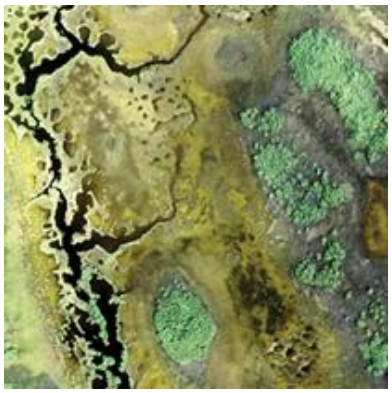
Z/I Imaging DMC
Remote Sensing Case Studies

Klaus Neumann Product Manager


INTERGRAPH

18. March 2010

Case study of DMC Utilizations

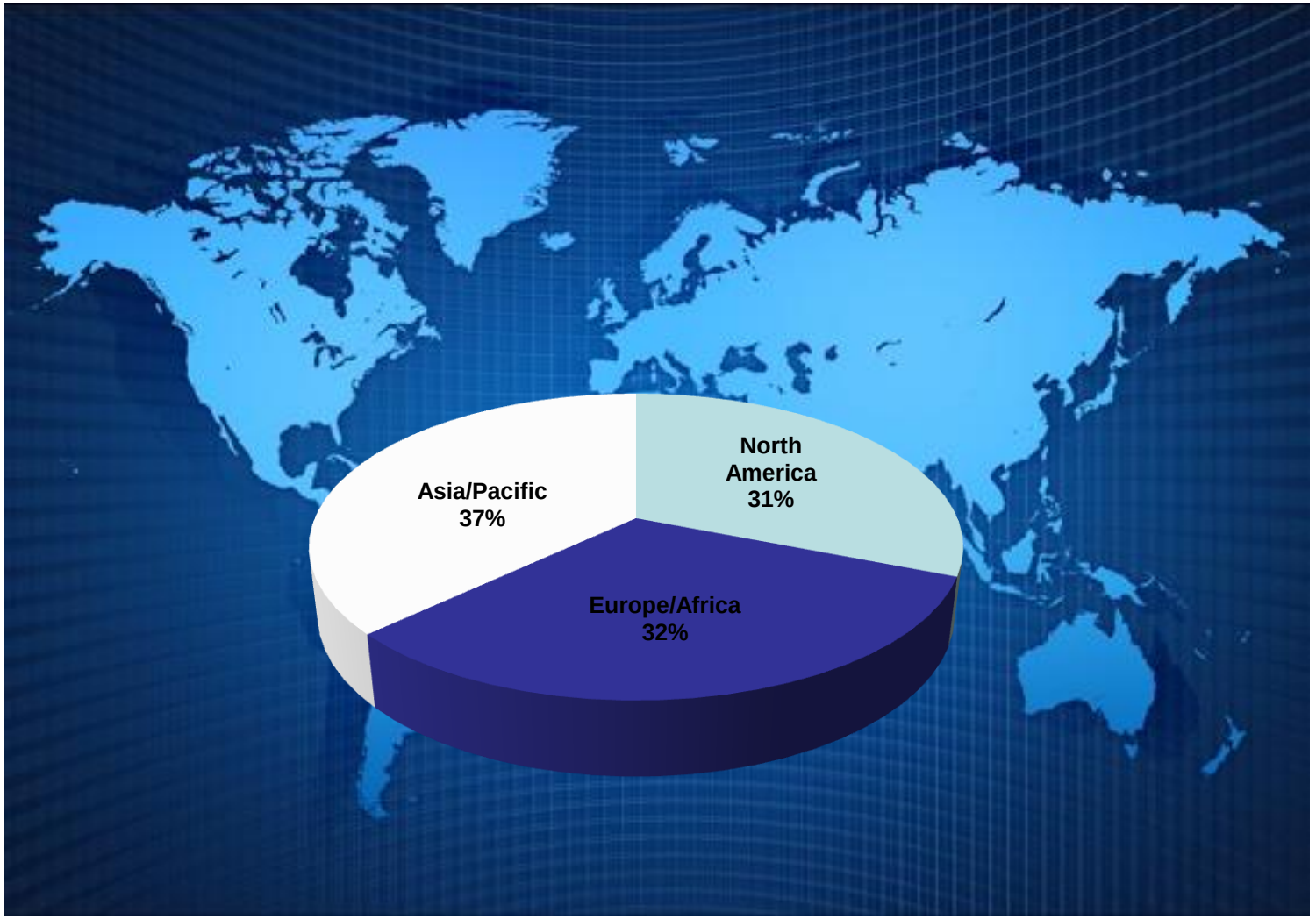
Aero Asahi Corporation

KOKUSAI KOGYO CO., LTD.

Asia Air Survey Co, Japan

DMC System

101 DMC sold



① Automatic search of secular change of house by using Ortho Photo and DSM

- **In Japan, aerial photograph is used for the secular change searching of the house which is the object of taxation.**
- **Ortho Photo is very useful as the basic data for the valuation of fixed assets.**
- **DMC is very useful for the photo-interpretation with it's high resolution and low noise image.**
- **Ortho Photo is also used as the background image for GIS.**

- **By developing an automatic method of secular change searching of house, to make more efficient this process and uniformize the quality.**

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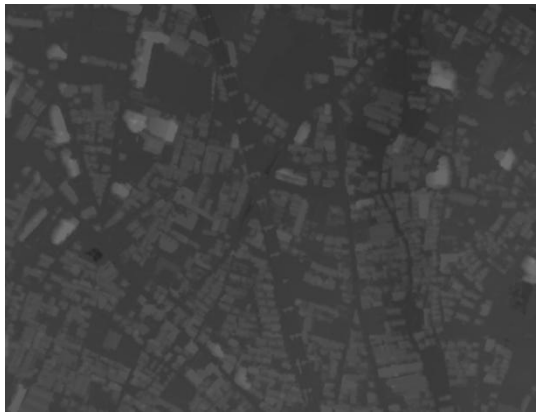
① Automatic search of secular change of house by using Ortho Photo and DSM

- **Method :**
- **To use the ortho photo and DSM of two stages.**
- **DSM is acquired by stereo matching.**
- **To acquire the information of candidate of secular change by using the difference of two stages images.**
- **The element for the automatic extraction is “Color” and “Height”.**
- **Color information is extracted by the ortho photo.**
- **Elevation information is extracted by DSM.**
- **Interval of elevation data is 1.0m.**
- **GSD of image is 10-20cm.**
- **Principal point of photo and flight height of two stages shall be same.**
  — To avoid miss-extraction caused by the difference of inclination of house. —



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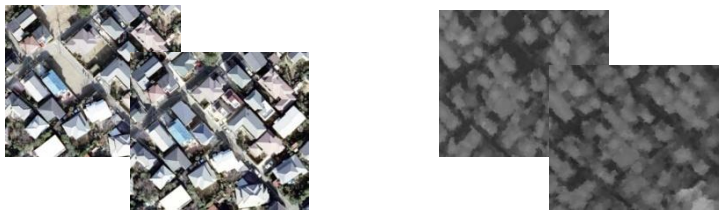
① Automatic search of secular change of house by using Ortho Photo and DSM

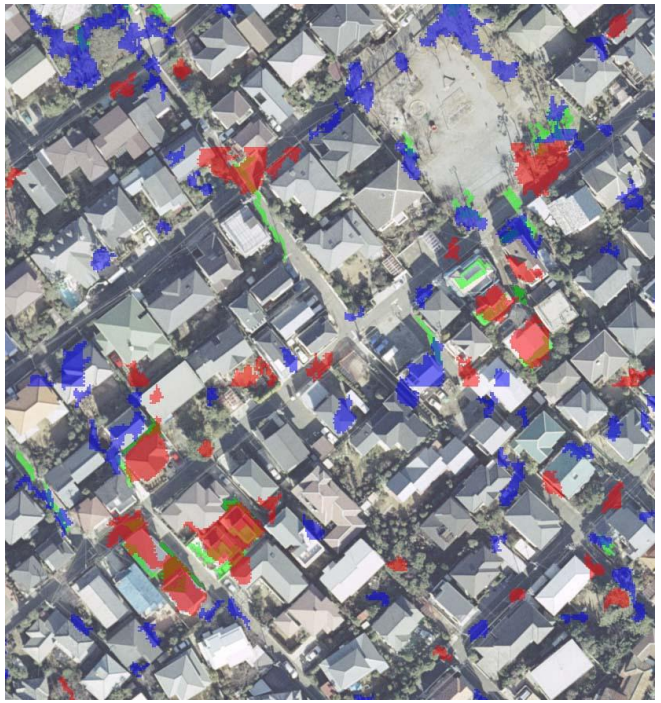


Data Input (Ortho photo ・ DSM)

Parameter Setting

(The threshold value of the difference of the elevation, the color and the area)

Extraction of Candidate of Secular Change



Different Color

Elevation (+)

