S) The Soviets have had for many years the technical capability to develop a multiple orbit bombardment system (MOBS).

(S) While the development of a MOBS is possible at any time, its testing could be interpreted as a violation of the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies." This treaty has been in force since October 1967. Specifically, Article IV of the treaty contains an agreement not to place in orbit around the Earth, install on the Moon or any other celestial body, or otherwise station in outer space, nuclear or any other weapons of mass destruction. Certainly, the employment of a Soviet MOBS would require the abrogation of the treaty by the Soviets prior to, or at employment of, the MOBS.

(U) Article IX, paragraph 1(c) of the SALT II Treaty contains a prohibition against the development, test, or deployment of "Systems for placing into Earth orbit nuclear weapons or any other kind of weapons of mass destruction. . ." This adds additional force to the "Outer Space Treaty" prohibition on the employment of a MOBS system.

(U) In *Military Thought*, Major General Serv I Rognedin has discussed some of the quantitative aspects of MOBS system versus other strategic weapon systems. Rognedin notes that a MOBS system is more expensive—cost per unit equivalent of TNT, less flexible—it takes longer to attack a target with lower accuracy, has greater vulnerability—it is easier to hit a satellite than a missile in flight or in a silo, and the existence of a MOBS would cause those countries not having an ASAT capability to rapidly develop one. All this indicates the Soviets hold a MOBS system in very low stead.

(S) Beyond the concept of a traditional nuclear orbital bombardment system, almost nothing is known about Soviet concepts for other weapons in space. There have been allusions to short duration, manned sortie missions for reconnaissance and weapons delivery, but these have always been in connection with references to Soviet programs analogous to the US Dynasoar program, a program that was originally intended as an orbital bomber. *Military Strategy* by Marshall Sokolovsky in its second edition contains a discussion of many of the types of systems presented later in this study, but the 1968 third edition drops this discussion and speaks of space only in the most general of terms. Where military space is discussed at all, it is in terms of preventing the "imperialist" from using space as a war fighting medium. There have been no identified references to the concepts of extending conventional warfare (e.g., air-to-ground, air-to-air) into space (e.g., space-to-ground, space-to-air), or to using space as an alternative means for performing terrestrial missions. In short, the Soviet use of space as an arena for military conflict is not currently well enough understood to allow even the generation of perceptual system needs and requirements.

3. Projected Space Program (U)

(S) The Soviet FOBS (the SS-9 Mod 3) is expected to be phased-out of the Soviet inventory. This action is independent of US ratification of the SALT II Treaty.

(S) The Soviet development of a strategic, offensive orbital weapons system (MOBS) is not expected to occur until a space system can compete with alternative means of strategic weapons delivery in terms of cost,

accuracy, timeliness, and targeting flexibility. Such changes are not expected to occur within the next 20 years.

~~(S)~~ The Soviet development and use of space-based weapons in nonstrategic scenarios is not as easy to foresee. The Soviet attitude toward the use of space as an arena for military conflict, or the use of space as a weapons delivery medium is unknown. Accordingly no projections are made in this area.

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SECTION IV

DEFENSIVE WEAPON SYSTEM (U)

1. General (U)

~~(S)~~ The Soviets have developed a nonnuclear orbital intercept capability to negate US and other non-Soviet satellites in low Earth orbits. (b)(1);1.4 (c) The interceptor uses a fixed radar antenna as its acquisition sensor and an explosive pellet warhead as its negation device.

(b)(1);1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

(b)(1);(b)(3):50 USC 3024(i);1.4 (c)

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(b)(1);1.4 (c)

(S) In addition to their demonstrated orbital ASAT interceptor, the Soviets have the inherent capability to attack low-altitude satellites with their existing antiballistic missile (ABM) system. The current ABM, (b)(1);1.4 (c) is an exoatmospheric interceptor with the capability to maneuver during powered flight until (b)(1);1.4 (c) intercept is achieved.

(S) The Soviets could use ballistic missiles (ICBMs, SLBMs, and IRBMs) or space launch vehicles or combinations of both armed with nuclear warheads and launched to detonate at a point in space. These direct ascent vehicles could be used at any altitude up to and including geosynchronous. The large kill radii of these warheads (tens to hundreds of kilometers) would more than compensate for missile guidance and ephemeris prediction errors. Ballistic missiles/space launch vehicles have the capability to attack satellites up to geosynchronous altitudes; however, there is no evidence that ballistic missiles have been tested in an ASAT mode.

(S) Finally, the Soviets are assessed to have the (b)(1);1.4 (c) capability to interfere with satellites using existing ground-based high-energy laser facilities. (b)(1);1.4 (c)

. Projection Rational (U)

2.a. Target Set (U)

(S) The orbits of active US military satellites can be grouped into four bands. The first encompasses those near-Earth satellites (to 2,000 km) with orbital inclinations of 28-110 degrees. This band encompasses the low-altitude meteorology and navigation missions, and the shuttle. A second band of 12-hour, 20,000-km circular orbits is to be populated by the NAVSTAR Global Positioning System (the US precision navigation system). A third band includes the 12-hour "Molniya"-type (740 × 39,350 km, 63 degree) orbit (b)(1);1.4 (c) The final band includes those satellites in or near geosynchronous orbit—military and civilian COMSATs, DSP, GOES, SMS. In general, any ASAT system (or systems) must deal with one or more of these bands.

(S) Satellites in band one normally have independent missions, where loss of the satellite completely terminates the mission until a replacement satellite can be launched. A one-shot ASAT could be used effectively in this band. In the other three bands satellites are aligned in networks. The loss of one satellite in a network will degrade the mission or function the network performs, but the other satellites would take up the slack in such a situation and the mission or function would continue. In these bands, a multishot ASAT seems attractive. This type of ASAT would need to be capable of negating several satellites in a single network before it could be considered effective for high-altitude use.

(b)(1);Sec. 1.4(c)

2.b. Low-Altitude Interceptors (U)

(S) Interest in low-altitude spacecraft is evident in the Soviet ability to actively detect and track foreign satellites. Current Soviet long-range space tracking radars were developed primarily for the ballistic missile early warning and ABM battle management roles. As such, the radars are limited in their ability to detect other than low-altitude satellites without modifications rendering them useless in their primary roles.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~ In summary, the concentration on low-altitude tracking of satellites, the high-value nature of US low-altitude satellites, and the flight-testing of a developmental interceptor point to a continued need for a Soviet capability to perform one-on-one interceptions/negations of target spacecraft in the low-altitude band. This in turn implies a continued reliance on the current SL-11 launched orbital interceptor or the same spacecraft with evolutionary modifications.

~~(S-NOFORN-WNINTEL)~~ There is evidence that one application of the Soviet High-Energy Laser (HEL) program is to develop a space-based laser weapon having an ASAT application.

(b)(1);1.4 (c)

~~(S)~~ A space-based laser ASAT could have significant advantages over the conventional orbital interceptor such as multishot and long-range capabilities. It also could have a greater capacity to overcome defensive measures such as maneuvering and decoy deployment, and has an inherent self-defense capability. The first deployment of a laser ASAT will probably be a low power demonstrator system used mainly as a feasibility study.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

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(b)(1):(b)(3):50 USC 3024(i):1.4 (c)

of the Freedom of Information and Privacy Act

2.c. High-Altitude Interceptors (U)

~~(S)~~ Although there is evidence the Soviets have a requirement to deny the US information from certain high-altitude missions, there is no currently identified evidence indicating a Soviet requirement for the destruction of high-altitude satellites. However, Soviet radio-electronic combat control measures call for 30 percent destruction of communications systems, 30 percent jamming of communications systems, and 40 percent of the systems left alone. The Soviets believe this effectively destroys the communication network. This doctrine could imply a requirement for high-altitude COMSAT interference.

~~(S)~~ The most obvious extension of Soviet ASAT capability to higher altitudes is to expand the capability of the current ASAT interceptor. By using an SL-12 booster in place of the current SL-11 booster, the Soviets could reach satellites in geostationary orbit with their current interceptor. When used in this manner, the resulting error volume guidance and propulsion inaccuracies is greater than the search volume of the current interceptor's radar system. To adapt the current interceptor to the SL-12 booster, the Soviets would probably have to incorporate a number of modifications to the booster and spacecraft. These changes include an improved guidance system in the booster or a midcourse command capability, and a sensor with increased acquisition range. While these changes are all within Soviet technological capabilities, each would require a moderate flight-test program of three to four successful flights, two of which were consecutive, lasting 2- to 4-years to have an operational system.

~~(S)~~ Another possible ASAT capability that could be derived from the current interceptor is a space mine. A space mine is a covert nuclear device built into a host satellite and positioned near a high-priority target satellite. The space mine would be detonated by a signal from a ground command station at the start of a high-level conflict. The deployment of a space mine is a direct violation of the Outer Space Treaty. Also, operationally the space mine does not appear to be an effective ASAT weapon. The space mine is subject to all the problems inherent with the orbiting and operating of a satellite (launch vehicle failure; orbital propulsion/maneuvering failures; telemetry, tracking and command failures, etc.) plus those relating to the nuclear weapon itself. It also must be stored in space for an extended period of time and its position continually tracked and maintained near its intended target. The close proximity maintained to its target would belie any stated mission for the satellite besides that of a space mine.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

Because of its nuclear weapons its use would be limited to high-level conflicts (i.e., direct US/Soviet nuclear warfare). All this must be contrasted to the use of a direct ascent nuclear weapon, which can attack its intended target in a matter of hours, is subject only to quantifiable weapon system reliability problems, and is launched immediately before or at the start of a high-level conflict.

~~(S)~~ Similar to the inherent low-altitude capability of the ABM [redacted] the Soviets currently have the pr(b)(1);1.4 (c) pulsion capability to attack high-altitude satellit using nuclear weapons launched on direct ascent trajectories by modified ICBMs or SLVs. Some sort of flight-test program lasting 2 to 4 years would be expected before IOC.

~~(S)~~ As stated earlier, a possible application of the Soviet HEL program could be ASATs. Because of its inherent multishot capability and long-range possibilities, an ASAT vehicle equipped with a laser as its negation device could be an effective system against satellites arrayed as network target sets.

(b)(1);1.4 (c)

Timeliness and orbital profile requirements for a geosynchronous laser ASAT, however, have yet to be determined and are scenario specific. In any case, attack could not occur sooner than 12 hours for a coorbital mission.

~~(S)~~ A second option the Soviets could pursue to attack network targets involves developing a multishot interceptor using a more conventional means for target negation, including a rocket launched from the interceptor vehicle with a high-explosive warhead or a recoilless rifle.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

Page 35 is withheld in full and not provided.

For example, conventional negation means will force the Soviets to get much closer than with a laser to achieve target kill. This means an increased amount of propellant is required for maneuvering than with a laser. The shorter kill ranges could mean increased relative closing and angular tracking velocities, which could affect the design of the acquistion and homing sensor and possible attack profiles. The conventional warhead systems offer a fire-control attack assessment advantage over a laser negation device. The conventional systems will kill the targets with some form of kinetic energy transfer. This is expected to lead to target fragmentation or severe, erratic, and observable target motions, all easily seen and understood by the attack assessment portions of the ASAT system. While a laser is capable of depositing a sufficient amount of energy on the target for breakup, the sure-kill criterion of a satellite for exposure to laser radiation is much less than the energy required to fragment the spacecraft. Kill verification for a spacecraft exposed to enough laser energy to kill it, but insufficient energy for fragmentation is uncertain. The observables—loss of signal or instability—may take a significant period of time to verify.

3. Projected Space Program (U)

~~(S)~~ The SL-11 launched orbital ASAT system will probably be retained for use against low-altitude target satellites through the mid term with modifications as required to counter perceived US countermeasures. This system has a demonstrated low-altitude intercept capability in both the one-orbit and two-orbit intercept profiles. However, it is limited in response time and operating altitude.

~~(S-NOFORN-WNINTEL)~~ The Soviets appear to be developing a space-based laser ASAT capability in addition to their existing ground-based laser ASAT capability.

(b)(1);1.4 (c)

~~(S)~~ Although highly unlikely, the Soviets could use nuclear weapons in an ASAT role with the most likely options being either ABMs, ICBMs, or SLVs. The use of an ABM in an ASAT role is expected to occur only if a nuclear conflict seemed unavoidable or was already underway. The Soviets could also launch nuclear weapons on SLVs and ICBMs to attack target spacecraft in high-altitude orbits.

SECTION V

RECONNAISSANCE SPACE SYSTEMS (U)

1. Photoreconnaissance Systems (U)

1.a. General (U)

~~(S)~~ Photoreconnaissance satellite systems form a large and diverse portion of the Soviet space program, using one-third of the total Soviet launches.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~

In addition, multispectral cameras on manned spacecraft have been used for Earth resources surveys. The Salyut M (military) space stations used both high- and low-resolution military reconnaissance cameras.

~~(S)~~ Since 1975 the Soviets have conducted an Earth-resources space photography program characterized by dedicated spacecraft sensors and an agency established for Earth resources data collection and study (*Priroda*). At first, the satellites were launched twice a year, usually in May and September for agricultural surveys. During the past two years, the number of missions flown has increased and the announced mission of the satellites has been expanded to include "the study of the Earth's natural resources."

(b)(1);1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

(b)(1);1.4 (c)

~~(S)~~

Satellites were launched at increased rates and flown for shorter durations to provide more frequent coverage and improved timeliness.

(b)(1);1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

For FAC2A1: Per DH note, third redaction box in column 2 is another one that apparently was extended by mistake, but since NASIC approved it we will go with it. Reconsider upon appeal.

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

~~(S)~~ Soviet manned spacecraft have routinely taken Earth and celestial photography since the inception of the manned space program.

These optical systems were used mainly over land and under lighting conditions like those used for unmanned photoreconnaissance vehicles. Several other features of these space stations, such as the data capsule recovery, also imply a covert reconnaissance system.

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

1.b. Projection Rationale (U)

~~(S)~~ Taking a macroperspective of the Soviets' photoreconnaissance satellite program one can develop a generalized statement of program goals. These goals are to conduct a comprehensive program of photographic observation from low-Earth orbit in support of:

(1) Monitoring the strategic and tactical force posture of potential adversary nations,

(2) Monitoring areas of world tension,

(3) Supporting tactical military operations,

(4) Surveying the Earth's natural and agricultural resources, and

(5) Performing geodetic studies.

While these goals were developed from an examination of the historical usage of the Soviets' photoreconnaissance program, they represent an exhaustive set of goals for any satellite photoreconnaissance program, and these goals are expected to hold in the future.

(U) From these goals, the following set of measures of merit for the Soviets' photoreconnaissance satellite program can be developed:

(1) Ground resolution of the imagery,

(2) Timeliness of the photographic data,

(3) On-orbit mission flexibility, and

(4) Continuity of photographic coverage.

Using these measures of merit we can examine the Soviets' current capability in each mission category (or goal) and determine any apparent deficiencies that could lead to requirements for new photoreconnaissance satellite systems.

(U) Table VI shows the resolutions required to perform three levels of photo interpretation needed to support the general missions of force and crisis monitoring. For Earth resources and geodetic missions the required resolution is on the order of tens to hundreds of meters.

(b)(1);1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);1.4 (c)

(U) Table VII presents timeliness criteria for a number of missions performed by the Soviet photoreconnaissance satellites. Timeliness refers to how soon a photograph is required for analysis after it was taken.

(b)(1);1.4 (c)

~~(S)~~ Again, a review of Table VII shows the current Soviet practice satisfies most of the data timeliness requirements. The one significant exception is the timeliness requirements for crisis monitoring.

(b)(1);1.4 (c)

TABLE VII

(U) PHOTOGRAPHIC DATA TIMELINESS

MISSION	DATA TIMELINESS
Monitoring strategic forces	Several weeks to a month
Monitoring tactical forces	Days to weeks
Monitoring crisis areas	One to five days for the duration of the crisis
Tactical targeting	Minutes to hours
Agricultural survey	Several weeks to a month
Natural resources survey	Several months to a year
Map making	Months to two years
Geodetic studies	Months to two years

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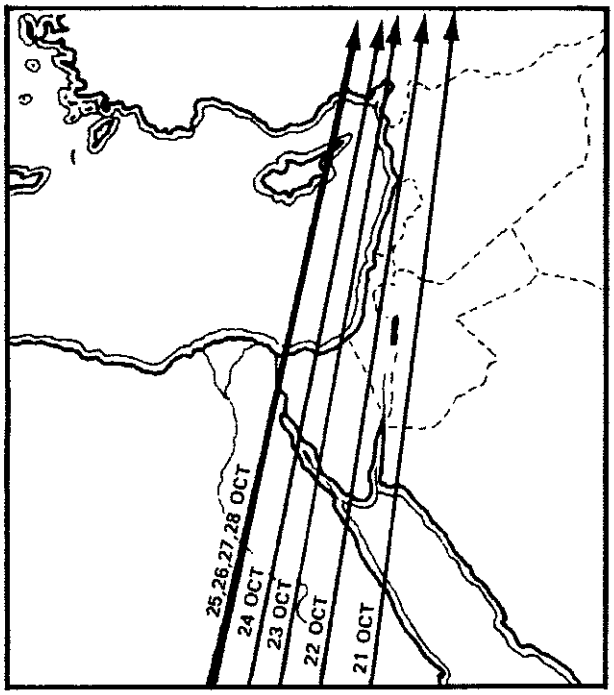

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Fig. 17 (U) Cosmos 602 Ground Trace

(b)(1);(b)(3):50 USC 3024(i);1.4 (c)

ground trace of Cosmos 602 from 21-28 October 1973, clearly illustrating the repeated daily overflights. Clearly, the Soviets have a requirement to increase their data timeliness when monitoring worldwide crises with photoreconnaissance satellites.

~~(S)~~ On-orbit flexibility is the spacecraft's ability to change its ground trace to satisfy its particular mission. In general, this is required to assure repeated overflights of an area or to position the ground trace with respect to an intended target. Those missions requiring on-orbit flexibility involve force and crisis monitoring.

(b)(1);1.4 (c)

~~(S)~~ Finally, continuity of coverage is related to the amount and frequency of data required to satisfy a given mission.

the Soviets have a requirement for almost continuous on-orbit coverage by photoreconnaissance satellites.

~~(S)~~ This review of Soviet photoreconnaissance requirements shows they have the following technical requirements:

(1) (U) Conduct area search/identification and specialized photoreconnaissance missions.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(2) ~~(S)~~ Achieve resolutions for search photography, for spotting/identification missions, and 10 m or more for the specialized missions

(b)(1);1.4 (c)

(3) (U) Achieve data return in 10 days to 4 weeks for most missions, but 1-5 day data return is needed for monitoring world-wide crises.

(4) (U) Provide on-orbit maneuverability to satisfy the requirements of selected missions.

(5) ~~(S)~~ Provide for a large number of on-orbit days for satellites used for force monitoring and other military related missions.

~~(S)~~ Of these requirements, timeliness is the most difficult. To meet this requirement, the Soviets could develop a photoreconnaissance system with improved data timeliness. To do this there appear to be two options the Soviets could pursue. One would adapt technology similar to that developed during the 1960's for the US lunar orbiter camera system. The satellite would use a traditional film-sensing medium, but instead of recovering the unprocessed film for eventual readout and exploitation, the film would be processed on board the satellite, and selected frames of imagery would be readout for "quick-look" exploitation. The

The readout device could be a simple device such as a vidicon or a photomultiplier tube. The readout could occur during nonimaging portions of the orbit, with the data stored and transmitted to the ground during favorable opportunities. In the second option, the Soviets would develop a system using some form of electro-optical sensor (discrete detector, vidicon, etc.), and the detector output would be relayed in real-time to a central ground processing station (either directly or through a data relay satellite). The first option is referred to in this study as a near real-time photoreconnaissance system, the second as a real-time photoreconnaissance system.

(b)(1);1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

1.c. Projected Space Program (U)

(b)(1);1.4 (c)

~~(S)~~ Based upon requirements, technical constraints, and historical trends, the [redacted] photoreconnaissance satellites will form the bulk of the Soviet's military photographic resources for the near and mid terms.

~~(S)~~ The Soviets have a requirement for increased timeliness in the photoreconnaissance data over that offered through their current film-return photoreconnaissance satellites. In all likelihood, the Soviets will begin developmental flights of a store/dump near real-time system sometime in the near term. While the Soviets may be interested in acquiring a more flexible and timely real-time photoreconnaissance system, the first flight of that system will not be until sometime in the far term. [redacted] (b)(1);1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);1.4 (c)

(U) The Soviets will continue to rely on coarse scale photoreconnaissance satellites to satisfy their requirements for natural resources and agricultural survey, and geodetic applications. The level of launch activity is expected to remain the same as that established during the late-1970's and early-1980's.

(b)(1);1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

(b)(1);1.4 (c)

2. Radar Ocean Reconnaissance System ~~(S)~~

2.a. General (U)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~ The Soviets began flight tests of the radar ocean reconnaissance satellite (RORSAT) system launched by the SL-5 All succeeding spacecraft were launched by the SL-11.

(b)(3):10 USC 424

(b)(1);1.4 (c)

~~(S)~~ Two orbits are associated with RORSATs. RORSATs are launched in a ballistic trajectory to an altitude of 270 km. with an inclination of 65 degrees. Payload operations are performed in this orbit. After mission completion, the satellite separates into at least three pieces. One piece transfers to a 980-km near-circular orbit. The remaining pieces are left in the original orbit for normal decay and reentry. After the orbit transfer, all pieces begin tumbling The purpose of the transfer is to store the remnants of the satellite's nuclear reactor power supply in a high orbit. From this high orbit, at least 500 years will pass before the reactor reenters the atmosphere, allowing the radioactivity to decay significantly.

(b)(1);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36;Sec. 1.4(c)

(b)(1);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36;Sec. 1.4(c)

~~(S)~~ The mission of the satellites is to detect and locate surface ships

(b)(1);1.4 (c)

radar as the primary mission sensor.

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

~~(S)~~

The extended solo mission of Cosmos 1176 was probably a test of the RORSAT system after the difficulties experienced with Cosmos 954 (which crashed in Canada). It is expected the Soviets will operationally deploy the RORSAT in the dual satellite configuration during crises periods and also during high interest naval operations and exercises.

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

~~(S WNINTEL)~~

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

2.b. Projection Rationale (U)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

(b)(1);1.4 (c) ~~(S)~~

Complementary use of other spacecraft sensors such as the EORSAT could also enable the Soviets to improve the quality of the RORSAT data.

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

2.c. Projected Space Program (U)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

The basic RORSAT configuration has remained unchanged

When Cosmos 954 impacted in Canada with its nuclear reactor, most analysts believed the Soviets would use the forced opportunity to modify the RORSAT—both to replace or fail-safe the nuclear reactor and to improve the radar. The Soviets appear to have made no change

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~ In summation, the Soviets will continue using the RORSAT in the near and mid terms. The spacecraft will remain relatively unchanged,

(b)(1);1.4 (c)

Significant modifications in the Soviets radar satellite program are expected in the far term. These are discussed in Section XV.

3. ELINT Ocean Reconnaissance Satellite (U)

3.a. General (U)

~~(S)~~

(b)(1);1.4 (c)

but continues to undergo some problems. The EORSAT is used for surveillance of NATO and US naval operation. The use of the EORSAT mainly over ocean areas indicates that it supports a ship targeting/monitoring mission.

