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EXAMINATION OF A RAPID COMPUTATIONAL APPROACH AIMED AT THE HIGH PRECISION ADJUSTMENT OF TM IMAGERY FOR DISTORTIONS DUE TO EFFECTS OF TERRAIN

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ABSTRACT

Most past practices for performing geodetic registration of MSS and TM data either have ignored the geometric distortions associated with the effects of terrain, have used ground control points (GCPs) in association with polynomial distortion functions or are the products of lengthy interactive efforts of an analyst. However,

1. The presence of any differences between the earth's surface and the reference surface used (e.g. the reference ellipsoid) will produce errors in the transforms relating the location of a point on the ground to its location in the focal plane. The magnitude of these errors are a function of the magnitude of the elevation deviations and the look angle of the satellite.

2. If we view elevation as a signal it should be clear we are unlikely to be able to reconstruct the higher frequency components of the elevation with anything like the number of samples represented by using any reasonable number of GCPs.

Infact, to achieve high geodetic accuracies/precisions (mean deviations = 0.2 IFOVs, RMS = .05 IFOVs) <u>in a production environment</u>, terrain adjustments must be made for every pixel. While this could be accomplished by combining the conventional method of solving the look point equation with the "trick" of redefining the reference ellipsoid for each pixel, 2000 hours of VAX 11/750 machine time would be required to correct one band of a TM scene using this method. The problem is to perform the corrections in an acceptably short length of time, using a modestly powerful computer.

In this paper we present the conceptual basis of an algorithm which is based upon several linearizing assumptions that vastly improve the performance rate but yield errors that fall within the previously given budget. In the framework of a sensitivity analysis, the results of comparing this algorithm to the "perfect" solution are presented to demonstrate the behavior of errors over a variety of satellite and topographic factors.

We believe this algorithm is applicable to and would support the same error budget for even higher resolution earth-viewing satellites such as SPOT.