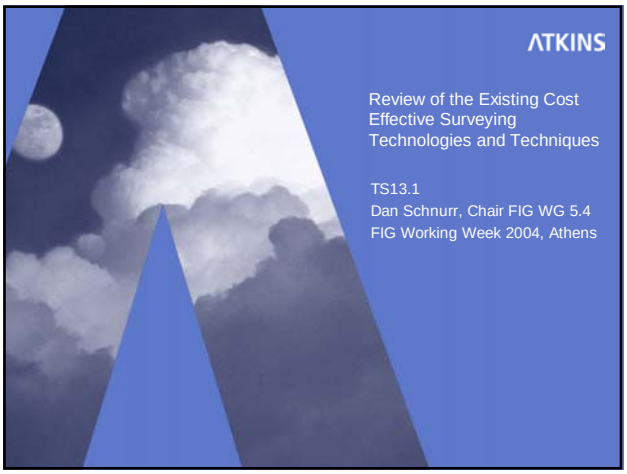

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Review of the Existing Cost Effective Surveying Technologies and Techniques

TS13.1
Dan Schnurr, Chair FIG WG 5.4
FIG Working Week 2004, Athens

Structure of paper / presentation

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- First – it is a review paper and a "live document"
- Targeted at a *"lay"* audience
- Working Group 5.4 – structure, remit and work plan
- Issues we are focussing on:
  - Mapping from 1:1000 to 1:25000 scale
  - Survey specifications
  - Current technology and techniques
  - Appropriate use
- Applications
- Conclusion
- References

Working Group 5.4

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- Working Group 5.4 – structure
  - Dan Schnurr, UK – Chair
  - Chryssy Potsiou, Greece
  - Gerda Schennach, Austria
  - Orhan Ercan, Turkey
  - Tim Viney, UK
  - Jo Padeyi, Trinidad and Tobago
  - Peter Dare, Canada
  - Mabel Alvarez de Lopez, Argentina
- Difficulties.....
  - huge subject, focus easily lost
  - "virtual collection of people"
  - other delegates are welcome to join!

Working Group 5.4

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- Working Group 5.4 – remit

  From the keynote address given by Dr. Anna Tibaijuka, UN-HABITAT to the XXII FIG Congress in Washington DC, 2002

  "To identify more cost effective ways to improve the availability and accessibility of tools of land information. To suggest these methods to aid more effective planning, development and management of the environment. Also to develop innovation, adaptation and resourcefulness in simplifying these tools to fit the local situation."
- Working Group 5.4 – work plan

  http://www.fig.net/figtree/commission5/wgroups/wg5_4.htm

Issues – Survey Specifications

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- Older mapping – e.g. DOS, UK worked towards specifications...
- Developed world
  - TOP10DK - Denmark
  - TOPO96 - UK
- Specification problems today
  - terrain in country, e.g. desert vs. rain forest, etc...
  - deliverables and formats
- No current guidelines or specification available, 1981 RICS Specification (revised 1987) is out of print and 17 years out of date.

Older mapping - example

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This example is from DOS mapping of Africa

1:5,000 scale photogrammetric mapping from circa. 1967

Current Technologies - issues

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- Huge variety of methods
  - satellite imagery
  - multispectral, thermal, hyperspectral scanning
  - microwave sensing (radar and laser)
  - aerial photography
- Accurate specification is vital
- Concept of mapping scale – symbology, detail shown, accuracy

Mapping Scale	"Ground resolution"	Typical Application
1:1000	0.2m	Urban cadastre, detailed engineering design and construction
1:2000	0.4m	Rural cadastral and other boundary demarcations
1:5000	1m	Town planning
1:10,000	2m	City planning
1:25,000	5m	Large area developments and Country wide medium scale maps

Current Technology - options

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- Simplest option:
  - use appropriate imagery source
  - use GPS method for ground control
- Not the only option:
  - Cost benefit must be assessed
- "Low-cost" GPS options also available
- LiDAR
- Moving targets.....
  - SPOT-5
  - Helios-2
  - Pleiades

"Low-cost" GPS – example

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L1 GPS carrier phase survey system with choke ring antenna

