Phase One Geospatial

Introduction



Phase One

Company

- FOUNDED in 1993 in Copenhagen, Denmark.
- Today we have partners in 50+ COUNTRIES across all 7 continents, and a core Phase One Team of 320+ employees across 11 countries.
- WE ARE A WORLD LEADING PROVIDER of medium format digital imaging systems and solutions for industrial applications and professional photographers
- We supply IMAGING BREAKTHROUGHS from high-resolution camera systems to advanced software solutions for better & more productive imaging workflows

PHASEONE
IMAGING BEYOND IMAGINATION



Phase One HQ Denmark

Phase One has a long history of digital imaging

Unparalleled image quality and precision

Geospatial Imaging

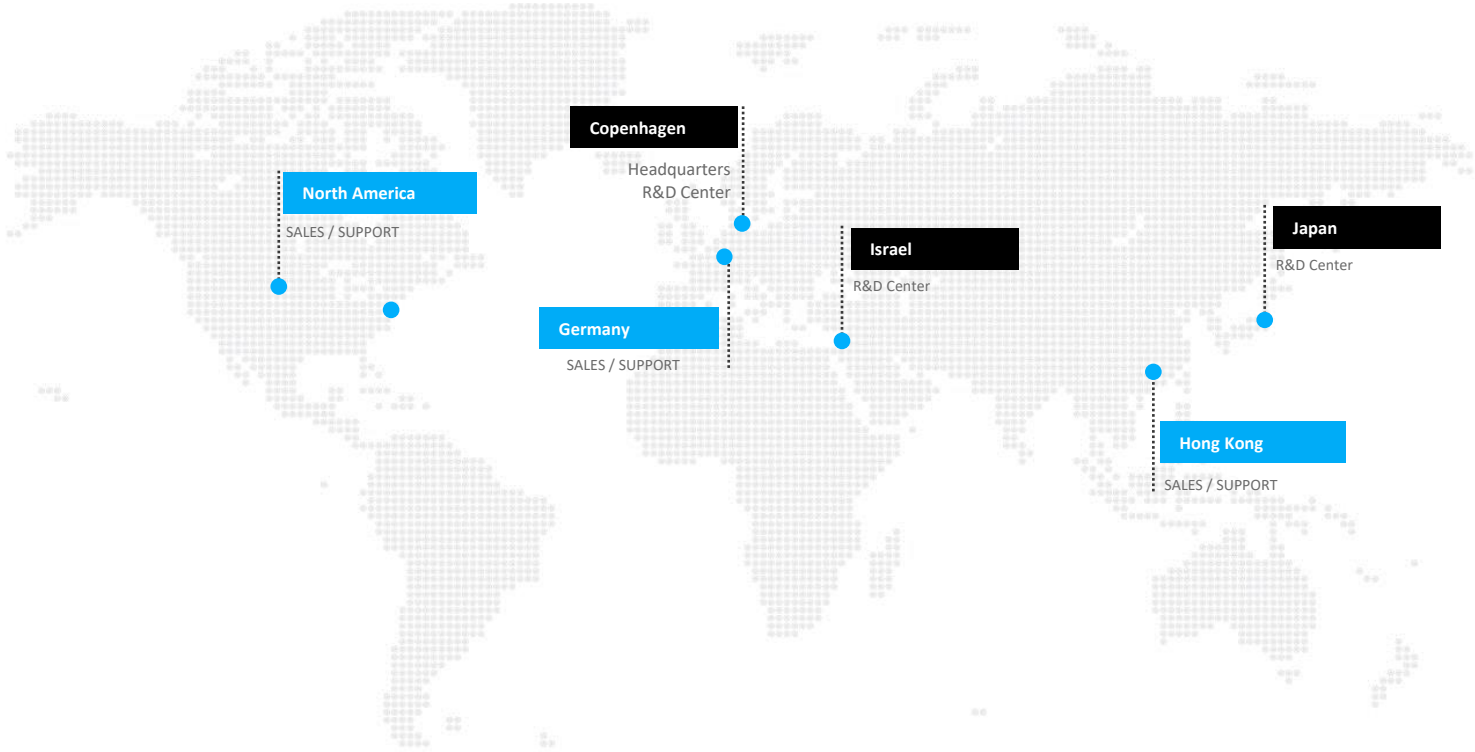


Bespoke Photography



Cultural Heritage & Scientific Imaging





Global coverage incl.
50+ distribution & service partners

PHASEONE
IMAGING BEYOND IMAGINATION

OUR RANGE OF PRODUCTS



Phase One, Rodenstock and Schneider-Kreuznach lenses

Enabling speeds of up to 1/2500s

Manufactured with precision for ultimate image quality, performance and durability.

Min. 500.000 shutter actuations

Available in a range of focal lengths from 23 mm to 300 mm.

Motorized lenses for UAV Inspection



50MP, 100MP, 150MP, 190MP to 280MP Sensors

Cost effective alternatives to large format cameras

RGB and NIR solutions

Multiple cameras synchronization

UAV Ready - low weight and close integration with Pro UAV platforms

USB3/10G Ethernet and XQD/CF Cards as Storage options

H/W interface for waypoint mapping



Rugged and Fanless platform

Power and Drive multiple cameras

Two removable solid state drives (SSD) with optional RAID system for data mirroring

Unlimited storage with multiple SSD drives

Pre-installed with iX Capture and Capture One

Software Solutions

Best in Quality Processing engine from RAW to TiFF/Jpeg

SDK for Win, Mac and Linux Platforms

Data Centers Processing support

IX Link for real time control via serial communication

Flight Planning and Flight Management Software

iXM Series





iXM

- First Phase One Camera with **IP53 weather protection design**
- FCC Class A, CE, RoHS
- Compact and robust design
  - 90mm x 90mm x 68mm
  - **630 gr (without lens)**
- Display removed to extend user cases and to enable cooling / heating systems





iXM-RS



- FCC Class A, CE, RoHS
- Compact and robust design
  - 90mm x 90mm x 91mm (100/150MP)
  - 1000 gr (without lens) (100/150MP) / 4700 gr (280MP incl. lenses)
- Display removed to extend user cases and to enable cooling / heating systems

Phase One Metric Aerial Cameras

Large, High Speed Storage – External and Internal Removable Memory

Ultrafast internal and external storage



USB 3.0

SUPERSPEED USB

10G Ethernet via SFP+



XQD or CFexpess cards

EXTERNAL STORAGE OPTIONS	INTERNAL STORAGE OPTIONS

High constant capture rate

50MP	= 2 FPS*
100MP	= 2-3 FPS*
150MP	= 2 FPS*
190MP	= 1.6 FPS*
280MP	= 2 FPS*

Phase One iXM-GS120

Unique, Further seeing, faster and robust

iXM-GS120 is the newest member in Phase One cameras family, bringing unmatched combination of image quality, performance and endurance, ideal for long and remote missions, high speed aerial platforms, high productivity requirements and challenging environmental conditions

iXM-GS120 advantages:

1. The only commercially available large frame global shutter camera
2. Largest magnification thanks to fine pixel pitch 3.45um
3. No moving parts for maximum reliability & endurance
4. Operating in lower temperatures. Lower limit below -30°C
5. Ready for UAV integration via Mavlink and P1SDK



iXM-GS120

Supported lenses

RSM Lenses



RSM 35mm f/5.6



RSM 80mm f/5.6



RSM 80mm AF f/5.6



RSM 150mm AF f/5.6



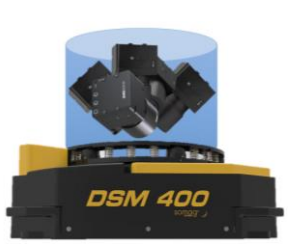
RSM 300mm AF f/8

RS Lenses
(Thru RS Adaptor)

- 50mm
- 70mm
- 90mm
- 110mm
- 150mm MK II
- 180mm

Phase One Metric Aerial Cameras

Various range of integrations

iXM	UAV applications	Small multi-camera arrays	Inspection
		  	 

iXM-RS	Manned Aircrafts	Phase One Aerial System (PAS)	Multi-Camera arrays	Camera next to LIDAR	Inspection
					



Phase One P3 Payload

Unmatched Productivity

Phase One P3

Why UAVs for Asset Inspections

UAVs are addressing key pain points in the inspection of critical and high value assets through…



Extended Operational Flexibility

UAVs breaks the dependence of specialized assets for inspections and reduced the operational costs



Enhanced Operator Safety

UAVs increases the safety of high risk inspections compared to manual inspections



Improved Business Productivity

UAVs increases the productivity of high volume/frequency inspections compared to manual inspections

Phase One P3

Why the P3

If your current UAV inspections are unable to…

…Capture sub milimeter details of complex structures from a safe distance

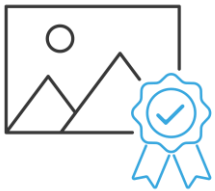
…Capture consistent sharp images in challenging, high contrast environments

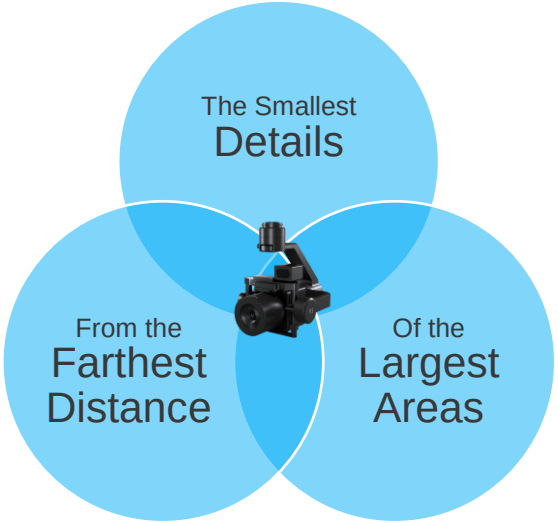
…Capture entire assets in sub milimeter details with a minimum of images

