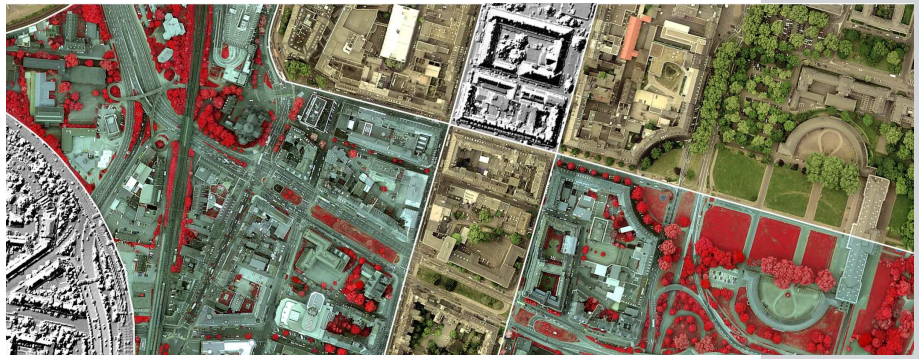
New Airborne Lidar Sensor Systems



TopoSys GmbH
Mr. Alexander Wiechert
Managing Director

Content

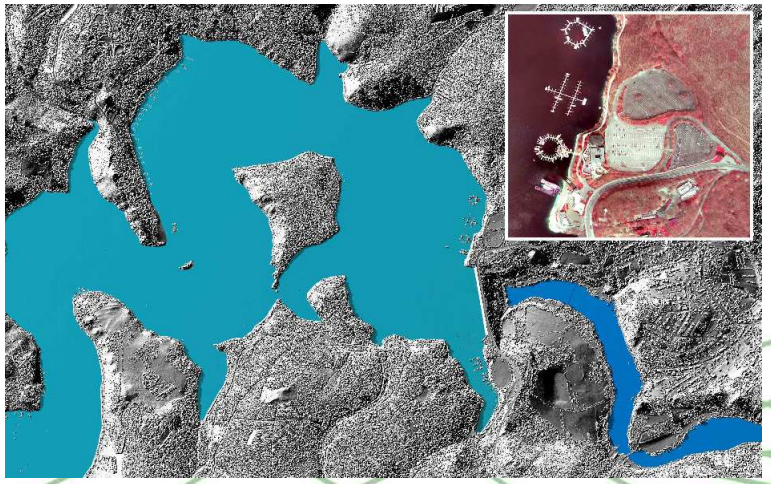
- About TopoSys
- 10 years of Lidar service business
  - Historical retrospect
  - Our expectations for the future
- 10 years of Lidar sensor development
  - How it began: Falcon I
  - Current model: Falcon II
  - The future: Falcon III, Harrier 56, Harrier 24

