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United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092
522 National Center

Memorandum for the Record (EC-67-Landsat)

By: EROS Coordinator, Topographic Division

Subject: Comparative resolution of the Return Beam Vidicon's (RBV's) on Landsat

Reference is made to EC-62-Landsat (USGS Open-File Report 78-507), which discussed and illustrated the RBV on Landsat-3.

Enclosed are two graphics which further illustrate RBV capabilities. The first graphic is a 2.9X scale reduction of an exhibit panel of Cape Cod and Monomoy Island area. The March 9 RBV image (E30004-14435-B, mislabelled -D on the print), was enlarged from a 1:500,000-scale film transparency received from NASA's Goddard Space Flight Center to 1:20,000 scale in order to compare it with an aerial photograph (negative) of the latter scale. Thus, the RBV was, in 3 steps enlarged about 84 times from its original scale of 1:1,684,500 as printed on NASA's Electron Beam Recorder (EBR). Conventional photographic (mapping) enlargers were utilized with high contrast materials used to determine how well the shoreline could be delineated. The result (about 1:57,000 scale as illustrated) is considered quite remarkable in that a reasonably sharp edge of the shoreline is retained. Previous efforts to enlarge Multispectral Scanner (MSS) imagery to 1:24,000 scale show a complete lack of edge sharpness because of the pixel structure. The RBV's have in this case illustrated a potentially valuable application to the monitoring of coastlines and coastal changes. Where such high contrast signatures are recorded, it is believed that coastal changes as small as 50 m can be identified on RBV imagery.

The second illustration compares band 5 of the MSS and the RBV of the Dulles/Reston, Virginia, area as imaged by Landsat-3 on June 30, 1978 (E-30117-15075). The enlargements were made to 1:100,000 scale in one step on a precision liquid-gate photographic enlarger (Eastman Beacon) from film transparencies received from NASA. This involved 34 times enlargement for the MSS and 17 times for the RBV. No attempt has been made to quantify the resolution in either case, but the differences are obvious. However, the multispectral (multicolor) approach used with MSS does increase contrast and, in turn, resolution with respect to certain features as compared to this black and white portrayal of the MSS band 5. This illustration is a 2X reduction of a 1:100,000 scale exhibit panel.

An optimum utilization of the RBV imagery would appear to be in multi-spectral combination with selected MSS bands such as 4 and 7. Such combinations are now being researched and examples should be available in early 1979.

The images illustrated were originally generated by NASA on their EBR. At this time, NASA's Image Processing Facility (IPF) is going into operation and replaces the EBR mode. Resampling of RBV will be accomplished on the basis of 19-m-square pixels, and the geometry of the perspective frame image will be converted mathematically to that of the MSS which is on the Hotine (Space) Oblique Mercator projection. All indications to date are that the IPF procedure will maintain or improve both the geometric and radiometric quality of the RBV data, although operational analysis of the resampled RBV images will be necessary to substantiate this prediction.

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Enclosures

Comparison of MSS to RBV -Landsat 3

Dulles Airport and Vicinity

MSS band 5

RBV

1 0 1 2 3 4 5 6 7 8 9 10
KILOMETRES

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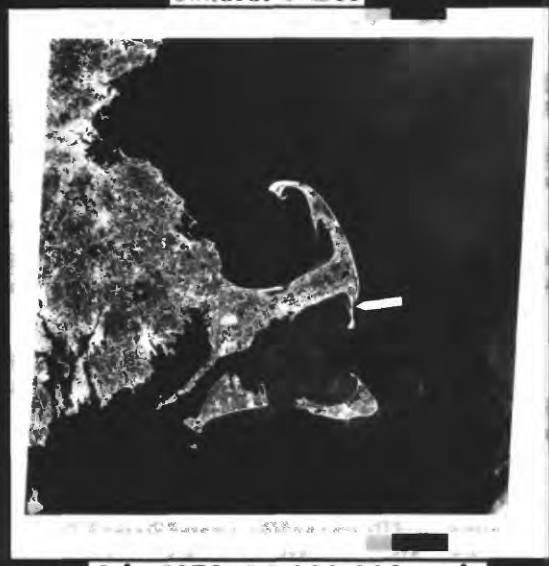
MARCH 3, 1849

COASTAL CHANGES OF CAPE COD MONITORED BY LANDSAT

Landsat-1 MSS

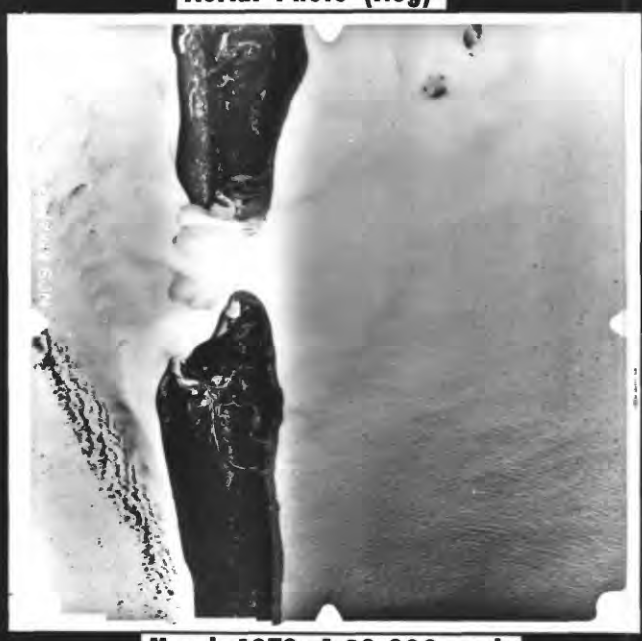


July 1974, 1:1,000,000 scale
Monomoy Island is continuous

Landsat-3 RBV

March 1978, 1:500,000 scale
500 meter rupture in Monomoy Island

Aerial Photo (Neg)



March 1978, 1:20,000 scale
Detail of Monomoy Island rupture
Low Tide

Enlarged Landsat 3 (Neg)

March 1978, 1:20,000 scale
Outline of Monomoy Island rupture
High Tide

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