



BYE-36436/65

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INFORMATION NEEDS
for
SATELLITE PHOTOGRAPHIC
RECONNAISSANCE

June 1965

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I. PURPOSE

This report attempts to consolidate all needs currently stated by the intelligence community for satellite photographic reconnaissance which might be satisfied by the Manned Orbital Laboratory (MOL). A list of reference documents used as source material is included. In cases where stated requirements from different source agencies conflict, a determination is made of the most reasonable need. A summary matrix is attached for quick reference.

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II. GENERAL DISCUSSION OF REQUIREMENTS

A. Detailed photographic reconnaissance requirements such as specific target lists, target priorities, frequency of observation, etc., are perishable. AFNIN aptly states the concept as follows (Reference 8):

"It is not feasible to attempt to single out one target or type of target as the most important since the highest priority objective as determined today will, in all probability, be replaced by another shortly depending on changes in the military, political, or technological climate. By the time the MOL is operational, a markedly different -- but no less imposing -- list could be compiled."

Attempts to forecast requirements of the 1968 (and beyond) time period are admittedly only speculation. Hence, requirement extrapolation beyond the current baseline as presented in this report is a difficult task. The best solution appears to be collection systems of sufficient flexibility to allow for reasonable prediction error.

B. The expression of photographic requirements by the intelligence community tends to be strongly affected by current and forecasted collection capabilities. Therefore, there has been no formal statement of need for manned visual observation and inspection

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of targets although it is conceivable that this form of reconnaissance could satisfy many intelligence needs. Similarly, response time is generally derived in terms of orbital parameters or recovery cycles even though the intelligence analyst always desires the information as soon as possible.

An attempt has been made in this report to identify the types and need of observations upon which stated requirements are based. This should allow some flexibility in determining methods of satisfying the basic need.

C. Quality of reconnaissance photography is commonly specified only in terms of ground resolution. Contrast, sun angle, spectrum distribution (including color), multiple observations (including stereo), and obliquity of observation are also important in obtaining intelligence information from photographic imagery. The infinite combinations of these factors applied to the many types of objectives prevent their discrete specification as quality requirements. They should not be ignored, however, in considering collection systems designed to satisfy the stated requirements.

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III. STATED REQUIREMENTS

A. Technical Intelligence

No clear division exists between photographic requirements for technical intelligence and those for target surveillance. In general, however, technical intelligence is concerned more with the capability and vulnerability of a potential enemy's military resources while surveillance is orientated toward order of battle information -- number, location, and state of readiness.

General agreement seems to exist in the intelligence community that photographic ground resolution of [REDACTED] is required for effective technical intelligence. The required amount of improvement over [REDACTED] is subject to considerable variance. Reference 3 specifies resolutions of [REDACTED] required for measuring missile site concrete reinforcement in order to determine hardness and for determining the operating frequency of radar by antenna reflector mesh and wave guide measurements. This specification recognizes, however, that information from sources other than overhead photography might be more effective for these tasks. Resolutions of [REDACTED] are specified for such tasks as determining: the type of missile R&D communications, the number of stages of an ABM/SAM, missile warhead size, aircraft payload dimensions, nuclear test site building

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wall thickness, types of test site instrumentation, aerospace ground equipment size, pipeline diameters, and communication antenna dimensions. Reference 7 judges [REDACTED] resolution a requirement for component part analysis and determination of aircraft, missiles, and electronic equipment characteristics. Reference 4 places the technical intelligence ground resolution requirement in the range of [REDACTED]. In summary, it is concluded that a [REDACTED] resolution is required to complete most of the technical intelligence tasks while [REDACTED] is highly desirable.

The quantity of photography and the frequency of coverage vary considerably with the type of technical objective. Production facilities, test ranges, new construction, and R&D facilities all require frequent inspection, while high resolution photography obtained only once of a missile warhead, established launch site or radar installation might suffice. Reference 1 establishes the current time sampling requirement schedule as follows:

<u>Frequency</u>	<u>Type</u>	<u>Total Objectives</u>	<u>No. Sampled</u>
Monthly	Sites at missile test ranges	50	8
	Elect & Comm Install under construction	4	<u>4</u>
			12

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Bi-Monthly	Missile launchers under construction	90	<u>9</u>
			9
Quarterly	Nuclear test sites	4	4
	AMM/SAM sites	11	8
	Air Defense install.	2200	880
	Major Ground Force install.	215	<u>55</u>
			947
Semi-Annually	Missile launchers	932	9
	Missile/Aircraft/Nuclear/ BW-CW Production & R&D Install.	149	<u>149</u>
			158
Annually	Long range air bases	37	37
	Submarine bases	36	36
	Air/Naval Tactical Strike Installations	384	96
	Elect. & Comm. Facilities	330	82
	Major Military Depots	266	<u>133</u>
			384
Bi-Annually	Other Production & R&D Installations	42	<u>42</u>
			42

