



3D Worlds for the Bundeswehr

Civil Commercial Imagery Evaluation Workshop

Fairfax Oaks, VA

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3D Worlds for the Bundeswehr

Introduction

Process Chain

Sensor System and Algorithm

Example of a Prototype



In accordance with the situation, the Bundeswehr Geoinformation Service is to incorporate the impact of relevant geospatial and environmental factors on the planning and conduct of operations into the decision-making process and to guarantee the supply of the **German Armed Forces** with Geoinformation.





Aren't there solutions in the world wide web
as Google, world wind or MS virtual world?

Yes, something similar but not for military use
and often in regions outside of our interest.



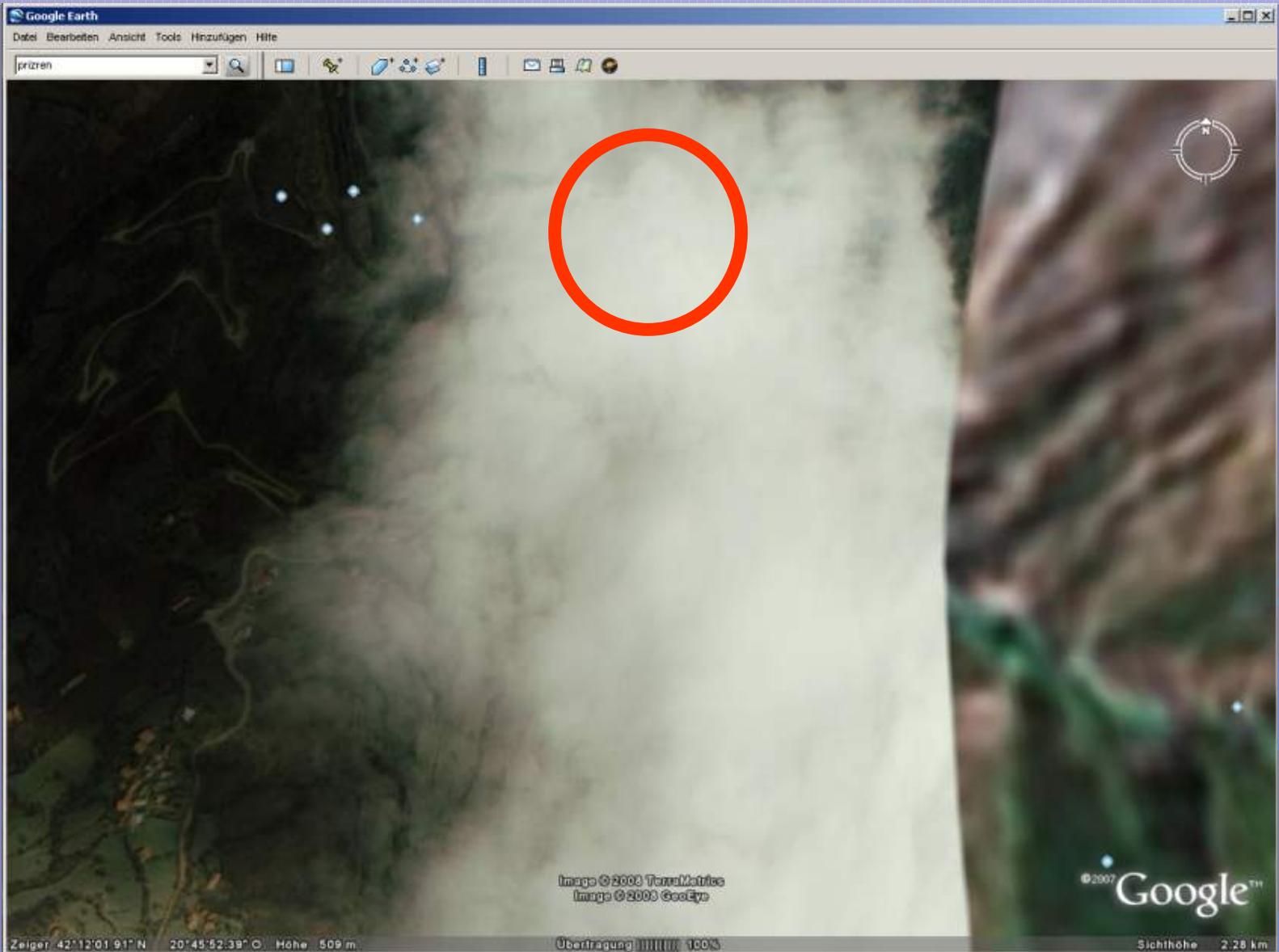
Example: Abbey of the Archangel, Prizren, KOS



Area of monks before 2002 ...



