SAROI First Workshop: Final Schedule

Dates: July 5th-July 18th 2021

Location: Center for Advanced Spatial Technologies, University of Arkansas, Fayetteville, Arkansas

Day 1 (M 7/6)	Fellows Arrival	Staffing	Description
All Day	Arrival coordination	Klehm	Klehm will coordinate airport pick-ups, parking pass distribution, housing coordination, meal voucher distribution as Fellows arrive in Fayetteville
Day 2 (Tu 7/7)	**Welcome Introductions**	**Staffing**	**Description**
7:00-8:30	Breakfast at campus dining		
9:00 – 9:30	Introductions, workshop overview and mechanics	Klehm, Limp, Cothren, Williamson, Payne, Green ("Mentors")	Staff and participants will be introduced, review of mechanics of workshop, housekeeping.
9:30-11:00	High density Survey, Measurement, Analysis, Publication and Archive	Klehm, Limp, Cothren	PIs will review the basic concept underlying high density survey, measurement, analysis, publication and archive. He will cover the relationship of these approaches to implication of the measurement of time, space and form and the relationship of the workshop topic to the general issues of the spatial turn in the humanities and the role of higher precision, denser observations
11:00-11:20	CAST Orientation	All	Orientation of labs, offices, other facilities.
11:20-11:45	ID Cards	Fellows	Fellows to Union to obtain ID cards
11:45 – 1:00	Lunch		
1:00 –3:00	Meet with Mentors	All	Fellows will break into groups of two and meet with their assigned (initial) mentor. Mentors will provide initial overview of equipment, software and strategies to be addressed in the workshop. Potential interlinkages with other mentors (as needed – depending on objectives) will be planned
1:00-3:00	COVID Testing	Fellows	COVID testing for remaining Fellows at Pat Walker
3:00-4:30	Participant project introductions: Lightning round	All	Each Fellow will present their overall objectives, data, issues and desired outcomes for their project
5:00-7:00	Happy Hour	Optional	Smoke and Barrel and/or other Dickson locations
Recommended Readings	Archaeology Data Service *Guides to good practice*: What is digital archiving https://guides.archaeologydataservice.ac.uk/g2gp/ArchivalStrat_1-0		

	Archival Strategies https://guides.archaeologydataservice.ac.uk/g2gp/ArchivalStrat_1-1 Planning for the creation of Digital Data https://guides.archaeologydataservice.ac.uk/g2gp/CreateData_1-0		
Day 3 (W 7/8)	Global Navigation Satellite Systems	Staffing	Description
7:00-8:30	Breakfast at campus dining		
9:00 – 11:30	Basics and Demo of GNSS and modern hardware and software alternatives	Limp, Menio, and Wyatt	Limp will review the basic characteristics of high precision GNSS as it is implemented in archaeology and heritage projects. He will contrast traditional mapping grade approaches with accessible high precision (e.g. centimeter accuracy) approaches. He will discuss various real-time and postprocessing approaches such as the freely available OPUS and global application of the PPP (precise point positioning) using public accessible web resources. An overview of propriety real-time system will be covered. Survey grade hardware from Leica, Trimble and EMLID will be demoed and compared.
11:45 – 1:00	Lunch		
1:00 – 4:30	Post-processing with GNSS	Limp, Menio, Wyatt	Lectures and demos on post-fieldwork processing showing how to move a pre-developed Arc or QGIS database to/from the GNSS. Will cover the basics of least squares, OPUS and PPP, and mappng systems, among various topics.
Recommended Readings	Hill, A, F Limp, J Casana, E Laugier, and M Williamson. "A New Era in Spatial Data Recording: Low-Cost GNSS." *Advances in Archaeological Practice* 7, no. 2 (May 2019): 169–77. Limp, F and A Barnes. "Solving the Grid-to-Ground Problem When Using High Precision GNSS in Archaeological Mapping." *Advances in Archaeological Practice: A Journal of the Society for American Archaeology* 2, no. 2 (May 1, 2014): 138–43.		
Day 4 (Th 7/8)	Introduction to photogrammetry	Staffing	Description
7:00-8:30	Breakfast at campus dining		
9:00 – 11:30	Photogrammetry, structure from motion, close range photogrammetry principles and applications	Green, Payne, and Cothren	Green will review basics of traditional photogrammetric applications. Initially photogrammetry Recommended specific metric cameras and specialized hardware and software. Developments from the machine vision community has led to new approaches which dramatically democratize the field. They will cover basic principles of structure from motion/close range photogrammetry and

