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ESCA

Calibration of Cartographic Cameras

3 Oct 1962

PURPOSE

The purpose of the attached memorandum to NRO is to assert the Army's capability and desire to assume responsibility for calibration of cameras in satellite cartographic systems as an integral part of the Army data reduction mission.

DISCUSSION

1. A conference was called by [redacted] of the Office of the [redacted] on 18 September 1962 to discuss the cartographic system (i.e., 35mm frame camera and 85mm stellar camera) planned for inclusion in all future satellite reconnaissance shots. The conference, attended by representatives of Lockheed, CIA, ACIC and ITEK, was concerned primarily with engineering problems associated with the new system.

2. The most important aspect of the meeting from an Army view-point is the assignment of responsibility for the calibration of the terrain and stellar cameras. At the start of the meeting it was evidently assumed by NRO that this responsibility for cartographic cameras was and would be charged to ACIC, who have performed some calibration of the frame cameras already flown in the reconnaissance program. The sole Army representative, [redacted] of Army Map Service, questioned the validity of this assignment, taking the stand that (1) cartographic camera calibration is an essential and integral part of the Army's data reduction mission and (2) the Department of the Army has superior facilities available for this task. The Chairman, [redacted] apparently in his role as an NRO representative, indicated general agreement with these premises and expressed a willingness to consider an Army proposal to take over this function. The Army representative agreed to confirm the Army position in writing.

3. Whereas the Army has the responsibility for data reduction, the accuracy of the end product is predetermined by the laws of propagation of the errors inherent in the basic data, in accordance with the particular geometry of the specific case of triangulation. Therefore, from an economical standpoint, it seems advisable; from the practical standpoint, it is considered vitally necessary to combine the missions for camera calibration and data evaluation in order to optimize the quality of the end product and at the same time provide the necessary information for improving the various phases of the photogrammetric procedures. The Army has been handicapped on past occasions when very considerable delays were met in acquiring essential camera calibration data. Further, the format and calibration procedures have not been compatible with cartographic requirements. With the plan to include cartographic cameras in all reconnaissance satellites, it is considered essential that the Army be given the camera calibration mission as an integral part of the Army data reduction mission.

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MEMORANDUM FOR: DIRECTOR, NATIONAL RECONNAISSANCE ORGANIZATION (S)

SUBJECT: Calibration of Cartographic Cameras

1. Reference is made to the conference called by [redacted] on 18 September 1962 pertaining to the new cartographic cameras now being added to reconnaissance satellites. Confirming the view expressed by the Army representative at this meeting, the Army is willing and has the best capability to assume the responsibility for calibration of these cartographic cameras. The Army considers that such calibration is an integral part of the Army data reduction mission.

2. The accuracy potential of any data evaluation process is based, ultimately, on the precise calibration of the basic tool of measurement, the photogrammetric camera. To separate the responsibility for camera calibration from the responsibility of using photographs from such cameras in the process of photogrammetric control extension and map compilation does not only seem impractical but certainly endangers the quality of the end product. Only if the calibration process is made a part of the overall data reduction mission will it become possible to analyze in a significant way the precision and accuracy of the triangulation process, and in turn provide the necessary information for improving the various phases of the photogrammetric mapping procedure.

3. The Army has, during the past ten years, developed the capability for precision photogrammetric triangulation. As part of this capability, means have been developed at the Army's Ballistics Measurement Laboratory, Aberdeen, Md., for calibrating precision photogrammetric cameras. At this facility a sophisticated field station for camera calibration under controlled environmental conditions is in operation. It is equipped with an astrodome, the presently most accurate stereocomparator for measuring image coordinates (Wild STK-1), laboratory type auxiliary equipment and electronic timing gear, together with special capping shutters and highly synchronized (plus or minus 25 microseconds) rotating disc shutters. Further, the Ballistic Research Laboratory Electronic Scientific Computer (BRLSC), together with a large family of computer programs that have been compiled, is available for the calibration of these photogrammetric cameras.

SUBJECT: Calibration of Cartographic Cameras

4. Upon the assignment of this responsibility to the Army, I am prepared to designate [redacted] Assistant Director of Topography, Directorate of Topography and Military Engineering, Office, Chief of Engineers, as Project Director for the Cartographic Camera Calibration Program.

Finn J. Larsen
Assistant Secretary of the Army (R&D)

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SUBJECT: Calibration of Cartographic Cameras

4. Information has been provided that the number of cameras to be calibrated under this program would vary from a minimum of one to possibly two cameras per month. Experience has indicated that the calibration of a camera would require a total of five days effort. The amount of computer time required for the calibration of each camera is negligible. The work would be accomplished at the Ballistics Measurement Laboratory of the Ballistics Research Laboratories, under [redacted] who is concurrently with GIMRADA. These laboratory facilities are, in fact, superior to any existing DOD facilities for this purpose.

CONCLUSIONS

1. Army assumption of responsibilities for calibration of all cartographic satellite camera systems is essential to the accomplishment of the Army's data reduction mission.

2. The Army has superior facilities in-being for this task.

RECOMMENDATION

That ASA(R&D) sign the attached Memorandum to Director, NRO.

COORDINATION

ACSI - Concur -
OCRD - Concur -

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Memo to DNRO

W. K. WILSON, JR.
Lieutenant General, USA
Chief of Engineers