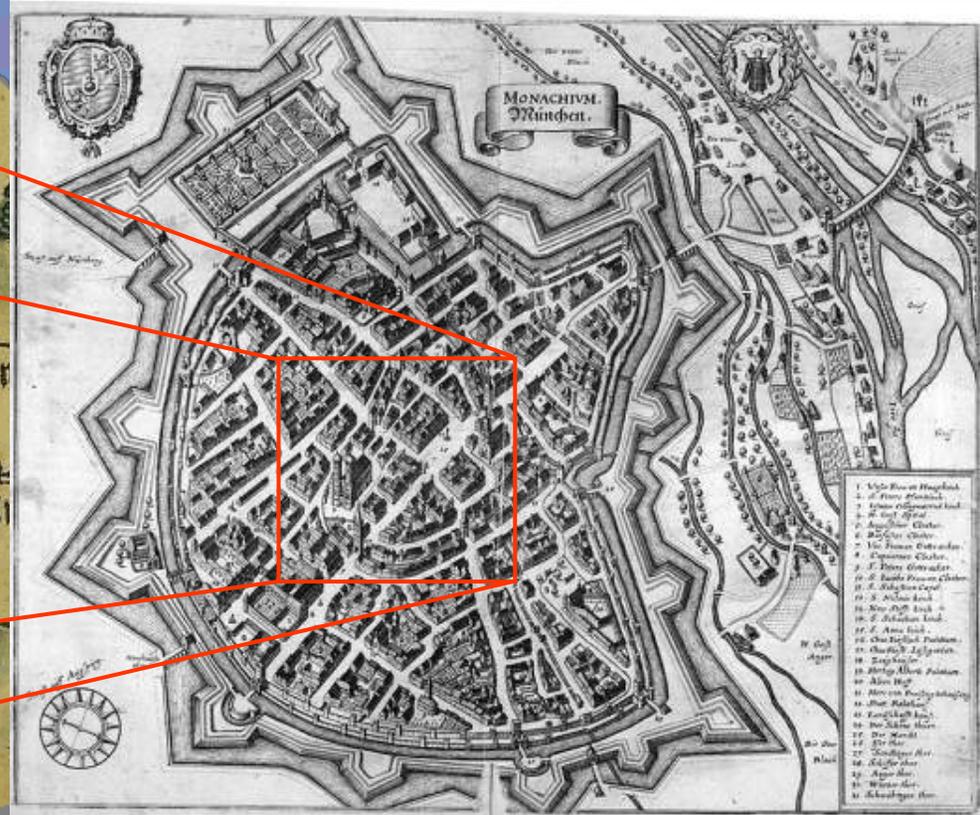
... and after the riot in March 2004





Is the request for a 3D-product something new?

Not really, the customers ask for a 3D-product since hundreds of years!





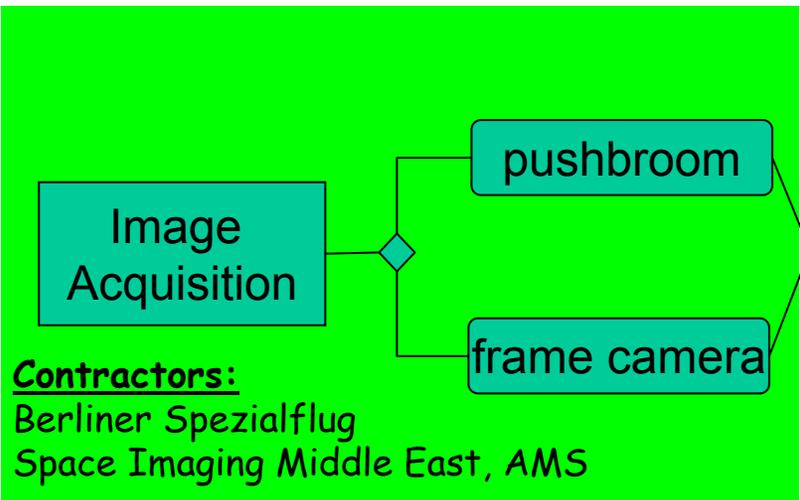
Generate a high resolution 3D model of a defined (urban) area!



