



VISIONMAP
Digital mapping systems

**VisionMap A3
take it higher!**

Phowo 2009

Sentimental moment...



Note the shadow

*Smaller is better:
<30kg*

Fits in the trunk of a Peugeot

Paradigm shift

- **Cluster of cameras – works well, but**
 - How far can it grow?
 - How big and heavy?
- **What if we could replace that with a very fast high res camera that will scan a large area by rotating?**



Paradigm shift

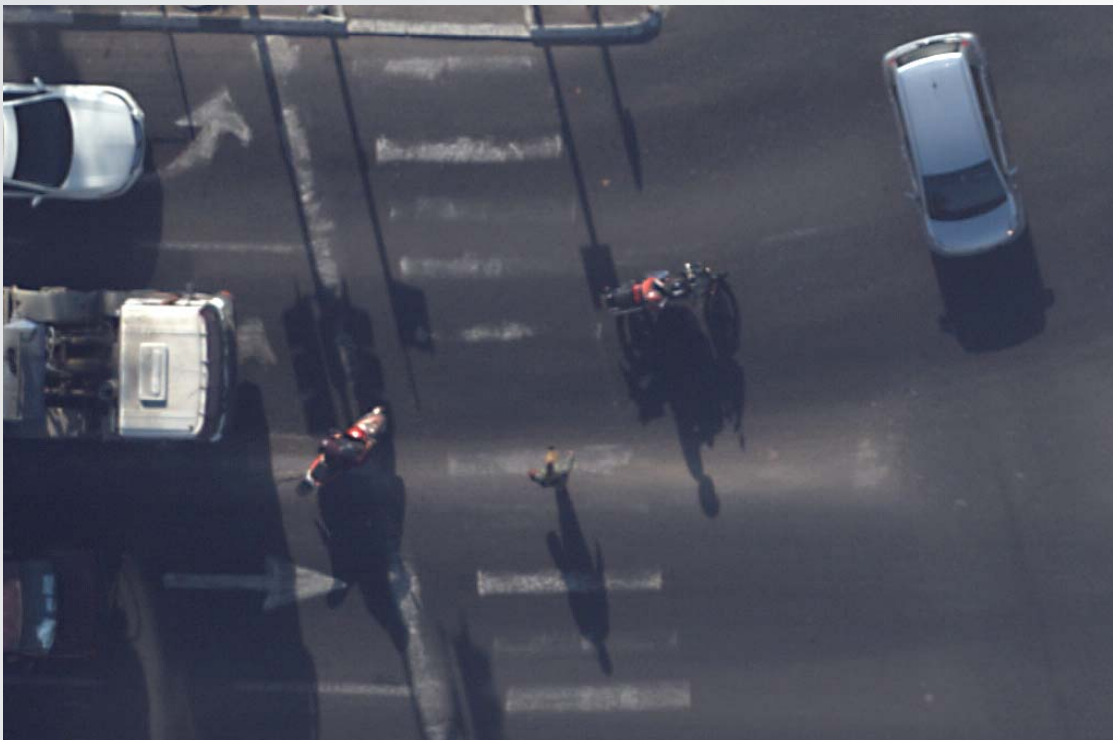
- **We would face many difficulties**
 - Image quality?
 - How to make this accurate?
 - How to tie the IMU in?
 - How to handle so many images?
- **But we would gain**
 - Much better resolution for given altitude
 - Better angles for photogrammetry
 - Enable oblique imagery in the same design
 - Smaller, lighter systems
 - Technically, huge potential for even further improvement



6500ft, scanning 40 degrees/sec



Image taken at 240 knots



Enabling technology - backscan

Static camera



Camera scans at 1radian/sec

Motion compensation: **off**



Camera scans at 1radian/sec

Motion compensation: **on**



- Compensation for any movement that can be measured by the gyros – inherent subpixel FMC & vibration compensation



VisionMap Proprietary




VisionMap DataViewer - [090613_stuttgart_5cm-b] - Orthophoto stuttgart_5cm_Ortho

File Import/Export View Window Reports Help

Projec... 090613_stuttgart_5cm-b Orthophoto stuttgart_5cm_Ortho Trajectory

Scanning in Stuttgart



0.3% (18.4 m/pixel) 5 km

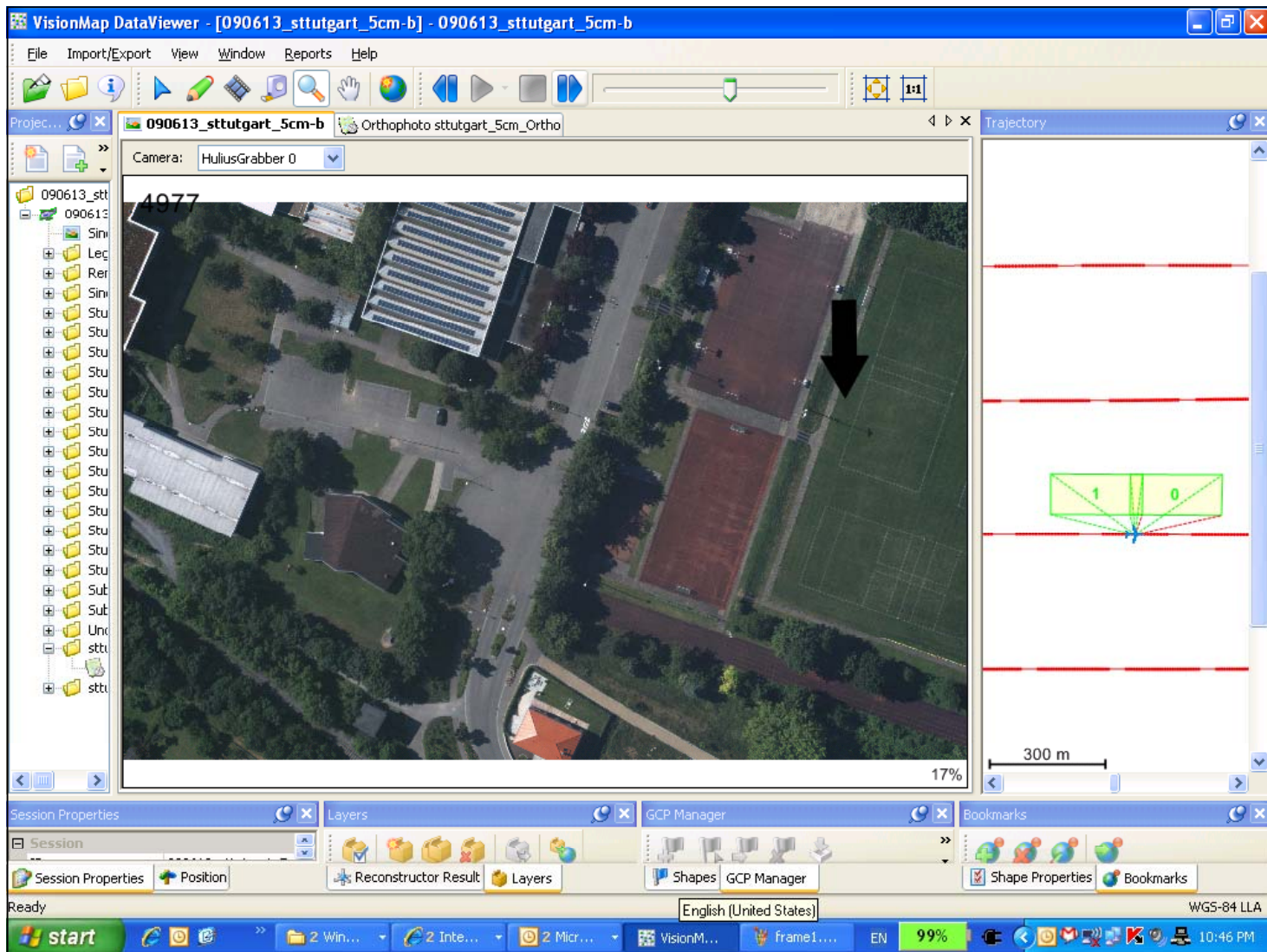
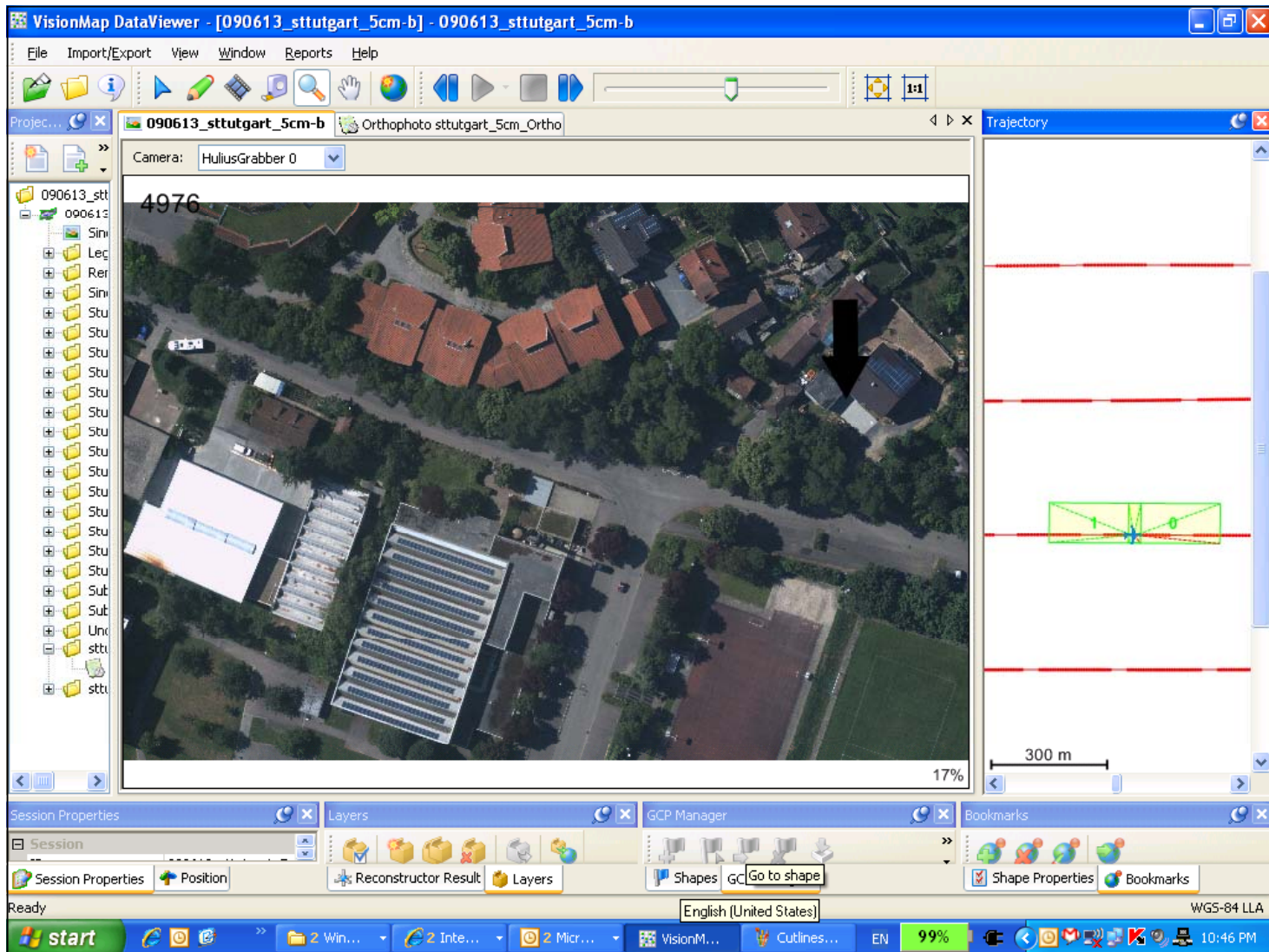
Session Properties Reconstructor Result GCP Manager Bookmarks

