

BEST PRACTICE IN THE USE OF UAV AND LOW-COST SOFTWARE FOR PHOTOGRAMMETRIC SURVEYS OF HERITAGE SITES

Greg Colley, Suave Aerial Photographers



Use of UAVs and low cost software for surveys of heritage sites

1. Introduction
2. Case Study: Chester Amphitheatre
3. Case Study: Chester Walls
4. Project and Equipment Costs
5. Technical constraints and future developments
6. Conclusion

Introduction

- The purpose of this presentation is to demonstrate that with the rise of UAVs and cheaper software, Photogrammetry is becoming more widely available.
- Two recent surveys are examined – both undertaken with a simple, electric helicopter style UAV.
- A further aim is to set out some simple examples of best practice, especially in urban areas.
- Finally we compare some aspects of cheaper UAVs and software with more expensive alternatives.

Case Study: Chester Amphitheatre

Amphitheatre changed in 2010 due to reinstatement and re-presentation after excavation (digging up more of the Amphitheatre for public enjoyment).



Chester Amphitheatre

- An update to the topographical database was required.
- Was performed by the Imaging Graphics & Survey department of English Heritage.
- A photogrammetric survey with aerial photos was the ideal solution and with UAVs becoming more available, they were the obvious choice.



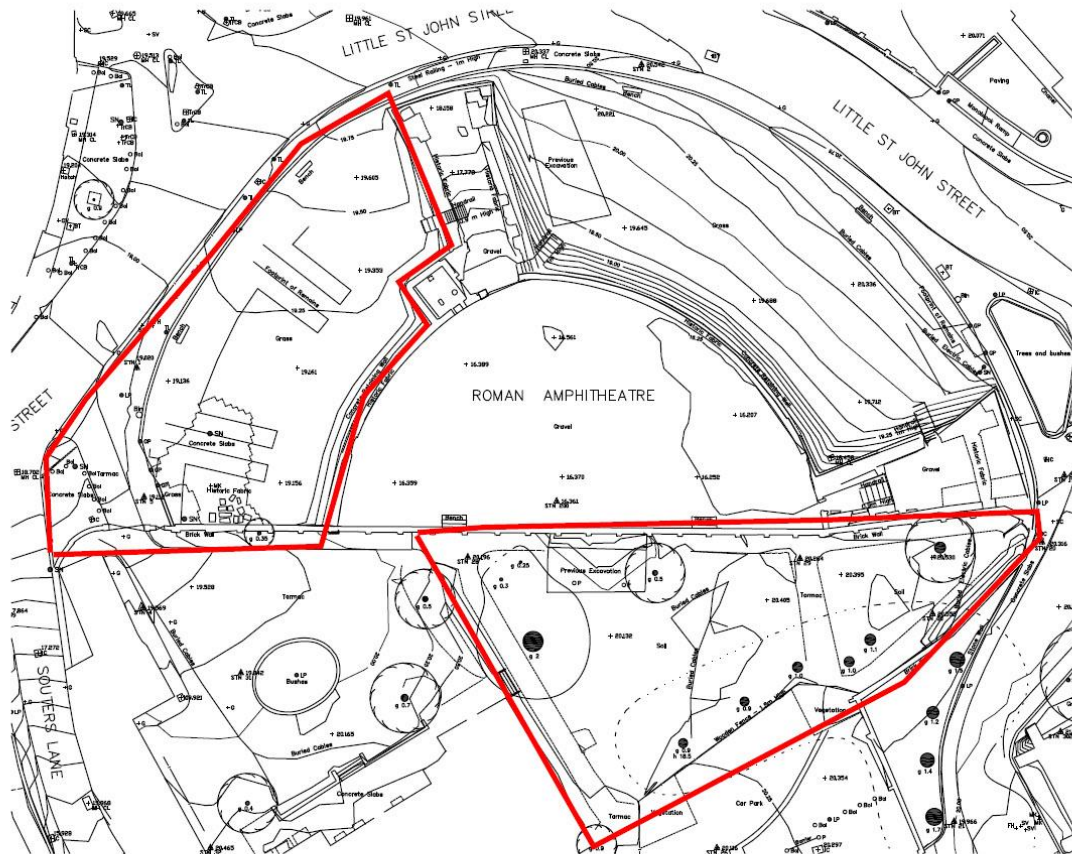
Chester Amphitheatre

- UAV was a computer assisted 6kg electric helicopter measuring a bit more than a meter in length and rotor diameter
- English Heritage (EH) provided its own Canon 5D MkII DSLR to be flown.
- The UAV's camera gimbal had basic vibration isolation and simple camera attitude dampening.



Chester Amphitheatre

- Sections updated in Topographical database



Chester Amphitheatre

- Standard Canon 28mm lens calibrated by EH, fixed shutter speed 1/1000th of a sec with auto aperture. f10 apertures provided sharper images than f4.5
- Photographic data processed by EH's Topcon Image Master
- Previous survey carried out in 2004 provided control points.
- For comparison, Suave also processed the data with AgiSoft PhotoScan.

Chester Amphitheatre

- A good result was obtained with Topcon's Image Master.
- It did include a degree of manual photo control points and break lines.
- The trade off between the number of images and how close they were vs the amount of manual controlling required was made apparent.
- Some new software products have an emphasis on quick process, processing loads (100s) of photos with minimal manual work.
- Software for processing Video (1000s) of photos is now becoming available.