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This schedule represents some 4700 observations per year. However, it is difficult to justify 3520 photographs per year of Air Defense installations for purely technical intelligence purposes. The CIA believes a reduced frequency of coverage (2600 per year) is adequate to provide an effective intelligence base. Reference 4 states, "there are over 200 high priority technical target complexes in Russia on which we urgently need high resolution photographic coverage. Moreover, this photography must be periodically repeated on a relatively frequent basis." No significant changes in number of objectives or coverage frequency requirements is forecast for the time period through 1970. It would appear that future coverage of 2500 to 3000 objectives per year would be required for technical intelligence usage with capabilities of up to 5000 per year desirable.

Stereo photography is required in the technical intelligence mission for mensuration. In addition, Reference 7 expresses a need for stereo to determine movement and to discriminate objects from surroundings.

B. Ocean Surveillance

A requirement exists for all-weather, rapid, repeated, night-or-day surveillance of all ocean ship and craft traffic.

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The primary purpose of this surveillance is to maintain identification and tracking information on all surface naval units, submarines, and merchant shipping of national and/or military concern to the United States. Reference 2 expresses this requirement as follows:

"Intelligence requirements for sea surveillance include identification and tracking of these targets which can threaten U. S. forces or our allies, or engage in operations affecting U. S. national interests. They are:

- a. Nuclear and conventional submarines.
- b. Missile launching cruisers, destroyers, and smaller craft such as OSA and KOMAR boats.
- c. Merchant ships over 1,000 gross register tons.
- d. Certain smaller craft down to 100 gross register tons equivalent, such as signal intelligence collection trawlers, high speed raiders, and clandestine agent transports."

In addition to the identification and tracking requirement, information is desired on ship characteristics, i. e., class, pendant numbers, armament, electronic, equipment, performance, status (ready, upkeep, etc.), combat capabilities, and logistic support capabilities (ammo-type, caliber, amount, etc.). (Ref 5).

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The surveillance accuracies required are:

<u>Limits</u>	<u>Peacetime</u> (Reference 2)	<u>Wartime</u> (Reference 5)
Position	50 NM	25 NM
Track	± 25 degrees	± 10 degrees
Speed	± 5 knots	± 2 knots
Completeness	90 %	100 %

Reference 6 estimates a photographic ground resolution of 10 feet required for classification of the larger ships. According to reference 10, classification of submarines requires resolutions of 3 feet. The identification of smaller craft and determination of ship characteristics would require ground resolutions down to [REDACTED] (Reference 3) Reference 6 estimates the "at sea" population at 8000 ships over 1000 gross tons, of which 5500 are merchant, 1500 Naval and 1000 special purpose.

Frequency of coverage and response times are extremely important in this application. Reference 6 estimates a 12-hour or less period between observations with near real-time-information readout [REDACTED] necessary to maintain position identity with a 90 % reporting effectiveness.

C. Search and Surveillance (General)

A requirement exists for photographic search and surveillance of the entire land area of the Sino-Soviet Bloc and selected areas of other parts of the world. This will permit detection and identification of activities associated with a strategic threat against the United States and defensive weapon

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systems whether large or small.

A three to five-foot ground resolution is required. It should be noted, however, that sometimes [REDACTED] ground resolution is essential to identify properly an object under surveillance.

(Reference 1) Reference 10 states that "A three-foot resolution would greatly improve our capability to:

- a. Monitor future offensive missile deployment and development,
- b. Locate mobile defensive missile systems,
- c. Locate and identify ABM installations and determine the inter-relationships among their facilities,
- d. Locate and identify submarines by class,
- e. Identify small nuclear energy production facilities and detect changes in known facilities, and
- f. Capitalize on targets of opportunity."

