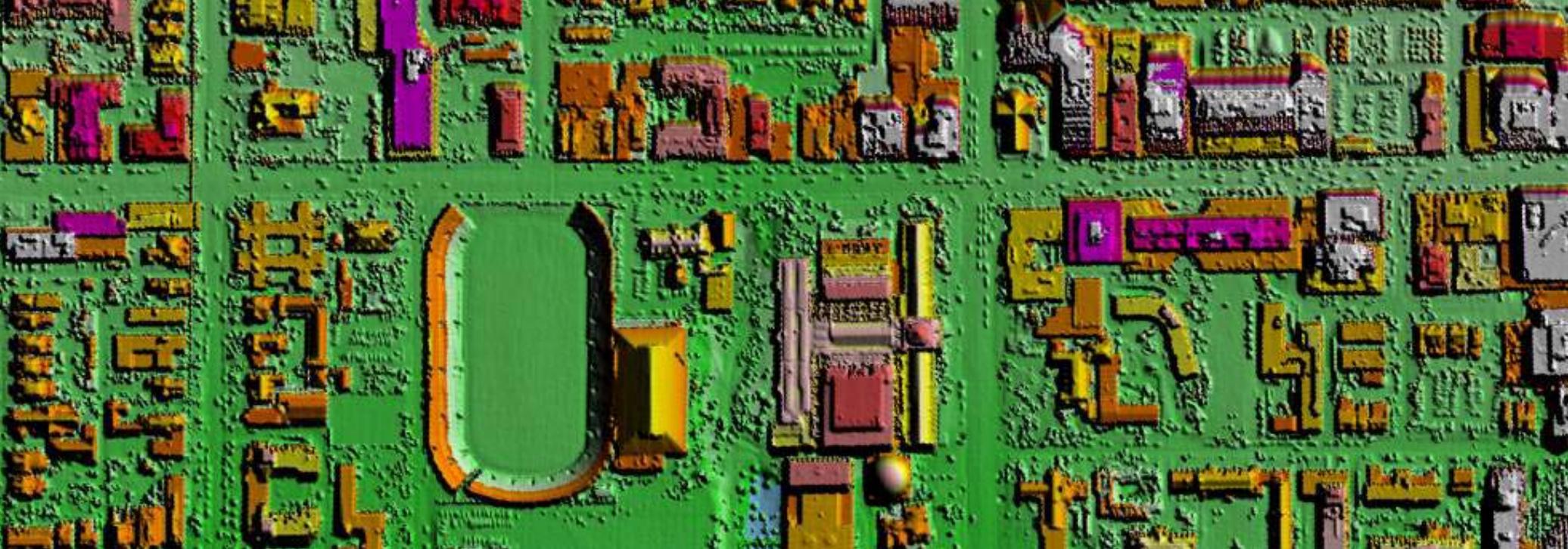


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Impact of High Resolution Terrain Data on C2 Decision Making

Dr. Nicholas Smith & Paul Bishop
8th ICCRTS, Washington
17-19th June 2003

“The relationship between warfare and terrain demands the faculty of quickly and accurately grasping the topography of any area”

Karl von Clausewitz

What do we mean by terrain ?

- The underlying shape of the Earth,
- Features appearing on that shape
 - natural and man-made
 - static (and mobile ?)

What do we need to understand it for ?

- Targeting - Mitigating undesired effects
- Situational Awareness - Gaining environmental advantage
- Route planning - Deployment and logistics planning
- Risk / Threat Assessment



To design processes and tools

C2 Planning

- Investigation of Courses of Action to plan specific elements of a campaign
- Exploitation of IT systems to improve and accelerate processes
 - Line-of-sight, Route planning & Mobility, Battlespace Planning & Deconfliction, Indirect Fire Missions & Cresting,...

