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THE JOINT CHIEFS OF STAFF  
WASHINGTON, D.C. 20301

JCSM 415-61  
6 FEB 1965

MEMORANDUM FOR THE SECRETARY OF DEFENSE

Subject: Requirements for Space Surveillance (U)

1. Reference is made to:

a. A memorandum by the Director of Defense Research and Engineering, dated 18 March 1961, subject: "Operational Control of the Space Detection and Tracking System (SPADATS)," which requested that CINCNORAD/CINCGNAD submit present and future user requirements to the Secretary of Defense, through the Joint Chiefs of Staff, for review and approval.

b. JCSM-415-61, dated 19 June 1961, subject: "Requirements for Space Detection and Tracking System - Improved (SPADATS-IMP) (U)."

2. CINCNORAD convened a world-wide users' conference, 17 - 19 November 1964, for the purpose of compiling user needs and updating the requirements for a space detection and tracking system previously submitted through the Joint Chiefs of Staff, reference 1 b, above. As a result of the conference, CINCNORAD has compiled and submitted, to the Joint Chiefs of Staff, NORAD qualitative requirement for a space detection and tracking system (NQR-2-65), together with a compilation of user requirements for output data.

3. The CINCNORAD statement of qualitative requirement (NQR-2-65) and the compilation of user requirements for SPADATS information (Appendices A and B hereto) are forwarded in order that the Detection and Tracking of Satellites Ad Hoc Working Group might consider them

EXEMPT FROM  
AUTOMATIC DECLASSIFICATION  
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GROUP 3  
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intervals; not  
automatically declassified

Soc Def Cent Nr. X - 589

RG 330  
UD-06W #31  
471.96

471.96 SPADATS  
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prior to final review. The Joint Chiefs of Staff withhold judgment of the specific requirements pending the results of a thorough analysis. Upon completion of this analysis, prior to 1 April 1965, the Joint Chiefs of Staff will furnish their views regarding those specific requirements for an improved space detection and tracking system and will recommend an assignment of developmental responsibility.

For the Joint Chiefs of Staff:

SIGNED

L. J. KIRN  
Rear Admiral, USN  
Deputy Director, Joint Staff

Attachments

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APPENDIX A

(U) NORAD QUALITATIVE REQUIREMENT  
FOR A  
SPACE DETECTION AND TRACKING SYSTEM  
(NQR 2-65)

VALS;  
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G. 1.4

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SECURITY

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2. This document is classified SECRET since it discusses space detection and tracking deficiencies and states requirements to correct these deficiencies which affect the national defense of the United States within the meaning of the Espionage Laws, Title 18, USC, Sections 793 and 794. The transmission or revelation of its contents in any manner to an unauthorized person is prohibited by law.
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NQR 2-65  
HEADQUARTERS NORTH AMERICAN AIR DEFENSE COMMAND  
Ent Air Force Base, Colorado

(U) NORAD QUALITATIVE REQUIREMENT FOR A  
SPACE DETECTION AND TRACKING SYSTEM

I. (S) FOREWORD

A. The long title of this document is NORAD Qualitative Requirement for a Space Detection and Tracking System (SPADATS).

B. The short title of this document is NQR 2-65.

C. This NQR has been prepared in support of NORAD Objectives Plan 1966-1975 (NADOP 66-75).

D. This NQR supersedes NORAD document "Requirements for Space Detection and Tracking System - Improved (SPADATS-IMP) (U)," dated 7 April 1961, submitted to JCS on 20 April 1961.

E. The Space Detection and Tracking System utilizes all available sensor information which can contribute to space defense and supports Unified, Specified and other Commands, scientific endeavors and national operations in space as required. This system includes sensors, communications, electronic data processing equipments and facilities having roles in space observations.

F. Terminology. This terminology is defined for use in this NQR only.

1. Circuit, First - The orbit of a space object from point of injection into orbit until its return to the point of injection in that orbital plane.

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2. Cooperating Sensors - Those sensors which are not under the operational control of CINCNORAD, but which provide data to SPADATS, usually on a non-interference basis. Special agreements which specify the degree and method of cooperation are made by NORAD (or by component commands at NORAD direction) with the organizations which operate the sensors.