Elevation (−)

The difference of the elevation = New DSM – Old DSM

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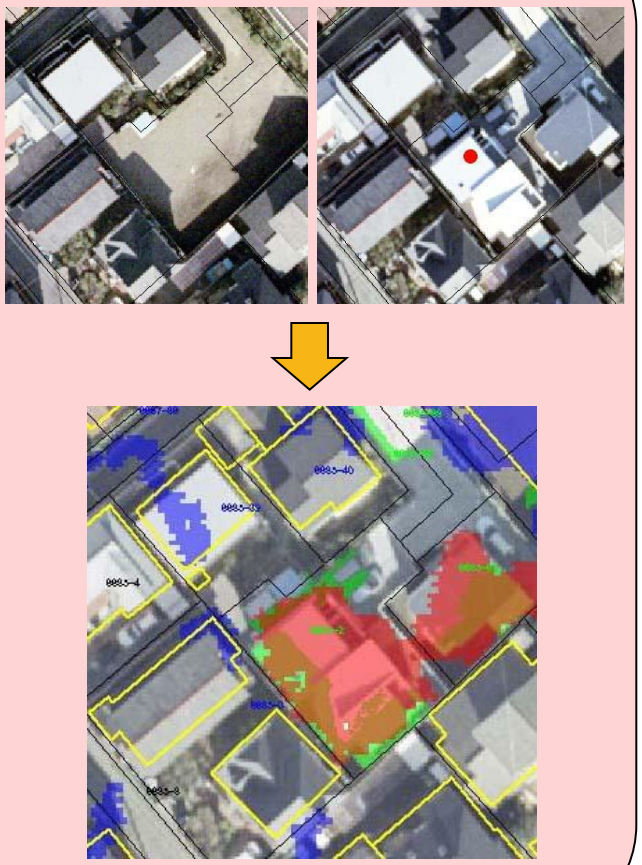
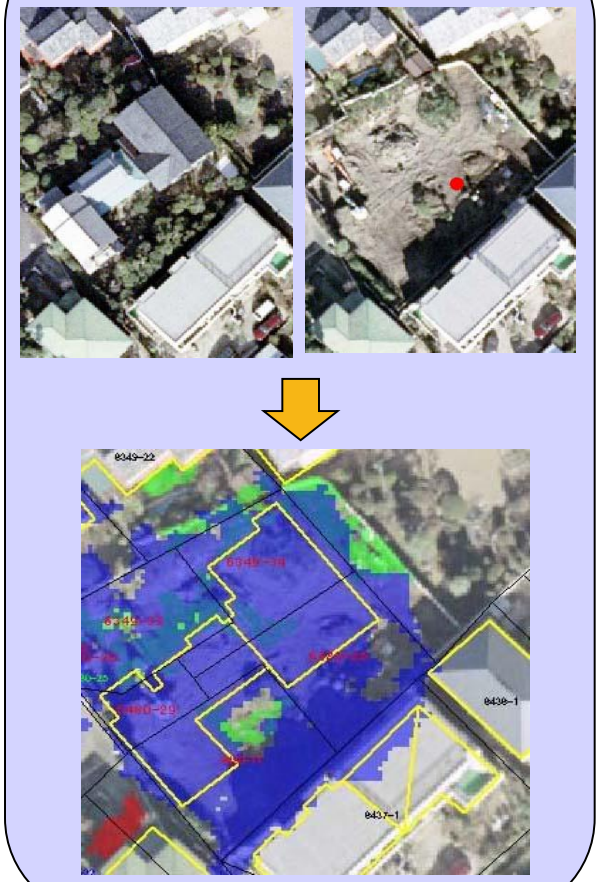
① Automatic search of secular change of house by using Ortho Photo and DSM

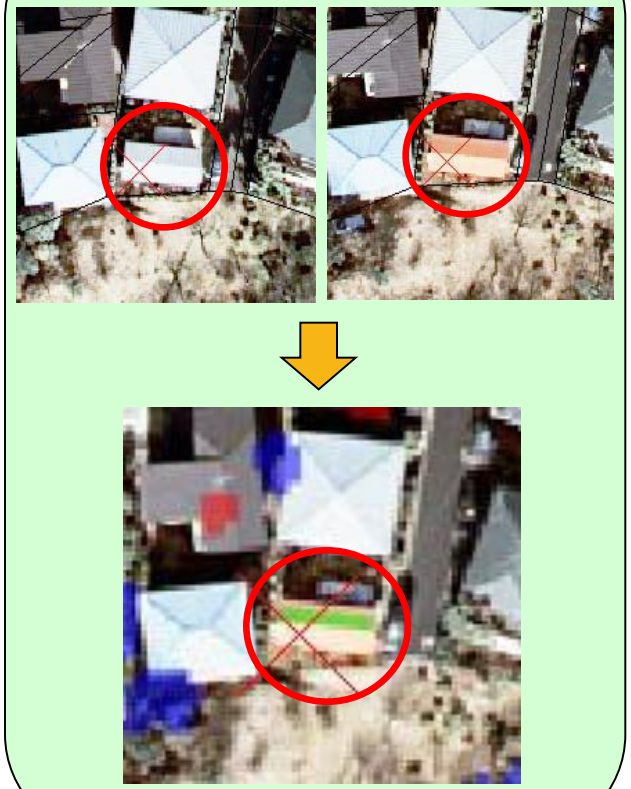
Plus



Minus



Different Color



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② Automatic extraction of green space by using the NIR band

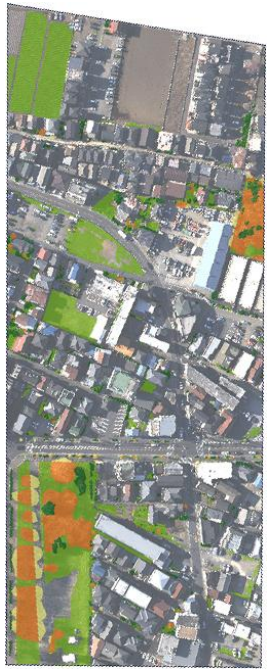
- **Calculation of NDVI value using the DMC IR band.**

  NDVI = (IR - R) / (IR + R)

- **GSD=20cm**

Used Image

Result of Automatic Extraction



Result of Interpretation

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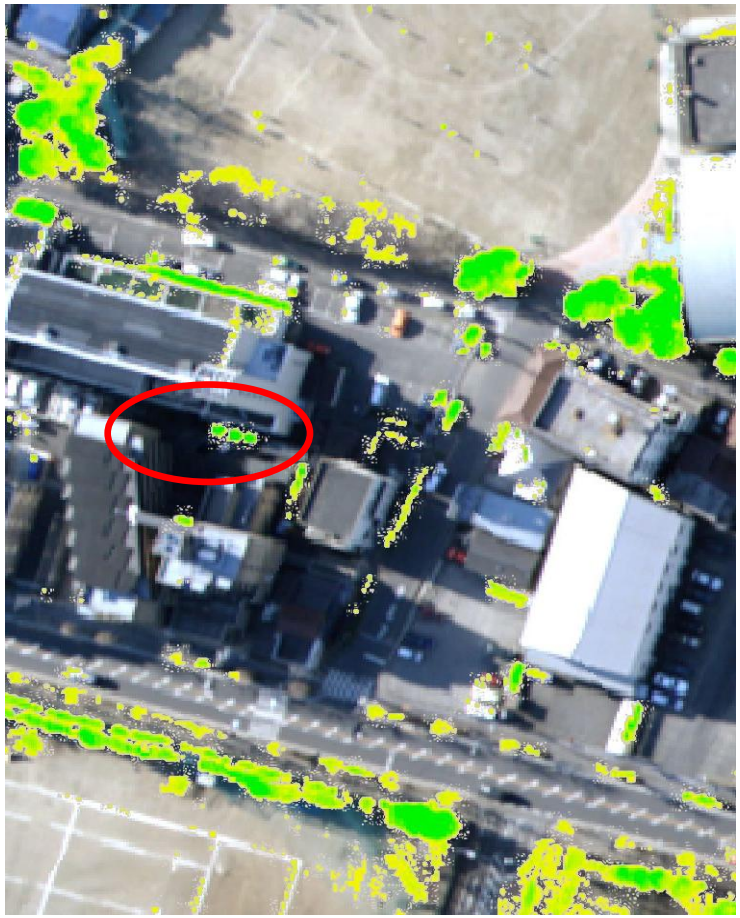
② Automatic extraction of green space by using the NIR band

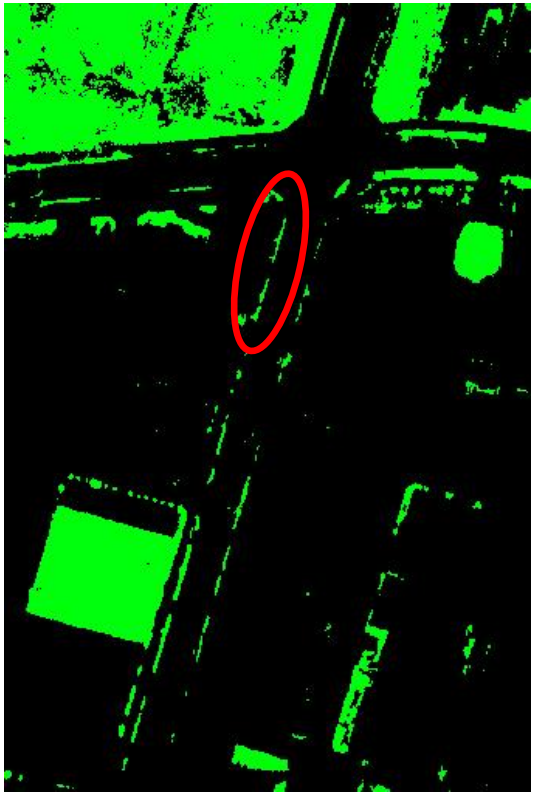
Used Image



Result of Automatic Extraction

Aero Asahi Corporation

② Automatic extraction of green space by using the NIR band



Result of Automatic Extraction

Used Image

Up to the roadside tree box can be extracted.

