

An aerial photograph of a suburban neighborhood. The image shows a grid of streets with houses, trees, and lawns. A large, bold, yellow text overlay is positioned in the upper left quadrant. The text reads "Advanced Mapping with Digital Sensors".

Advanced Mapping with Digital Sensors

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Why Digital Imagery?

- Eliminates film, lab processing, digital scanning
- Highest quality imagery available today
 - Very high signal-to-noise ratio (SNR)
- 12-bit data results in stunning imagery
 - 4096 values versus 256 in 8-bit imagery
- No artifacts to deal with... lint, dust, scratches
- Very stable geometry, first generation imagery
- Simultaneous collection of pan, color, and IR

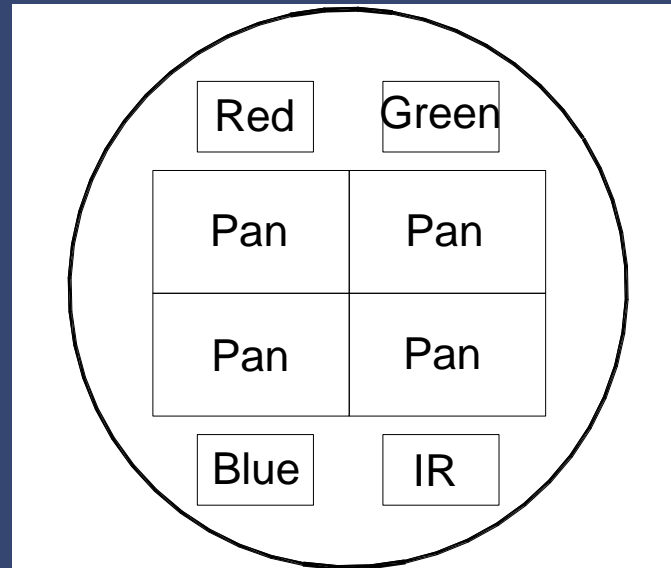
Advantages of 12-bit Imagery



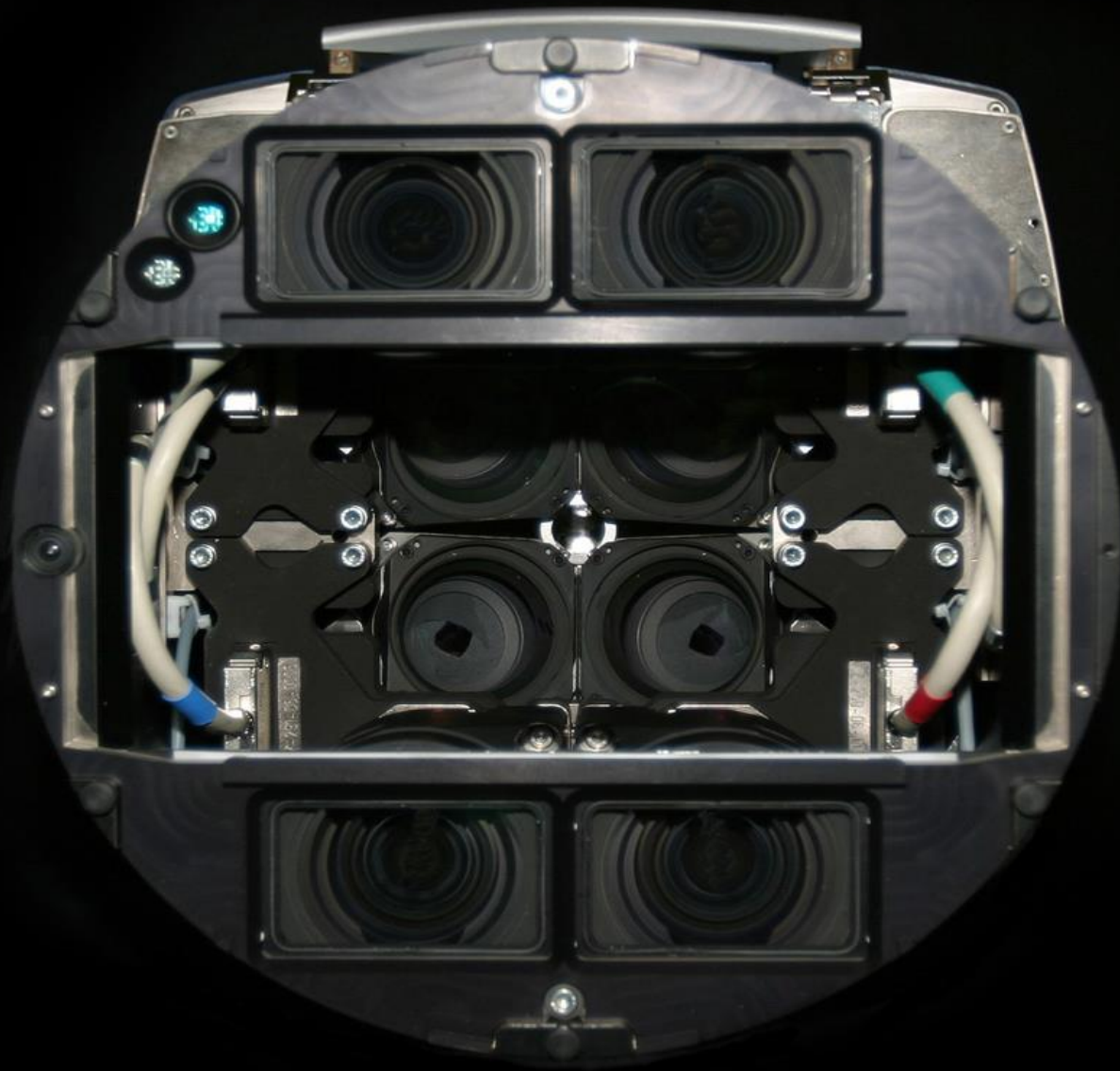




Z/I Digital Mapping Camera



State-of-the-art digital framing camera produces exceptional imagery.







Digital Cameras

- Cost \$400K to \$1.5M
- Two types... framing camera and push broom.
- Several advantages, few disadvantages compared to film cameras.



Digital Sensors Today

- Large-Format Framing Camera
 - Z/I Digital Mapping Camera (DMC)
 - Vexcel Ultra Cam D
- Large-Format Push Broom Sensor
 - Leica Geosystems ADS 40
 - Jena JAS 150
- Medium Format Framing Sensors
 - Applanix Digital Sensor System (DSS)
 - Digital Modular Aerial Camera (DIMAC)

Digital Camera versus Film

- Advantages
 - B&W, color, and infrared in a single pass.
 - No need for film, processing, other lab products.
 - Scanning not required.
 - Imagery free from lint, dust, scratches.
 - Production of imagery can start on the same day of flight.
 - Better spectral resolution than film cameras.
- Disadvantages
 - Calibration somewhat of an issue
 - Data storage from capture until production!



