NFIC ROUTING SLIP

FROM: **SCHEUFELE**　　　　　DATE: **2 Dec 61**

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Where did we get term "? —" "Spatial frequency" thought it was "resolution."

REMARKS:　JOHN:　Pls note underscore on page 2.　Were
you not planning on leaving the image quality meter
at HF for other developmental work.　In view, however,
of the need here, we probably should get it back here
as soon as possible.　Let's discuss ASAP.

[handwritten] 7 Jan 62.

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NOV 1 5 1961

ACL GCL

DSP Lacy

CFC C+2

EE

HFS

TALENT KEYHOLE
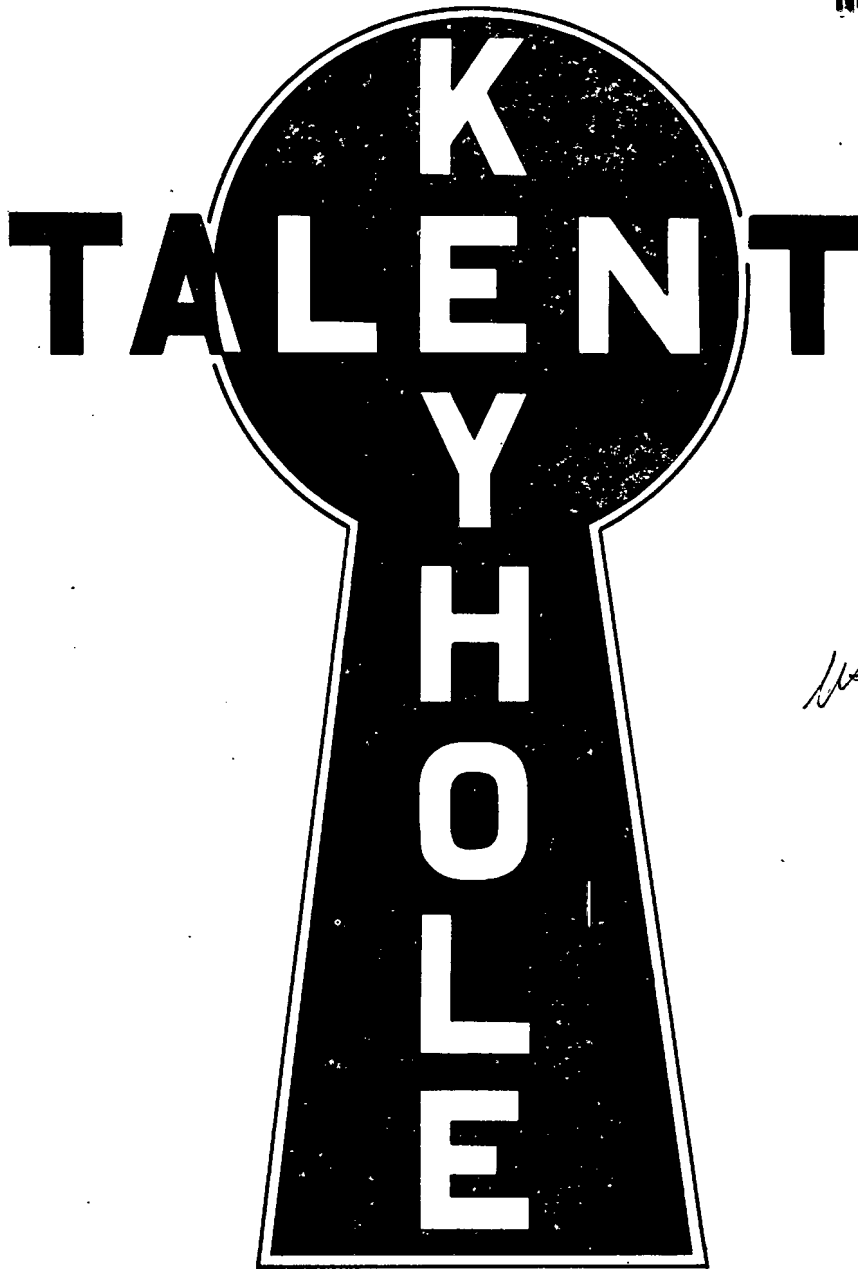
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NOTICE TO ALL HOLDERS OF TCS-10384-61-KH ---

The attached document (TCS-10490-61-KH) supersedes TCS-10384-61-KH,

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14 November 1961

MEMORANDUM FOR: Chairman, United States Intelligence Board

SUBJECT: Criteria for Judging the Adequacy of
KEYHOLE Photography

1. This memorandum is submitted in response to a recent USIB Directive requesting the NPIC "to refine its criteria for judging the adequacy of KEYHOLE coverage with respect to confirming the presence or absence of ICBM deployment in areas which have been covered." 1/

2. For several weeks the NPIC has held a series of discussions and conferences with representatives of the major agencies involved in this problem. There are essentially three basic parts to the problem: establishment of definitions for rating photography on a qualitative basis; determining the significance of varying percentages of cloud cover; and developing mechanical procedures for recording and reporting the desired information.

