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TO: Mr. David Fischel
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FROM: Dr. Nevin A. Bryant/Dr. Albert L. Zobrist
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Jet Propulsion Laboratory

SUBJECT: Quarterly Progress Report Landsat-D Proposal A-25 "Evaluation of Landsat-4 TM and MSS Ground Geometry Performance Without Ground Control"

General Status of Work

The techniques and software developed to characterize the Nov. 2, 1982 Washington, D. C. scene for the Landsat-D Early Results Symposium have been improved upon and are being systematically applied to a Dec. 12, 1982 Imperial Valley, CA scene. Acquisition of a second Harrisburg, PA scene has occurred, while ordering of a second Imperial Valley scene will be deferred until TDRSS acquisitions are available. Digital Elevation files, for both test areas, are in the process of being acquired. One hundred seventy-two tiepoints have been located in the Imperial Valley scene. They have been digitized from USGS maps to determine their lat-long coordinates. A least squares fit is currently being performed between line-sample image data and the lat-long positions of the tiepoints. Thematic Mapper scanner sweeps have been determined for the Imperial Valley P-data. VICAR jobs are currently under way to analyze sample-direction offsets between sweeps in the data, as well as band to band registration offsets. Tiepoint location is about to begin in the Harrisburg scene. Between 200 + 300 tiepoints will be found interactively on TSO in the next few weeks. Then, a similar procedure as that followed with the Imperial Valley image will begin.

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Open Problems

A second TM scene for the Imperial Valley will have to be chosen. The decision whether to go with a 1982 image acquisition or use a newly acquired scene via TDRSS can be deferred for up to six months.

Solved Problems

Adequate digital elevation data are available to quantitatively assess the impact of relief upon horizontal displacement of pixels along a line/swath and the probable impact upon scene-to-scene registration. Two scenes have been acquired for Harrisburg, so the scene-to-scene registration analysis can be undertaken.

Results to Date

Early results were presented at the Landsat-4 Early Results Symposium, February 22-24, 1983 on both the MSS and TM geometric performance. A more in-depth assessment of the TM ground segment performance was presented at the ERIM Symposium, Ann Arbor, May 9-13, 1983. Those results showed that sensor and ephemeris corrections without ground control, for both the MSS and TM are within expected limits. For the Washington, D. C. scene analysed initially, it was shown that the MSS ground data processing system must achieve a better success rate in gcp correlations to remove ephemeris inaccuracies adequately to obtain successful scene-to-scene registration. As the JPL gcp chip matching algorithms achieved considerably more success then the MSS Ground Data Processing Segment (20 vs 2), it is suspected that the problem lies in a need to improve the gcp chip matching algorithm. For the TM data, a one hertz roll condition detected by the JPL gcp analysis could have been removed by the incorporation of ground control as planned for the operational TM ground data processing system.

Planned Research Fourth Quarter FY84

The preliminary results obtained from the Washington, D. C. scene P-tapes are being analysed in detailed for the Imperial Valley and Harrisburg scenes. That is, registration to a ground control point network and line-to-line and swath-to-swath matching analysis is being undertaken for both scenes to confirm the initial results obtained from the Washington, D. C. product. In addition, digital elevation files, both DLMS 3 second arc and Gestalt Photomapper one second arc data are being collected and processed for subsequent relief displacement analysis.

Publications

1. Bryant, N. A., A. L. Zobrist, B. Gokhman, "Geometric Accuracy Assessment of Landsat-4 Thematic Mapper P-Tapes", Proceedings Seventeenth International Symposium on Remote Sensing of Environment, ERIM, Ann Arbor, May 9-13, 1983.

Data Provided by GSFC:

1. Imagery acknowledged in previous quarterly report.

2. Second A and P format TM scene, Harrisburg, Pennsylvania.

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