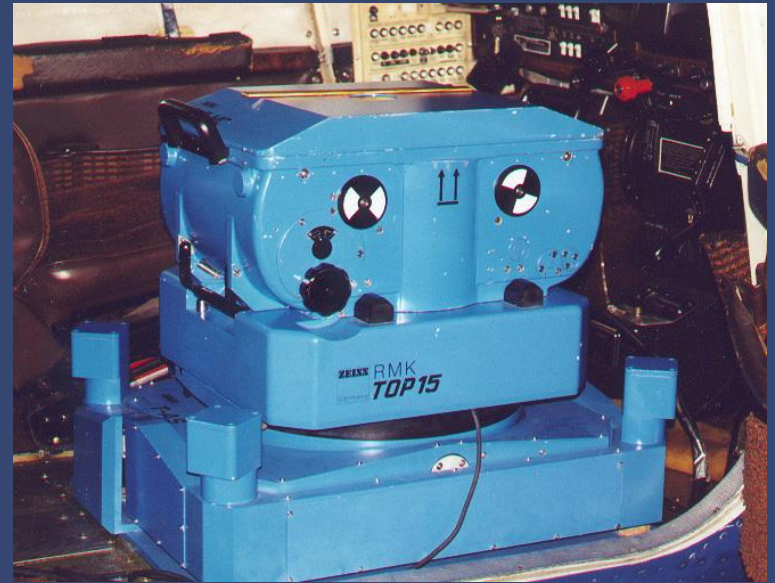
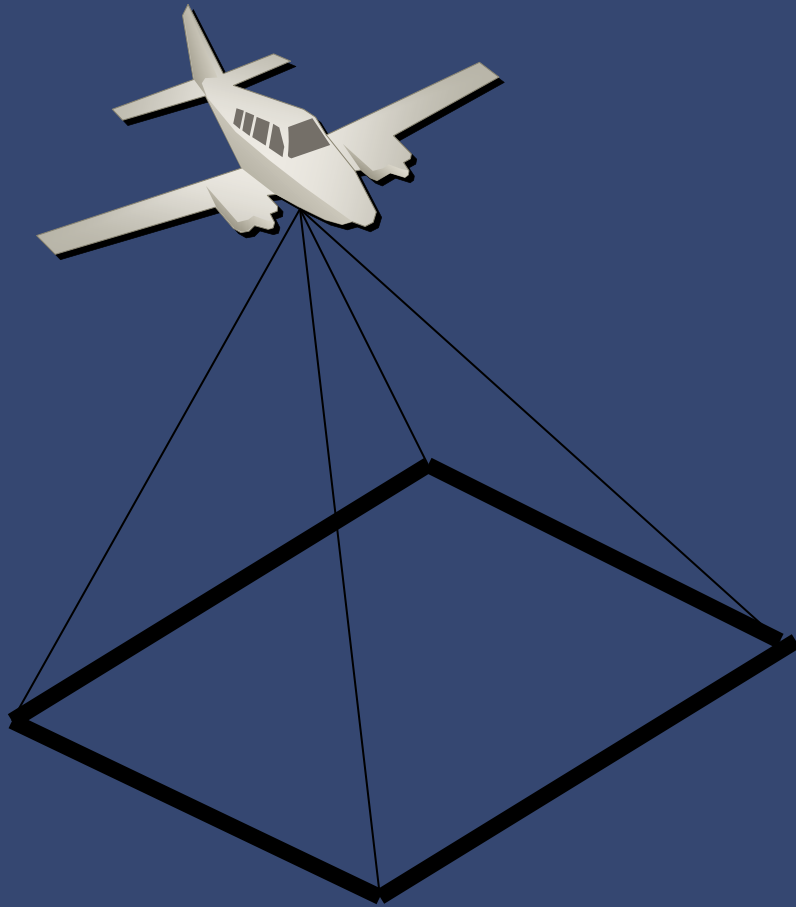
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Traditional Film Approach



Film Approach

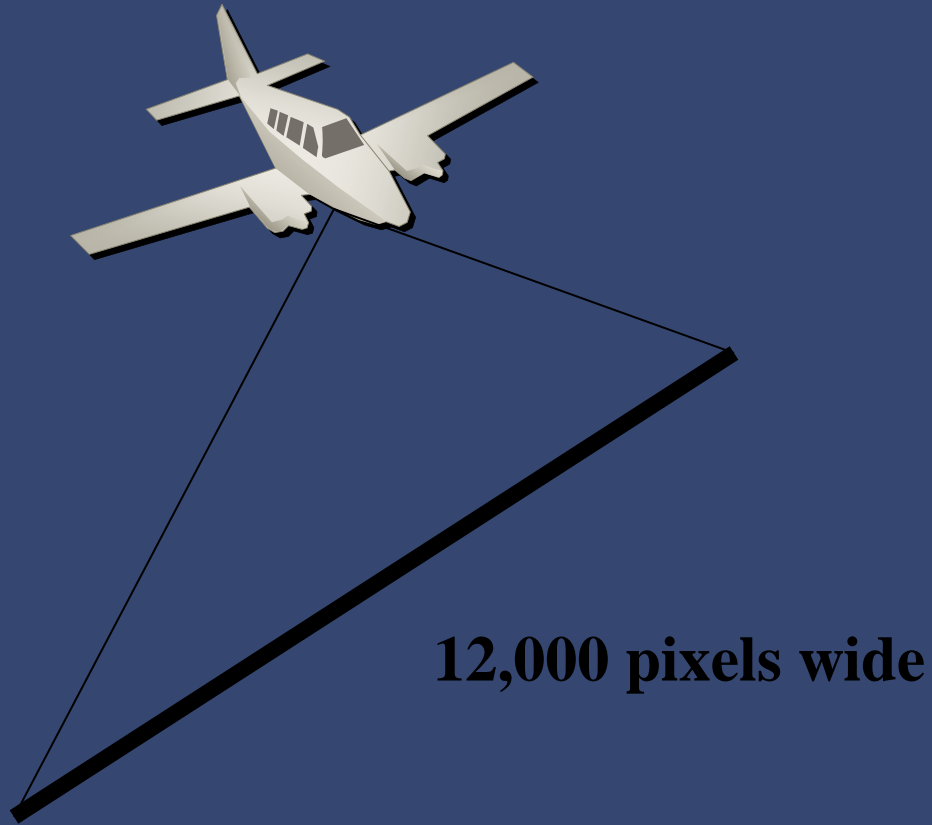
Advantages

- Many film cameras owned by mapping firms
- Most have FMC capabilities
- Relatively inexpensive (\$100k to \$500k)
- Strong geometry for mapping applications

