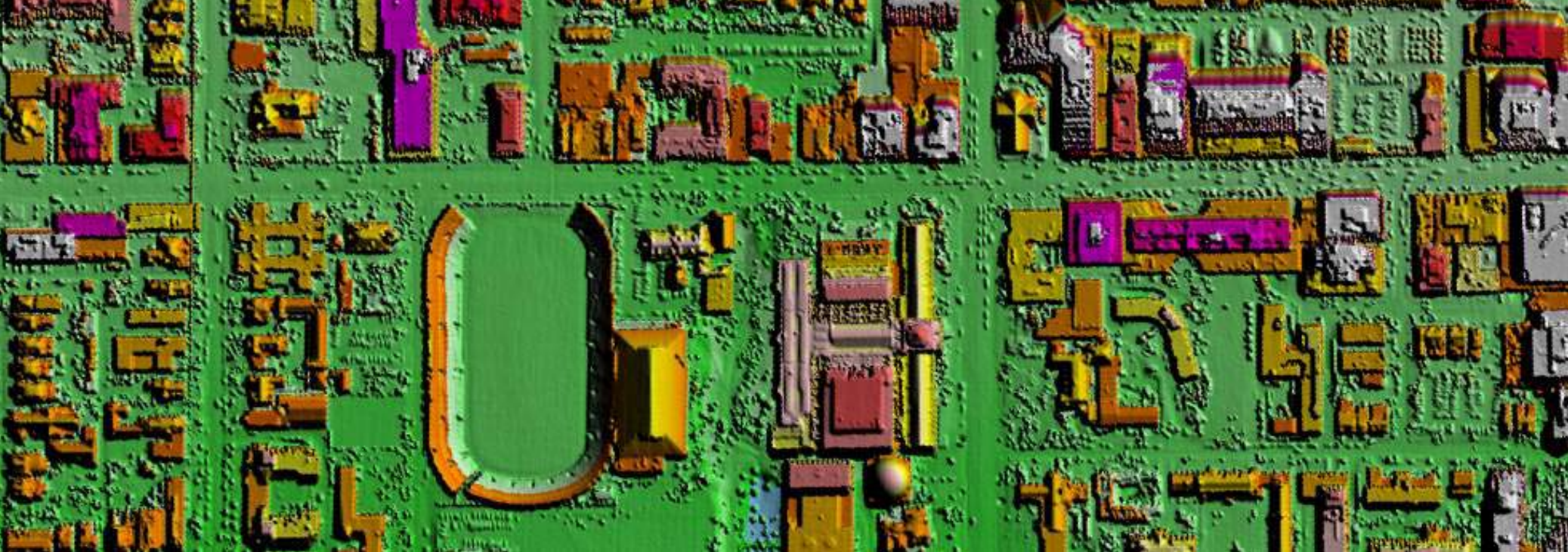


***QinetiQ***



# 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

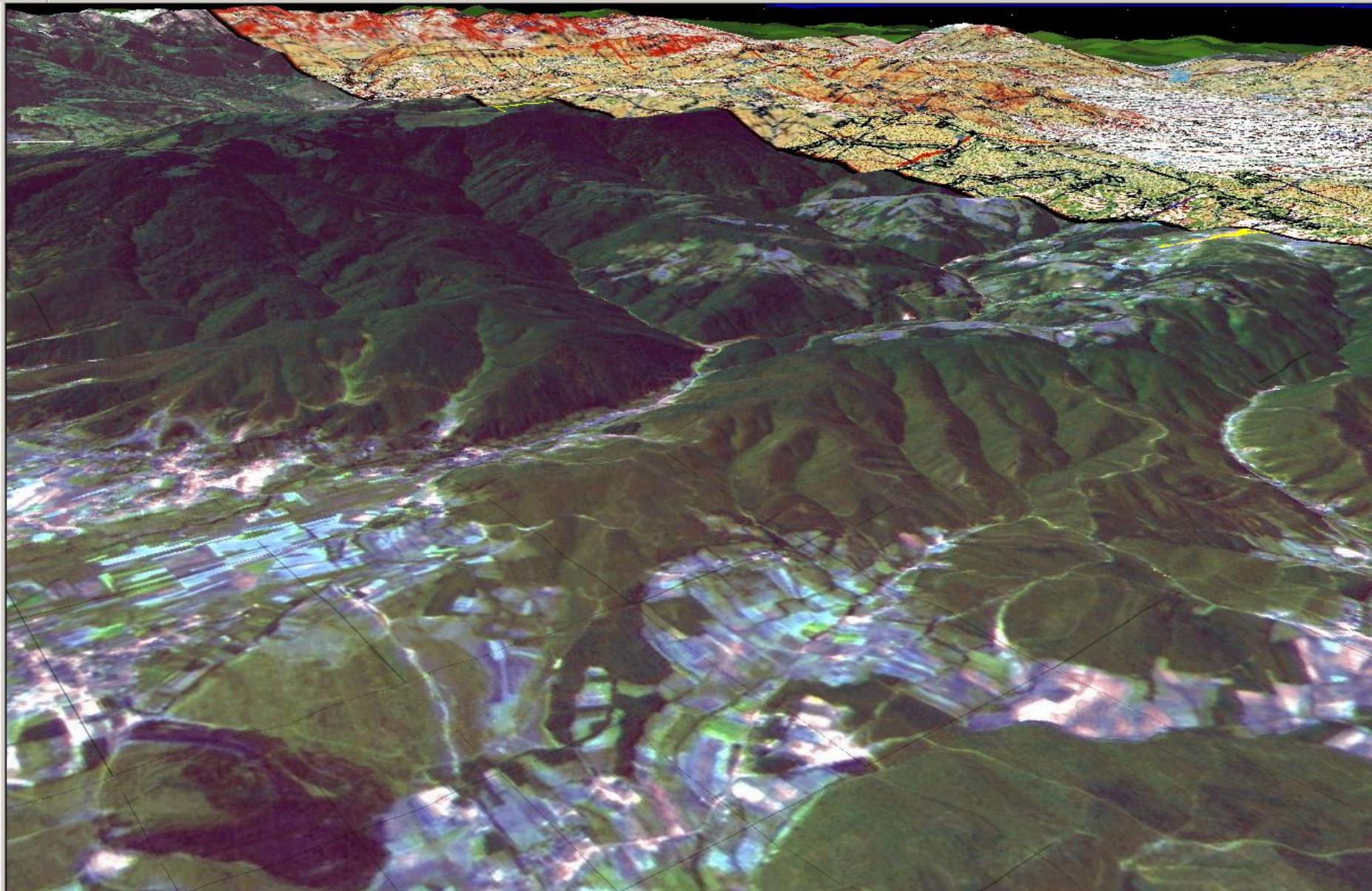
- Based on low resolution “terrain databases”
  - Digital Terrain Elevation Data (30-100m spacing)
  - Analysis limited to “shape of the Earth”
  - Limited ability to consider smaller, short lifetime features in planning
- Integration of digital and non-digital information
  - Recce reports, visual imagery,...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