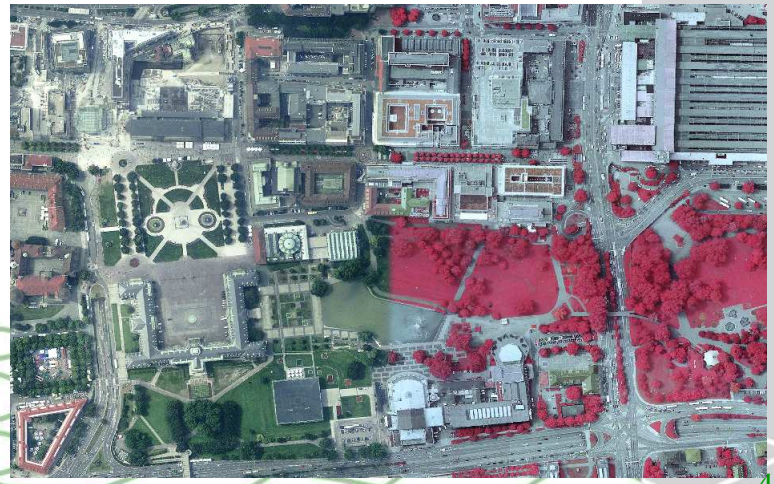
About Us

About Us

- **Founded in 1995 as spin-off of Dornier GmbH**

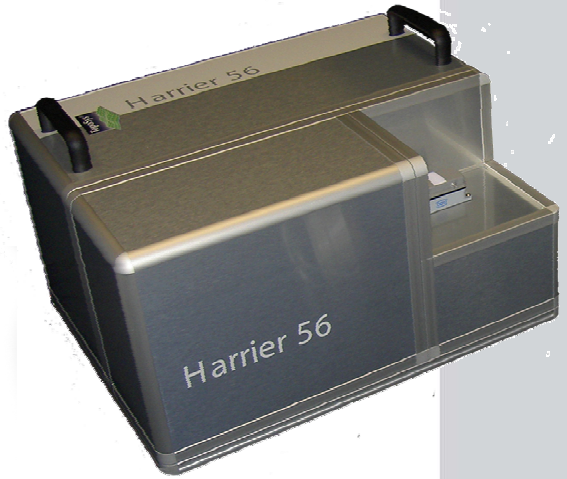
- **10 years experience in Lidar scanning**
  - **Established as European leading service provider**
  - **Priority on high density DEM and RGB/CIR true ortho images**
  - **Full service ranging from consultancy to planning as well as from flight operations to data processing**





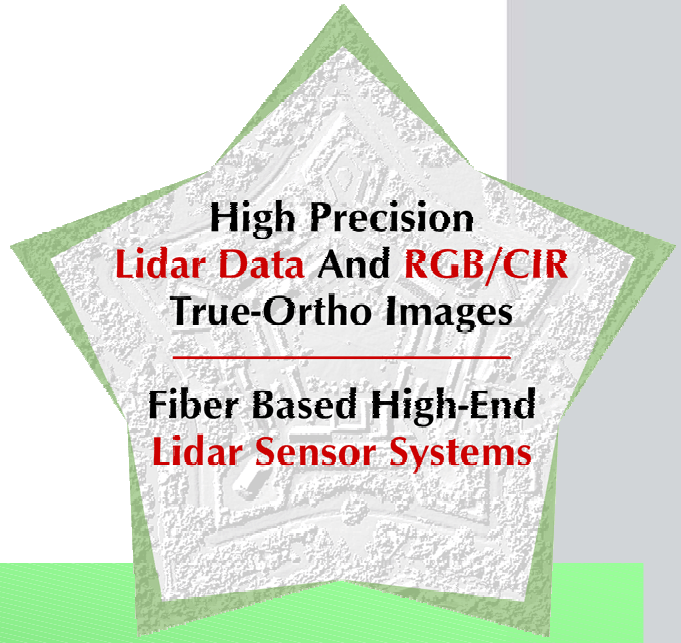
About Us

- **10 years experience in Lidar sensor system development**
  - **Fiber based sensor systems Falcon I, Falcon II and Falcon III**
  - **Polygon mirror system Harrier 56 and 24**
  - **Full service like training, support, maintenance**



About Us

- **Outstanding dual role as**
  - **a Lidar system manufacturer**
    and
  - **a Lidar data service provider**



„Precision is our Dimension“

Maximum of customer benefits is the result

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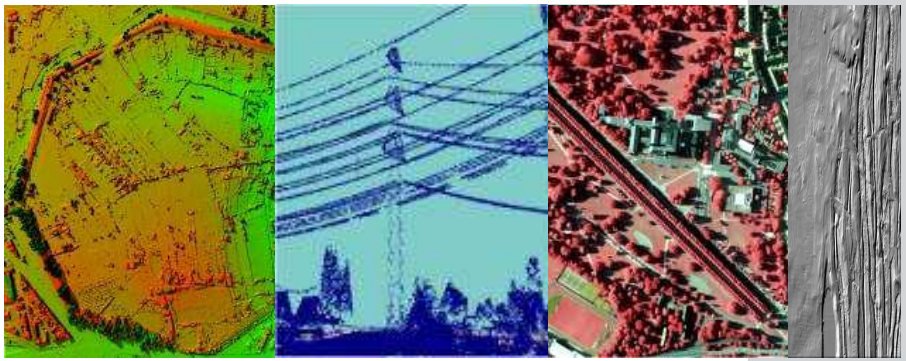
Topographische Systemdaten