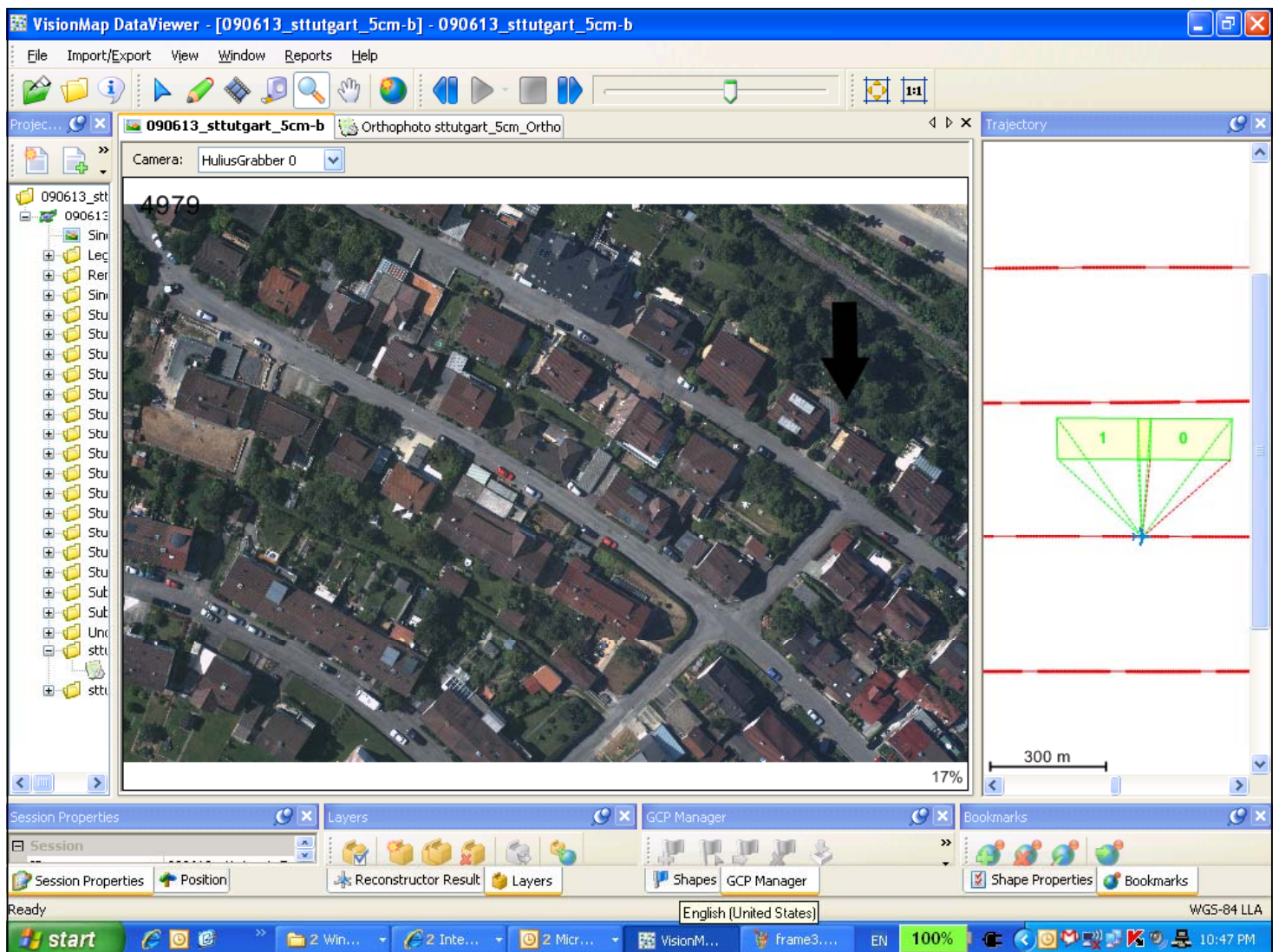
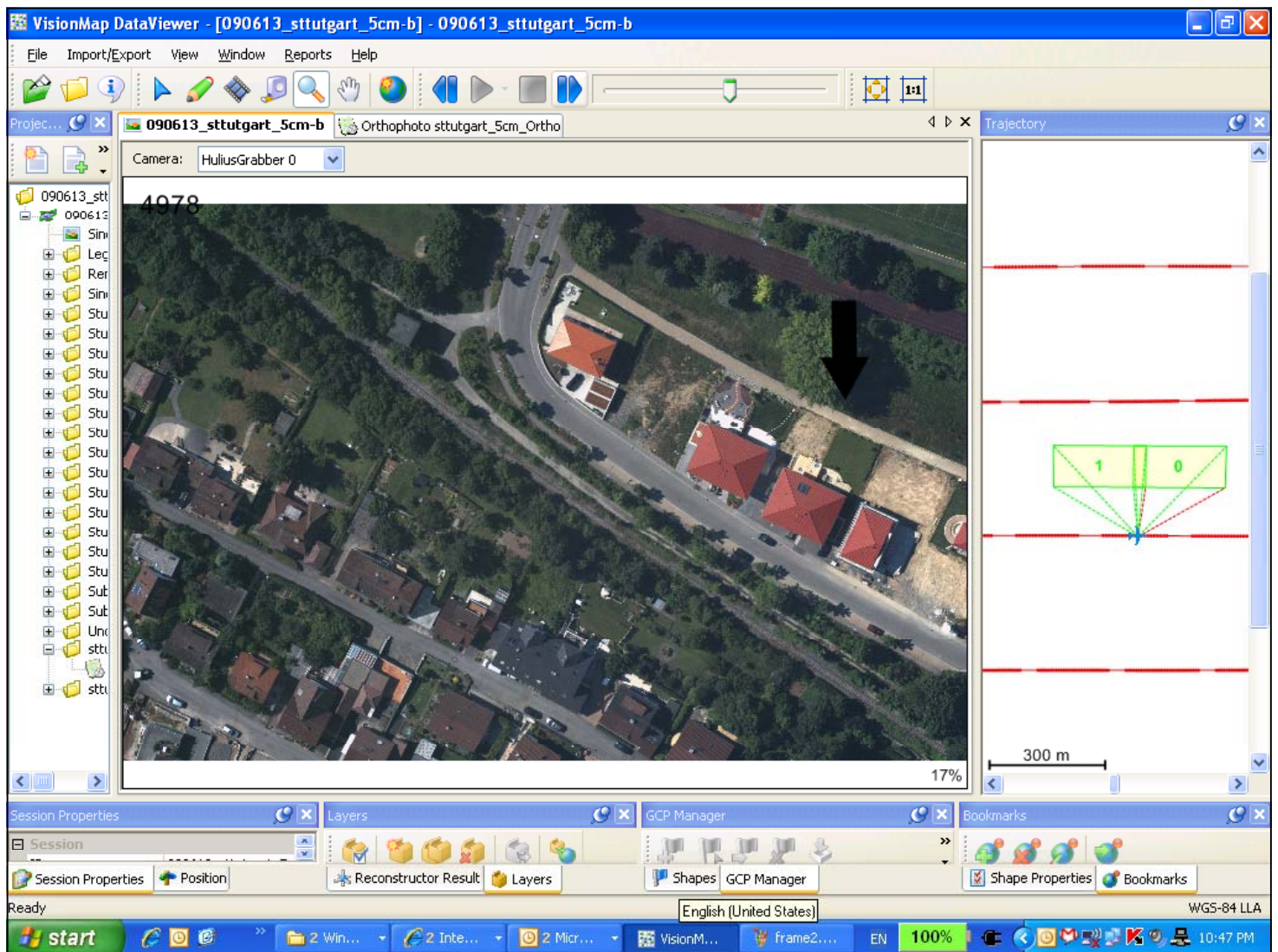
Session 090613_stuttgart_5cm-b