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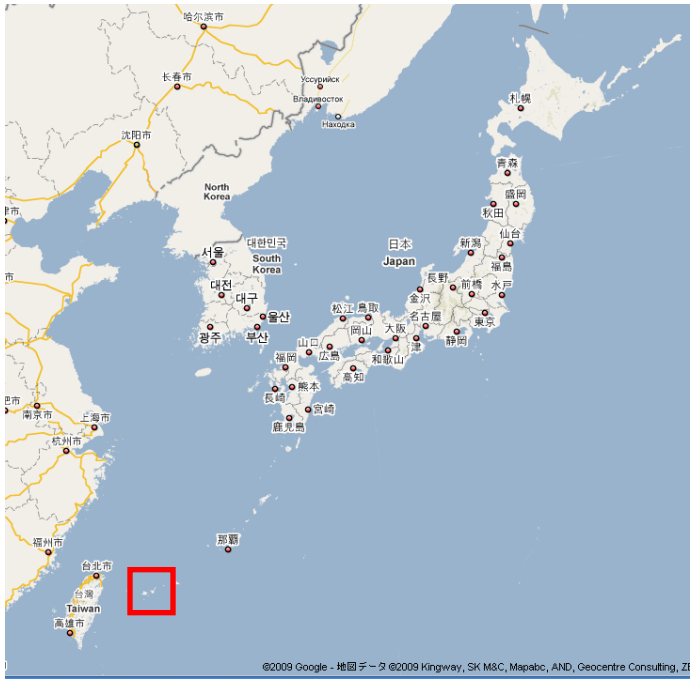
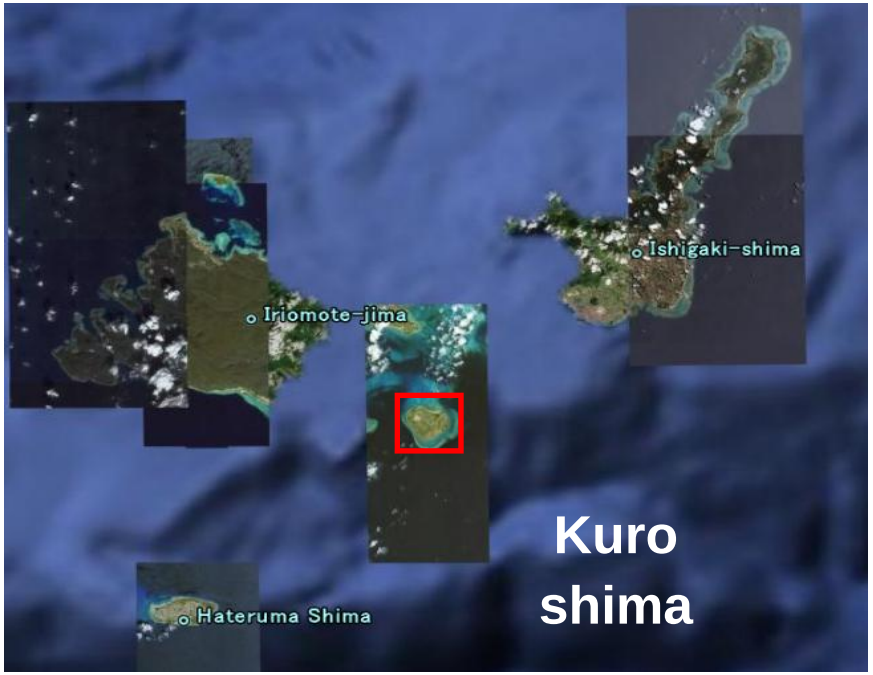
③ Study on the possibility of the coral monitoring by using the NIR band

- DMC image of Kuroshima island in Okinawa is used.
- To study that the Monitoring of Coral Albinism using the IR band is Possible.
- Take notice of the Chlorophyll which Zooxanthella that lives symbiotically with coral use to photosynthesis





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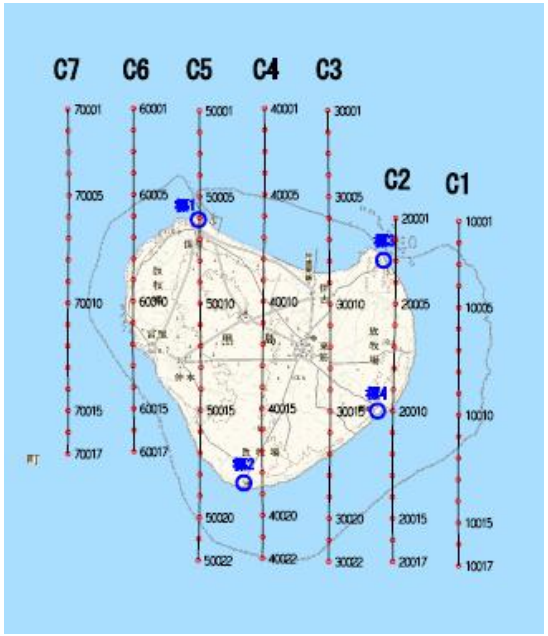
③ Study on the possibility of the coral monitoring by using the NIR band

- Photographing Date　March, 2009
  - Flight height　960m
    - GSD　9.6cm
- Preparation of NDVI Image using NIR-Band



Flight Plan

Ortho Image

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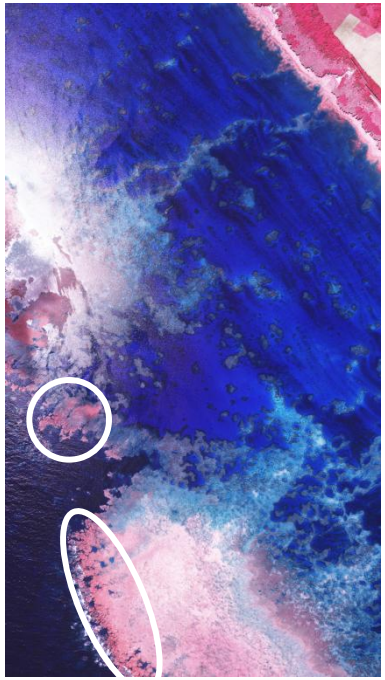
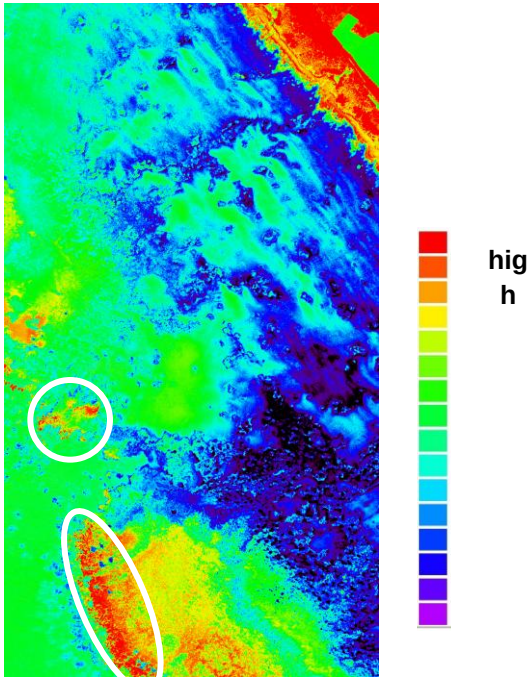
③ Study on the possibility of the coral monitoring by using the NIR band

True color



False color



NDVI

- It is possible to identify the active part and passive part of coral activity.
- Influence of Spectro-Attenuation Characteristic of water in the R zone and NIR zone was worried about, but reflection was confirmed until certain depth.
- Since the photography was not Immediately after Coral Albinism, distinct albinism part was not acquired.

