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~~(S)~~ NATIONAL RECONNAISSANCE OFFICE
WASHINGTON, D.C.

PRO-A-1F

THE NRO STAFF

6 AUG 1968

MEMORANDUM FOR THE CHAIRMAN, COMIREX

SUBJECT: Use of NRP Satellite Systems for Geodesy

This memorandum is in response to your letters of October 6, 1967, and June 5, 1968, requesting that NRO study the impact of the 12-inch terrain index camera upon resolution and coverage of the HEXAGON system in the performance of the system's primary intelligence measures, and the possible ways in which covert satellite systems could be used to aid in achieving world-wide geodetic accuracies by 1970. The baseline configuration and design of the HEXAGON system took into account the need for an improved terrain index camera. The requirements levied upon this system therefore included the intelligence community coverage requirements and those for MC&G. The primary sensor system film load is based on achieving the coverage specified by both the intelligence community and MC&G. The design altitude of the HEXAGON system is based on the resolution requirements of the intelligence community and inclusion of the 12-inch terrain index camera for mapping purposes will not alter this altitude. Therefore, the inclusion of the 12-inch terrain index camera will have no impact on the HEXAGON system in the performance of the system's primary intelligence mission.

The alternative approach to acquiring data for medium and large scale maps would be to fly the 12-inch terrain camera as a separate system. The study performed by the NRO for Mr. Helms (BYE-4575-67), which was also furnished to you, contains the costs of this approach which are considerably more expensive than the inclusion of the 12-inch stellar index camera in the HEXAGON program.

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Several alternatives have been studied which have varying degrees of probability in improving world-wide geodetic accuracies.

The CORONA system could provide geodetic data with improved accuracy by modification to incorporate the TRANSIT Beacon along with the SGLS. The first vehicle which could carry the DISIC camera, SGLS, and the TRANSIT Beacon is CR-11 which is scheduled for launch in June 1970. The critical item here is the availability of the SGLS and, therefore, June 1970 represents the earliest time in which improved geodetic data could be obtained from an NRP system. The budgetary estimate of the TRANSIT modification for the 5 vehicles remaining in inventory after this time, is $720K. This estimate may normally be expected to increase somewhat when detailed engineering is completed. It is estimated that this system could marginally meet the geodetic accuracy requirements of 450 feet horizontal and 300 feet vertical.

[redacted]

within the Sino-Soviet Bloc. The 12-inch terrain photography of the HEXAGON program could then be used to establish positions of other points of interest within the Bloc in the same manner as photogrammetric control is extended from photo identifiable points of known position in other areas of the world. The HEXAGON program is configured to carry the SGLS tracking system but would have to be modified to include the TRANSIT Beacon and a low-G accelerometer as a minimum.

The budgetary estimate to preserve the option for this modification is estimated to be about $70K. This would cover only the SV contractor design costs to insure that space, power, and necessary cable connections are available within the SV. It would not cover cost of hardware procurement or integration. It is estimated that use of the combined data

from the HEXAGON [redacted] would adequately meet the USIB stated geodetic requirements. The system, however, would not be operational until approximately the seventh HEXAGON vehicle which is the first currently scheduled to carry the 12-inch SI camera.

A further qualification on this approach is that the accuracy of the geodetic data obtained within the Sino-Soviet Bloc is dependent on the approval [redacted] not be approved, some degradation of the Sino-Soviet data is expected. However, it is estimated that the USIB requirements might be met by the HEXAGON system alone, but with little margin.

The approaches outlined above all envision use of the systems mentioned in their primary mode for intelligence purposes, i.e., HEXAGON would not be flown at a higher altitude, etc.

One other modification has been suggested for the HEXAGON system which would replace the stellar camera with star trackers, an inertial reference system, and tape recorders. While this approach would eliminate the necessity for reducing the stellar data for attitude, it would not increase the accuracy of the system, but would greatly increase the cost and weight of the components required for the geodetic mission. This automated attitude system is not needed to meet the intelligence community's desires for this type of system. A system, with accuracy commensurate with the intelligence community's needs, is being incorporated in the HEXAGON program by means of instrumenting the attitude control gyros.

The studies to date indicate that the approach offering the highest probability of success in achieving the geodetic accuracies desired is that of using the HEXAGON program modified for the low-G accelerometer and the Transit Beacon.

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Detailed evaluation of this alternative, especially costs, has not been completed, therefore, the option of collecting improved geodetic data by means of the CORONA system will be protected (at no cost) pending completion of the evaluation of the feasibility of the HEXAGON modifications.

R. A. Berg

RUSSELL A. BERG
Brigadier General, USAF
Director

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