Phase One P3

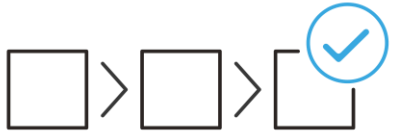
Unmatched Productivity Delivered

Best in Class Image Quality w. the iXM Medium Format Sensor





Comprehensive integration toolbox



Phase One P3

Capture sub milimeter details of complex structures from a safe distance

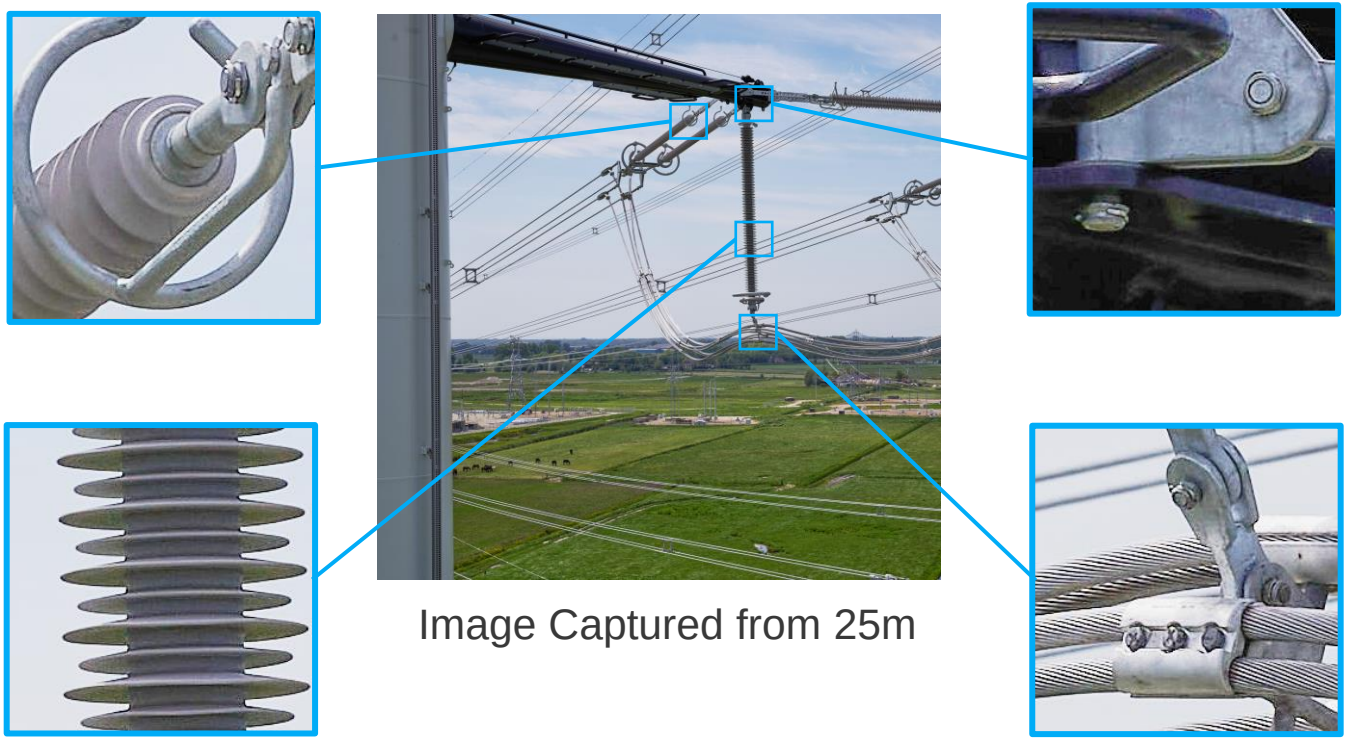


Image Captured from 25m

Phase One P3

Capture consistent sharp images in challenging, high contrast environments

Image Captured in IIQ → Image Converted int o JPG → Image Corrections Applied → Image Analysed → Image Delivered to Customer



Unprocessed Image



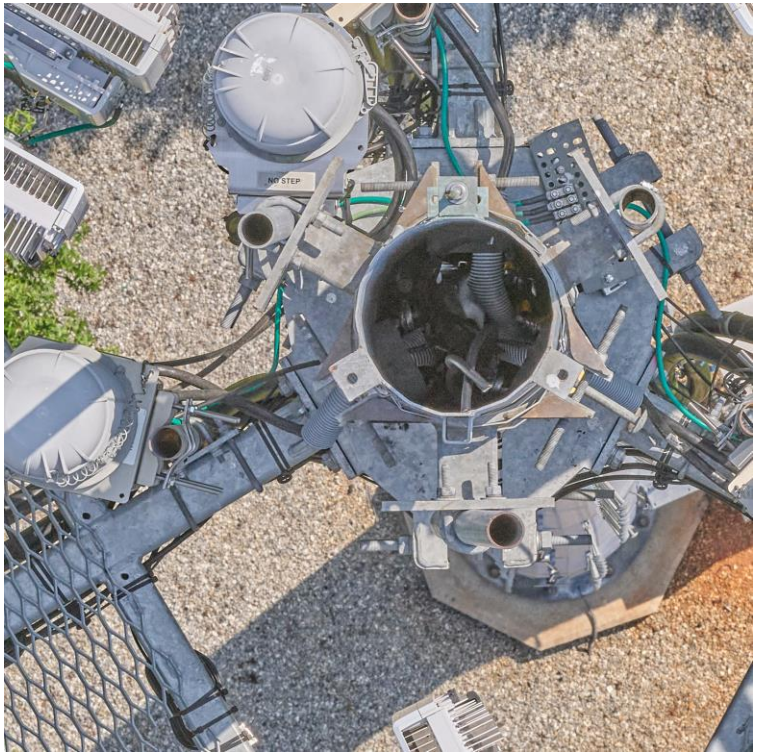
Same corrections have been applied

Image Captured in IIQ → Image Corrections Applied → Image Analysed → Image Converted into JPG → Image Delivered to Customer



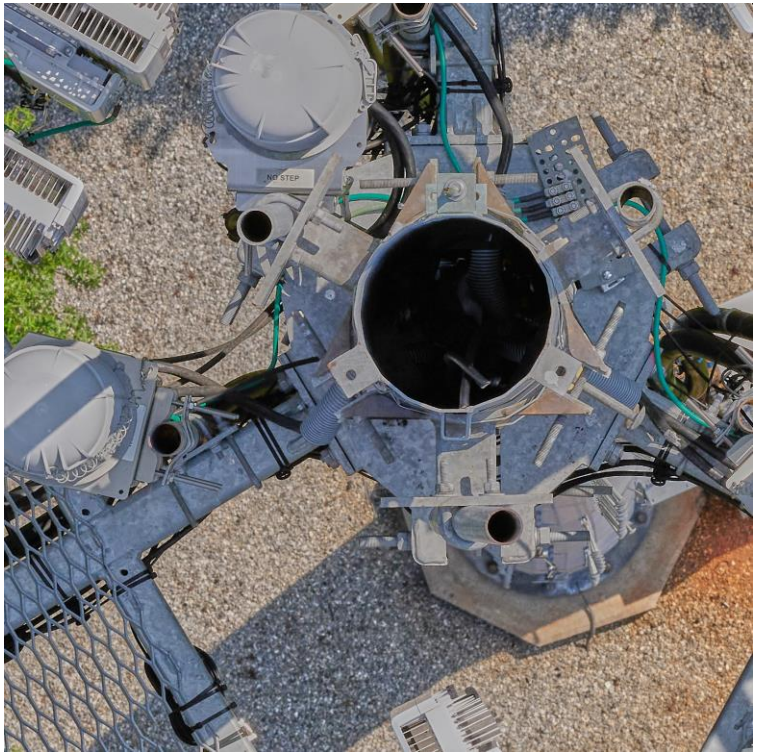
Phase One P3

Comparison of Dynamic Range



IIQ

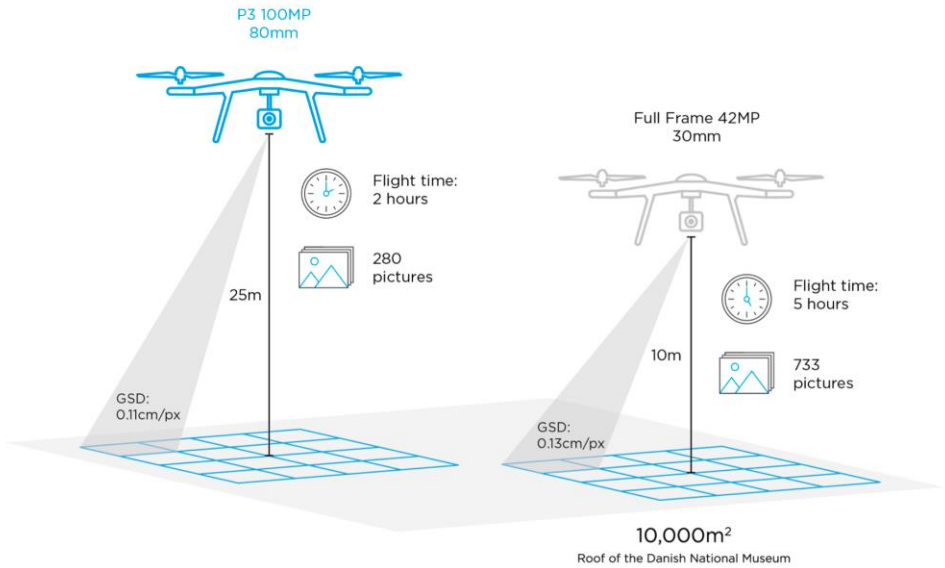
Same corrections have been applied



JPEG

Phase One P3

Capture entire assets in sub milimeter details with a minimum of images





Phase One P3

Payload Highlights

P3 for DJI-M300

P3 for Mavlink

P3 for Auterion

Versatile Platform Support

Interface to DJI, Auterion and MAVLink UAVs or use Phase One integration Toolbox for seamless integration with your exisitng workflows