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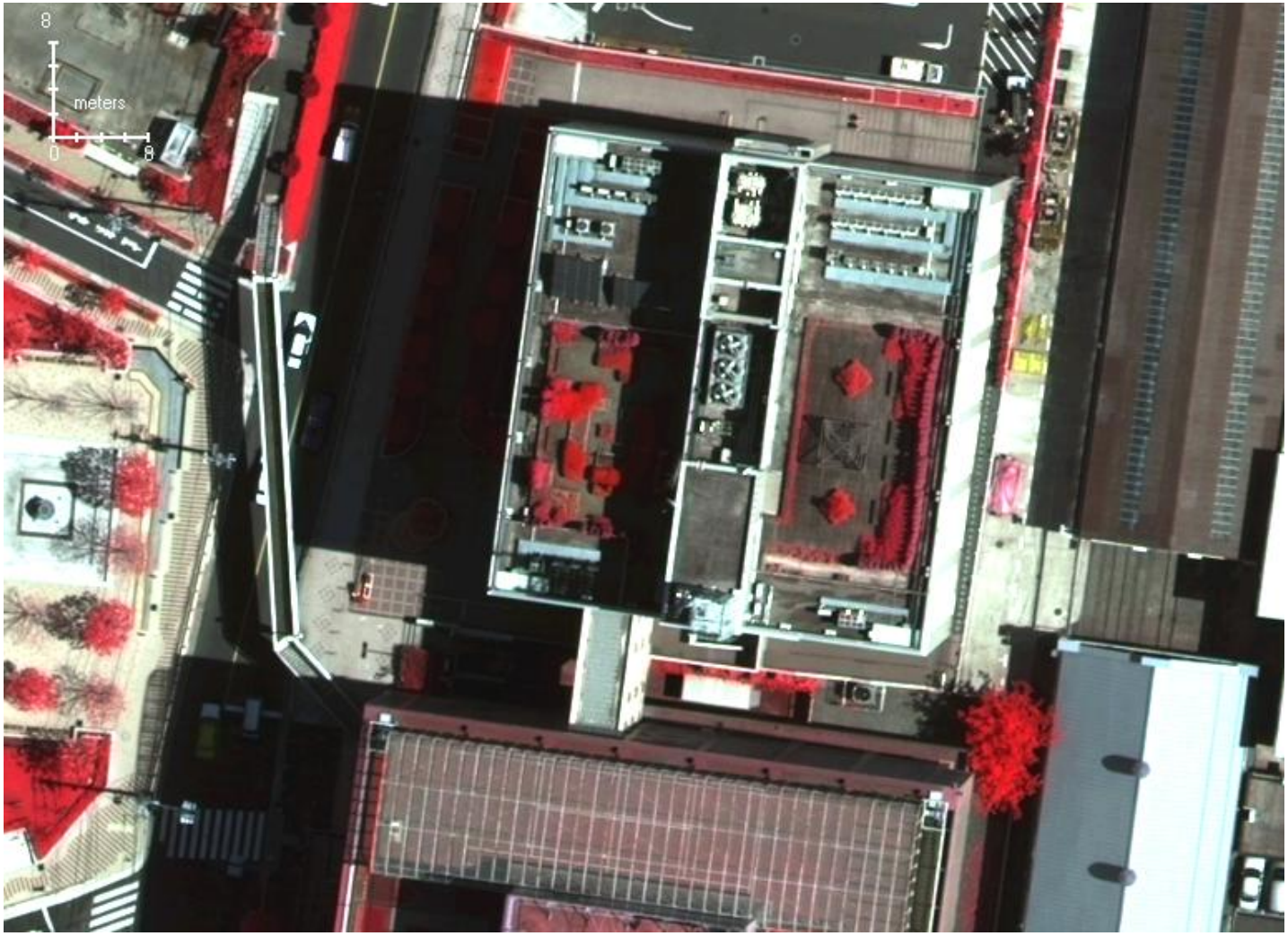
Application - Urban Green Coverage Research

DMC CIR imagery



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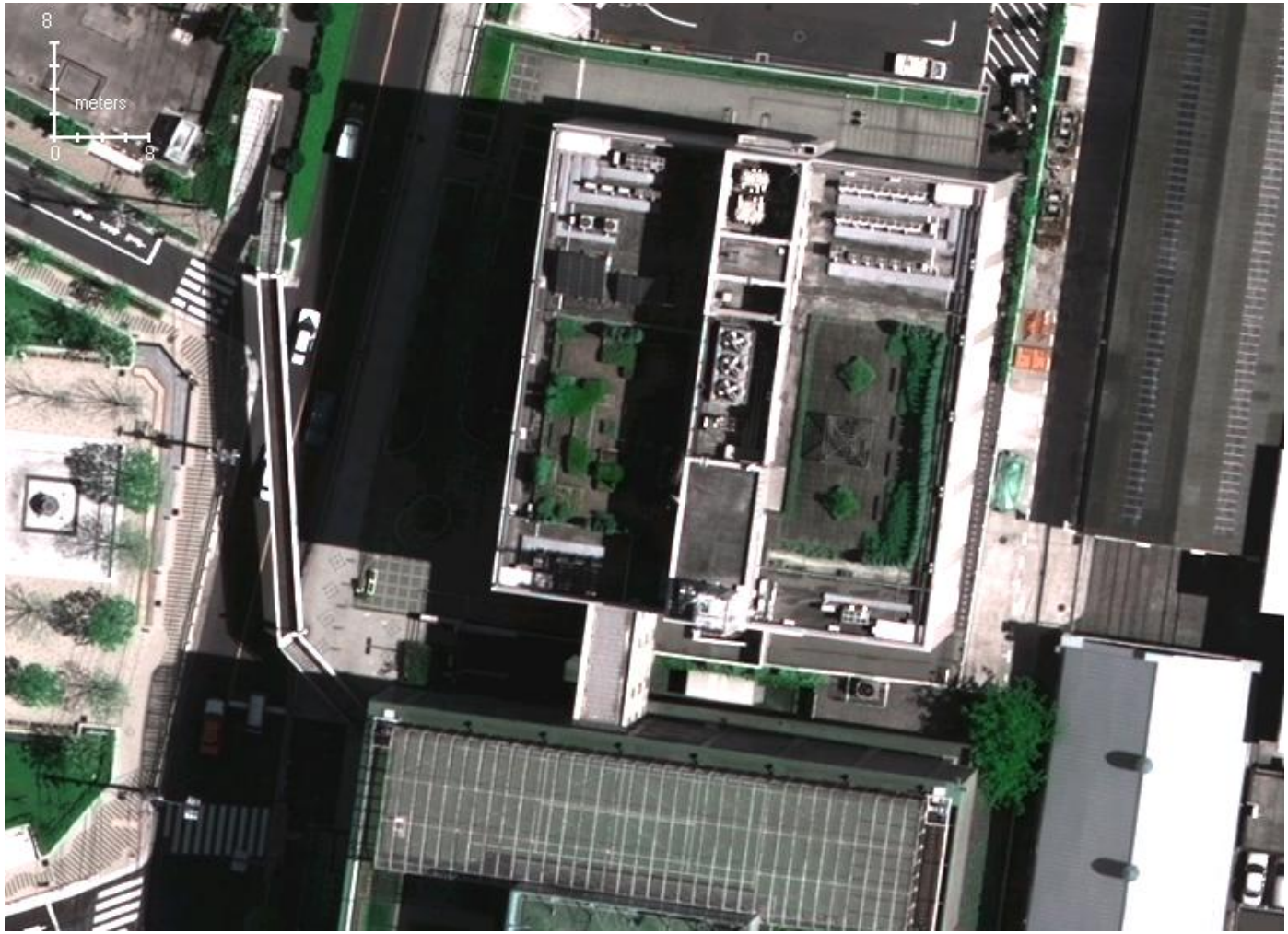
Application - Urban Green Coverage Research

DMC RGB imagery



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Application - Urban Green Coverage Research

