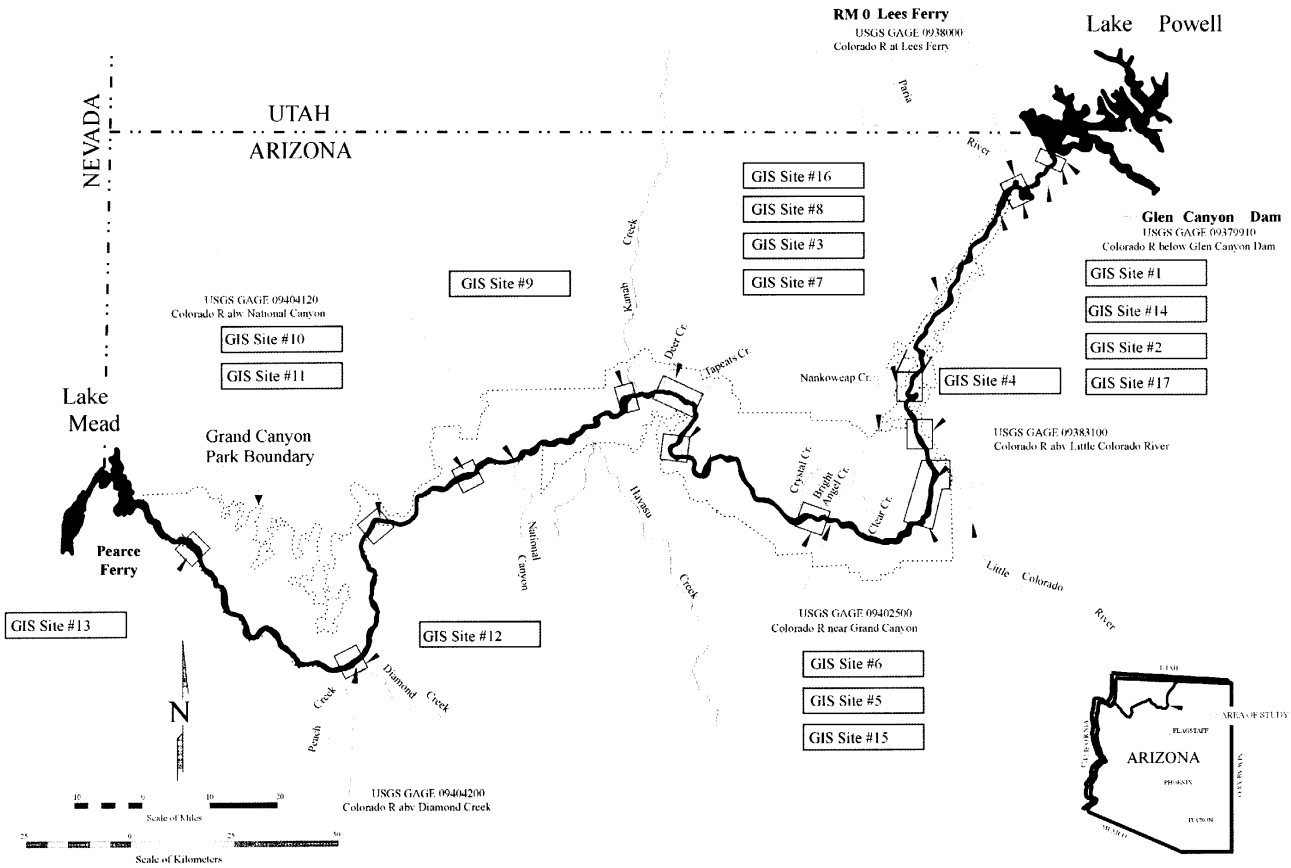
Grand Canyon Monitoring and Research Center

March 2000 LIDAR and Color Infrared Orthophotography Data Collection

To obtain more information: Call Steve Mietz at the GCMRC at 520-556-7050

GIS Monitoring Sites

Grand Canyon Monitoring and Research Center



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:

Method	Cost Estimates
Traditional Photogrammetry (method used for development of 1990 basedata)	$3 Million
Aerial Triangulation (NOAA estimate)	Up to $1 Million
LIDAR/CIR orthophotos (EARTHDATA)	$375,000
Future technology	?