3. Detection - The determination that a space object exists in space.

4. Identification - The determination of the national ownership and the point of origin of a detected space object.

5. Mission Assessment - The determination of the specific function(s) that a foreign spacecraft is performing or is capable of performing.

6. Mission Assessment (Quick Look) - That preliminary mission assessment which is performed in the early phases of the space object's flight, usually on the basis of partial or incomplete information.

7. Negation - The act of conducting appropriate defensive measures to nullify the threat posed by a foreign satellite. Negation is a general term which includes all actions taken which would preclude a spacecraft from successfully accomplishing its designated mission. This includes kill, disruption of key subsystems of the spacecraft, passive measures to deny specific information to reconnaissance spacecraft, etc.

8. Spacecraft - A space object, either manned or unmanned, which is placed into orbit to perform a specific mission; frequently called a satellite or payload.

Appendix A

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9. Space Object - Any man-made object which is in space, including spacecraft, decoys, expended boosters, and debris.

II. (S) STATEMENT OF REQUIREMENT

A. NORAD requires an early detection, tracking and orbit determination capability on all space objects. This requirement includes appropriate data processing to permit identifying space objects, determining their mission, and supporting the space operations of the U.S. and its allies. A capability to discharge this requirement is basic to the production of information required for:

1. The support of measures to negate the spacecraft mission.
2. Other military commands to take appropriate measures to protect their forces from the threat posed by foreign spacecraft.
3. Supporting National space operations.
4. Providing data essential to the evaluation of foreign space programs and capabilities.
5. Providing data to support scientific research.

B. In addition to supporting the NORAD space defense objectives established in NADOP 66-75, 1 October 1964, this NQR supports the CONAD space defense mission as assigned in JCS SM 1400-63, 20 November 1963, Subject: Unified Command Plan.

C. This requirement is established to counter the threat postulated in the current NORAD Intelligence for Planning (NORIP).

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The present system must be improved to provide timely detection and warning and to provide sufficiently accurate data for mission assessment and weapon support.

III. (U) MISSION. The mission of the NORAD Space Detection and Tracking System is to detect, track and identify all man-made objects in space in order to support the NORAD/CONAD COC by providing the information basic to CINCNORAD/CINCONAD decisions in space operations and to support the requirements of other users.

IV. (S) SYSTEM DESCRIPTION

A. General

1. Present

a. The current NORAD SPADAT system utilizes the USAF SPACETRACK, USN SPASUR, and RCAF Satellite Tracking Unit systems, and cooperating sensors such as selected sensors of the National Test Ranges and NASA.

b. The information gathered by SPADATS sensors is forwarded to the NORAD SPADATS Center through which CINCNORAD exercises operational control of the system.

c. The SPADATS Center, an integral part of the NORAD COC, forwards orbital elements and other significant information on space objects to other user agencies as required.

d. The SPADATS Center is the NORAD control agency which tasks the component systems for specific data and serves as the focal point for all NORAD space sensor operations.

2. Future Space Defense Center (SDC)

a. With a ~~part~~ of the SDC as an integral part

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of the NORAD COC the NORAD Space Detection and Tracking system will support the functions of the Space Defense Center (SDC) and the SPADATS Center will become an element of the SDC.

b. Operational control of the system will be exercised by CINCNORAD through the SDC. The service components and cooperating agencies will be tasked for sensor data (or sensors tasked directly in an emergency) in response to CINCNORAD and user requirements.

B. Basic Considerations.

1. NORAD recognizes that the high cost of space sensor systems, the long lead time associated with their development, and the present lack of agreement on definition of the threat have a great influence on developmental decisions as well as on operational planning. NORAD requirements for improvements have been time-phased to meet an increasing threat and to minimize the impact of capital expenditures on any one fiscal period.

2. Near term improvements (by 1966) to the present sensor system must correct the major existing deficiencies in coverage and sensor capabilities. A detection capability must be provided for all Soviet space vehicles launched from presently known sites. System saturation level must be raised to cope with an increasing number of space objects. These capabilities must be primarily oriented toward detecting and keeping track

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of space objects in earth orbit with  $0^{\circ}$  to near-polar orbit inclinations.

3. Later improvements (1966-1970) must expand the system coverage to include: launches from countries other than the USSR; orbital paths of any inclination; greatly increased altitudes; and the ability to cope with maneuvering spacecraft. Appropriate elements of the system must be designed to support active space defense systems of the future.