Lidar Service Business

Applications

- Urban planning
- Wireless network planning
- Noise protection planning
- Corridor mapping
- Forest inventory
- Flood plain mapping
- Hydraulic simulations
- Coastal monitoring
- Power line mapping
- Monitoring of deposits and mines
- Environmental protection
- Disaster management
- Archeology

„Precision is our Dimension“

We deliver reliable data for demanding applications

References

- Germany
  - Large scale mapping projects
  - Open pit mines
  - Urban planning
  - Hydraulics, flood protection
  - Gouverment and military projects
- Spain, Portugal, Belgium
  - Flood plain mapping
  - Power line mapping
- Netherlands
  - Coastal survey
- Italy
  - Flood plain mapping
- Denmark
  - City models, urban planning
- Finland
  - Forest inventory
- Austria
  - Mapping of mountainous areas
  - Motorway mapping

„Precision is our Dimension“

Customer trust us - internationally

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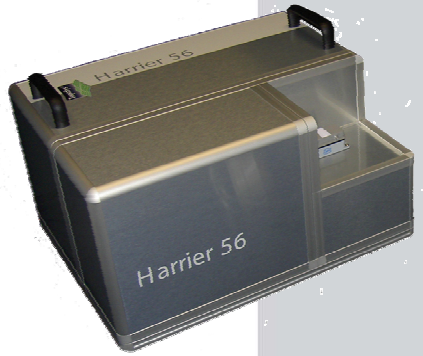


Lidar Sensor Systems

History: Falcon I (1996)

- Fiber scanner core technology developed since 1984 at Dornier GmbH for obstacle detection
  - Helicopter obstacle avoidance
  - Autonomous vehicle guidance
- Main design goals
  - Precision
  - Reliability
- Usage
  - Military helicopters
  - Military vehicles
  - Civil helicopters (Eurocopter)

History: Falcon I (1996)

- For TopoSys internal usage only
- Used since 1996 for precise Lidar scanning
- One system in the air
- Parameters
  - Fiber Scanner 128 fibres
  - Measurement rate 83 kHz!!
  - 14 degree viewing angle
  - Max. altitude 800m
  - 30 to 7 points / sqm
  - Operative 1996 - 2003

Presence: Falcon II

- Used by TopoSys since 2000 for precise Lidar scanning basically in Europe
- Available to the global market since 2004
- Parameters
  - Fiber Scanner 128 fibres
  - Measurement rate 83 kHz
  - 14 degree viewing angle
  - Max. altitude 1600m
  - 30 to 3 points / sqm
- Improvements until 2005
  - Echo separation 1.2 m
  - Distance measurement accuracy 1.95 cm
  - RGB/NIR Line scanner
  - Roll angle compensation

Future: Sensor System Family

- **FALCON III**
  The real wonder of the world: Add precision to wide area mapping at effective measurement rate of 125,000 Hz

- **HARRIER 56**
  Get the real details: Wide-angle full waveform digitization Laser scanner combined with a calibrated 22M digital camera

- **HARRIER 24**
  Enhance your business opportunities: Medium-format digital imaging system combined with a wide angle Laser scanner

Falcon III

New: 125 kHz
at 1,000 m

Add precision to wide area mapping at 125,000 effective measurement rate

The Falcon III sets a new edge for high end Laser scanning and allows its operator to offer a never seen before combination of precise, dense elevation data, high-quality digital imagery and survey capacity.