(b)(1);1.4 (c)

~~(S)~~ All EORSATs have been launched from TTMTC. The SL-11 launch vehicle

with an inclination of 65 degrees.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

3.b. Projection Rationale (U)

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

(b)(1);1.4 (c)

~~(S)~~ As additional naval radars (both US and those of other potential opponent nations) become operational, some of these radars will probably lie outside the frequency coverage of the EORSAT. When the numbers of these new radars become large, the Soviets may modify the EORSAT to allow them to cover these new radars and frequencies.

~~(S)~~ The deployment of EORSAT spacecraft in any form of a network is currently uncertain. The Soviets have used both single and dual satellite EORSAT deployments, and at present the Soviets have not shown any preference between the two. Accordingly, the actual operational constellation used by the EORSAT may depend on short-term tactical requirements rather than any long-term, optimized surveillance goal.

3.c. Projected Space Program (U)

~~(S)~~ The EORSAT is expected to change little in the near and mid terms. The Soviets may occasionally modify the frequency coverage of the EORSAT to ensure coverage of naval targets of interest.

4. ELINT Reconnaissance Satellites (U)

4.a. General (U)

(b)(1);1.4 (c)

~~(S)~~ The Soviets have developed (b)(1);1.4 (c) of generalized ELINT collections systems.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

4.b. Projection Rationale (U)

~~(S)~~ The general task of an ELINT satellite mission is to collect information on the radio frequency (RF), pulse duration (PD), and pulse repetition frequency (PRF) or pulse repetition interval (PRI) of emitters active in a certain geographical area, enabling identification of the particular emitters responsible for the signals. Other quantities that can be measured are scan rates and antenna pattern lobe beamwidths of the transmitting entities. It may be further possible to determine the location of the emitters involved; The uses of the entire range of ELINT information are extensive.

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

Spatial mapping of location indicates specific deployment and permits estimation of the RF environment over territorial regions of interest. Identification of particular emitters permits changes in deployment to be noted

(b)(1);(b)(3):50 USC 3024(i);Sec. 1.4(c);(b)(3):P.L. 86-36

~~(S)~~ The advantages of using an Earth satellite to perform the ELINT mission are apparent. Most compelling is the access to geographic areas unavailable by other means. Additional features include the ability of a single satellite to cover a vast area within its orbit, the availability of satellite processed data, and the elimination of manning requirements for some degree of data reduction.

(b)(1);1.4 (c)

~~(S)~~ Given the parameters an ELINT satellite will be able to measure plus an idea of the intelligence information to be derived from the measurements, there are two distinct missions an ELINT satellite can perform, one involving electronic mapping and the other involving the collection of scientific and technical intelligence. This section will discuss the mapping mission; the scientific and technical surveillance mission will be discussed in Section VI.

~~(S)~~ An ELINT satellite mapping mission would attempt to cover as much of the Earth as possible to determine the spatial distribution, location, and operational usage pattern of as many emitters as possible. The results would be of both strategic and tactical value against a potential adversary in determining deployment of specific units with known capabilities and weaknesses.

(b)(1);1.4 (c)

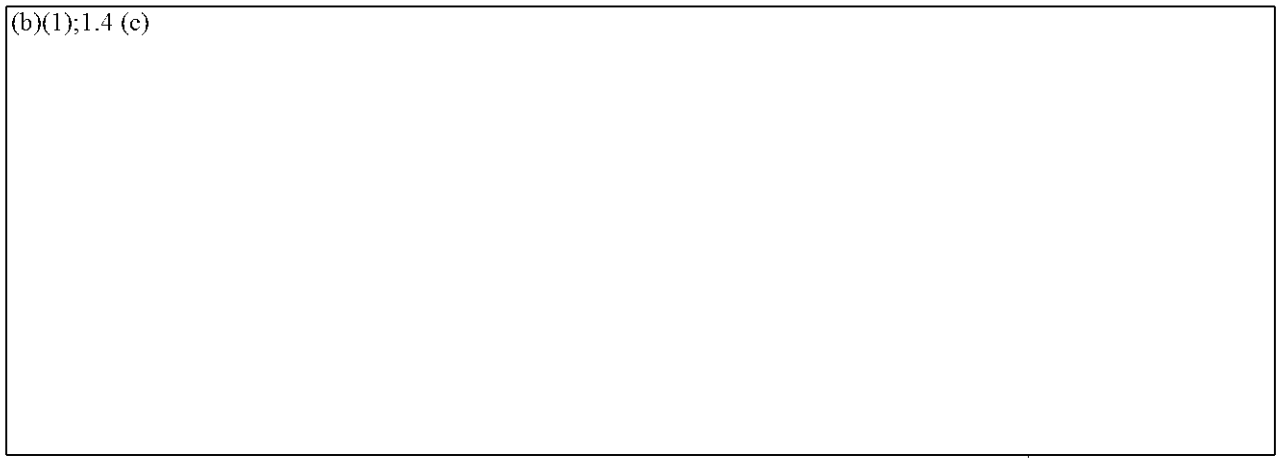
The requirement is to collect sufficient data to enable ultimate determination of what type of radar is in a given location, and periodically thereafter to verify its continued operation. A mapping mission will require a constellation of several satellites in low circular orbits to be active at any one time.

~~(S)~~ The Soviets' current ELINT fulfill the mapping mission function.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)



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(b)(1);1.4 (c)

~~SECRET~~

Fig. 19

4.c. Projected Space Program (U)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~ The ELINT system will be the Soviets' principal ELINT collector throughout the near term, and into the mid term. The Soviets may choose to make evolutionary changes in the ELINT spacecraft to improve certain aspects of the data collection,

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~ In the near term, or at the very latest the beginning of the mid term, the Soviets will introduce an improved ELINT collector, the follow-on ELINT system. This system will incorporate a number of improvements over the ELINT system

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);1.4 (c)

(b)(1);1.4 (c)

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SECTION VI

SURVEILLANCE SPACE SYSTEMS (U)

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

1. Launch Detection Satellites (U)

1.a. General (U)

~~(S)~~ The Soviets are developing and deploying a missile launch detection satellite (LDS) system.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

All LDS satellites occupy a highly eccentric orbit 650 × 39,500 km with an inclination of 62.8 degrees. Only one LDS satellite, Cosmos 775, was ever launched into geostationary orbit.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(U) Table X presents the technical parameters of the LDS 2 system.

(b)(1);1.4 (c)

~~(S)~~ The LDS satellite

(b)(1);1.4 (c)

used a sensor system for missile launch detection

(b)(1);1.4 (c)

(b)(1);1.4 (c)

1.b. Projection Rationale (U)

(b)(1);Sec. 1.4(c)

~~(S)~~ Based upon the orbital arrangement of the operational LDS spacecraft, the Soviets appear to be developing a multiple satellite constellation of nine spacecraft.

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

(b)(1);(b)(3):50 USC 3024(i);1.4 (c)

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

1.c. Projected Space Program (U)

~~(S)~~ The Soviets will achieve full IOC of the LDS network (they have coverage but not redundancy now) in the next few years. The Soviets are expected to make evolutionary improvements to the satellites throughout the projection period, which may consist of one or more of the following improvements:

(b)(1);1.4 (c)

(2) A geostationary satellite with hemispheric coverage, also addressing ICBM and SLBM launches.

2. SIGINT Surveillance (U)

2.a. General (U)

(b)(1);1.4 (c)

2.b. Projection Rationale (U)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(C-NOFORN-WNINTEL)~~ (b)(1);1.4 (c)

These indicate the Soviets have two projects under way, overtly for radio astronomy and the search for extra-terrestrial intelligence. One, Project Rakas, involves the development and orbiting of a monolithic, 30-m diameter antenna on a low-altitude spacecraft. The second project involves the orbiting of 10-m diameter antennas, but in this case the orbit will be a 12-hour, Molniya-type orbit. Both projects are under the aegis of Nikoly S. Kardashev, a noted Soviet radio astronomer and Deputy Director of IKI. Project Rakas appears to be a Soviet attempt to go it alone following the US rejection of the Salyut-Shuttle experiments. It may also be a continuation of the experimental effort begun with the KRT-10 radio telescope experiments on Salyut 6. The second program is probably military related or controlled. The reported launch rate for these high-altitude radio telescopes—one per year—is greater than appears to be required to support a purely scientific mission. Unlike Rakas, where Kardashev is the nominal head of the project, this project is firmly under Kardashev's control.

(b)(1);1.4 (c)

~~(C-NOFORN-WNINTEL)~~ The Soviets, as part of their package of proposed experiments for the Salyut-Shuttle cooperative space venture, proposed a series of

radio astronomy experiments demonstrating all the technology necessary for a SIGINT surveillance system, although the receiver would be aimed at space rather than terrestrial emitters. US participation in these experiments involved antenna erection and relay of data through the Tracking and Data Relay Satellite. The Soviets would supply all necessary receivers and data processing and transmission equipment. Because of the conservative nature of Soviet involvement in international space cooperation, it does not seem probable for the Soviets to propose something they could not fulfill.

(b)(1);1.4 (c)

2.c. Projected Space Program (U)

(b)(1);1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);1.4 (c)

~~SECRET~~

3. Aircraft Surveillance Satellites (U)

(b)(1);1.4 (c)

3.a. General (U)

~~(S)~~ The impending deployment of US cruise missiles on airborne platforms presents the Soviets with a two-faceted problem. The first is that the cruise missile carrier is a very high-value target (prior to missile launch). The second is that the carrier will probably release its cruise missiles beyond the current range of the Soviets' early warning network. Thus, it would be to the Soviets' advantage to be able to detect and track the carrier aircraft at some distance from the Soviet Union so defensive forces could be vectored to the location of the carrier aircraft and negate it prior to the launch of its cruise missiles. An obvious solution to this problem would be a spaceborne sensor (or system of sensors) capable of performing surveillance of the routes taken by the carrier aircraft from their bases (or refueling points) to their missile launch points.

~~(S)~~ As currently envisioned, the cruise-missile carrier will be an aircraft with a large radar cross section (modified B-52 or B-1B). That, coupled with the velocity and altitude of the aircraft, could allow the Soviets to develop a satellite with a radar sensor for the detection and tracking of the carrier aircraft.

3.b. Projection Rationale (U)

~~(S)~~ As discussed, the US strategic planner has presented the Soviet Union with a high-value target, which the Soviets currently have little opportunity to counter because of their inability to detect and track the target. Space-based sensors offer an attractive means to overcome this problem. Both active and passive sensors could be used to perform the aircraft surveillance mission, with an active radar sensor the most easily realizable.

~~(S)~~ Current estimates of the technology the Soviets could use in developing a space-based, aircraft detection radar indicate the Soviets will not have a space-based aircraft detection system in the 1980's.

3.c. Projected Space Program (U) (b)(1);1.4 (c)

~~(S)~~ Although there is ample need for a satellite-borne aircraft detection capability, the Soviets are not expected to have a viable capability during the projection period.

FAC2A1: unclass description of redacted classified table not withheld becuse heading is non-substantive and follows same format as other sections.

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SECTION VII

COMMUNICATIONS SYSTEMS (U)

1. Real-Time (U)

1.a. General (U)

~~(S)~~ The need to communicate over the vast geographic areas of the Soviet Union made it imperative for the Soviets to develop a reliable and efficient communications system with a minimum expenditure of time and resources. The application of space technology to long-distance communication problems had particular appeal to the Soviets for the extension and augmentation of their terrestrial telecommunications network.

~~(S)~~ The number of active COMSATs presently maintained by the Soviets permits them to divert various communications relay functions from landlines and ground-based radio relay systems to satellite relay systems in times of disaster with no apparent loss of communications capability.

~~(S)~~ Soviet COMSAT systems can be broadly categorized into real-time and store/dump communications relay systems. Table XII is a list of current Soviet COMSATs.

TABLE XII

(U) COMMUNICATIONS SATELLITE SYSTEMS

Real-Time

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

Molniya 1
Molniya 3
Ekran (Soviet designation for Statsionar T)
Raduga (Soviet designation for Statsionar 1, 2, and 3)
Gorizont (Soviet designation for Statsionar 4 and 5)

Store/Dump

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

~~SECRET~~

~~(S)~~ The first Molniya 1 satellite was launched in 1965.

The Molniya 1 system now employs at least eight spacecraft. The individual satellites are deployed in highly elliptical (500 × 41,000 km) 12-hour orbits inclined at 62.8 degrees with right ascensions spaced 45 degrees apart.

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

~~(S)~~ During 1971, the Soviets launched their first second-generation Molniya COMSAT (Molniya 2). The Soviets have phased out the Molniya 2 system with the last Molniya 2 launched on 11 February 1977.

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

~~(S)~~ The first Molniya 3 COMSAT was launched on 21 November 1974.

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

The Soviets have established a four satellite Molniya 3 network, using a Molniya-type orbit, for full-time communications relay in the northern hemisphere. The Molniya 3 COMSATs initially provided relay of civil television and telephone communications. They also supported international communications commitments, such as INTERSPUTNIK and the US/USSR Hotline. However, as the Soviets developed their network of geostationary COMSATs, most civil and INTERSPUTNIK traffic was shifted to the geostationary satellites

~~(S)~~ Two amateur radio satellites, called Radio 1 and Radio 2, were launched on 26 October 1978 with Cosmos 1045 by a single SL-14 booster. The satellites are the first of an announced Soviet amateur radio satellite system similar in concept to the US Oscar amateur radio satellites. The Radios translate a 145-MHz uplink to 29 MHz and then rebroadcast it.

(U) All of the Soviet's geostationary COMSATs are real-time relay systems. They will be discussed in paragraph 3, this Section.

1.b. Projection Rationale (U)

~~(S)~~ As the Soviets introduce new geostationary satellites, the question of whether or not they will continue to use their 12-hour COMSATs—Molniya 1 and Molniya 3—must be addressed. While some of the capability of these satellites is duplicated with the geostationary satellites, the Molniya series satellites offer

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

several advantages over geostationary satellites. Perhaps the first of these is their ability to serve high latitude areas in the Soviet Union in an easier, more straightforward manner. Secondly, the Molniya satellites, by virtue of their orbits (b)(1);1.4 (c) offer an increased measure of survivability over geostationary COMSATs. Finally, the Molniya 3 can offer a redundant relay path to that offered in a geostationary satellite, such as a Raduga or Gorizont. So, for the near and mid terms it seems the Soviets will maintain their Molniya 3 spacecraft network.

~~(S NOFORN WNINTEL)~~ The Molniya 1 satellites also present the problem of whether the Soviets will maintain them in the future. The Molniya 1 satellites (b)(1);1.4 (c) technology they represent is approximately 20 years old. This foretells abandonment of this system and the merging of the traffic onto either Molniya 3 or the geostationary satellites. However, this must be contrasted against the proven Soviet tendency not to abandon operating systems (b)(1);1.4 (c) General Soviet practice for a system with a maturity level similar to that of the Molniya 1 is to retain the system but to degrade its status from a primary support system, to one of a number of redundant paths, to a secondary or backup system, and finally to system phase-out. The Molniya 1 system appears to have entered this process. (b)(1);1.4 (c)

How long before the Molniya 1 system completes this transition process can not be determined. Certainly, the Molniya 1 will be retained into the mid term. Whether the Soviets retain the satellite throughout the next 10 years is debatable.

~~(S)~~ In addition to the Molniya 1 and 3, the Soviets could introduce other communications relay satelites into the 12-hour, semisynchronous orbit. These spacecraft are not expected to be "common carrier" communications satellites—like Molniya 1 and 3—but specialized relay platforms (b)(1);1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);1.4 (c)

(b)(1);1.4 (c)

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

~~(S)~~ The introduction of a new common carrier communications satellite into the Molniya-type orbit (b)(1);1.4 (c) is considered an unlikely event, at this time. The reasons for this are connected with the issue of crowding the RF spectrum discussed later in this section.

1.c. Projected Space Program (U)

~~(S)~~ The Molniya 1 spacecraft system is in a state of transition potentially leading to its phase-out. The Soviets are expected to retain the Molniya 1 into the mid term with the spacecraft phasing out sometime toward the end of the mid term.

~~(S)~~ The Molniya 3 space system is expected to be retained throughout the near and mid terms. Although the Molniya 3 potentially duplicates the service provided by geostationary communications satellites, its orbit provides better polar coverage and a measure of survivability and wartime robustness to the Soviets overall communications system.

~~(S)~~ Special-purpose data relay satellites are expected in the mid term. These spacecraft will serve as a funnel for data (b)(1);1.4 (c)

~~(S)~~ Finally, the Soviets are expected to launch special purpose communications relay spacecraft periodically over the next 10 years. As with Radio 1 and 2, these satellites will be launched piggyback with other spacecraft.

2. Store/Dump Communications Satellites (U)

2.a. General (U)

~~(S-NOFORN-WNINTEL)~~ The Soviet Union has developed (b)(1);1.4 (c) store/dump communications satellite system.

(b)(1);1.4 (c)

~~(S-NOFORN)~~ The Soviets use the multiple payload communications satellites (MPCS) for the

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

~~(S)~~ (b)(1);1.4 (c) The mode of operation is assessed to be recorded message relay.

~~(S-NOFORN)~~ With the MPCS the Soviets have developed a COMSAT system that is available for long periods of time each day

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

2.b. Projection Rationale (U)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(S) No significant changes in hardware or deployment are expected through the mid term. The possibility exists that the Soviets may expand the network to increase the system relay capacity.

2.c. Projected Space Program (U)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(S) In the mid term, the number of active, on-orbit spacecraft could be increased to handle an increased traffic load.

3. Geostationary Communications Satellites (U)

3.a. General (U)

(S) The Soviets did not take advantage of geostationary COMSATs as early as the Western nations. This is probably because highly elliptical orbits, like those used by the Molniya satellites, are better suited for coverage of the high northern latitudes in the USSR. (Also, no suitable launch vehicle was available.)

(S) The first Soviet geosynchronous spacecraft, Cosmos 637, was launched in March 1974 to check the ability of the SL-12 launch vehicle to place a payload into geosynchronous orbit. The first geostationary COMSAT, Molniya 1S, was launched in July 1974 and stabilized at 85 degrees east longitude. Molniya 1S was a test system for the Statsionar COMSATs.

(U) The first operational Soviet geostationary satellite, Raduga 1 (the name given to Statsionar 1 at launch) was orbited in December 1975 and positioned at 85° E longitude. Following this the Soviets launched additional geostationary COMSATs—Statsionars 2, 3, 4, and 5—giving them the names Raduga (Statsionar 2 and 3) and Gorizont (Statsionar 4 and 5). All these satellites operate in the traditional 3/6 GHz COMSAT frequency band.

(U) The Soviets have also developed a geostationary COMSAT for the relay of television to small community antennas in remote areas of the Soviet Union that cannot be served by more conventional COMSAT ground facilities. The satellites take a TV signal transmitted from the Moscow area at 6.2 GHz and beam it back to the Soviet Union at 714 MHz. This satellite was filed as Statsionar T by the Soviets and given the name Ekran at its launch. The Soviets keep an operating Ekran at 99° E longitude.

3.b. Projection Rationale (U)

(U) The Soviets have announced their intentions, through International Frequency Registration Board (IFRB) filings to operate as many as 36 distinct geostationary COMSATs. These satellites fall into five general categories—Statsionar 1-15 and Statsionar T and T-2, Volna 1-7, Gals 1-4, Luch 1-4, Luch P 1-4*. They have also been allocated by the World Administrative Radio Conference (WARC) a number of frequency subpoint combinations for direct broadcast TV satellites operating in the 12-GHz frequency spectrum. Table XIII and Figure 22 summarize the geostationary communications satellite program the Soviets have filed with the IFRB. Table XIV summarizes the Soviet 12-GHz, geostationary, direct-broadcast satellite allocations.

(C) The Statsionar satellites are part of the Soviets' 17-satellite Statsionar network. The Soviets are in the process of establishing the worldwide Statsionar network. To date they have launched 5 of the 15 common carrier spacecraft, and one of the two direct broadcast TV satellites. The satellites will be (and are now) used to satisfy the requirements for Soviet domestic and international long-haul communications, and TV relay. They also support the INTERSPUTNIK network (the Soviet counterpart to INTELSAT). The Statsionar satellites operate at the C-band COMSAT frequencies (6-GHz uplink/4-GHz downlink), and have provisions for multiple receive and transmit antennas.

(b)(1);1.4 (c)

Statsionars 1-10 were to have all been on orbit 1979. These dates have not been met. Statsionars 11-15 are due to be operational in 1983-1984. These dates are also not expected to be met.

(C) Statsionar T-2 will be the Soviet's second direct broadcast TV satellite. It will be positioned in geostationary orbit at 99° E longitude. The satellite system will relay TV signals to a wide network of

*(U) After the information cutoff date the Soviets filed for eight more geostationary communications satellites; Volna 8, Gals 5, a three-satellite data relay network similar to the US Tracking and Data Relay Satellite, and Potok 1-3 for the relay of digital data between selected ground sites.

TABLE XIII

(U) SOVIET GEOSTATIONARY COMMUNICATIONS SATELLITE PROGRAM

COMMUNICATIONS SATELLITE	SATELLLITE SUBPOINT LONGITUDE
Statsionar 2	35° E
Statsionar 12	40° E
Statsionar 9 Volna 3 Gals 2 Luch P 2	45° E
Statsionar 5	53° E*
Volna 4 Luch 2	58° E
Statsionar 13	80° E
Statsionar 1 Statsionar 3 Volna 5 Gals 3 Luch P 3	85° E
Statsionar 6 Luch 3	90° E
Statsionar 14	95° E
Statsionar T, T-2	99° E
Statsionar 15	130° E
Statsionar 7 Volna 6 Luch 4	140° E
Statsionar 10 Volna 7 Gals 4 Luch P 4	170° W
Statsionar 8 Volna 1 Gals 1 Luch P 1	25° W
Statsionar 4 Volna 2 Luch 1	14° W
Statsionar 11	8.5° W

*Statsionar 5 originally announced at 58° E, subsequently its position was changed to 35° E.

Earth-receiving stations within the territorial limits of the Soviet Union. Statsionar T-2 will have an uplink at 6 GHz from the Moscow area and downlink the TV transmission at 754 MHz. [redacted] (b)(1);1.4 (c)

[redacted] The announcement of Statsionar T-2 is part of the commitment the Soviets made in the 11th Five Year Plan (1981-1986) to provide a second All-Union TV channel. As such it will provide additional TV service over that provided by the current Ekran (Statsionar T) direct-broadcast satellite. There has been [redacted] reporting on a follow-on to Ekran for several years. This reporting indicated the Soviets had planned to introduce a satellite with a two-television-channel UHF downlink, it now appears that prior to this they will acquire their two-channel capability through the use of two single-channel TV relay satellites. The dates given in the IFRB filings for Statsionar T-2 initial service are 1981-1982. Based upon Soviet experience with Ekran, the Soviets will probably launch Statsionar T-2 by the end of 1982. (b)(1);1.4 (c)

~~(C)~~ The Volna (or wave) system is a seven-satellite system comprised of two smaller systems. Volna 2, 4, and 6 will each operate in two separate frequency bands (one for maritime use and one for aeronautical use). Operational frequencies are maritime uplink 1.636-1.644 GHz, maritime downlink 1.535-1.542 GHz; and aeronautical uplink 1.645-1.660 GHz, aeronautical downlink 1.543-1.558 GHz. Volna 1, 3, 5, and 7 will operate in the same frequency bands plus another mobile band (uplink 335-399 MHz, downlink 240-328 MHz). The odd-numbered Volna satellites are intended to have both narrowband (8-kHz emission bandwidth) and wideband (250-kHz emission bandwidth) transmissions from both aircraft and land mobile. The even-numbered Volna satellites are intended only for narrowband transmissions from ships and aircraft. Figures 23 and 24 are pictorial representations of the two Volna systems.