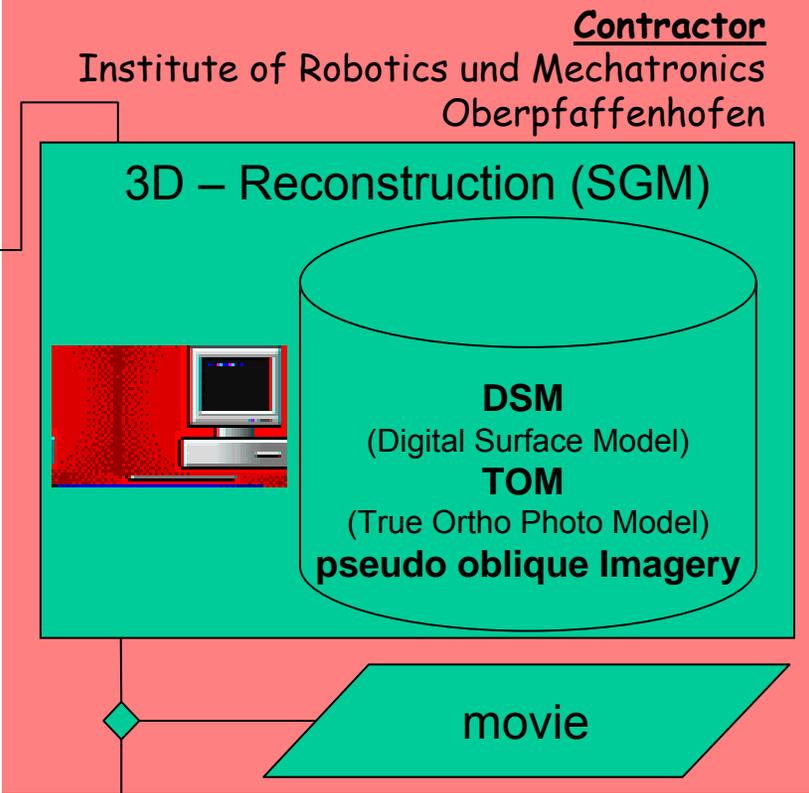




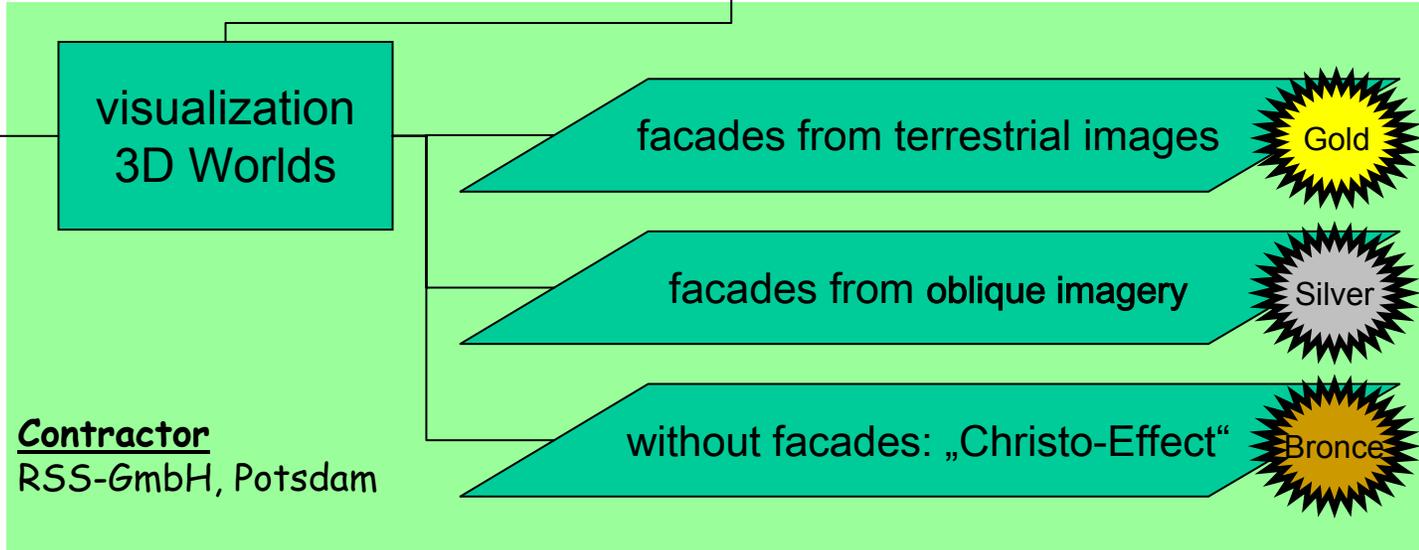
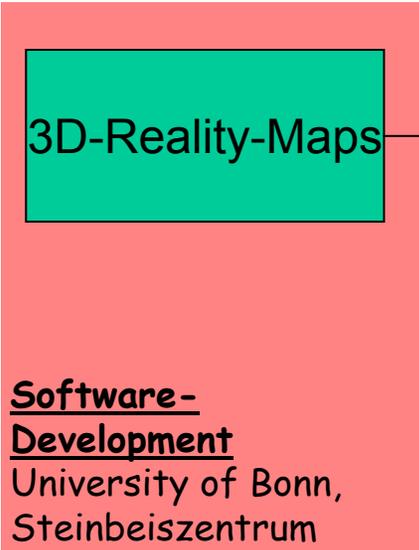
The Process Chain