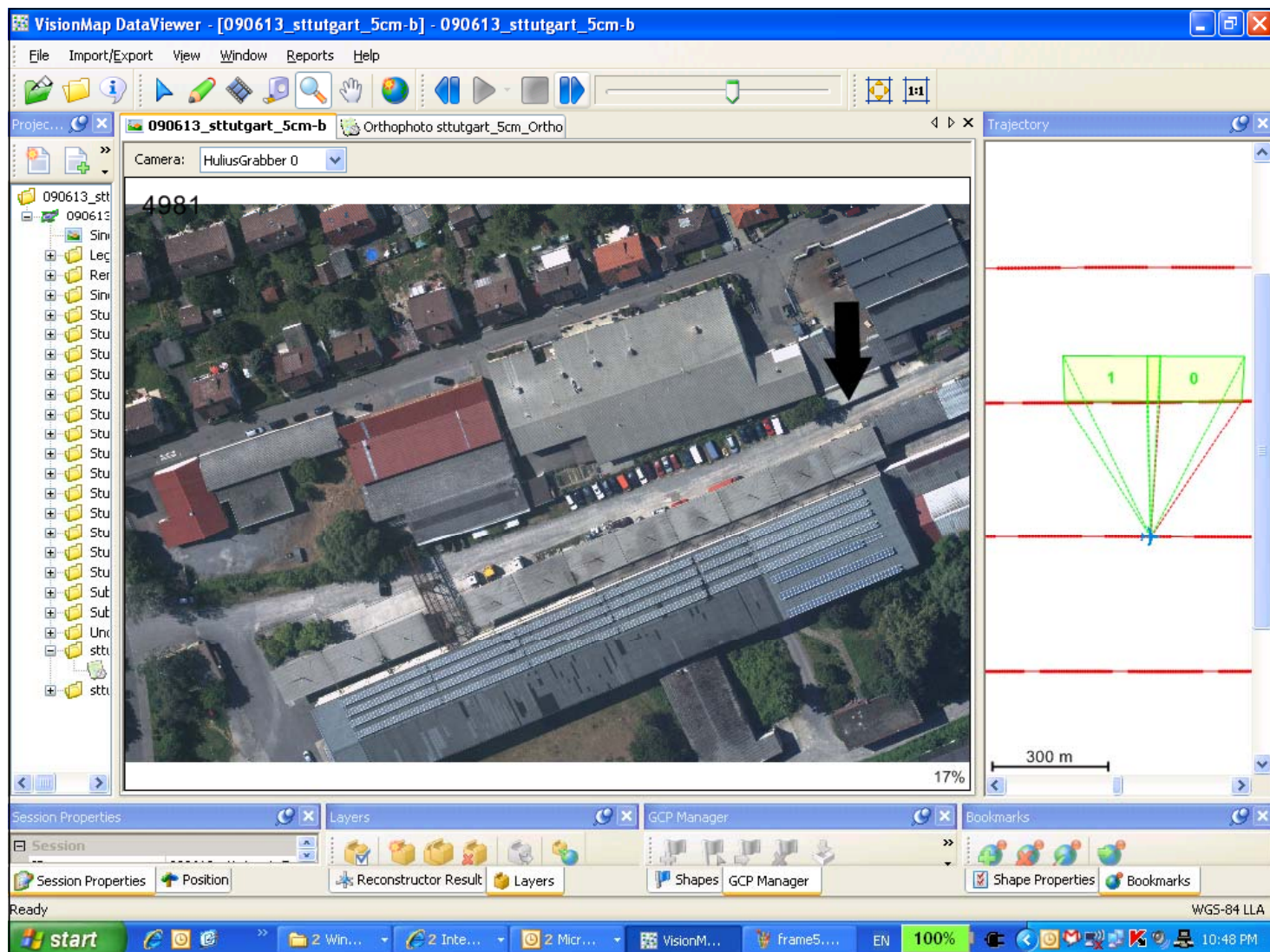
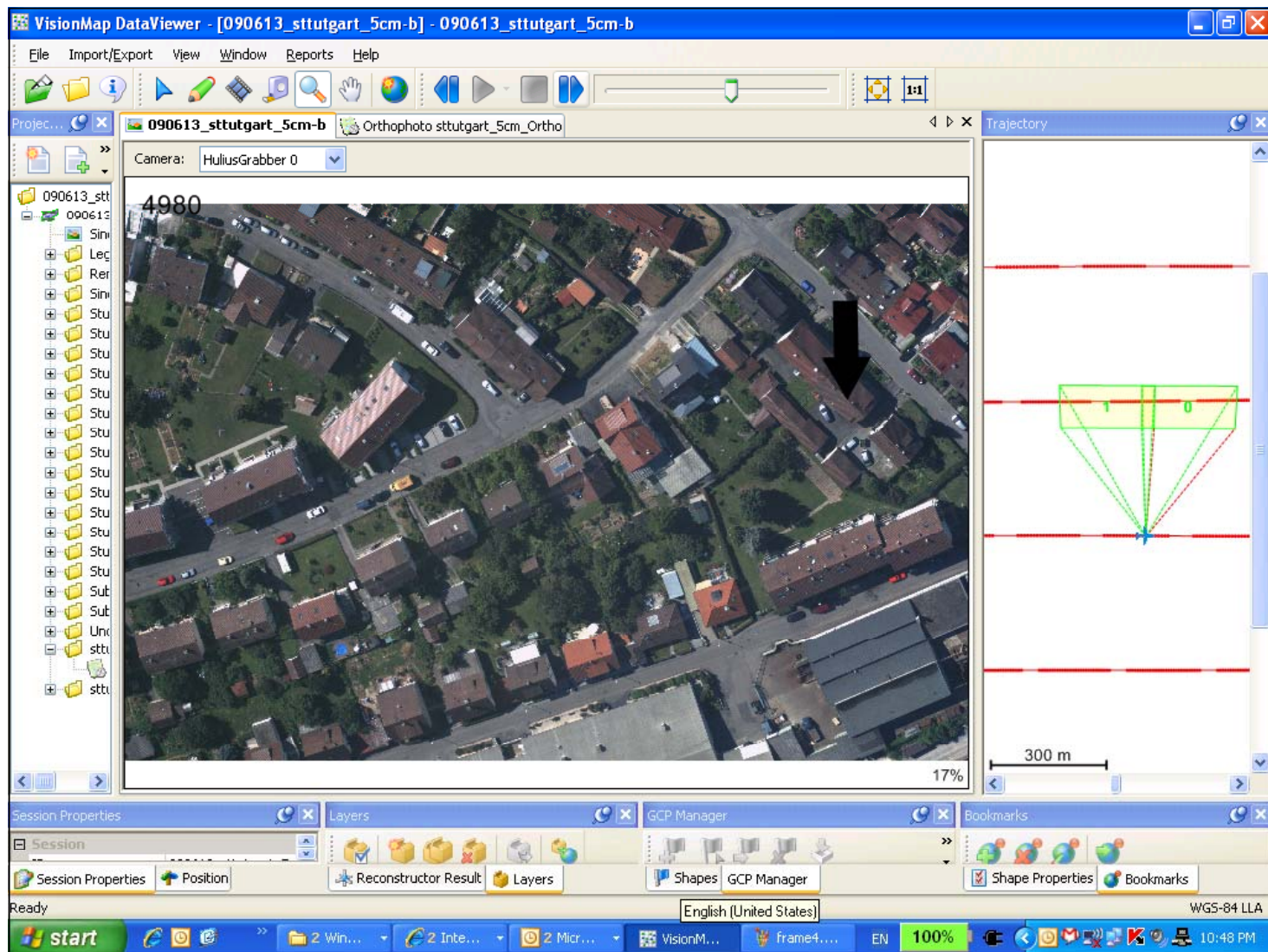
Session Properties Position Reconstructor Result Layers Shapes GCP Manager Shape Properties Bookmarks

