LiDAR in Sport

using airborne LiDAR to create maps for orienteering

Tyson Hillyard
I am an Orienteer

- Tyson Hillyard
- Orienteering since 1990
  - Past President of Tjuringa Orienteers
  - Past Manager of the Southern Arrows – South Australia’s Elite Orienteering Squad
  - President of Wallaringa Orienteers
- Surveyor since 2000
- Father since 2014
- SSSI Remote Sensing and Photogrammetry Rep for South Australia since 2016
- Now Survey Manager at Aerometrex
What is Orienteering?

- It’s a SPATIAL Sport
What is Orienteering?

• It’s a SPATIAL Sport

• Competitors use a detailed topographic map to navigate through a series of checkpoints. The winner is the person who completes the course in the fastest time.
What is Orienteering?

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- Competitors use a detailed topographic map to navigate a course. The winner is the person who completes the course in the fastest time.
- Caters for athletes from 5 to 100 years old
What is Orienteering?

• It’s a SPATIAL Sport
• Competitors use a detailed topographic map to navigate a course. The winner is the person who completes the course in the fastest time.
• Caters for athletes from 5 to 100 years old
• Courses are set with varying length, physical and navigation difficulty
102 Index contours
Every fifth contour line, with much detail represented using
2mm symbol. The index contour line shall be printed in a sans-serif
and in a brown colour.

103 Form lines
Form lines are used to delineate the ground. Form lines are
complete with ordnance marks. Only one form line per
500m² is allowed.
201 Impassable
A cliff, quarry or pass/climb or is impassable.
For vertical rock faces a top line may be indicated. The gap between top line and impassable feature is
0.35-0.4 (OM)
0.12-0.5 (CC)
min. 0.6 (OM) min. 0.7 (OM)
When an impassable feature shall clearly extend with the contours.
Minimum length: 5 m.
Colour: black.

ISOM 2017
• International Specification for Orienteering Maps
• Other standards for Sprint Orienteering Maps, Mountain Bike Orienteering Maps and Ski Orienteering Maps
310 Indistinct marsh
An indistinct marsh is defined as a water
marsh to firm ground. The vegetation is
openness. The symbol is oriented.
Minimum area: 2.
Colour: blue.

311 Well, fountain
A prominent well, fountain. Footprint: 12 m x
Colour: blue.

312 Spring (P)
A source of water. Location is the center
open downstream. Footprint: 13.5 m
Colour: blue.

ISOM 2017

- International Specification for Orienteering Maps
- Other standards for Sprint Orienteering Maps, Mountain Bike Orienteering Maps and Ski Orienteering Maps
- Defines details on
  - Features to be mapped
  - Colours to be used
  - Standards for Scale
  - Tolerances for size and spacing of symbols
  - Accuracy requirements
• Map does not need to be strictly spatially accurate
But it needs to spatially interpretable by a competitor at speed
Map does not need to be strictly spatially accurate but it needs to spatially interpretable by a competitor at speed.

Advances being made in colour definition to make the sport fairer for those with colour vision deficiencies.
The symbol  is the "bottom" symbol that a "top" symbol can be combined with. In general, the symbols is the symbol combinations that a "top" symbol can be combined with.

**ISOM 2017**

- Map does not need to be strictly spatially accurate, but it needs to spatially interpretable by a competitor at speed.
- Advances being made in colour definition to make the sport fairer for those with colour vision deficiencies.
- Only mapping specification that is truly global:
  - Aviation Charts
  - Meteorological Charts
  - Nautical Charts
  - Geological Charts
Mapping the old way

- Basemap usually from Photogrammetry to generate contours, generalized vegetation, linear features, point features. Limited by what can be seen from above
- 100’s hours in the field locating, identifying, interpreting and mapping features with basic techniques
- Handheld GPS, single frequency, code only
- Many mappers still mapping on Cartographic Film
- Some lucky enough to have field tablet PCs
Orienteering Drafting

- Drafted in specialist software
- A lot like a usual CAD drafting package, but more focused on the symbology and feature drawing than precise CAD drafting.
- OCAD - Proprietary
- Open Orienteering Mapper - Open Source
LiDAR Revolution

- Growth in LiDAR use started around 2011
- Governments making datasets “Open”
- Access to greater computing power
- Generation of Contours is primary goal – with greater detail than photogrammetry
- Vegetation
- Cliffs and Boulders
- Other user interpretable features, eg tracks, fences
LiDAR data sources and tools

- Open data sets - ELVIS from ICSM
- Sourcing existing data from landowners / councils
- Contracting specific surveys $$$$
- Orienteering SA were lucky to get support from ARA in 2018
- QGIS
- Free parts of LAStools – las2txt, LASzip
- Kartapullautin
- OCAD
Kartapullautin

• Free for non-commercial use

• Generates / extracts:
  ▪ Contours and Formlines
  ▪ Vegetation density estimate
  ▪ Cliffs

• pullauta.ini controls the parameters for terrain and vegetation extraction

• Very simple to use, but difficult to master
Vegetation Extraction

- Vegetation is classified by ease of movement of a competitor

- Open land with scattered trees
- Rough open land with scattered trees
- Forest: fast run
- Forest: slow run
- Forest: walk
- Forest: impenetrable
- Undergrowth: slow
- Undergrowth: walk
DTM Visualisation

- Contours are main source of topographic shape for the Orienteer
- Steepness, shape, orientation
- Contours are derived 2.5m or 5m
- OCAD
- Kartapullautin
- Field / Mapper interpretation
DTM Visualisation

- LiDAR DTM is rendered to allow better interpretation of terrain features
- Where contours are “over smoothed”
- Hillshading
- Slope
- Sky View Factor
LiDAR and Mapping

Benefits

• Reduces fieldwork time considerably
• Decreases the chances that features are missed in fieldwork
• Drastically lowers drafting time
LiDAR and Mapping

Challenges

- Accessing data
- Training mappers in new technology
- Developing partnerships with LiDAR suppliers
- Getting enough people interested in mapping
Thankyou

- Orienteering
  - http://sa.orienteering.asn.au
  - http://orienteering.asn.au
  - http://orienteering.sport

- Orienteering Maps
  - http://omaps.worldofo.com
  - https://orienteering.sport/iof/mapping/

- Tyson Hillyard
  - Tyson.hillyard@gmail.com
  - http://www.linkedin.com/in/tyson-hillyard