Aero-
trian-
gulation
&
Radio-
metric
correction



Project Lead
DLR Dir. Sensorconcepts und
Applications, Berlin-Adlershof

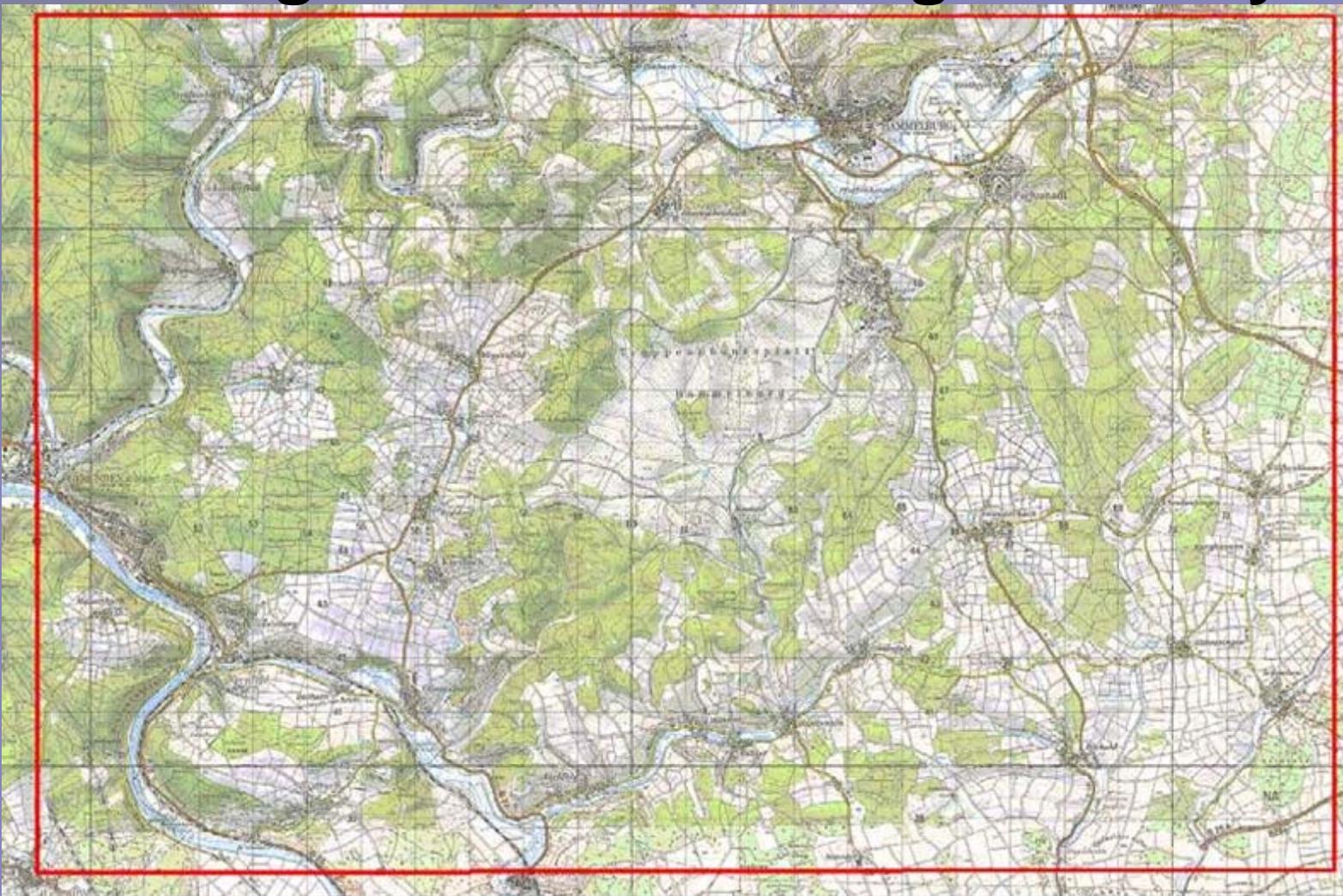




test area
test area

training area Hammelburg/Germany

16 km





coverage



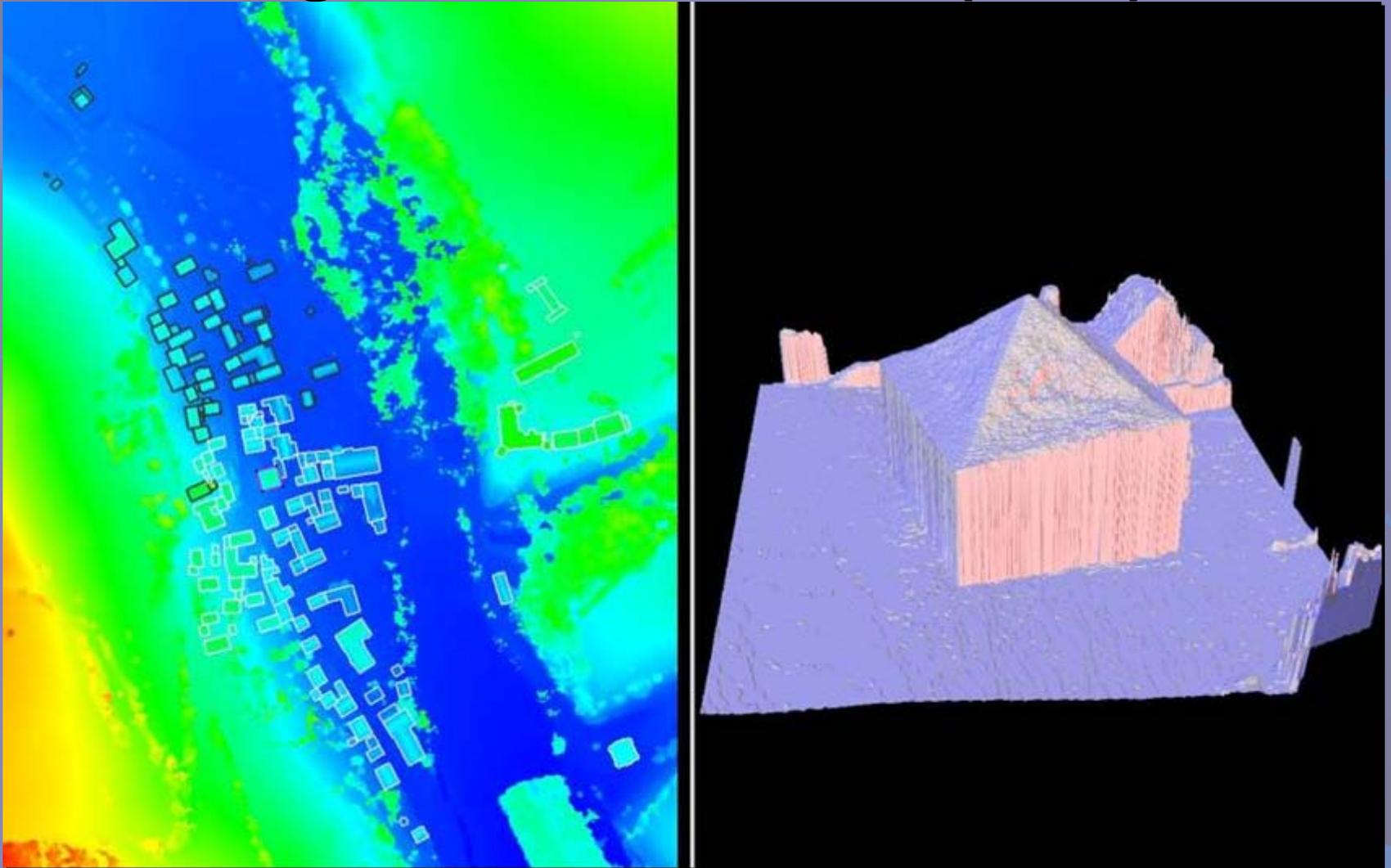


Airborne Sensor System





Digital Surface Model (DSM)





