

Digital Aerial Camera Technology Update

Klaus Neumann Product Manager Sensor Systems

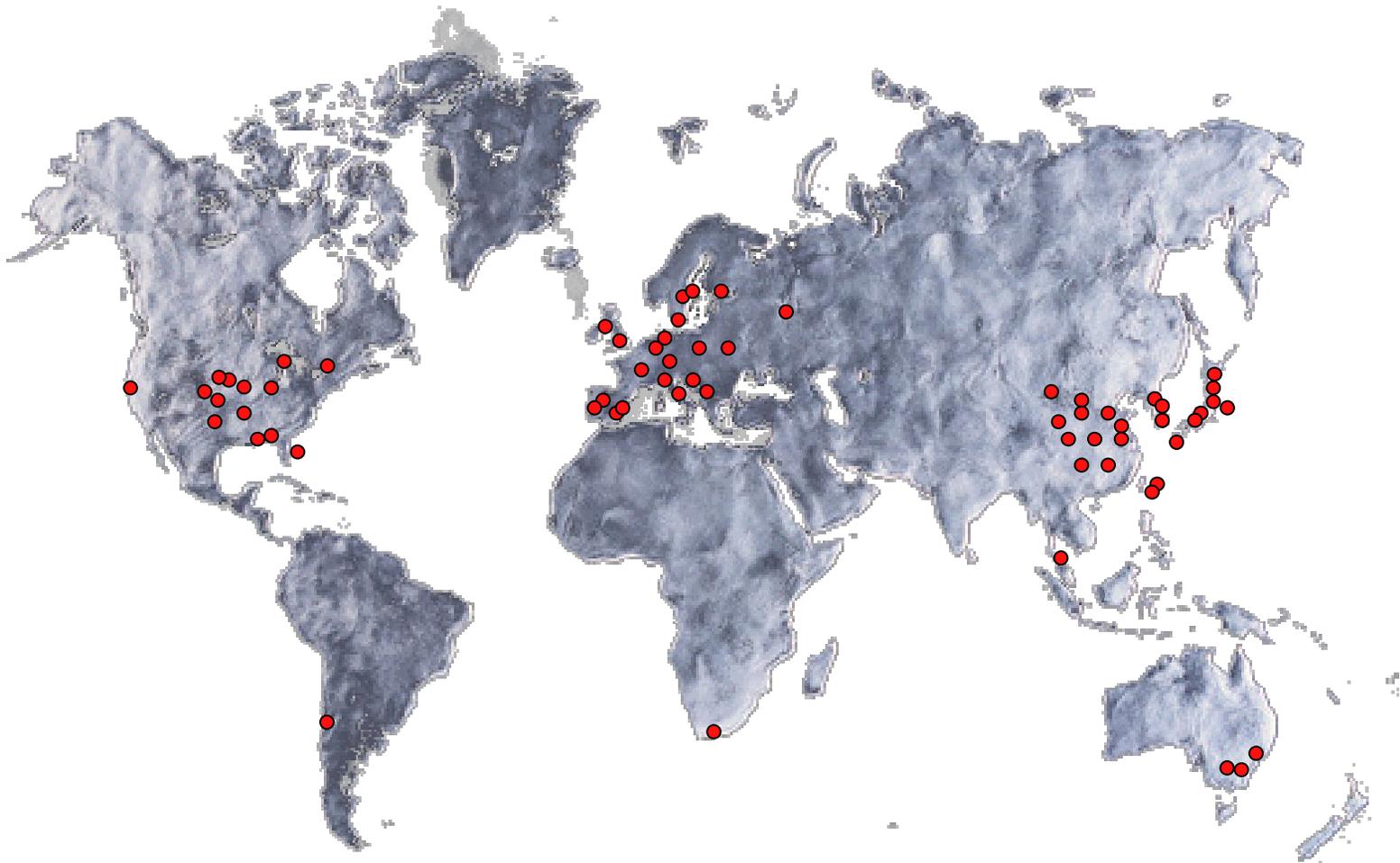


The logo for Intergraph, featuring the word "INTERGRAPH" in a bold, blue, sans-serif font. A grey swoosh underline is positioned above the letters "I" and "N".