~~(C)~~ The Gals (for tack, as in sailing terminology) system, which according to the IFRB filings was to be operational during 1980, is a four-satellite system with a communications uplink at 7.9-8.4 GHz and downlink at 7.25-7.75 GHz. The Gals system is registered for use with official communications, but this X-band spectral regime is traditionally associated with military communications. The satellites will each have 10 transponders with 50-MHz center spacing between them. The Gals system is the most complex of the geostationary communications satellites the Soviets have filed with the IFRB. [redacted] (b)(1);1.4 (c)

From the IFRB data the satellite is capable of relaying both narrowband and wideband (16-kHz and 3-MHz emission bandwidth) transmissions. The Gals system

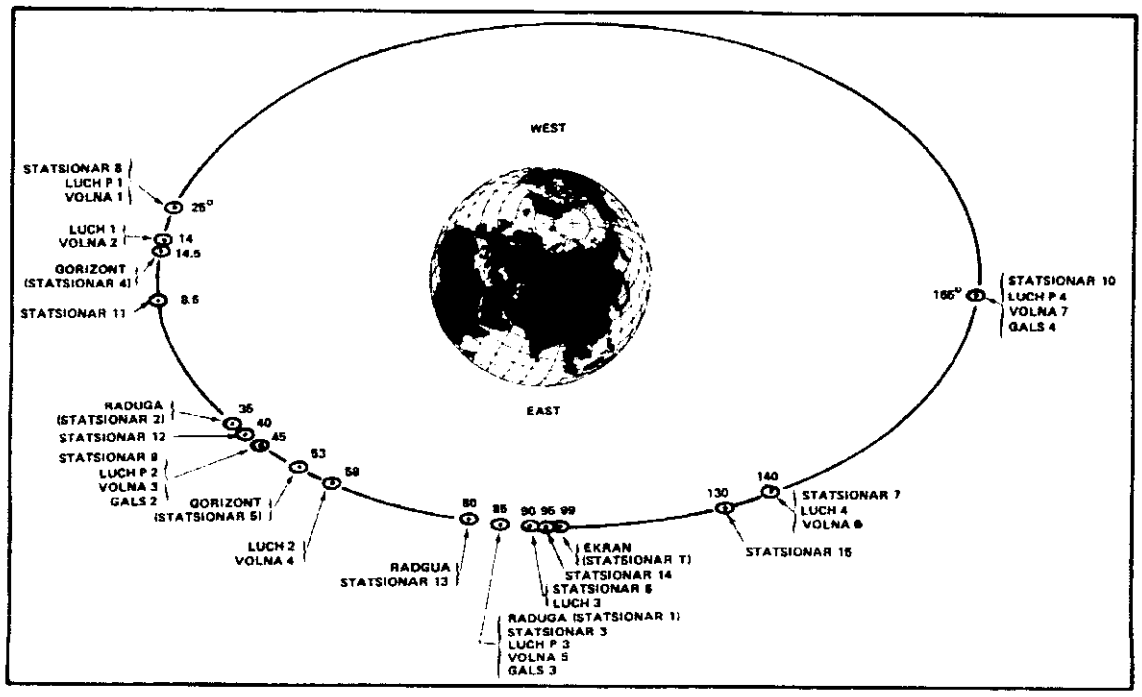

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Fig. 22 (U) Geostationary Communications Satellite Systems

TABLE XIV

(U) SOVIET DIRECT BROADCAST SATELLITES ASSIGNMENTS BY THE WARC-12 GHz

SATELLITE SUBPOINT	NUMBER OF CHANNELS	REGION OF COVERAGE
23° E	26	Western European Soviet Union
44° E	20	Eastern European Soviet Union
74° E	6	Western Siberia
110° E	7	Central Siberia
140° E	11	Eastern Siberia

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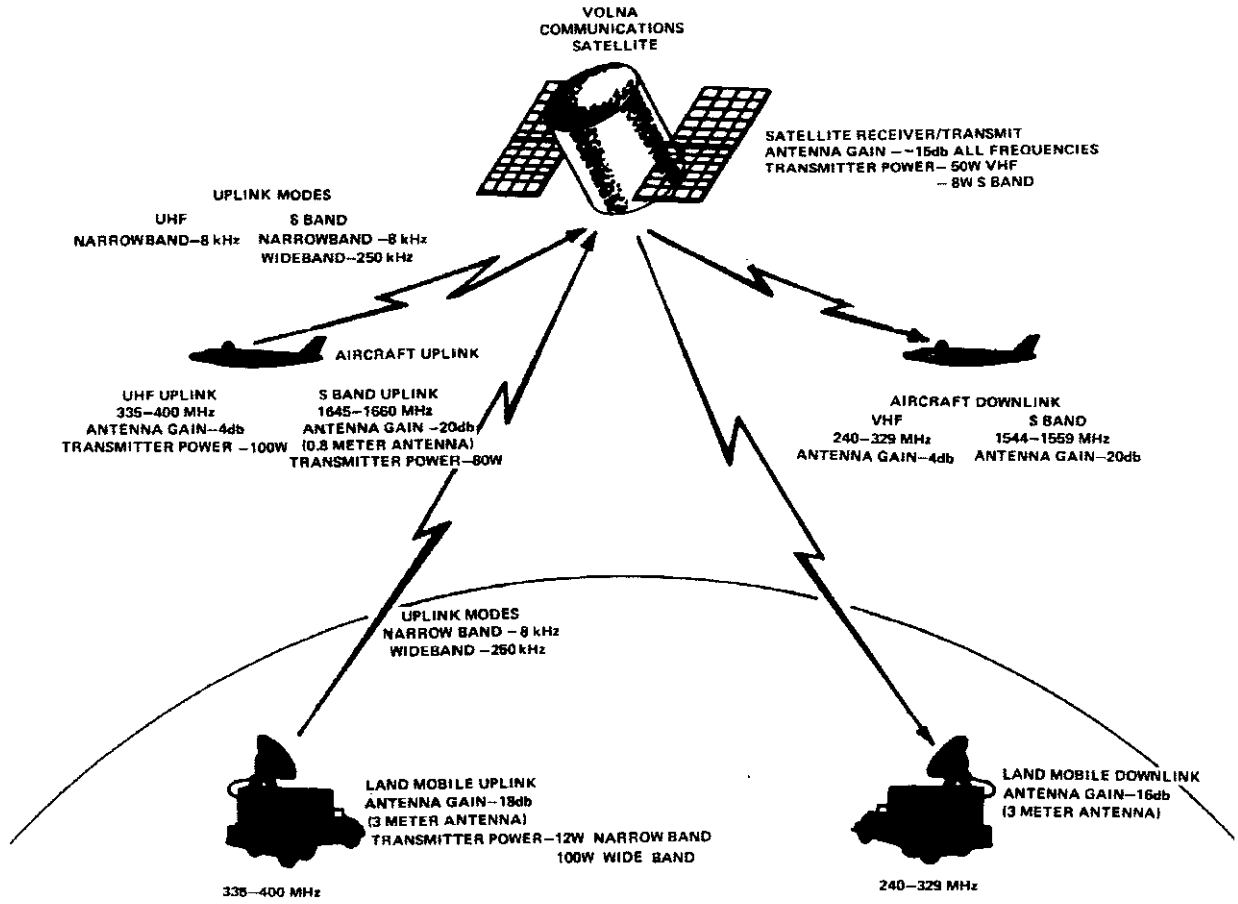

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Fig. 23 (U) Volna 1, 3, 5, 7 Pictorial Representation

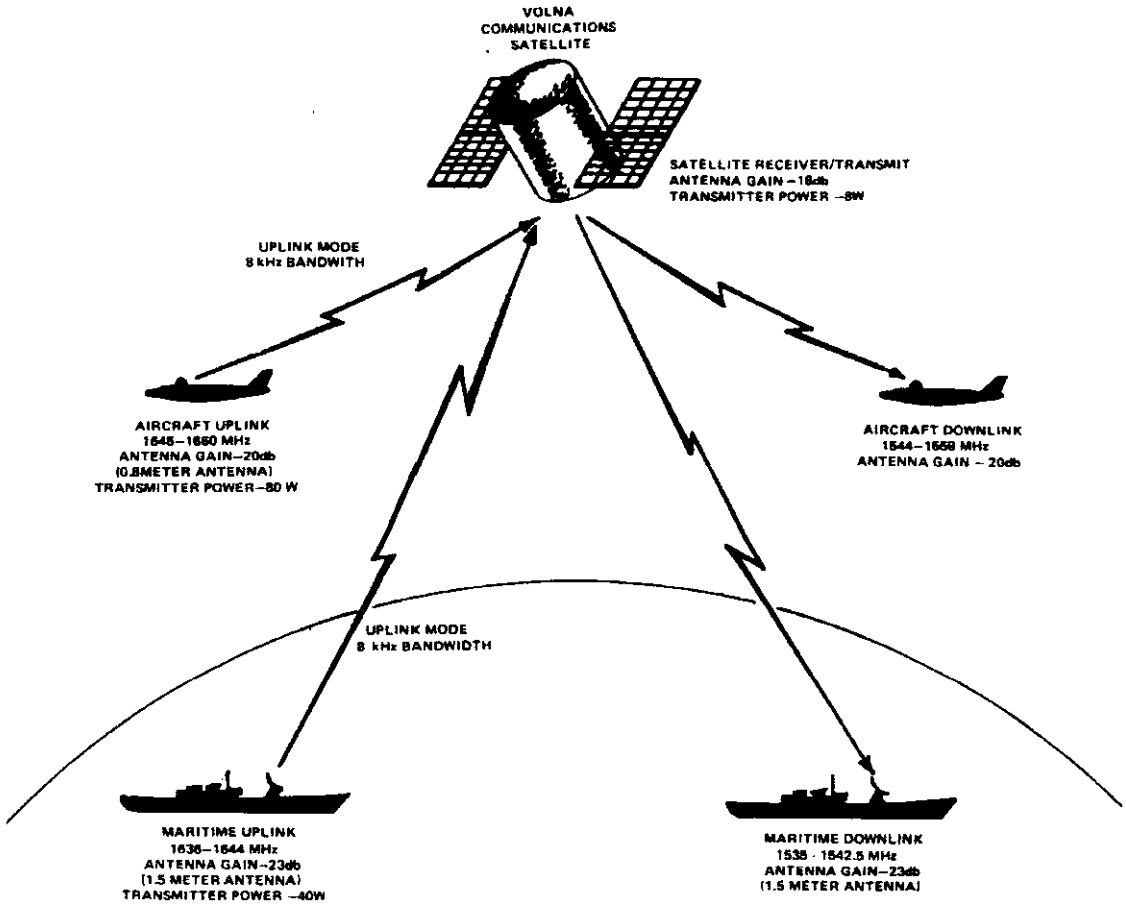

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Fig. 24 (U) Volna 2, 4, 6 Pictorial Representation

is the most complex of the geostationary communications satellites the Soviets have filed with the IFRB.

(b)(1);1.4 (c)

From the IFRB data the satellite is capable of relaying both narrowband and wideband (16-kHz and 3-MHz emission bandwidth) transmissions. The Gals system is designed to communicate with two types of users—a fixed user with a large high-gain (12 meter) antenna, and a potentially mobile user, with a smaller moderate gain (3 meter) antenna. Figure 25 is a pictorial representation of the Gals system.

(U) The Luch (or ray) system, intended to be operational during 1981, consists of four satellites. Two of the spacecraft, Luch 1 and 2, are to support international communications while Luch 3 and 4 are scheduled for domestic communications. Each of the Luch satellites will have 10 transponders with a 50-MHz center spacing operating in the 14-14.5 GHz range for the uplink and 10.95-11.2 GHz and 11.45-11.75 GHz for the downlink. Figure 26 is a pictorial representation of the Luch system.

~~(C)~~ The Luch P system is very similar to the Luch system discussed in the previous paragraph. Luch P is a four satellite system with ten, 50-MHz center-spaced transponders. The communications uplink is 14-14.5 GHz and the downlinks are 10.95-11.20 GHz and 11.45-11.70 GHz. The system is designed so one satellite will serve the Atlantic Ocean area; two satellites will serve the northern Indian Ocean area and Eurasian land mass; and the final satellite will serve the Pacific Ocean area. According to the IFRB filings the Luch P

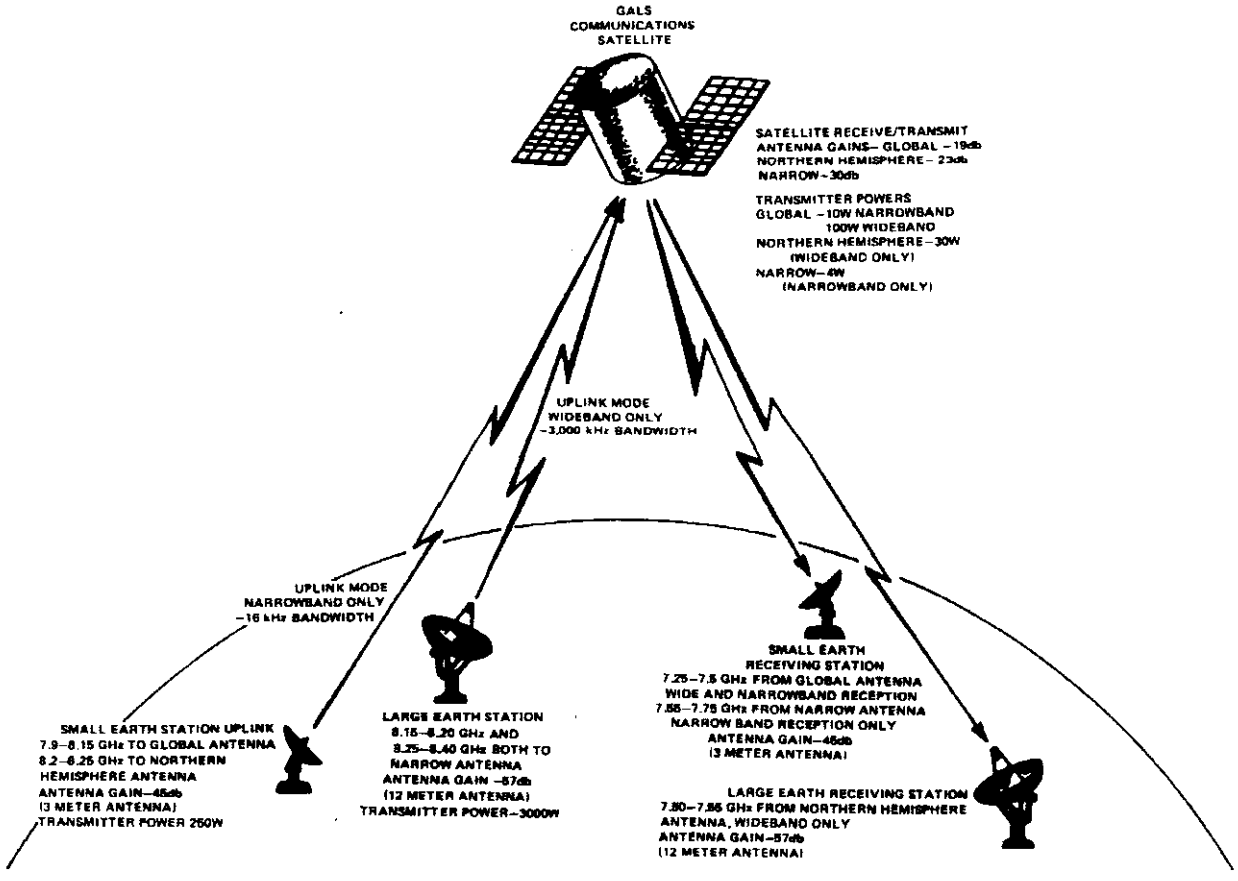

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Fig. 25 (U) GALS Pictorial Representation

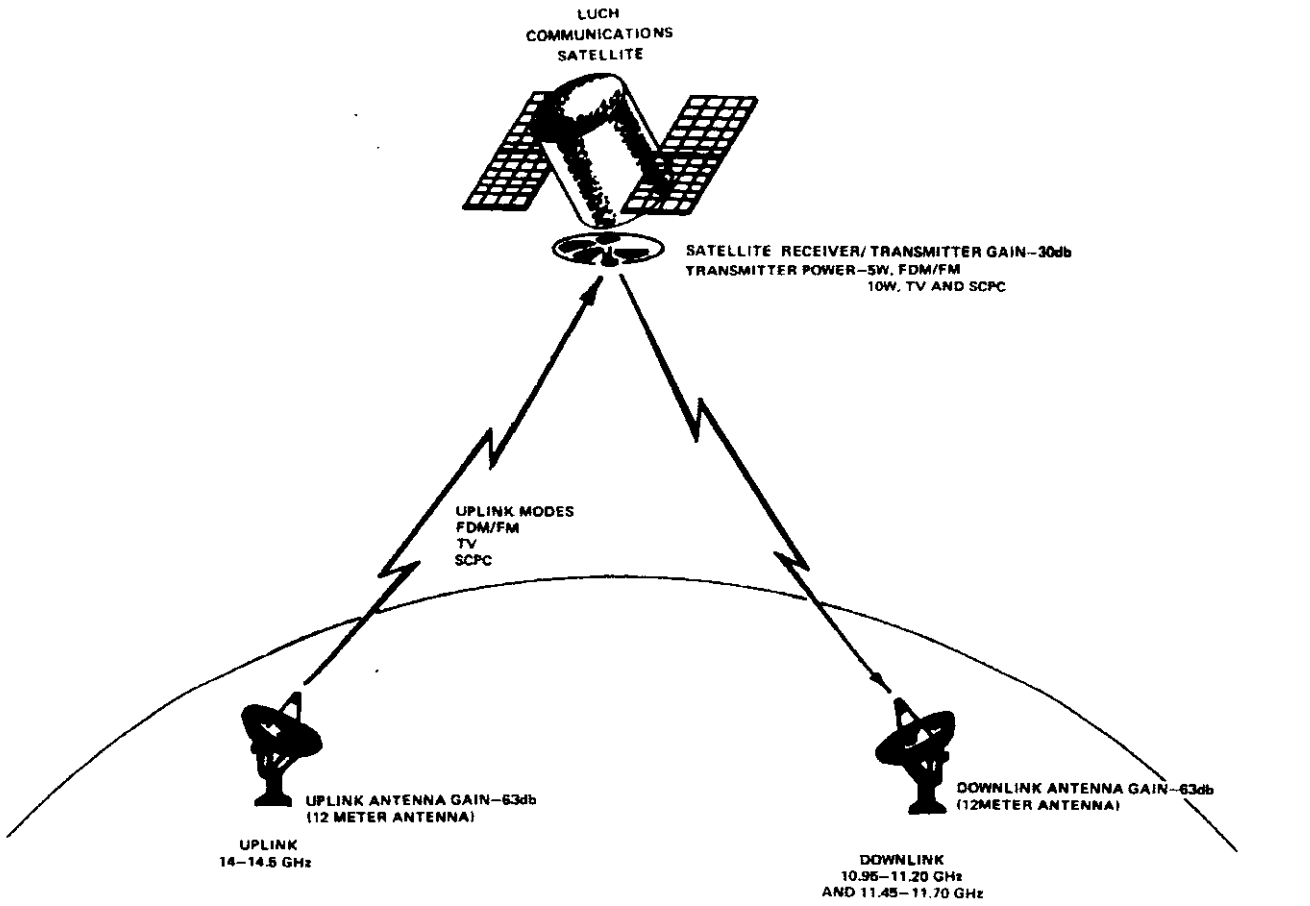

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Fig. 26 (U) Luch Pictorial Representation

system is scheduled for operation during 1981. The most apparent difference between the Luch and Luch P systems is the use of a 12-meter-diameter ground antenna to transmit and receive with Luch, while Luch P will use a 6-meter diameter antenna for the same function. Figure 27 is a pictorial representation of the Luch P system.

(U) In addition to the COMSATs announced by the Soviets through the IFRB, the Soviets have the option of launching direct broadcast TV satellites to as many as five subpoints. In February and March 1977, the World Administrative Radio Conference established criteria and regulations for direct broadcast TV satellites operating in the nominal 12-GHz band (WARC-12 GHz). The WARC-12 GHz also allocated subpoints and channel assignments to those countries located on the African and Eurasian continents. The Soviet Union, as a result of this action, was assigned five subpoints and 70 direct-broadcast TV channels. Table XIV shows the subpoints, number of channels assigned to the subpoints, and general regions covered. To date the Soviets have not taken advantage of the WARC assignments through the filing of IFRB notifications.

(S) While the Soviets have announced an ambitious program for geostationary COMSATs, they have left considerable doubt whether each announced satellite subpoint location has a one-to-one correspondence with an actual geostationary satellite. A review of Table XIII shows there is considerable overlap among the announced systems. Six of the 16 subpoints have three or more satellites assigned to them. The frequencies of the Statsionar, Volna, Gals, Luch, and Luch P are 1-3 GHz apart, which would allow the use of multiple transponder types on a single COMSAT without frequency interference among the systems. There is no major technical problem with placing two (or more) frequency bands on a given COMSAT.