Falcon III

- **Main Features**
  - **Beam deflection** — **Fixed, fiber based**
  - **Field of view** — **30 degrees fixed**
  - **Measurement rate** — **50 kHz – 125 kHz**
  - **Operating altitude** — **30 m - 2,500 m**
  - **Intensity capture** — **12 bit dynamic range**
  - **Scan frequency** — **165 Hz - 415 Hz**
  - **Echo separation** — **2.0 m**
  - **Eye save** — **> 0.27 m**
  - **Swath width** — **51 % of op. altitude**
  - **Range resolution** — **0.010 m**
  - **Operation** — **Aircraft and helicopter**
  - **Camera** — **Integrated RGB/NIR line scanner**

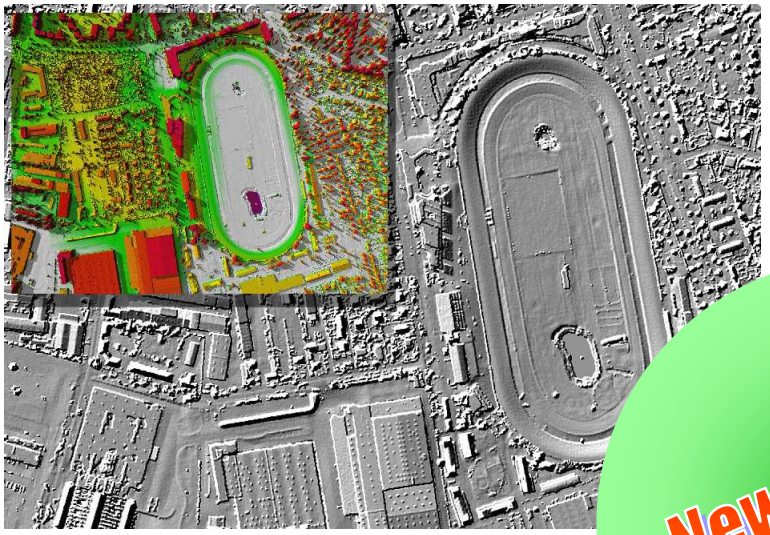
Falcon III

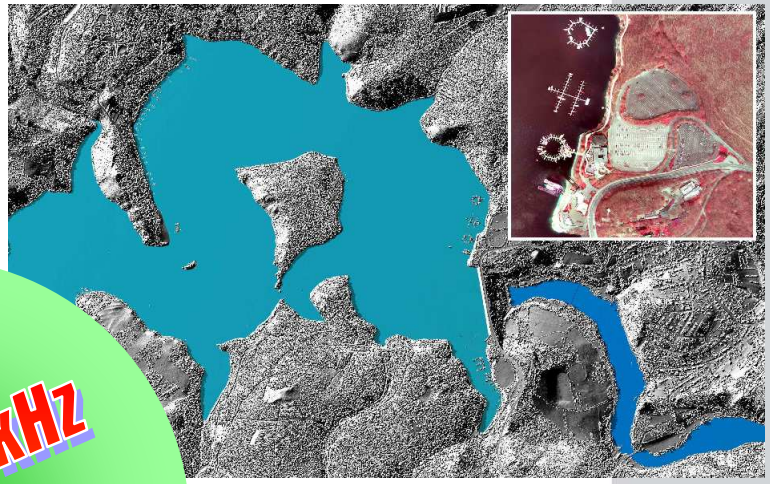
- **Options**
  - Integrated line scanner (RGB, NIR)
  - Integrated Applanix DSS 322
  - Full waveform digitization
  - Integrated flight management system

- **Customer Benefits**
  - Highly satisfied service customers due to outstanding data quality
  - Economical success of the service provider due to survey efficiency
  - Use of LIDAR data for much more applications