Zeiss Jena Cleanroom Facilities



96 DMC sales worldwide



**30 operational DMCs
in the US and Canada**

DMC System Overview



Camera validation

- DMC is USGS certified
- In-field calibration verification
- Ongoing project on absolute radiometric calibration
- 740 nm cutoff filter for NIR channel
- 4 channel tiff output format
- 3001 flies the DMC for NGA
- GeoEye operates two DMCs

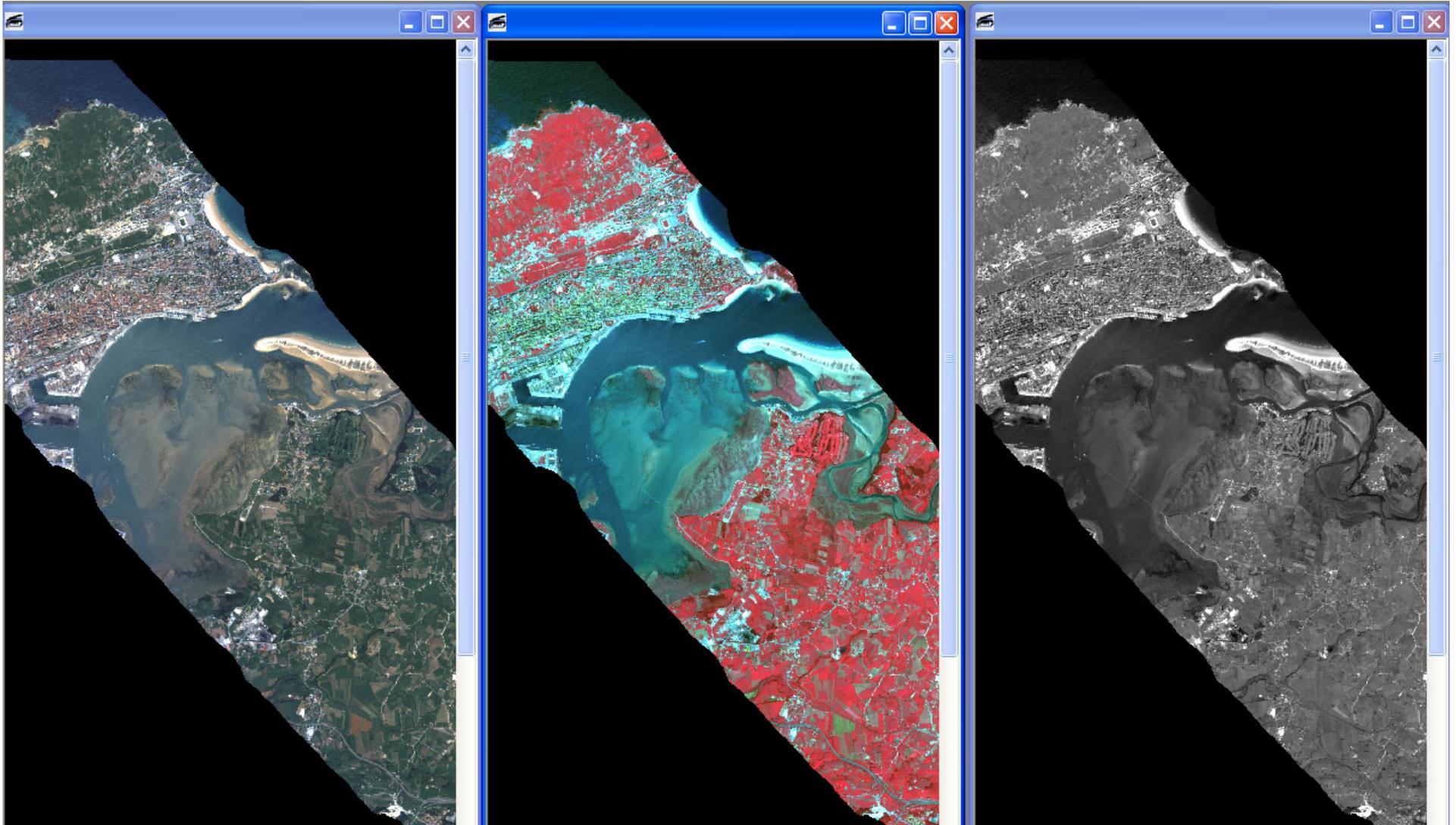
Color calibration