C. System Qualitative Requirements

1. Automatic data processing centers and a network of sensing devices with appropriate automatic data processing equipments located in the proper geographical locations are required to detect and track all space objects and to determine the mission of all spacecraft prior to the completion of the first circuit or prior to first pass over a Unified or Specified Command's area of responsibility, whichever comes first. The specifications listed below apply.

a. Altitude Coverage - to the following altitudes:

(1) To permit engagement of hostile spacecraft by envisioned weapon systems:

By 1966 - 2,600 NM

1966-1970 - 20,000 NM

Post 1970 - Greater than 20,000 NM

(2) To provide accurate tracking data on highly elliptical orbits as well as near-circular orbits. This tracking coverage should extend to the maximum altitude within the state of the art of ground, air and space-based sensor technology.

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b. Target Size - NORAD requires detection and tracking of all spacecraft of all nations including our own. The physical size of spacecraft will vary according to the assigned mission. To provide for a full spectrum of observations, detection techniques should include radar, optics and IR as well as other portions of the electromagnetic spectrum as the state of the art improves. As a guide, the radar cross section requirements are indicated below. These figures are based on the predicted Soviet capability to reduce the apparent radar cross section of a space object by shaping and/or coating with radar absorbent material and not on a forecast reduction in actual physical space object size. A comparable detection capability by optical, IR and other sensors is required.

Present	1M <sup>2</sup>
1966-1970	.1M <sup>2</sup>
Post 1970	.001M <sup>2</sup>

c. Detection Probability - Desired system probability of detection is:

	<u>BY 1966</u>	<u>1966-1970</u>	<u>Post 1970</u>
Orbital inclination	0° to near polar orbit	All	All
Probability of Detection Prior to:			
Completion of First Circuit	.90	.95	.95
1st Pass Over Unified & Specified Command Areas	.85 *	.99	.999

\* Over North American Continent only.

Appendix A

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d. Catalog Accuracy - Based on time of arrival at a calculated point in the orbit plane is:

Present	+ 15 Sec
1966-1970	+ 3 Sec
Post 1970	+ 1 Sec

e. Weapons Support - Support weapon systems and other special projects with 3 sigma accuracies on the order of + 1.0 NM along track and of + 0.5 NM cross track and radially through the post-1970 time period.

f. Reaction Time - Determine orbital elements of selected spacecraft with the accuracy indicated in paragraph IV C 1 e, above, for weapons employment within the following time periods:

By 1967	4 hours
1967-1970	Less than 4 hours
Post 1970	Minimum required for weapons support

g. Space Population - The space object population environment with which the system must cope within specified accuracies is 5,000 by 1970. System proposals to satisfy NORAD requirements must have a growth capability inherent to their design. Growth potential should be sufficient to allow as many as 10,000 space objects.

2. The Space Detection and Tracking System must:

a. Provide accurate predictions of spacecraft positions to produce targeting data for intercept operations

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and selected observations subsequent to spacecraft intercept actions to assess the results.

- b. Provide ephemeris data and acquisition information on lunar and deep space vehicles.
- c. Provide decay and re-entry prediction information.
- d. Provide earliest warning of and information concerning deorbiting spacecraft to weapons complexes and to other users as appropriate.
- e. Determine orbit changes within one period after occurrence.
- f. Include devices or techniques to permit reliable operation when subjected to enemy countermeasures.
- g. Contain the means for exercising the system to ascertain its effectiveness, for training personnel and for calibration while concurrently conducting normal operations.
- h. Interact with future launch detection and other warning systems to insure maximum use of all available information for sensor and-system alert.
- i. Possess the ability to process and transmit data within the system in sufficient time to enable sensors to be fully utilized to acquire data on space objects.
- j. Exploit the capability of sensors or facilities associated with ballistic missile defense systems or with space systems to detect and track space objects, integrating

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such sensors or facilities within the SPADAT System where appropriate.

k. For sensors or facilities designed to support deep space operations, exploit their capability to contribute to the detecting and tracking of space objects, integrating such sensors or facilities within the SPADAT System where appropriate.