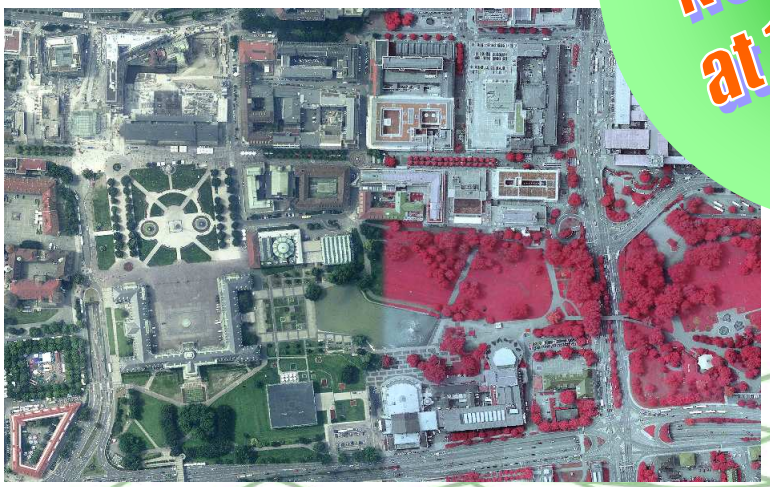
- **Applications**
  - Efficient precise wide area mapping and high definition corridor mapping
  - City models, forest mapping, corridor mapping, flood protection, hydraulic simu-lations, archeology, costal survey, erosion monitoring, etc

Falcon III

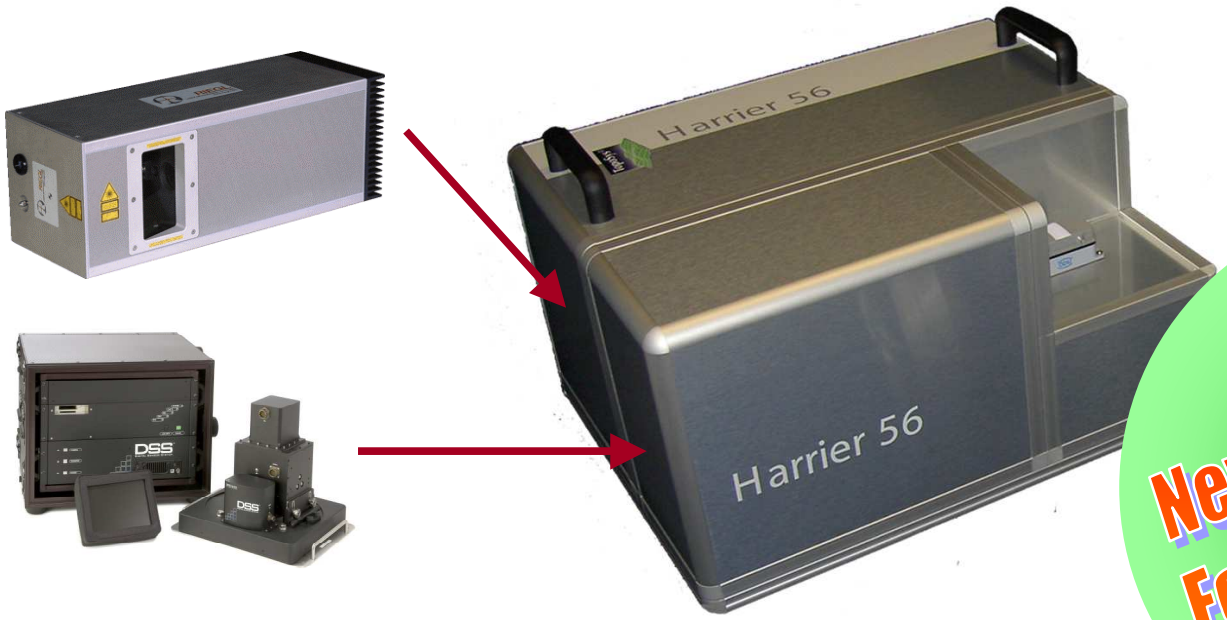




New: 125 kHz
at 1,000 m



Harrier 56



New: Full Wave Form Digitization

Get the real details

The combination of a wide angle full wave form digitization Laser scanner and a calibrated 22M digital camera makes the Harrier 56 the perfect tool for corridor mapping, aerial survey and remote sensing whenever your customer asks you to deliver the real details