ICC
Institut Cartogràfic
de Catalunya

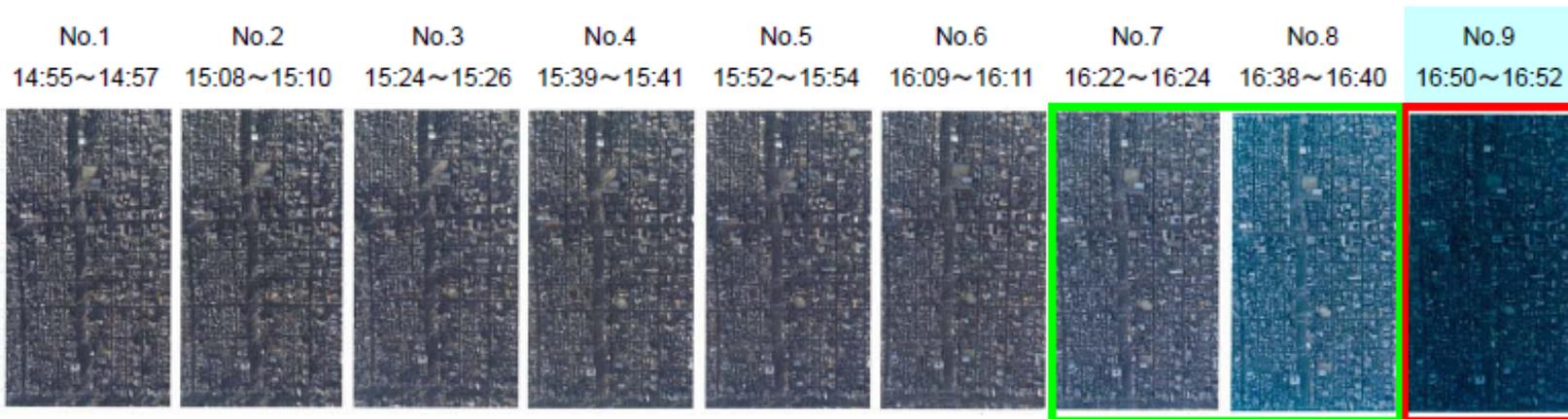


Simulated DMC imagery from 36-band CASI imagery on Santander

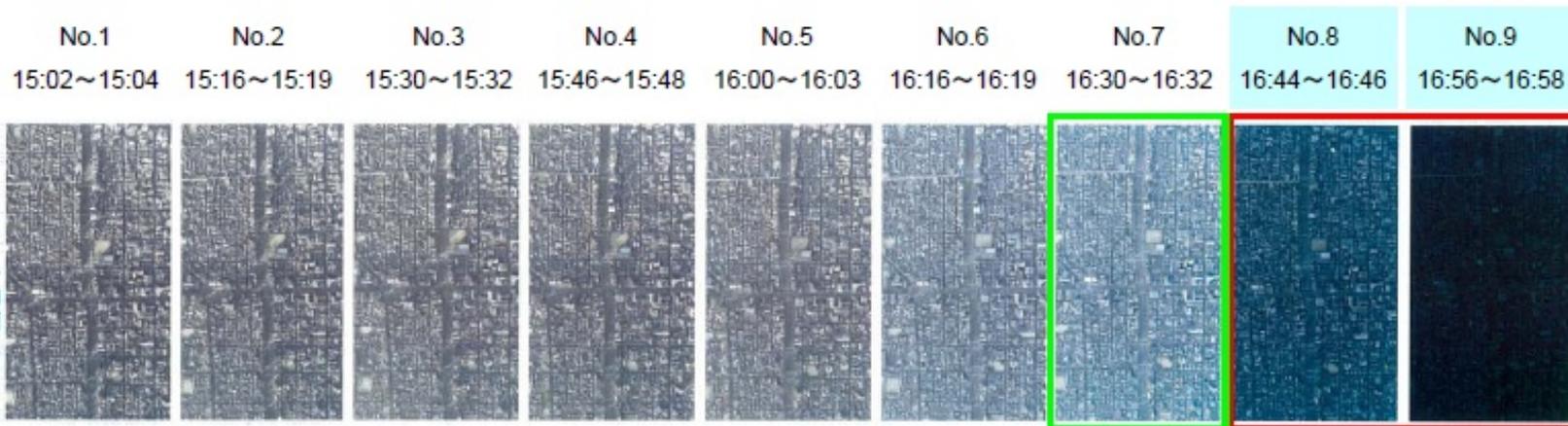


Time-series imagery at same place

Automatic Exposure Value control

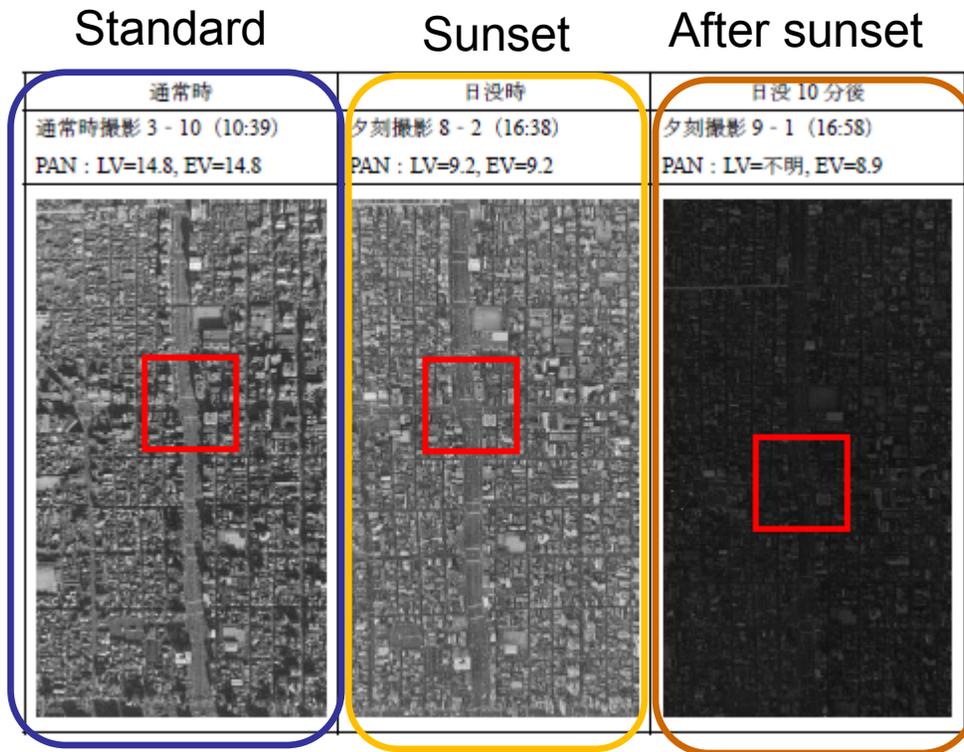


Manual Exposure Value control (+3)



Comparison of panchromatic images

- Comparison of images of normal hour, sunset flight and after sunset flight.