3. With respect to qualitative ratings, it is possible to establish criteria which will help the intelligence community in various ways to assess KEYHOLE coverage. However, these criteria cannot be so definitive as to eliminate all differences of opinion as to whether or not ICBM's, or other targets, may be deployed in a given area. There are a number of reasons for this:

    a. Photographic evidence can never be absolute in a negative sense. That is, one can say that a photograph does not show any recognizable missile activity, but one can never say absolutely that this proves there are no missiles present. A degree of confidence or judgment enters in, and in the specific area of recent discussions the level of confidence depends upon the extent to which one believes that the Soviets will employ recognizable signatures or patterns for activities associated with their missile deployment. At the present time most of the intelligence community believes that these patterns or signatures will be

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1/ Paragraph 2a, USIB-D-33.11/2, 26 October 1961

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large and clear enough to be reasonably sure of identification on KEYHOLE photography. However, one can postulate deception schemes which cannot be detected on any photography, KEYHOLE or otherwise. The confidence level in a negative report depends to a considerable degree, therefore, on one's concept of the configuration of deployed Soviet missiles and the types of areas in which deployment is likely to occur. No qualitative rating of photography will settle this question.

    b. The interpretability of a photograph is conditioned by many factors: the characteristics of the camera system, the conditions under which it was exposed and developed, the characteristics of the terrain and objects photographed, the capabilities of the photo interpreter, and the availability of collateral. Further, at the present time any rating system must depend upon judgment rather than upon some inherent quality of the film itself which is capable of measurement. We have under development at NPIC an "image quality meter" which will measure film quality in terms of acutance, granularity and spatial frequency. It is hoped that this equipment can be correlated with the interpretability and human factors so that during the next year we can obtain better quality indicators. However, at present we must rely on human judgment.

4/mm ?

    c. Even if a rigidly defined, generally acceptable quality rating were immediately available, photography is only one intelligence input. Recent discussions involving ICBM deployment have frequently implied that it is the sole input or the basic element at issue, when in fact other evidence or considerations have been contributory and in some cases overriding.

    d. With the above limitations understood, we have nevertheless recently developed at NPIC a set of quality definitions for use in rating KEYHOLE photography. These definitions, attached as Inclosure 1, have been generally agreed upon by Service representatives at NPIC and are believed to be generally acceptable by others. While not as definitive as desired by some, they can be equated to at least part of the current problem. For example, there would be a high level of confidence that any Yurya type sites would be detected in cloud-free areas rated as quality categories 2 or 3.

    4. With respect to cloud cover, the significance of varying percentages is again one of judgment.

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a. For point targets visible in cloud-free areas, the probability of detection through clouds can theoretically be expressed mathematically for a single mission, and for combinations of missions as well, assuming random cloud distribution. However, the problem is not really quite so simple: cloud shadows affect interpretability to a degree not directly related to the percentage of cloud cover; the time interval between missions influences the significance of the coverage; cloud patterns are not random; and most of our targets are really complexes in which one distinguishable feature may give away an entire area. It becomes difficult to say what probability of detection can be associated with a given level of cloud cover.

b. After discussions of this problem, we have decided to continue recording cloud cover in the same five categories as we have in the past 0 - 9%, 10 - 25%, 26 - 50%, 51 - 99%, and 100%. The significance of these amounts of cover undoubtedly will be interpreted by various agencies in various ways. For example, at NPIC we would consider, that given reasonably good KEYHOLE photography (categories 2 or 3, Inclosure 1) we would have a very high level of confidence in being able to detect Yurya-type complexes or any similar configuration in areas with 25% scattered cloud cover or less, particularly since every ICBM site and most MRBM sites have been discovered in areas of heavier cloud cover.

c. We have kept graphical records on cloud cover on all missions and the information from these is available to the intelligence community through NPIC representatives. For example, our records indicate that on all missions to date, 57.5% of the area of the USSR has been covered by photography with 25% or less cloud cover. We do not yet have detailed quality records, so we cannot indicate how much of this is poor, or how much is usable for detecting Yurya-type complexes. However, we believe that a fairly high percentage of the film is suitable for this purpose and considering that there is additional usable coverage with more than 25% cloud cover, it is reasonable to estimate that at least 50% of the USSR has been covered by photography on which Yurya-type complexes would have a high probability of detection.

