Grand Canyon Monitoring and Research Center

March 2000 LIDAR and Color Infrared Orthophotography Data Collection

To obtain more information: Call Steve Mietz at the GCMRC at 520-556-7050
COMPARISON OF 1990 BASEDATA TO 2000 BASEDATA

1990

• Non-continuous (imagery and topography only at GIS sites)
• Black/White orthophotography (.5 M pixel resolution)
• Varying Contour Interval from .5 – 1.5 M
• 300 CFS swath

2000

• Continuous imagery and topography from Lake Powell to Mead
• Color Infrared orthophotography (.3 M pixel resolution)
• Contour Interval – 1 meter throughout river corridor
• 1.35 KM swath
HISTORICAL PRICES VS CURRENT COSTS FOR BASEDATA

Costs for producing canyon-wide orthophotography and topographic base data vary by methodologies with the most current technology yielding the least cost for the best products:

<table>
<thead>
<tr>
<th>Method</th>
<th>Cost Estimates</th>
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<tbody>
<tr>
<td>Traditional Photogrammetry</td>
<td>$3 Million</td>
</tr>
<tr>
<td>(method used for development of 1990 basedata)</td>
<td></td>
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<tr>
<td>Aerial Triangulation (NOAA estimate)</td>
<td>Up to $1 Million</td>
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<tr>
<td>LIDAR/CIR orthophotos (EARTHDATA)</td>
<td>$375,000</td>
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<td>Future technology</td>
<td>?</td>
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Through the evaluation process of current and emerging technologies, the GCMRC Remote Sensing initiative has already saved millions, while delivering superior products to the stakeholders and scientists.
EVALUATION PROCESS

The Remote Sensing Initiative tested competing technologies under "real world" conditions before implementing throughout the canyon and/or developing into a monitoring protocol.

This poster demonstrates an evaluation between competing technologies for the collection of orthophotography. In this case, scanning from film photos to create digital photos was found to be superior to direct digital camera collection.
PRODUCTS FROM MARCH 2000 DATA COLLECTION

Topographic Base Map Deliverables are:

1 meter contours
1 meter Digital Elevation Model (DEM)
Metadata

Imagery and Photographic Deliverables are:

Color Infrared orthophotography at .3 meter pixel resolution
Raw Black/White digital photos with camera parameters
Raw CIR digital photos with camera parameters
The 1998 LIDAR and CIR orthophotos that the GCMRC received as part of the Remote Sensing evaluation will serve as examples of the types of data that will be delivered for the entire canyon from the March 2000 data collection.

Demo of 1998 Paria River Data using Arcview
ANALYSIS USING LIDAR DATA

- Change detection
- Flood Prediction
- 3D Visualization

CHANGE DETECTION OF SAND BARS

One of the most powerful analyses that can be performed in a GIS is change detection. In this example, orthophotography is used to delineate the extent of sandbars at several sites. Once the sandbar is outlined in orthophoto, changes can be quantified in area, volume, and spatial extent. The use of LIDAR data in conjunction with GIS will allow the Corps to monitor changes in vegetation, sandbars, and cultural sites throughout the entire river corridor in comparison with past and future datasets. Before the March data collection, these types of analyses were limited to the Corps sites.
WATER SURFACE EXTENTS AT SPECIFIC FLOWS
3D VISUALIZATION

DEMO OF 3D MOVIE
REMOTE SENSING TO BE TESTED AS PART OF LSSF

• Resource mapping using multispectral sensor
• Vegetation monitoring using digital CIR photography
• Topographic change detection using high resolution (25 cm) LIDAR
• Sediment transport using digital CIR spectral signatures in water
• Channel morphology using high-gain digital B/W photography
• Cultural site monitoring using multispectral sensor
• Fish habitat monitoring using thermal IR band.