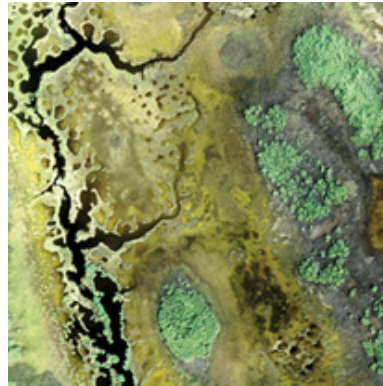


# Transition to Digital Acquisition

Presented to USDA Imagery Planning Meeting 12/04/08

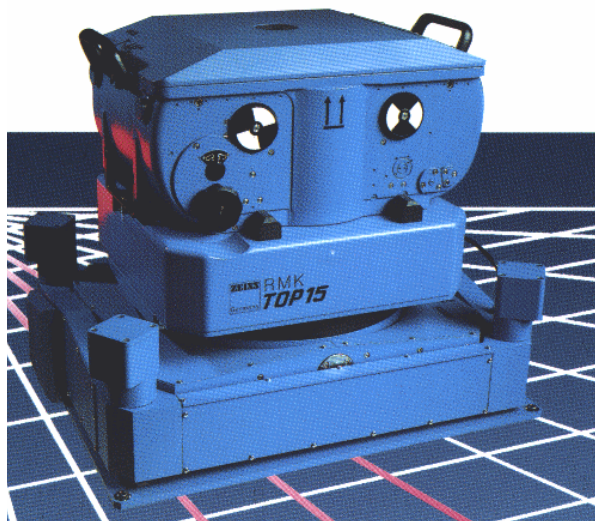
By: Alistair Stuart



 **INTERGRAPH**

# Transition to Digital Acquisition

From film-based photography to digital image acquisition.



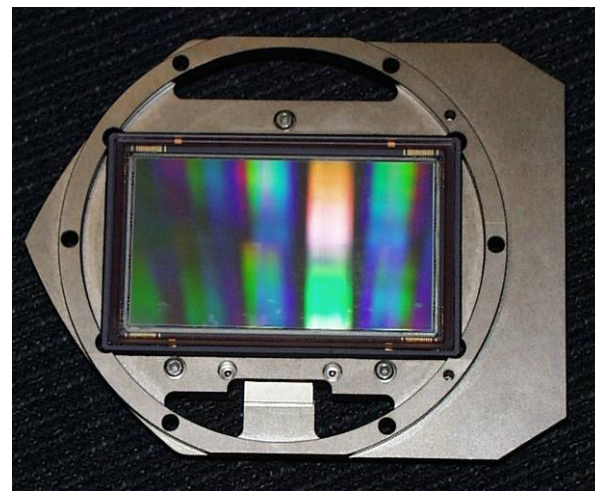
90 years

# Transition to Digital Acquisition

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## General Benefits of Digital Acquisition:

- Superior image quality
- 12-bit image data
- 4-band multispectral
- Higher geometric accuracy
- Compressed delivery schedule
- Completely electronic workflows



# Transition to Digital Acquisition

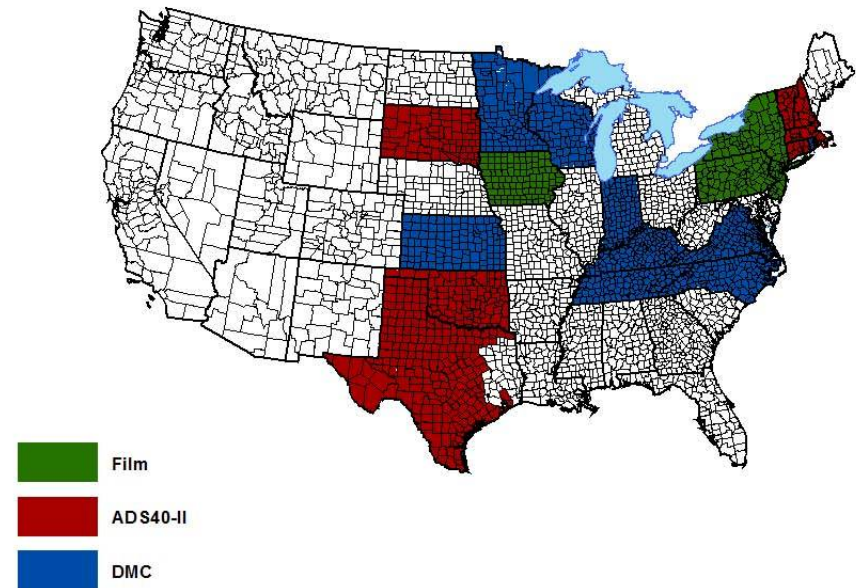
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## Image acquisition programs:

- **National imagery programs: NAIP, IFTN**
- **Traditional resource imagery: Forest Service**
- **Small area acquisition programs:**
  - **natural resource management & conservation**
  - **water resource / wetlands management**
  - **fish & wildlife**

- Transition to digital already well under way (>85% in 2008)
- 4 primes are DMC users
- Ideal program for large-format digital sensors:
  - Large area coverage
  - Rapid turnaround
  - Ortho deliverable
  - 4-band

2008 NAIP CAMERA TYPES





# NAIP - Future

- 100% digital in 2009
- 4-band multispectral
- Tighter absolute positional accuracy requirements
- Morph into IFTN?



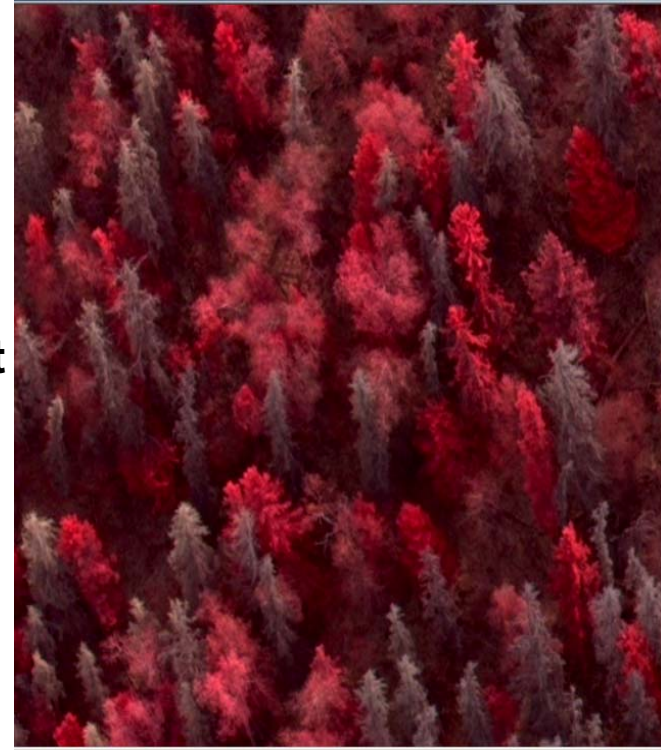
# Forestry Resource Programs

## Applications include:

- **Vegetation species mapping**
- **Wildfire fuel mapping**
- **Resource inventory, timber yield measurement**
- **Facilities mapping and design**

## Requirements:

- **Higher resolution (1 foot)**
- **60% forward overlap for stereo coverage**
- **ABGPS & IMU, Aerial Triangulation**
- **4-band (RGB & NIR)**
- **Pilot projects flown in 2008 with DMC**



# Small Area Acquisition Programs

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## Includes:

- **NRI/PSU**      **National Resource Inventory / Primary Sample Units**
- **FIA**            **Forest Inventory and Analysis**
- **CRP**            **Conservation Reserve Program**
- **WRP**            **Wetlands Reserve Program**



## Future Trends:

- **Film -> Digital**
- **Natural Color -> 4-band Multispectral**
- **Photo Analysis -> Orthoimages and GIS Mapping**
- **Increasing positional accuracy requirements:**
  - **ABGPS and IMU data**

# Transition to Digital Acquisition

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## Categories of digital sensors:

- **Large format – FOV equal or greater than 6” film cameras**
  - large area ortho programs created new market
  - big investment required(> \$1M)
  
- **Medium format – FOV ~ 50% of 6” film cameras**
  - more affordable
  - until now, no metric or 4-band sensors available
  - potential replacement of 6” film cameras for other applications
  
- **Small format**
  - not interesting – don’t meet geometric / radiometric requirements
  - previous “medium format” sensors should actually be here

# Transition to Digital Acquisition

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## Intergraph Solutions include:

- **DMC**            **large format metric digital mapping camera**
- **RMK D**        **medium format metric digital mapping camera**
- **Z/I Mount**    **3-axis gyro-stabilized mount**
- **Z/I Inflight**   **GPS flight management system**
- **GPS/IMU**     **direct georeferencing systems**

