

# Newest Technologies for Compact Aerial Survey Cameras

Tobias Tölg  
CEO  
[t.toelg@rollei-metric.com](mailto:t.toelg@rollei-metric.com)

RolleiMetric Systempartner of

**BAE SYSTEMS**

**SOCET SET**

**PATOSCAN**

- **Rollei Metric GmbH**
- **AIC History and Present**
- **AICxN**
- **Conclusion and Prospects**

At the 01.01.07 the Rollei GmbH started with a new company called RolleiMetric GmbH.

The Rollei Metric GmbH based on the former special engineering department at Rollei and will work beside Rollei as independent company.

Rollei is the 100% shareholder.

The future business of Rollei Metric will be based on the AIC and all aerial applications, as well as the existing close range products, distribution of BAE Systems and others.

# RolleiMetric camera systems



**d-Series**



**Comp.. cameras**



**Nikon cal. by RM**  
(with GPS interface)



**6008 Dig Metric**



**AIC**



**AICx2**  
(multi head)



**panoScan**

## AIC History and Present

- **Rolleiflex 6008** with fixed mounted digital back with 6 MegaPixel (MP) in 2003
- First use in aerial production
- Modified for the airborne use
- Can be combined with FMS, GPS, IMU, etc.





## New concepts in digital aerial survey cameras the Rollei AIC (Aerial Industrial Camera)

- Camera Body
- Lens System
- Electronics
- Digital Back

First versions in  
operation since 2004



- Professional lens systems (Schneider, Zeiss)
- Electronic Shutter is in the lens system. Extremely low number of moving parts (~15 in shutter)
- Forward motion is minimized with fast shutter speed - up to 1/1000 of a second.