INTERGRAPH

Ratio of green coverage – Extracted from CIR imagery

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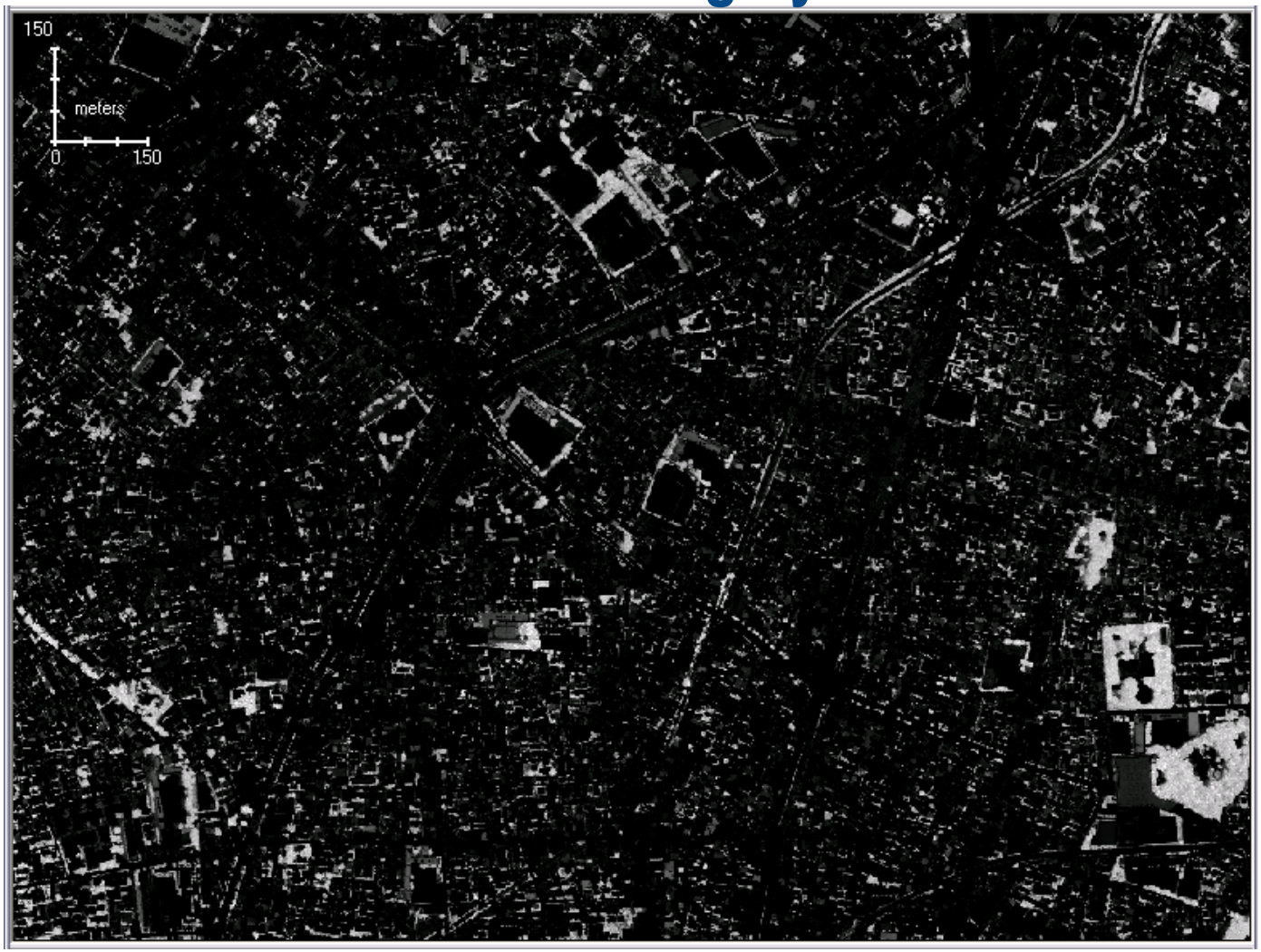
Application - Urban Green Coverage Research

NDVI imagery



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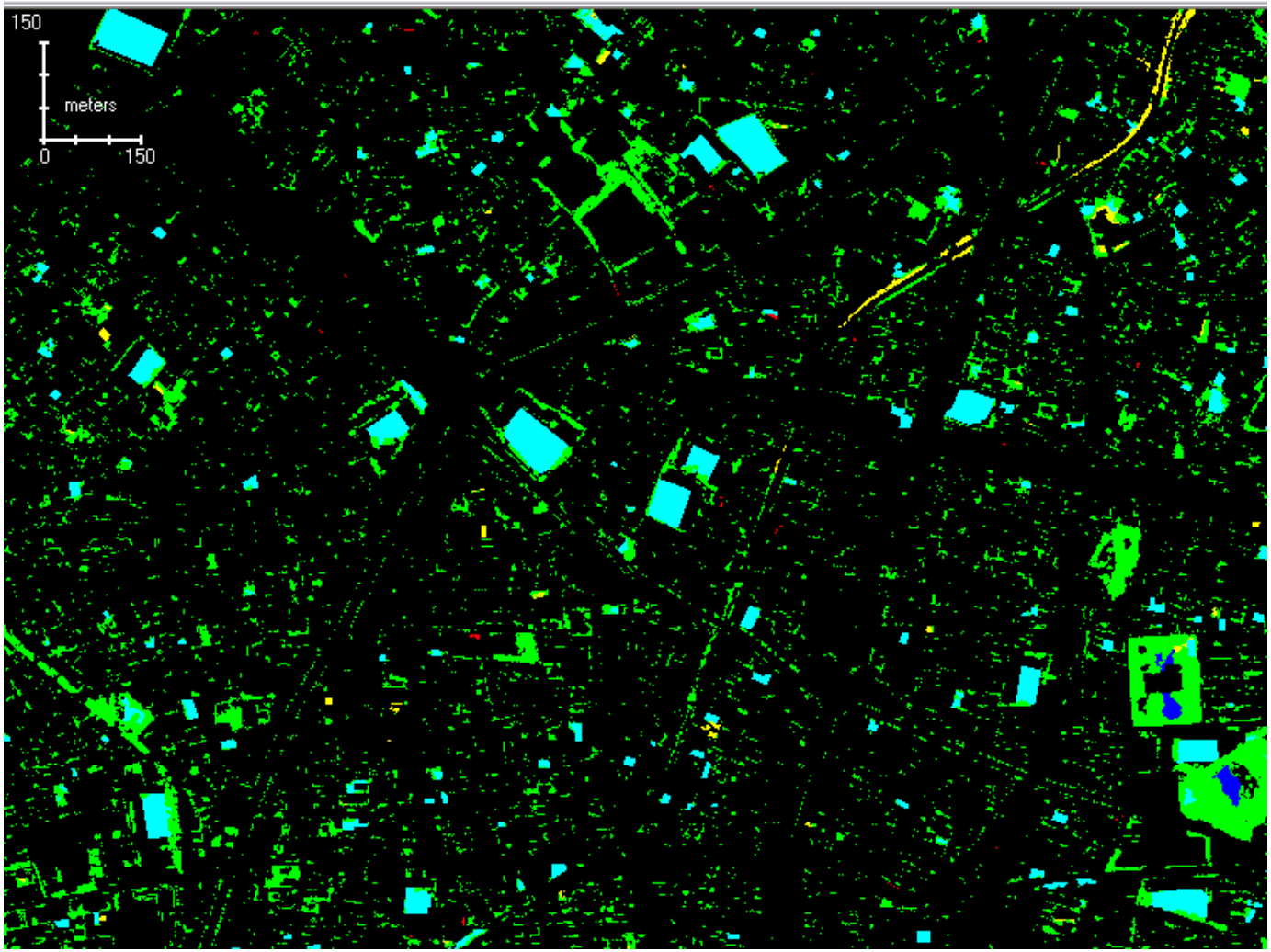
Application - Urban Green Coverage Research

