Rapid Progradation of River Deltas into Lake Powell
March 2002 to March 2004

John C Dohrenwend
Southwest Satellite Imaging
An ongoing program of monitoring and analysis including:

1. Ground-based observation documented by repeat photography
2. Water-based observation and measurement
3. Aerial observation
4. Analysis of repeat satellite imagery (Aster & Landsat)
With a little help from my friends:

Bob Jones, Tagalong Expeditions, Moab
John Weisheit, Living Rivers, Moab
Tom Farr, Jet Propulsion Laboratory, Pasadena
Charlie Trautwein, EROS Data Center, Sioux Falls
Aden Seidlitz, BLM, Richfield District
Tim Finger, BLM, Richfield District
COLORADO RIVER DELTA AT HITE MARINA

JULY 1999

1959 RIVER CHANNEL ELEVATION

1963-1986

1986-2000

modified from Mussetter & Morris, 2001
LAKE POWELL - POOL ELEVATION

Top of Active Storage (3,700 ft)

10 Jul 99  10 Mar 00  08 Nov 00  09 Jul 01  10 Mar 02  08 Nov 02  09 Jul 03  09 Mar 04
The Delta of the Colorado
The Delta of the Dirty Devil
Flash Flood on the Dirty Devil
Delta Surface Processes
Methane Springs & Mud Volcanoes

Channel Incision

Lateral Slumping
Methane Springs and Mud Volcanoes
Channel Incision
Lateral Slumping
Extensive slumping has been limited to the lower end of the delta (within 10 river miles of the active delta front).
zone of recent exposure and pervasive slumping
Timing of Lateral Slumping

Lateral slumping has been most active following periods of high river flow and (or) rapid channel incision.
So how much erosion …?
… and where?
Delta Surface Erosion
June 2002 - March 2004
Total ~ 26,000 Acre ft
And where has it gone?
And where has it gone?

From June 2002 to April 2004, deposition on the delta front has more or less equaled erosion on the delta surface.

~26,000 acre feet have been eroded from the delta surface (upstream of the Dirty Devil)

~24,000 acre feet of sediment have been deposited on the delta front (downstream from the Dirty Devil)
In spite of low flows on the Colorado during the past two years, the rate of deposition on the delta front at Hite has been:

(a) approximately equal to the rate of deposition between 1963 and 1986; and

(b) almost twice the rate of deposition between 1986 and 2000.
What about the San Juan?
An unresolved issue

Complex erosional and depositional responses to concomitant variations in baselevel and river flow
(i.e. a comprehensive model for the delta system)
slumping near delta front

rapid channel erosion
(widening, deepening & slumping)
So what happens next?
PREDICTIONS

During the next 12 to 24 months:

- The surfaces of the Colorado and San Juan deltas will continue to be exposed and will continue to erode
- If the drought continues, rates of erosion on delta surfaces and deposition on delta fronts will probably decrease
- If the drought continues and releases from Glen Canyon Dam continue at the present rate, the elevation of Lake Powell will probably drop to 3490 feet by September 2005
GLEN CANYON DAM

POOL ELEVATION (FEET)

3700
3583
3490
3470
3374

September 2005
CONCLUSION

The erosional degradation and rapid progradation of the exposed Colorado River delta at Lake Powell affords an excellent opportunity for the study of sedimentation in large reservoirs. To forecast the useful life of such reservoirs more accurately, subsequent changes in this delta system should be precisely and systematically monitored over the next several years.