1. Provide for continuous system operation.

3. Alternate Computation Facility/Facilities is/are required for the Space Detection and Tracking System Center in order to provide reliability and continuity of operation, maintain appraisal of the Space situation, and provide adequate computational resources to insure peakload production of SPADATS products.

V. (S) AVAILABILITY

A. The improvement of present system capabilities and the development and deployment of new systems must progress in a phased relationship with increasing foreign space activity. Meeting the time phased system requirements outlined in paragraph IV C will provide:

1. An appropriate capability to detect, track and assess the mission of spacecraft which could pose a threat to CINCNORAD's area of responsibility in the near future.

2. A capability to fulfill the NORAD responsibilities for detection and tracking of all spacecraft. This capability

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must keep pace with the increase in foreign space activity potential.

VI. (S) EMPLOYMENT. The Space Detection and Tracking System includes all component space sensors and sensor systems and is employed under the centralized control of the Commander-in-Chief, NORAD. Wherever operationally feasible, sensor data is processed and filtered at the sensor site. Selected sensor observations on space objects are transmitted to the NORAD Space Defense Center for processing. Information obtained from this system contributes to a quick look mission assessment. This system is an integral part of the NORAD space defense system and provides accurate and timely data for threat assessment and weapons employment.

FOR THE COMMANDER-IN-CHIEF:

M M MAGEE  
Major General, USA  
Chief of Staff

JAMES W. FEARS  
Lieutenant Colonel, USAF  
Director of Administrative Services

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APPENDIX BUSER REQUIREMENTS FOR  
SPADATS INFORMATION

1. (S) Detection of New Foreign Space Objects: This requirement is for notification of initial detection during first circuit of any foreign spacecraft launched on any inclination. Initially, this requirement must be limited to launches from the Soviet land mass. As additional nations achieve space capabilities, the requirement will be expanded. It is recognized that the full requirement cannot be satisfied immediately, however, it is a basic requirement to the NORAD mission and fundamental to the interests of other Unified and Specified Commanders. The requirement, therefore, is continuing in nature and must be satisfied expeditiously.

2. (S) Evaluated Characteristics of Foreign Space Objects:

An evaluated estimate of the physical and behavioral characteristics that can be inferred from an analysis of observable signatures from SPADATS sensors. The estimate should include information on size, shape, configuration, stabilization, motion relative to center of gravity, and orientation.

3. (C) Evaluated Characteristics of U.S. Space Objects:

An evaluated estimate of the physical and behavioral characteristics that can be inferred from an analysis of observable signatures from the SPADATS sensors. This information will be provided on a request basis in support of NASA launches to confirm or monitor vehicle performance, and to assist in development of a space signatures catalog.

4. (S) Mission Assessment of Foreign Spacecraft: An

assessment based on all available information from operational and intelligence sources. Initially, the requirement will include only Soviet spacecraft. As additional nations achieve space-launch capabilities, the requirement will expand to include additional foreign powers. A "quick look" mission assessment utilizing available information must be provided during the first circuit.

5. (S) Space Threat and Situation Warning: Threat warning will be disseminated concerning evaluation of a space threat as it pertains to the North American Continent. In addition, warning of space situations which might pose a threat in other areas will be provided to the appropriate U&S commanders.

6. (S) Notification of Active Space Defense Actions: This notification is dependent on an extension of necessary security clearances to the unified and specified commands and military departments.

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7. (S) Orbit Modification of Foreign Spacecraft: This requirement is to detect orbit modifications within one circuit and to notify appropriate agencies of the detected change. Orbit modifications include injections into deep space from a parking orbit, maneuvers, and de-orbit of a spacecraft. The present capability to accomplish this function must be expanded in the growth and development of SPADATS.

8. (S) Predictions of Spacecraft Decay and Re-Entry: This function is relevant to catalog maintenance, surveillance of foreign space activity, and support of U.S. space and space defense operations. NASA has a unique requirement for predictions of the decay and re-entry of large space boosters in conjunction with special NASA operations.

9. (S) Orbital Elements on all Foreign Spacecraft: Orbital elements will be provided in the standard SPADATS element format. The information needed at present is limited to Soviet spacecraft, but should be expanded as additional nations achieve a space operations capability.

10. (S) Orbital Elements on all Spacecraft with Military Applications: The information required includes foreign spacecraft as discussed in Item 9, plus United States communications, navigational, weather and geodetic spacecraft with military applications.