# Transition to Digital Acquisition

## Intergraph Sensors:

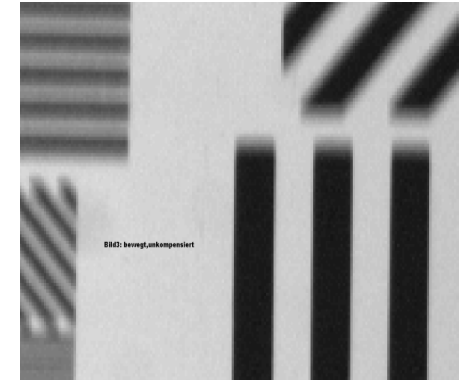
- Custom-designed, high quality optics
- Metric cameras - geometric accuracy
- Electronic Forward Motion Compensation
- 4-band multispectral
- Field-serviceable – maximize uptime



# Transition to Digital Acquisition

## Intergraph Sensors:

- Custom-designed, high quality optics
- Metric cameras - geometric accuracy
- **Electronic Forward Motion Compensation**
- 4-band multispectral
- Field-serviceable – maximize uptime



# Transition to Digital Acquisition

## Intergraph Sensors:

- Custom-designed, high quality optics
- Metric cameras - geometric accuracy
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# Transition to Digital Acquisition

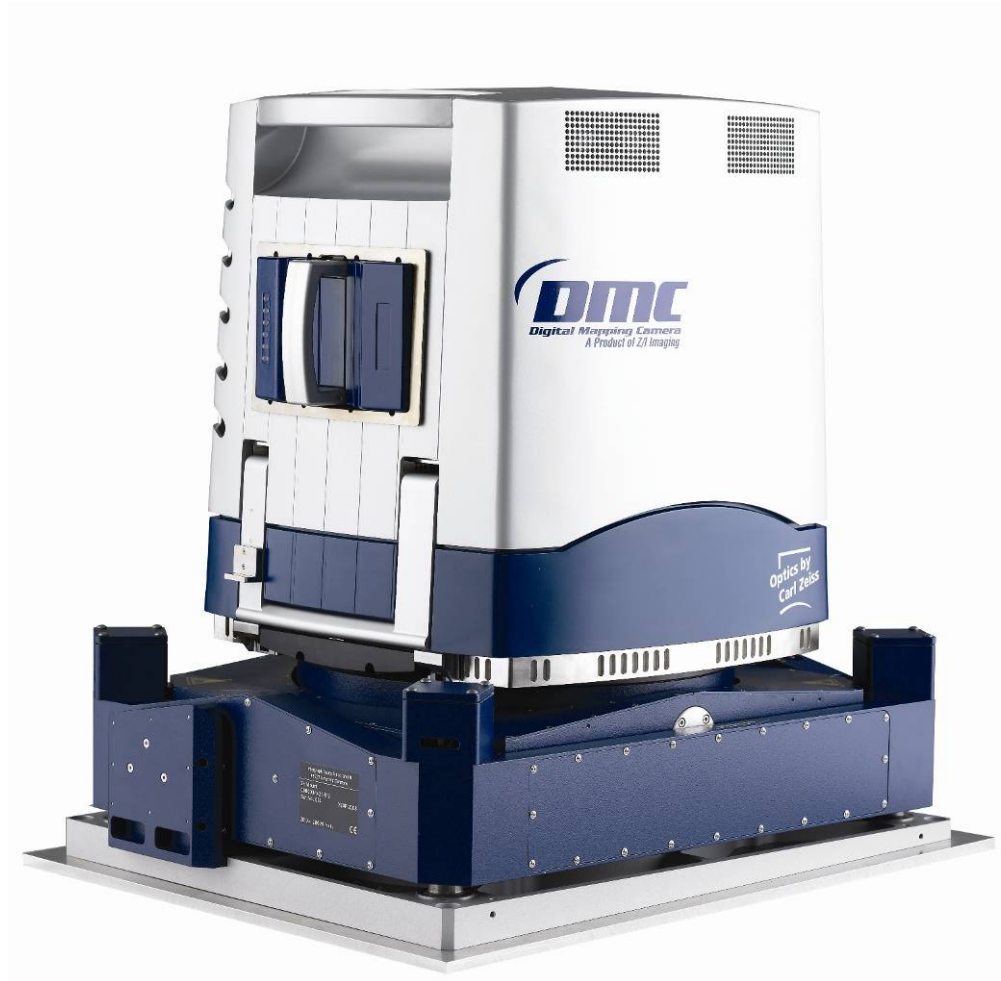
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## Intergraph Sensors:

- Custom-designed, high quality optics
- Metric cameras - geometric accuracy
- Electronic Forward Motion Compensation
- 4-band multispectral
- **Field-serviceable – maximize uptime**



# DMC Digital Mapping Camera



# DMC Overview

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- **Large format (13,824 x 7,680 pixel) metric frame camera**
- **Custom Optics by Carl Zeiss      F = 120mm    FOV = 70° x 42°**
- **Shutter, aperture continuously variable: 1/50 – 1/300 sec ; f/4 – f/22**
- **Electronic (TDI) Forward Motion Compensation**
- **Radiometric resolution: 12 bit**
- **Frame rate: 2.1 sec / image**
- **4-band Multispectral (B, G, R, NIR), pan-sharpened**
- **Solid State data storage – cartridges hold up to 2,000 images each**
- **Higher mapping accuracy than film**

**Suitable for deployment on:**

- **NAIP**
- **IFTN (all proposed resolutions)**
- **Forest resource mapping**
- **Any other large area programs**
- **Also capable of large scale mapping**
  
- **Versatility!**





- State-wide ortho projects
- 1.0 meter pixel

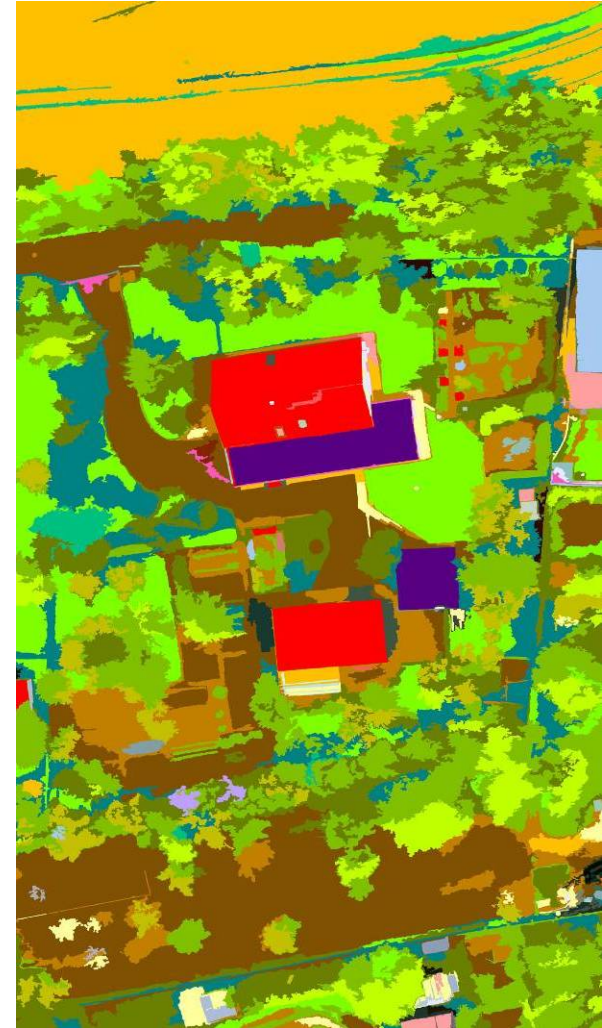
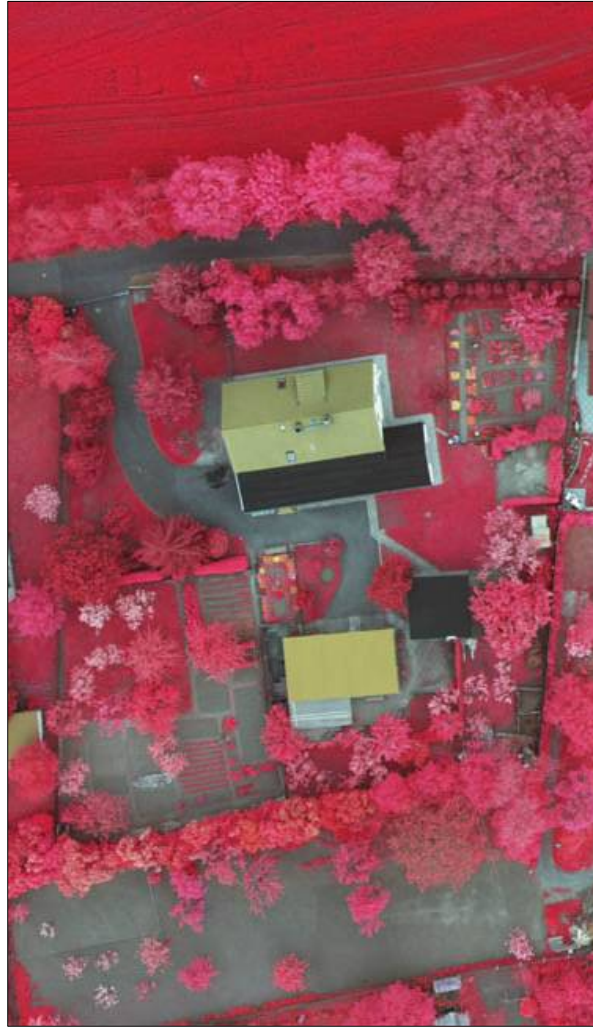




