



# THE GIGAPXL PROJECT

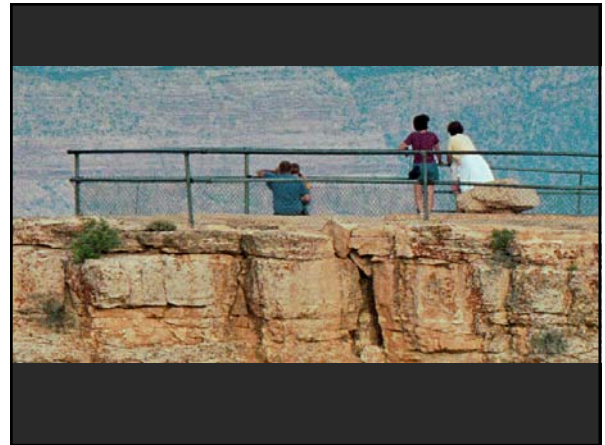
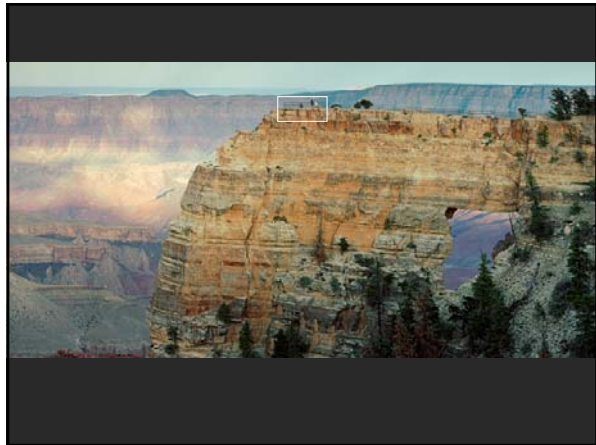
Graham Flint  
Catherine Aves  
Michael Jones



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Angel's Window on trail to Cape Royal  
9" x 18" format, 200mm lens  
1-stop grad filter, center filter, f/22, ¼ sec



## CULTURAL ARCHIVES



Newspaper Rock State Historical Park

- Real-world dimensions ~ 8m x 4m
- Normal viewing distance ~ 4.5 m
- Close-up zoom ratio ~ 15:1



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## CULTURAL ARCHIVES



- Close-up viewing distance ~ 0.3 m
- Required pixel count at rock face (20/20 vision equivalent) ~ 11.5 mm<sup>-1</sup>
- Full image pixel count ~ 4.2 gigapixel

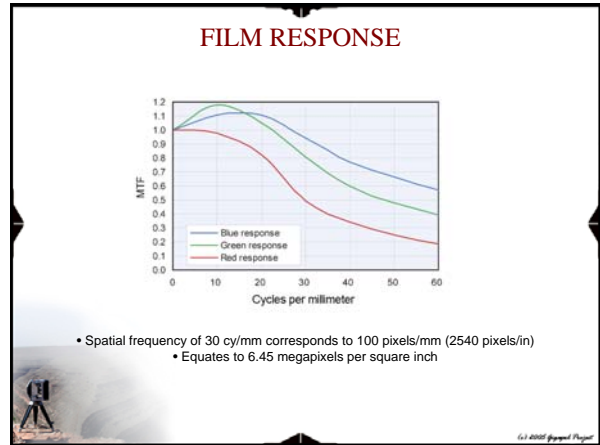
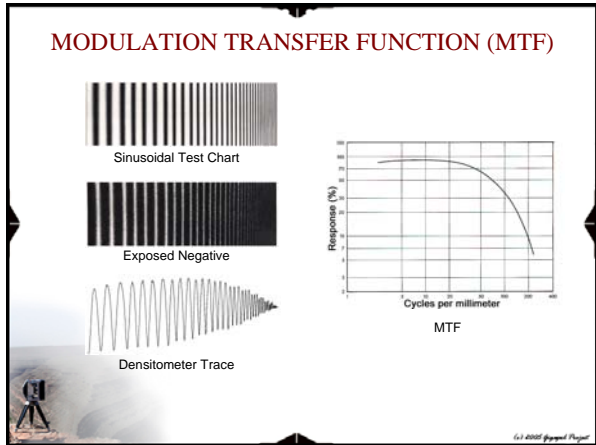
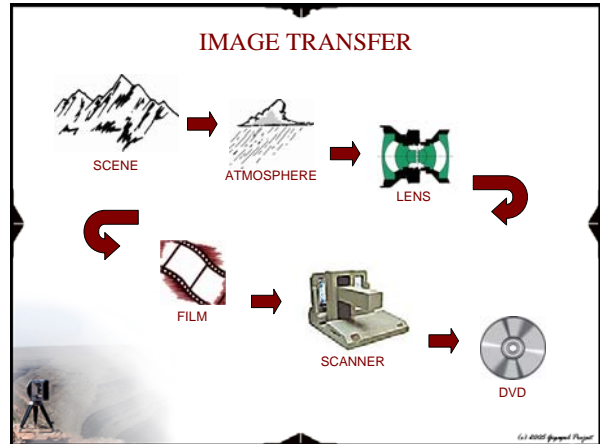