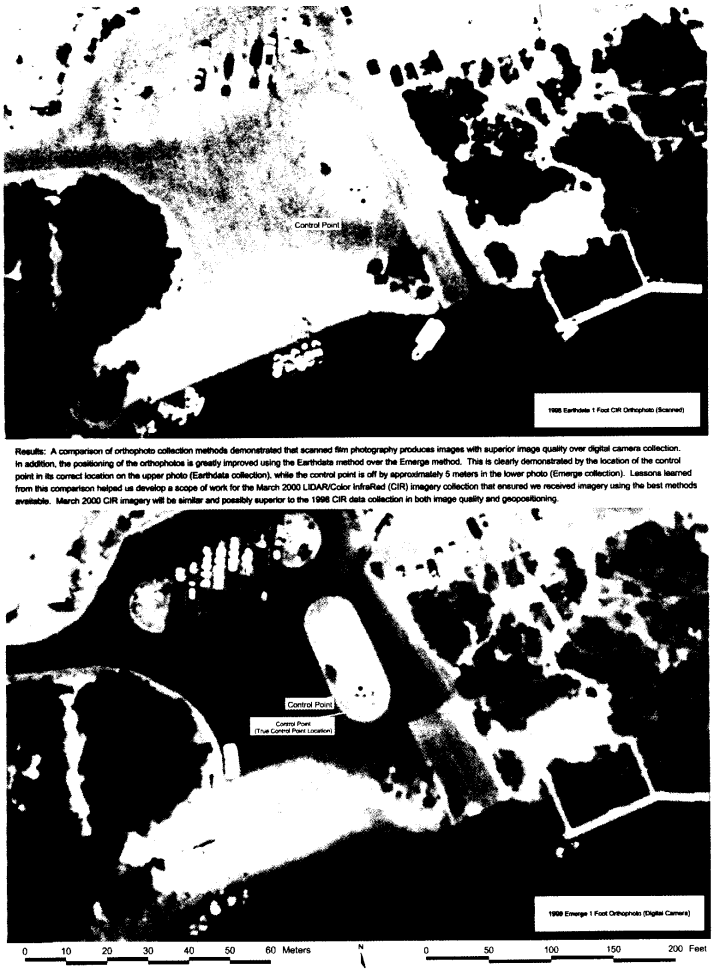
Through the evaluation process of current and emerging technologies, the GCMRC Remote Sensing initiative has already saved millions, while delivering superior products to the stakeholders and scientists.

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.

Comparison of Orthophoto Collection Methods



Results: A comparison of orthophoto collection methods demonstrated that scanned film photography produces images with superior image quality over digital camera collection. In addition, the positioning of the orthophotos is greatly improved using the Earthdata method over the Emerge method. This is clearly demonstrated by the location of the control point in its correct location on the upper photo (Earthdata collection), while the control point is off by approximately 5 meters in the lower photo (Emerge collection). Lessons learned from this comparison helped us develop a scope of work for the March 2000 LIDAR/Color InfraRed (CIR) imagery collection that ensured we received imagery using the best methods available. March 2000 CIR imagery will be similar and possibly superior to the 1998 CIR data collection in both image quality and geopositioning.

PRODUCTS FROM MARCH 2000 DATA COLLECTION

Topographic Base Map Deliverables are:

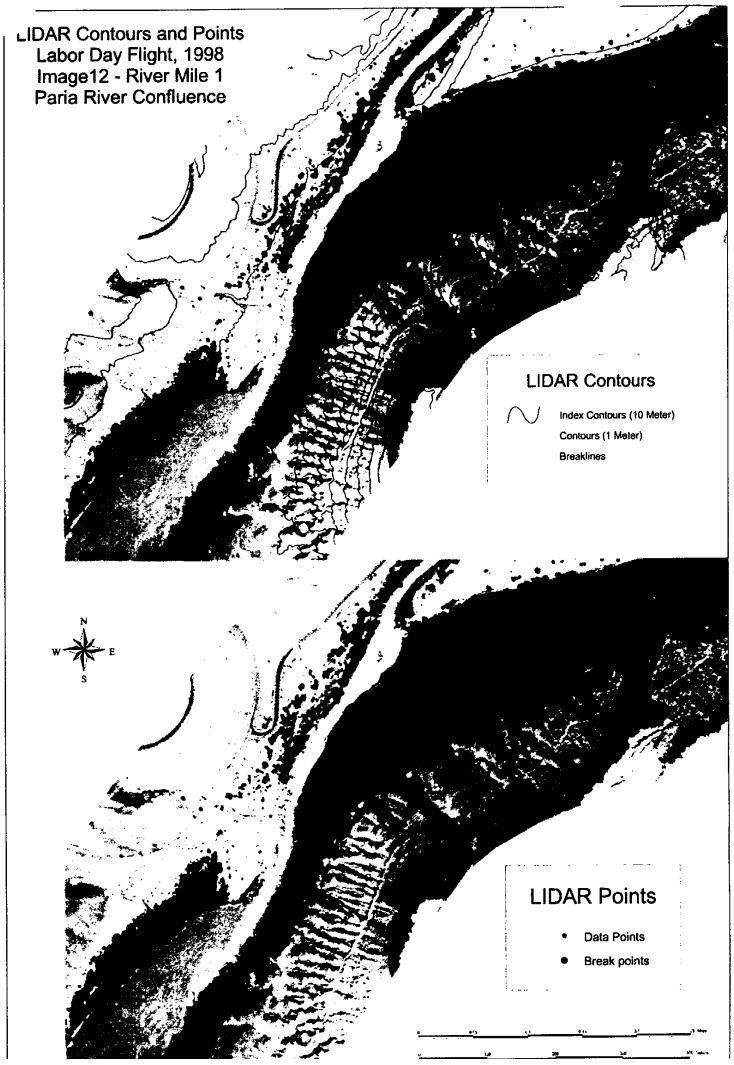
1 meter contours
1 meter Digital Elevation Model (DEM)
Metadata