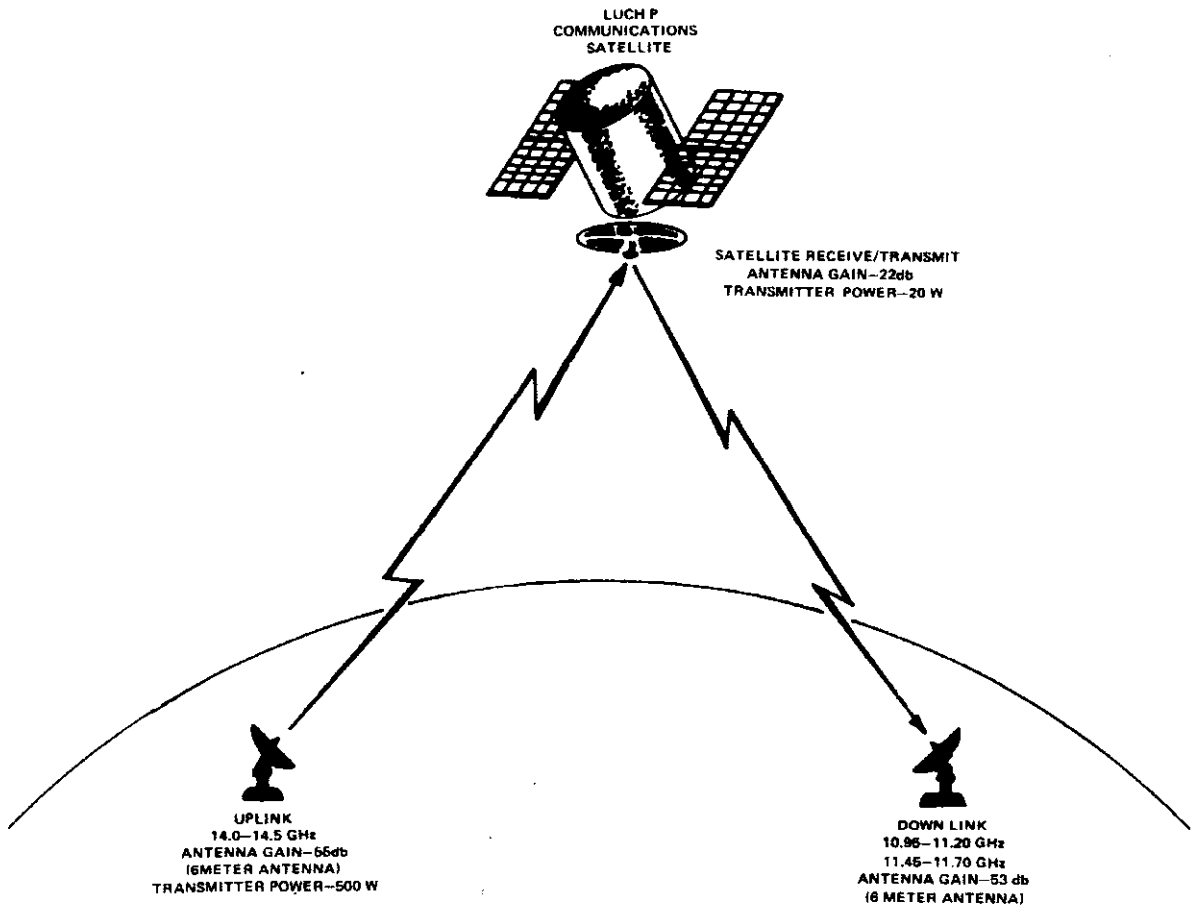

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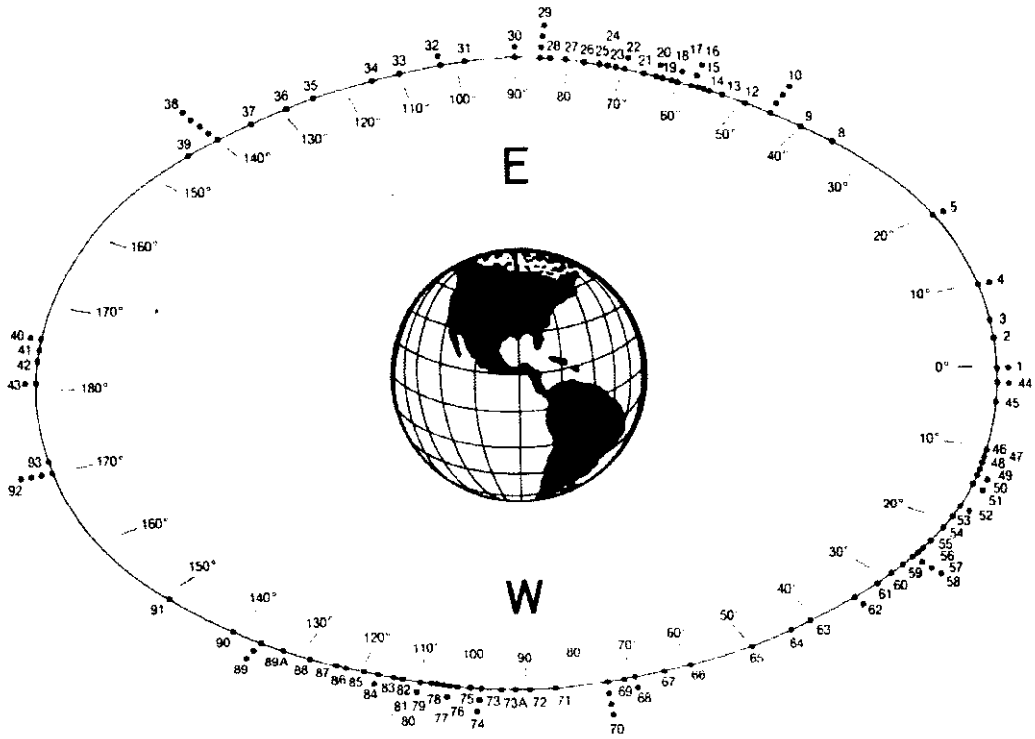
Fig. 27 (U) Luch-P Pictorial Representation

(S) There are limited intelligence data to indicate the Soviets could choose to combine several announced systems into a common satellite having several communications transponders. This is implied by the IFRB filings for Volna. Notice Figure 23 shows Volna communications only between mobile users, not from a mobile user to a master station or a master station to a mobile user. Also the information shows more downlink capacity for the Volna system than uplink. All this implies an interconnectivity between a Statsionar or Gals uplink and a Volna downlink.

(C) A similar uplink/downlink capacity mismatch exists with the Gals system (i.e., downlink capacity is greater than the uplink capacity). This also suggests Gals could be combined with some other communications satellite transponder package.

(C) Figure 28 depicts the current and planned geostationary satellites, as of 31 March 1980. The figure shows that while the space for geostationary satellites is at a premium, there is little "stacking" of satellites at a given longitude. In fact, in the highlighted instances of stacking, the Soviet Union is the only country to "stack" satellites at subpoints (when other countries "stack" satellites it is normally a replacement for existing spacecraft, like the INTELSAT V replacement for INTELSAT IV at 0° longitude). Again, this "stacking" of spacecraft at a given longitude implies more than one of the announced systems may be located on the same spacecraft.

(S) The use of multiple system transponder spacecraft is further strengthened by a consideration of the availability of the SL-12 launch vehicle, the only Soviet launch vehicle capable of placing payloads into geostationary orbit. Historical usage of this vehicle indicates an SL-12 (and its three-stage variant, the SL-13) production rate of about six to eight vehicles per year. Of this number, between four and six of these



0°-10° E
1. METEOSAT, NORDSAT*
2. GEOS*
3. ARABSAT 1*
4. ECS, OTS (ESA)

10°-30° E
5. EBS,* ARABSAT 2*

30°-40°E
8. RADUGA 3 (USSR)
9. MARECS (ESA)

40°-50° E
10. VOLNA 3, GALS 2,* STATSIONAR 9, LUCH-P2* (USSR)
12. SYMPHONIE 1

50°-60° E
13. DSCS-2
14. INTELSAT III F3
15. INTELSAT*
16. VOLNA-4,* STATSIONAR 5,* LUCH-2* (USSR)
17. INTELSAT IVA F6, INTELSAT*

60°-70° E
18. INTELSAT IV F5
19. INTELSAT IV F1
20. INTELSAT IVA F3, INTELSAT*
21. INTELSAT*
22. GOMS,* GOES, STW-2* (CHINA)

70°-80° E
23. INSAT* (INDIA)
24. MARISAT
25. INSAT (INDIA)
26. PALAPA-2 (INDONESIA)
27. RADUGA-1B (USSR)

80°-90° E
28. PALAPA 1 (INDONESIA)
29. VOLNA-5, STATSIONAR-3, LUCH-P3, GALS-3* (USSR)
30. STATSIONAR-6,* LUCH-3* (USSR)

90°-100° E
31. EKRAN-B

100°-110° E
32. ISCOM* (INDIA) AUSTRALIA*

110°-120° E
34. CS (JAPAN)

120°-130° E
35. STW-1* (CHINA)
36. ETS-2 (JAPAN)

130°-140° E
37. CSE (JAPAN)
38. HIMIWARI (GMS-1), GMS-2,* VOLNA-6,* STATSIONAR-7,* LUCH-4*

140°-150° E
39. ECS*

170°-180° E
40. INTELSAT IV F8, INTELSAT*
41. DSCS
42. MARISAT
43. INTELSAT IV F4, INTELSAT*

0°-10° W
44. INTELSAT,* INTELSAT IV F7
45. INTELSAT IV F2

10°-20° W
46. SYMPHONIE-2
47. MARECS*
48. DSCS II
49. STATSIONAR-4*
50. LUCH-1,* VOLNA-1* (USSR)
51. SIRIO, (ITALY) MARISAT
52. INTELSAT,* NATO 3A
53. INTELSAT IV F3

20°-30° W
54. INTELSAT*
55. FLEETSATCOM
56. INTELSAT*
57. INTELSAT IV-A F1
58. GALS-1,* LUCH-P1 STATSIONAR-8,* VOLNA-1* (USSR)
59. INTELSAT*
60. INTELSAT IV-A F2

30°-40° W
61. INTELSAT*
62. INTELSAT IV-A F4, INTELSAT*

40°-50° W
63. TDRS*
64. LES-9

50°-60° W
65. NATO 3C*

60°-70° W
66. BRAZILSAT*
67. BRAZILSAT*
68. FLEETSATCOM, BRAZILSAT*

70°-80° W
69. IUE*
70. BRAZILSAT,* GOES-2, COLUMBIA,* ANDEAN*

80°-90° W
71. GOES-1
72. COMSTAR-3

90°-100° W
73. COMSTAR-2
73A. WESTAR-3
74. WESTAR-1, SATCOM-C, TDRS*

100°-110° W
75. FLEETSATCOM
76. ADV. WESTAR*
77. LES-8 ANIK-A1 (CANADA)
78. SMS-1
79. ATS-3
80. SBS
81. ANIK-B1, ANIK-A2 (CANADA)

110°-120° W
82. ANIK-C1 (CANADA)
83. ANIK-A3 (CANADA)
84. ANIK-C2* (CANADA)
85. SATCOM-2

120°-130° W
86. SBS-A*
87. WESTAR 2
88. COMSTAR-1

130°-140° W
89. SMS-2, GEOS, SATCOM-1
89A. SATCOM-3

140°-150° W
90. NATO-3
91. ATS-1

170°-180° W
92. GALS-4,* LUCH-P4,* STATSIONAR-10,* VOLNA-7* (USSR)
93. TDRS

*Planned

FTD A82-1281

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Fig. 28 (U) Geostationary Satellites

vehicles are used to support geostationary communications satellite launches. This launch rate and demonstrated COMSAT lifetimes (12 to 18 months) would allow the Soviets to support a network of 6-10 satellites in steady-state conditions, and a lower number if the Soviets have a requirement for full-time coverage. This is far short of the 36 satellites the Soviets have registered with the IRFB, and which they indicated would be launched by 1984.

~~(S NOFORN WNINTEL)~~ There is some indication of Soviet attempts to increase the production capability for the SL-12/SL-13 to as many as 15 vehicles per year. Noncommunications satellite uses for the SL-12/SL-13 vehicle are also expected to increase. Therefore, while the Soviets are expected to have more vehicles available to support geostationary COMSAT launches, the number of vehicles will probably fall short of the number necessary to support a 36-satellite network. An eventual network size of 12-18 satellites is probably the most likely number. At this time the available information does not permit a more precise definition of frequency subpoint combinations, although the Soviets are initially expected to concentrate on subpoints serving the Eurasian and Atlantic regions and to use the more traditional frequencies. Routine Soviet operation in the 11-14 GHz region is not expected until the end of the decade. Although the projected SL-Y launch vehicle is expected to support geostationary payload launches, its introduction is not expected to impact on SL-12 availability until well into the mid term.

~~(C)~~ An alternate view of the Soviets massive IRFB filings program is that the Soviets are taking advantage of the international first come, first served allocation policy to stake out favorable frequency/subpoint combinations. Once the Soviets have filed for a frequency/subpoint combination, they are in a position to force other countries to adjudicate potential interference or other conflicts with the Soviets. Throughout the process the Soviets would maintain a dominant position.

~~(S)~~ The trend in the Soviet IFRB filings is to go to higher frequencies. In the West the transition to the higher frequencies is driven by congestion in the lower parts of the spectrum, especially at the 3/6 GHz region of most current and planned COMSATs. The Soviets have managed through a combination of planning and luck to avoid this congestion. Their downlinks operate in the 3.4-3.9 portion of the 3.4-4.2 GHz band allocated by the International Telecommunications Union for COMSAT downlinks. The West has avoided use of the 3.4-3.8 GHz portion of this band because of indigenous interference problems (principally in the US). Thus, the Soviets have encountered relatively little problem with downlink congestion as compared to the West. The orbital subpoints currently used by the Soviets encounter relatively little uplink interference when compared to the heavy traffic areas in the Atlantic region used by the West. Finally, as mentioned above they have taken advantage of the international policy to stake out advantageous subpoints, forcing other nations to minimize potential interference with the Soviet-announced systems at a particular subpoint. Therefore, the Soviets will not encounter the interference and congestion problems as soon as the Western nations have and will not be forced to go to the higher frequencies (i.e., Luch, Gals, Luch P) as quickly as are Western nations. This implies the Soviets will not fulfill the launch schedule implicit in their IFRB filings.

3.c. Projected Space Program (U)

~~(S)~~ During the next 10 years the Soviets will establish a worldwide geostationary COMSAT network. The network will concentrate on the development of C-band (4/6 GHz) satellites, but some satellites in the overall network will operate at one or more of the frequencies filed for by the Soviets in their IFRB filings. A total network size of 12-18 active satellites is most likely. The Soviets are expected to emphasize satellites in the Indian and Atlantic Ocean areas (Cuba, Europe, Soviet Union, and Asia service) in the establishment of their COMSAT network.

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SECTION VIII

METEOROLOGICAL SYSTEMS (U)

1. General (U)

~~(S)~~ The Soviets expressed an early interest in obtaining meteorological measurements from space. [redacted] the Soviets initiated a dedicated METSAT program that has broadened over the years.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~ Since March 1969, the Soviets have maintained a multi-spacecraft network of their Meteor METSATs with an average launch rate of three to four spacecraft per year. The network is traditionally made up of a mix of Meteor 1 and Meteor 2 spacecraft with two orbits being used. Meteor 1 spacecraft launched between December 1971 and June 1977 and all Meteor 2 spacecraft are in near polar 81-degree, 900-km circular orbits. Beginning with Meteor 1/28, the Soviets have launched the Meteor 1 spacecraft into sun-synchronous 98-degree, 650-km circular orbits. The 81-degree Meteor 1 spacecraft have been phased out. Although the 81-degree Meteor 1 spacecraft were randomly oriented, the Soviets appear to be maintaining the Meteor 2 in a three-satellite network with about a 78-degree plane separation and the 98-degree Meteor 1 in a two-satellite network with either a 0-degree or an 180-degree plane separation.

~~(S)~~ The primary imaging system on the 98-degree Meteor 1 and the Meteor 2 is the Multispectral Scanner Unit (MSU). The MSUs provide visible and IR imagery at low (MSU-M) and medium (MSU-S) resolution for both meteorological and Earth-resources applications. According to Soviet reports, these spacecraft also relay data transmissions from remote automatic stations mounted on ocean buoys. Table XV lists the characteristics of the Earth-observation sensors carried on the Meteor vehicles plus other system parameters.

(b)(1);1.4 (c)

(S) The Soviets have maintained as many as 12 Meteor spacecraft [redacted] at one time. [redacted] Over a period of several months, the orbital alignments changed with respect to the sun line; the angles between satellite planes, and the phasing of satellites within their orbit planes also changed. [redacted]

(b)(1);1.4 (c)

(b)(1);(b)(3):10 USC 424;1.4 (c)

TABLE XV

(U) METEOR SENSOR CHARACTERISTICS
(900-km Orbit)

SENSORS	SPECTRAL RANGE (μm)	RESOLUTION (km)	FIELD-OF-VIEW (km)
Multispectral scanner system			
MSU-M	0.5-1.0	1.4-2.2	[redacted] (b)(1);1.4 (c)
MSU-S	0.55 0.9	0.2-0.4 0.2-0.4	
Automatic picture transmission	0.4-0.7 8-12	1-2 8-10	

~~SECRET~~

(b)(1);1.4 (c)

2. Projection Rationale (U)

(U) Over the past several years, the Soviets have openly described plans for their METSAT program. These plans in general speak of the establishment of a three-tier spacecraft network for satellite meteorology. The first tier, for detailed meteorological observation, would be composed of low-altitude manned (or man-maintained) meteorological observation platforms. The second tier would be made up of the Meteor network. And the final tier would consist of high-altitude spacecraft for the collection of medium-scale, synoptic meteorological data on an eventual worldwide basis.

(U) The Soviets have expressed interest in a low-altitude tier for meteorology measurements. Although their manned platforms have not been solely dedicated to meteorology measurements, there are advantages in a low-altitude tier. First, low-altitude meteorology provides much higher resolution than available from their Meteor series. The crew can adjust their measurements to fit prevailing conditions, instruments can be repaired or adjusted if necessary, and a wider variety of experiments can be attempted.

~~(S)~~ Two methods of manned operation have been implemented by the Soviets for their lowest tier of weather measurements. The first method relied on the early Soyuz vehicles (through Soyuz 9, plus Soyuz 12, and Soyuz 13). These spacecraft were instrumented for space measurements, including meteorology-related equipment, and were manned throughout the experiments. The Salyut R vehicles have also employed this method. The second method uses a man-maintained vehicle principally as an automatic station, as exemplified by Salyut M.

(b)(1);1.4 (c)

The Soviets have frequently mentioned sunrise and sunset Earth-limb experiments in connection with their Soyuz and Salyut missions. Two important aspects of these experiments have been to determine aerosol distributions and to estimate depletion of the ozone layer. Also mentioned several times were (1) experiments to measure the polarization of Earth- and atmosphere-reflected sunlight, and (2) manned vehicle measurements jointly with Meteor spacecraft, aircraft, or ships.

~~(S)~~ The Soviets are expected to continue their development of the "lower tier" of their METSAT network. This development will be part of their METSAT program and their stated goal of developing long-duration manned space stations. Within the next 5-7 years, the Soviets will probably attempt to keep some form of continuous manning with their space station program (or continuously operating, man-maintained space stations). This will allow them to complete the lower tier of their meteorological network. The actual instruments may operate in an automatic rather than a manual cosmonaut-controlled mode. Cosmonaut activity would be limited to instrument maintenance and special experimental collection of meteorological data.

~~(S)~~ In line with maintenance of the second tier of their METSAT system, the Soviets are expected to maintain the multi-Meteor spacecraft networks through the far term.

~~(S)~~ The Soviets will augment the near-polar, near-Earth Meteor network by employing meteorological payloads on-board geostationary satellites. Eventually, this network will probably consist of several satellites spaced about the equatorial plane. Although sensor ground resolutions could well be an order of magnitude inferior to those of the near-Earth system, geostationary satellites would provide the unique advantage of continuous lower latitude coverage combined with real-time data transmission. These characteristics would provide a series of images closely spaced in time, allowing meteorologists to watch the formation and movement of storm systems.

~~(C-NOFORN-WNINTEL)~~ Until the latter part of 1977, the Soviets were committed to supply a geostationary METSAT (referred to as the geostationary operational meteorological satellite—GOMS) by fall of 1978 at 70° E longitude as a part of the Global Atmospheric Research Program (GARP). In late 1977, the Soviets withdrew from their commitment to supply GOMS to GARP in 1978. However, they did indicate their intention to launch their own GOMS at a later date. Initially, the Soviets gave a date of 1979-1980 as the intended launch time for their GOMS; however, they, have not made this schedule. Soviet statements now indicate they will launch GOMS sometime during the 1982-1984 period. While the Soviets officially give operational reasons for this slippage (i.e., the northern location of the Soviet Union is best served by low-altitude, polar orbiting satellites), the Soviets are encountering technical problems in the development of GOMS and this is the primary reason for the slippage in the GOMS schedule.

(b)(1);1.4 (c)

~~(C-NOFORN)~~ The announced performance of the GOMS, as specified for GARP, is shown in Table XVI. At this time, there is little reason to believe, when

launched, the GOMS performance will differ markedly from that shown in Table XVI. The actual orbital placement of GOMS will probably be to the west of the 70° E longitude announced from GARP. This placement will provide better coverage of the European portions of the Soviet Union. As time progresses and the Soviets gain experience with the coverage provided by GOMS, they may increase the number of operating geostationary METSATs to provide increased coverage of the Eurasian landmass.

TABLE XVI

(U) GOMS ANNOUNCED PERFORMANCE PARAMETERS

Sensor resolution	
Visible scanning radiometer	1.5 km
IR	12 km
Data rate	1 visible, 1 IR image in 20 minutes of a 30-minute period. Remaining 10 minutes for telemetry etc. Average data rate 1.5 Mbs.
(b)(1);1.4 (c)	
Spacecraft stabilization	3 axis
Design life	24-36 months

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(S) The location of the Soviet land mass makes the collection of synoptic meteorological data from geosynchronous orbits less than optimal. The Soviets could choose to collect synoptic meteorological data from satellites (of similar performance to the GOMS) in the 12-hour Molniya-type orbit in order to gain access to the north polar regions.

(C) There is evidence the Soviets will continue to improve and adapt their current Meteor satellites. The Soviets have spoken about plans to improve the multispectral scanner on the Meteor to achieve a resolution of less than 100 m (pixel size of 30 m). In addition, the Soviets have written about but have not definitively described the more advanced METSAT/Earth resources sensors, such as a lidar, for inclusion on Meteor payloads.

(S) A comparison of the demonstrated Meteor sensor capabilities with current equivalent US capabilities shows that there is potential for sensor improvements. These improvements include increased resolution in the visual and IR scanners and incorporation of microwave scanners into the payload. Additionally, total Earth coverage and coverage repeatability can be improved through an increase in orbital altitude and more routine use of orbit-adjustment devices for maintaining networks.

(U) These improvements are further justified when one considers the progress being made in the entire process of weather forecasting. The improved understanding of the atmospheric process achieved by research will provide a more highly developed weather forecasting capability and will probably result in the capability to effectively use large quantities of higher resolution data. As a result, higher spatial and spectral resolution data will be required. Additionally, consistent intervals between observations will probably be needed to facilitate data processing. These factors predict the evolutionary improvements discussed.

(C) Finally, the Meteor will reportedly serve as the host satellite for the cooperative US/French/Canadian/Soviet search and rescue satellite (SARSAT) experiment. The SARSAT experiment will use the Doppler principle to locate a fixed emitter (in this case a search and rescue beacon); the Doppler data will be processed on the satellite and transmitted in real-time and playback modes to the ground. The Soviets in SARSAT coordination meetings have stated that a Meteor satellite will serve as the host spacecraft much as the US NOAA METSAT will serve as the host for US SARSAT equipment.

3. Projected Space Program (U)

(S) The Soviets will strive toward, and probably attain, the announced goal of a three-tier METSAT network. The lower tier will consist of meteorological packages on the Soviet manned space stations. These packages will allow the Soviets to perform detailed observations of meteorological phenomena of interest. The middle tier will be composed of the Meteor series spacecraft. The Soviets will continue to make evolutionary improvements to the satellites as required to meet various needs. The third, or upper tier will be made up of high-altitude METSATs for synoptic observation. This capability will initially take the form of a single satellite for observation of the Soviet Union. This capability will probably expand so that by 1990, the Soviets could have an Eurasian capability for the collection of synoptic meterological data from geosynchronous orbit. This capability may be supplemented by satellites in Molniya-type orbits to allow the Soviets to collect synoptic meteorological data in latitudes above 65° N.