Plotting with photo interpretation

Using the standard image

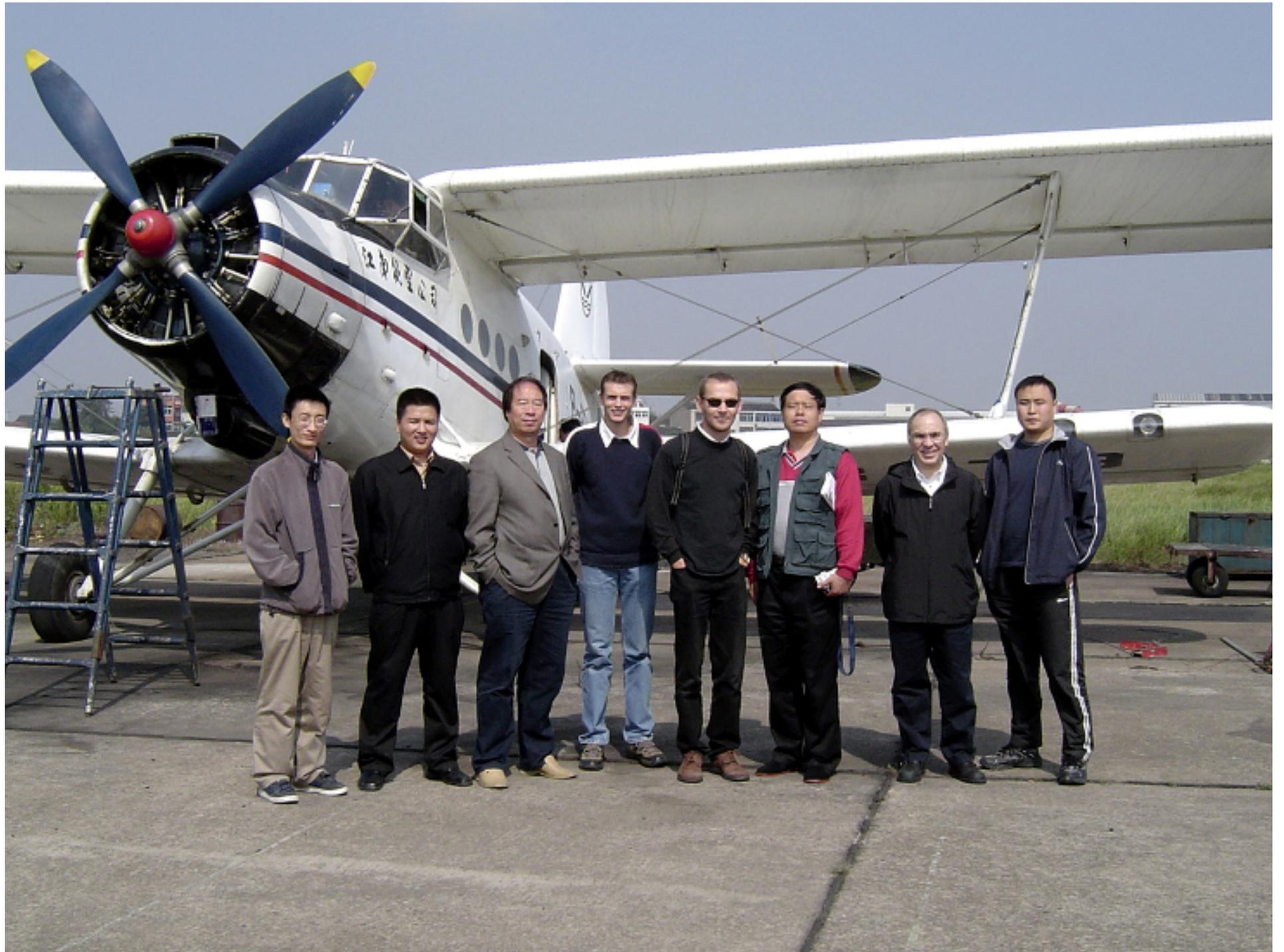


Using the after sunset image



DMC platforms





Air Truck



DMC Installed in Air truck



RMK D



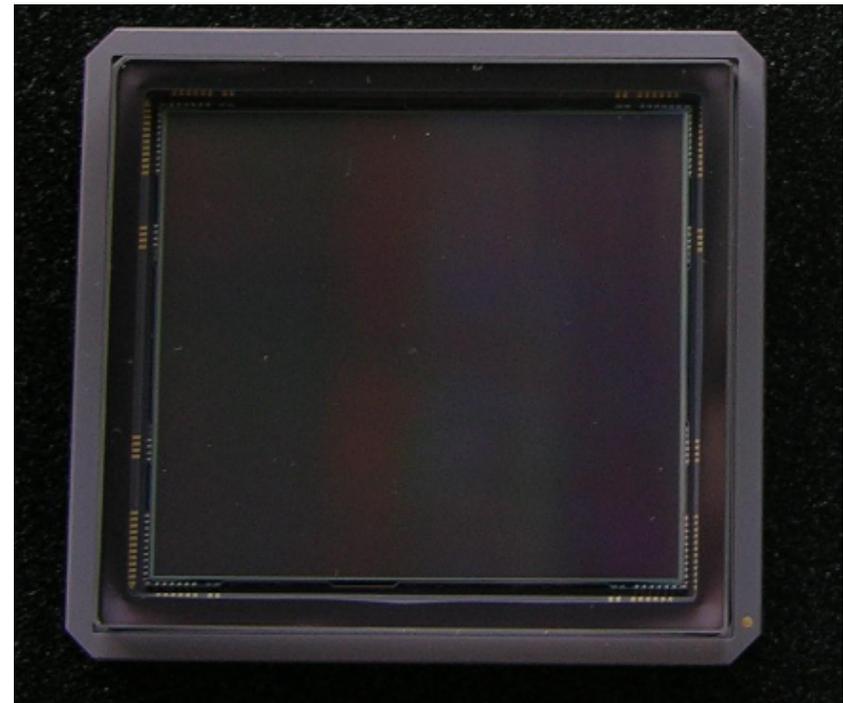
RMK D is the first **metric** medium format and frame sensor based aerial digital camera.

RMK D Technical Features



Customized, large 42 MP CCDs from Dalsa

- 7.2 micron pixel size
- 6096 x 6846 pixel
- Intergraph propriety design
- 1 sec frame rate
- High dynamic range