The search function requires photographic coverage of approximately 12,000,000 square nautical miles every six months. The present surveillance objective time-sampling requirement schedule from reference 1 is as follows:

<u>Frequency</u>	<u>Type Objective</u>	<u>Total Objectives</u>	<u>Number Sampled</u>
Bi-monthly	Suspect Missile Unidentified areas	56	56

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<u>Frequency</u>	<u>Type Objective</u>	<u>Total Objectives</u>	<u>Number Sampled</u>
Bi-monthly	Missile Launchers Under construction	91	91
	Missile ranges	4	4
	Long-range Air Army Bases (Primary)	32	32
	Submarine Bases	36	36
	Nuclear Test Sites	4	<u>4</u> 132
Quarterly	Long-range Air Army Bases (Staging)	5	5
	Missile/Aircraft/ Nuclear BW/CW Production & R&D Install.	149	149
	Air/Naval Tactical Strike Install.	384	384
	Air Defense Installations	2200	<u>1320</u> 1858
Semi-Annually	Operational ICBM/MRBM/ RBM Sites	217	217
	Suspect AMM/Long-range SAM Sites	11	11
	Major Ground Force Install.	218	<u>218</u> 537
Annually	Air Transport Bases	80	80
	Major Military Depots	266	133
	Other Production & R&D Install.	42	42

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Annually	Specific Electronic & Comm. Install.	330	330
	Remaining Ground Force Install.	880	880

This schedule represents a coverage of over 10,200 observations per year. The CIA believes a decreased frequency of coverage resulting in 5839 observations per year will provide an effective base for intelligence analysis and estimative purposes. The number of objectives are forecasted to increase only slightly (approximately 10%) by 1970. (Reference 1)

D. Crisis Management

During periods of international crisis and for special events such as military maneuvers, etc., a requirement exists for photographic coverage of selected objectives at qualities comparable to the general search and surveillance requirement.

The principal difference between this requirement and that for search and surveillance is in response time. Reference 1 expresses this need as "real-time response within ten hours." In the crisis management situation, it can be expected that coverage of selected objectives which sample the military or political status (indicator targets) will be required during relatively short periods of time. Although not stated, it is estimated that coverage of about 300 objectives within a 24-hour

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time period is required.

E. Mapping and Charting

Stereo pan and frame photography is required for the identifying and delineating physical and cultural features, the photogrammetric compilation of these features with respect to central points, and the production of required contours and related relief data. A ground resolution of 10 feet is considered necessary for interpreting physical and cultural features at 2:1 contrast levels.

The Mapping and Charting contour accuracies required (with 90% assurance) are listed below (Reference 9). (As a general rule, if the contour accuracies are met, the horizontal control accuracy requirements and minimum horizontal and vertical control degradation requirements relative to the production of maps and charts will also be met.)

Medium Scale Maps and Charts (1:200,000 and 1:250,000)

<u>Contour Interval</u>	<u>Accuracy</u>	<u>Effective Distance</u>
100-150 feet	50-75 feet	40 miles
	(Ridge lines approaching target) 20 feet	15-20 miles

Large Scale Maps and Charts (1:50,000)

30-60 feet	15-30 feet	10-20 miles
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The medium scale requirement relates to radar prediction for all weather low level penetration by aircraft, and that for the large scale to first round effectiveness over maximum artillery ranges. .

During the 1965-1970 time period frame maps and charts are required on about 16.4 million square miles of inaccessible areas and 21.6 million in the free world areas.

F. Geodesy (Primary Control Networks)

World-wide frame photography, normally small scale is required to provide geodetic base of position and elevation data. The present accuracy requirement is 950 feet horizontal and vertical control (Reference 9), although the vertical requirement may be reduced 250 to 300 feet pending possible use of a high ballistic coefficient re-entry vehicle. As of October 1964, existing 1 1/2" and 3" focal length cameras had provided coverage of 44 million square miles of the total 56 million square mile land mass area of the earth. For the reduced elevation requirements, this data may be of marginal accuracy. Improved index cameras to be used in future satellite missions is expected to meet this requirement by the end of fiscal year 1966.

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G. Strike Effectiveness Assessment (BDA)

A need exists during a general war (strategic exchange of nuclear weapons) to "determine the results obtained from Single Integrated Operations Plan (SIOP) strikes with priority on these military threat targets which would have the most immediate effect upon the ability of the United States to conduct further military operations." (Reference 11). This implies, and is stated in reference 12, a capability to also assess damage to the United States and its allies or self-surveillance. The immediate threat targets include heavy and medium bomber airfields, primary staging airfields, and ICBM/IRBM/MRBM missile sites. An all-weather system to satisfy this requirement is considered necessary. (Reference 1). However, it is conceivable that damage assessment could be determined from visual and photographic observation of sampled targets.

Ground resolution required for this task is stated as five to eight feet in references 1 and 12, although reference 11 estimates that assessment of 90% of the programmed weapons could be achieved with resolution as poor as 150 feet. A considerable variance in this requirement can be expected due to widely varying conditions of weapon yield, weapon utilization, and target geology.

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Reference 11 forecasts 1850 objectives in the Sino-Soviet land mass for the 1967 time period, 75% of which are located west of 100°E longitude. 100% coverage of immediate nuclear threat targets is required. Response time is extremely critical in this application with real-time a requirement. Information acquired within 4, 6, 12, 24 or even 48 hours is extremely important. Reference 1 requires both real-time (24 hours) and retrievable packages with interval of coverage every six hours.