**New:** Precise AIC  
bayonet connector

→ Stabilisation of  
Interior Orientation





## The second Generation of the AIC in 2007

New professional lenses

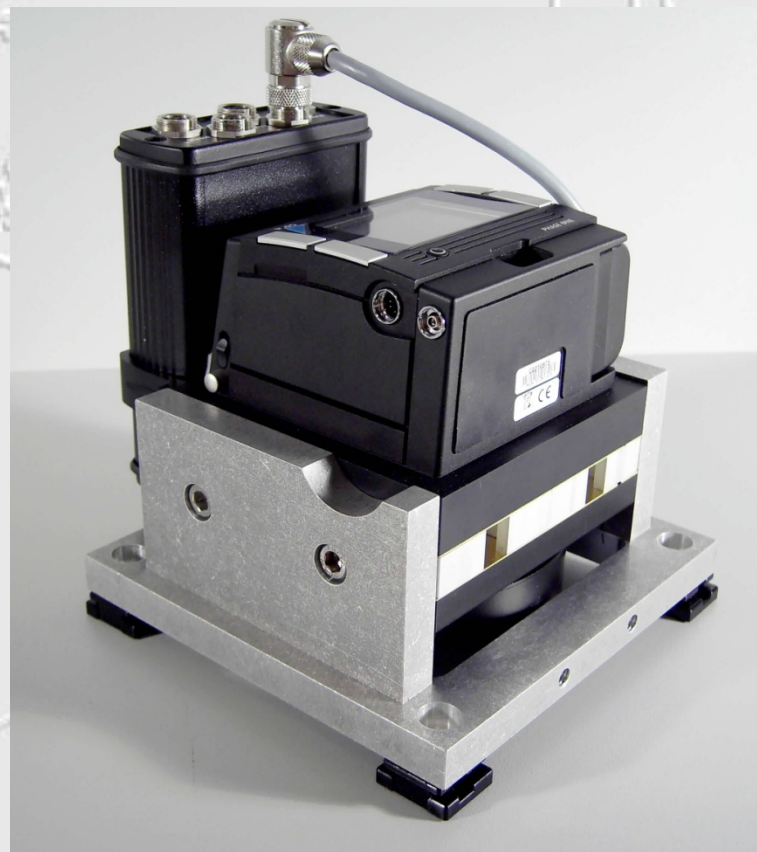
Lower Weight

Smaller Design

Higher Resolution

Existing Systems  
can be upgraded

Second product line  
beside generation one



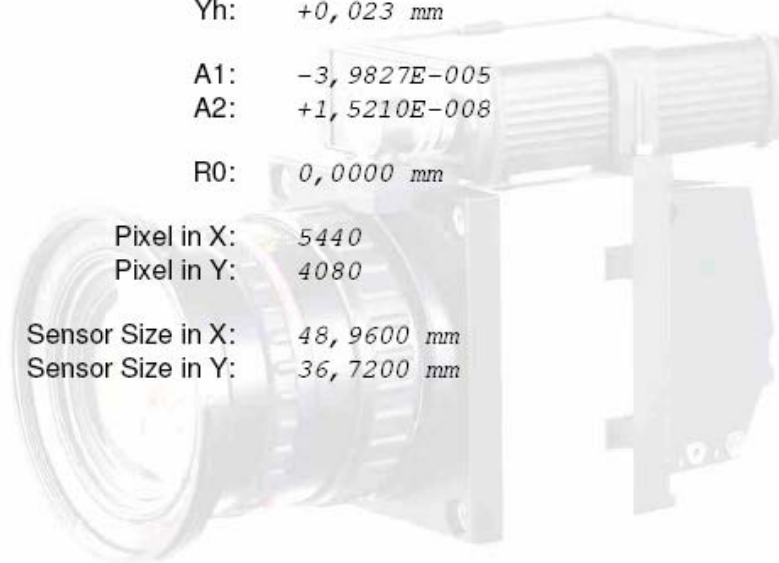
## The second generation of the AIC in 2007



Special lens systems for digital aerial imaging

# Camera Calibration AIC

<b>AIC-modular-LS (H25)</b>	No:	200504016
<b>Super Angulon 2,8/50 mm metric</b>	No:	9200530
<b>Focus Stop</b>		<i>infinity</i>
<b>Interior Orientation</b>	CK:	-51,818 mm
	Xh:	+0,228 mm
	Yh:	+0,023 mm
	A1:	-3,9827E-005
	A2:	+1,5210E-008
	R0:	0,0000 mm
	Pixel in X:	5440
	Pixel in Y:	4080
	Sensor Size in X:	48,9600 mm
	Sensor Size in Y:	36,7200 mm

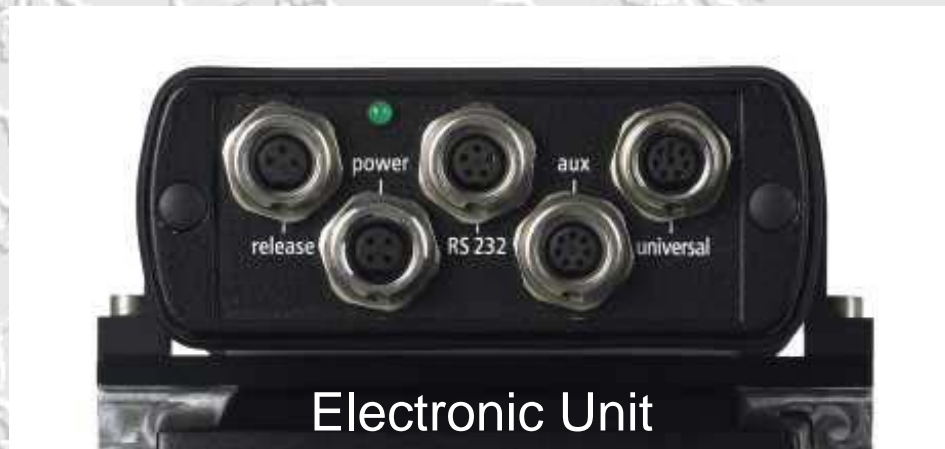


- Aircraft power supply.
- FMS connectable
- IMU/GPS
- Serial interface (RS232) to control the camera during mission.
- Advanced Light Meter Unit.
- Mountings for existing LFC can be used.
- Integration with LIDAR Systems
- OEM Agreement with Optech (2005)
- TopoSys system partner (2007)





# Open System – Interfaces to all existing Systems



Electronic Unit

Release  
(Flight Management  
System)

RS 232  
(Computer)

Universal  
(GPS, IMU)

CCNS4, Trackair etc.

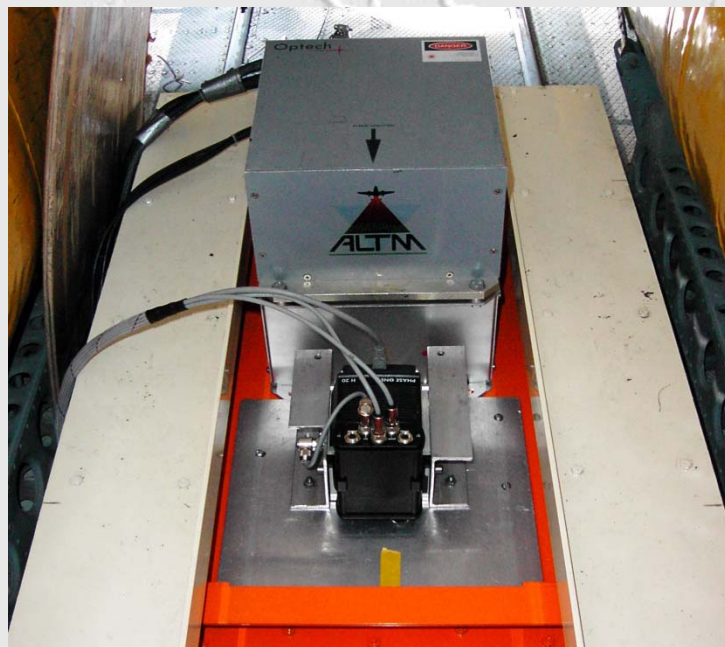
Power  
(Computer/Aircraft)