RMK D Technical Features *(continued)*

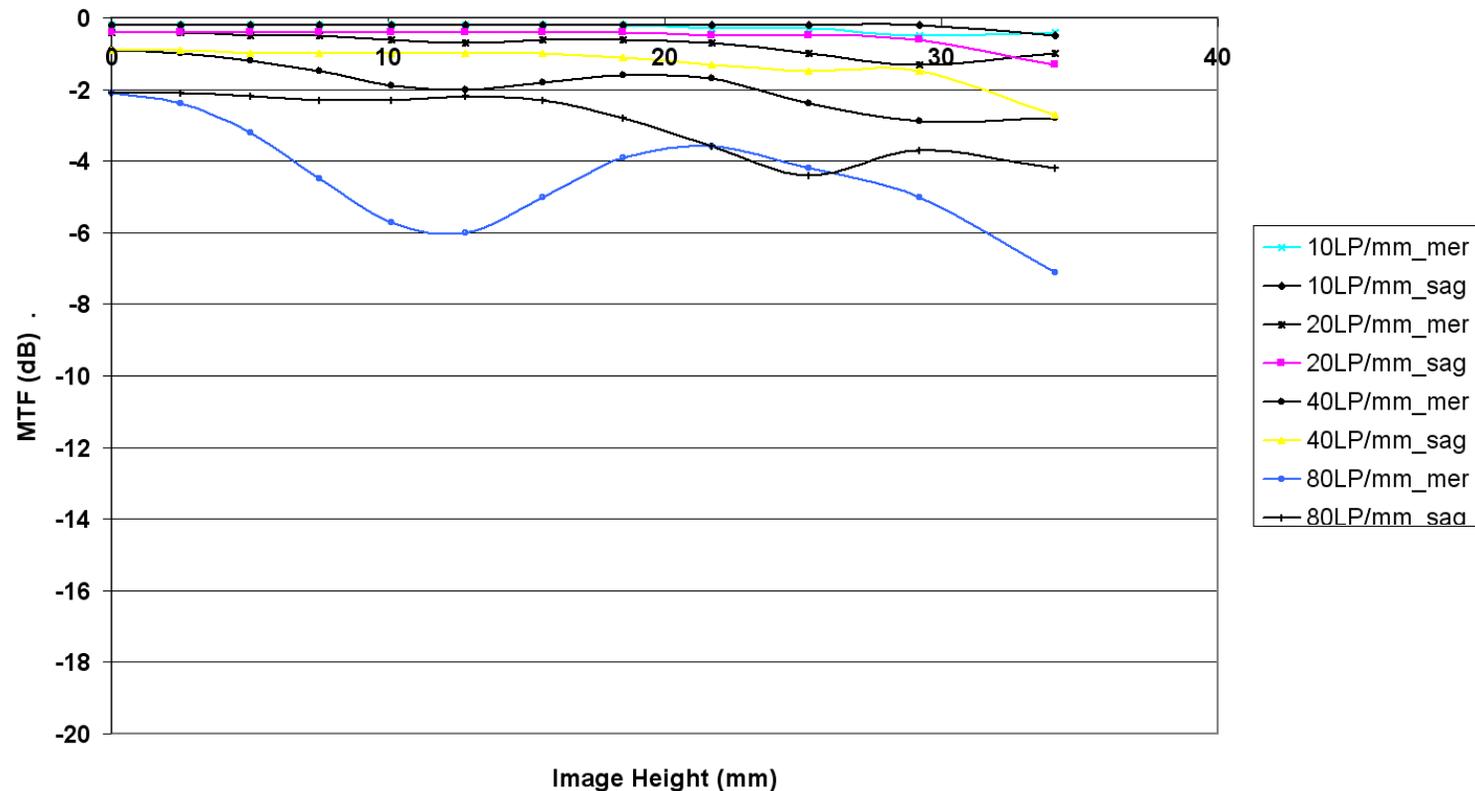


- Multi spectral sensor, RGB and NIR channels
- 1:1 color resolution, no Bayer pattern
- FMC forward motion compensation based on TDI
- large base/height ratio of 0.42
- High resolution 8cm at 500m flying height
- 6" GSD at 3100ft, 1' GSD at 6200 ft
- 50° field of view, ideal for combination with LIDAR

RMK D Technical Features *(continued)*

- Customized Carl Zeiss lens systems with strong MTF

RMK-D S-Biogon 4.0/45 mm; Grün-Kanal - Apertur 4.0 20°C



Special lens design for new sensors - why ...?

Image of a DMC



Calculated Image with characteristics of a lens system with a wrong MTF

RMK D Performance



- RMK-D cycle rate of 1 sec allows for:
 - **0.06 [m] GSD** (2.4 [inch]) with **80%** end lap at **152 [knots]**
- Expected accuracy
 - **depends on:** geometry, point definition (targeted/signalized, natural), image contrast, operator (matching), and procedure used in the measurement
 - **can correctly be estimated** with either real or simulated data. In the absence of these, one can estimate

$$SX = SY = \text{Scale} * 0.003 \text{ mm}$$

stdv. of a point will be 2 times the square root of 2
($2 \times 1.4 = 2.8 \mu\text{m}$) is close to stereo point measurement accuracy