Green coverage distribution map



Legend

- Tree
- Grass
- Rooftop landscape
- Water

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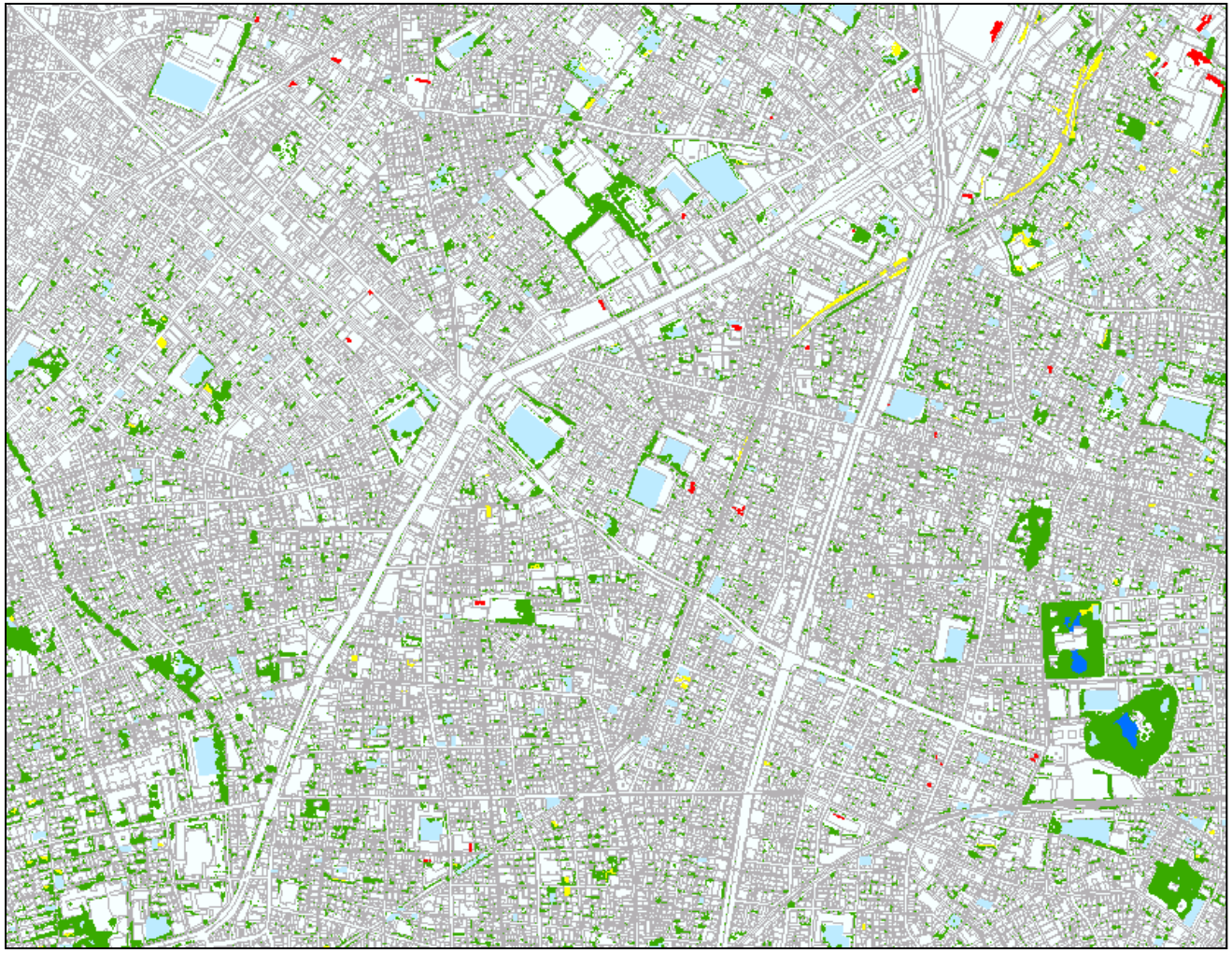
Application - Urban Green Coverage Research

Overlay with 1/2500 topographic map



Legend

- Tree
- Grass
- Rooftop landscape
- Water

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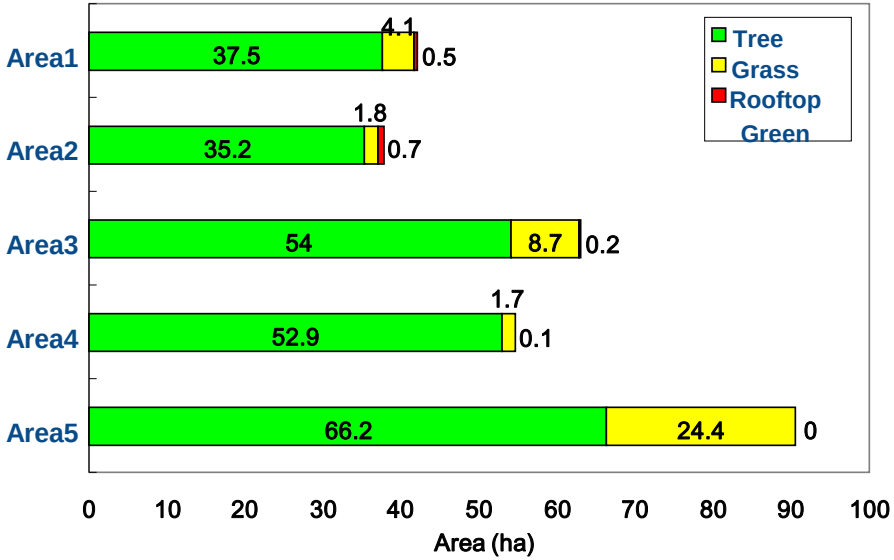
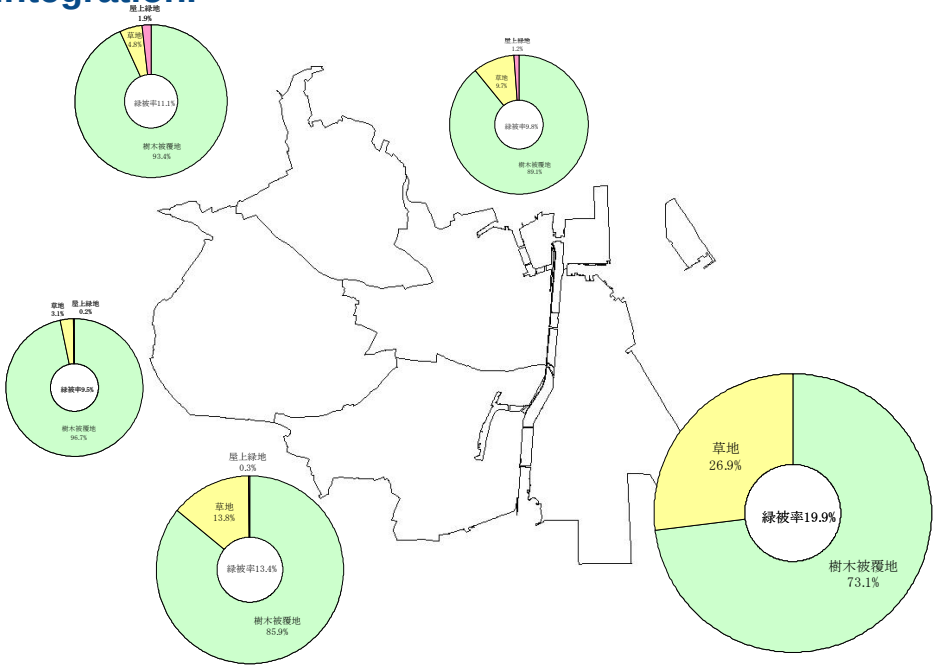
Application - Urban Green Coverage Research

Summary – Potential DMC application in Environmental Research

- **Fully digital processing using DMC imagery.**
- **Correctness of extraction result has improved.**
- **Efficiency of work has improved – greater turnover.**
- **Still has a potential can be tuned for better integration.**

  > Data and Sensor fusion





*Size of circle represents the % of green coverage

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The latest business – Solar Energy (3 main entities)

INTERGRAPH

Full-scale Entry into New Energy Business: Acquisition of German GEOSOL Group

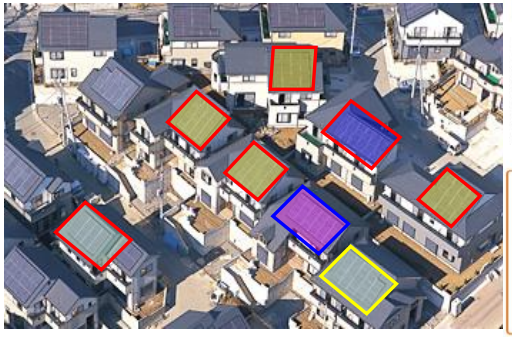
New application of KKC's geospatial profession – DMC will provide the power

1. Mega solar power generation
（Business partnership with GEOSOL）

- *1,000KW generation.*
- *Providing power ideally for 300 homes.*
- *First mega solar installation in Japan.*

2. Rooftop simulation

- *Proving services through WEB.*
- *Using photogrammetric principles.*



3. Supporting for Renewal Energy

(RE)community structure

- *Community utilizes renewal energy.*
- *Providing the consulting service.*

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Application of DMC

agriculture *project*

- **“Agriculture” business**

Purpose : Development for agriculture and promotion of farm village.

Application of data: maintenance for farm information , make efficient use of farmland agricultural support… → maintenance with GIS

Abandonment of cultivation areas are able to be used & again

Application ~ Farm field ~

Obtain images by a farm unit

Behind maintaining farm information,

there are basic information ,image ,square measure

Cultivation trend, and etc……

National Orthophoto map

- **Total taken photos**

  35,000 photos

- **Total square measure we cover.**

  14,700 k m2

- **Ortho resolution:**

  40cm (Standard)

- **We have all copyright**

Application ~ Cutting out ~

- Cut Ortho image into each border by using border data.
- Transform data into ERDAS IMG format.