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### WHY USE FILM IN THE DIGITAL AGE?

Pixels per frame	$4 \times 10^9$
Capture time	1/125 sec
Data per pixel	36 bits
Information capture rate	$1.8 \times 10^{13}$ bits/sec

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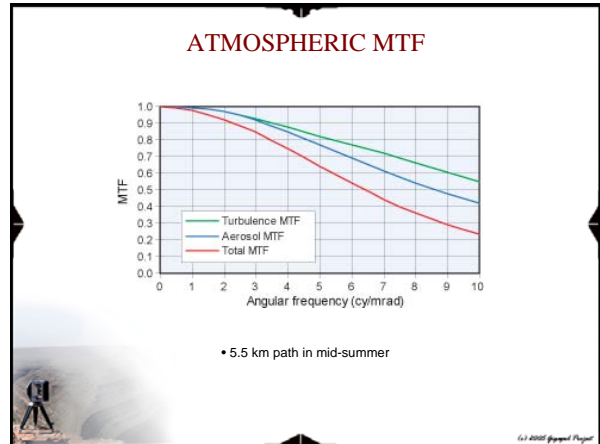
### CHOICE OF FORMAT

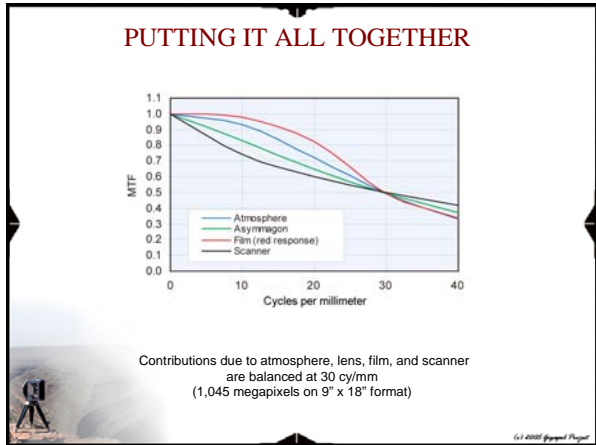
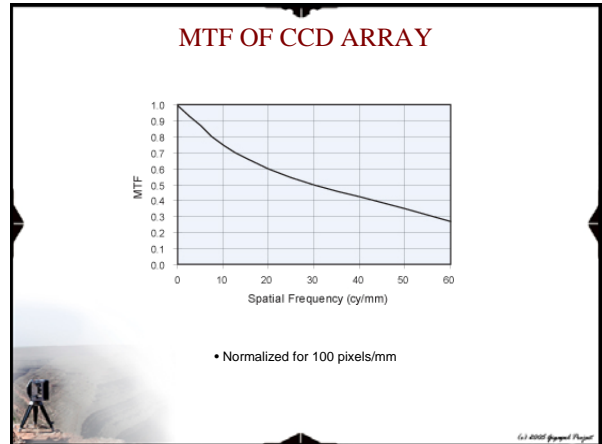