11. (S) Special Orbital Elements for the Military Community: These elements are to be provided upon request for specific spacecraft and to a specified degree of accuracy. The accuracies specified in the NQR for space defensive weapons support will satisfy the most stringent requirements established by the U&S commanders.

12. (S) Special Orbital Elements for the Intelligence Community: This requirement is limited to Soviet spacecraft, initially, and must be expanded to other spacecraft as additional foreign nations achieve launch capability. Specifically, the requirement is for accuracies and timeliness as follows:

a. End of First Circuit: 80 NM - X, Y, Z Vel 45 meters/sec, inclination  $1^{\circ}$  20 seconds at the time of latest observation (1966-1970 time period).

b.  $\pm$  1 second arrival in plane for payloads transmitting at frequencies above 900 MCS.

(1) Within 6 hours if not VHF (1966-1970)

(2) Within 24 hours if VHF (1966-1970)

(3) Prior to the completion of the first circuit (Post 1970).

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Note: It is recognized that requirement "a" cannot be satisfied without first circuit detection and a tracking capability on all inclinations, and cannot be satisfied on normal Sino-Soviet inclinations without significant improvement in automation of SPADATS data processing. These requirements must be fulfilled if NSA is to satisfy present DIA levied requirements for telemetry collection. The Post-1970 requirement is based upon the NORAD need for near real-time readout of all significant spacecraft data.

13. (S) Deep Space Ephemerides for the Intelligence Community: Specifically, the requirement is for accuracies and timeliness as follows:

a. Within  $4\frac{1}{2}$  hours after injection from a  $65^\circ$  parking orbit, with accuracy adequate to permit acquisition of signals by sensors with  $0.5^\circ$  beam width during period 5 to 10 hours after injection.

b. Subsequent ephemerides of equivalent accuracy as long as payload is active.

Note: This requirement is based upon DIA requirements for collection of technical intelligence data from Soviet lunar and deep space probes.

14. (S) Unclassified Orbital Data in Support of the Committee on Space Research (COSPAR): Orbital data for this purpose is required by NASA in the SATOR code. In addition to orbital data, SPADATS will also provide international designators as required.

15. (U) SPADATS Bulletins on Selected Foreign Spacecraft: Bulletins include a statement of orbital elements, ascending node equator crossings, and a conversion grid for manually constructing orbital earth traces. These bulletins are provided on specific request only.

16. (U) Acquisition Data: Pointing information will be provided for specified sensors and selected space objects upon request

17. (U) Tracking Support: This requirement involves the use of SPADATS sensors, and may be on a pre-planned or an emergency basis in support of NASA and DOD space activities. Normally, such support involves only sensor observations, but may also include computed orbital data when required.

18. (U) SPADATS Box Score Information: This is a periodic quantitative summary of space objects by nation or origin, near-earth and deep space spacecraft, and debris.

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19. (C) Space Order of Battle: This publication will include a listing of all U.S. and foreign spacecraft of military interest. The document will consolidate, within security limitations, essential information on orbital characteristics, mission assessment of foreign spacecraft and military capabilities of U.S. spacecraft. It will be up-dated on a semi-monthly basis and will include near-future schedules for U.S. space vehicles of a military nature. The publication was proposed by CINCSTRIKE and is endorsed by other U&S commanders. NORAD concurs in and is capable of producing such a publication.

20. (S) Information on DOD Spacecraft Frequency Utilization: Pre-launch information concerning DOD spacecraft radiating in the following frequency spectrums:

- a. 136.000 MC to 137.999 MC
- b. 235.0 and 237.8 MC
- c. 400.04 to 402.0 MC
- d. 1700 to 1710 MC
- e. 1750 to 1850 MC
- f. 2200 to 2290 MC

21. (U) Space Object Histories: This requirement is for a copy of the SPADATS master catalog computer printout on orbital elements of all spacecraft and primary debris since Sputnik 1, in sufficient detail to permit scientific studies to support USN R&D activities. The information is currently available.

22. (S) Space Catalog on All Objects in Space: A compilation of data on all active space objects stored in the NORAD Space Defense Center computer. This listing meets the NORAD requirement for maintenance of a catalog on all objects in space, and enables NORAD to satisfy the user requirements outlined above.