VHR True Orthophoto Mosaic



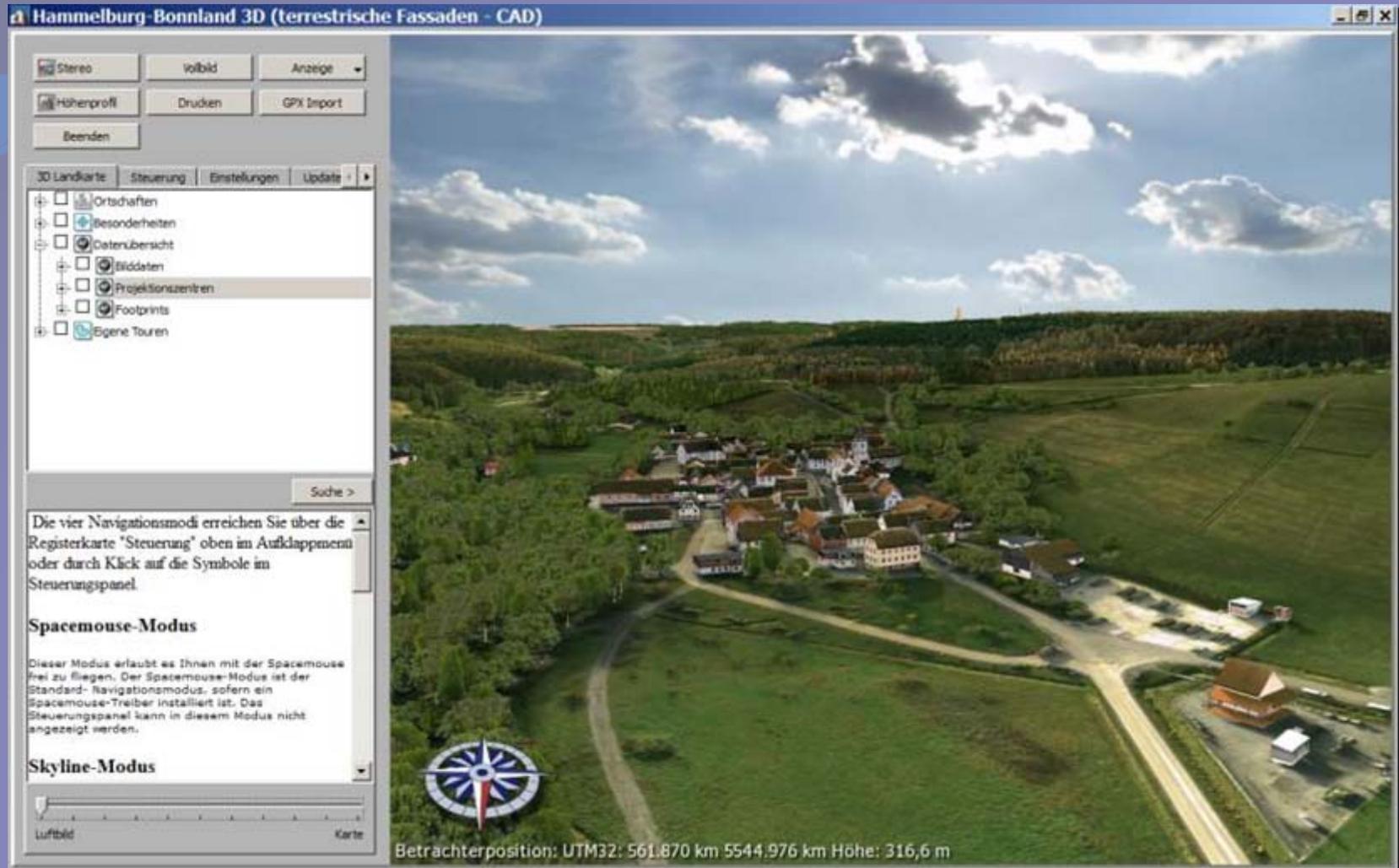


Facades





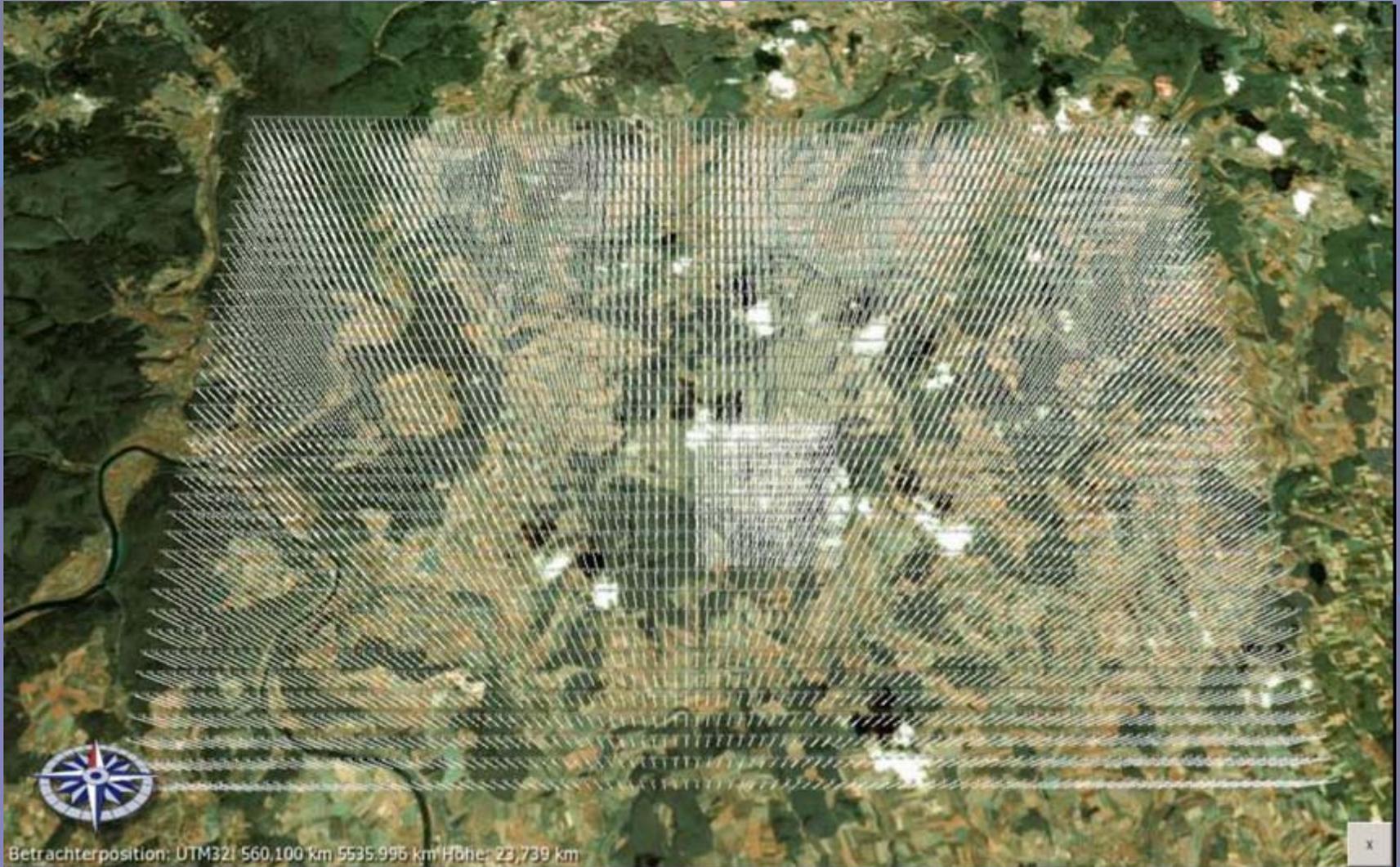
Visualization





necessary redundancy 12





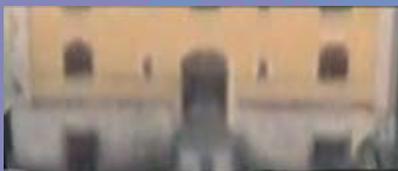


3D-reconstruction is fully automated!