Disadvantages

- Must scan analog film to get to digital environment
- Film grain, dust, lint, hairs evident in imagery

Pushbroom Sensor (Leica ADS 40)



Pushbroom Digital Approach

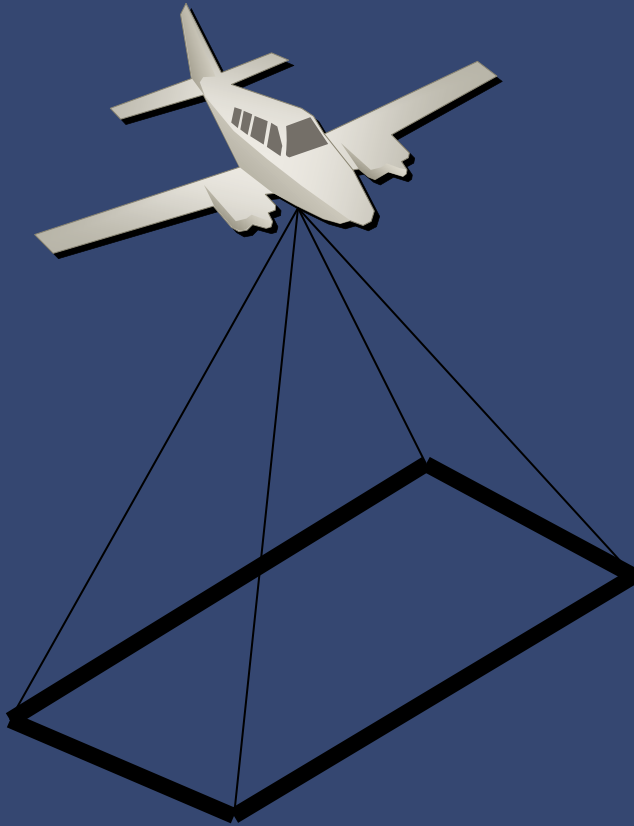
Advantages

- High quality digital imagery (1' and less resolution)
- Medium cost digital platform (\$1M)
- Simultaneous capture of pan, color, and IR
- Productive for creation of digital orthophotos
- Does not require mosaic lines in the direction of flight

Disadvantages

- Weaker mapping geometry than both film and DMC
- Aerotriangulation solution less rigorous
- More difficult to create stereopairs for compilation

Framing Sensor (Z/I DMC)



DMC Approach

Advantages

- Highest quality digital imagery available today
- FMC included on all cameras
- Very strong geometry for mapping
- Ideal for AT, easy to create stereopairs for compilation
- Capable of very high image resolution (to 0.10 feet)
- Simultaneous capture of pan, color, and IR

Disadvantages

- Most expensive hardware available (\$1.8M)
- Requires ortho mosaic lines in the direction of flight

Comparison of Camera Options

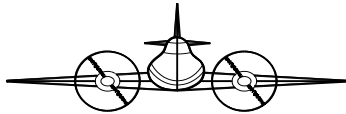
	DMC	ADS 40	Film
Highest Quality Imagery	√	√	
Forward Motion Compensation	√		√
Strong Mapping Geometry	√		√
Most Productive for Orthos		√	
Ability to Perform AT	√		√
B&W, Color, Color IR	√	√	
Maximum Ideal Resolution	0.10'	0.5'	0.25'

Data Issues

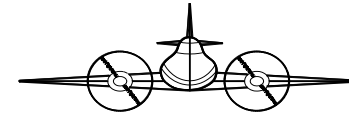
- High resolution cameras can create 900 GB of data per flying day.
- Data storage and backup problems are significant.
- Timing from flight to production an issue.