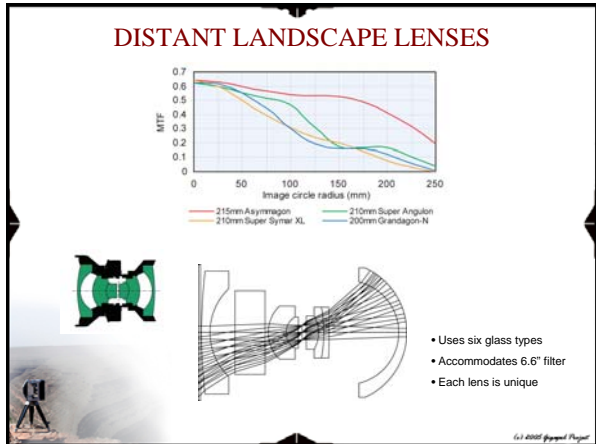
1000 megapixels at 6.45 megapixels/sq.in. requires a film area of 155 square inches (twice the area of an 8" x 10")

14" x 14" plate  
(196 sq in)

9" x 18" roll  
(162 sq in)

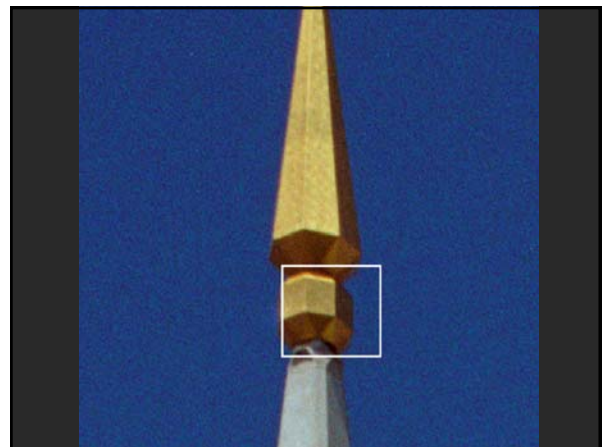
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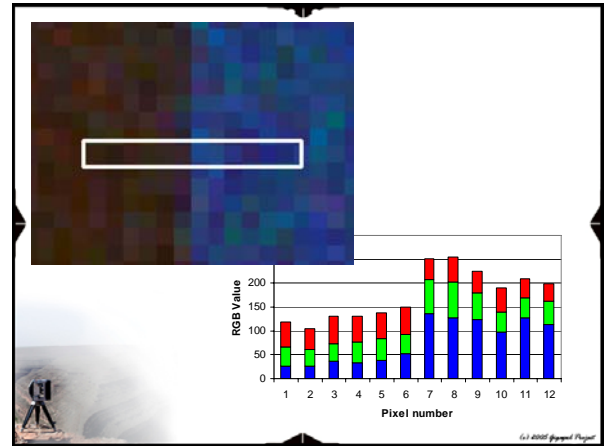
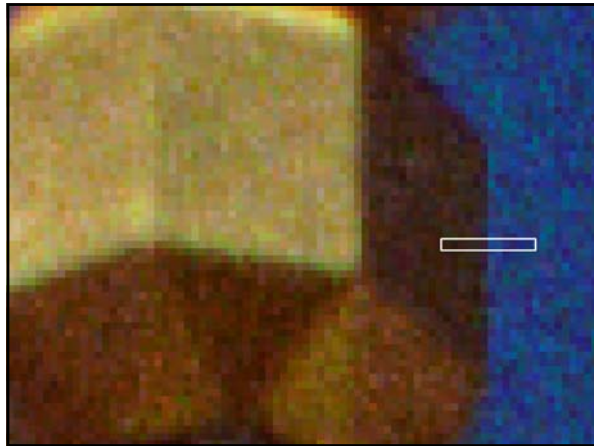