Auxiliary  
(camera connection)





Installed in a plane using the hole of a NT2 (Zeiss)



Installed in a helicopter with an Optech ALTM Lidar-System



## RolleiMetric AIC Integration in LIDAR systems



## From medium to **LARGE** with medium???

- It is not an new idea or even concept
- It is the logical way
- The combination of two or more AIC cameras
- Possible are up to 8 cameras at the moment
- Synchronization time better than 200 micro sec.
- Image stitching software
- Open system with exchangeable lenses
- Proven technology

## RolleiMetric AICx2

Types of sensors / digital backs (PhaseOne\*)

**P 20** 4,1 K / 4,1 K (16,8 MP) (36,9/36,9 mm<sup>2</sup>, 9μm)

**P 25** 4,1 K / 5,4 K (22,1 MP) (36,9/48,7 mm<sup>2</sup>, 9μm)

**P 45** 5,4 K / 7,2 K (39,5 MP) (36,9/48,7 mm<sup>2</sup>, 6,8μm)

e. g. AIC x2



ca. 5 k

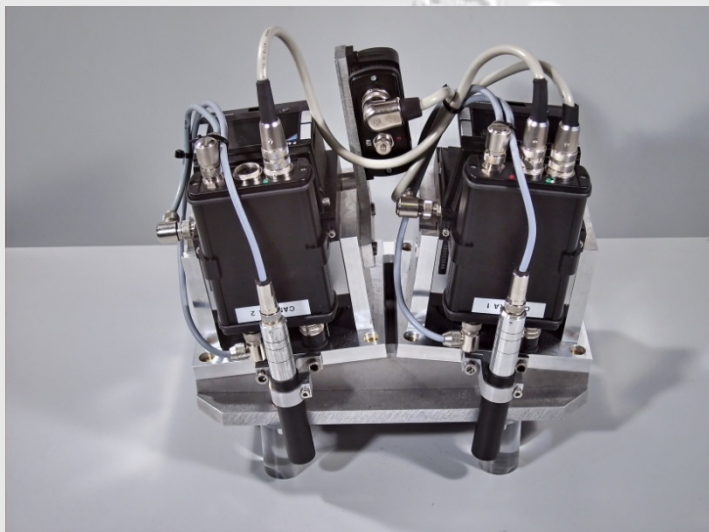
ca. 14 k

\* RolleiMetric and Phase One (Leading company in direct digital imagery) have a close co-operation in the field of metric cameras



AIC

**RolleiMetric**  
roll on mapping



**RolleiMetric AICx2**



# New housing for the AICx2

(multi head system)

.. fully integrated

FMS  
GPS/IMU  
Raid/Computer  
Power



apprx.70 (79) MP

ca. 5 k

ca. 14 k

The AICxN is designed as a multi head camera system. All parameters of each single camera are in connection to the first camera of the system. RolleiMetric defines the reference camera in the setup.

For all calculations of the virtual image of an AICxN the following parameters are used:

- The interior orientation of each single camera head (R0, XH, YH, A1, A2, CK)
- The relative orientation between the reference camera and the others (Omega, Phi, Kappa, dX, dY, dZ)
- Optical properties of each camera, e.g. white balance, vignitation and others

The image plane of the virtual camera will be defined by the normalenvector of the single camera image layers.

$$x_{N,virt} = \sum_{i=0}^{n < n_{Cam}} x_{N,i}$$

$x_N$  - Normalenvector Image plane

The rotation of the virtual camera coordinate system in comparison to the single cameras will be defined by a complete rotation.

$$R_{virt,i} = R_{virt,ref} \cdot R_i$$

The projection centre of the virtual camera is calculated as centre of gravity of the projection centres of the single cameras.