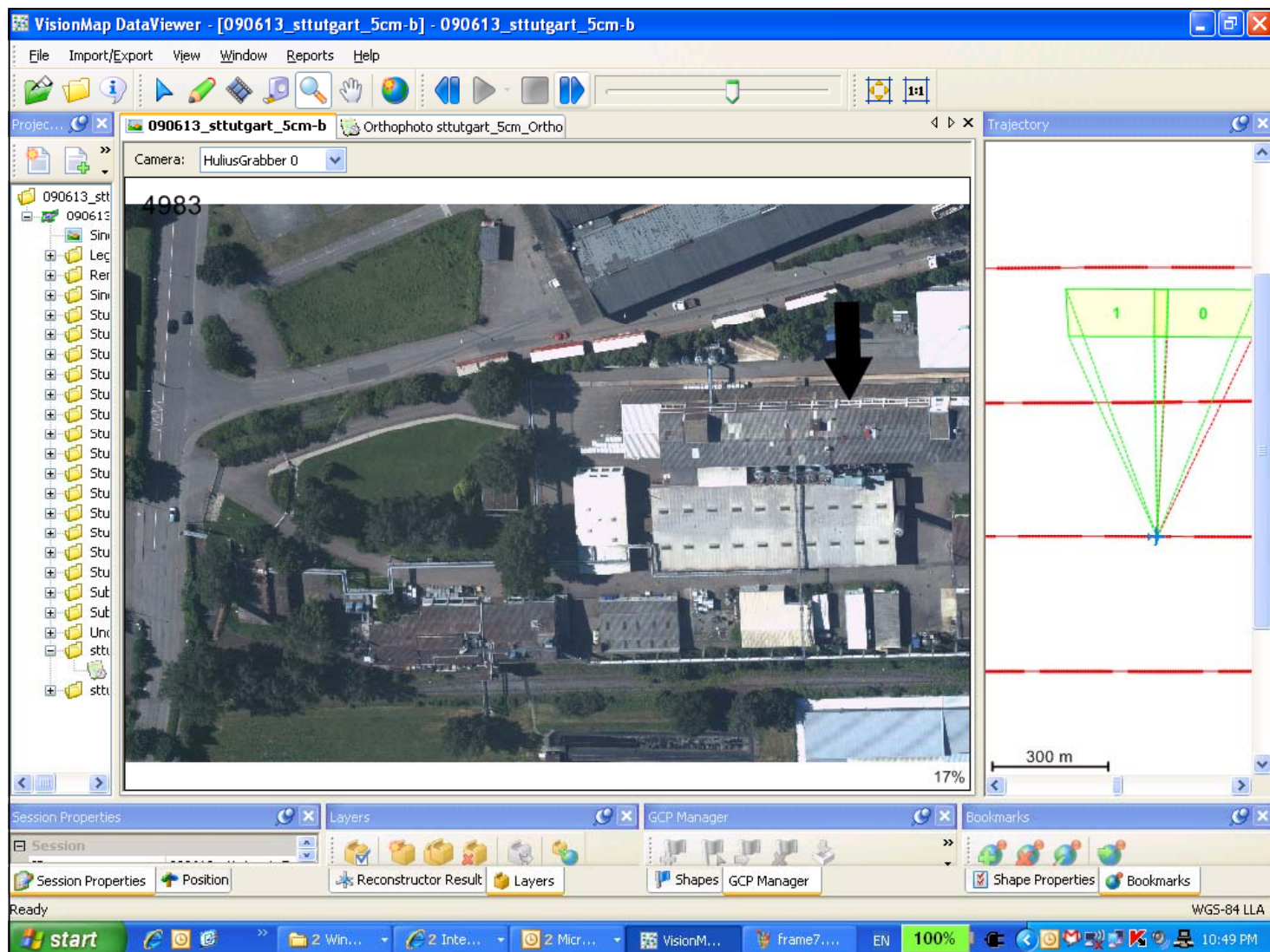
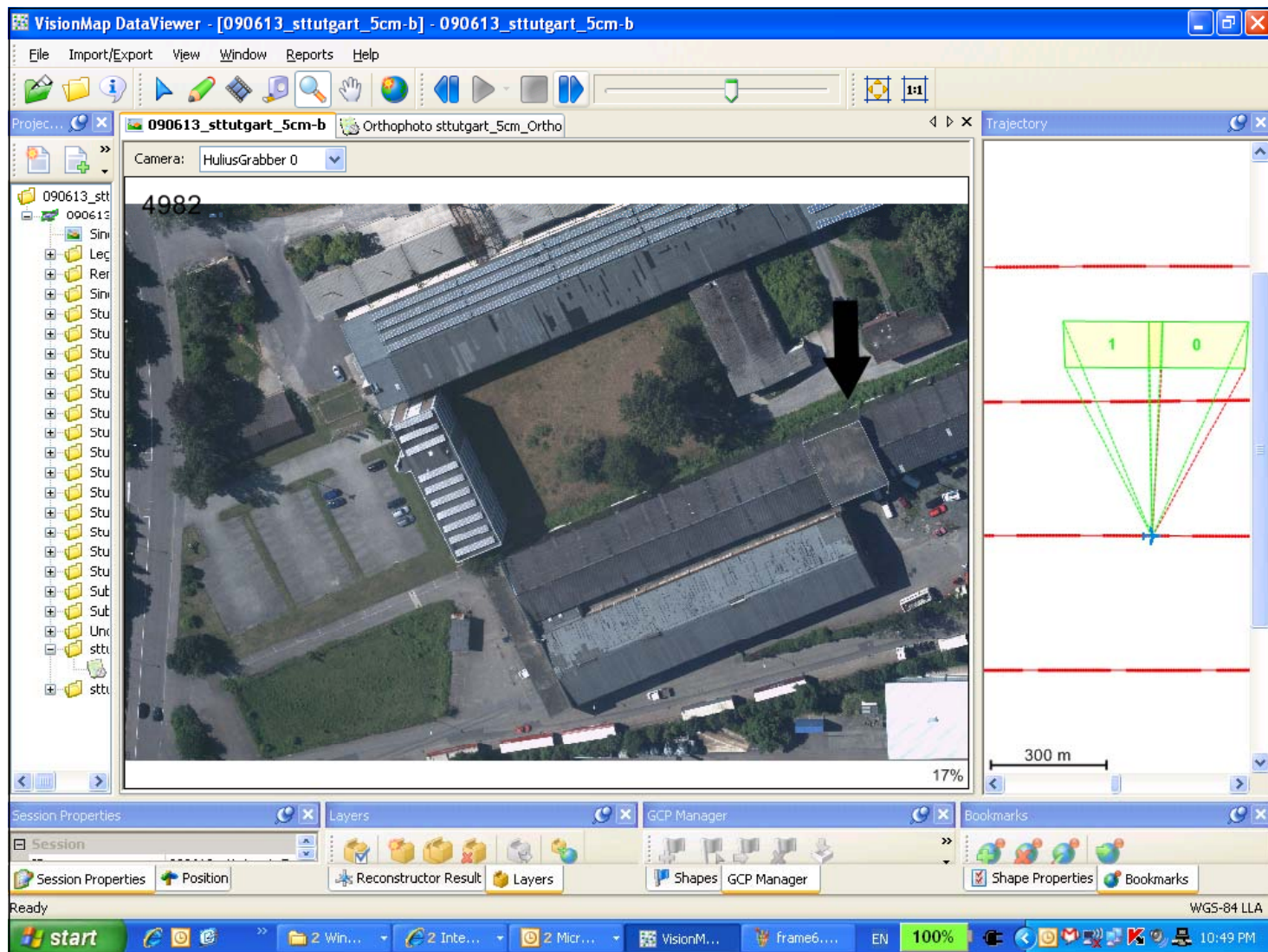
Ready English (United States) WG5-84 LLA

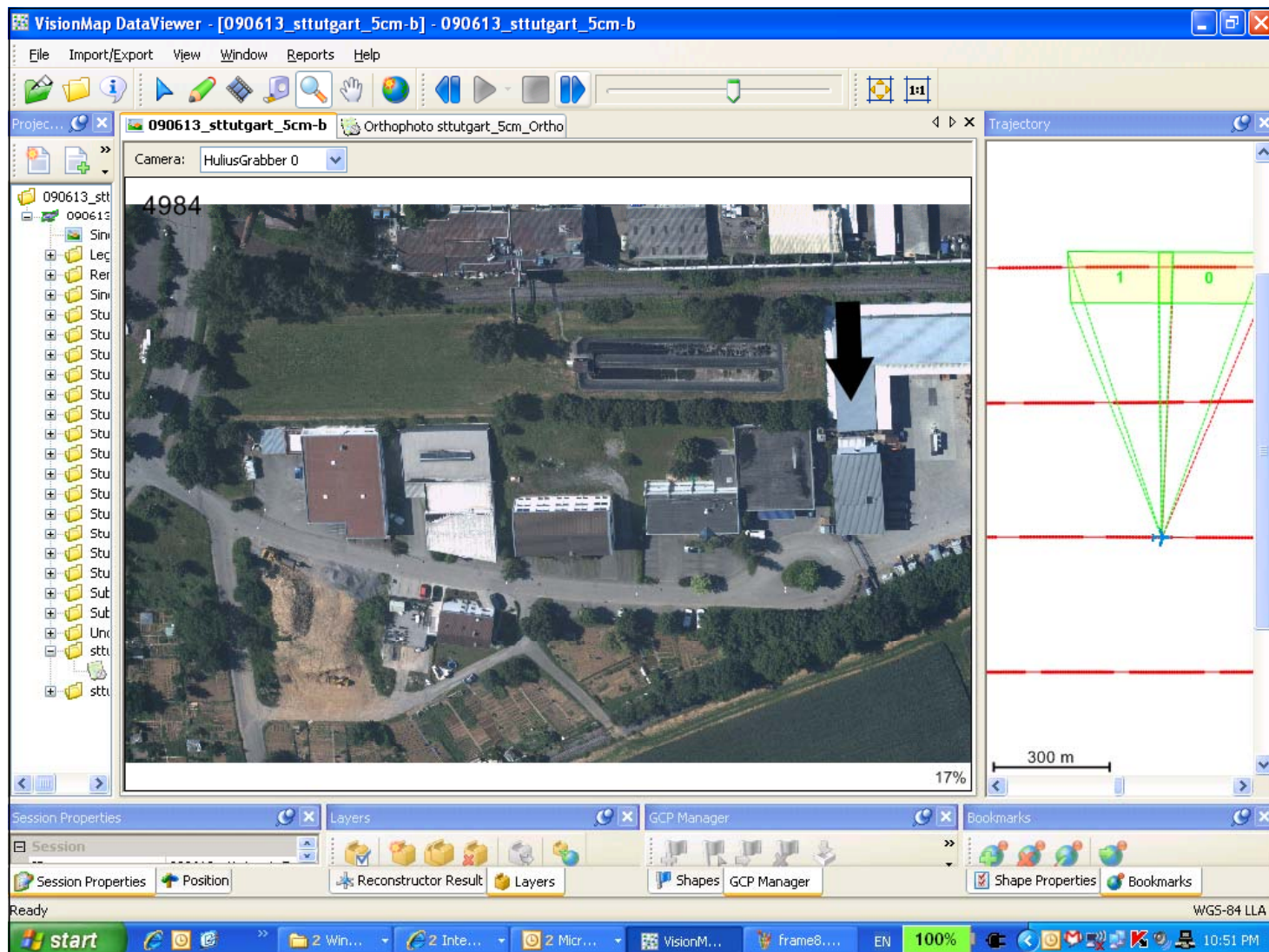
start 2 Windows... 2 Internet... 2 Microsoft... VisionMap Da... EN 100% 10:42 PM