3-axis stabilization



Smart Focusing

Builtin Laser Range Finder to ensure consistent focus in complex and high contrast situation

Wide Lense Range

35*, 80 and 150mm lenses, to meet your GSD requirement from any distance witout compromising on safety

Medium Format Sensor 50/100MP

50 & 100MP sensor ensure largest coverage, highest dynamic range and smallest GSD in the market

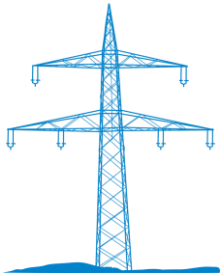
Phase One P3

Where small details make a big difference



High Value Asset Inspection

Most large infrastructure projects require frequent detailed inspections with the highest quality and consistency, as the consequences of missing even a small fault can have massive financial implications.



High Risk Asset Inspection

For many inspections, getting up close is not an option as it is not only very risky for the UAV but also for the asset being inspected. Achieving high quality images in such high-risk inspections is an unmet challenge.



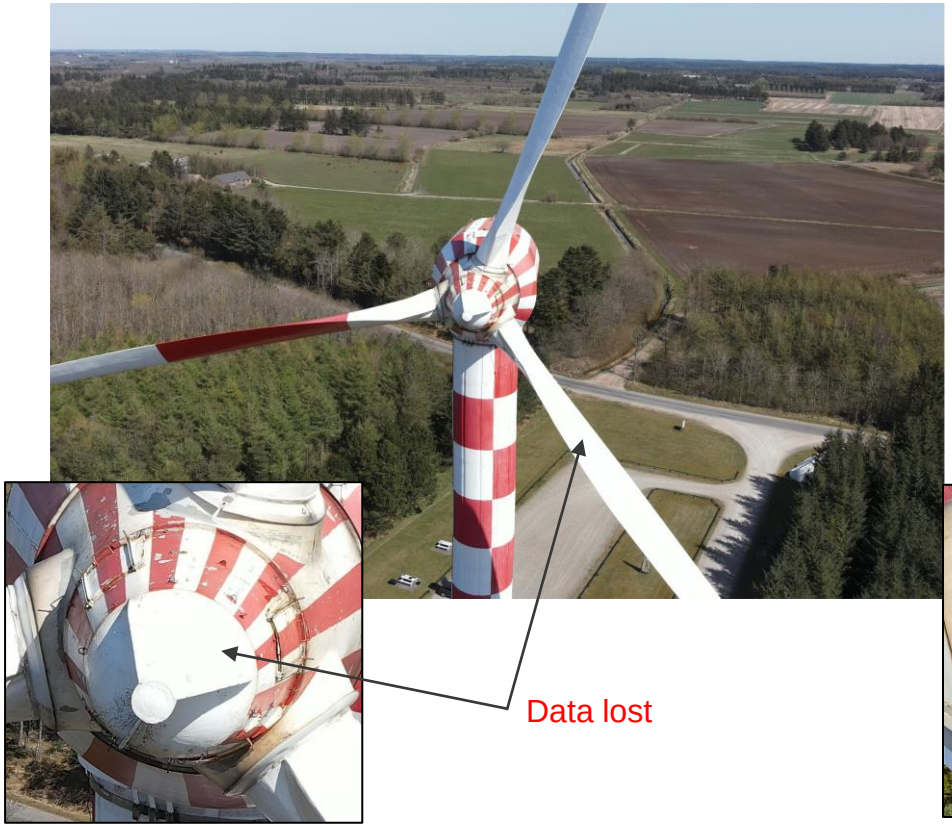
Time Critical Asset Inspections

You don’t always get second chances. In such situations, it is critical that the images you capture contain the required information, as repeating the inspection may be difficult due to external conditions.

Image comparison

Wind turbine inspection – Image with same GSD

Zenmuse P1



PhaseOne P3 (80mm)



Image comparison

Wind turbine inspection – Image with same GSD

Zenmuse P1



PhaseOne P3 (80mm)



Post treatment of the IIQ images



The white color of the wind turbine on sunny day make it very difficult to work with the P1 sensor as many areas become over exposed.

With the P3, thanks to the IIQ file format, in the same flight condition it is possible to avoid over exposure.

Image comparison

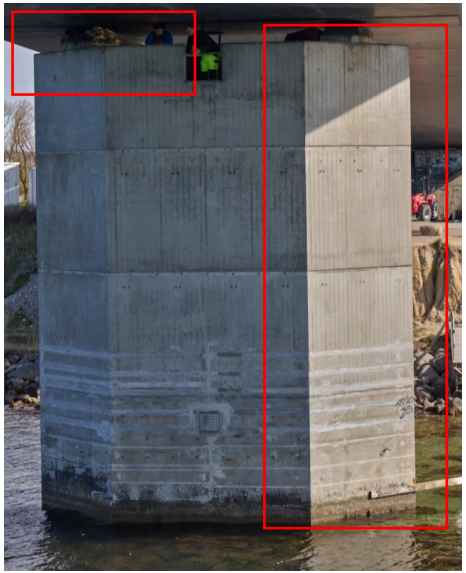
Bridge pier inspection – Image with the same GSD

Zenmuse P1 (35mm)



PhaseOne P3 (80mm)





During the inspection, some side of the pier was directly illuminated by the sun creating strong contrast on the concrete.

With the P1, it led to over exposed areas = loosing information

With the P3, thanks to the IIQ file format, in the same flight condition it is possible to keep the data in the bright area while keeping information in the dark areas.

Phase One P3

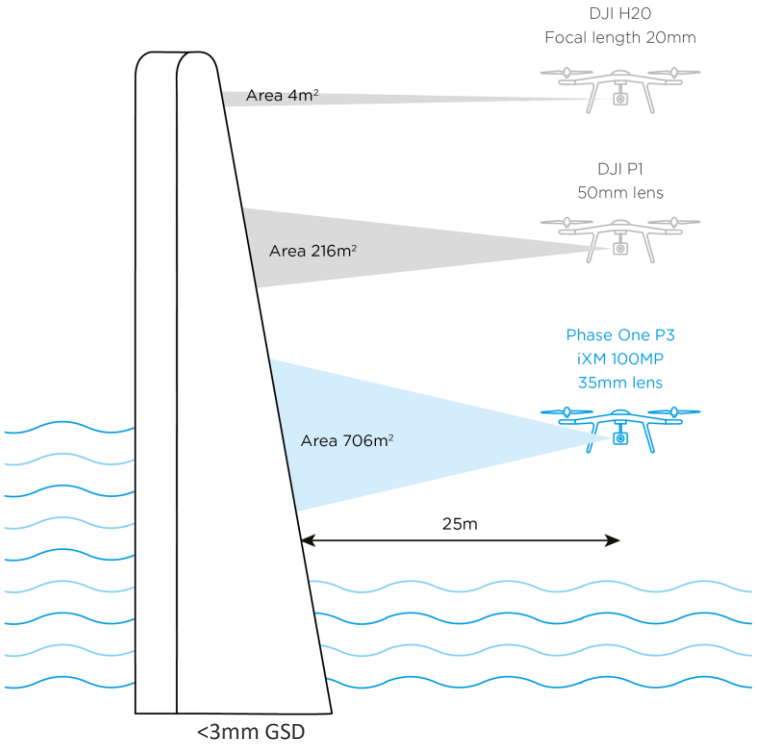
Highest Image Quality in High Contrast Environments





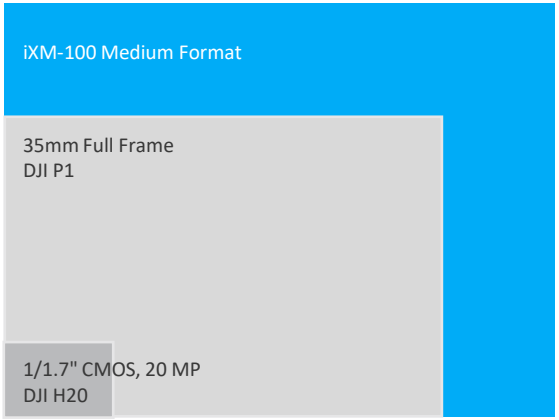
Image courtesy of Nordic Unmanned AS, Norway

P3 - Largest areas with smallest Ground Sampling Distance (GSD)



Larger Coverage for Faster Missions

- The iXM is the bench market for medium format sensor
- This sensor is 1.7 times larger than a standard 35mm full-frame sensor, which translates directly into inspection productivity.



Phase One P3

Largest Coverage with Smallest GSD

We used the P3 for DJI with PhaseOne's iXM 100MP camera for a dam inspection. It is a small and compact system and with the given endurance of the DJI M300 drone we could easily double the outcome and productivity compared to another camera used previously. As we inspected the water side of the dam, best possible productivity was essential to complete the job in time. Furthermore, the image quality and detail level is a class of its own. The integrated system made it easy to operate and we were able to use the P3 system out of the box with our M300.