# Terrain Data Sources

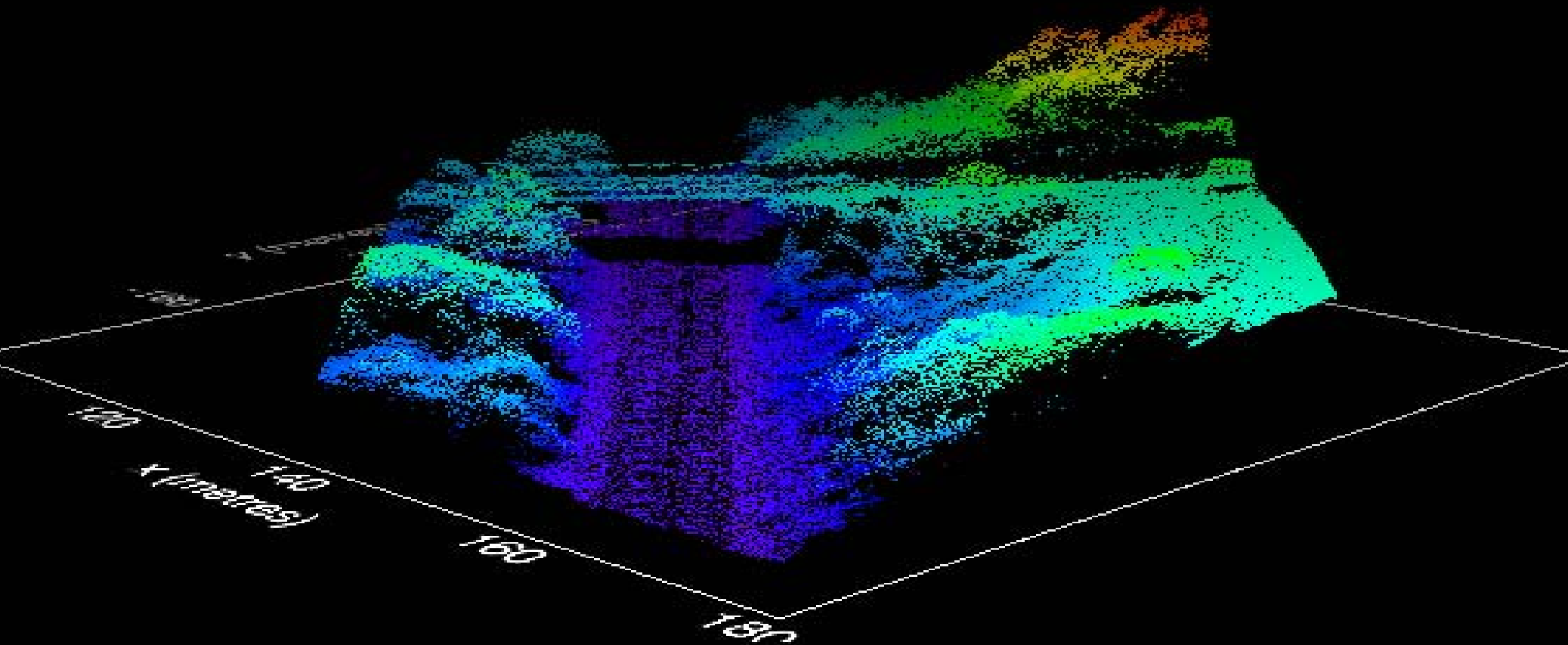
- “Library” sources
  - Digital Terrain Elevation Data (DTED)
    - Provided by NIMA and National Mapping Agencies
  - Satellite Imagery
    - Generally stored from suitable orbits
    - Shuttle Radar Topography Mission
- “On-the-fly” sources
  - Surveillance Assets
    - Many different sensors collecting 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

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

•Library Data

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<b>Recce Teams</b>	Low	Low	Medium	High

- Library Data
- On-the-fly Data

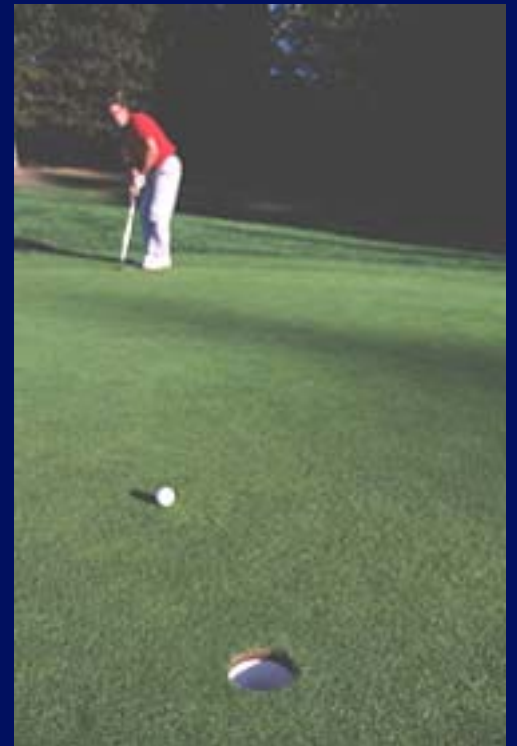
# Towards Feature Analysis in C2 Planning

- 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





# 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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