Used successfully in Maldives 2002

Examples of possible imagery sources

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Platform	Imagery / System	Resolution	Imagery control method	Typical mapping
Satellite	Landsat	10m	"Level 1" GPS	1:50,000
	SPOT	5m	"Level 2" GPS	1:25,000
	IKONOS	1m	"Level 3" GPS	1:10,000
Fixed Wing Aircraft	1:24,000 VAP	0.5m	"Level 3" GPS	1:10,000
	1:12,000 VAP	0.25m	"Level 4" GPS	1:5,000
	1:3,000 VAP	0.06m	"Level 4" GPS	1:1,000
	LiDAR – low res.	0.3m	"Level 4" GPS	1:5,000
Helicopter	1:1000 VAP	0.02m	Land survey	1:500
	1:600 VAP	0.01m	Land survey	1:200
	LiDAR – high res.	0.05m	"Level 4" GPS	1:500

Note: VAP – Vertical Aerial Photography
Land survey – traditional levelling / EDM measurement

SPOT image – example

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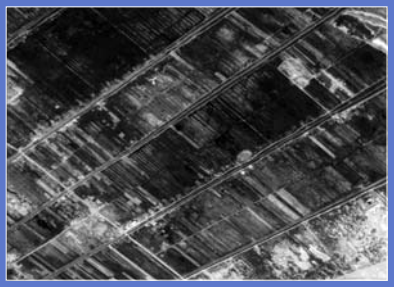

SPOT panchromatic imagery showing field boundaries

GPS methods – "Levels" of accuracy

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- To simplify GPS control methods
  - Split into levels of accuracy according to method
  - 4 basic methods for ground control

GPS "Level"	Description of GPS measurement method	Accuracy
Level 1	Standalone pseudorange GPS Positioning	10 – 25m
Level 2	Differential code GPS, or "DGPS"	2 – 5m
Level 3	Carrier smoothed differential code GPS	0.4 – 0.8m
Level 4	Double differenced carrier phase GPS	0.01 – 0.04m

Importance of correct imagery selection

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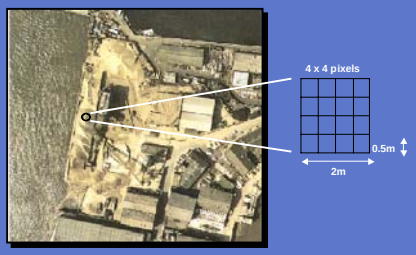

2m x 2m square on the ground (1:10,000 scale mapping)

represented by 4 x 4 image pixels (1:24,000 imagery at 20μm)

Incorrect imagery selection - example

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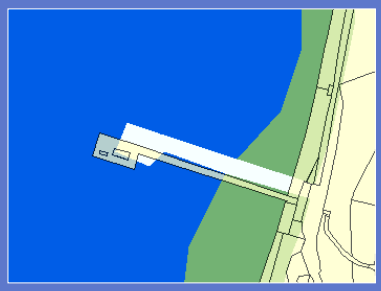

Problem when incorrect imagery scale is used to derive mapping: Zooming in to 1:30,000 mapping generated from imagery shows errors when compared to 1:2,500 vector mapping.

Applications and delivery

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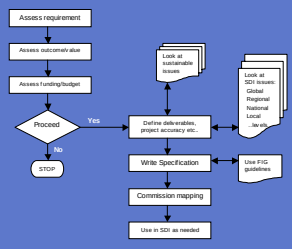
- Applications
  - environmental
  - e-government
  - public sector
  - agriculture
  - transportation
  - statistics
- Process flow-line
  - standardised
  - best possible use



Conclusions

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- Specification and guidelines to help the end user are vital to ensure cost effective use of the available technology.
- Regardless of specification and final application, a standardised flow line should be followed to ensure appropriate use of the available technology.
- Precise requirements and needs of the local situation must be met by the mapping project. Capacity/ability of local circumstances and commercial environment must also be balanced.
- FIG Publication planned “Guidelines for Cost Effective Survey Measurement in the Developing World.” – Munich 2006.

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