Juri Klusak
CEO, Orthodrone GmbH



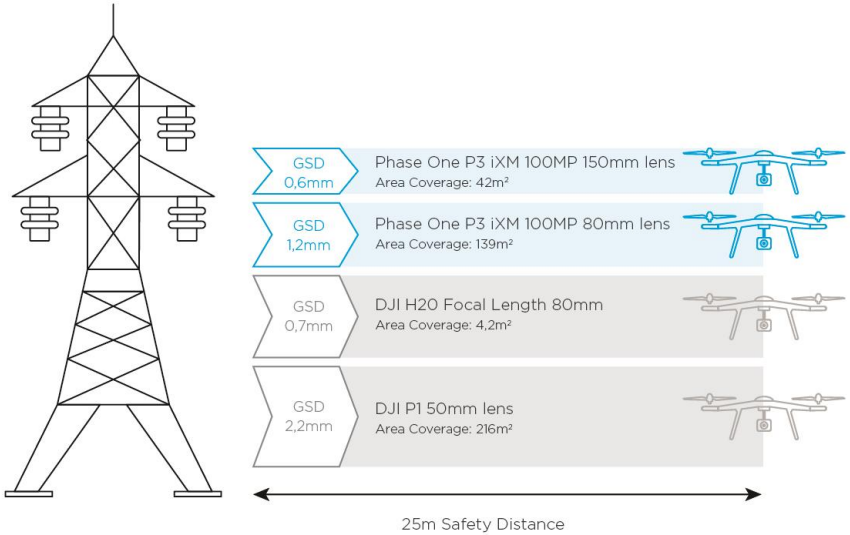
Image courtesy of Image courtesy of Orthodrone GmbH (DE) / Axpo Power AG (CH)

Phase One P3

Maximum Safety Without Compromising Quality & Coverage

Get the finest details from farther distance.

Uncompromised image quality when closing the distance is limited by safety or regulations.



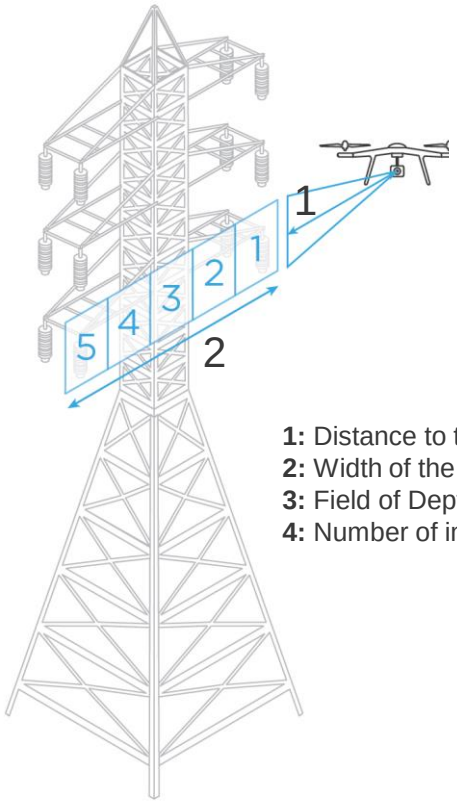
Maintain operational safety

- The lens offering increases the productivity and ensure safe operations, without compromising on Image quality.
- All of Phase One's lenses are calibrated from the factory to the highest quality standards.
- Best Coverage to GSD Ratio

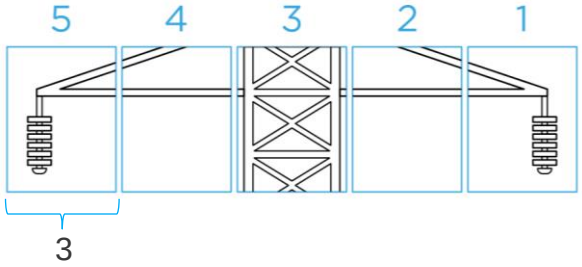


Phase One P3 – Smart Focus Features

Advanced Focusing Feature: Focus Bracketing



4: Image sequence with changing focus distance



1: Distance to the object – Measured with the P3's laser range finder
2: Width of the asset – Provided by the asset owner
3: Field of Depth (FoD) - Calculated
4: Number of images required to capture the full depth of view - Calculated

Why use Focus Bracketing

- To get more effective flight time as the operator only position the UAV once per image sequence
- To Increase consistency regardless of the skill level of the pilot. This makes it easier to scale the inspection operations
- To Increase automatization as the need for a human in loop for quality assurance is reduced

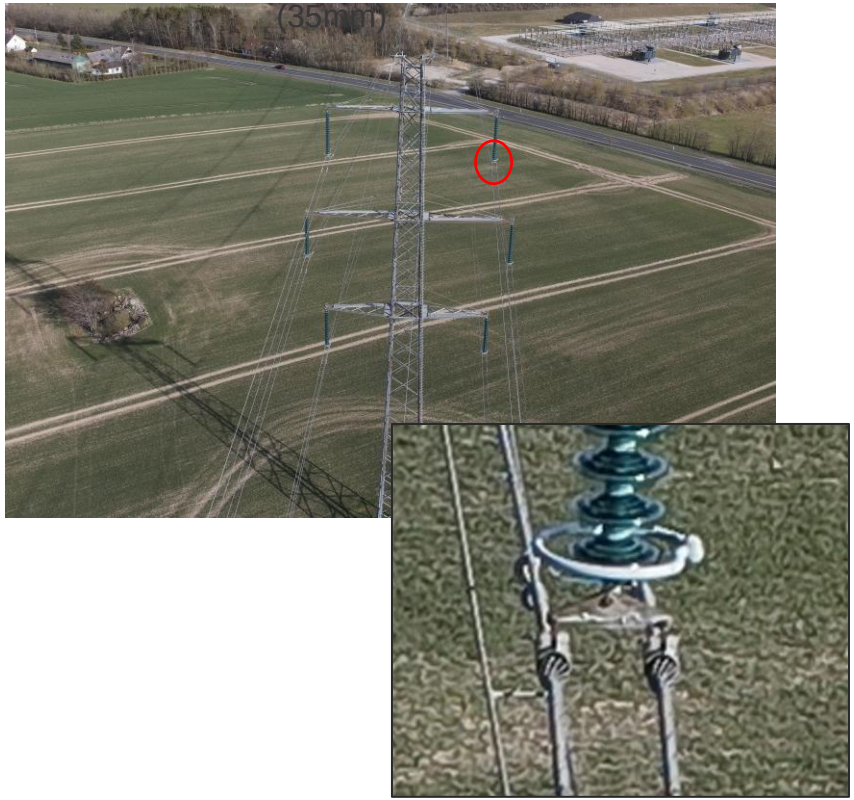
When to use Focus Bracketing

- When you need to inspect many deep and complex assets with many details in areas that are remote or inaccessible making reflying very costly

Image comparison

Powerline Inspection – Image from the same distance (40m)

Zenmuse P1 (35mm)



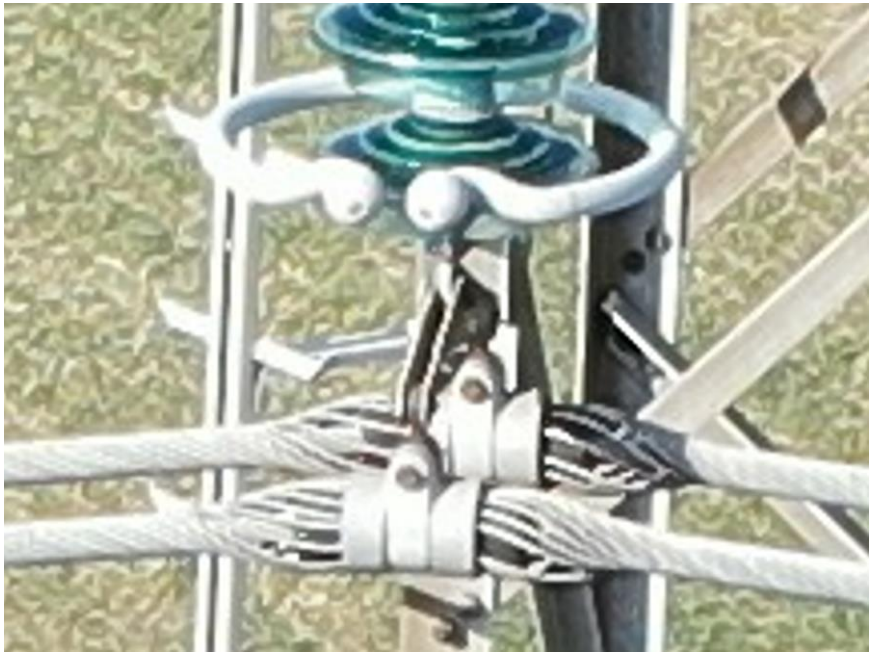
PhaseOne P3 (80mm)



Image comparison

Powerline Inspection– Image from the same distance (40m)

Zenmuse P1



PhaseOne P3 (80mm)



Phase One P3

Maximum Safety Without Compromising Quality & Coverage

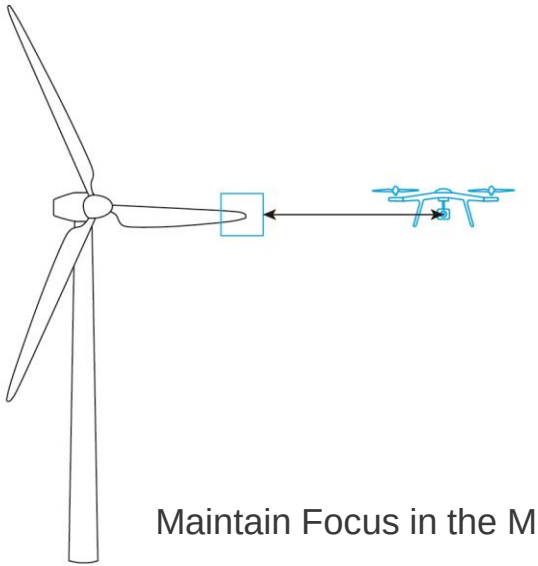
The P3 Payload allows the installation of the industry-leading iXM-100 to be partnered with the competent specifications of the DJI M300. The P3 enables our customers to utilize the best camera technology on one of the most capable platforms available in our industry, whether for inspection or mapping applications.