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5. With respect to mechanical procedures for recording and report-ing coverage, some progress has been made. The size of the problem can be appreciated when it is realized that we already have some 14,471 frames of photography on hand. Since a frame is too large a unit to assess for quality or cloud cover purposes and must be broken into small sections, we obviously have an operation which could become extremely time-consuming for the type of people and resources most critical to positive exploitation of photography. We have been plotting and providing cloud coverage data on all missions and have been studying the quality problem for many months; but I have been reluctant to commit NPIC to any other time-consuming recording or reporting tasks until the utility thereof has been demonstrated. With a view to the necessity for joint efforts in this area and the necessity for computer application we have been working with AFIC towards a com-munity solution. Present NPIC views as to a solution are summarized as follows:

KEYHOLE

a. As a basic vehicle we are planning to use a computer-planned recording and reporting system developed by the Air Force and already in partial operation. NPIC negotiations for certain modifications to this system are presently underway, since it was originally designed for a somewhat different output for internal Air Force use.

b. Joint NPIC teams would, under this modified system, evaluate every frame of photography, previous and forthcoming. Each frame would be broken into 15 parts and each part would receive one of the following ratings: good; fair; poor (these first three defined as in Inclosure 1 and applied to photography with less than 10% cloud cover); cloud readable with 10 - 25% cloud cover; cloud readable with 26 - 50% cloud cover; cloud readable with 51 - 99% cloud cover; completely cloud covered; or unusable (fog, darkness, malfunction).

c. These evaluations would then be furnished to AFIC for computer programming and publication as an Air Force report, containing other generally related information.

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d. Once the program is established and data fed to the computer, according to AFIC it will be possible to obtain basic statistical data showing the percentages of the USSR, or selected geographical areas therein, covered by photography of the various categories described in paragraph b above. Further, the computer will be able to print out map overlays showing area coverage by category.

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6. It is uncertain at this time as to how long it will take to obtain the initial computer outputs, but it probably will be after 1 January 1962. Therefore, we are planning at NPIC to provide an interim solution using graphical methods. If we are successful in our analyses and procedures we may be able to provide graphical qualitative coverage summaries by 1 December.

7. Availability of the type of data described above will not eliminate requirements for special area and target studies, such as the recent CIA report on railroad coverage. 2/ While the general qualitative criteria in reference report are consistent with the proposals herein, reports from specific criteria relating to distance from the railroad lines and the treatment of cloud cover cannot be reconstructed from a system designed to provide area qualitative data. Similarly, spot area studies by the Deployment Working Group, GMAIC, will require separate photographic evaluation, although these studies will be assisted by qualitative coverage statistics which should become available from the computer on an area basis.

8. In summary, we have developed certain qualitative and cloud cover criteria which will be useful in evaluating KEYHOLE coverage and steps are being taken to record and report it. This will not eliminate differences in estimates of the significance of coverage of specific areas due to factors other than photographic quality. Although it would be desirable to develop a more definitive base for coverage data, I believe that we have carried the solution of the problem as far as is practical at this time.

2/ Effective KEYHOLE Coverage of the Soviet Rail Network, CIA, TCS-10055/61/KH, 18 October 61

ARTHUR C. LUNDAHL
Director
National Photographic Interpretation Center

1 Inclosure

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Proposed Quality Definitions

Category 1 (poor)	Image of such low definition that targets cannot be distinguished or identified within any reasonable degree (75%) of certainty. Corners and edges are not sharp, contrast is either low or very high, image will not stand magnification beyond about 15X, poor exposure, low sun angle.
Category 2 (fair)	Image of sufficient definition as to ensure a high (90%) confidence level that targets can be distinguished and in many cases major features identified. Corners and edges are visible but not necessarily sharp. Contrast is not extremely high or low, image will stand 20X magnification, satisfactory exposure and light conditions.
Category 3* (good)	Image of such clear definition that it is virtually certain that targets can be distinguished and major features readily identified. Corners and edges are sharp, contrast is represented by a fuller range of densities, image will stand 30X magnification or greater, proper exposure, optimum light conditions.
Distinguished	Recognized; discerned; separated into classes, kinds or categories
Identified	Establish the identity of; ascertain to be the same as some known type or description; to specifically name.
Definition	Distinctness or clarity of detail and outline
Targets	100 feet or more in diameter or least dimension such as ICBM launch pads of the Yurya type, aircraft, ships, industrial complexes, and RR yards.
Major features	Larger distinguishing features such as launch pads, road pattern, straight vs swept wing, main buildings, fuel storage tanks, railroad cars, etc.

*It is anticipated that future collection systems will provide photography of higher quality; hence this must be considered as only an interim upper limit.

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