			new developments in machine vision as applicable to archeological and heritage projects using a range of practical examples. Issues of lighting, overlap, software selection and their application to objects and structures.
11:45 – 1:00	Lunch		
1:00 – 4:30	Meet with mentors	Institute Fellows and staff	Continue hands-on work with staff and equipment, software and materials
Recommended Readings	Barnes, A. Close range photogrammetry https://guides.archaeologydataservice.ac.uk/g2gp/Photogram_Toc Verhoeven, G.J. 2017. Mesh Is More—Using All Geometric Dimensions for the Archaeological Analysis and Interpretative Mapping of 3D Surfaces. J Archaeol Method Theory 24, 999–1033. https://doi.org/10.1007/s10816-016-9305-z Kingsland, Kaitlyn. 2020. Comparative analysis of digital photogrammetry software for cultural heritage. Digital Applications in Archaeology and Cultural Heritage 18: e00157. https://doi.org/10.1016/j.daach.2020.e00157.		
Day 5 (F 7/9)	Topic/objective Applying photogrammetric methods to aerial and sUAS applications	Staffing	Description
7:00-8:30	Breakfast at campus dining		
9:00 – 11:30	Photogrammetric applications in aerial and sUAS applications	Williamson	A major area of the application of modern photogrammetric systems is in the development of orthophotographs and digital elevation data (DEM) from optical cameras placed on low cost aerial platforms (aka small unmanned aerial systems, “drones.”) These developments place orthophotography and DEM creation within the reach of most archeologists and heritage professionals. Workflows covering both field procedures and data processing will be covered by Williamson. The use of software such a DroneDeploy to plan and execute data acquisition efforts will be followed by a review of the key elements of processing – using as an example the widely used Metashape software. Other commercial solutions and FOSS alternatives will be introduced. Special concerns – such as the role of both nadir and oblique images in the creation of accurate DEMs will be covered.
11:45 – 1:00	Lunch		
1:00 – 4:30	Meet with mentors	Fellows	Continue hands-on work with staff and equipment, software and materials
4:45-6:30	Happy Hour		Arsaga’s Mill District

Recommended Readings	Campana, Stefano. "Drones in Archaeology. State-of-the-Art and Future Perspectives." *Archaeological Prospection* 24, no. 4 (2017): 275–96. Waagen, J. "New Technology and Archaeological Practice. Improving the Primary Archaeological Recording Process in Excavation by Means of UAS Photogrammetry." *Journal of Archaeological Science 101* (January 1, 2019): 11–20.		
Day 6 (Sa 7/10)	Optional activities	Staffing	Description
All Day	Free time	Optional	
Day 7 (Su 7/11)	Optional activities	Staffing	Description
All Day	Free time	Optional	See previous day
Day 8 (M 7/12)	Terrestrial laser scanning	Staffing	Description
7:00-8:30	Breakfast at campus dining		
9:00 – 11:30	Basic concepts in TLS, TLS at site and structure scales, comparing and contrasting laser scanning with structured light	Payne and Williamson	Payne and Williamson will review the basic characteristics of laser scanning including the operating requirements, data characteristics and processing requirements. Range and precision relationships and capabilities will be examined. A Leica P40 will be demonstrated. Data processing workflow examples will be covered with a demonstration of the use of using Leica's Cyclone as well as the open source options. Payne will also introduce the Brueckmann smartEngine HD structured light scanner and handheld Artec Space Spyder (on loan from the Arkansas Archeological Survey) to discuss the use of scanning versus structured light for objects will be evaluated.
11:45 – 1:00	Lunch		
1:00-4:30	3D scanning and processing demonstration/ARAS visit	Payne and interested Fellows	Hands-on demonstration with Brueckmann and Artec for interested Fellows
Recommended Readings	Payne, A. *Laser scanning for Archaeology: Guide to good practice*. https://guides.archaeologydataservice.ac.uk/g2gp/LaserScan_Toc Eudald Carbonell. 2020. 3D monitoring of Paleolithic archaeological excavations using terrestrial laser scanner systems (Sierra de Atapuerca, Railway Trench sites, Burgos, N Spain). Digital Applications in Archaeology and Cultural Heritage 19: e00156. https://doi.org/10.1016/j.daach.2020.e00156. Davis, A., Belton, D., Helmholz, P. et al. Pilbara rock art: laser scanning, photogrammetry and 3D photographic reconstruction as heritage management tools. Herit Sci 5, 25 (2017). https://doi.org/10.1186/s40494-017-0140-7		
Day 9 (Tu 7/13)	sUAS operations	Staffing	Description