James Pick
Business Development Manager, Coptrz



Phase One P3

Smart Focus - Sharper Images – No Repetition



Maintain Focus in the Most Difficult Circumstances

- With the LRF the camera always focus on the center of the image, even in high contrast situations such as the tip of a wind turbine blade.
  - Laser Range Finder
  - Focus Limitations

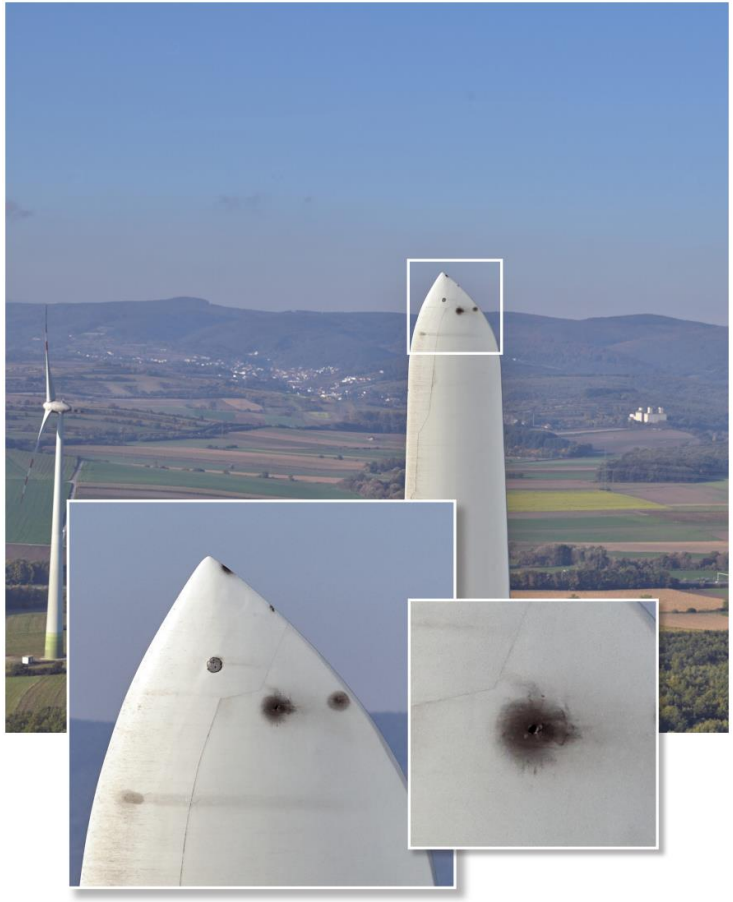


Image courtesy of 4D-IT GmbH, Austria

Phase One P3

Specifications

	P3 DJI	P3 Mavlink	P3 Auterion
Weight (w. 80mm AF Lens)	2,6kg		
Sensor	Medium Format iXM 50 (8280 x 6208) & 100MP (11664 x 8750)		
Environmental Rating	IP53 (iXM only)		
Gimbal Stabalization	3 Axis		
Laser Range Finder (Effective Range)	Approximately 90m		
Supported Lense Range	35*, 80, or 150mm		
Camera Control (key features)	ISO, Shutter Speed, Exposure, AE, Focus Distance, AF/MF, LRF Range max/min, Focus Peaking		
Camera Metadata (key features)	EXIF (incl. IMU & Custom Field), ICC Profile, XMP (incl. GPS) & IPTC		
Live view	HDMI		
Smart Focusing	Auto focus based on LRF input		
Flight Planning Software	DJI Pilot	Q Ground Control & Mission Planner	Mission Control
Electric Interface	Skyport V2	HDMI, Telemetry, USB-c	
Software Interface	Support for PSDK & MSDK	Support for MavLink Protocol v1	
Hardware Compatibility	DJI M300 only	Mavlink based platforms Cube Orange & PixHawk 4.0	Auterion based platforms SkyNode

*only fixed focus



UAV Ecosystem

Separate your UAV decision for your Payload decision

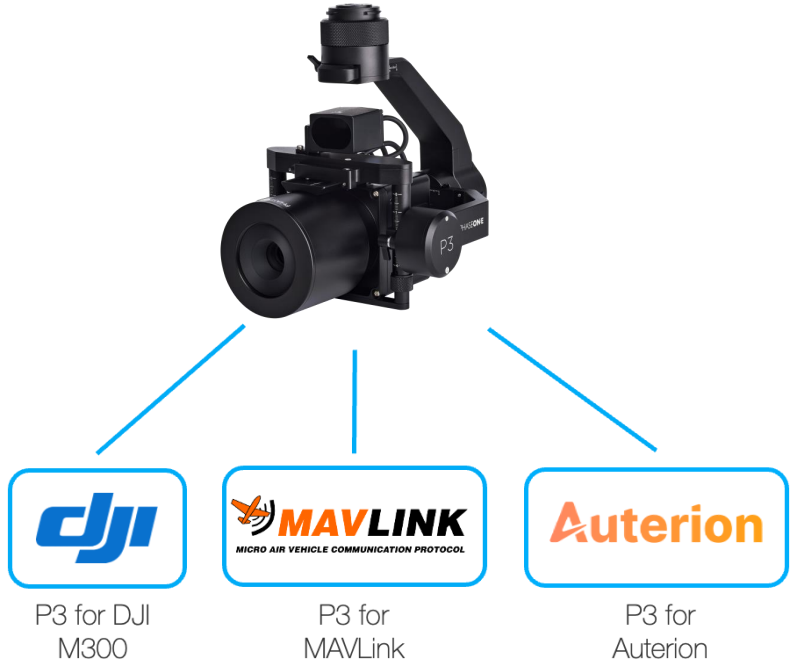
Phase One P3 Integration

One Camera – Three UAV Ecosystems

The P3 Payload’s compatibility with major UAV ecosystems untethers your choice of imaging solution from your UAV decision. Secure your long-term business success with the most versatile imaging solution.

Phase Ones invests in continuous development of new and existing imaging solutions.

The P3 Payload is your guarantee for business agility



PhaseOne P3

P3 for DJI M300 - Integrated Workflow



Existing Platforms – Instant Payback

P3 DJI – Ready for flight

The P3 payload for the DJI M300 is a ready-for-flight, plug and play solution that gets you started with the tools you already have from day one and delivers higher value to your customers.

P3 DJI provides:

- Plug and Play integration
- Extended meta data
- DJI Workflow via the DJI Pilot App

PhaseOne P3

P3 for DJI M300 - Integrated Workflow



Camera setting

- Set focus peaking threshold
- Set ISO
- Set shutter speed
- Set aperture
- Set exposure compensation
- Toggle auto exposure (AE)
- Set focus distance
- Toggle auto and manual focus (AF/MF)
- Show histogram
- Set camera limitations: focus distance, SS, A or ISO (with CaptureOne & iXM Capture)

Operation modes

- Dual & single operator mode
- Lock & follow mode
- Support for manual flight with DJI Smart Controller
- Support for mission flight with DJI Smart Controller
  - Oblique flight mode
  - Record flight

Data

- Store metadata
  - Time
  - Position
  - Altitude
  - Speed
  - Drone orientation
  - Payload orientation
  - Lens focus position
  - Laser Range Finder ranging
- Support RTK GPS

Phase One P3

P3 for MAVLink



MAVLINK
MICRO AIR VEHICLE COMMUNICATION PROTOCOL

Open Platforms – Full Flexibility

P3 MAVLink – Ready for integration

The P3 payload for MAVLink is designed to significantly reduce your time to market by fast-tracking your integration efforts. You have the freedom to customize the integration for your specific platform and application requirements.

P3 MAVLink provides:

- Support for MAVLink
  - PX4 & ArduPilot
  - Cube Orange & PixHawk
  - Q Ground Control & Mission Planner

- Complete documentation accessible via the Phase One Integrator Portal (https://geospatial.phaseone.com/resources-support/sdk-software/)

Phase One P3

P3 for Auterion



Auterion

Future Proofing – Enterprise Scalability

P3 MAVLink – Ready for Scaling

Faster expansion and diversification of your drone fleet. Supporting customers' current and future business regardless of their platform, the P3 Auterion deliver unmatched, end-to-end productivity.