$$x_{0,virt} = \left( \sum_{i=0}^{n < n_{Cam}} x_{0,i} \right) / n_{Cam}$$

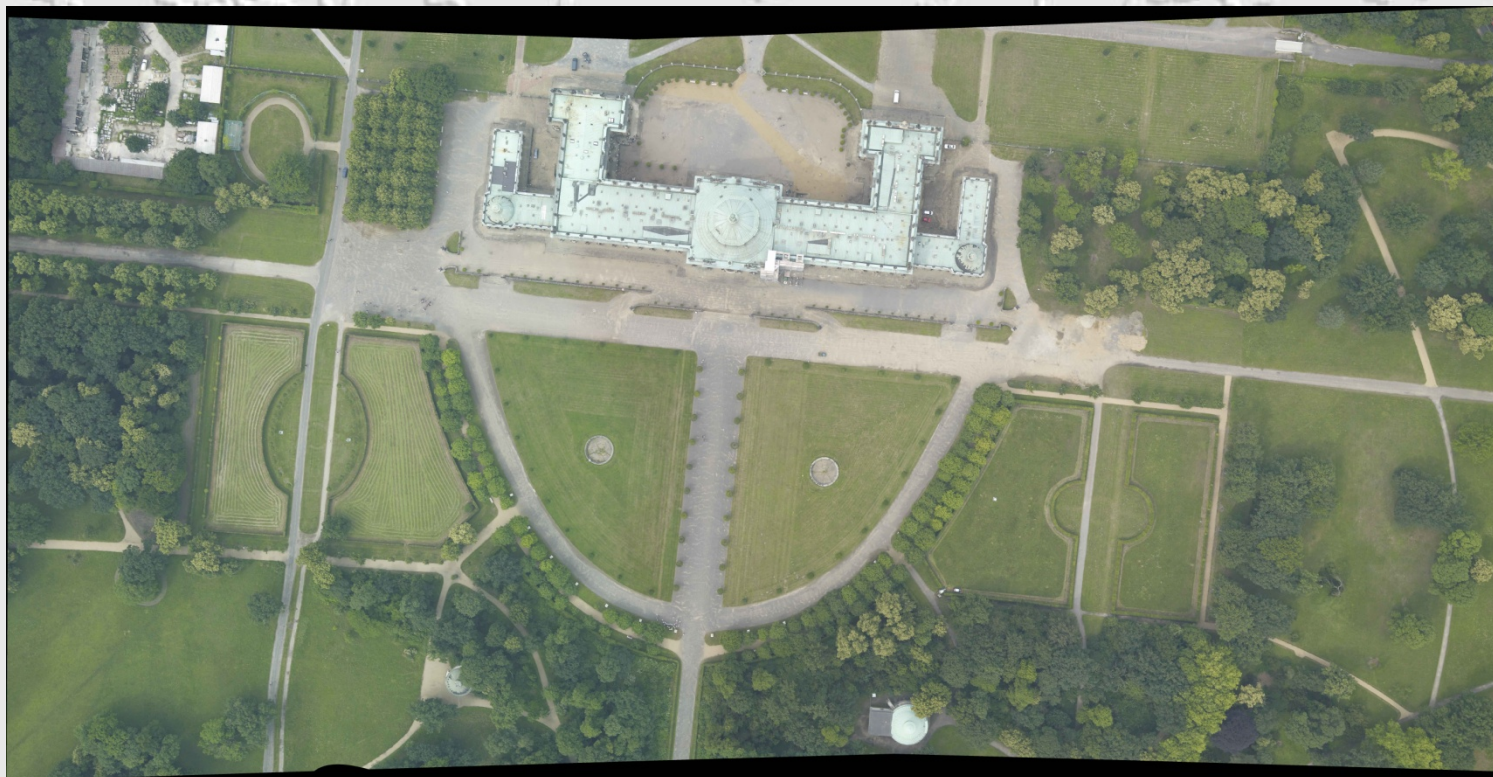
$n_{Cam}$  - Number of cameras



710

**RolleiMetric**  
roll on mapping





Stitched Image, Flight Alpha Luftbild, GSD 12 cm, AICx2, 80 mm PQS lenses





Stitched Image, Test Flight RolleiMetric, GSD 12 cm, AICx2, 150 mm PQS lenses,

App. 15% Overlapping 13K by 5K Pixel

## Conclusions and Prospects

- Medium format will enter in large format mapping camera solution
- The AIC is a open system with interfaces to all existing systems, e.g. GPS/IMU, FMS, Mountings
- The development in the medium sensor market is rising and new sensors will follow soon.
- The **price/performance** ratio of a medium format camera is more attractive.





Thank you very much  
and  
enjoy the ongoing  
51<sup>st</sup> Photogrammetric Week