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SECTION IX

NAVIGATIONAL AND GEODETIC SYSTEMS (U)

1. General (U)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~

(b)(1);1.4 (c)

The NAVSAT launch, Cosmos 1000 on 31 March 1978, was accompanied by a TASS announcement of the navigational mission of this satellite. This was the first time the Soviets publically acknowledged a navigational mission for any of their satellites. TASS announcements accompanying all subsequent naval support satellite launches contained no reference to their navigational mission. The NAVSAT orbital parameters and stabilization are similar to the NAVSAT

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~ The current Soviet NAVSATs are of the passive, one-way Doppler type. The user measures the Doppler shift in harmonically related signals transmitted by the satellite to determine his position relative to the satellite.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~ the Soviets have maintained a series of geodetic satellites (GEOSATs) in circular orbits

)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

2. Projection Rationale (U)

~~(S)~~ The requirements for navigational support satellites can be broken into two broad user categories—stable and dynamic. The first group is stationary or moving in such a manner that their velocity uncertainty contributes little, if any, to the observed Doppler shift of the navigation satellite's signal, making the additional error caused by this velocity uncertainity a minor part of the total fix error. Also, because of their relatively fixed location, this first group of users does not need continuous or frequent knowledge of their positions. The dynamic user presents a different case. His rapid movement, and resultant velocity uncertainty, causes the error in determining the Doppler shift to become large and the position fix to become poor. Also, the dynamic user requires frequent or continuous

position fixes to support his mission. Finally, since a dynamic user is frequently in an aircraft, three-dimensional fixes are also required. A traditional Doppler navigation system cannot support the dynamic user either in fix accuracy, fix frequency, or with the required number of dimensions. Thus, the Soviet

(b)(1);1.4 (c)

Doppler navigation satellites can and do support a wide variety of nondynamic civil and military users, but these same satellites cannot support dynamic users requiring accurate position fixes.

(S) While it is possible to build a single navigation satellite to satisfy both user groups, past Soviet practice suggests they would retain their current capability; attempt to meet the needs of the dynamic users with another, new system; and after the new system is operational, attempt to merge the users onto a single system. This appears to be the path the Soviets are following.

(S) First, the Soviets are expected to maintain some form of Doppler satellite navigation capability through the 1980's. With the launch of Cosmos 1000 and their exhibit at the 1979 Paris Air Show, the Soviets have openly discussed their Doppler NAVSAT capability. The Soviets have described the users of their NAVSATs as the traditional nondynamic users discussed above—shipborne navigators, marine researchers, and geodesists. It seems unlikely the Soviets would phase out a capability so soon after its announced introduction.

(C) Secondly, at the 1979 meeting of the World Administration Radio Conference, the Soviets took a strong position for maintaining and possibly expanding the 1215-1240 MHz portion of the radio spectrum now allocated for the US NAVSTAR, Global Positioning System (GPS). Also, in what may be a quid pro quo arrangement, the Soviets put forward a request for the addition of 30 MHz, from 1580-1610 MHz, to the GPS allocation. The reason given by the Soviets for this additional allocation was that the 30 MHz was needed for a Soviet GPS-type system. The system, if it is like GPS, could support the dynamic users. The Soviets gave no date for when the Soviet GPS counterpart would be available.

(S) The Soviets also gave no information on the type of navigation concept their system would use. Two equally likely concepts involve measurement of either angle and range differences or range differences between multiple satellites and the user. Either concept could replace the Doppler method for position-fixing conventional users and could provide additional information such as precise azimuth angle settings for ballistic missile submarines. Furthermore, the concepts could extend NAVSAT service to most types of aircraft, both civil and military. Further, velocity and three dimensional position will also be available from this advanced NAVSAT system.

(S) The specific orbits and orbital arrangements to be used are not known; a purely equatorial system would limit coverage to the latitude belt within 70 degrees of the equator, where an inclined system, while providing global coverage, would complicate the operation of the system.

(S) It is not known whether the Soviets will employ separate spacecraft for navigation or incorporate a navigation payload on a multipurpose spacecraft. However, since the navigation concept involved will require more satellites than needed for other prospective payload missions, such as communications relay and meteorology, separate spacecraft will probably be employed.

(S) The Soviets geodetic requirements probably no longer require a separate network of geodetic satellites. Most routine geodetic missions can be satisfie (b)(1);1.4 (c) through the extended collection of Doppler beacon from satellites like the NAVSATs. These type of data routinely yield positio to 5 km, referenced to the Earth's center of mass. Fo more precise or specialized requirements the Soviets will probably develop, or cause to be devoloped, special experiments or packages on Intercosmos spacecraft.

3. Projected Space Program (U)

(b)(1);1.4 (c)

(S) The Soviets will continue to deploy and us both the NAVSAT systems for at least the next 10 years.

(S) Also, the Soviets appear to be developing a GPS-analog system. Such a system has the potential of providing greatly improved accuracy over a traditional Doppler NAVSAT. If the Soviets seriously intend to build a GPS-type system, such a system would require a network in which three or four satellites would be in simultaneous view of the user. This implies a high-altitude orbit. The satellites would transmit time and positional data on multiple frequencies, probably between 1215 and 1610 MHz. Actual modulation of the signal, orbital parameters, and network size are indeterminate at this time. The Soviets could have a GPS-type system within the next 3-7 years. Accordingly, the Soviets' GPS-analog system, the high-altitude NAVSAT, is expected to have its first flight in 1985. Because of the requirement for multiple satellites, achievement of a realizable navigation capability is not expected to occur until 5-7 years after first launch.

(U) Tables XVII and XVIII summarize the Soviet Doppler and high-altitude NAVSATs.

(b)(1);1.4 (c)

TABLE XVII

(U) SOVIET DOPPLER NAVIGATION SATELLITES

Position fix accuracy	
Stationary user	75-120 m
Slowly moving user (ship)	125 m
Rapidly moving user (airborne)	290 m
Velocity determination	No
Availability (average wait for fix at the equator, minutes)	
(b)(1);1.4 (c)	42
	53

(b)(1);1.4 (c)

~~SECRET~~

TABLE XVIII

(U) SOVIET HIGH-ALTITUDE NAVIGATION SATELLITES

Position fix accuracy	
Stationary user	≤30 m (all dimensions)
Slowly moving user	≤30 m (all dimensions)
Rapidly moving user	≤30 m (all dimensions)
Velocity determination	Yes
Availability (average wait for fix, minutes)	0*
Orbital parameters	Unknown, but orbital period expected to be ≥6 hours, because of view constraints.

*For optimized area of coverage. It is possible the Soviets will chose not to develop a worldwide system.

~~SECRET~~

~~(S)~~ An accurate geodetic datum is needed to support any type of navigational satellite system. While the Soviets have phased out their dedicated GEOSATs, they still have a number of ways to obtain the geodetic data they require. The use of the NAVSATs, [redacted] should allow the Soviets to fulfill most of their data needs. Special geodetic data are also available from geodetic experiments on other satellites. Finally, the Soviets could, if required, launch special GEOSATs and/or payloads to meet specific needs. The Soviets will have a satellite geodesy program throughout the period of the study. The specific nature of the program (i.e., whether or not the Soviets will have a dedicated GEOSAT) will be determined by relatively short-term requirements.

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SECTION X

CALIBRATION SYSTEMS (U)

1. General (U)

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

(b)(1);1.4 (c)

2. Projection Rationale (U)

(b)(1);1.4 (c)

~~(S)~~

Generally, it appears the Soviets will continue to develop, test, and operate radars and other missile/satellite tracking devices requiring some form of calibration. Special satellites—calibration satellites—will almost certainly continue to be an efficient means to meet the calibration needs of these devices. Consequently, the Soviets are expected to develop new varieties of calibration satellites, especially configured for these new radars and tracking devices. The exact nature and performance of these satellites cannot be specified.

~~(S)~~ For the Soviets to develop any type of laser as a satellite negation device, they must perform a number of subsystems development and systems verification experiments. These experiments include target acquisition, pointing and tracking the laser at a satellite with acceptable level of jitter over time periods representative of worst case engagements, determining flux on target of the laser under actual engagement conditions, and actual negation of a cooperative target. All these experiments will require one or more target satellites for successful completion. While there need not be a unique, single mission laser target satellite, the Soviets have a requirement for a series of laser target-related payload experiments.

(b)(1);1.4 (c)

3. Projected Space Program (U)

~~(S)~~ The Soviets are expected to maintain some form of calibration satellite capability for the next 10 years. The exact nature of the satellites will be adjusted by the Soviets to meet specific calibration requirements of various radars, tracking devices, and possible future weapon systems such as ASAT lasers.

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SECTION XI

MANNED SPACE SYSTEMS (U)

1. General (U)

~~(S)~~ Current Soviet goals in manned space flights are the determination of man's survivability and usefulness in a space station environment. The Soviets are vigorously working toward achieving practical results from their manned space station program in investigations of Earth resources, materials manufacturing, and astronomical surveys; and from military tasks such as reconnaissance and [redacted] observation. Their success with the Salyut 6 mission, in particular with its resupply and repair capabilities, has been a key element in the progress of the Soviet manned space program.

(b)(1);1.4 (c)

~~(S)~~ The Vostok and Voskhod flights (1961-1965) proved man could survive and work in space. The Voskhod spacecraft carried 2- and 3-man crews and first demonstrated cosmonaut extravehicular activity. Vostok and Voskhod, coupled with the successes of the parallel US programs, paved the way for more ambitious projects.

~~(S)~~ From 1966 to 1970, the Soyuz tested Soviet rendezvous and docking procedures and established man's capability to survive longer (18 days on Soyuz 9) flights. Although some Vostok/Voskhod technology was retained, Soyuz represented a new design and a clear departure from reliance on off-the-shelf hardware. Although the Soyuz program was beset by some early failures, the flights were significant because Soyuz was the first Soviet manned spacecraft to use solar panels, hot gas attitude-control jets, and two inhabitable compartments; the first to maneuver and dock in orbit; and the first to use a lifting reentry technique. The Soyuz served as the ferry vehicle for the Salyut space station and was the Soviet spacecraft for the joint Soyuz-Apollo flight.

~~(S)~~ The Salyut space station program proceeded in two directions. The Salyut R vehicle is for R&D purposes and performs most of its objectives while manned. The Salyut M (Military) station has a different configuration, is used for military-related experiments, and can perform many of its objectives while unmanned.

~~(S)~~ The Soviets have modified the Soyuz spacecraft into an unmanned resupply vehicle for the Salyut space stations (to date only demonstrated with Salyut R). The Soviets refer to this resupply vehicle as Progress. The vehicle is used to transport both station and cosmonaut consumables from Earth to a Salyut space station. Unlike Soyuz, the Progress vehicle is not recoverable, and the Soviets dispose of the Progress vehicle when the transfer operations are completed.

~~(S)~~ The Soyuz T was introduced in a manned configuration in 1980, 6 years after its initial unmanned test flight. Soyuz T uses the Soyuz configuration. However, the interior has been modified extensively to modernize systems such as the on-board computer, propulsion, attitude control, and propellant tankage. Soyuz T has replaced the Soyuz vehicle and near future manned space flights will use the Soyuz T vehicle.

2. Projection Rationale (U)

~~(S)~~ There is an abundance of evidence indicating Soviet commitment to their manned space program is increasing. This evidence takes the form of open source statements, current development activity, and facilities indicators.

~~(S)~~ Since the late 1960's, an announced goal of the Soviet space program has been the development of long-duration orbital stations with multiple crew mannings. The Soviets have spoken of achieving this goal in several contexts. The first is in the context of the ongoing Salyut/Soyuz/Progress program. The second context involves the discussion of modular space stations using several modules to construct a large station to serve a variety of interests. The final context is of a "permanent" space station capable of supporting thousands of man-days in an unreplenished mode. The actual size or configuration of this permanent space station has been ill defined.

(U) Soviet intentions for developing and exploiting space stations were stated in 1974 by B. N. Petrov. These can be summarized as a three-phase effort:

(1) Placing fully assembled stations into orbit with powerful launch vehicles.

(2) Placing station modules in orbit, then docking the modules to create a space station.

(3) Placing smaller units, assemblies, equipment, and instrument modules in orbit and using a special space vehicle to assemble the modules into a station tailorable to fit changing mission objectives.

(S) The Soviets have also spoken of their space station program in terms of station attributes and potential missions. The most prominent spokesmen in this area include Petrov; K. P. Feoktistov, the cosmonaut and designer of the Salyut 1, 4, and 6 stations; and S. D. Grishin, reported head of the Flight-Control Center in Kaliningrad. Table XIX shows the station attributes and missions mentioned.

(U) Taking Petrov's statement as a template, it would appear the Soviets have completed the first phase of their space station program involving the use of fully assembled stations in Earth orbit. And with the launch and docking of Cosmos 1267 with Salyut 6 have embarked upon the second phase.

(U) While there have been references to a modular concept of space station construction since the beginning of the Soviet space program, the details of such a program were not well defined until 1975 when Feoktistov discussed the possibility of adding an additional docking port to the Salyut 4 vehicle and then creating a larger station complex by joining Salyut vehicles together "like beads on a necklace."

(U) During the mission of Salyut 6, Feoktistov and Grishin have made numerous statements regarding the Soviets concept of a modular space station. Both discuss a station composed of five to eight units, each launched separately into Earth orbit. In orbit the vehicles would be joined together to form a single station. Both discuss the possibility of modifying or changing the station as the mission objectives of the station change over time. This would be done by changing the station configuration through the addition or deletion of modules. Figure 29 is a Soviet drawing of a modular space station.

(U) Grishin has also expanded upon the modular concept by describing an operational concept similar to the third phase of Petrov's program. Grishin talks about a modular system using independent or semi-independent modules to ferry experimental hardware, instruments, materials, and perhaps men to and from a modular station. Grishin also describes the use of these "smaller" modules as experimental packages that would move out of the local environment of the main station, conduct their mission, and return to the main station at the end of their mission.

(U) Feoktistov echoed many of the same thoughts following the docking of Cosmos 1267 with Salyut 6. Feoktistov characterized Cosmos 1267 as:

> . . .a prototype space module of the kind that will be linked together to form a multipurpose orbital station. One of the modules will be a fitted-out laboratory, others will perform purely technological duties. There will also be observatory modules and whole plants for manufacturing products in zero-*g*. Lounge modules will be living quarters for cosmonauts to take a rest after the heavy workload they will handle in space. . . There will be numerous orbiting stations carrying rotating resident crews. . . Each station can be easily modified by changing modules to fit the changing needs of the mission. . .

(U) As can be seen, a variety of potential missions have been discussed within the modular space station concept. All of these are basically extensions of many of the experiments seen on the Salyut R stations: Earth resources study/observation, biomedical studies, and the manufacturing and processing of materials in a zero-gravity space environment. Feoktistov in his recent statements has expanded on these missions to include the use of the station as a logistical base where the station would "act as launch platforms for upper stages carrying spacecraft to deeper regions of space" and serve as "a repair point for satellites already in orbit."

TABLE XIX

(U) FUTURE SOVIET SPACE STATIONS

PHYSICAL SIZE	CREW SIZE	MANNED MISSION DURATION	MISSIONS
Orbital mass: 25,000 kg	2-4	Maximize periods consistent with experience and medical safety factors	Earth and celestial observations Biomedical studies Space manufacturing Military missions such as reconnaissance are also probable.
Number of station modules: 5-8	6-10 most probable		

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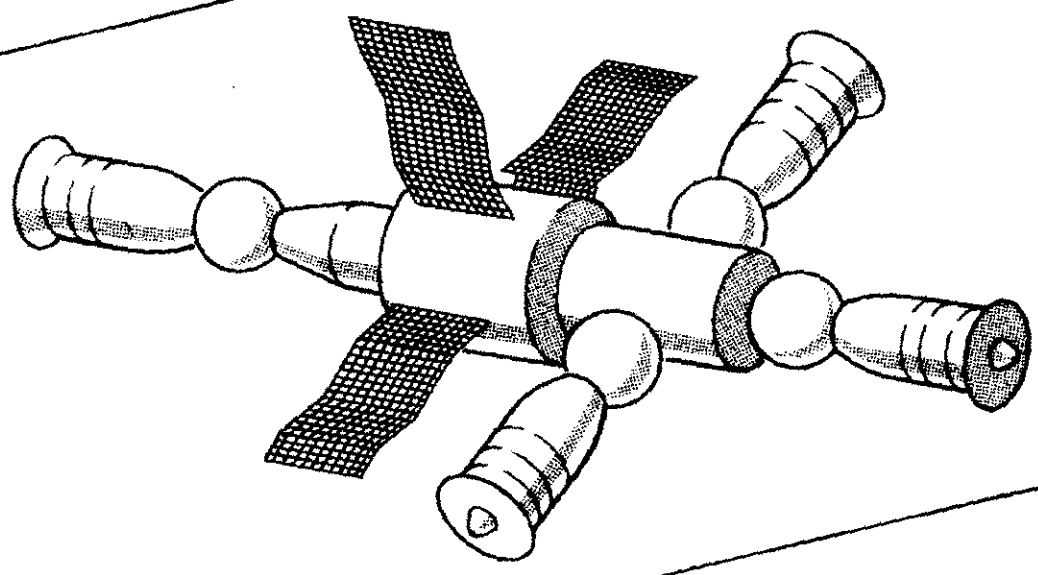

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Fig. 29 (U) Modular Space Station

~~(S)~~ While Cosmos 1267 and Salyut 6 represent an initial attempt at prototyping a modular space station, the actual achievement of a Soviet modular space station capability is expected to occur some time in the near term. The initial configuration of a modular station will probably involve a Salyut size-core vehicle linked to two or more modules about the size of a Cosmos 1267 station segment. The linking of two Salyut-size vehicles could also occur. After initial attainment of a modular station the Soviets will probably embark on a program to modify and tailor the station on orbit to suit specific mission objectives. This tailoring will probably include the addition and deletion of modules from the station, and the use of special adaptors with various modules. Along with this will be attempts to increase the duration of single mission manning, and possibly attainment of continuous manning of the station.

~~(S)~~ As was mentioned previously, the Soviets have also discussed what they refer to as a "permanent" space station. Such a station is characterized in terms of crew size (10-20 cosmonauts) and unreplenished man-days in orbit (several thousand). Although the Soviets have never really defined station size or configuration, there are two options the Soviets could pursue to attain their goal of a permanent space station. The first is to extend the modular space station concept. The second involves developing a new large station in the 100,000+ kg weight class—roughly equivalent to the US Skylab. While there is evidence to support both options, whichever way the Soviets go it is clear a "permanent" space station will not occur until after the development and flight of their modular space station(s).

(U) Both Feoktistov and Grishin have spoken about a modular space station in terms previously associated with the "permament" space station concept. Both men speak of modular stations with crew sizes of 10-20 cosmonauts and talk about permanent manning of a modular space station. This implies the Soviets may attempt to satisfy their goal of a "permanent" space station through some type of advanced modular space station.

~~(S)~~ ~~WNINTEL~~) A more traditional approach to a "permanent" space station would be to use a single large vehicle, much like the US Skylab of the early 1970's. Such a vehicle would weigh in excess of 100,000 kg and be stocked with enough station consumables to support in excess of 1,000 man-days in habitation in an unreplenished mode. Such a vehicle would require a large booster—similar to the

(b)(3):10 USC 424

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US Saturn V—to place the space station into Earth orbit. Photography of Tyuratam indicates the Soviets are developing such a vehicle. The Soviets have been modifying the two launch pads and support facilities associated with their previous attempt to develop a Saturn V-class booster, the SL-X. They are also constructing a new launch pad for this new large launch vehicle, arbitrarily designated the SL-W. At this point the exact time when the SL-W will make its first flight is unclear, but could be as early as the end of the near term. A large Skylab-type space station must await successful development of the SL-W launch vehicle.

~~(S)~~ Along with the continued development of their space station program, the Soviets are developing a partially reusable crew transportation/station resupply vehicle. The system will use an expendable booster with a reusable payload/upper stage. (b)(1);1.4 (c)

(b)(1);1.4 (c) ~~(C)~~ open source reporting have revealed a Soviet program to develop a completely reusable, horizontal takeoff, and horizontal-landing space system called the Raketoplan Project. The Raketoplan Project appeared to be as an orbital vehicle, similar to the US Dynasoar, for supplying and replenishing orbital space stations.

(b)(1);(b)(3):10 USC 424;1.4 (c)

(b)(1);1.4 (c)

~~(C)~~ Contacts with prominent Soviets indicate development of a Soviet reusable space system (RSS) capability. In the early 1970's, as the US Space Shuttle was being finalized, the Soviets said they had a program that would yield "something functionally at least compatible to the US shuttle but a smaller vehicle than the US." These statements were coupled with the Soviet desire to discuss the economics and logistics of reusable space systems. As time has progressed, Soviet statements in the area of RSS have become less and less positive. In later contacts, the Soviets have indicated they are still involved in conceptual design and trade-off studies for RSS and are waiting to assimilate US experience with the space shuttle before making a final decision on their own RSS. Recent contacts revealed the Soviets have made an initial decision on a RSS, although some design variables remain open pending the acquisition of US data from our space shuttle experience.

(U) These conference contacts were confirmed in Soviet open source announcements. In June 1978, Radio Moscow, in answer to a question from a Southern California listener, confirmed the existence of a Soviet space shuttle program and provided the following description:

(b)(1);1.4 (c)

> The Soviets prototype is somewhat different in design (from previous mass media descriptions). The craft will resemble an airplane, with delta wings and a cigar-like fuselage. Its rear part will carry three powerful rocket engines. The overall length of the vehicle will be about 200 ft, and its diameter with fuel containers around 26 ft. The Soviet design calls for a specially designed launcher powered by rocket engines.

(b)(3):10 USC 424

~~(S)~~ ~~WNINTEL~~) Analysis of this statement has led to several conclusions about the Soviet RSS effort. First, the previous mass media descriptions relate to Western European articles on a completely reusable, horizontal takeoff, horizontal landing vehicle most often called Kosmolyot, which is almost identical to the Raketoplan project (Raketoplan was used to identify the program in one article). The Radio Moscow program described a typical delta wing configuration. The three powerful rocket engines are believed to refer to a three-stage launch vehicle. The length and diameter figures are believed to be the total erected length of the launch vehicle and payload and the maximum diameter of the launch vehicle/payload combination. The use of a three-stage launch vehicle with an approximate 61-m total system length and an

8-m maximum diameter strongly implies an SL-13, whose gantry can accommodate a vehicle about 63 m in height and has a maximum diameter of 7.6 m. The SL-13 can place approximately 19,000 kg into low-Earth orbit.

(U) This assessment is further confirmed by a recent statement in the French journal *Air and Cosmos*. In an article describing the French Hermes project (a vertically launched, reusable payload on an expendable booster), the statement is made that the Soviets have a very similar program. The Hermes is to be a vehicle for use with up to two-five men, with a mission of independent flight or space station resupply. The Hermes is to have a weight of 18,000-20,000 kg.

(C-NOFORN) Additional definition of the Soviet RSS program was obtained at the XXXth Conference of the International Astronautical Federation. Here the Soviets described their space shuttle program as similar (at least conceptually) to the US Dynasoar. Their vehicle would weigh 13,500 kg (it is unclear whether this is a fully loaded weight), be launched by the Salyut launch vehicle (the SL-13), have no cargo carrying capability, and have an expected first flight in the near future. The mission the vehicle will perform will be space station support and crew ferry.