P3 Auterion provides:

- Full support for the Auterion Ecosystem via the SkyNode and Mission Control
- Leverage on smart workflows and communication infrastructure with extended connectivity
- Complete documentation accessible via the Phase One Integrator Portal (https://geospatial.phaseone.com/resources-support/developer/)

iXM 100MP Metric Aerial Camera

Delivers the crucial details

Example: **Area Mapping**



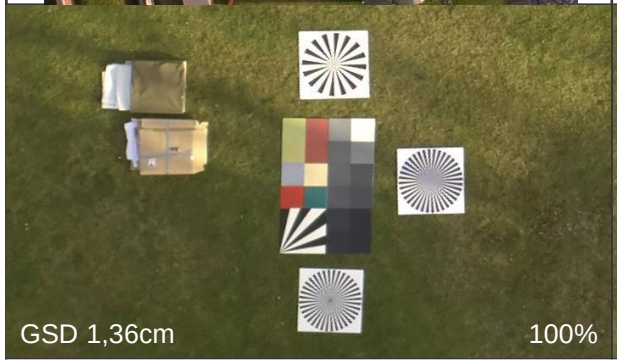
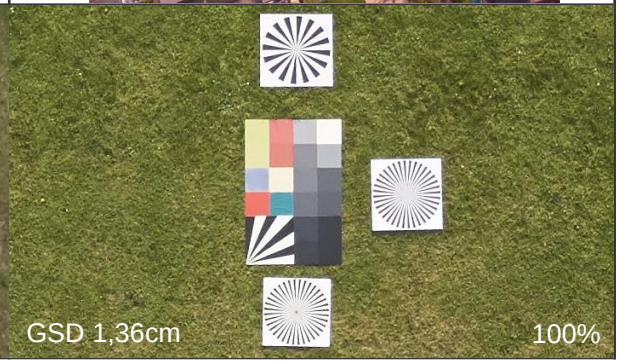
Zeche Zollern, Germany
Coordinates: 51° 31′ 4.08″ N, 7° 20′ 4.74″ E

Project Size: 500m x 215m
Target GSD: 1,36cm

Comparision – Aera Mapping – GSD 1.36cm

PHASEONE
IMAGING BEYOND IMAGINATION

DJI Phantom 4 Pro (20MP) Focal length 8mm, (equivalent to Full Frame 35mm = 21,6mm) Sensor Size 13,2mm x 8,8mm, Pixel Size 2,4µm 5472 x 3648 px	DJI Zensmuse X5S (20.8MP) Focal length 24mm, (equivalent to Full Frame 35mm = 48mm) Sensor Size 17,3mm x 13mm, Pixel Size 3,28µm 5280 x 3956 px	Phase One iXM-100 (101MP) Focal length 35mm, (equivalent to Full Frame 35mm = 27mm) Sensor Size 43,9mm x 32,9mm, Pixel Size 3,76µm 11664 x 8750 px
		
Flight Altitude = 45m AGL GSD = 1.36cm Image Coverage = 74.4m x 49.6m	Flight Altitude = 99m AGL GSD = 1.36cm Image Coverage = 71.8m x 53.8m	Flight Altitude = 126m AGL GSD = 1.36cm Image Coverage = 158.6m x 119.0m

DJI Phantom 4 Pro (20MP) Focal length 8mm, (equivalent to Full Frame 35mm = 21,6mm) Sensor Size 13,2mm x 8,8mm, Pixel Size 2,4µm 5472 x 3648 px	DJI Zensmuse X5S (20.8MP) Focal length 24mm, (equivalent to Full Frame 35mm = 48mm) Sensor Size 17,3mm x 13mm, Pixel Size 3,28µm 5280 x 3956 px	Phase One iXM-100 (101MP) Focal length 35mm, (equivalent to Full Frame 35mm = 27mm) Sensor Size 43,9mm x 32,9mm, Pixel Size 3,76µm 11664 x 8750 px
		
		

Comparision – Aera Mapping – GSD 1.36cm

PHASEONE
IMAGING BEYOND IMAGINATION

DJI Phantom 4 Pro (20MP)

Focal length 8mm, (equivalent to Full Frame 35mm = 21,6mm)
Sensor Size 13,2mm x 8,8mm, Pixel Size 2,4µm
5472 x 3648 px



DJI Zensmuse X5S (20.8MP)

Focal length 24mm, (equivalent to Full Frame 35mm = 48mm)
Sensor Size 17,3mm x 13mm, Pixel Size 3,28µm
5280 x 3956 px



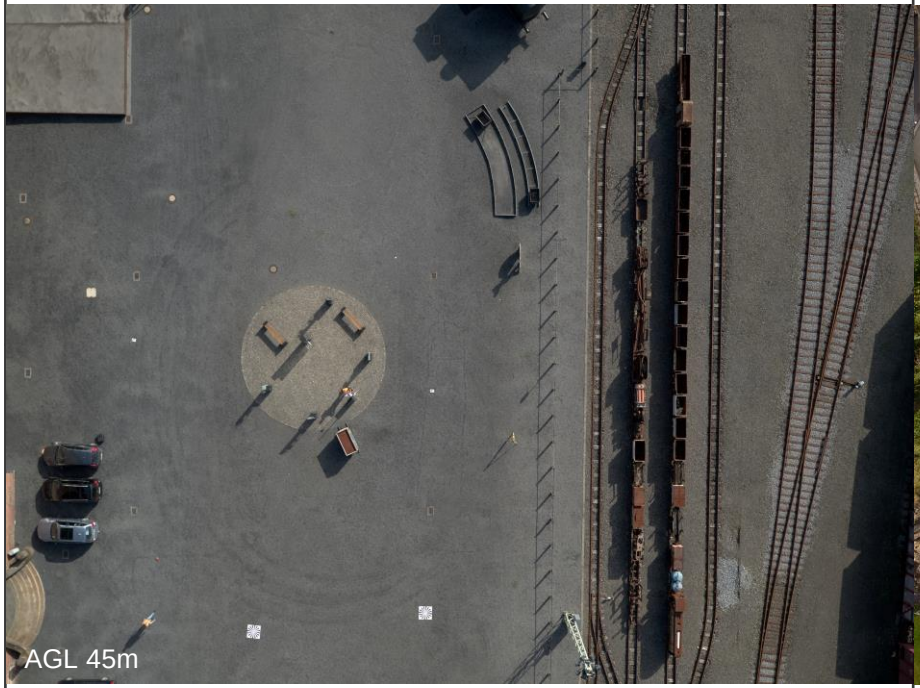
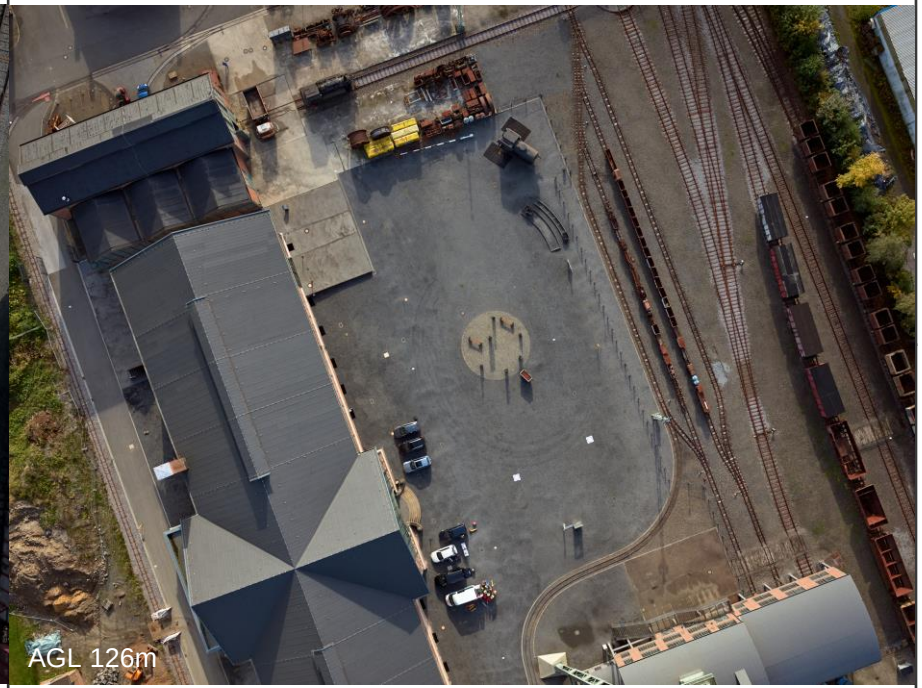
Phase One iXM-100 (101MP)

Focal length 35mm, (equivalent to Full Frame 35mm = 27mm)
Sensor Size 43,9mm x 32,9mm, Pixel Size 3,76µm
11664 x 8750 px



Comparision – Aera Mapping – GSD 1.36cm

PHASEONE
IMAGING BEYOND IMAGINATION

DJI Phantom 4 Pro (20MP) Focal length 8mm, (equivalent to Full Frame 35mm = 21,6mm) Sensor Size 13,2mm x 8,8mm, Pixel Size 2,4µm 5472 x 3648 px	Phase One iXM-100 (101MP) Focal length 35mm, (equivalent to Full Frame 35mm = 27mm) Sensor Size 43,9mm x 32,9mm, Pixel Size 3,76µm 11664 x 8750 px
	

Comparision – Aera Mapping – GSD 1.36cm

PHASEONE
IMAGING BEYOND IMAGINATION

DJI Phantom 4 Pro (20MP)

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Phase One iXM-100 (101MP)

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Sensor Size 43,9mm x 32,9mm, Pixel Size 3,76µm
11664 x 8750 px