7:00-8:30	Breakfast at campus dining		
9:00 – 11:30	Thermal, multispectral, and other sensors for archaeological applications	Klehm and Williamson	Using archaeological examples, Klehm and Williamson will introduce thermal, multispectral, and hyperspectral sensors for aerial imagery; provide an overview of the conditions and environments in which to use them; review availability and cost; present the trajectory of their use in projects, from data collection to data processing; and discuss associated issues and challenges (e.g. ground control, flight plan, data storage and processing requirements).
11:45 – 1:00	Lunch		
1:00 – 4:30	Meet with mentors	Other Fellows and staff	Continue hands-on work with staff and equipment, software and materials
7:00-9:00	Optional Dinner	All	Feed and Folly
Recommended Readings	Brooke, C, and B Clutterbuck. "Mapping Heterogeneous Buried Archaeological Features Using Multisensor Data from Unmanned Aerial Vehicles." *Remote Sensing* 12, no. 1 (January 2020): 41. 31 pages. Hill, Austin Chad, Elise Jacoby Laugier, and Jesse Casana (2020) Archaeological Remote Sensing Using Multi-Temporal, Drone-Acquired Thermal and Near Infrared (NIR) Imagery: A Case Study at the Enfield Shaker Village, New Hampshire. *Remote Sensing 12:* 690.		

Day 10 (W 7/14)	Topic/objective Lidar Basic Principles	Staffing	Description
7:00-8:30	Breakfast at campus dining		
9:00 – 11:30	Field demonstration of various sUAS platforms and instruments	Williamson	DJI Inspire and Matrice 600 multi-rotor UASs carrying optical, four-band MSS, thermal, LiDAR, and hyperspectral instruments will be demonstrated. The new Skydio AI based sUAS platform will be demonstrated with optical sensor.
11:45 – 1:00	Lunch		
1:00 – 4:30	Lidar principles as applicable to aerial platforms	Green and Williamson	Green and Williamson will review the basic characteristics of LiDAR data. Instrument characteristics for both aerial and sUAS platforms. Single, multiple and full-waveform systems comparison will be noted as well as processing strategies to obtain bare earth data from vegetated and forested data sets. Accuracy assessment methods and implications will be covered. Comparisons of traditional bare earth processing strategies to those appropriate for archaeological site definition will be covered. The LAS tool kit will be demonstrated along with various LiDAR tools with ArcPro

Recommended Readings	B, Terry E., K. Sassaman, A Zambrano, E N Broadbent, B Wilkinson, and R Kanaski. "Rare Pre-Columbian Settlement on the Florida Gulf Coast Revealed through High-Resolution Drone LiDAR." *Proceedings of the National Academy of Sciences* 116, no. 47 (November 19, 2019): 23493–98 Murtha, T., Broadbent, E., Golden, C., Scherer, A., Schroder, W., Wilkinson, B., & Zambrano, A. (2019). Drone-Mounted Lidar Survey of Maya Settlement and Landscape. *Latin American Antiquity, 30*(3), 630-636. doi:10.1017/laq.2019.51 Parker VanValkenburgh, K. C. Cushman, Luis Jaime Castillo Butters, Carol Rojas Vega, Carson B. Roberts, Charles Kepler & James Kellner (2020) Lasers Without Lost Cities: Using Drone Lidar to Capture Architectural Complexity at Kuelap, Amazonas, Peru, Journal of Field Archaeology, 45:sup1, S75-S88, DOI: 10.1080/00934690.2020.1713287