PennDOT Accuracy Analysis

2,000'

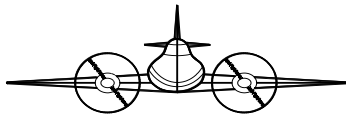


Film



DMC

1,200'



Film

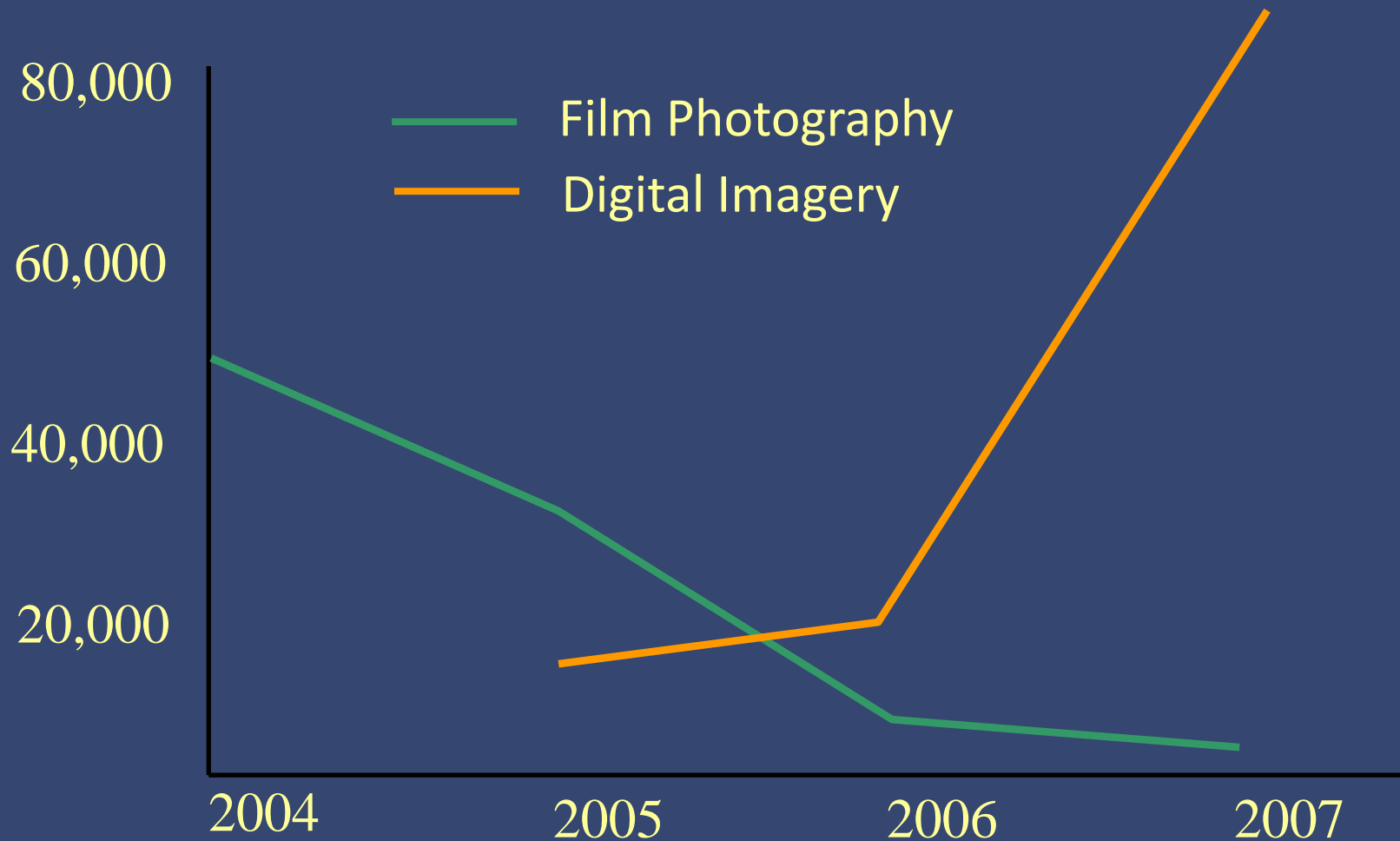
DMC Accuracy Analysis

- Performed in conjunction with PennDOT
- Film flown at 1,200' and 2,000' AMT
- DMC flown at 2,000'AMT
- 45 ground check points
- *Horizontal* accuracy of DMC comparable to 1,200' AMT film (RMSE 0.27' vs 0.28')
- *Vertical* accuracy of DMC comparable to 2,000' AMT film (RMSE 0.27' vs 0.27')