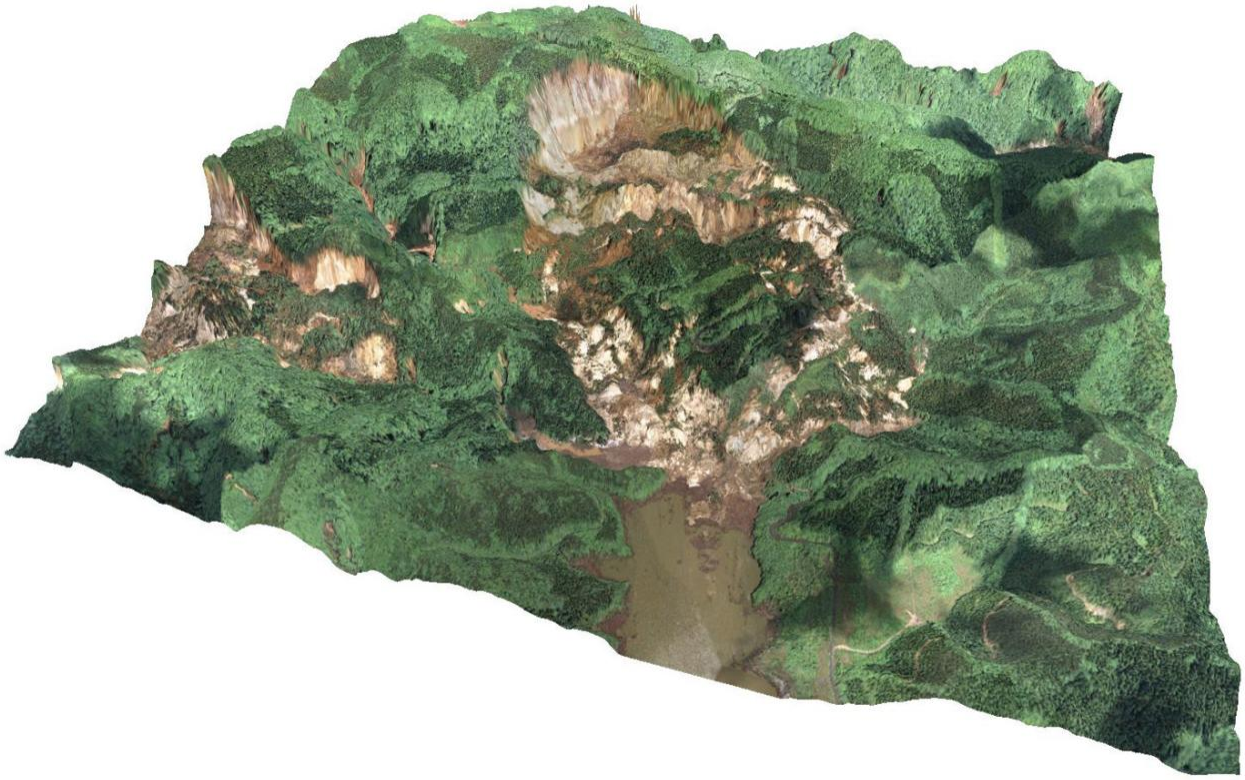
Generate data for Web distribution

Application ~ 3D Model ~

Land Viewer

View any locations from any angles as you like!

3D Model Viewer



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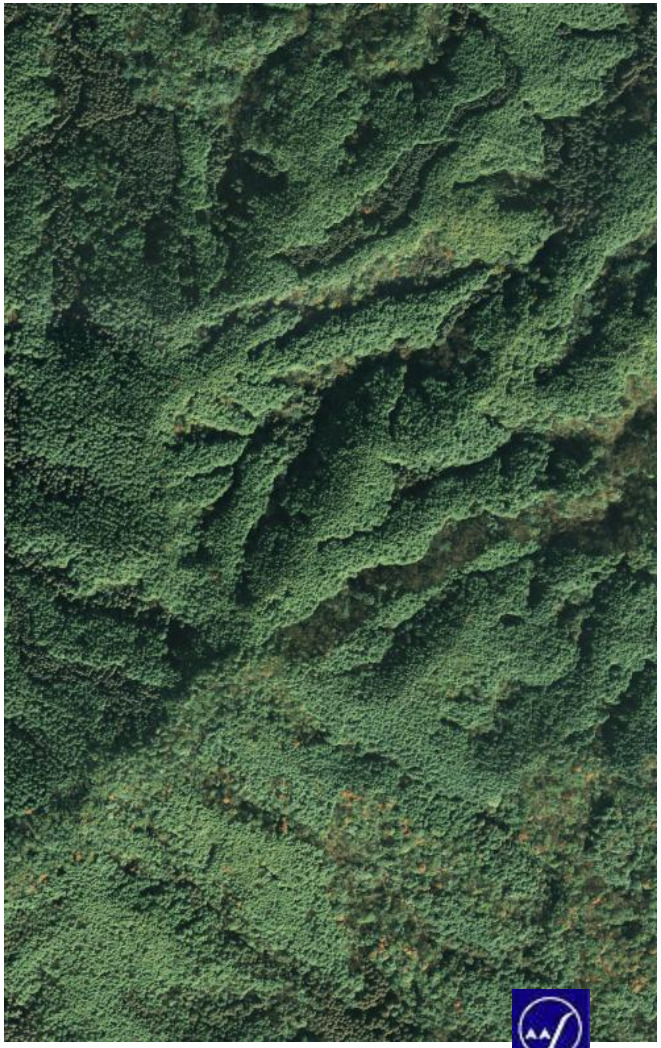
Application of DMC ~ Trends in our office ~

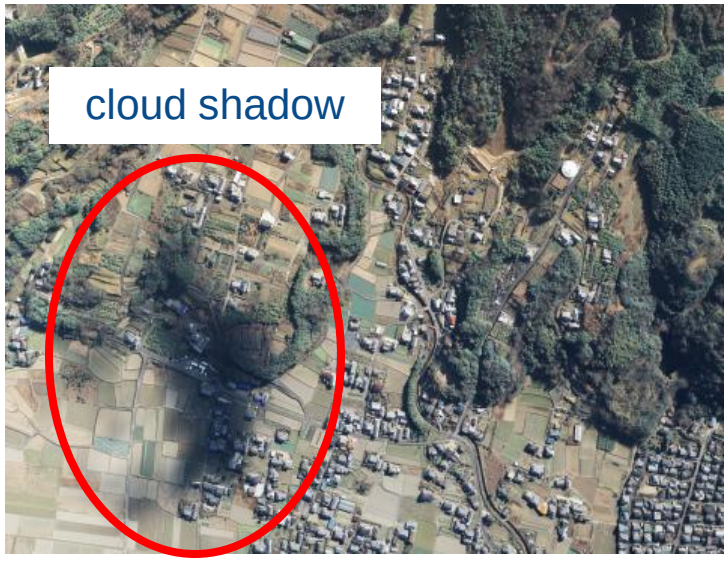
- **Forest planning**

It is a purpose to survey national ,private and communal forest. And Promotion of Forest



DMC advantages

- Advantages :dynamic range is wide



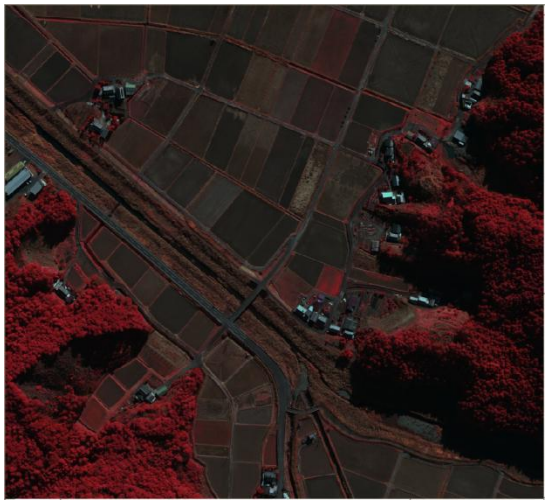
- Enables to reduce the effect of cloud shadow.
- Enables color tone (hue) correction on necessary part (ex. farmland)

  → Entire balance of color tone (hue) never breaks up.