### ULTRA-WIDE CAMERA DESIGN

- 60-shot magazine
- Rapid manual advance
- Vacuum film hold down
- Dial indicator focus/tilt
- Interchangeable magazines
- Exposure counter
- Wheel sockets





### SCANNING & PROCESSING

- Scanner: Leica Geosystems DSW700 (2000-4000 ppi)
- Processing Hardware:
  - Two custom PCs (AMD Athlon 64 & PIV 3GHz) each with:
    - Two 120Gb drives (one each exclusively for Photoshop files and scratch space)
    - Two dual DVD burners
    - RAM: 3Gb (2Gb dedicated to PS)
    - NVidia Quadro4 980 XGL graphics board
- Printer: Epson Stylus Pro 9600
  - 7-color Ultrachrome inks
  - Epson Enhanced Matte paper
- Storage media: DVDs & external hard drives (Lacie, terabyte)
- Software:
  - Adobe Photoshop CS2
  - ColorByte ImagePrint RIP

### PORTRAIT OF AMERICA STATUS

- > 1,100 photographs
- 502 locations
- 46 states & provinces
- 28 national parks
- 39 state/regional parks & monuments
- 91 cities

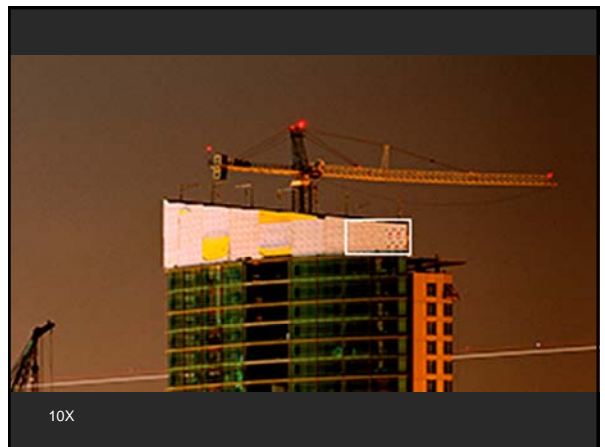
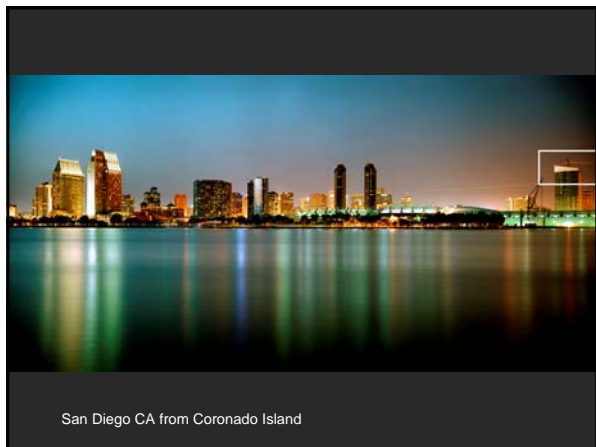
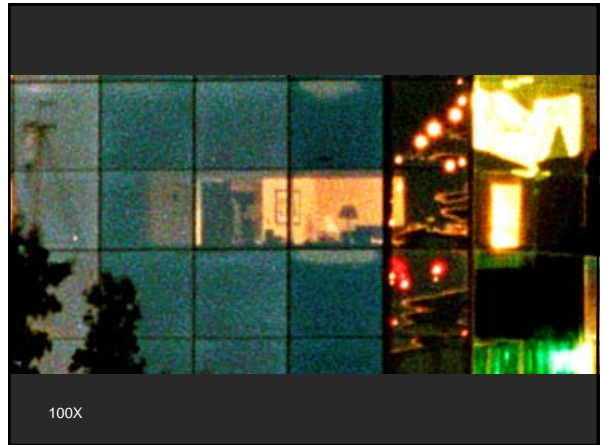
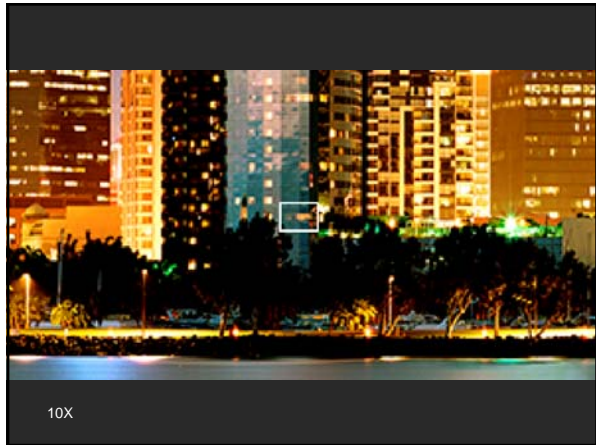
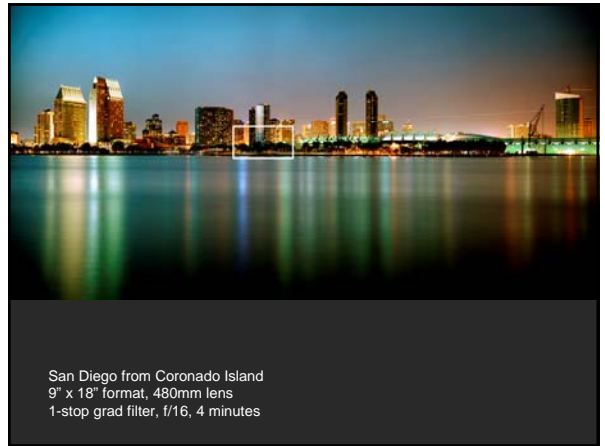
05/05/05