Harrier 56

- **Main Features**
  - Beam deflection — Fixed, polygon
  - Field of view — 45 degrees fixed (60 as option)
  - Range capture — Full waveform digitization
  - Measurement rate — 55 kHz
  - Operating altitude — 30 m - 1,500 m
  - Intensity capture — 16 bit
  - Scan frequency — 5 Hz – 160 Hz
  - Eye save — Class I
  - Swath width — 76 % of op. altitude
  - Range resolution — 0.020 m
  - Operation — Helicopter and aircraft
  - Camera — Integrated Applanix DSS 322 as option

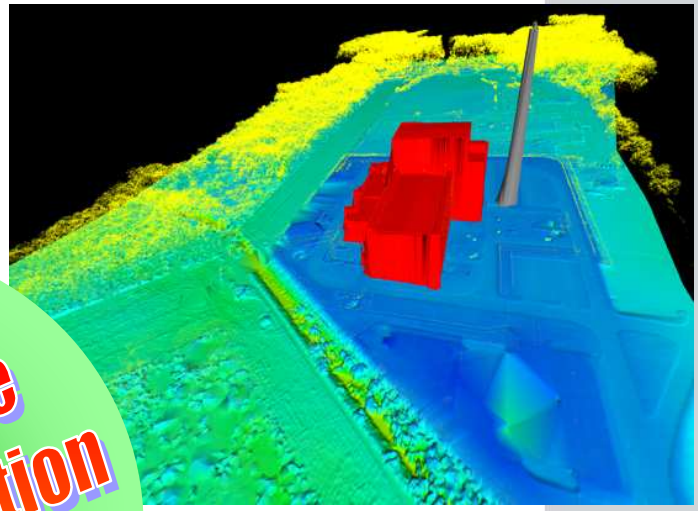
Harrier 56

- **Options**
  - Integrated Applanix DSS 322
  - Enhanced field of view
  - Integrated flight management system
  - Portable storage system

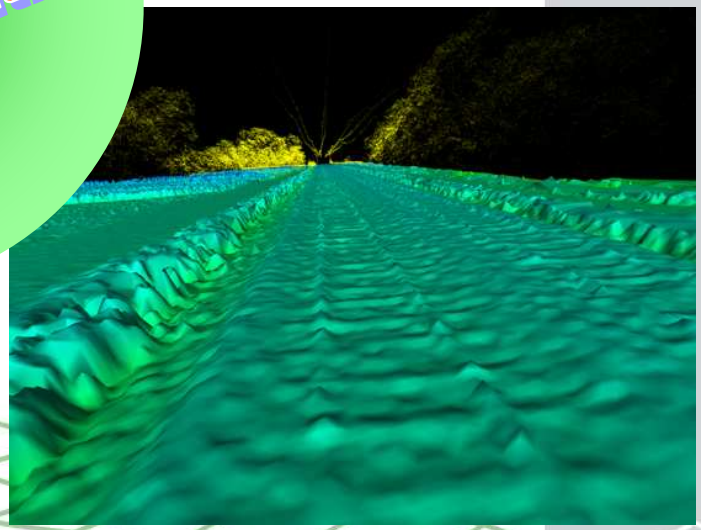
- **Customer Benefits**
  - Compact system
  - Complete solution
  - Competitive advantage
  - Flexible usage
  - Integrated data flow and work flow of LIDAR data and image data processing

- **Applications**
  - Corridor mapping and area mapping, aerial survey and remote sensing
  - All kind of high resolution ortho images, rapid response, pipeline monitoring, power line mapping, corridors, city models, com-mon Lidar projects, detailed analysis and studies, target classification

Harrier 56



New: Full Wave Form Digitization



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Harrier 24

New: Add Lidar To Your Business

Enhance your business opportunities

The Harrier 24 is basically the digital imaging answer for aerial survey and remote sensing. But the system is not restricted to images only. Having a wide angle Laser scanner integrated, the Harrier 24 allows you to add new business just by switching on the Laser