- Large-scale engineering projects
- < 5cm pixel



# Data Classification



# RMK D



- **The New Medium Format Digital Aerial Camera from Intergraph**

- **Medium format (6000 x 6500 pixels) metric frame camera**
- **Custom Optics by Carl Zeiss      F = 45mm    FOV = 52° x 55°**
- **Electronic (TDI) Forward Motion Compensation**
- **Frame rate: 1 second / image**
- **Radiometric resolution: 12 bit**
- **4-Band B, G, R, NIR – Full resolution, no Bayer pattern**
- **Solid-state data storage**
- **Light weight (~130 lbs) and Power-efficient (25Amp max load)**

- **Metric accuracy for even large-scale mapping projects**
- **Higher B/H ratio ( 0.42 ) for vertical accuracy**
- **Swath width approx 50% of DMC**
- **Entry-level pricing ~50% of large-format sensors**
- **Affordable to small businesses**

# RMK D Applications

Suitable for deployment on:

- Small Area Programs
- NRI PSU
- WRP
- Others?
  
- Pilot projects in 2009?





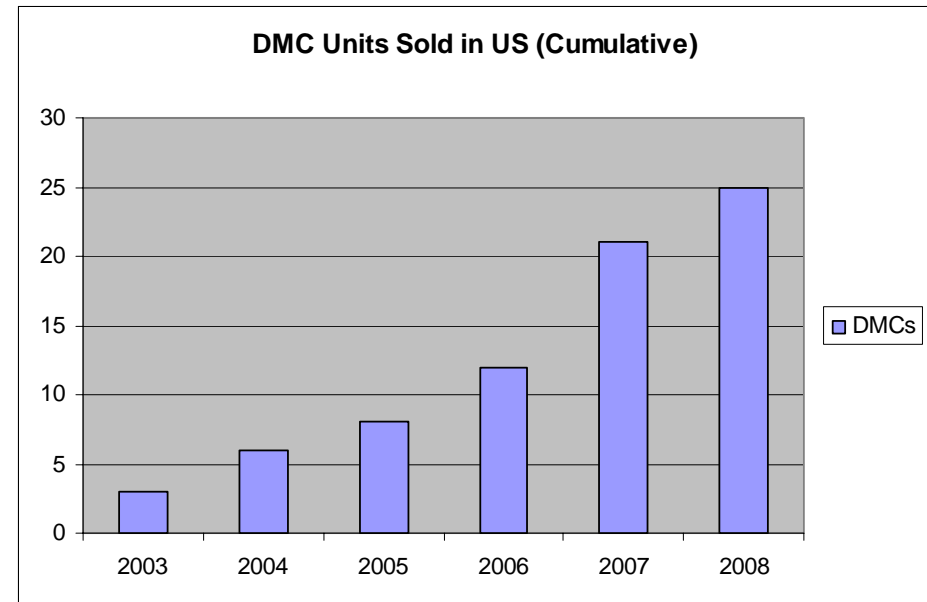
# US Commercial Capacity

## Systems deployed to date in the US:

- **DMC**                    **25 systems, of which 21 are with commercial users**
- **RMK D**                **First systems to be installed in 2009**

## Future Potential:

- **Film camera replacements: 150**





## Conclusions:

- **Transition for some large area programs almost complete**
- **New metric medium format sensors suitable for small area programs**
- **Significant benefits to users: image data quality and versatility**
- **Digital acquisition capacity of commercial fliers increasing**