(S) Given the data above it appears the Soviet RSS program, their space shuttle, is designed to yield a reusable spacecraft launched on an expendable SL-13 launch vehicle. The spacecraft is expected to weigh ~15,000 kg, and will probably perform a space station support/crew ferry mission. First flight of this vehicle will occur in the 1983 to 1985 period. A postulated configuration is shown in Figure 30.

(U) Based on a review of Soviet statements and other intelligence evidence, the Soviets are not currently developing a space shuttle analogous to the US Space Transportation System. The Soviets have frequently stated they believe the US system is not economical and not suited to their space program with its emphasis on manned space stations. This emphasis requires crew transport and resupply missions for support.

(U) To support these space station missions, they say they need a special type of spacecraft. The requirements for this spacecraft are:

(1) Economy in operation through repeated use.

(2) Orbital maneuverability for rendezvous and docking, and to shuttle between stations.

(3) Capability of reentry within a wide corridor, and landing at a specific place.

(4) Manned operation.

The Soviets' reusable spacecraft discussed above appears to be a partial fulfillment of these Soviet requirements.

(U) An alternative use for the payload capability of the SL-W launch vehicle would be for the Soviets to embark upon a lunar program similar to the US Apollo program of the 1960's and 1970's. Recent Soviet statements on lunar exploration seem to discount the possibility of a manned lunar landing. Instead, the Soviets talk about an extensive program using automated lunar probes-orbiters, landers, and sample-return vehicles. However, all the Soviet statements regarding manned lunar activity are only about what the current Five-Year Plan calls for, nothing is said about possible activity past 1986. Thus, the Soviets appear to be holding open the option for some type of manned lunar activity toward the end of the 1980's. This is consistent with the ongoing development of the new large Soviet launch vehicle, the SL-W. This vehicle will probably be available to support some form of manned lunar mission by the end of the mid term.

3. Projected Space Program (U)

(S) The Soviet manned space program will continue at approximately the same level of effort for the next 10 years. The overall emphasis of the program will continue to be the exploitation of near-Earth space through the use of manned space stations.

(S) The Soviets have started their modular space station program. In this program a space station will be constructed from multiple, independently launched modules. Eventually, the Soviets are expected to continuously man the modular station, and to use the station modularity to tailor the station to meet short-term mission or experimental needs.

(S) The Soviets have an operational objective of developing a "permanent" space station. This station is characterized by crew sizes of 10 or more cosmonauts and support capabilities in excess of 1,000 man-days of unreplenished operation. At this point, it is unclear how the Soviets will achieve this goal. They could develop a large modular-type station, or alternatively they could develop a large station similar to the US Skylab. At present, the Soviets' ongoing development of a Saturn V-class booster, the SL-W, could be rationalized in terms of the development of a 100,000-kg (or larger) orbital station as their "permanent" station. It is clear the development of a modular station based on Salyut-sized modules (20,000 kg), will precede the "permanent" space station. The Soviets are expected to have a "permanent" station capability by the end of the mid term.

(S) Along with their space station program the Soviets are developing a reusable spacecraft with a

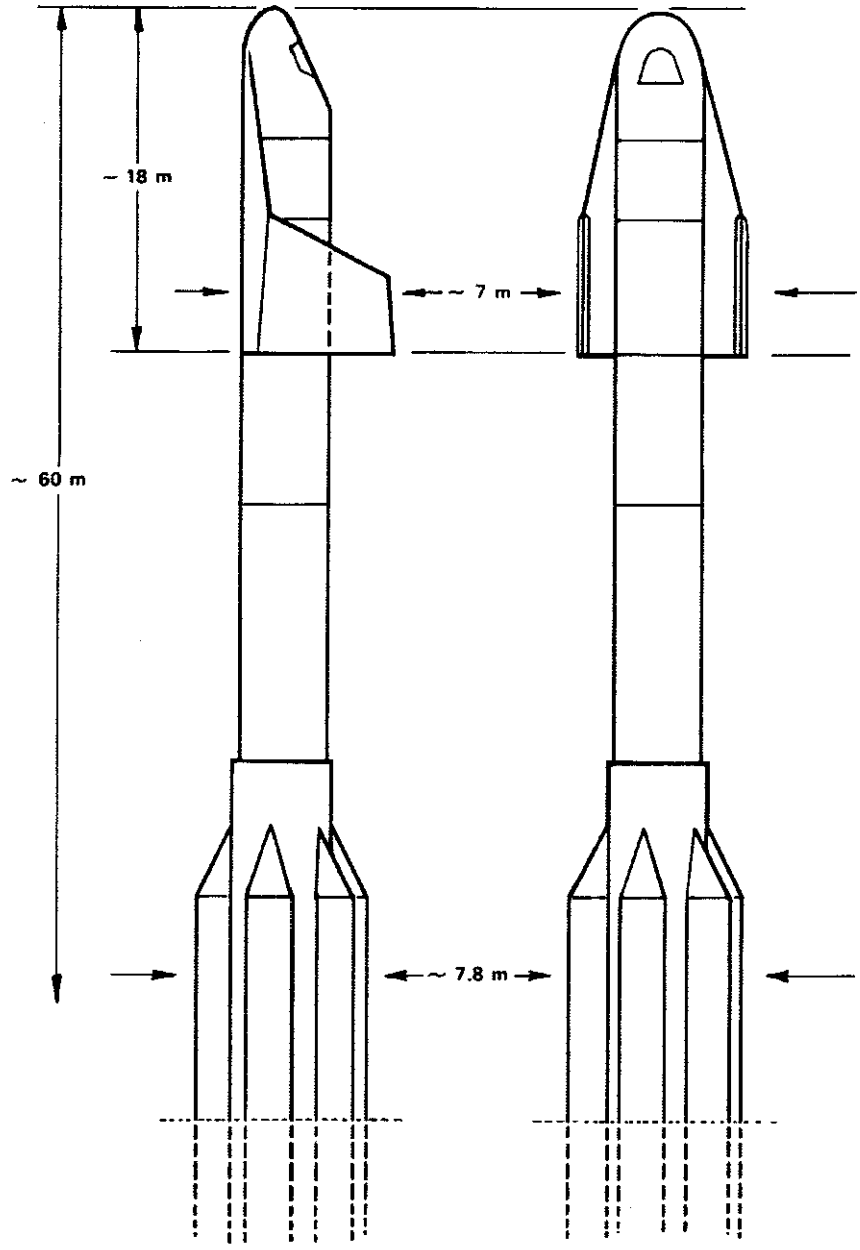

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Fig. 30 (U) Postulated Reusable Spacecraft Configuration

space station crew ferry mission. The spacecraft, the RSS, will be launched some time during the 1983-1985 period by an SL-13 launch vehicle. The RSS will weigh about 15,000 kg and have a crew size of two to five cosmonauts. While the stated mission of the RSS will be space station support, the RSS will not replace the Soyuz T/Progress spacecraft. The current RSS appears to be part of a longer term effort aimed at the development of a completely reusable space system. The longer term effort is discussed in Section XV.

~~(S)~~ The Soviets have retained their option for possible manned lunar missions some time in the mid term. Such missions will probably require the SL-W launch vehicle, which will probably not be available until the mid term.

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SECTION XII

SCIENTIFIC, LUNAR, AND PLANETARY SYSTEMS (U)

(b)(1);1.4 (c)

1. Scientific Systems (U)

1.a. General (U)

~~(S)~~ Unclassified Soviet near-Earth scientific space systems are coordinated by the Intercosmos Council. The Intercosmos program originated in the late 1960's to provide East European Communist countries an opportunity to participate in space activities. National committees were formed in each member country to sponsor research in space physics, communications, meteorology, biology, and medicine. The Intercosmos Council was formed under the USSR Academy of Sciences to coordinate the activities of the member countries. The Soviet Union has dominated and controlled the program since it was started.

~~(S)~~ The most prominent activity of the Intercosmos organization has been the Intercosmos satellites. However, it has also been involved in other space missions such as Prognoz, Oreol, interplanetary flights, and manned missions. The Intercosmos satellites have traditionally supported basic and applied research in three general areas—solar emissions, ionospheric and magnetospheric structure, and cosmic radiation studies. Recently they have also been devoted to oceanographic/meteorological research.

~~(S)~~ The Prognoz satellites study the effects of solar activity on interplanetary space and the Earth's magnetosphere. Data are collected on particle radiation, gamma rays, X-rays, magnetic fields, and the interactions between the solar wind and the magnetosphere. These measurements allow the Soviets to predict the effect of solar proton flares on radiation levels in near-Earth space. The satellites also provide solar flare warnings for the Soviet manned space program and may help in the development of reliable communications links and methods for disrupting communications during wartime.

(U) The biosatellite (BIOSAT) program provides data for use in the study of space biology and medicine. Priority in this program appears to favor studies of the biological effect of weightlessness and radiation. These studies, performed on small animals as well as other plant and animal material, provide the manned space program with information to support long-duration flights. Other investigations on such matters as advanced life support components and biological rhythms are also made in this program.

~~(S)~~ The Soviet BIOSAT program has no known direct military mission. However, the spacecraft structure and many subsystems are similar, if not identical, to the Soviet [redacted] unmanned photoreconnaissance vehicle. The basic BIOSAT program is equally applicable to manned military and manned scientific spacecraft.

(U) East European Communist Bloc, French, and US scientists have provided experiments for the Soviet BIOSAT. The vehicle is often referenced in relation to the Intercosmos program of cooperation between the Soviet Union and East European Communist countries.

(U) In February 1979, the Soviet near-Earth scientific program expanded to include a dedicated oceanographic research satellite (OCEAN). The OCEAN satellites use a variety of sensors—active and passive—to obtain data related to the ocean. The ultimate purpose is to allow the Soviets to obtain optimum ship routing, to increase fisheries' resources and to expand the Soviets' climatological data base.

~~(S)~~ In recent years, the Intercosmos Council has expanded its membership to include Cuba, Mongolia, and Vietnam and has also negotiated bilateral cooperative agreements with non-Communist countries—France, Sweden, and India. France has contributed experiments for several Soviet satellites and three French-built satellites have been launched by the Soviets. Sweden has provided payload experiments for Intercosmos satellites. The Soviets launched two satellites for India and have agreed to launch a Swedish-built satellite.

1.b. Projection Rationale (U)

~~(S)~~ The Soviets have made a large number of statements regarding the future course of their scientific space program. These statements indicate the programs previously discussed will continue for the next 10 years.

~~(S)~~ The Intercosmos program will rely on the basic AUOS modular spacecraft introduced with Intercosmos 15. They intend to adapt the basic satellite to a variety of experiments to continue the experimental program discussed.

~~(S)~~ Intelligence reporting indicates the Soviets may be phasing out the Prognoz series in favor of an evolutionary derivitive called Intershock. Intershock will continue the traditional solar activity studies

started by Prognoz in addition to investigating the structure of the Earth's Bow Shock, shock waves caused by the interaction of solar gases with the Earth's magnetopause. The Intershock satellites are expected to be launched into a very eccentric orbit with a period of above 100 hours, similar to the orbits used for the Prognoz satellites. The first launch of Intershock is expected to occur in late 1982, marking the end of the Prognoz series.

~~(C)~~ The current Soviet BIOSAT program is expected to continue for the next several years. A joint US-USSR experiment involving two, possibly three, Rhesus monkeys is scheduled to occur in 1982, with an additional flight in 1984 and again in 1986. The experiments will consist of monitoring the animals physiological reactions, with emphasis given to an intensive cardiovascular study in an environment of prolonged weightlessness. The Soviets are currently having problems with space allocation and instrumentation of the monkeys, which is becoming much more complex then originally planned. The Soviets are also soliciting experiments from other countries, most noticeably Sweden, for future BIOSAT payloads.

~~(S)~~ As discussed earlier, the Soviets have launched Indian built payloads. They are expected to launch foreign built spacecraft throughout the projection period when such launches fit into the overall national goals.

1.c. Projected Space Program (U)

~~(S)~~ The Soviets are expected to continue their scientific space program at the present level of effort throughout the projection period.

2. Exploratory Systems (U)

2.a. General (U)

(U) The Soviet exploratory space systems include spacecraft for lunar and planetary space programs. These systems have been a highly visible part of the Soviet space program since its inception.

~~(S)~~ The Soviet Union has maintained a lunar exploration program since 1958. Much of the data collected on early missions was in support of unmanned and manned lunar missions. However, a great deal of purely scientific data was also obtained.

~~(S)~~ Soviet lunar exploration has been performed by unmanned landers with Earth-return, unmanned landers with rover, and orbiter systems. These systems are designed to study the lunar environment and are used to develop the engineering techniques for future lunar and planetary exploration. Such techniques include lunar orbit insertion, lunar orbit maneuvers, lunar landing and lift-off, Earth atmospheric reentry (using various methods), and capsule recovery.

(U) Initial Soviet lunar exploration took place from December 1958 to April 1960. During this time period, the Soviets attempted to launch six probes consisting of both flybys and impactors. Only three of the probes were successful, Lunik 3 being the first spacecraft to photograph the backside of the Moon. The initial launches used the SL-3 launch vehicle and the direct-ascent techniques of translunar injection.

~~(S)~~ Between 1963 and 1968 the Soviets launched their second series of lunar exploration probes consisting of 19 lunar orbiters and landers launched by the SL-6. They used the parking orbit technique of translunar injection and had only six successes (two landers and four orbiters) in the 5-year program.

~~(S)~~ The current series of Soviet lunar explorers are launched by the SL-12. Since November 1967, there have been 23 SL-12 lunar launches of which 12 were successful—three lander/return, two lander/rover, two orbiters, and five Zond circumlunar missions. The lander/return, lander/rover, and orbiter systems are considered operational and all have similar subsystems, configuration, and construction. The Zond circumlunar system was originally developed as a test bed for manned circumlunar space flights, a mission which is believed to since have been cancelled. The Zond reentry capsule and reentry experience are applicable to a future manned lunar landing system.

~~(S)~~ Soviet planetary exploration began in 1960 with the attempted launch of two Mars flyby spacecraft, both of which suffered launch vehicle failures. The Soviets launched four more flybys—all successful—during the 1962 and 1964 Mars launch windows. They did not attempt to launch a Mars probe during the 1966 window and began using a new orbiter/lander spacecraft during the 1969 launch window. This spacecraft first operated successfully in 1971. During the 1973 Mars launch window, because of higher energy requirements, the Soviets launched two orbiter and two lander spacecraft separately rather than two of the heavier orbiter/lander spacecraft.

~~(S)~~ Four months after the first Mars launch attempt in 1960, the Soviets attempted to launch a Venus impactor spacecraft, but the launch vehicle failed. They launched a total of seven Venus impactors and flybys (all failures) during the 1961, 1962, 1964, and 1965 launch windows. The first Venus orbiter/lander was launched in 1965. Two similar orbiter/landers were launched during each of the 1967,

1969, 1970, and 1972 windows. With the SL-12 launched Venus 9 and 10 (orbiter/landers) in 1975 and Venus 11 and 12 in 1978, the Soviet Union embarked upon a new era of Venus exploration making use of heavier, more capable spacecraft and entry modules.

2.b. Projection Rationale (U)

~~(C)~~ For the last 7 years, the Soviet lunar and planetary program appears to have been conducted as a limited level of effort endeavor with a total of 5 missions since 1 January 1975 (Luna 24 and Venus 9-12). It appears this level will increase during the 1980's.

(b)(1);1.4 (c)

~~(C)~~ Soviet plans for planetary exploration have been fairly well documented in [redacted] open source reporting. For the last several years the Soviets have been involved in a joint development with the French for a Venus probe to be launched during the 1984 launch window. The probe was originally going to use a French-developed balloon for exploration of the upper reaches of the Venusian atmosphere. Recently, the effort has been changed to one where the French are supplying experiments for a Venus probe to be released from a planetary flyby vehicle. This vehicle will then have its trajectory altered to allow it to flyby Halley's Comet in 1986. In addition, the Soviets have spoken of a repeat of the Venus 11-12 mission during the Fall 1981 launch window, and Venus probes during the 1983 and 1986 launch windows.

~~(C-NOFORN)~~ The Soviets appear to have significantly reduced the priority of their Mars exploration program. This may be due in part to the success of the US Viking program, or to a decision to concentrate on Venus and divert surplus manpower to other programs.

~~(C-NOFORN)~~ The Soviets appear to have no plans in the near term to explore Mercury or the outer planets. They have stated they currently have no capability to perform these missions and have cited their inability to navigate as the reason. Western European sources suggest the Soviets may have booster constraints. The Soviets have at times proposed to concede Mercury, Mars, and the outer planets to the US while they, alone, concentrate on Venus.

(b)(3):10 USC 424

(b)(1)

~~(S-~~ ~~WNINTEL~~) [redacted] the Soviets may be planning to conduct missions to the outer planets sometime in the mid term.

(b)(1);1.4 (c)

[redacted]

(b)(1);1.4 (c)

[redacted] Also the development of the SL-W could support very large and sophisticated planetary probes and overcome the apparent booster limitations discussed earlier.

(b)(3):10 USC 424

~~(S~~ [redacted] ~~WNINTEL~~) The Soviets are also constructing a network of four large, 64-m and 70-m dishes throughout the Soviet Union. (See Figure 32.) These very large dishes will significantly improve the Soviet capability to support planetary and lunar missions. They [redacted] will enable the Soviets to increase the data rate from their planetary probes. This increased data rate is a prerequisite for the sophisticated missions discussed above. The entire four dish network should be operational in 1985, allowing the Soviets to support these more sophisticated missions in the mid term.

(b)(1);1.4 (c)

~~(S)~~ It appears the Soviets will launch four to six Venus probes in the 1981-1984 period. After 1985, the Soviets will probably increase the scope of their planetary exploration program to include missions to Jupiter and the other large planets. They will continue to launch probes to the nearby planets with the emphasis on the exploration of Venus.

~~(C)~~ There have been a number of open source and unofficial Soviet pronouncements about a new lunar program beginning in the first half of the 1980's. Potential missions under this program include lunar polar orbiters, sampler/return missions to the far side of the moon, and advanced lunar rovers.

~~(C)~~ The Soviets have admitted they are working on a polar lunar orbiter mission. Information is not sufficient at this time to define the vehicle's scientific payload. It appears the Soviets are also considering a lunar lander/return mission. The timing of the lander/return mission may in part depend upon the success of the Soviet lunar orbiter mission(s). There are additional data to indicate the Soviets are currently interested in the Van de Graaff region of the moon (27° S/172° E). Finally, advanced lunar rovers are under consideration and have been modeled and discussed. There has been no firm indication as to exact timing and whether the rover mission will operate on the near or far side of the moon. (Far side operation would require a lunar orbiting relay satellite for successful operation.) All told it appears the Soviets will probably have from 5-7 lunar missions in the near term. While no firm correlation can be made, this new lunar program may be part of a larger program aimed at a manned lunar mission by the end of the 1980's.

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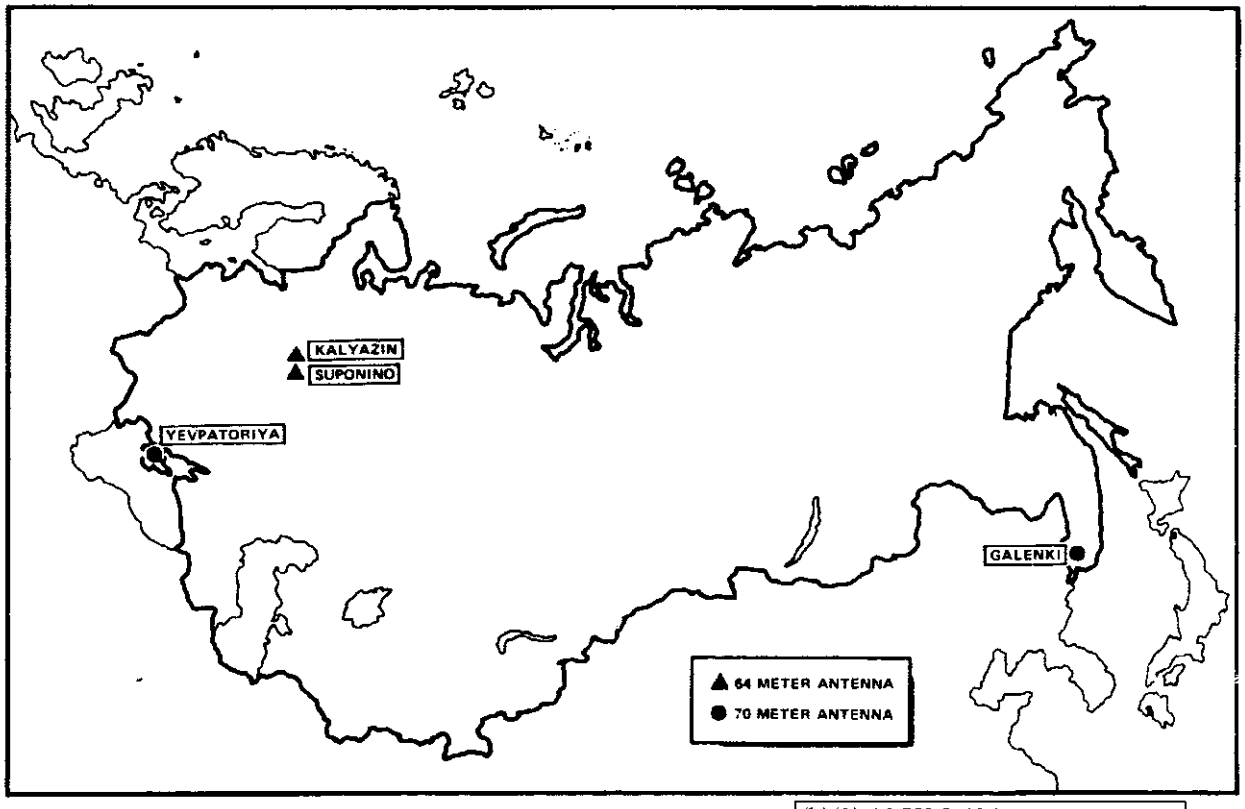

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Fig. 32 (U) Large Antenna Network

~~(S)~~ Although recent Soviet statements seem to rule out any manned lunar activity, upon careful examination the statements appear to be hedged with respect to time. They leave open the option of a manned lunar program toward the end of the 1980's, and are consistent with the information discussed above.

~~(U)~~ In summary, it appears the Soviets will have an increase in their lunar exploration activity in the near term. This activity may presage a manned lunar program in the late 1980's.

2.c. Projected Space Program (U)

~~(S)~~ The Soviet exploratory space program will continue for the next 10 years. The level of effort (measured by number of launches) will increase over that observed from 1975-1981. This is because the Soviets are expected to embark upon their "new lunar program." This program is expected to account for five to seven launches in the next 5 or 6 years. In addition, the Soviets will maintain their planetary program at about the same level as evidenced in the past (one or two launches in each planetary launch window). The focus of the planetary program will be Venus, with the Soviets launching probes in the 1981, 1983, 1984, and 1986 launch windows. Additional missions—most likely to Jupiter—are possible in the mid term.