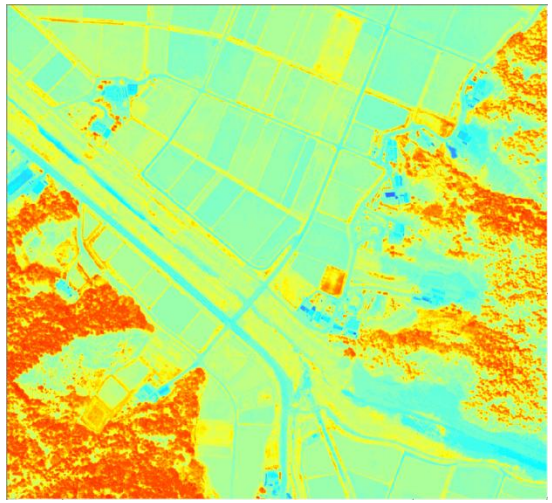
DMC advantages

- Advantage : near-infrared ray (N I R) sensor

R G B image



C I R image



N D V I image

- Having effect to figure out vegetation.
- Allowing calculation of NDVI

→Analysis using spectral characteristics

→Enables image analysis

New Radiometric Calibration

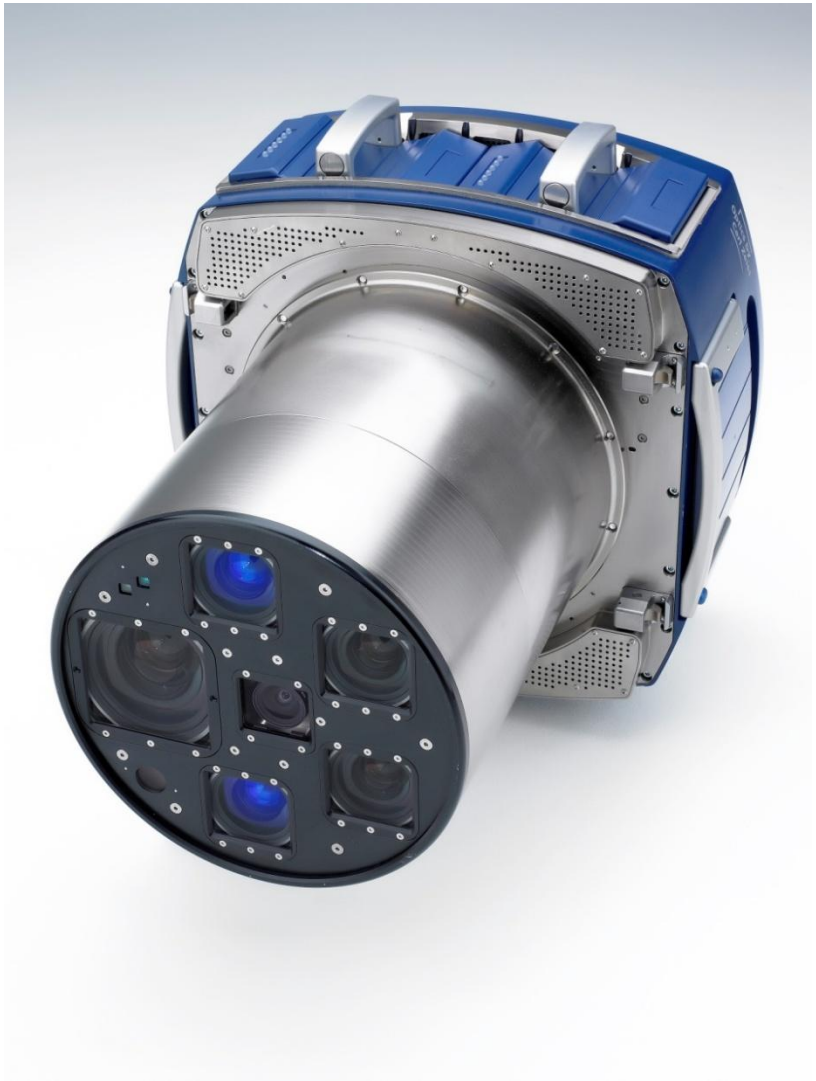
- **Improved overall DMC image color quality**
  - Improve the color balance between individual camera heads within a single DMC
  - Analyze and improve the radiometric consistency between different DMCs
- **Provides methods and approaches for DMC and RMK D absolute radiometric calibration, which will:**
  - Enable the development of a new suite of remote sensing products that have historically been dominated by satellite based systems
  - Build upon relative radiometric calibration processes (flat fielding or normalization, linearity, band-to-band)

New Radiometric Calibration

- Laboratory radiometric calibration for DMC and RMK D better than 3% and comparable to satellite- based land imagers
- Z/I has instituted an absolute radiometric calibration process that will enable of new generation of products and improved operation for the DMC and RMK D
- New radiometric calibration offered for existing DMC customers

INTERGRAPH

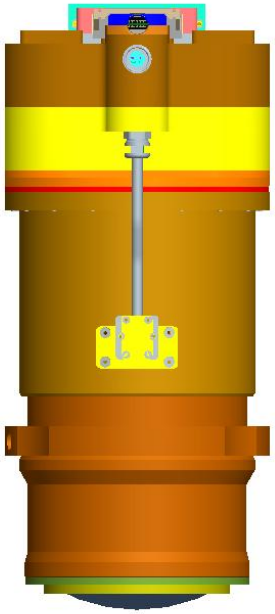
RMK DX
A Product of Z/I Imaging

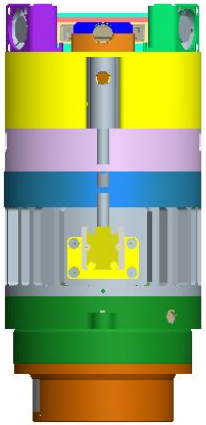


- Multi spectral sensor, RGB and IR
- 2:1 pan-sharpened color resolution
- FMC forward motion compensation
- 2 second frame rate
- B/H ratio of 0.36 @ 60% overlap
- 4x42 MPixel, 7.2 um MS CCD
- 1x140 MPixel, 7.2um PAN CCD
- Finished Image Size:12,096 x 11,200
- 10cm GSD @ ~4200 ft flying height

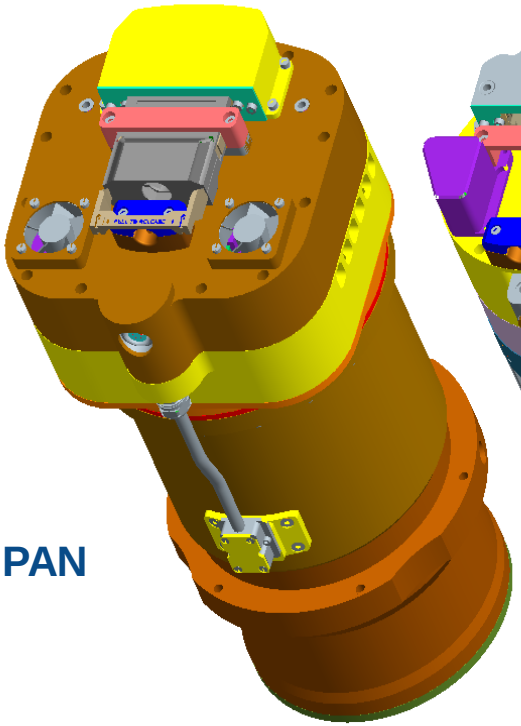
RMK DX Camera Heads

PAN

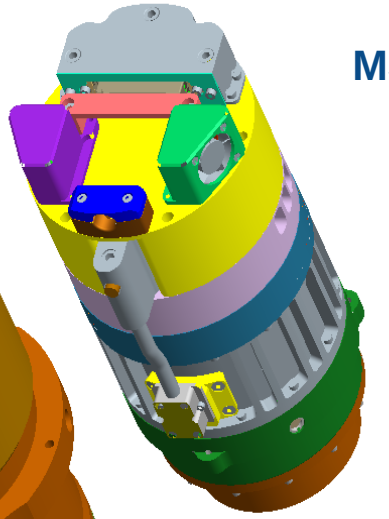




MS



PAN



MS

RMK DX Camera Design

RMK DX
A Product of Z/I Imaging

feature	value
pixel across track	12096
pixel along track	11200
FoV across track	50.7 °
FoV along track	47.3 °
focal length	92,0 mm
GSD@500m	3.9 cm
B/H	0,35
pixel size	7.2 micron
number of camera heads	5
PAN : Color Resolution	1:2
frame rate	2,0 sec
color channels	R,G,B, NIR
resolution per pixel	14 bit
FMC	yes
CCD dynamic range	>69 db
onboard storage	1.5 Tbyte

Technical specs

flying height over ground	flying height over ground	GSD	GSD
320 m	1050 ft	2,5 cm	1,0 "
500 m	1640 ft	3,9 cm	1,5 "
650 m	2132 ft	5,1 cm	2,0 "
800 m	2624 ft	6,3 cm	2,5 "
970 m	3182 ft	7,6 cm	3,0 "
1300 m	4264 ft	10,2 cm	4,0 "
1950 m	6396 ft	15,3 cm	6,0 "
3200 m	10496 ft	25,0 cm	9,9 "
3900 m	12792 ft	30,5 cm	12,0 "
5000 m	16400 ft	39,1 cm	15,4 "
10000 m	32800 ft	78,3 cm	30,8 "

GSD and flying height

INTERGRAPH

RMK DX
A Product of Z/I Imaging

- Basic RMK D design
- RMK DX will include a ***5th PAN camera head***
- Single large format CCD
- The CCD has ***12 k x 12k pixel at 7.2 micron*** pixel size
- Focal length of the PAN camera will be 92 mm.

- ***First monolithic cone ever***
  - ***with one single CCD sensor***
  - ***resulting in nearly 12k Pixel swath width***

RMK DX User Benefits

- Single monolithic PAN camera head
- Very high frame rate
- 1:2 PAN to color ratio
- Small size and weight

Thank you for your attention!

Klaus Neumann

Product Manager Sensor Systems

Z/I Imaging

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