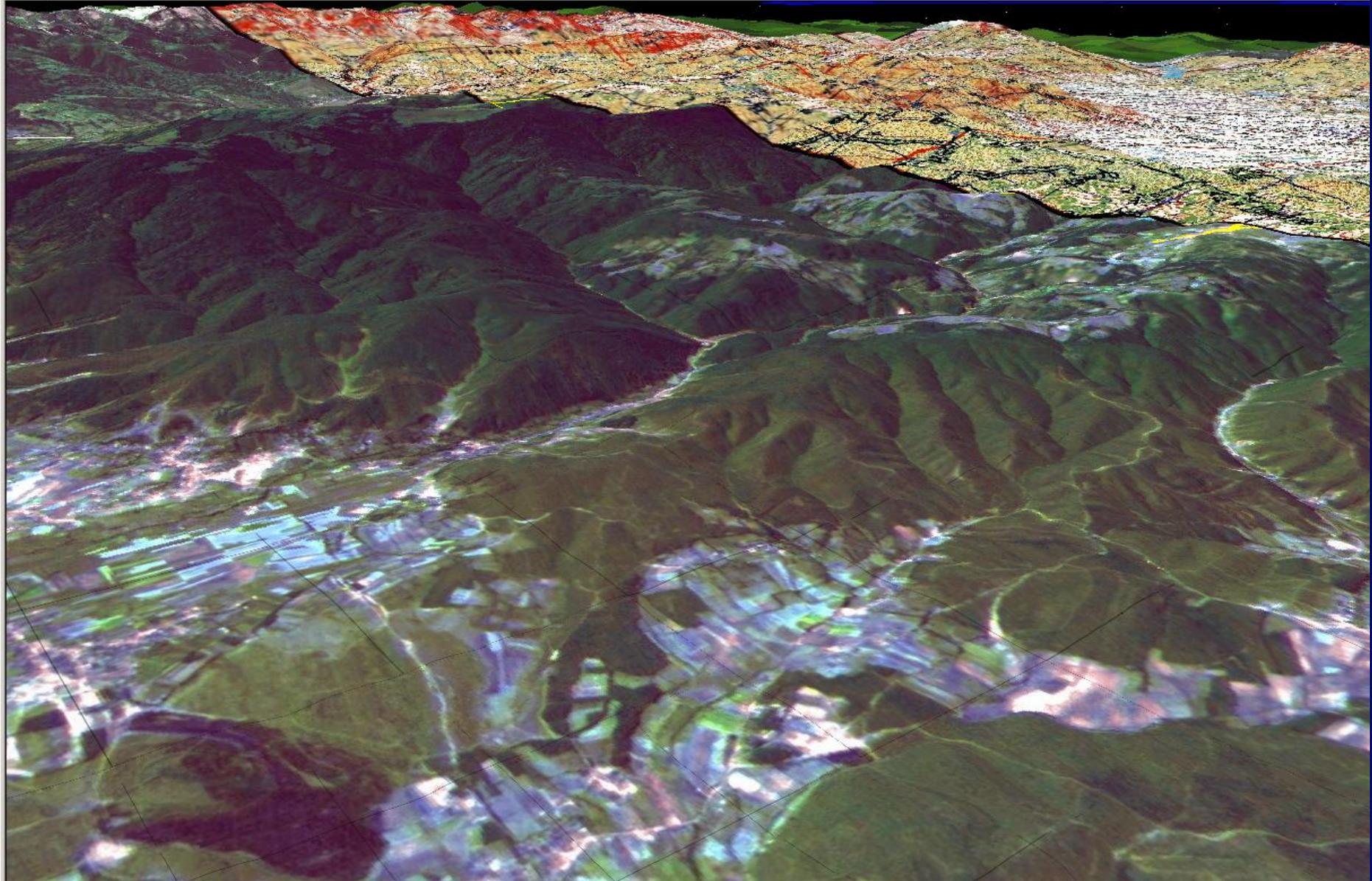
Weaknesses of Tools

- Based on low resolution “terrain databases”
 - Digital Terrain Elevation Data (30-100m spacing)
 - Analysis limited to “shape of the Earth”
 - Limited ability to consider smaller, short lifetime features in planning
- Integration of digital and non-digital information
 - Recce reports, visual imagery,...
 - Commander experience
 - Human judgement of trade-offs