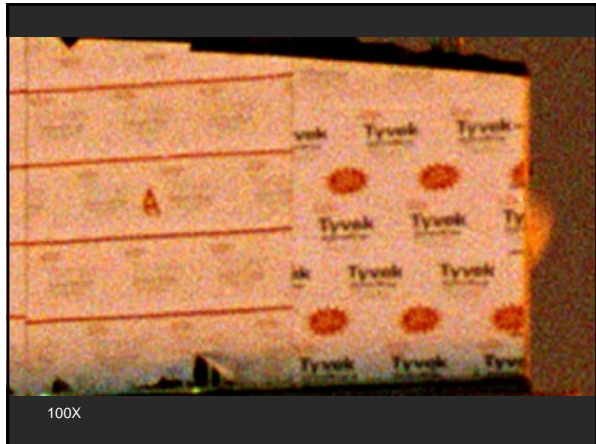
Red – sites photographed  
Blue – sites to be photographed summer/fall 2005

### PORTRAIT OF THE WORLD

Focus on UNESCO World Heritage Sites

- Multicultural significance
- Sites presently at risk
- 788 locations worldwide
- Vastly greater task
  - Teams
  - Cameras
  - Logistics






100X

**BUILDING RESTORATION**

Example of deteriorating building  
At 5.5X chisel marks visible

Ultra-high resolution provides large-scale prints for use as restoration guides



Museum of Art  
Balboa Park  
San Diego CA



**REVELATIONS IN THE DIGITAL DARKROOM**  
*or*  
Just one more benefit of ultra-high resolution



Parasailers at Torrey Pines, San Diego CA





## NOISE REDUCTION

- Structured noise addressed via straightforward FFT routine
- Random noise (grain related)
  - Favorable ratio of smallest image feature to grain density
  - Wavelet-based image decomposition and reconstruction
- Superior to standard Photoshop™ plug-ins
- Less effective than elaborate movie industry techniques (CINESITE, etc.)
- Well suited to images in the 1-4 billion pixel regime