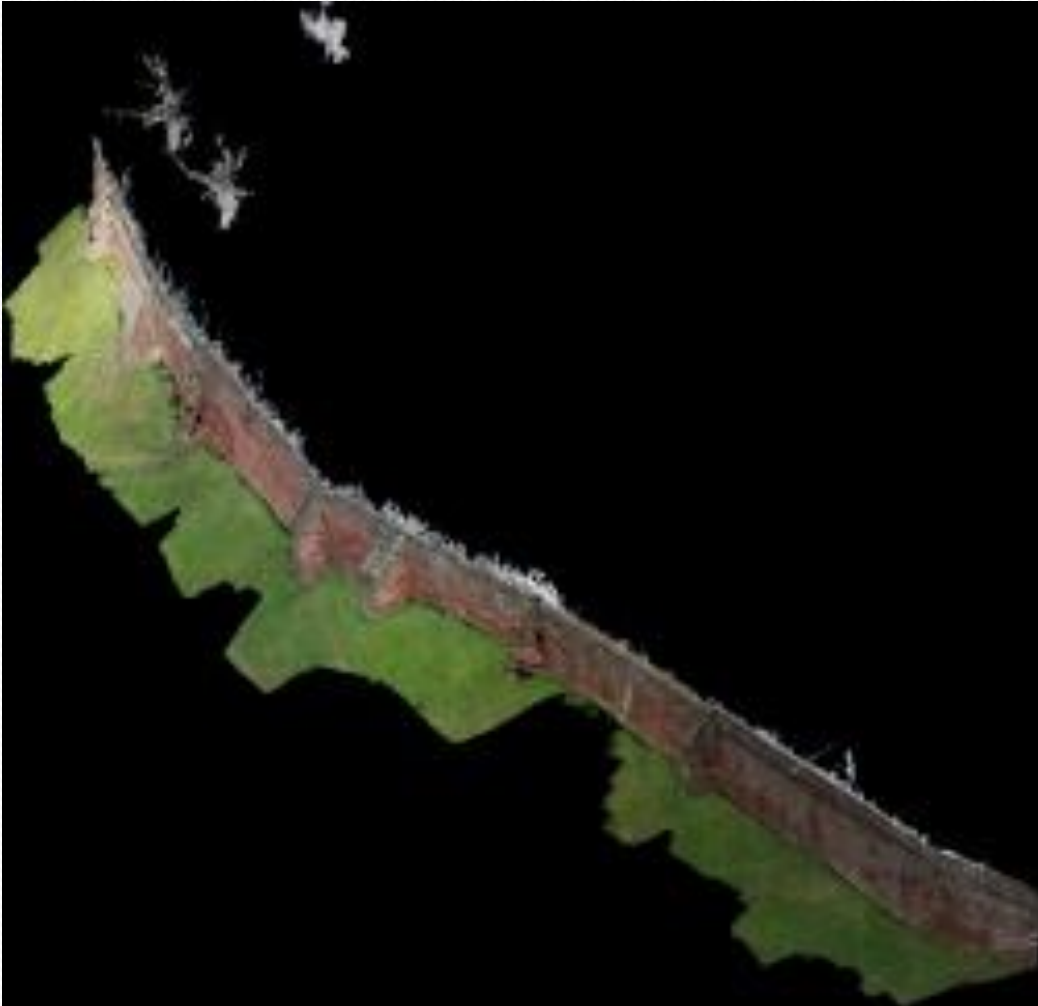
Chester Amphitheatre - Safety

- The CAA was consulted extensively on this project as it was in a city. It was clear that the UAV had to keep 30 meters from general public and not fly directly over. Could get closer under our control / with their consent.
- Site assessment was made with Google Earth for above and other considerations.
- Watch out for unobvious public paths and employ marshals.
- Turbulence more of an issue in built up areas.

Case Study: Chester Walls

- Cheshire West and Chester Council (CW&C) has been making a detailed model of Chester Walls. Mostly with Photogrammetry and some of that with UAVs due to steep embankments.
- Again, CW&C's Nikon D300 was flown. 20mm lens, 1/1000th of a second, aiming for f7 and allowing auto ISO to correctly expose.

Case Study: Chester Walls



Again, quick verification was done in Agisoft PhotoScan before going to Topcon Image Master for main processing.

Some costs

Software Cost:

Basic Topcon software: £1,400

Basic AgiSoft software: £110

Software continues to get better with more features and capabilities being added all the time ultimately making it more suited for each market including Heritage.

Technical constraints and future developments

Blurred images result from numerous reasons.

- Vibration from aircraft motors and rotors / propellers.
- Simple UAV's have little to no vibration suppression.
- Advanced UAVs tend to be better made with lower inherent vibration. Also vibration suppression is a priority.



Constraints and Developments

Blurred Images...