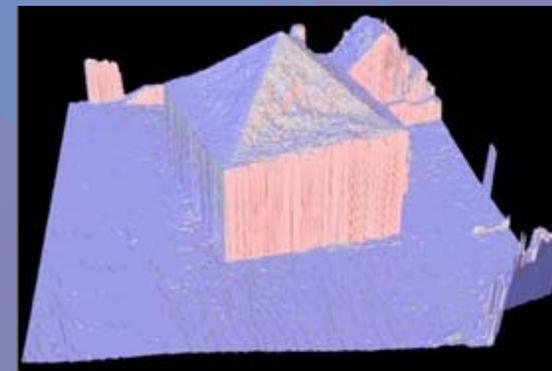
generating the
True-Orthophoto-Mosaic
TOM



extraction
the
fascades



generating the
Digital Surface Model
DSM





original image



digital camera

synthetic image



3D-World





synthetic image



Cursor Position UTM32 542769 km 5195052 km Elevation 3276.7 m

3D World Stubai-Glacier, source: RSS



**Maximal use of aerial data
collection by producing pixel
wise TOM, DSM, facades and
the 3D-visualization!**



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Sensors and Algorithms



Project 3D Worlds (Prototypes)

- airborne sensor MS Vexcel UltracamX



Future Production of 3D Worlds (Products)

- airborne sensor DLR AMS Geo & AMS T



Development of high resolution cameras for the fast data capture of huge areas.

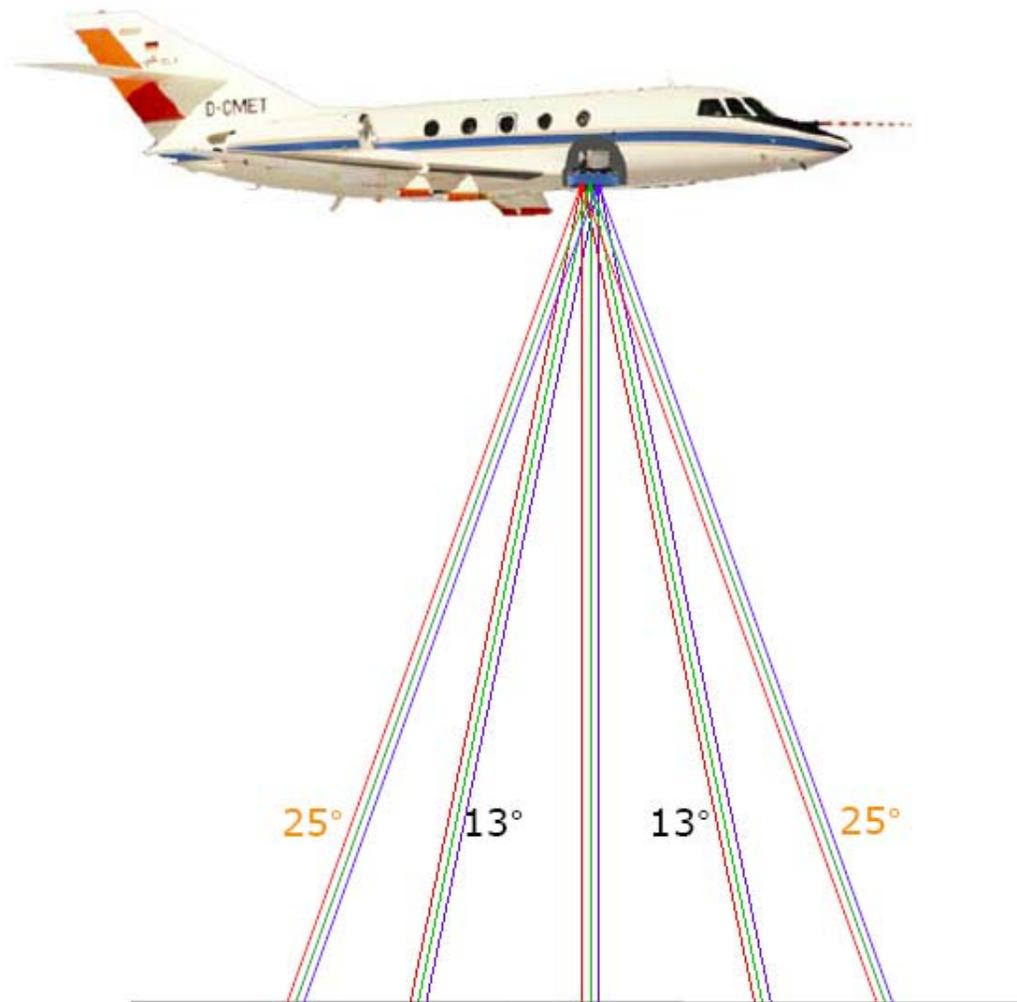


MFC 5

MFC 1

MFC 3

Sensor geometry of pushbroom cameras (MFC 3/5)