Harrier 24

- **Main Features**
  - Beam deflection — Fixed, polygon
  - Field of view — 60 degrees fixed (80 as option)
  - Range capture — Full waveform digitization
  - Measurement rate — 10 kHz
  - Operating altitude — 30 m - 450 m
  - Scan frequency — 6 Hz – 80 Hz
  - Eye save — Class I
  - Swath width — 100 % of op. altitude
  - Range resolution — 0.020 m
  - Operation — Helicopter
  - Camera — Integrated Applanix DSS 322 as option
  - Operating altitude — 0 – 6,500 m
  - Array size — 4,092 x 5,436 pixel

Harrier 24

- **Options**
  - Integrated Applanix DSS 322
  - Enhanced field of view
  - Integrated flight management system

- **Customer Benefits**
  - Low budget LIDAR system
  - Complete aerial image solution
  - Competitive advantage
  - Flexible usage
  - Integrated data flow and work flow of LIDAR and image data processing

- **Applications**
  - Low-resolution area mapping, stereo corri-dor mapping, aerial survey and remote sensing
  - All kind of high resolution ortho images, rapid response, pipeline monitoring, power line mapping, corridors, ice and snow monitoring, glacier monitoring

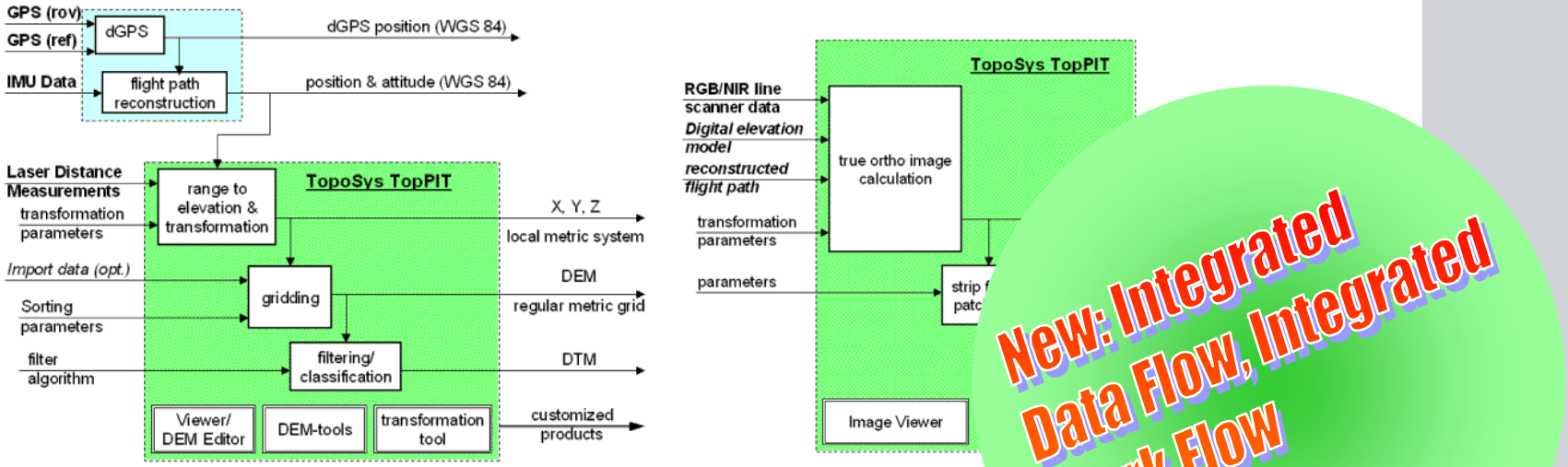
Harrier 24

Efficiency and Point Densities

		LiDAR	Image (GSD)	Productivity
Falcon I				
o	30m/s, 400m:	27 points/sqm	-	11 sqkm/hour
o	60m/s, 800m:	7 points/sqm	-	43 sqkm/hour
Falcon II				
o	30m/s, 400m:	27 points/sqm	10 cm	11 sqkm/hour
o	60m/s , 1200m:	5 points/sqm	50 cm	65 sqkm/hour
Falcon III				
o	15m/s, 250m:	66 points/sqm	3 cm	7 sqkm/hour
o	30m/s, 400m:	21 points/sqm	3 cm	22 sqkm/hour
o	60m/s, 2000m:	1,3 points/sqm	15 cm	215 sqkm/hour
Harrier 56				
o	20m/s, 200m:	15 points/sqm	3 cm	12 sqkm/hour
o	40m/s, 800m:	1,8 points/sqm	5 cm	95 sqkm/hour
Harrier 24				
o	15m/s, 100m:	4 points/sqm	3 cm	6 sqkm/hour
o	30m/s, 200m:	1 points/sqm	3 cm	25 sqkm/hour

Note: productivity is calculated without turns and overlapp.