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### Balboa Reflecting Pool

Reflecting pond, Balboa Park, San Diego CA

### Balboa Reflecting Pool

## THE GIGAPXL PROJECT

Near-term objectives (1-2 years)

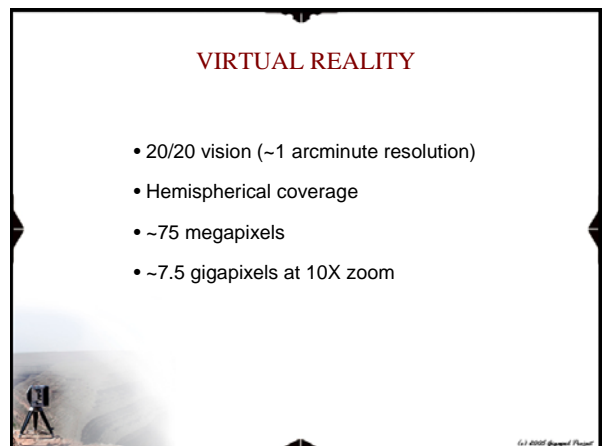
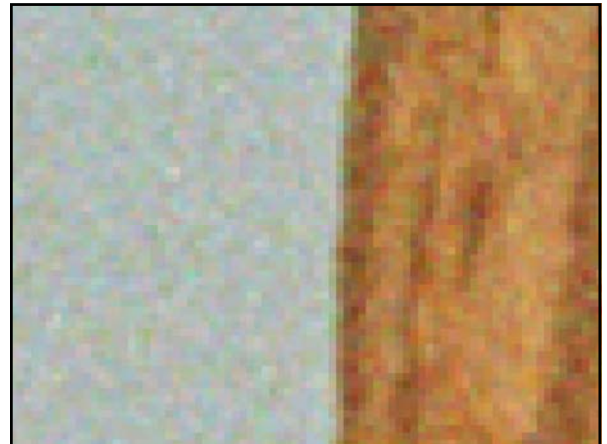
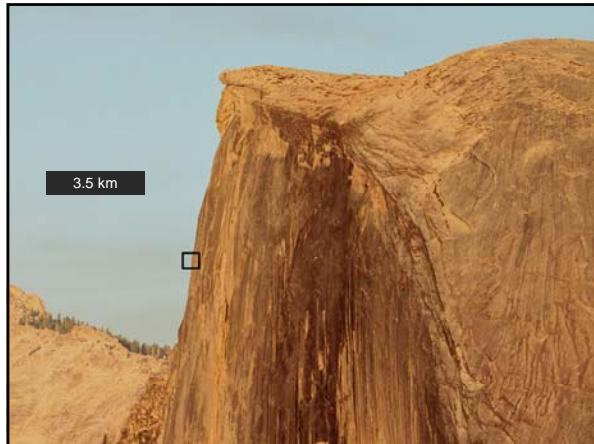
- Maximize the information content of photographic images
- Generate an ultra-high-resolution portrait of North America
- Disseminate images for use and enjoyment by others

Long-term objectives (3-6 years)

- Expand to world-wide coverage
- Provide future generations with an archive of sites which cannot be physically preserved

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Half Dome from Glacier Point, Yosemite NP





## CHOICE OF FOCAL LENGTH

- Focal length too short, film resolution dominates
- Focal length too long, atmospheric blurring dominates
- Distant landscapes (5-20 km)
  - Matched focal length 200-300 mm
  - Ultra-wide angle for 9" x 18"
- Typical cityscapes (0.1-1.5 km)
  - Matched focal length 400-600 mm
  - "Normal" lens for 9" x 18" format



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