Digital Sensor Summary

- We are early on the technology curve
- 2008 will see many more mapping firms purchasing a digital sensor
- Hardware manufacturers will continue impressive R&D investments
- Not right for every project, but can be significant for the right ones
- Amount of spectral information far superior to any other acquisition method

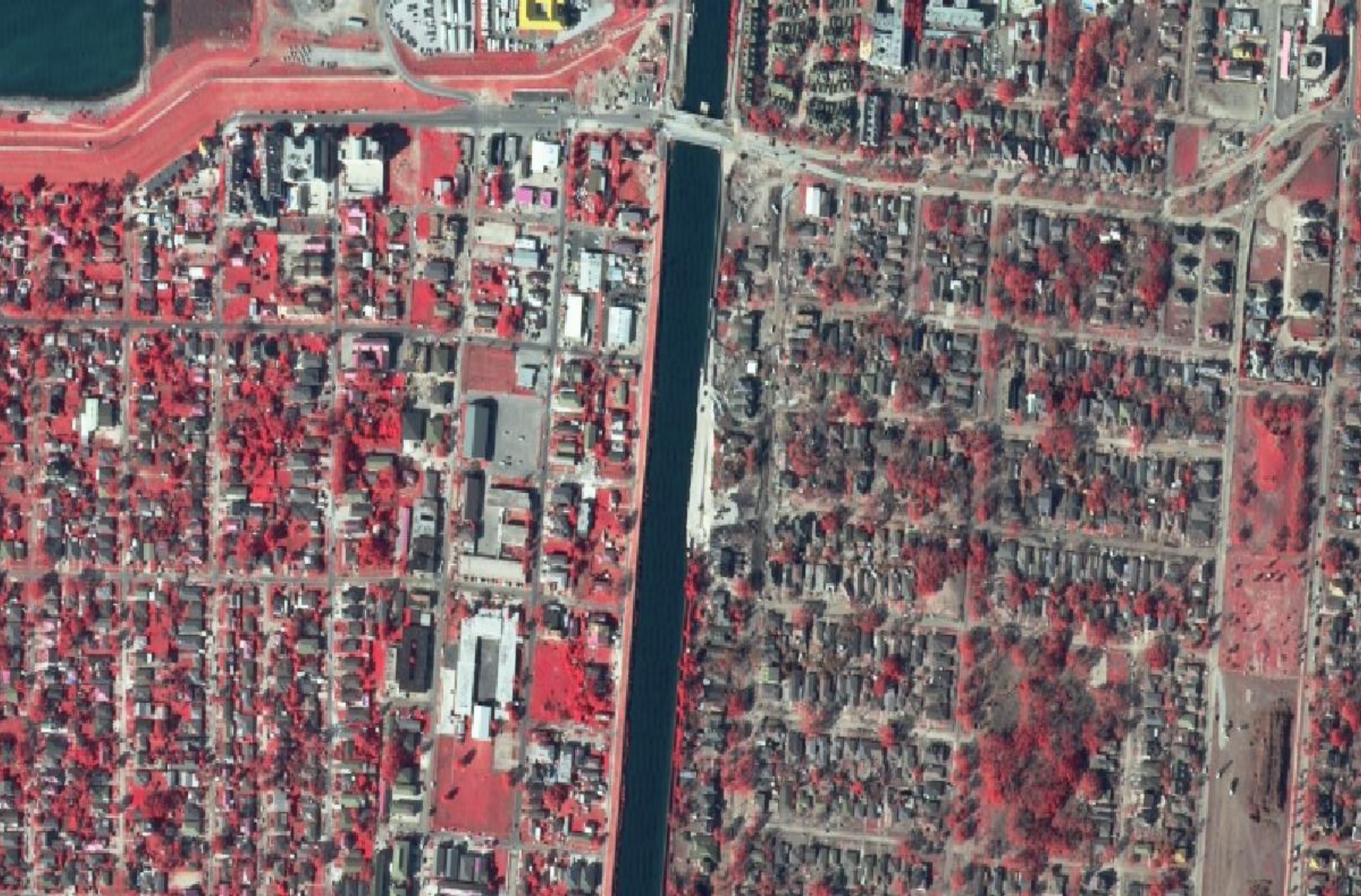
Number of Exposures... Film vs Digital













Questions?