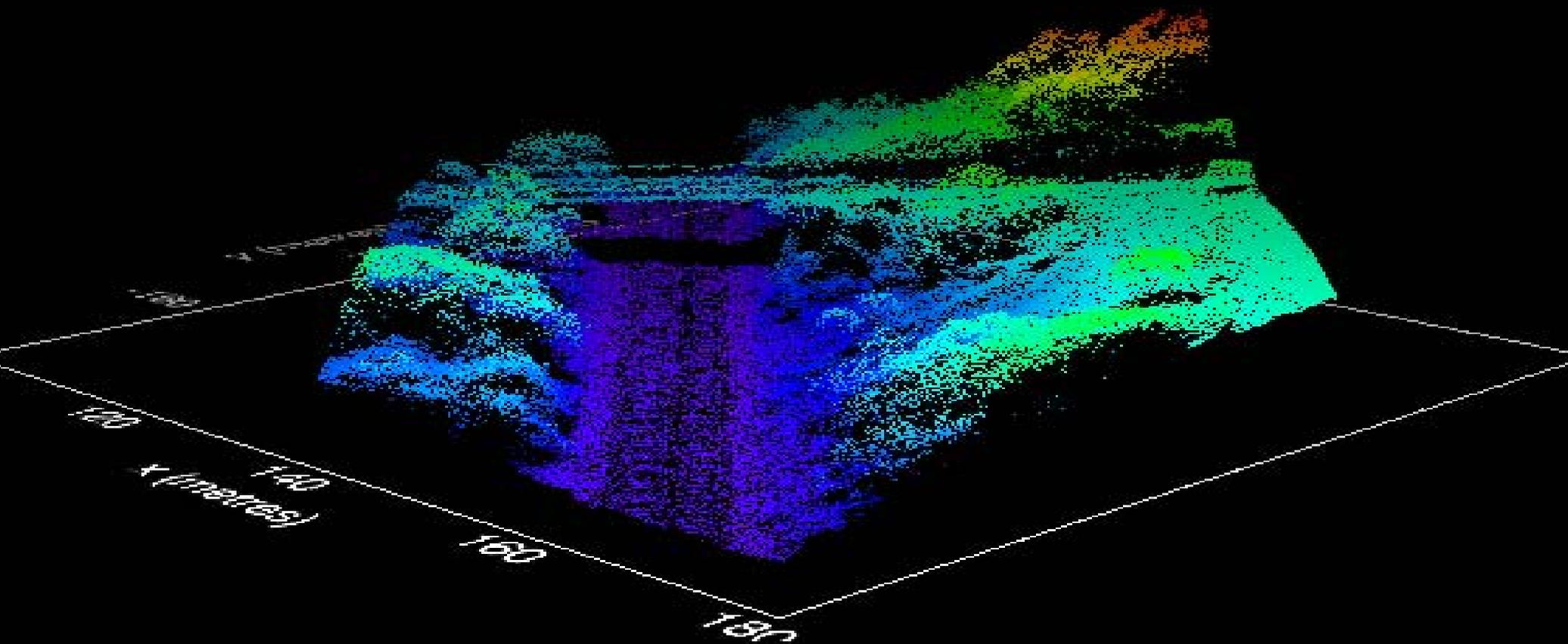
Terrain Data Sources

- “Library” sources
 - Digital Terrain Elevation Data (DTED)
 - Provided by NIMA and National Mapping Agencies
 - Satellite Imagery
 - Generally stored from suitable orbits
 - Shuttle Radar Topography Mission
- “On-the-fly” sources
 - Surveillance Assets
 - Many different sensors collecting terrain information at varying degrees of coverage, resolution and accuracy
 - Recce Team (man on the ground)
 - A vital source of information but limited potential to integrate with other digital data sources