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

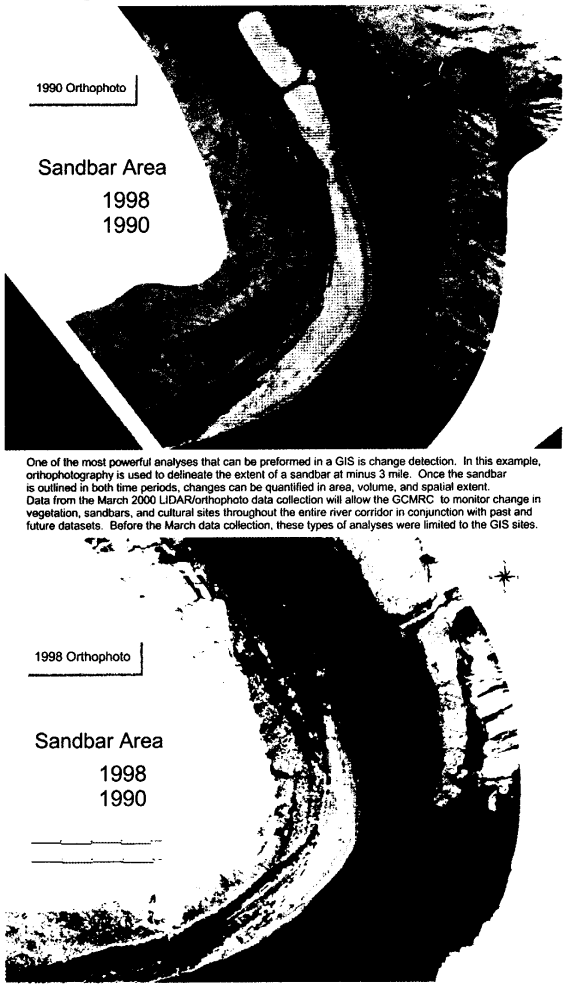


ANALYSIS USING LIDAR DATA

- Change detection
- Flood Prediction
- 3D Visualization

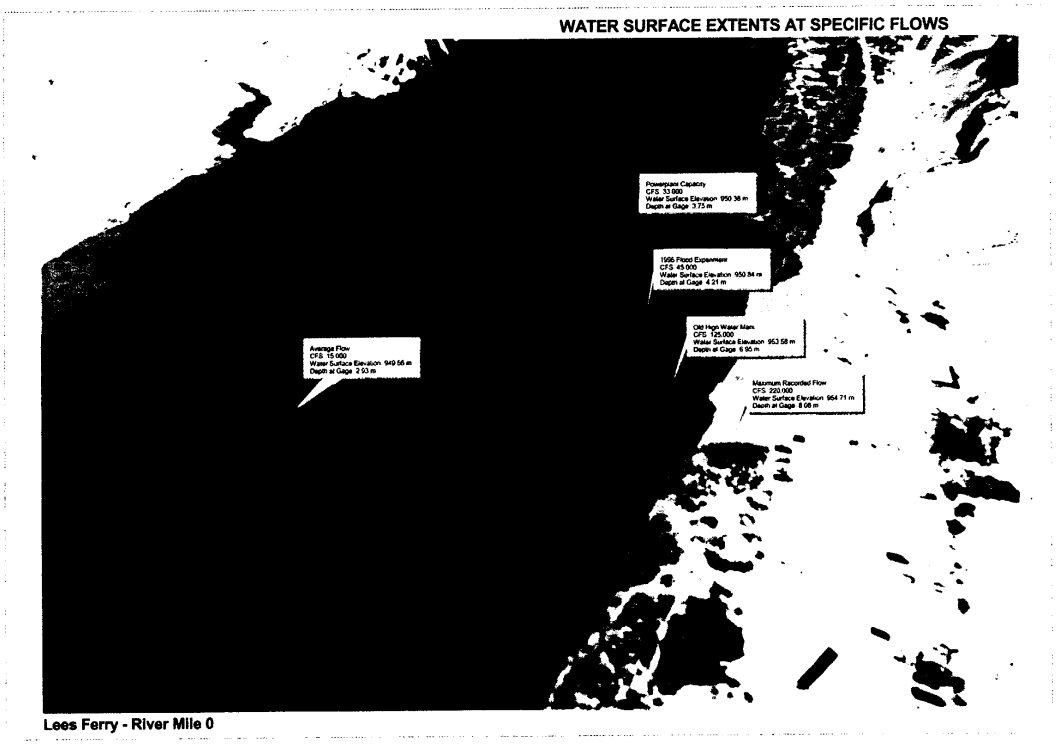
CHANGE DETECTION OF SAND BARS

Change Detection using Orthophotography



One of the most powerful analyses that can be preformed in a GIS is change detection. In this example, orthophotography is used to delineate the extent of a sandbar at minus 3 mile. Once the sandbar is outlined in both time periods, changes can be quantified in area, volume, and spatial extent. Data from the March 2000 LIDAR/orthophoto data collection will allow the GCMRC to monitor change in vegetation, sandbars, and cultural sites throughout the entire river corridor in conjunction with past and future datasets. Before the March data collection, these types of analyses were limited to the GIS 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.