H. Post Attack Reconnaissance

A requirement exists to detect those residual forces still capable of military operations after a nuclear exchange. The specific purpose is very similar to cold war search and surveillance - to locate residual military capability, and determine its operational capability and force posture. As in search and surveillance, the ground resolution requirement is three to five feet and the total Sino-Soviet land mass is subject to selected search (Reference 11).

The number of targets to be surveilled is dependent on the attack option exercised, the degree of strike success, and the results of search - making a specific number impossible to state.

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Response time is less critical than in the strike effectiveness assessment mission but, for the case of a very limited exchange, is still specified in reference 11 as "as near real-time as possible." As the size of nuclear exchange increases, the response time can be relaxed up to 48 hours.

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Crisis
Management

3-5 feet

Not
Stated

Not
Stated
(note 1)

Not
Stated
(note 2)

Real-time
(within 10 hrs.)
1. Requires sampling of
specified indicator targets.
Estimate: 300
2. Frequency variable with
crisis.
Estimate: 24-hour cycle

2402

Mapping and
Charting

10 feet
(note 1)

Required for
contours and
relief

16,400,000 sq mi
(world-wide)

Once in 1965-70
time period

Not
Stated
1. At 2:1 contrast ratio.

Geodesy

Max: 250-300 ft
vert. position
accuracy
950 foot horizontal

Not
Stated

44,000,000 sq mi
(world-wide)

Once by end of
1966 (note 1)

Not
Stated
1. This requirement should be
satisfied by existing and
programmed collection systems.

77D

Strike Effective-
ness
Assessment (BDA)
(and self
surveillance)

5-8 ft required
150 ft useful
(note 1)

Not
Stated

100% of immediate
nuclear threat
targets
(approx. 1850)

Once after each
strike

Real-time re-
quired - within
4 to 48 hours
extremely
important

1. All weather capability
required.

Post Attach
Reconnaissance
(note 1)

3-5 feet

Not
Stated

Search: selected
portions of Sino-
Soviet land mass.
Surveillance:
variable with
strike results
(1850 max.)

Search: Once after
each strike.
Surveillance:
Variable with strike
(max. 4 to 6 hour
cycle)

Near real-time
up to 48 hours
important

1. This requirement is very
similar to general search
and surveillance except for
response time.

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REFERENCES

1. COMOR D - 13/29, dtd 14 December 1964, Long-Range Requirements for Satellite Image-Forming Sensors.
TS TK Daff/Ruff TCS-5454-64
2. COMOR D - 13/39 (Revised) dtd 5 April 1965, Sea Surveillance by Satellite. TS/Byeman BYE-40569-65
3. COMOR D - 13/36, dtd 19 February 1965, Elements of Information. SECRET TK (with Attachment)
TCS-0041-65
4. AFSC Letter to SAFUS, dtd 9 February 1965, Qualitative Intelligence Requirement for High Resolution Photography to Obtain Data on Sino-Soviet Technological Developments. (Two Attachments) TS/TK TCS-450003-65
5. Navy Preliminary General Operational Requirement No. 35 - Ocean Surveillance, undated. SECRET
6. Report, Ocean Surveillance Study (U), dtd 15 Sept 64, Boeing Co., Aerospace Division. SECRET, USN Project No. RT-019-02-1L.
7. Report, Technical Intelligence Use of Photography Resolving [REDACTED] on Target (U), dtd 16 Apr 1964, Foreign Technology Division, AFSC. TS/TK/Chess/Ruff/Daff
TCS-TH1843-64
8. AFNIN Letter to General Evans, SA FSL, dtd 31 March 65, Specific Targets for Surveillance by the Manned Orbital Laboratory (MOL). TS/DORIAN/CORONA/GAMBIT
BYE 24195--65
9. COMOR D-13/33, dtd 18 Jan 1965, Long-Range Requirements for Satellite Image-Forming Sensors. TS/TK
TCS-0003-65
10. COMOR D - 13/22, dtd 13 Jan 1965, Long-Range Requirements for Satellite Image-Forming Sensors (Section II.)
TS TK CORONA/GAMBIT BYE-40507-65/1

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SAFSS By 36436-65

11. Report, Strategic War Reconnaissance Satellite Study,
dtd 3 July 1963, Strategic Air Command. TS TK
TK-01840-3

12. Memorandum, JCS to SecDef, dtd 30 October 1964,
Strategic Reconnaissance, JCSM 862-64. TS/BYEMAN
BYE 5287-64

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