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USER REQUIREMENTS SPADATS INFORMATION

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Appendix B

	CINCNORAD	DEF SMAC (NSA)	DIA	CINCPAC	CINCAL	CINCLANT	CINCSO*	CINCEUR	CINCSRIKE	CINCSAC	DEPT ARMY	DEPT NAVY	DEPT A.F.	NASA
1. DETECTIONS OF NEW FOREIGN SPACE OBJECTS	X		X	X		X		X	X	X	X	X	X	(3)
2. EVALUATED CHARACTERISTICS OF FOREIGN SPACE OBJECTS	X		X							X	X		X	R (3)
3. EVALUATED CHARACTERISTICS OF U.S. SPACE OBJECTS	X												X	R (3)
4. MISSION ASSESSMENT OF FOREIGN SPACECRAFT	X		X	X	X	X		X	X	X	X	X	X	X
5. SPACE THREAT & SITUATION WARNING	X		X	X	X	X		X	X	X	X	X	X	X
6. NOTIFICATION OF ACTIVE SPACE DEFENSE ACTION	X			X	X	X		X	X	X	X	X	X	X
7. ORBIT MODIFICATIONS FOR FOREIGN SPACECRAFT	X		X	X		X		X		X	X	X	X	(3)
8. PREDICTIONS OF SPACECRAFT DECAY & RE-ENTRY	X									X			X	R (3)
9. ORBITAL ELEMENTS ON ALL FOREIGN SPACECRAFT	X			X	X					X	X		X	(3)
10. ORBITAL ELEMENTS ON ALL SPACECRAFT WITH MILITARY APPLICATIONS	X							X	R			X	X	(3)

\* CINCSO was not represented at the conference and in formal response to NORAD request indicated no requirements.

	CINCNORAD	DEF SMAC (NSA)	DIA	CINCPAC	CINCAL	CINCLANT	CINCSO	CINCEUR	CINCSRIKE	CINCSAC	DEPT ARMY	DEPT NAVY	DEPT A.F.	NASA
11. SPECIAL ORBITAL ELEMENTS FOR THE MILITARY COMMUNITY	X									X	X	X	X (3)	
12. SPECIAL ORBITAL ELEMENTS FOR THE INTELLIGENCE COMMUNITY	X	X	X											
13. DEEP SPACE EPHEMERIDES FOR THE INTELLIGENCE COMMUNITY	X	X	X											
14. UNCLASSIFIED ORBITAL DATA IN SUPPORT OF COSPAR	X													X
15. SPADATS BULLETINS ON SELECTED FOREIGN SPACECRAFT	X					X		X	X	R	X	X	X (3)	
16. ACQUISITION DATA	X										R	R	R (3)	
17. TRACKING SUPPORT	X										R	R	R (3)	R
18. SPADATS BOX SCORE INFORMATION	X		X	X		X		X	X	X	X	X	X (3)	
19. SPACE ORDER OF BATTLE	X			X	X			X	X	X	X		X	
20. INFORMATION ON DOD SPACECRAFT FREQUENCY UTILIZATION													X (3)	X
21. SPACE OBJECT HISTORIES	X											X	X (3)	
22. SPACE CATALOG ON ALL OBJECTS IN SPACE	X													

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X - - - - - REQUIRED BY USER ON A REGULAR BASIS

R - - - - - UPON REQUEST

- (1) - - - - - ULTIMATELY THIS INFORMATION SHOULD BE AVAILABLE TO FIELD ARMY COMMANDERS PRIOR TO FIRST PASS DURING WHICH A SATELLITE COULD PERFORM A HOSTILE ACT OVER THEIR AREA OF CONCERN.
- (2) - - - - - THE REQUIREMENT FOR THIS WARNING IS QUALIFIED AS REQUIRED PRIOR TO FIRST PASS OF A HOSTILE SPACE VEHICLE OVER THE FORCES OF THE COMMANDS INDICATED. NORAD'S REQUIREMENT IS PRIOR TO FIRST PASS OVER THE NORTH AMERICAN CONTINENT.
- (3) - - - - - INFORMATION AVAILABLE TO THE USAF SPACETRACK CENTER THROUGH JOINT SPADATS/SPACETRACK ACCESS TO THE SPACE FUNCTION COMPUTATIONAL DATA BASE.