Using drones in archaeological research: Kasakh Valley Archaeological Survey (KVAS), Armenia

Ian Lindsay
Department of Anthropology
Purdue University

Purdue GIS Day
November 4, 2016
Archaeological aerial thermography: a case study at the Chaco-era Blue J community, New Mexico

Jesse Casana a,*, John Kantner b, Adam Wiewel a, Jackson Cothren c

a Department of Anthropology, University of Arkansas, Main 330, Fayetteville, AR 72701, United States
b University of North Florida, 1 UNF Dr., Jacksonville, FL 32224, United States
c Department of Geosciences and Center for Advanced Spatial Technologies, University of Arkansas, JBHT 320, Fayetteville, AR 72701, United States

Journal of Archaeological Science (2014)
Indiana Drones: UAV/UAS in Archaeology

• Several price points
  ✓ ~$500 = home-made UAV
  ✓ $1000 = 3DR Solo (+ a la cart accessories)
  ✓ $1300 = DJI Phantom 3 Pro
  ✓ $3000 = DJI Inspire
  ✓ $40,000 = Trimble UX5
Common applications

- hi-res aerial photography of excavations (stills, video)
- site documentation and modeling
  - record hard-to-access sites (e.g., rock art)
  - surface site cataloging
  - remote sensing: LiDAR, thermal imaging, etc.
  - orthomosaics, 3D mapping of sites and landscapes
    - excavation units “structure-from-motion (SfM)”
    - DEM, contour map generation
    - morphometric, volumetric analysis
- site monitoring (e.g., looting, construction)
- outreach, education
Indiana Drones: UAV/UAS in Archaeology

- Common applications
  - field selfies
Analytical applications of drones

- **Photogrammetry**
  - analysis using geospatial modeling and visualization of landscapes
    - terrestrial: digital photos/laser scanning
    - aerial: balloons/kite images
      - drones

- **Software:**
  - AutoDesk 123D Catch (Free)
  - PhotoModeler ($1145)
  - ERDAS Imagine LPS
  - Agisoft PhotoScan Pro ($550 edu.; $3500 retail)
  - Pix4Dmapper Pro ($1990 edu.; $8700 retail)
Extent of LBA/Iron 1 Forts in Armenian Highland (1500-800 BC)
Project ArAGATS study areas

[Map of the region showing various archaeological sites and study areas, including Tsaghkahovit Plain, Pambak Valley, Shirak Plain, and different sites such as Lusagyugh, Aparan, and Hartavan.]

- **Tsaghkahovit Plain**
- **Pambak Valley**
- **Shirak Plain**
- **Kasakh Valley**
- **Mt. Aragats** (4090 m)

- **2014-2018 survey area**
- **Bronze-Iron Age site**
- **Site targeted for testing**
- **Shenkani bog**

Contour interval 400m

[Map legend includes symbols for different features and locations within the region.]
LBA/Iron 1 Fortresses

Böyük Qaleh, northwest Iran (Biscione 2009)

Horom, Shirak Plain, Armenia

Tsaghkahovit, Tsaghkahovit Plain, Armenia

Aliler Kale, Van basin, Turkey (Sevin 2004)
LBA/Iron 1 Fortresses

Çubuklu, Van basin, Turkey (Özfirat 2009)

Voskevaz, Ararat Valley, Armenia

Knole, Georgia (Shanshashvili and Narimanishvili 2012)

Tsaghkahovit, Tsaghkahovit plain, Armenia (Lindsay 2011)
Gegharot fortress shrine complexes

West Citadel Shrine
Images of (1) storage area and (2) altar in the East Citadel Shrine at Gegharot
Fortress shrines:
ritual, production, storage
Upper Kazakh River Valley survey area, Armenia

Studying Late Bronze Age fortresses and associated landscapes
Indiana Drones: UAV/UAS in Archaeology
Indiana Drones: UAV/UAS in Archaeology
DJI Phantom 3 Pro

- iOS and Android compatible
- 12 megapixel camera
- 4K video
- 5 km distance
- 20 min battery

DJI Go app on iPhone
DJI Phantom 3 Pro

- built in GPS
  - hovers w/in 1m
  - go-home feature
- waypoint programming or pre-program mission grid

Pix4D Capture app
Analytical applications of drones

- **Photogrammetry workflow**
  - Pix4Dmapper Pro
Analytical applications of drones

- **Photogrammetry**
  - Kuchak fortress, Armenia
    - 480 images
  - Hi-res orthomosaic images
    - excavation planning
    - morphometric analysis

Orthomosaic (Pix4Dmapper Pro)
Analytical applications of drones

- **Photogrammetry**
  - Aparani Berd fortress, Armenia
  - 1000 images
Drones in archaeology: Site monitoring and mitigation

• topsoil mine encroaching on Bronze Age cemetery in rural Armenia
Drones in archaeology: Site monitoring and mitigation

- 13th century medieval Armenian church with eroding cemetery from prior excavations
Drones in archaeology: Outreach, education, story telling
Drones in archaeology: Outreach, education, story telling
Thank You

Dr. Nicole Kong and Shirley Yue, GIS Day organizers
Project ArAGATS team members
Purdue University College of Liberal Arts
National Science Foundation
Evelyn Stowe, Wilke undergraduate intern