~~(S)~~ A detailed assessment of Soviet exploratory missions beyond the near term is difficult to make. The number and experimental objectives of the spacecraft are probably not well defined even for the Soviets. The one exception to this may be a manned lunar mission. The Soviets appear to have left themselves the option of manned lunar missions toward the end of the 1980's. As currently envisioned, such missions would require the Soviets to develop a SLV equivalent to the US Saturn V vehicle. The Soviets have such a vehicle under development and it should be available to support late 1980's lunar missions.

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TABLE XX

(U) ENGINES AVAILABLE FOR SPACE LAUNCH SYSTEMS

APPLICATION	DEVELOPMENT SITE	PROPELLANTS	THRUST (kN)[1]	SPECIFIC IMPULSE[2] $\left(\frac{N-sec}{kg}\right)$
Booster		N_2O_4/monomethyl hydrazine (MMH)	4,500	2,700
(b)(1);1.4 (c)		LOX/hydrocarbon	4,500	2,780
		N_2O_4/MMH	900	2,700
		N_2O_4/MMH	650	2,700
Upper Stage		N_2O_4/MMH	220	3,215
		LOX/hydrocarbon	220	3,310
		N_2O_4/MMH	220	3,160
		LOX/hydrocarbon	220	3,250
		N_2O_4/MMH	450	3,250
		N_2O_4/MMH	150	3,220
		LOX/LH_2	165	4,210

[1](U) One engine development, either propellant combination possible.
[2](U) Booster thrust and specific impulse at sea level, upper stage at vacuum.

(b)(3):10 USC 424

~~SECRET~~ ~~WNINTEL~~

(b)(1);(b)(3):10 USC 424;1.4 (c)

~~(S)~~ At present the data available on the SL-Y are insufficient to accurately define its configuration, characteristics, and capabilities. Initial estimates of the SL-Y's performance can be gleaned from the photography of the launch site, observed propulsion development programs and perceived Soviet launch vehicle requirements. The Soviets appear to have a requirement for a launch vehicle capable of placing between 10,000 and 12,000 kg into low-Earth orbit—a capability midway between the SL-4 and SL-13.

~~(S)~~ As discussed in Section VII, the Soviets have announced an extensive geostationary COMSAT program. While the Soviets are not expected to launch all the satellites they have announced, they are expected to have a network of 12-15 active COMSATs by the end of the decade. To support this requirement the Soviets could use their only currently geostationary capable launch vehicle, the SL-12, but this is considered unlikely because of the availability of the vehicle. The historical usage patterns indicate from five to eight SL-12's and SL-13's (the three-stage version of the SL-12) are produced and used each year. To support a 12-satellite COMSAT network (with a 2-year mean time between failure for any given satellite) and allow for contingencies requires the entire yearly production run. This would leave no vehicles available to support other programs using the SL-12/ SL-13 launch vehicle (geostationary METSAT program, the lunar and planetary program, and the space station program).

(b)(3):10 USC 424

~~(S~~ ~~WNINTEL~~) At one time, construction activity at the SL-12/SL-13 production facility, (b)(1);1.4 (c) was thought to be related to an increase in SL-12/SL-13 production. While this still could be the case, the validity of this premise is in question. The large facility has been externally complete for almost

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(b)(1):(b)(3):10 USC 424:1.4 (c)

of the Freedom of Information and Privacy Act

SECTION XIII

LAUNCH VEHICLES (U)

1. General (U)

~~(S)~~ Of the 14 space launch systems successfully flown by the Soviets, at least 11 have used stages from ballistic missiles.

~~(S)~~ The SL-1/SL-2, SL-3, SL-4, SL-5, SL-6, and SL-10 are Soviet launch vehicles based upon the SS-6 ICBM. The SL-1/SL-2 launched the first artificial Earth satellite, Sputnik 1. The SL-3, SL-4, and SL-6 (the active derivatives of this first satellite launcher) account for the majority of Soviet space launch attempts. The SL-3 and SL-4 are the Soviets' only man-rated launch vehicles.

~~(S)~~ The SL-7 was developed from the SS-4 MRBM and was used by the Soviets to launch small payloads (less than 500 kg) into low-Earth orbit. During the mid-1970's, SL-7 usage sharply declined as the payloads supported by this vehicle were transferred to the more versatile SL-8. The SL-7 is no longer an active launch system.

~~(S)~~ The SL-8 uses the SS-5 IRBM as a first stage with a restartable second stage. The vehicle is used by the Soviets to support a variety of military and scientific payloads. After the SS-6 based launch vehicles, the SL-8 is the work horse of the Soviet space program.

~~(S)~~ The SL-11 and the SL-14 were developed from the SS-9 ICBM for use as SLVs. The SL-11 has been traditionally used to launch payloads associated with the PVO—ASAT, RORSAT, and EORSAT. The SL-14 is the SS-9 with a restartable third stage. The Soviets have demonstrated a number of different orbital profiles using the restart capability of the third stage. To date, no definitive payload/programmatic associations have been made for the vehicle.

~~(S)~~ The inactive SL-9 and its active four- and three-stage versions, the SL-12 and SL-13, respectively, have been used by the Soviets to launch large payloads into space. The SL-12 is the only Soviet launch vehicle the Soviets have used for placing payloads into geostationary orbit.

~~(S-NOFORN-WNINTEL)~~ During the 1960's and 1970's, the Soviets attempted to develop a vehicle with a payload capability roughly equivalent to that of the US Saturn V (150,000 kg to a 185-km orbit). This vehicle was known [redacted] as the TT-05 or SL-X and to the Soviets as 11A52. This development program resulted in three failures in three launch attempts (in 1969, 1971, and 1972); the vehicle was observed erected on the pad in 1974, although no launch was attempted. For several years, there has been little apparent activity on this system.

(b)(1);1.4 (c)

[redacted]

(U) Figure 33 shows scaled drawings of the current Soviet launch vehicles.

(b)(1);1.4 (c)

2. Projection Rationale (U)

~~(S)~~ During the near and mid terms the Soviets will rely exclusively on traditional, vertically launched, expendable launch vehicles to place payloads into space. This situation is expected to continue well into the far term.

(b)(1);(b)(3):10 USC 424;1.4 (c)

[redacted]

~~(S)~~ The vehicle to be launched from Site W, arbitrarily designated the SL-W, will be the successor to the ill-fated TT-05. Recent [redacted] data reveal the Soviets cancelled the TT-05 (known to the Soviets as 11A52 or 11F94) in the spring of 1974. These data also indicate the Soviets did not abandon the requirement that spurred the development of the TT-05—a manned

(b)(1);1.4 (c)

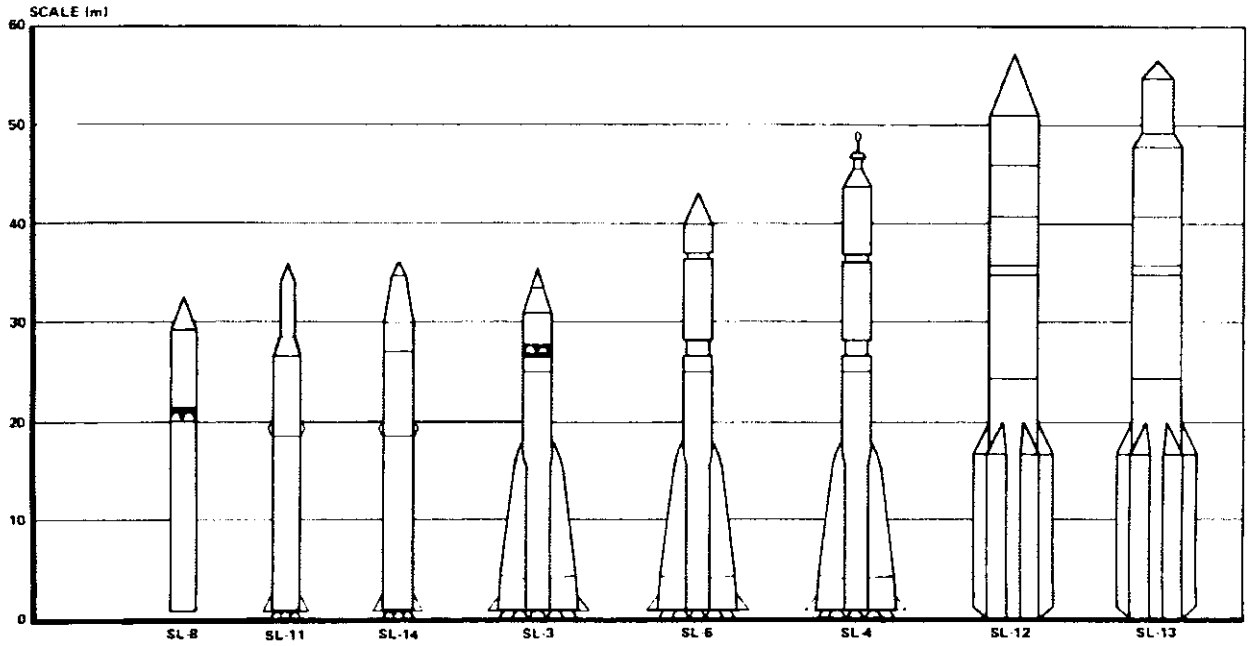

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Fig. 33 (U) Soviet Space Launch Vehicles

lunar landing using a 150,000-kg payload in Earth orbit for the lunar injection staging.

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

By 1977 the design work on this new vehicle was well underway. The new vehicle will reportedly use liquid oxygen as the oxidizer in its three stages, and the third stage will use a high-energy propellant as the fuel—reportedly slush hydrogen, a mixture of liquid and solid hydrogen.

(b)(3):10 USC 424;1.4 (c)

(b)(1);(b)(3):10 USC 424;1.4 (c)

Pgs. 93-95 are denied in full

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(b)(1):(b)(3):10 USC 424:1.4 (c)

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(b)(1);1.4 (c)

6 years and there has been no increase in the SL-12/SL-13 launch rate.

(b)(1);1.4 (c)

In all, this suggests the SL-12/13 production rate may not be appreciably increased to support the needs of the geostationary COMSAT program.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

an examination of the Soviets' current family of launch vehicles indicates an apparent gap in capability between the SL-4/SL-6 and the SL-13/ SL-12. A launch vehicle with 10,000-12,000 kg to low-Earth orbit would fill this gap. This is illustrated in Figure 38. Such a vehicle, given engine restart capability, could fill the geostationary

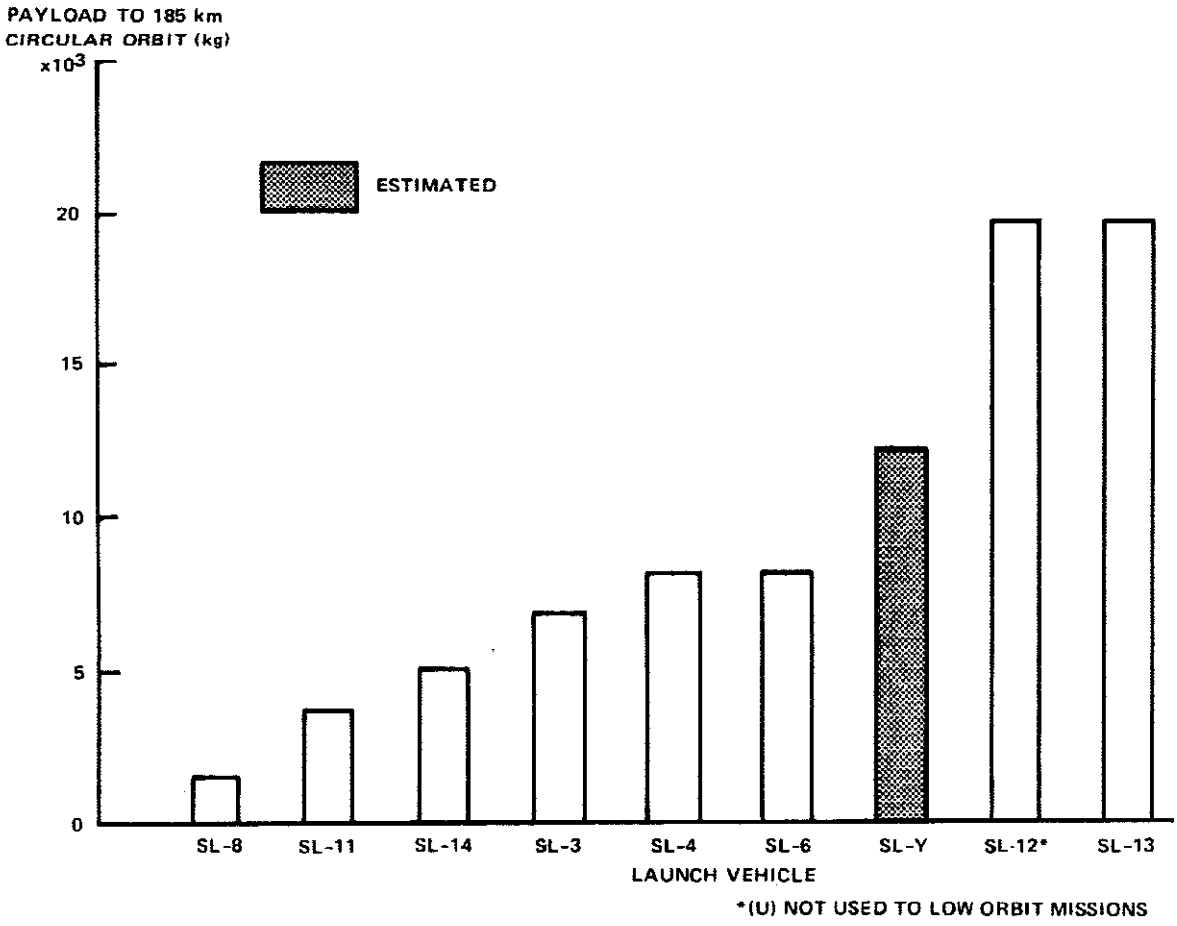

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Fig. 38 (U) Launch Vehicle Capability

COMSAT requirement of placing about 1,500 kg into geostationary orbit.

~~(S)~~ Also, the Soviets' modular space station could use a capability midway between the SL-4 and SL-13. Such a capability could be used by the Soviets to ferry independent modules to a main station for limited duration missions. Also, there are current payloads that could be launched on a 10,000-12,000 kg booster. These payloads, (b)(1);1.4 (c) are also thought to be related to the modular station program.

(b)(1);(b)(3):10 USC 424;1.4 (c)

(b)(1);(b)(3):10 USC 424;1.4 (c)

(b)(1);1.4 (c)

~~(S)~~ The SL-Y design is very indeterminate at this time. Design options are such that the payload of the SL-Y could range from 10,000 to 20,000 kg to low-Earth orbit or perhaps greater. The pace of construction at Site Y suggests a first flight for the SL-Y sometime in the 1984-1985 period.

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(b)(1):1.4 (c)

of the Freedom of Information and Privacy Act

(b)(1);(b)(3):10 USC 424;1.4 (c)

~~(S)~~ An obvious need for the Soviets, given their high annual launch rates, would be a reusable launch system capability. Soviet open source statements and limited intelligence data seem to indicate the Soviets recognize the advantages of a reusable launch system capability, and the Soviets also recognize the problems associated with such a development. The Soviet concept of a reusable launch system is one of complete reuse, horizontal takeoff and landing, using advanced propulsion and cooling technology. The Soviets state their concept of a reusable launch system will not come into being until the late-1990's.

3. Projected Space Program (U)

~~(S)~~ The Soviets will rely upon their current family of expendable launch vehicles for the next 10 years. They are expected to supplement these vehicles with two new launch vehicles (several versions of these two vehicles are possible). These new vehicles are arbitrarily designated the SL-W and SL-Y.

~~(S)~~ The SL-W is the successor to the Soviets abandoned TT-05 launch vehicle. It will use most of the same support facilities built for the TT-05, and is expected to have the same order of magnitude payload capability (150,000 kg or more) to low-Earth orbit. First flight of the SL-W is expected during the 1984-1986 period.

~~(S)~~ The second new launch vehicle, SL-Y, is expected to have its first flight also around the 1984-1986 period. The capability of the SL-Y is not well understood, at this time. There is a perceived need in the 10,000-12,000 kg range, but propulsion (and possible propellant) options would give a vehicle in the 20,000-kg class. The best estimate of SL-Y capability is 10,000-20,000 kg into low-Earth, although payloads in excess of 20,000 kg are possible.

(b)(1);(b)(3):10 USC 424;1.4 (c)

~~(S)~~ The Soviets are not expected to have an analog to the US space shuttle in the next 10 years.

(b)(1);(b)(3):10 USC 424;(b)(3):50 USC 3024(i);1.4 (c)

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SECTION XIV

PROJECTED SPACE PROGRAMS (U)

(U) This section presents the highlights of the 10-year projections developed in the previous sections of this study. The information developed in the study is presented in a short summary form where the expected activity in each system area is discussed, and in tabular form where operating regimes, launch rates, and phase-in/phase-out of systems are depicted.

1. Offensive Weapons (U)

~~(S)~~ The Soviets are expected to remove the FOBS (SS-9 Mod 3) from their inventory. A MOBS for the delivery of nuclear warheads is not expected to be developed.

2. ASAT (U)

~~(S)~~ The Soviets will likely retain the SL-11 launched satellite interceptor throughout the period of this projection. They will undoubtedly make evolutionary improvements in their ASAT to ensure its continued effectiveness against a variety of US targets

(b)(1);Sec. 1.4(c)

~~(S-NOFORN-WNINTEL~~) Analysis of the Soviet laser program indicates a possible early application of a laser as a weapon would be in an ASAT system. However, it is not clear at this time what the Soviets first laser weapon in space will be like.

(b)(1);1.4 (c)

~~(S)~~ Neither version of the current SL-11 interceptor can intercept targets above approximately 5,000 km. If the Soviets perceive a requirement to intercept these high-altitude targets they must develop a new capability. The Soviets could take advantage of the network arrangement of high-altitude targets and develop a high-altitude interceptor with a multishot capability. They could develop a multishot intercepter based upon a laser similar to the moderate power system discussed above, or they could develop a more conventional technology system. Both have their strengths and weaknesses and it is not clear whether they will pursue either option. In addition, there is a low probability option to use nuclear weapons for negation of a limited number of high-altitude satellites.

3. Reconnaissance Systems (U)

~~(S)~~ The Soviets are expected to continue to fly film-recovery missions throughout the period of this study.

(b)(1);1.4 (c)

The recent flight of however, may signal the Soviets' intent to develop a new generation of longer life spacecraft Available data are insufficient to establish a trend.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~ Current Soviet film recovery capabilities do not provide decision makers with imagery data any sooner than 48 hours from the last image. For battlefield management functions, this situation will likely become untenable. A significant increase in photoreconnaissance spacecraft utility is realized for these missions if the imagery data can be returned in a more timely manner.

(b)(1);1.4 (c)

the need for a crisis monitoring system strongly imply the Soviets are striving toward more timely retrieval of imagery data; the question that remains is how will they meet this requirement.

(b)(1);1.4 (c)

~~(S)~~ There are two options open to the Soviets. The first would be the adaption of the equipment to achieve a near real-time, store/dump photoreconnaissance capability. The Soviets could develop such an operational capability sometime in the near term. An alternative option is the development of a real-time imaging system.

(b)(1);1.4 (c)

Accordingly, the deployment of a real-time imagery system will not occur before the far term.

(b)(1)1.4(c);(b)(3):50 USC 3024(i);(b)(3):P.L. 86-36

(S) The Soviets are expected to continue the and Earth resources photographic missions throughout the next 10 years.

(b)(1):1.4 (c)

(S) The future of the RORSAT is unclear. It was thought the radar and nuclear power supply would be modified following the Cosmos 954 incident. However, no major changes appear to have been made. The RORSAT is expected to remain unchanged but may be modified

(b)(1);1.4 (c)

(S) The EORSAT is assessed to have reached IOC. The Soviets are expected to keep the satellite relatively unchanged for the next 10 years. However, they may adopt a network arrangement or modify the frequency coverage to ensure coverage of targets of interest. (b)(1);1.4 (c)

(S) The Soviets' collection of ELINT data from satellites will continue throughout the period of this study. In the near term, the ELINT and ELINT will be used to collect this data. Toward the end of the near term, or in the mid term, the Soviets are expected to introduce a new ELINT system, the follow-on ELINT, with expanded frequency coverage to replace the ELINT and ELINT spacecraft.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

(b)(1);1.4 (c)

4. Surveillance Systems (U)

(S) The launch detection satellite network is expected to reach IOC in the next few years. Over the next 10 years, the Soviets are expected to make evolutionary improvements to the satellite and to achieve a hemispheric (or near hemispheric) field of view.

(b)(1);1.4 (c)

(S) While the Soviets are undoubtedly interested in developing a spaceborne capability for the detection and tracking of high value aircraft (AWACS, airborne command posts, and cruise missile carrier aircraft), they will probably not fly such a space system during the next 10 years.

5. Communications Systems (U)

(S) The Soviet Union has developed a diverse COMSAT program and has deployed COMSATs into low-Earth, highly elliptical, and geostationary orbits.

(S) The Soviets are expected to retain the Molynia 1 and Molniya 3 satellite systems in the near term. The Molniya 1 may be transitioning to a backup system as the Molniya 3 and the geostationary satellites assume more of the relay load. As such, the Molniya 1 may be phased out in the mid term. The Molniya 3 will be retained through the mid term.

(b)(1);1.4 (c)

(S) The Soviets will not achieve their announced schedule for future geostationary COMSATs (Statsionar 6-15, Statsionar T-2, Volna 1-7, Gals 1-4, Luch 1-4, and Luch P 1-4). They will probably stretch out the launch schedule and may place multiple transponders on some spacecraft. The exact correspondence between satellites, subpoints, and frequencies is uncertain at this time, but the Soviets will probably achieve the frequency and subpoint capability cited in the announcements.

(S-NOFORN) The Soviets will maintain a low-altitude store/dump COMSAT capability.

(b)(1);1.4 (c)

(U) The amateur radio satellites—Radio—are expected to have a sporadic launch rate through the projection period.

(S) If the Soviets choose to develop a real-time imagery system, they will require a data relay satellite to support the imagery satellite(s). The data relay satellite is an extension of the current COMSAT technology; as such, it should pose little technical difficulty to the Soviets to develop the data relay satellite. The satellite will only appear, however, when the Soviets are ready to operate their real-time imagery satellite.

6. Meteorological Systems (U)

(S) The Soviets are working towards, and will probably attain, a three-tier METSAT network made

up of manned, Meteor, and high-altitude spacecraft. Evolutionary changes will be made to the Meteor satellites as required. The high-altitude tier will initially be a single GOMS launched at the end of the near term. By 1990 this capability will probably be extended to provide Eurasian synoptic coverage. This synoptic capability may be supplemented by satellites in Molniya-type orbits to provide a coverage of latitudes above 65° N.