$$(1) \quad sZ = \pm X\text{‰} \text{ hg} = \pm 0.08\text{‰} \text{ hg}$$

automatic point generation

$$(2) \quad sZ = H / B * sX = 2.5 * SX$$

manual measurement

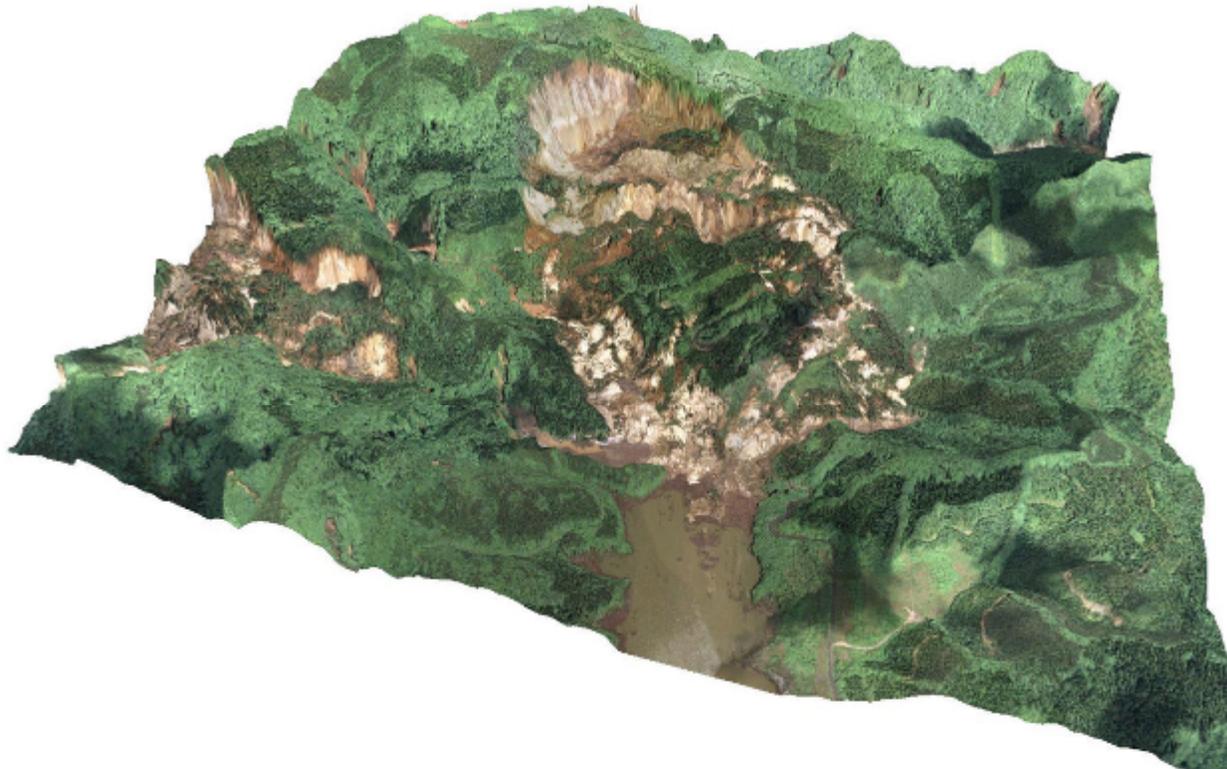
Scale	Flying Height [m]	GSD [m]	Expected Object Point Accuracy - Stereo		
			XY [m]	Z1 [m]	Z2 [m]
1:11,111	500	0.08	0.033 = 0.4 GSD	0.04 = 0.5 GSD	0.08 = 1.0 GSD
1:22,222	1,000	0.16	0.067 = 0.4 GSD	0.08 = 0.5 GSD	0.167 = 1.0 GSD
1:27,778	1,250	0.20	0.083 = 0.4 GSD	0.10 = 0.5 GSD	0.207 = 1.0 GSD