NEW DATA



Example of LIDAR High Resolution Data



Data courtesy of QinetiQ Survey & Surveillance

Data Sources and their Attributes

Source	Area Coverage	Resolution	Positional Accuracy	Timeliness
Digital Terrain Elevation Data	High	Low	Low	Low
Satellite Imagery	Medium	Medium	Medium	Medium

•Library Data

Data Sources and their Attributes

Source	Area Coverage	Resolution	Positional Accuracy	Timeliness
Digital Terrain Elevation Data	High	Low	Low	Low
Satellite Imagery	Medium	Medium	Medium	Medium
Surveillance Assets	Low	High	Medium	High
Recce Teams	Low	Low	Medium	High

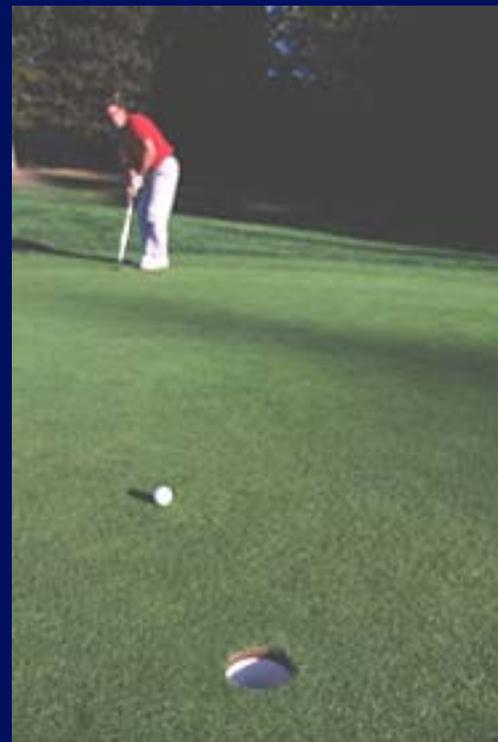
- Library Data
- On-the-fly Data

Towards Feature Analysis in C2 Planning

- Emphasis shifts from “shape of the Earth” to feature analysis
 - Enabled by high resolution data
 - Focus on “short” lifetime, static features
- On-the-fly data feeds into planning processes
 - Library data can not give timely data of features
 - Need to exploit ISTAR info more effectively
- This places demands on the planning processes
 - Need to ensure rapid planning cycles
 - Need tools to integrate “library” and “on-the-fly” data
 - Need scalable C2 planning tools

Scalability is the Answer

- Can not perform detailed analysis over wide areas
 - Need a wide area view followed by analysis of areas identified
- Collection of detailed data over wide areas is inefficient and time consuming
 - A move from “library” data to “on-the-fly” data in C2 planning
- The human approach to spatial problems is already scalable
 - Designing decision support tools that work with analysts



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Some Associated Issues

- Terrain data is never perfect (and it never will be)
 - Exploit the data you have most effectively
 - Expose decision makers to the weaknesses in data
- Data is only valuable when it supports decision making
 - Ensure new data capture provides operational benefit
- Terrain data is only one element of problem solving
 - IT systems are good for solving well defined problems
 - Only humans can “weigh up options”
 - No IT system can replace experience

Conclusions

- High resolution data can enable small, short-lived features to be included in C2 planning processes
 - This is a significant step up in capability
- The temporal nature of these features requires greater data capture “on the fly”
 - Exploit high resolution surveillance data
 - There is also the requirement for a rapid planning cycle
- A scalable approach to planning is therefore critical
 - Need to provide appropriate decision support tools
- NCW will be a key enabler
 - Networked data sources will allow integration of “library” and “on-the-fly” data and remote access by the C2 planner

Any questions ?

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