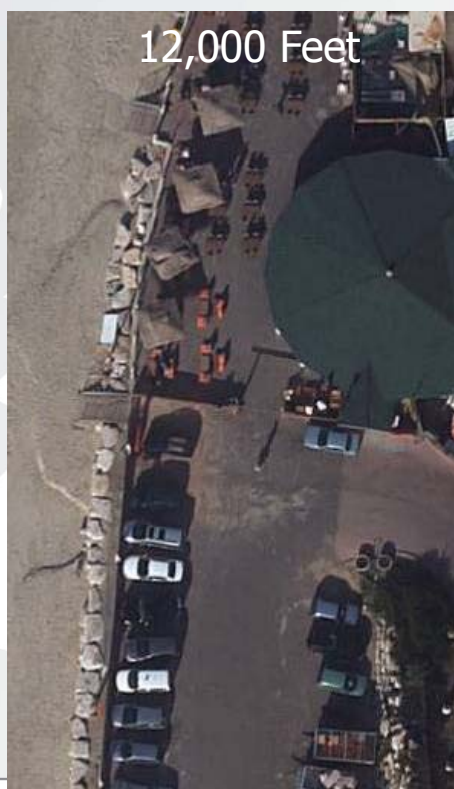




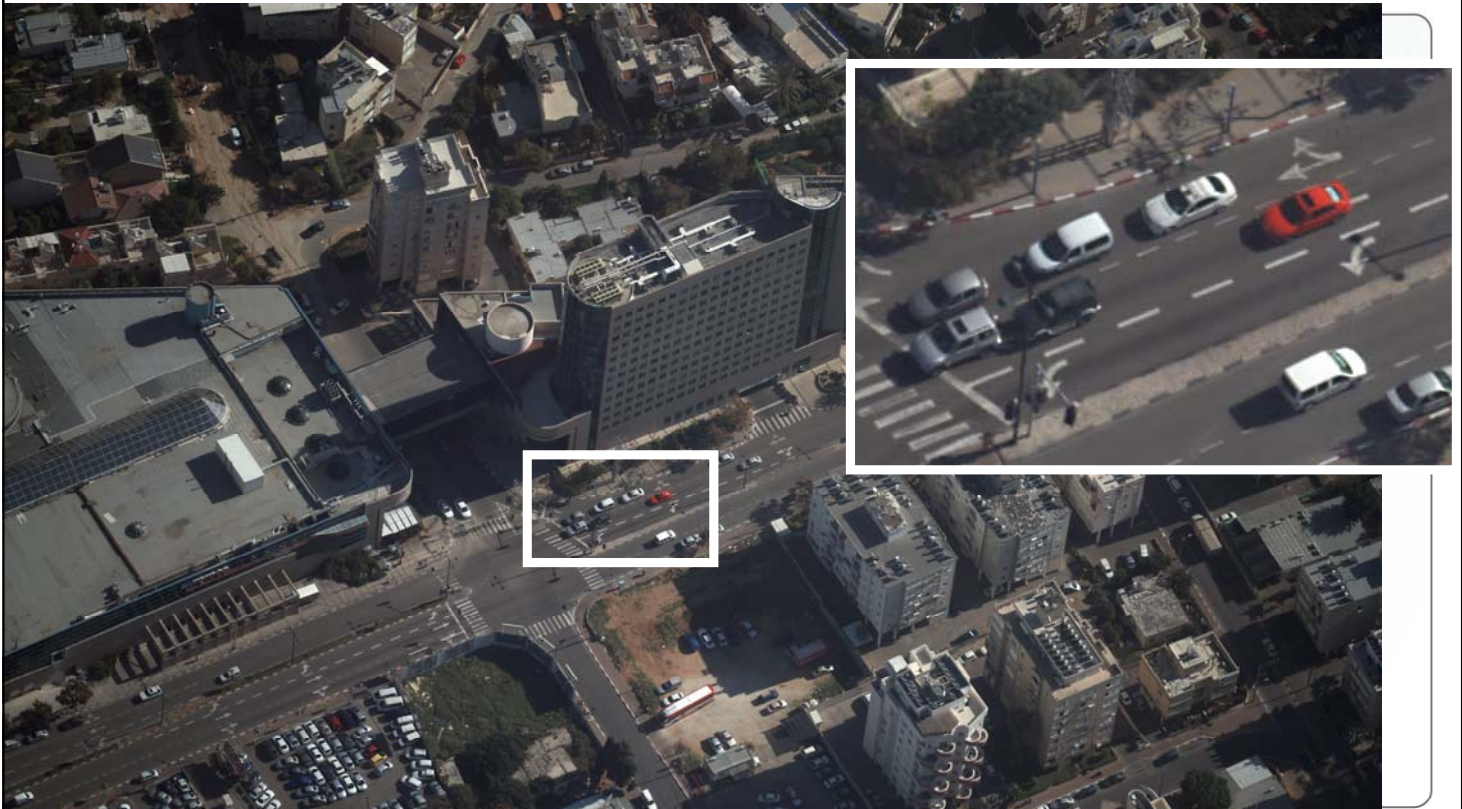




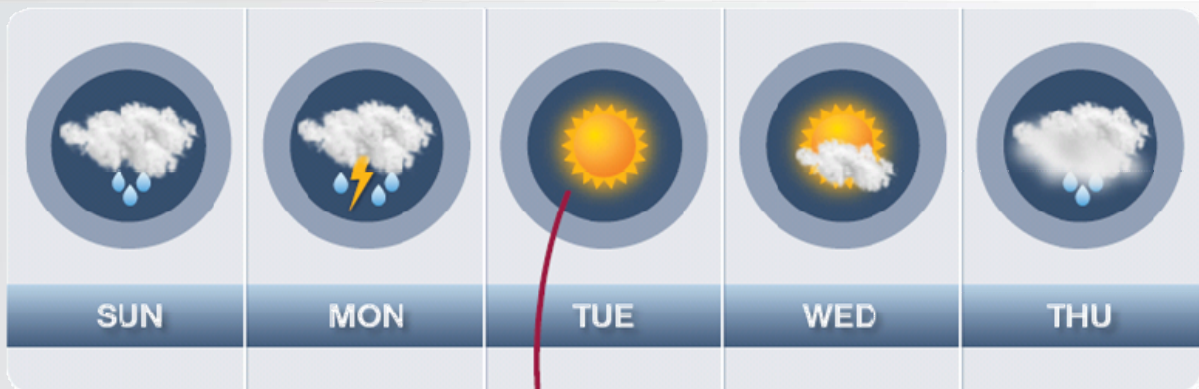
300mm FL imagery



Oblique imagery



Resulting performance

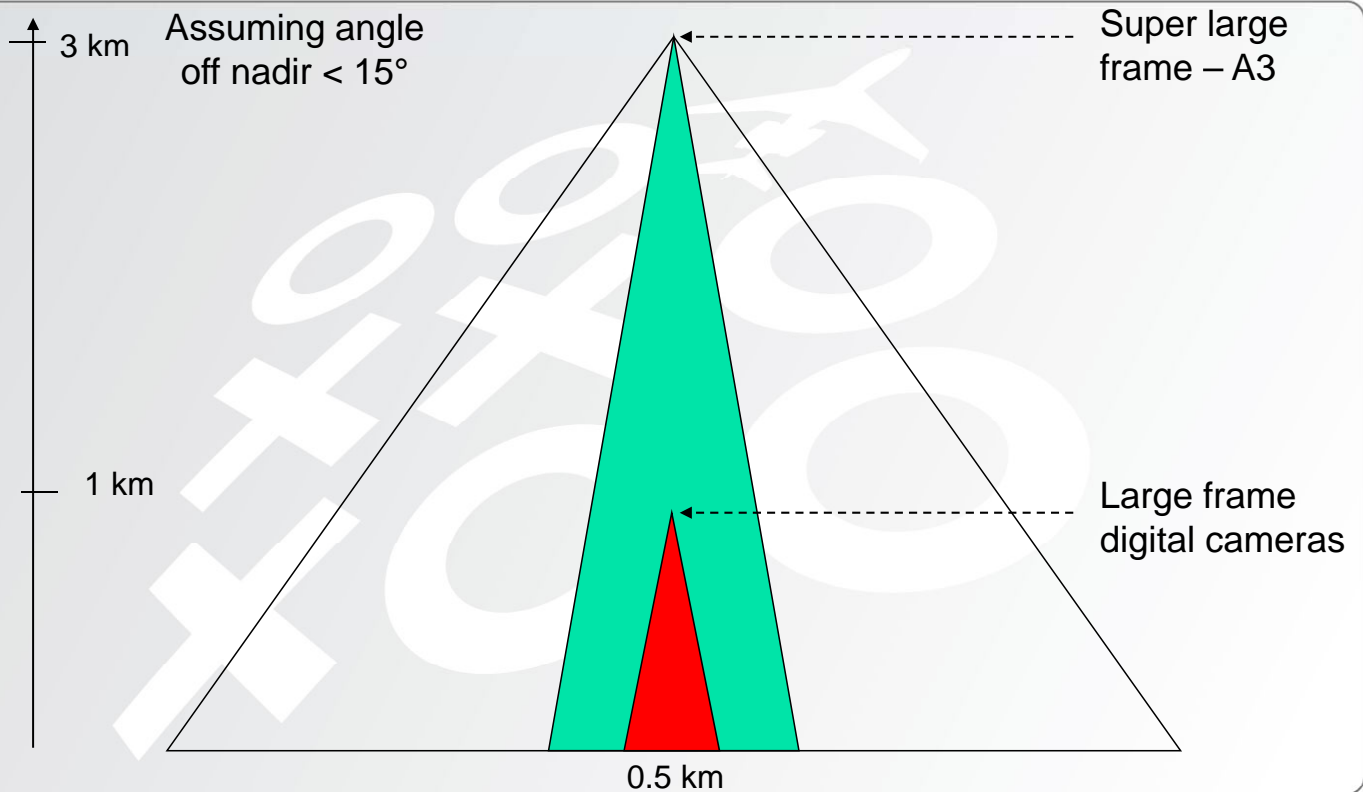