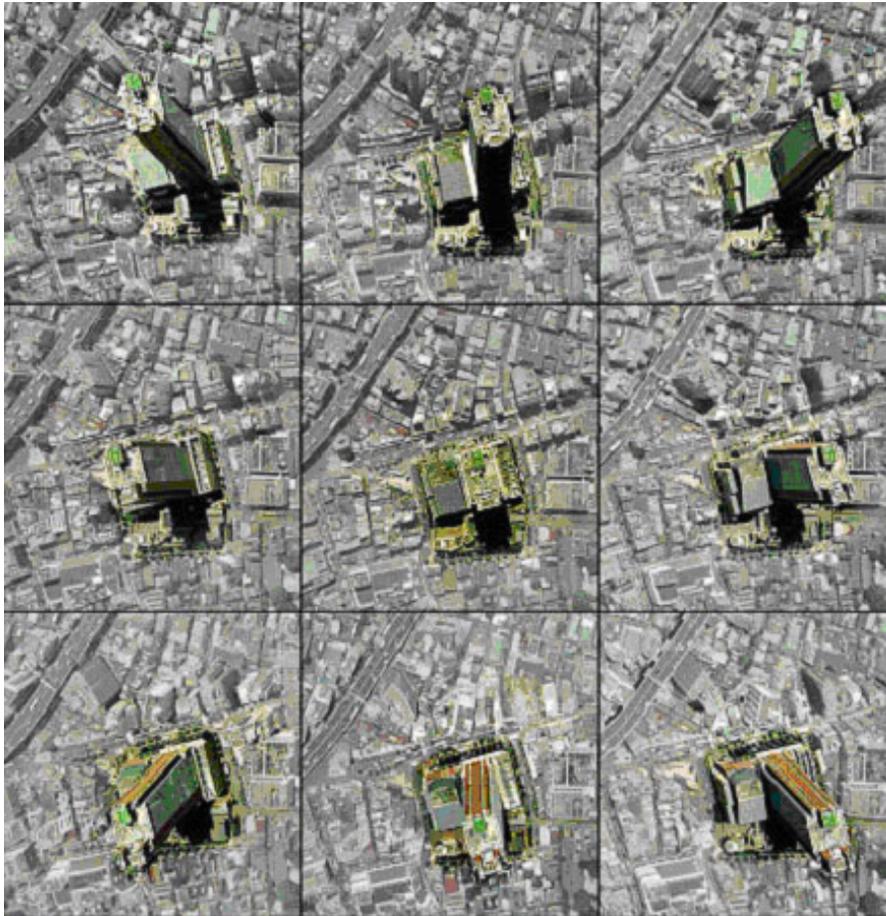
ARATOZAWA DAM LAND SLIDE

http://www.ajiko.co.jp/bousai/miyagi2008/miyagi_iwate.htm

3D Model Viewer



Ortho images from cities



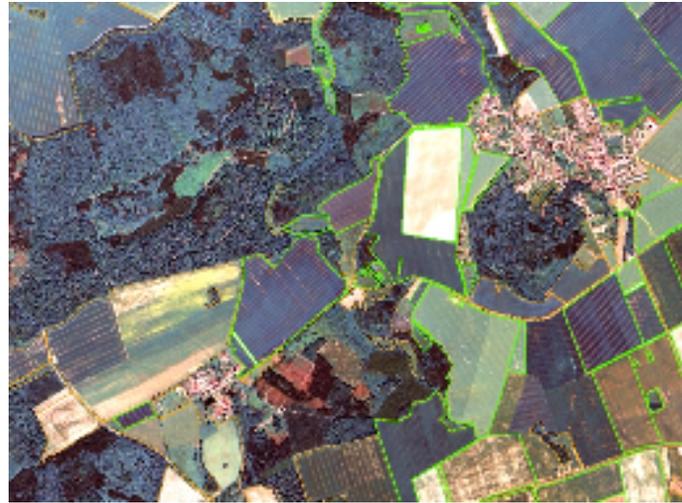
Project for InVeKoS, Germany

Data acquisition with DMC Digital Mapping Camera by

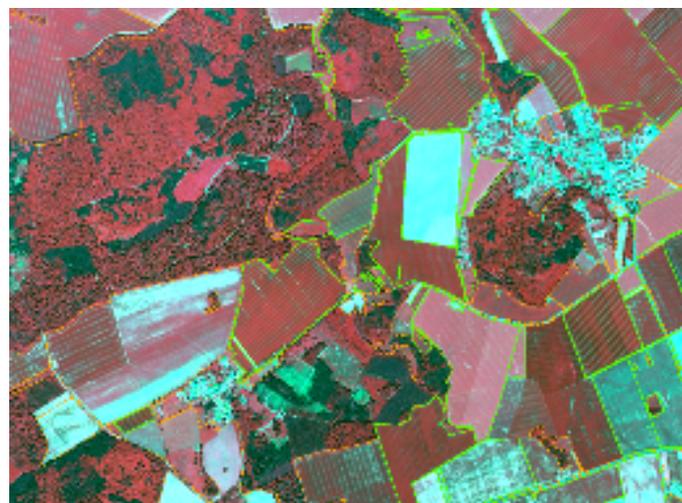


Data processed by

- Project summary:
- 1045.5 km²
 - 72 cm GSD
 - 60% / 30% Stereo Overlap
 - 1m RGB and CIR Digital Ortho Photos



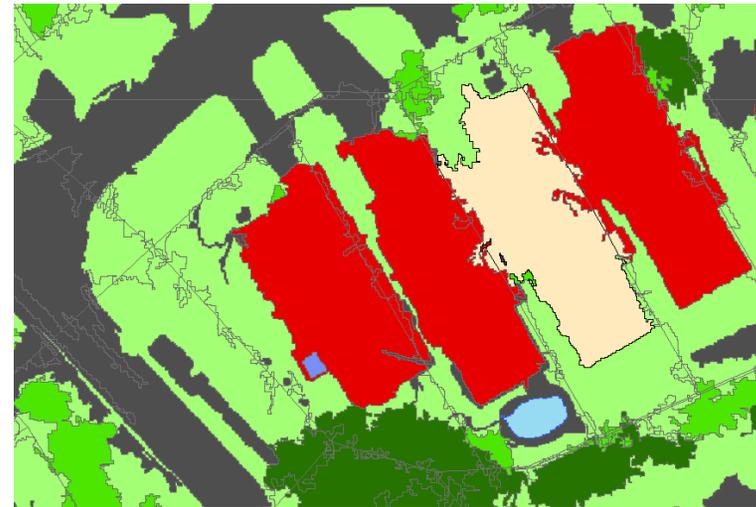
True Color Ortho Photo



Color IR Ortho Photo

Practical Applications

- Urban Feature Classification
- Vegetation Classification
- Raw DMC 4Band Imager



RMK D applications examples

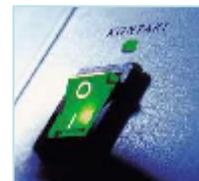


- Large scale engineering mapping
- Corridor mapping
- Agriculture and forestry monitoring
- Fast response, disaster management
- Easily deployable on various platforms

RMK D for NAIP and NRI

- 1 m GSD at 20000 ft flying height
- 1:1 color resolution
- Square image format
- 4 channel tiff output

Thank you!



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