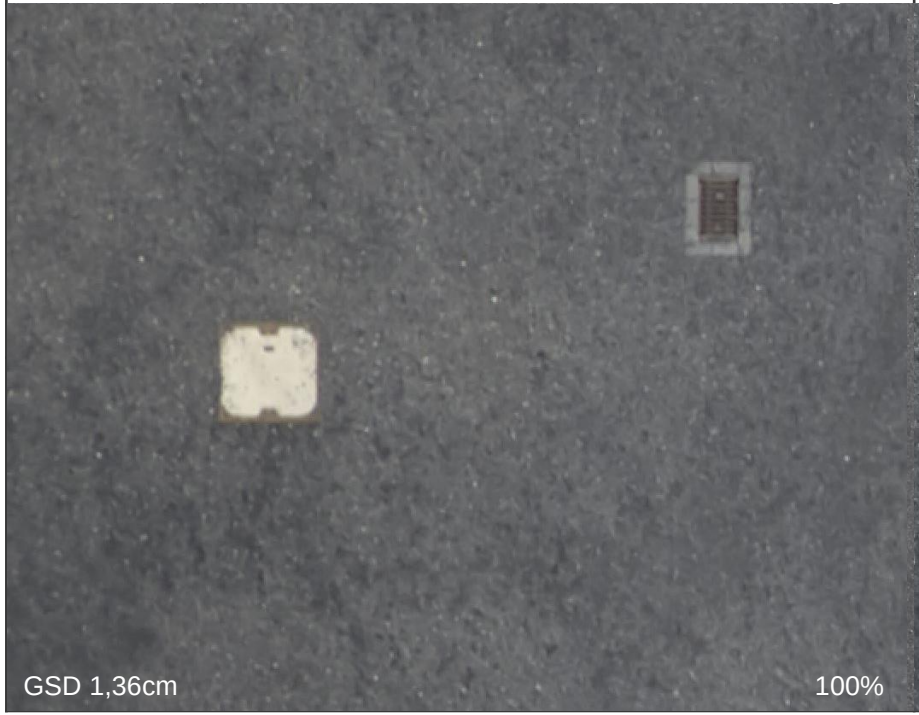


Comparision – Aera Mapping – GSD 1.36cm

PHASEONE
IMAGING BEYOND IMAGINATION

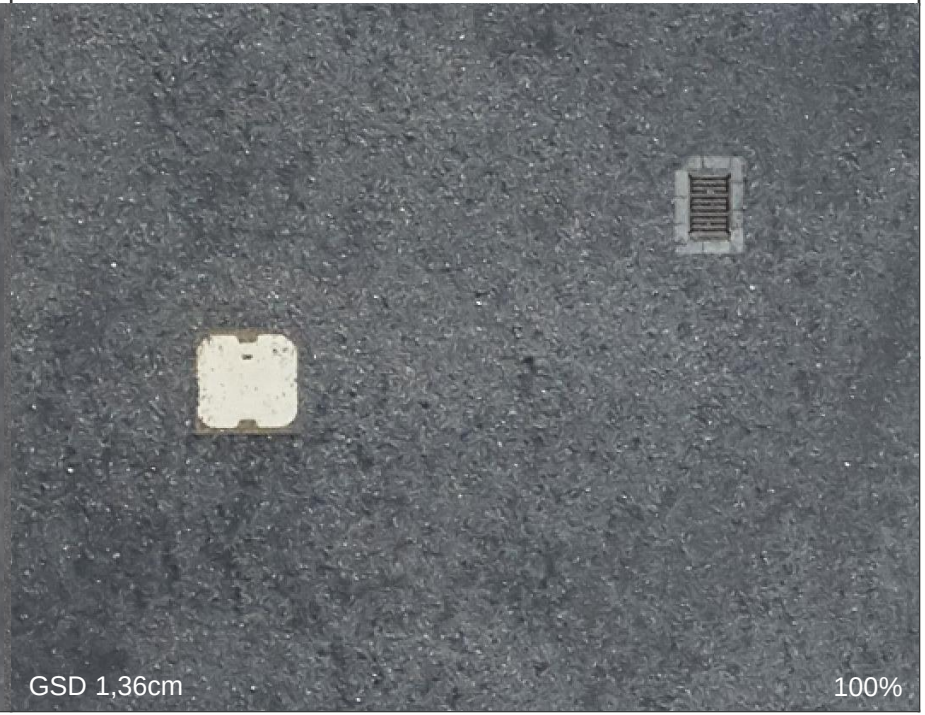
DJI Phantom 4 Pro (20MP)

Focal length 8mm, (equivalent to Full Frame 35mm = 21,6mm)
Sensor Size 13,2mm x 8,8mm, Pixel Size 2,4µm
5472 x 3648 px



Phase One iXM-100 (101MP)

Focal length 35mm, (equivalent to Full Frame 35mm = 27mm)
Sensor Size 43,9mm x 32,9mm, Pixel Size 3,76µm
11664 x 8750 px



Phase One iXM Example Images

Oblique Mapping Project in KSA

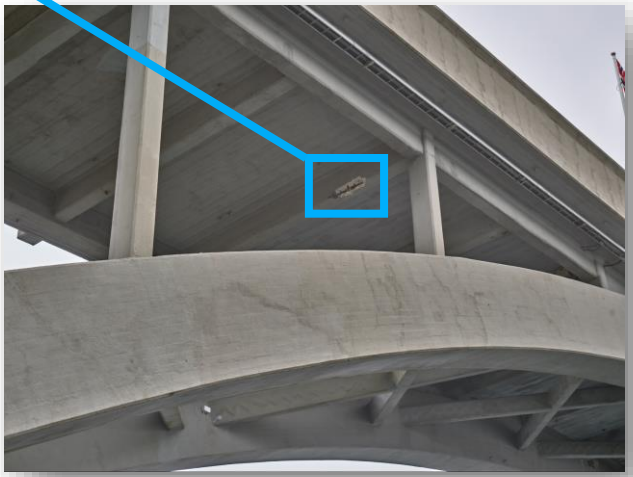




Phase One iXM Example Images

Haugesund Bridge in Norway (1/2)





Phase One iXM Example Images

Haugesund Bridge in Norway (2/2)

