LADAR Laser Radar Tutorial

Summary 4 Sept 2003

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Outline

- LADAR and DEMs – a new language
- Three slices on what we could have done
- What we have actually done
- What remains
- Putting it all together
  - Range equation
  - System designs
  - Commentary on system designs
  - Where our attention needs to be focused

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LADAR – New Method – New Language

- What is a DEM?
- What is a TIN?
- What is the difference between a DEM, DTM, and DSM?
- What are mass points and breaklines?
- How can I use DEMs to solve problems?
- How can I get DEMs?
- How are DEMs produced from photogrammetry?
- IFSAR? LIDAR/LADAR? SONAR?
- What are the capabilities and limitations of these technologies for producing DEMs?
- How do I check the quality of a DEM?

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Intended Outline

- Introduction: (4 hours)
- Week 1: (May 15) Introduction – (b)(3)
- Design and major elements of laser radar system
- Historical development
- Applications
- Week 2: (May 29) The Range Equation and Scaling Laws – (b)(3)
- Performance analysis
- Design methods and trade space
- Study Overviews (4 hours)

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Intended Outline - 2

- 3D Mapping Systems: (4 hours)
- Week 5: (June 19) The World in 3D:
- Digital Elevation Maps
- Coordinates & Datum
- Precision and Accuracy
- Week 6: (June 26) Comparative Mapping – Photogrammetry, SAR, Lidar
- Week 7: (July 3) Review and Live Demo
- Week 8: (July 10) Adv.
- Source and safety issues in class applications
- Week 9: (July 17) Adv.

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Intended Outline - 3

- Targets
- Atmospherics – (b)(3)
- Week 10: (July 24) Adv.
- Receivers
- Week 11: (July 31) Adv
- Systems Engineering
- Week 12: (August 7)
- Requirements and Trade Studies
- Week 13: (August 14)
- Intro to trade space
- Week 14: (August 21)
- Week 15: (August 28)
- Putting it all together – good and bad system designs
- Week 16:

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LADAR Technology Training

- Topical overview courses (4 hour)
  - Laser Radar Overview – (b)(1) (b)(3)
- Topical deep-dives (NRO science team – 4 hours)
  - Geiger Mode Laser Radar – (b)(3)
  - Laser Warning Receivers –
  - Atmospheric Effects on Laser Radar – (b)(1) (b)(3)
  - LADAR Data Exploitation (b)(3)
  - LADAR mapping – TBD –
- Weekly tutorial (16 weeks – interspersed with topicals)
  - Physics of remote sensing
  - Lasers and laser remote sensing
  - Laser Doppler vibrometry -
  - Exploitation and applications

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Re-examination of Precursor Work

Foundation work:

Tactical and Commercial Laser Radars

NRO/USG studies

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What We Did?

- Week 1&2 – Introduction to Laser Radar – (b)(3)
  - Range equation and eye safety
- Week 3 – (b)(1) (b)(3)
- Week 4 –
- Week 5 –
- Week 6 – Photogrammetry and DEMs
- Week 7 – IFSAR and DEMs
- Week 8 - Topographic LIDAR (LADAR) and DEMs
- Week 9 – DEMs – HRTE and all source methods
- Week 10 - All-source DEMs – Photogrammetry, SAR, and LADAR – a comparison
- Week 11 – Topographic LIDAR – Commercial and Airborne
- Week 12 – Putting it all together

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The Range Equation

- Last week:

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- What does this mean?
  - Nominally the system engineering budget closes, I.e. it is a reasonable engineering challenge, but there is no magic!

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System Designs

- Link budget – no brainer from the air – commercial development

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