In a single day your image acquisition
can be more than

5000 Km^2
15 cm GSD

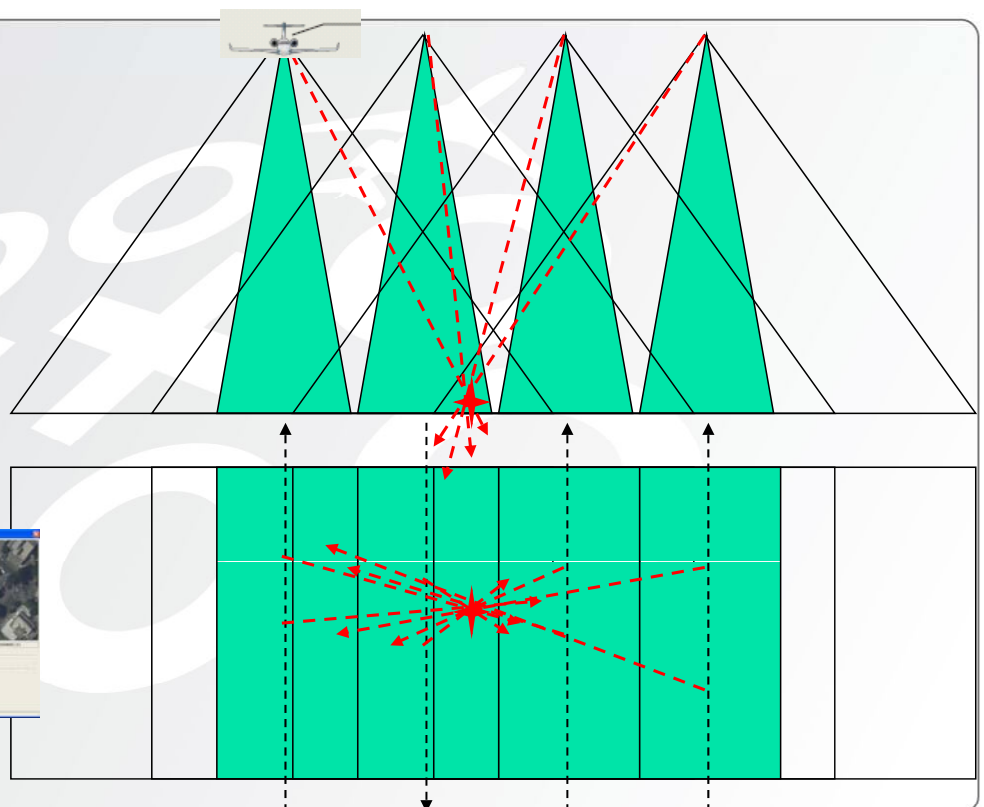
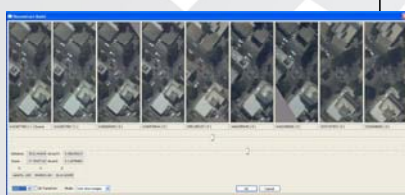


Why altitude matters



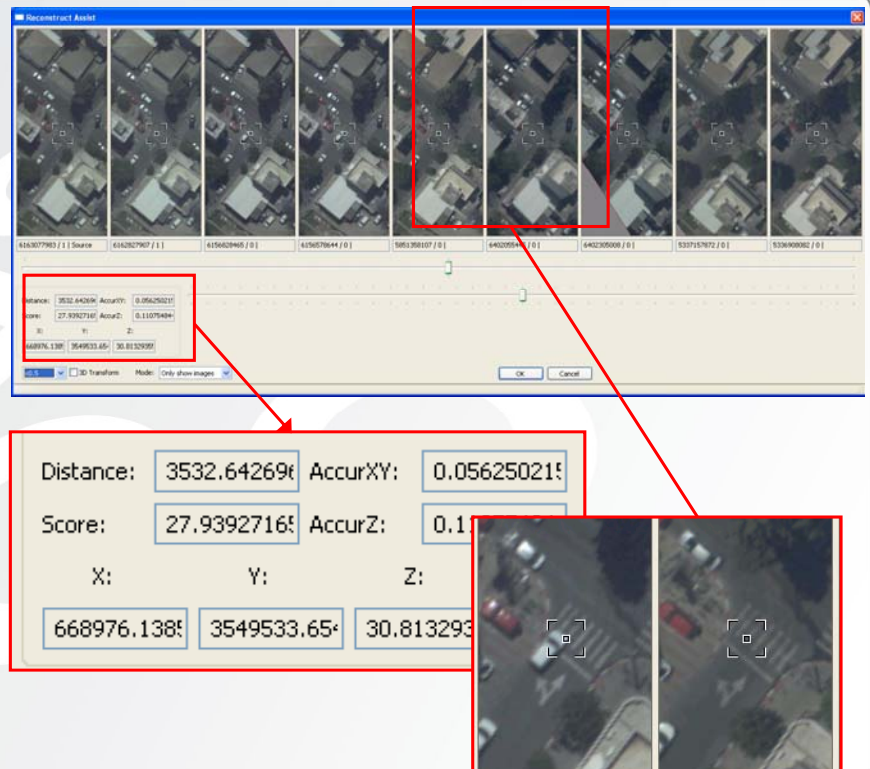
A rotating mapping camera?

