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Memorandum for the Record (EC-65-Landsat)

From: EROS Coordinator, Topographic Division

Subject: Plans for high-gain Landsat coverage of coastlines and shallow seas

Recently the Defense Mapping Agency (DMA) requested NASA to obtain Landsat coverage of the coastlines and shallow seas of the world, except for the United States, Canada, northern Europe, and the polar regions. Other agencies such as Interior have also requested coverage of specific shallow sea areas and there is reason to believe that comprehensive coastal and shallow sea coverage will soon be started.

DMA's request calls for the high-gain mode, which currently means that both MSS bands 4 and 5 are placed in high-gain, which triples their signal response. However, we question this mode as being optimum for coastal areas.

Recently the undersigned and James Hammack (DMAHC) conducted a digital test of the high-gain mode of Landsat image 2885-14444, taken on June 25, 1977, which included parts of the Florida coast and the Bahamas. The effectiveness of the high-gain mode for water penetration could not be verified in the Bahama area because of atmospheric conditions, but the Florida coast was clear and provided an excellent example of how high gain affects response over coastline land areas.

Fabian Polcyn (NASA/Cousteau Ocean Bathymetry Experiment, July 1976) reported that high-gain band 4 saturated at 1.3 m water depth and the high-gain band 5 saturated at 0.3 m depth. This experiment involved an area with a high-reflectance (about 30% in band 4) ocean bottom, and we believe that these figures are generally valid. The June 25, 1977, high-gain image confirmed our concern in that about 50% of the Florida coastal area did saturate on both bands 4 and 5. The saturation is concentrated in the land areas clear of vegetation, and these include beaches as well as manmade clearings and built-up areas. It was further noted that the saturation of bands 4 and 5 were near-identical, indication that for such areas there is very high redundancy between bands 4 and 5. Band 4 is undoubtedly important for some land features, but its loss over coastal land areas, due to saturation

in high-gain mode, is something that may be acceptable. However, the saturation of band 5 would effectively negate the multispectral imagery of such areas.

Based on this and other evidence, we conclude that the optimum mode for Landsat imaging of coastal and shallow sea areas is with only band 4 in high gain and bands 5, 6, and 7 in normal gain. It should be noted that for other applications, such as very low Sun angle coverage of high latitude regions, both bands 4 and 5 should be in high-gain mode.

This memorandum is restricted to the technical aspects of the Landsat high-gain response. Putting Landsat into high gain and the actual bands selected for high gain are operational matters that involve NASA decisions. However, user expressions of requirements to NASA will undoubtedly influence their actions on this matter.

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