7. Navigational and Geodetic Systems (U)

(S) The Soviets currently maintain (b)(1);1.4 (c) Doppler NAVSAT systems. (b)(1);1.4 (c) The Soviets will rely on the (b)(1);1.4 (c) NAVSAT for military users and for civil, nonmilitary users. (b)(1);1.4 (c) through the projection period. (b)(1);1.4 (c)

(S) Doppler NAVSAT cannot provide navigational fixes to rapidly moving users (i.e., aircraft). Further, an examination of battlefield utility indicates that if a means were available to provide three-dimensional position to 50 m, or better, a significant increase in the effectiveness of aircraft delivered ordnance is realized. A Soviet analog of NAVSTAR/GPS would satisfy both the aircraft navigation and weapons delivery requirements. The Soviets have requested a 30-MHz band between 1580 and 1610 MHz for a NAVSAT system they have described as a NAVSTAR analog. The Soviets are expected to have an operational three-dimensional navigational capability by the end of the mid term.

(S) The Soviets will maintain their satellite geodesy program throughout the projection period to allow them to maintain their worldwide geodetic datum. Whether a dedicated GEOSAT will be used or whether geodetic experiments will be carried on other satellites will be determined by short-term requirements.

8. Calibration Systems (U)

(S) Some form of calibration satellites are expected to be maintained throughout the projection period. (b)(1);1.4 (c)

9. Manned and Scientific Space Systems (U)

(S) The Soviet manned space program will continue at approximately the same level of effort throughout the projection period. The overall emphasis of the program will continue to be in the development and exploitation of modular and "permanent" low-orbiting manned space stations.

(S) To support these stations, the Soviets will use a variety of support spacecraft. The principal spacecraft will be the Soyuz T and Progress. The Soviets will begin testing of a RSS to support the space station crew ferry mission and will carry from three to five cosmonauts. The RSS appears to be part of a long-term program aimed at the development of a completely reusable space system, (see Section XV), and as such will not replace the Soyuz T/Progress spacecraft.

(S) The Soviets are expected to maintain their planetary program at approximately the same level (one or two launches in each planetary launch window) with emphasis on Venus and additional missions (probably Jupiter) possible. The Soviets "new lunar program" is expected to start soon. This program is expected to account for five to seven launches in the next five or six years with the option of manned lunar missions toward the end of the 1980's. Such a mission would require the Soviets to develop an SLV equivalent to the US Saturn V vehicle. The Soviets have such a vehicle under development, and it should be available to support late 1980's lunar missions.

10. Launch Vehicles (U)

(S) The current family of Soviet launch vehicles will remain in use throughout the projection period. The Soviets are expected to supplement these vehicles with two new classes of launch vehicle, the SL-W and SL-Y, during the 1984-1986 period.

(S) The SL-W is assessed to be a Saturn V-class launch vehicle capable of placing 150,000 kg or more into low-Earth orbit. The SL-Y is a smaller vehicle. The best estimate of SL-Y capability is 10,000-20,000 kg into low-Earth, although payloads in excess of 20,000 kg are possible.

(S) Current indications are that the Soviets will not have a reusable launch system analogous to the US space shuttle during this projection period.

(U) The projections in this study are summarized in Tables XXII through XXV. Table XXII is a compilation of expected launch rates for the payloads discussed in this study. Table XXIII associates these payloads with launch vehicles. Table XXIV is a projection of launch vehicle utilization. Figure 40 presents the projections of this study in graphical form. Finally, Table XXV discusses the orbital network for these systems.

Pgs. 106-107 are denied in full

TABLE XXIV

(U) LAUNCH VEHICLE UTILIZATION

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
SL-3	6	6	7	9	8	10	10	10	9	10	9	9
SL-4	46	42	45	47	49	47	49	46	49	45	47	48
SL-6	12	14	9	12	11	12	12	13	12	13	12	12
SL-8	16	18	20	21	19	18	17	18	18	19	18	18
SL-11	4	8	6	6	6	6	6	6	6	6	6	6
SL-12	5	6	6	6	8	7	6	6	7	6	7	7
SL-13	0	1	2	1	0	1	2	1	2	2	2	2
SL-14	1	5	2	2	3	2	3	2	3	2	3	3
SL-W	—	—	—	—	—	1	1	1	1	3	3	2
SL-Y	—	—	—	—	—	1	2	4	6	7	7	11
TOTAL	90	100	97	104	104	105	108	107	113	113	114	118

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(b)(1);(b)(3):50 USC 3024(i);1.4 (c)

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SECTION XV

FORECAST OPTIONS FOR THE TWENTY-YEAR PERIOD (U)

1. Introduction (U)

(U) This section addresses certain high-payoff options the Soviets may choose to implement in the period beyond the 10-year projection developed earlier in this study. The forecast presented in this section is not all inclusive, but rather highlights those areas which, if the Soviets choose to incorporate them into a space system, offer a high payoff or demonstrate a significant technology advancement. However, the judgment of what constitutes a high payoff or significant technology advancement tends to be quite subjective.

(U) In general most of the information presented in this section has been developed from two major types of information: currently ongoing technology development/acquisition programs, and Soviet advocacy statements regarding their long-term goals for their space program.

(U) Both types of information are subject to some degree of subjectivity, in both the acquisition and the analysis of the relevant intelligence information and in translating that information into the proper time and place to predict its application in a system and the timing of that system.

2. Projected Twenty-Year Options (U)

~~(S)~~ From the technology and advocacy data bases, it appears the most visible and perhaps important areas of progress in the Soviet space program in the far term revolve around the development and potential use of orbital directed energy weapons, collection of information using Earth-orbital platforms, the transfer of information using Earth-orbiting satellites as a link in the transfer process, and the continuing exploitation of space by manned spacecraft.

~~(S)~~ As was discussed in Section IV, a likely outcome of the Soviets' extensive laser and other directed energy technology programs is the development of an orbital vehicle for ASAT application.

(b)(1);1.4 (c)

~~(S)~~ The arming effort would involve the testing of a laser ASAT in a variety of operational profiles and at the limits of its design envelope. The Soviets would be expected to refine their 1980's prototype by matching the laser with its acquisition, pointing and tracking systems (i.e., the power level of the laser would be such that the lethal range would be about at the limiting range of these systems).

~~(S)~~ They may also attempt to use other types of directed energy devices in an ASAT role. Ths most obvious would be a particle beam weapon (PBW). The most feasible type of PBW that could be used in an ASAT role in space is a neutral beam weapon. Charged particle beams may propagate in the atmosphere, but they cannot propagate over long distances in space since a charged beam would rapidly spread; thus becoming diffused and ineffective over relatively short distances. Neutral beams in the atmosphere would rapidly become ionized and propagate for only short distances; however, in space they should propagate for very long distances with little beam spread.

(b)(1);1.4 (c)

~~(S)~~ Finally, the extension of directed energy technology from ASAT to ballistic missile defense (BMD) is an option the Soviets may choose to investigate in the late 1990's. In the BMD role an orbital platform with a directed energy weapon uses the weapon to damage a ballistic missile and/or its payload during or just after the boost phase of its flight—prior to the separation of the missile's RVs. The BMD problem is not a trivial one because it places extensive demands on the acquisition, pointing, and tracking systems of the directed energy weapon. Because of the geographic diversity (and uncertainty) of ballistic missile launch points, large numbers of satellite weapons platforms would be required to ensure the proper geometry to effect missile kill. Furthermore, the vulnerability of the missile boosters is not known. All this implies that the most the Soviets could be expected to do by the year 2000 would be to conduct limited proof-of-concept experiments using a spaceborne directed energy weapon to illuminate and perhaps destroy a missile booster during its flyout, in a carefully controlled geometry.

~~(S)~~ The Soviets collection and exploitation of information obtained from Earth-orbiting platforms is

expected to expand greatly in the 1990's. Throughout most of the 1980's (as is the case today) the Soviets are expected to continue to rely upon the use of analog devices to collect and then exploit information from Earth orbit for political, economic, and military purposes. By the 1990's the Soviets are expected to begin to extensively apply digital techniques to their spacecraft.

(b)(1);1.4 (c)

(b)(1);1.4 (c)

~~(S)~~ (b)(1);1.4 (c)

the Soviets could also choose to develop active radar sensors for a variety of missions. The Soviets could develop an imaging radar system to supplement their photoreconnaissance satellites with a day/night all-weather capability. In addition they could develop non-imaging radar systems to aid real-time reconnaissance and surveillance of shipping (much like the RORSAT) and aircraft. In the radar area the sensor is not the driving technology. The critical technologies involve the Soviets' ability to process and/or transmit large amounts of data (hundreds to thousands of megabits per second).

~~(S)~~ The current trend in Soviet COMSATs and systems is toward higher frequencies, bandwidths, and data rates. There has been reporting on Soviet intentions to develop satellite-to-satellite links at frequencies capable of supporting hundreds of megabits per second. All this seems to indicate the Soviets are moving toward a capability to transfer large amounts of data through satellite links. Exact attainment of this capability is uncertain as it appears to be constrained both by technology and other systems requiring a capacity to transfer large amounts of data. It is apparent that increased utilization of space and the translation from analog to digital information with the degree of detail demanded in high-resolution visual and IR imagery and radar (imaging and nonimaging) missions will force the Soviets to develop a 100-1,000 Mbs relay capability.

~~(S)~~ The final option open to the Soviets (and one they appear to be pursuing) involves the continued exploitation of the role of man in space. As envisioned, this would require two principal components, a space transportation capability and a large space station for use as a staging or logistical base.

~~(S)~~ As discussed in Section XI, the Soviets have an ongoing program to develop a reusable spacecraft launched by an expendable booster. The spacecraft would perform its mission and be recovered horizontally on a runway at Tyuratam. This program, although it will be heralded by the Soviets as a counterpart to the US Space Shuttle, is not aimed at analogous performance. Instead it is believed to be part of a much larger scale effort aimed at the development of a true space transportation capability.

~~(C-NOFORN~~) Authoritative Soviets have openly discussed their concept. They have described a two-stage vehicle that is completely reusable, would takeoff and land like an airplane, and would use combined cycle propulsion to minimize the amount of propellant carried. This vehicle, in fact, would not be like the US Space Shuttle, a single system to satisfy a wide spectrum of needs, but would probably encompass several versions, each optimized for a limited mission. The development of the vehicle is also characterized by the Soviets as an extensive undertaking, both from a technical and capital investment perspective. Such a Soviet program is a long-term effort starting with the collection of extensive theoretical data, experimental hardware studies, component and subsystem development, and finally system integration and test.

(U) An examination of the technology base reveals the Soviets are following this pattern. The Soviets are conducting extensive experimental programs in propulsion and aerodynamics.

(U) A Soviet space transportation system will use air-breathing propulsion for the first stage of a reusable booster. The initial application of air-breathing engines will be made using a combined cycle system accelerating up to Mach 4-6. The Soviets have stated there are three candidate engines being investigated; the turboramjet, turborocket, and rocket-ramjet. The combined cycle engines have wide operating Mach numbers and altitudes and can all produce thrust at zero velocity.

combined cycle engines have wide operating Mach numbers and altitudes and can all produce thrust at zero velocity.

(U) Extensive component development is being carried out that would be applicable to all three engines. From the status of the component research, whichever engine the Soviets finally choose could be ready for development testing in the 1980's, using hydrocarbon fuels. The use of cryogenic fuels is expected in the 1990's.

(S-WNINTEL) The Soviets have investigated a number of different aerodynamics aspects related to a completely reusable space system. Some of the earliest work in this area dealt with lifting bodies. Figure 41 is an illustration of some of the designs investigated by the Soviets. Most of the work investigated heat transfer at angles of attack and speeds encountered in the late phases of Earth atmosphere reentry (higher Mach numbers could not be simulated in ground facilities). This work transitioned to the lifting body vehicle mentioned in Section XI where the Soviets appear to be verifying low-speed handling characteristics of the lifting body vehicle. The reusable spacecraft is the next phase of the effort. This vehicle will give the Soviets the opportunity to investigate the high speed, reentry aerodynamics and thermodynamics they cannot simulate on the ground. All this work would point to a completely reusable spacecraft when mated to a "booster" vehicle.

(U) Soviet investigations of waverider shapes are consistent with the stated Soviet preference for a two-stage vehicle. Figure 42 shows some of the shapes investigated by the Soviets, and a potential way of marrying booster and spacecraft configurations. Soviet research in waveriders has progressed from the abstract to the more detailed. Until about 1970, the Soviet waverider research consisted primarily of parametric trade-off studies with the objective of determining optimum geometric configurations. After 1970, Soviet literature indicated the research was concentrating on a few optimum design shapes—relatively high aspect ratio, large V-angle wing configurations. Since 1975, the research has been primarily on the effects of off-design flight conditions and the development of optimum flight condition curves. These activities suggest a long-term goal.

(S) From the status and pace of this research, it appears the Soviets will introduce a completely reusable, space transportation system in the late 1980's or early in the next century.

(S) The Soviets have acknowledged a need for a capability to place large bulky payloads of 250,000 kg or more into Earth orbit. The approach to this requirement will most likely be to develop a large expendable, heavy-lift vehicle—possibly a follow-on to the SL-W. The heavy-lift vehicle will probably be cost competitive with the Soviets space transportation system discussed above by taking advantage of economics of scale. It would take a number of space shuttle or current expendable vehicle launches to place an equivalent payload in orbit as one heavy-lift vehicle.

(S) The development of this heavy lift vehicle would be a massive undertaking and would not be attempted until the SL-W is operational.

(S) This ability to place payloads routinely into Earth orbit with a minimum of recurrent costs represents an important milestone in the utilization of space, in general, and specifically in military uses of space. As discussed in Section XI the overt goal of the Soviet space program has been the exploitation of near-Earth space through manned space stations. As these stations become more complex and the missions they support more sophisticated, the stations are expected to transition from experimental platforms to operational bases. Clearly this coupled with the space transportation and heavy-lift capability discussed earlier in this section opens up a wide variety of missions. The most significant from the standpoint of space utilization is the use of these stations as logistics bases. In this mode the station could be used to perform on-orbit spacecraft maintenance repair and modification, satellite assembly, spacecraft refueling, and as a staging point for other Earth orbital and deep-space missions. Soviet statements recognize the importance of this mission and the achievement of this capability is critical to the achievement of the Soviet goal of full exploitation of near-Earth space.

(U) Table XXVI is a summary of the material presented in this section.

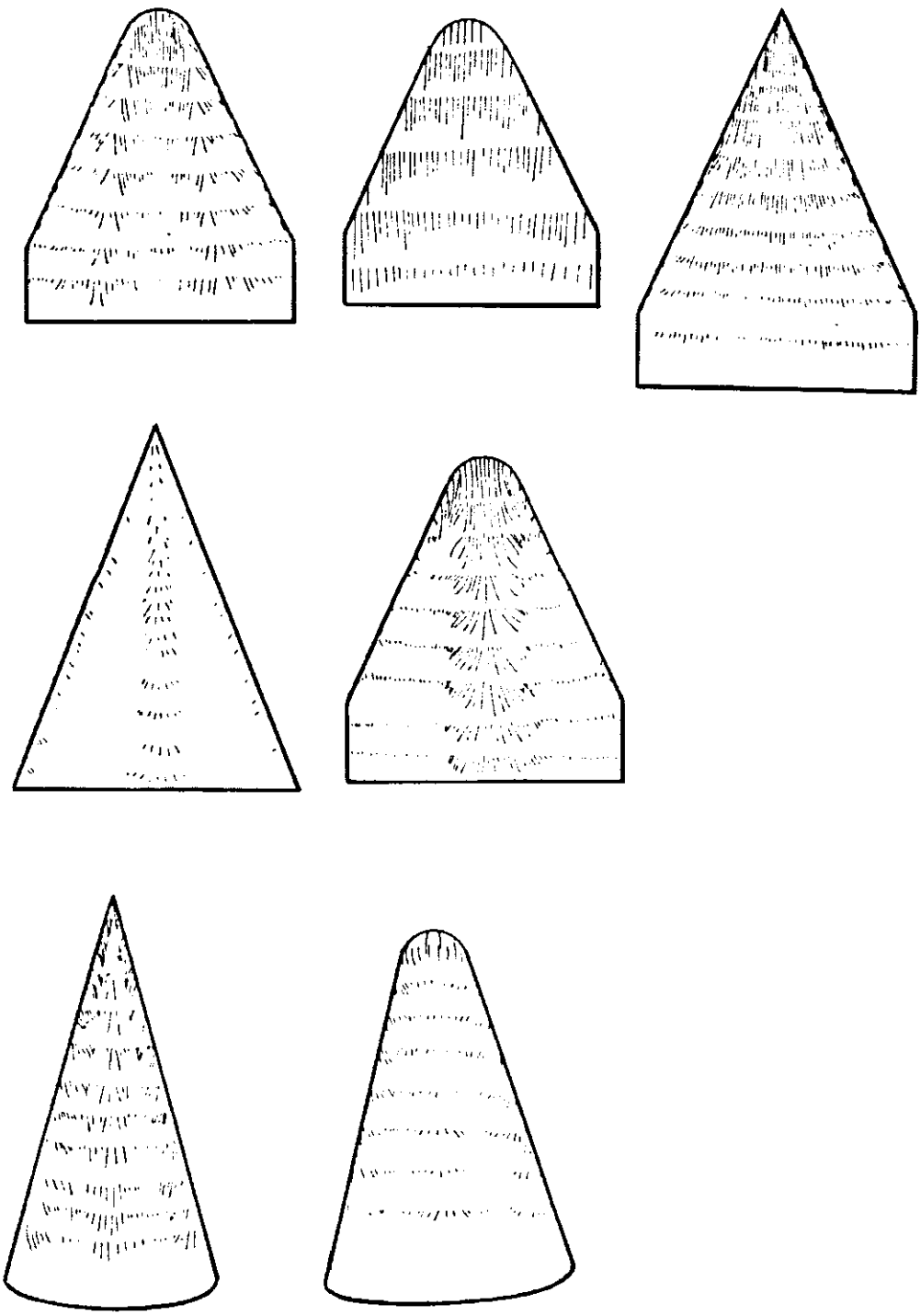

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Fig. 41 (U) Lifting Body Experimental Models

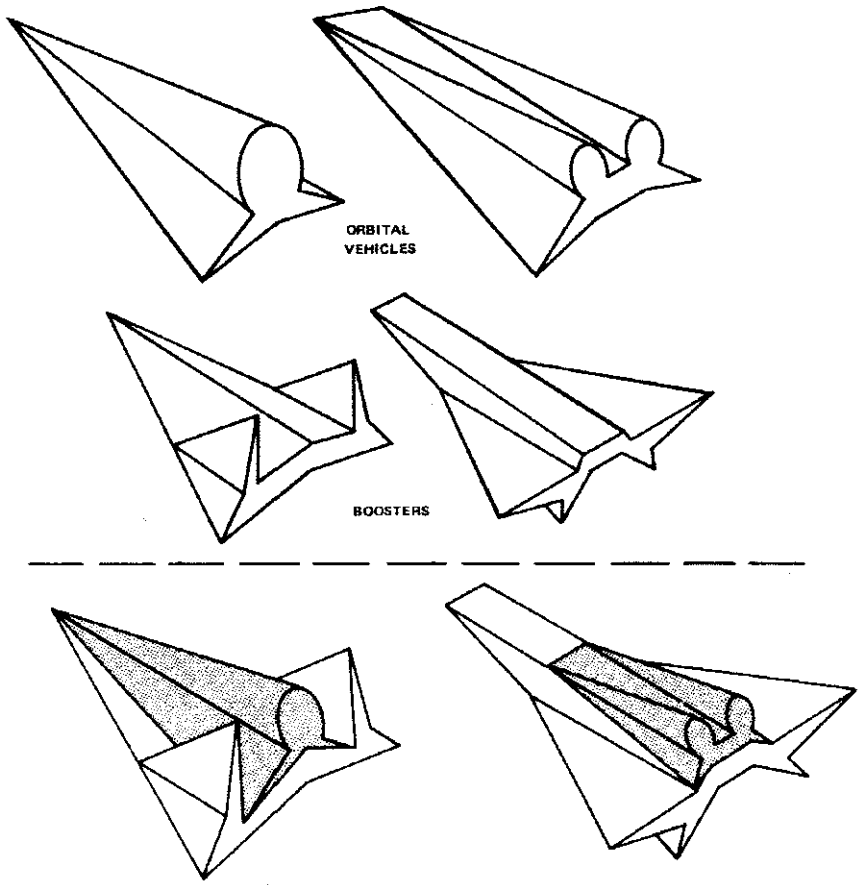

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Fig. 42 (U) Various Soviet Waverider Design Studies

TABLE XXVI

(U) SOVIET TWENTY-YEAR OPTIONS

SYSTEM OPTION	CRITICAL TECHNOLOGY	REMARKS
Weaponization of directed energy lasers	None	Effort concentrated on integration of technologies developed and proven in early 1980's.
Particle beams	Accelerators, beam stripping, power, acquisition, pointing and tracking	(b)(1);1.4 (c) Status of technology unknown. Feasibility demonstration needed.
Advanced visible and IR sensors	Detectors and data processing	(b)(1);1.4 (c)
Spaceborne radars	Data processing and data transfer	
Advanced COMSATs	Signal processing, switching	Indicated by trends and will be "forced" to happen if forecast systems occur.
Space transportation system	Propulsion, aerodynamics, materials	Strong technology program and open advocacy of ultimate concept.
Heavy lift vehicle	Propulsion, system integration	Stated requirement, possible SL-W follow-on.
Logistical space platform	Space transportation, heavy lift vehicle, space fabrication, life support	Key to ultimate exploitation of near-Earth space.

~~SECRET~~

APPENDIX I

UNCORRELATED INDICATORS OF FUTURE ACTIVITY (U)

1. Space Mission Control Facilities (U)

~~(S)~~ The information presented in this appendix attempts to discuss new construction developments at space mission control facilities as indicators of future systems. These indicators are difficult to understand because of the ambiguous nature of space mission control construction activity. They could indicate the start of a new ground site to support a future space system; or they could indicate an expansion or improvement of a current capability. Often, this dilemma is only resolved when the facility is completed and associated with an orbital vehicle, too late to be used as a valid future systems indicator.

~~(S)~~ The construction activity discussed is firmly tied to the Soviet space program. The activity clearly indicates a continued large investment in the Soviet space program. But at present, we do not know how to couple the construction with individual program components of the Soviet space program in making, validating, or refuting individual projections. Where possible, potential applications are presented for the new construction at each site.

(b)(1);(b)(3):10 USC 424;1.4 (c)

(b)(1);1.4 (c)

(b)(1);(b)(3):10 USC 424;1.4 (c)

(b)(1);(b)(3):50 USC 3024(i);1.4 (c)

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(b)(1);1.4 (c)

(b)(1);(b)(3):10 USC 424;(b)(3):50 USC 3024(i);1.4 (c)

2. Design Bureaus (U)

~~(S)~~ The following section, like the preceding one, is a presentation of uncorrelated indicators of future space activity, in this case new construction at spacecraft design and development facilities. Although the product charter is generally known at these facilities, a change in the charter, resulting in a future system, is difficult to determine. Intuitively, new construction would signify support for a future system; however, the two have never been correlated. The construction could indicate increased effort aimed at improving an existing system or increasing its production, a modernization of the facility, or could simply result from internal bureaucratic factors. Obviously, these cast a shadow on any forecast made based simply on a new construction occurring at a spacecraft design and development facility. This section is included in an attempt to be complete, as we do believe there is merit in using this method of forecasting.

(b)(1);1.4 (c)

(b)(1);(b)(3):10 USC 424;(b)(3):50 USC 3024(i);1.4 (c)

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