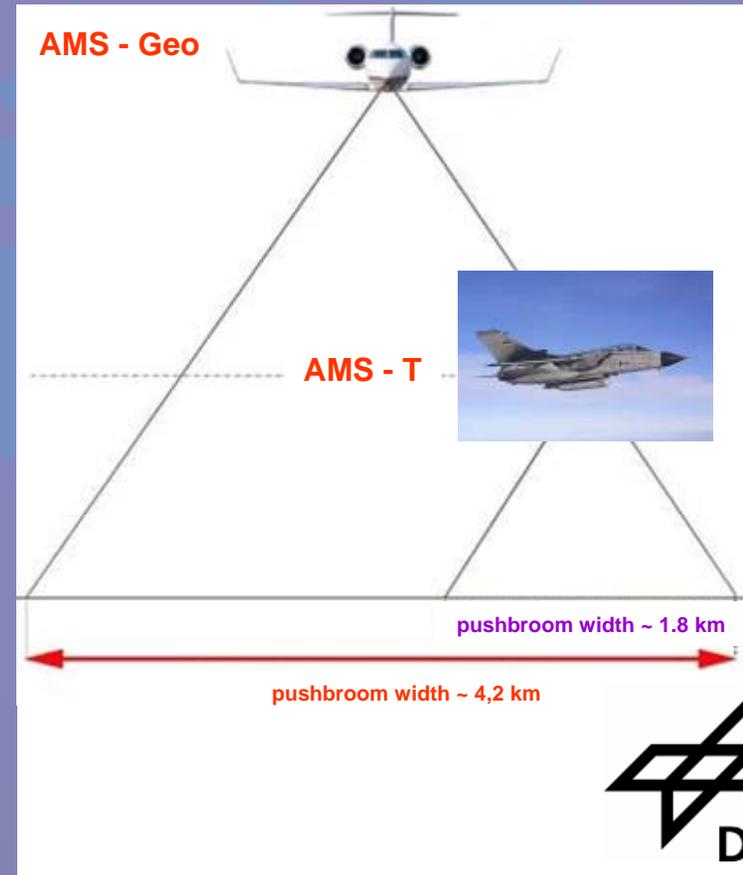
Airborne Multispectral Stereoscanner (AMS)

AMS Geo

- 28 000 Pixel each line/pushbroom
- ground sampling distance 10 cm/Pixel
- platform: aerial survey aircraft
- ~ 150 knts

AMS T

- 10 000 Pixel each line/pushbroom
- ground sampling distance 15-20 cm/Pixel
- platform: TORNADO Navy Recce Pod
- > 450 knts

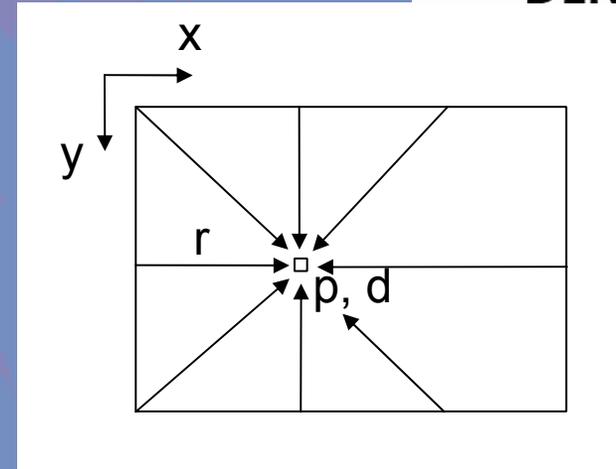




Semi-Global Matching (SGM)



- Accurate and run-time efficient method (Hirschmüller, CVPR 2005, 2006 und TPAMI 2008)
- Based on pixel-wise matching
- Matching is supported by a global cost function that penalizes disparity changes
- The global cost function is approximated by pathwise optimizations from all directions towards each pixel
- Matching cost is radiometrically robust, i.e. either Mutual Information or Census (Hirschmüller und Scharstein, CVPR 2007 und TPAMI 2009)
- Quality is comparable to that of global methods
- Complexity is the same as for fast local methods, i.e. $O(W*H*D)$, which results in short processing times, compared to global methods
- Implemented for huge aerial push broom and frame camera images
- More than 100 000 km² of aerial images in 5-20 cm/Pixel resolution have already been processed on a small computer cluster





Evaluation issues

Absolute Accuracy

DSM $x,y < 50$ cm

TOM $x,y < 50$ cm

Future evaluation issues:

- phenomena's in the DSM and 3D visualization
- the benefit for the user



*Prototype
3D - World
Presentation*

Thank you for your attention!

BGIS - Bw Single Source Provider
Geoinformationen aus einer Hand