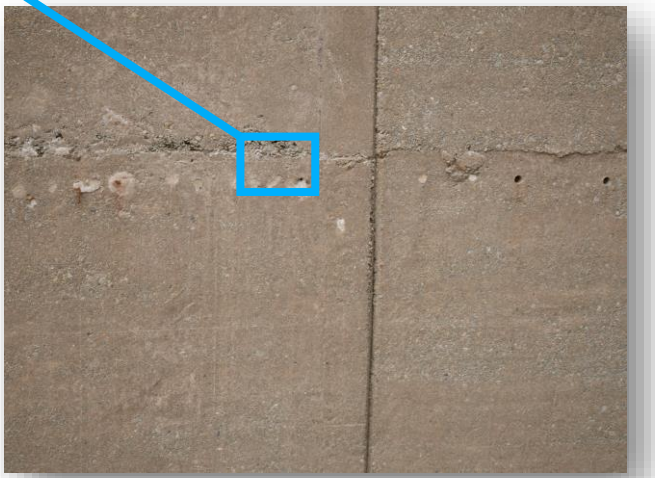




Phase One iXM Example Images

Dam Inspection in Schweiz - Cracks





Phase One iXM Example Images

Inspection of a Wind Turbine in the US – Bolts & Corrosion



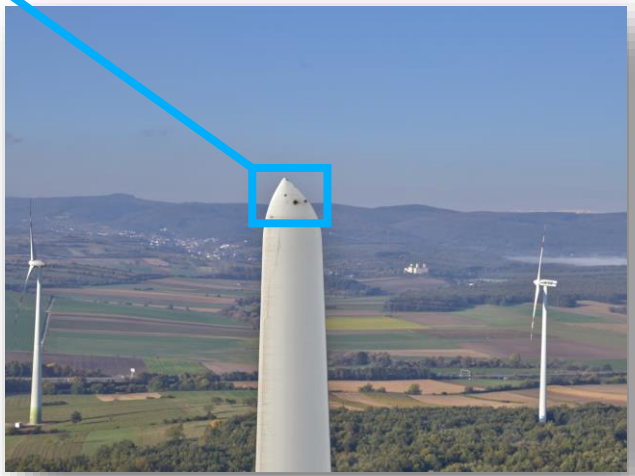


4D Consulting Service Software Development

Phase One iXM Example Images

Inspection of a Wind Turbine in the US – Lightning Strike



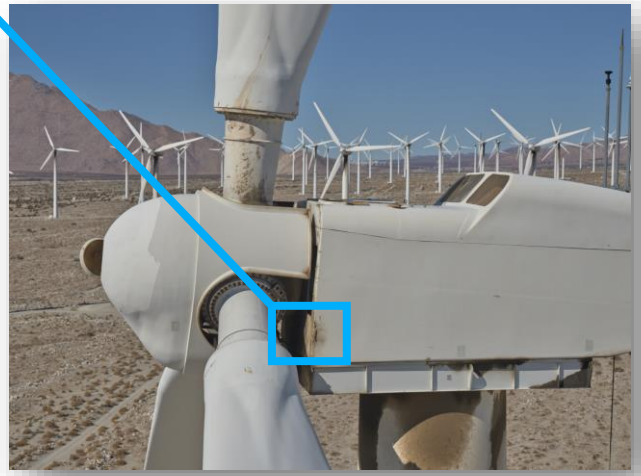


4D IT Consulting Service Software Development

Phase One iXM Example Images

Inspection of a Wind Turbine in the US – Damages

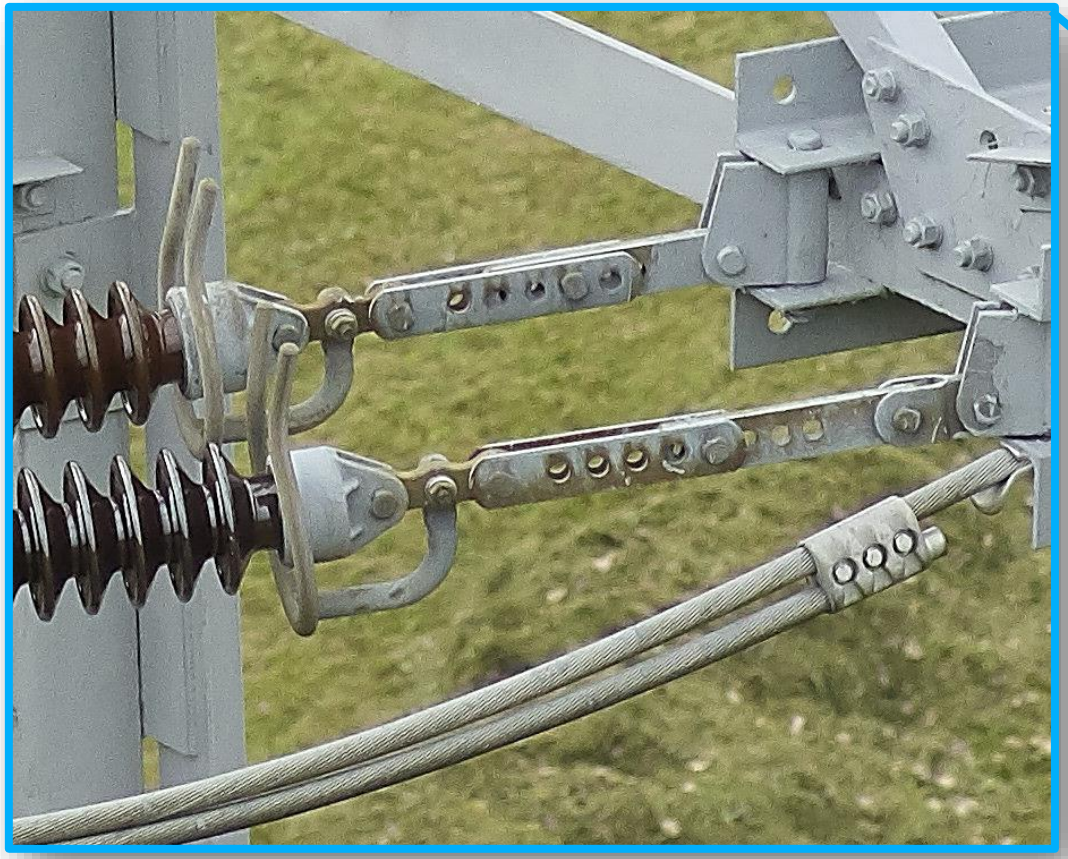




4D IT Consulting Service Software Development

Phase One iXM Example Images

Inspection of a Power Mast in the NL – Insulators





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AERIAL SURVEY & INSPECTION

Phase One iXM Example Images

Inspection of a Power Mast in the NL – Clams (1/2)

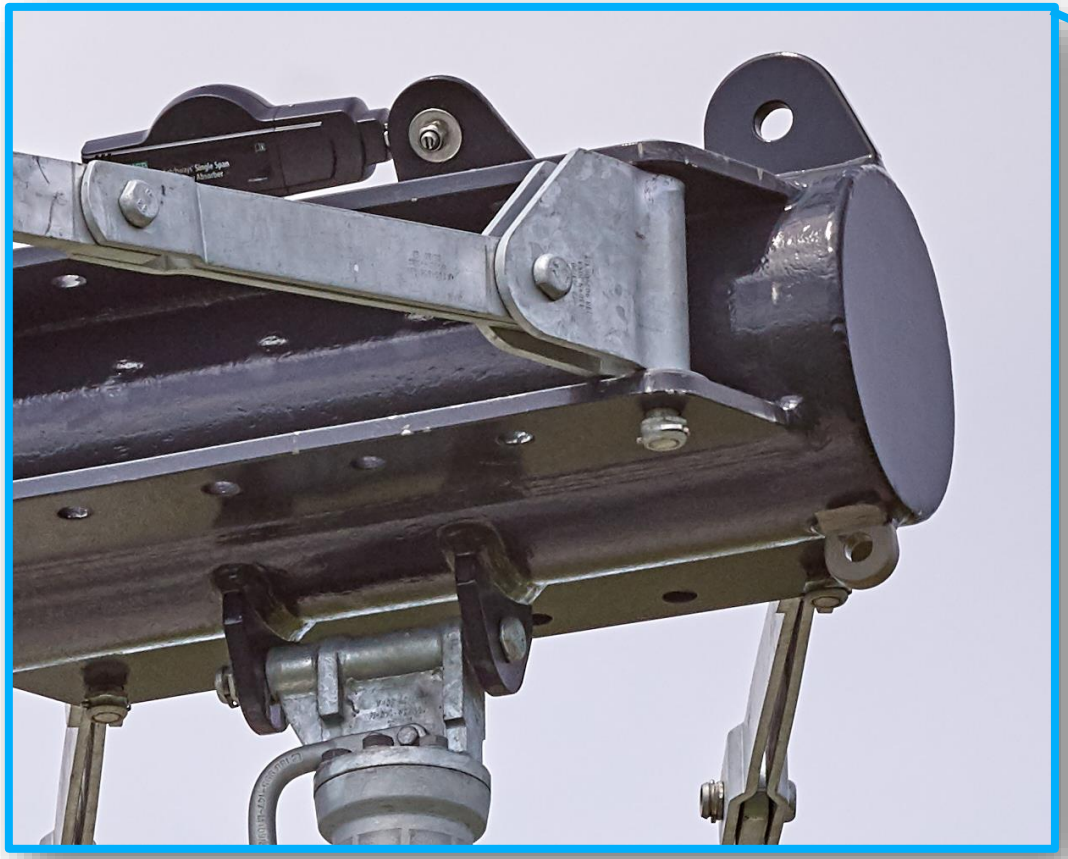


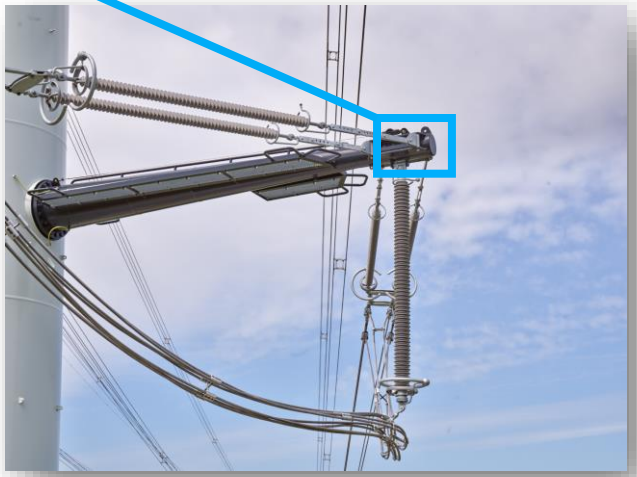


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AERIAL SURVEY & INSPECTION

Phase One iXM Example Images

Inspection of a Power Mast in the NL – Calms (2/2)

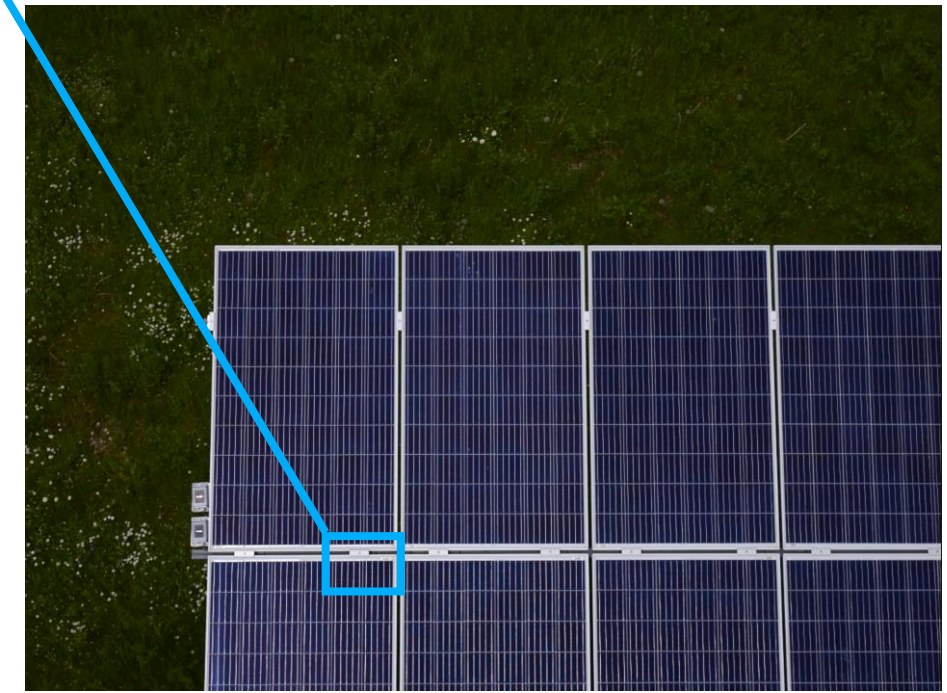




Phase One iXM Example Images

PV Panel Serial Number Acquisition





Phase One iXM Example Images

Flare Tower Inspection





Phase One iXM Example Images

Rail track inspection







1MM RESOLUTION & 7.7M IMAGE WIDTH AT 35M (150MM LENS)

Phase One Industrial medium-format cameras with 150mm RS lens provides a resolution of up to 0.3mm (from 10m flight height) and 0.9mm (from 35m height, flown at HHLA)



SURVEYING SYSTEMS IN OPERATION

By using a drone harbor cranes can remain in operation while undergoing inspection



PHASE ONE DRONE SOLUTION

Fully Integrated Drone Solution iXM-100 and DJI M600 PRO Drone

ALSTOM

Thanks!

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