- Multiple images
- Multiple directions
- 90-100° angles
- X00,000 tie-points

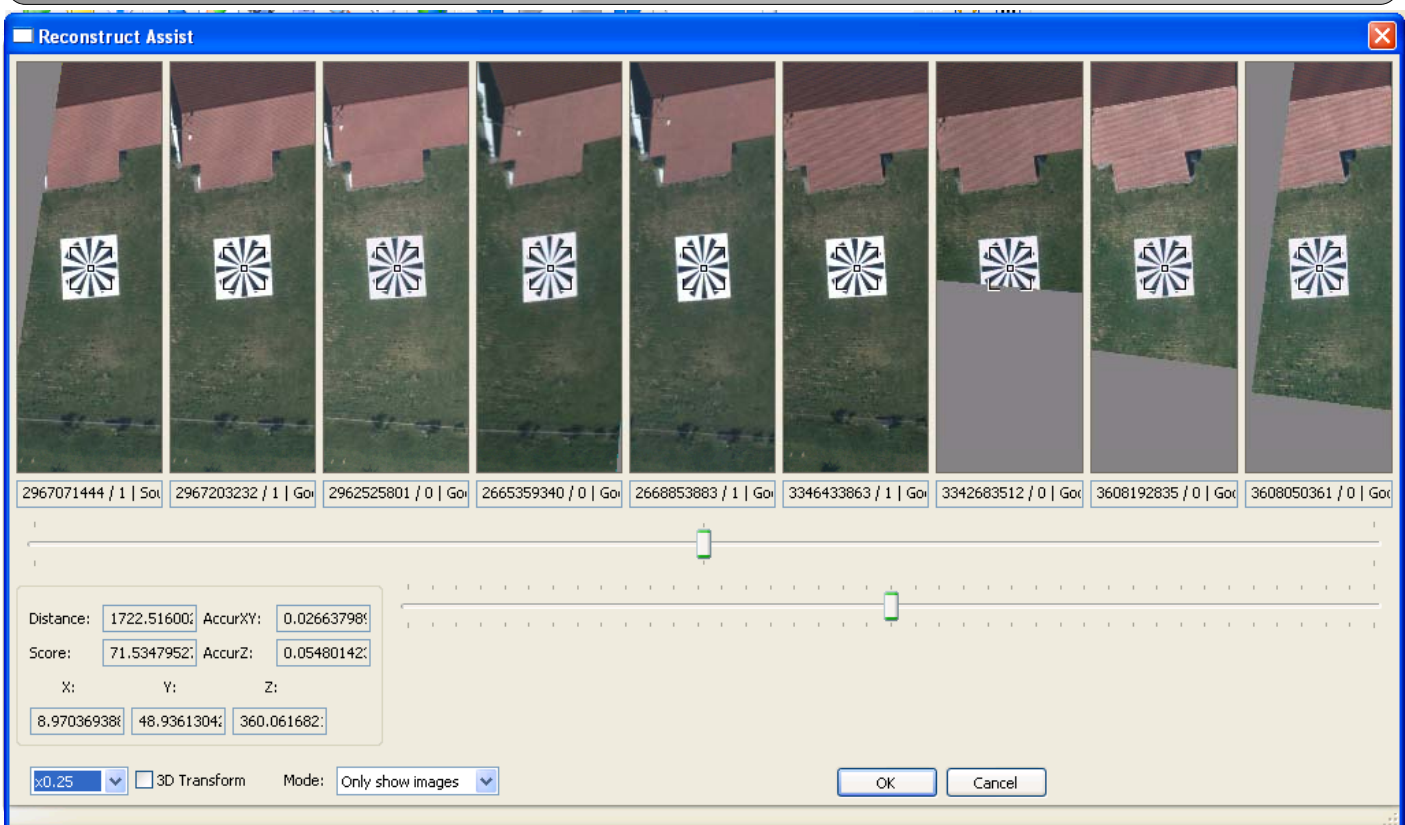


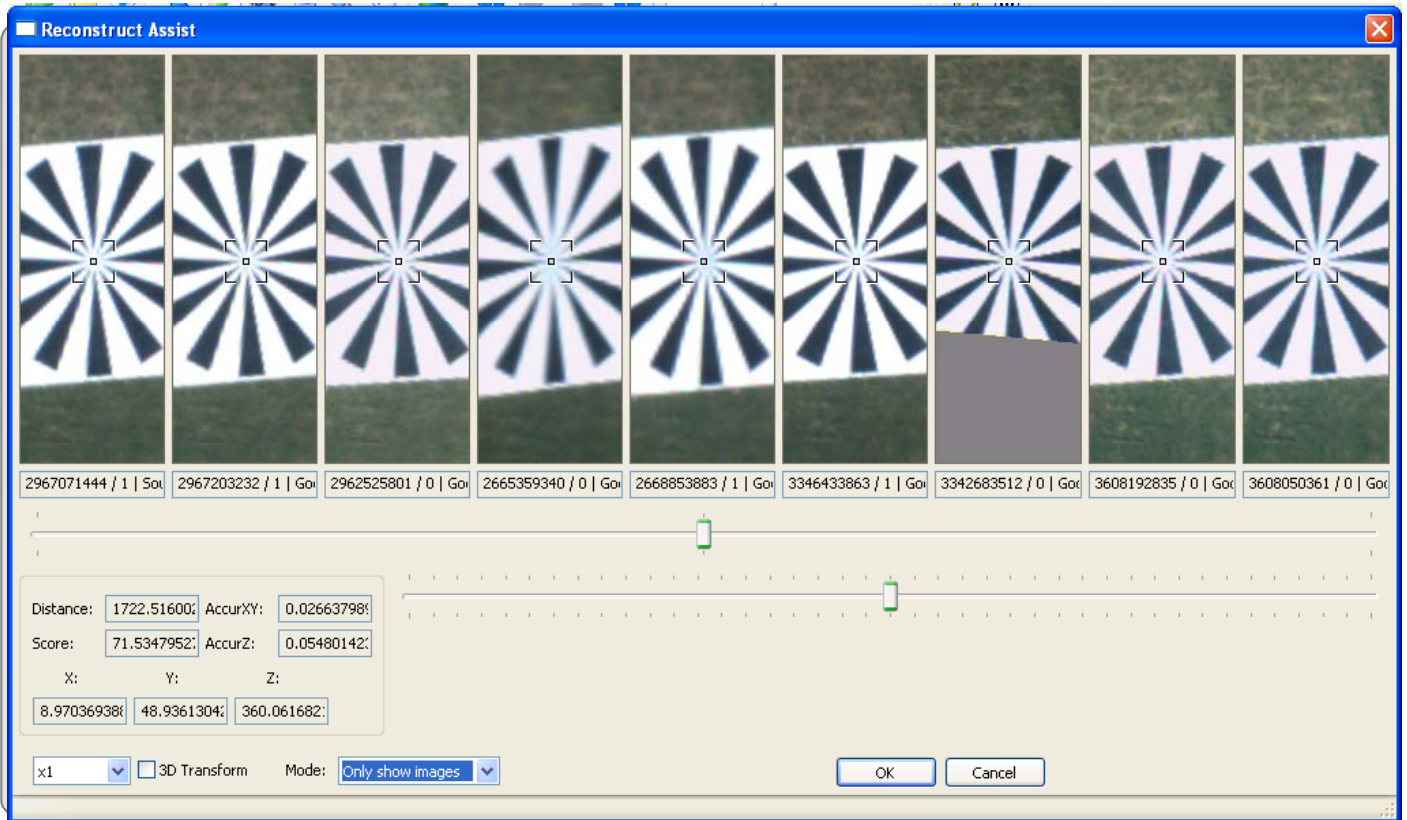
Cost effective bundle adjustment

- No IMU
- No control points
- No DGPS – just PPP!
- Blocks of 700,000 frames have been solved
- Fully automated process
- Tools to validate