Depending on the structure of the project, the real productivity will be lower

TopPIT Software



New: Integrated Data Flow, Integrated Work Flow

Streamline your production,
lower your costs

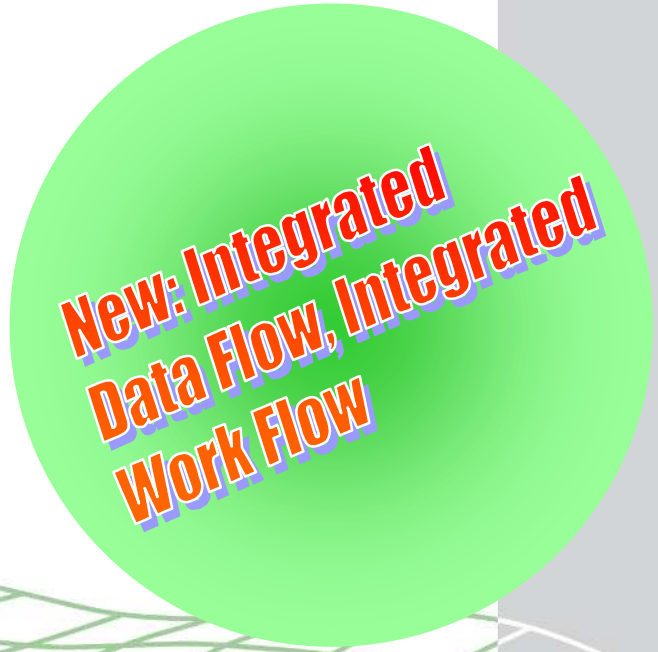
Integrated data flow and work flow for Lidar data and aerial image data

TopPIT Software

- **Features**
  - **Pre-Processing of Lidar data**
  - **Post-Processing of Lidar data**
  - **RGB/CIR true-ortho image processing**
  - **At present over 50 coordinate sys-tems implemented**
  - **Simple integration of user-defined coordinate systems, ellipsoids, transformations and geoids (open data base)**
  - **TopoSys Converter (TSC), a high-performance, versatile tool for converting elevation models.**
  - **TopPIT-XV for visualization and for manually editing of raster data and RGB/NIR data**

TopPIT Software

- **Customer Benefit**
  - Workflow oriented, reduces pro-duction time
  - Complete solution
  - No additional software required
  - Open system, easy to be integrated in an existing environment
  - Standard interfaces
  - Three sensor systems, one processing software



Sensor Sales

- **Falcon II**
  - Available to the global market since 2004
  - Three units sold in 2005
  - Two letter of intent signed, closing expected Januar 2006
- **Harrier 56 and Harrier 24**
  - Available to the global market since end of 2005
  - Already two purchase contracts signed
  - Two additional contracts under final negotiation
- **Falcon III**
  - Will be available to the global market fourth quater of 2006
  - Already one letter of intent signed for a pilot customer
- **After one year of sensor business activities TopoSys has achieved a market share of about 15% to 20% in the global sensor business**

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Thank you very much

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