Day 11 (Th 7/15)	Topic/objective Satellite remote sensing and historical imagery	Staffing	Description
7:00-8:30	Breakfast at campus dining		
9:00- 11:30	Use of high-resolution satellites and historical imagery for archeological and heritage investigations	Klehm, Green, and Cothren	Klehm will cover the characteristics, processing elements and anticipated usages of modern high resolution satellite image sources such as World View 3 and Planet. Band characteristic and their relationship to archaeological "signatures" will be covered as they impact site discovery, site assessment and landscape level investigations and the relationships between data sources and processing alternatives. The characteristics and uses for older high-resolution sources such as the 1960s Corona satellite imagery and U2 imagery will be covered. Online sources for various datasets will be reviewed.
11:45 – 1:00	Lunch		
1:00 – 4:30	Meet with mentors	Institute Fellows and staff	Continue hands-on work with staff and equipment, software and materials
Recommended Readings	Casana, Jesse (2020) Global-Scale Archaeological Prospection using CORONA Satellite Imagery: Automated, Crowd-Sourced, and Expert-led Approaches, Journal of Field Archaeology, 45:sup1, S89-S100, https://doi.org/10.1080/00934690.2020.1713285 Hammer, E., & Ur, J. (2019). Near Eastern Landscapes and Declassified U2 Aerial Imagery. *Advances in Archaeological Practice, 7*(2), 107-126. doi:10.1017/aap.2018.38 Klehm, C, A Barnes, F Follett, K Simon, C Kiahtipes, and S Mothulatshipi. "Toward Archaeological Predictive Modeling in the Bosutswe Region of Botswana: Utilizing Multispectral Satellite Imagery to Conceptualize Ancient Landscapes." *Journal of Anthropological Archaeology* 54 (June 1, 2019): 68–83.		

Day 12 (F 7/16)	Topic/objective microCT, data management plans	Staffing	Description
9:00-11:30			Overview of microCT applications for archaeology, including for bioarchaeology, paleopathology,

	microCT applications for archaeology	Terhune, M. Wilson	ceramics, textiles, beads, archaeobotanical, and microsedimentological analyses. Lecture will include a virtual introduction to the MICRO Lab at CAST, and walk through the collection of microCT data, processing steps, and final products
11:45 -1:00	Lunch		
1:00-2:30	Data Management Plans	Klehm	Klehm will review data management plan systems initially discussed in Day 1. The DMP will ensure researchers are considering, from this initial period, issues such as documentation and metadata issues, compliance with good standards, storage and backup, long-term preservation plans, and accessibility. The DMB lecture will also set up Fellows for the Archiving and Publication Workshop in the second session.
2:30-4:00	Informal workshop and pre-workshop materials evaluation	Fellows and Staff	
4:00-6:00	Happy Hour		Lambeth Lounge (Inn at Carnall Hall)
Recommended Readings	Calo, C.M., Rizzutto, M.A., Carmello-Guerreiro, S.M. et al. 2020. A correlation analysis of Light Microscopy and X-ray MicroCT imaging methods applied to archaeological plant remains' morphological attributes visualization. Sci Rep 10, 15105. Panzer, S., Nerlich, A., Hutterer, R., et al. 2020. Fatal trauma in a mummified shrew: Micro-CT examination of a little ancient Egyptian bundle. Journal of Archaeological Science: Reports 34(B): 102679. https://doi.org/10.1016/j.jasrep.2020.102679 Rios-Garaizar J, López-Bultó O, Iriarte E, Pérez-Garrido C, Piqué R, et al. (2018) A Middle Palaeolithic wooden digging stick from Aranbaltza III, Spain. PLOS ONE 13(3): e0195044. https://doi.org/10.1371/journal.pone.0195044 Work Digital/Think Archive: Data Management Plan Overview. Dig Ventures, on behalf of Historic England. https://www.dropbox.com/s/oumidbhfqg3wf9c/WDTA-DMP-Checklist-FINAL.pdf?dl=0 (2019)		

Day 13 (Sa 7/17)		Staffing	Description
7:00-4:00	Free time	Optional	
4:00-4:30	Final Dinner Carpool Meetup/Departure Time		
5:00-8:00	Final Dinner	Optional	Final dinner celebration
Day 14 (Su 7/18)	Fellows Depart	Staffing	Description
All Day	Departure coordination	Klehm	Klehm will coordinate housing check-outs and airport drop-offs as Fellows depart from Fayetteville