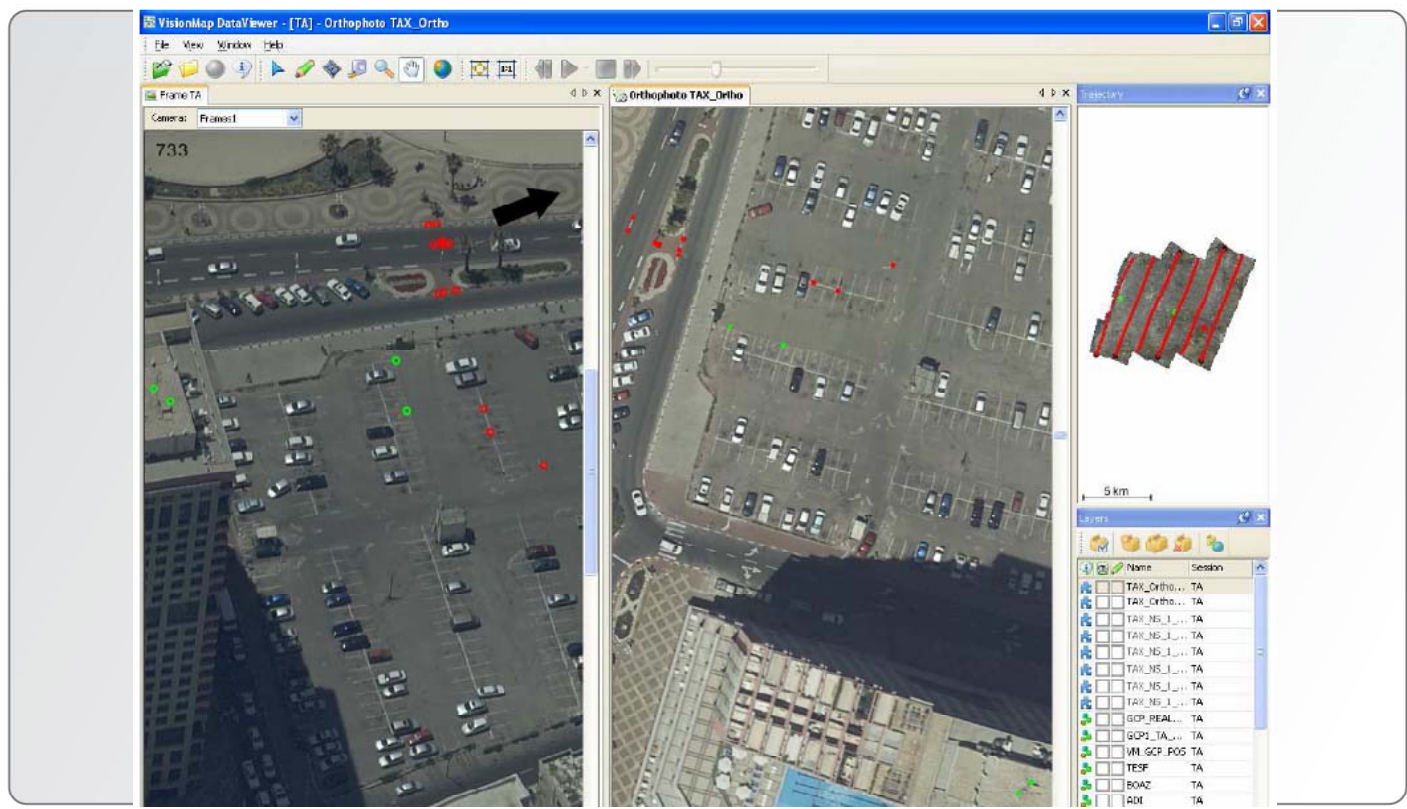


And in Vaihingen Enz

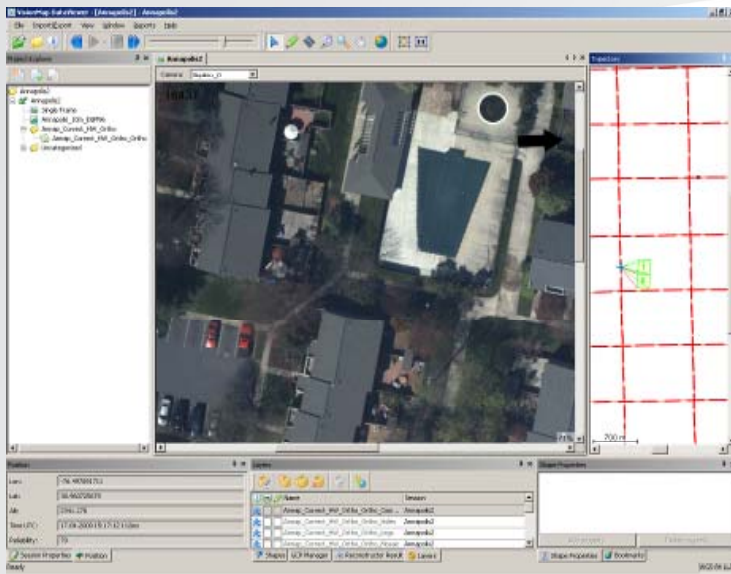




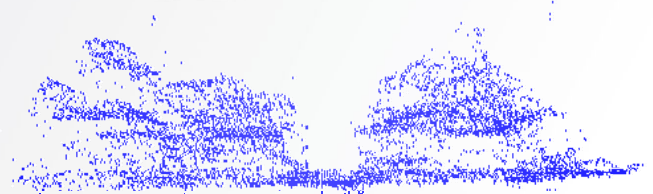
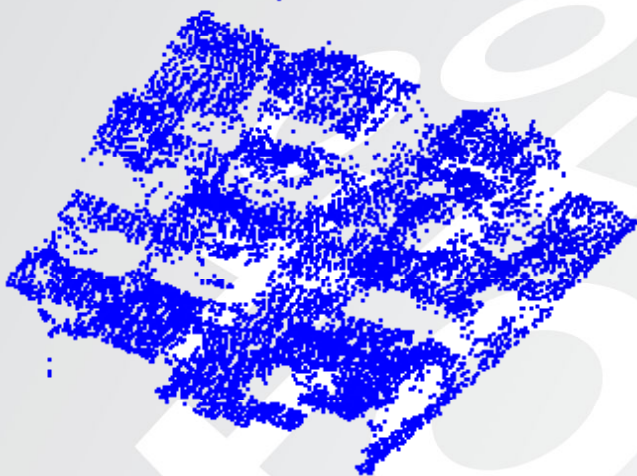
Nadir/oblique bundle



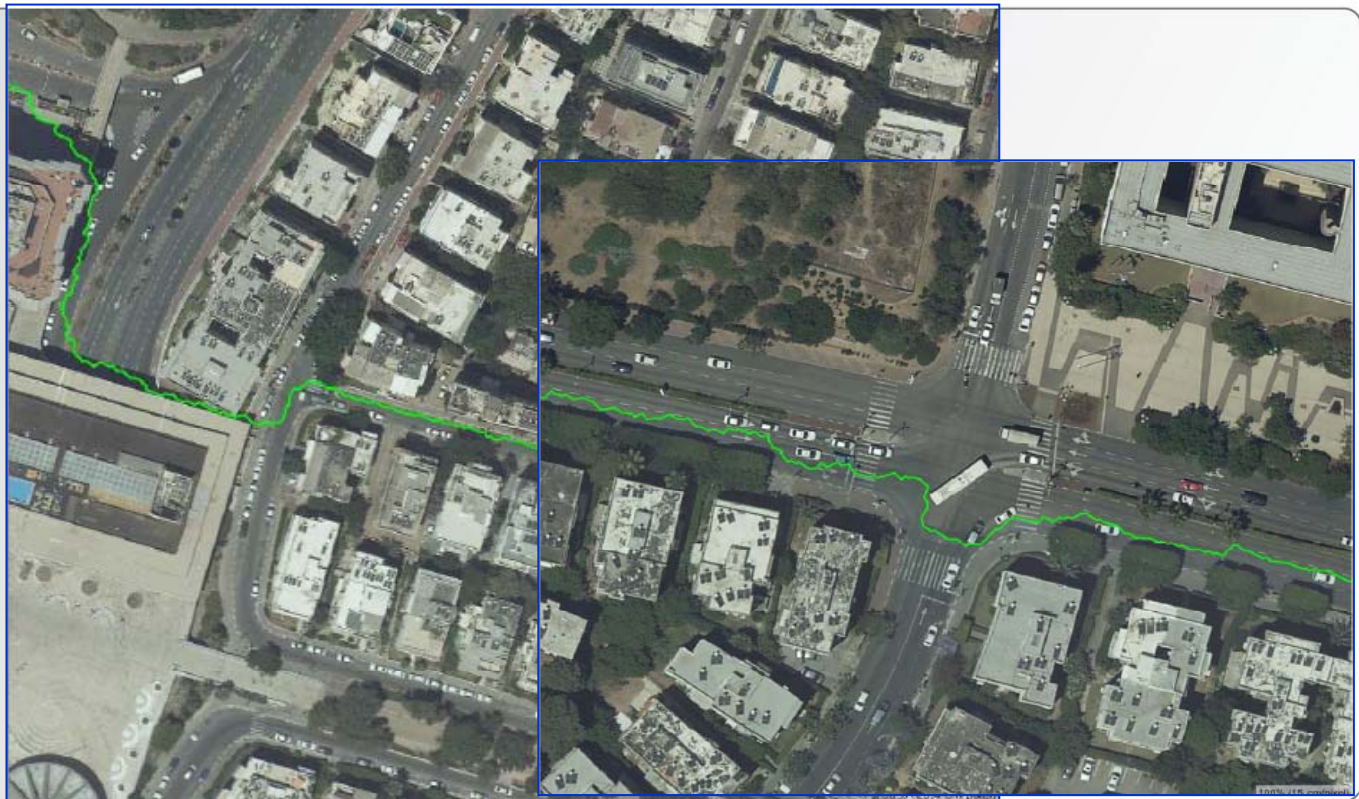
Automatic processing software



Processing results



Automated mosaicing



VisionMap Proprietary



Competitive Analysis

2			Digital Cameras							Analog Camera	
3											
4		From A3	Calculated								
5	Parameters	A3									
6	Focus (mm)	300	62.77	120	100	100	100	70	60	150	300
7	Pixel Size / Scan resolution (micron)	9	6.5	12	7.2	6	7	7.2	6.8	15	15
8	Focus (pix)	33,333	9,657	10,000	13,889	16,667	14,286	9,722	8,824	10,000	20,000
9	Frame size cross track (pix)	62,517	12,000	13,824	14,400	17,310	17,500	9,735	7,216	15,000	15,000
10	Frame size along track (pix)	7,850	∞	7,680	9,400	11,310	11,500	6,588	5,412	15,000	15,000
11	FOV cross track (deg)	94.6	63.7	69.3	54.8	54.9	63.0	53.2	44.5	73.7	41.1
12	FOV along track (deg)	13.47	42.6	42.0	37.4	37.5	43.9	37.4	34.1	73.7	41.1
13	FPS (frame/sec)	7.40	-	0.48	0.74	0.74	0.70	0.40	0.36		
14	Total Weight (without Mount, kg)	45	197	110	150	150			33	300	300
51	GSD (m)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
52	Ground speed (knot)	240	240	240	240	240	240	240	240	240	240
53	Ground speed (km/hour)	444	444	444	444	444	444	444	444	444	444
54	Allowable orthophoto angle (2α, degree)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
55	Side orthophoto overlap (%)	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
56	Flight altitude (m)	3,322	966	1,000	1,389	1,667	1,429	972	882	1,000	2,000
57	Forward overlap (calculated, %)	40%	-	66%	82%	85%	85%	53%	37%		
58	Side overlap (calculated, %)	63%	59%	63%	51%	51%	58%	49%	38%	66%	32%
59	Orthophoto width (cross track from one strip, m)	1,780	517	536	744	893	766	521	473	536	1,072
60	Frame height (along track, m)	785	753	768	940	1,131	1,150	659	541	1,500	1,500
61	Frame width (cross track, m)	4,279	1,200	1,382	1,440	1,731	1,750	974	722	1,500	1,500
62	Frame area (sq. km)	3.62	0.90	1.06	1.35	1.96	2.01	0.64	0.39	2.25	2.25
63	Full one strip coverage (sq.km/hour)	1,902	533	614	640	769	778	433	321	667	667
64	Full multi strip coverage (sq.km/hour)	712	219	226	314	377	323	220	200	226	453
65	Ortho one strip coverage (sq. km/hour)	791	230	238	331	397	340	232	210	238	476
66	Ortho multi strip coverage (sq.km/hour)	712	219	226	314	377	323	220	200	226	453
67	Productivity Coefficient (PA3/Pi)		3.26	3.15	2.27	1.89	2.20	3.24	3.57	3.15	1.57



VisionMap Proprietary



Conclusion

- What if we could replace that with a very fast high res camera that will scan a large area by rotating?
 - A3!!!
- We would face many difficulties
 - Image quality? 3D compensation/backscan
 - How to make this accurate? Multi-ray/angle/redundancy
 - How to tie the IMU in? Classic photogrammetry!
 - How to handle so many images? Parallel scalable processing
- But we would gain
 - Much better resolution for given altitude
 - Better angles for photogrammetry
 - Enable oblique imagery in the same design
 - Smaller, lighter systems
 - Technically, huge potential for even further improvement