- Camera attitude. As the UAV buffets about (fast changes in all 3 axis, yaw, roll & pitch) with turbulence, this can be transferred to the camera.
- Simple UAV's have little to no camera attitude stabilisation, maybe oil filled dampers.
- Advanced UAV's can have advanced computer controlled camera attitude stabilisation. Employing 3 axis gyros & IMU sensors to control high speed servos on the gymbal to hold the camera pointing in exactly the same direction.
- Position hold. Simple UAVs have no ability to hold their position whilst more advanced UAVs can hold their position very accurately using an assortment of advanced sensors, not just GPS but gyros, IMUs, barometers, compasses, etc, etc.
- Obviously a faster shutter speed helps too.

Conclusion

- The rise of the UAVs with cheaper software is making more photogrammetry available to more people.
- Basic versions of software often contain the same computational engine and most of the features of the more expensive software.
- There is some very good, cheap software out there capable of offering simple, fast workflow, producing high quality, textured, 3D models (sometimes geo-referenced), handling many hundreds of photos. The models can be exported into virtually any other package.

Conclusion

- This cheaper software was used to rapidly verify the data from Chester Walls where any missing overlap or unacceptable quality would have been immediately identified allowing the operator to reshoot the next day.
- Photos taken with Helicopter style UAVs naturally lend themselves to 3D modelling, effortlessly taking loads of oblique photos at a wide variety of angles and positions.



Thank You!

Questions?

www.SuaveAirPhotos.co.uk

