

# Geospatial Modeling & Visualization

A Method Store for Advanced Survey and Modeling Technologies

GMV Geophysics GPS Modeling Digital Photogrammetry 3D Scanning Equipment Data and Projects by Region

## Survey Options for GMV Technologies – Summary Table

Click on the image below to activate the interactive guide. The table summarizes the technologies referenced on the GMV, their typical applications and properties as experienced in the projects and workflows within this site.

Survey Options for GMV Technologies											
	General Usage/ Resolution	Primary Strength(s)	Primary Weakness(es)	Typical Data Collection Time	Typical Basic Processing Time (e.g. preliminary cleaning & alignment)	Capture Standing Structures / Ruins	Capture Interior Spaces/Rooms	Capture Fine Scale Features (e.g. shallow inscriptions, tool markings)	Capture Planimetric Features	Capture Topography	Scattered Features / Artifacts
<b>3D Scanning Long-Range (50-500 meters)</b> ex: Optech ILRIS 3D	Long distance (>200m) 3D documentation of exterior, standing architectural structures/remains & surrounding topography CENTIMETER RESOLUTION	• Long distance scans up to 500m are possible but depend on target reflectivity • With good coverage point, can capture large areas • Can scan at night with the same results as daylight scans	• Specific to Optech • Small field of view • No color collected • More noise than Leica 210 • Very slow (2,500 pts/sec) • Terrible in interior spaces • Requires external power source (or power socket or battery)	Typically 20 minutes per scan but dense scans over very long distances can take more than 1 hour 5-10 minutes of setup time per scan	Double the data collection time	✓			✓	✓ (if high vantage point is accessible)	
<b>3D Scanning Mid-Range (1-200 meters)</b> ex: Leica C10 (200 m, 200m) ex: Z+F 5006i (600 m, 200m)	3D documentation of interior & exterior standing architectural structures/remains & surrounding topography MILLIMETER to CENTIMETER RESOLUTION	• Relatively fast • Include options to collect color • 360°/70° full dome field of view • Works well in exterior & interior	• Cannot capture 60° area before camera resulting in circular hole in data in this area • Darkly colored surfaces and/or highly reflective/ specular surfaces are problematic to scan	For 1x1 on resolution of 20 m distance Time of flight C, 10 is typically 20 minutes per scan* Phase based (Z-F) 4 mins per scan* 5-10 minutes of setup time per scan * Collecting color & acquiring targets requires additional time	Double the data collection time	✓	✓		✓	✓ (high vantage point helps significantly)	
<b>3D Scanning Short-Range (1-5 meters)</b> ex: Breuckmann HB	3D documentation of small objects/artifacts, engravings, inscriptions SUB-MILLIMETER RESOLUTION	• Extremely precise & accurate data for resolutions up to 60 microns • Excellent RGB control w/ RAW capabilities • Can be used w/ terrestrial laser scanning • Quick processing time	• Requires external power • Relatively time-consuming collection time when subject is in fixed position (for each scan) • Darkly colored and/or reflective surfaces are problematic • Systems are designed for use in interior / lab / controlled conditions. In the field is challenging but possible.	For fairly flat surfaces approx. 2 hours to collect 60 micron resolution of 20 m area OR 10 micron resolution of 10 m area For rough or angled, uneven terrain with non-reflective surfaces time of 2 hours (approx. generally a minimum of 1 hour) & usually with the subject 30 minutes of setup time per scan * 1 hour 15 minutes per scan (time after travel or time change)	1/8 - 1/4 data collection time (before noise is removed or non-removed) Varies greatly if noise is present		✓		✓ (best option for 3D)		
<b>Reflection Transformation Imaging (RTI)</b>	2D documentation (w/ simulated 3D effect) of small objects/artifacts, engravings, inscriptions SUB-MILLIMETER RESOLUTION	• Very high resolution/ accuracy of surface normal information • Ability to analyze very finely scaled features • Fast data collection & processing • Very easy to view & share	• Final product is a fixed view of object (surface in current color or color) • Multiple views cannot be stitched together/ registered can be viewed simultaneously • Surfaces in direct sunlight are challenging	Typically 20-40 minutes to collect image set 15 minutes of setup time	1 - 1.5 hours per RTI image set			✓ (best option for speed but limited to 2D results)			
<b>Terrestrial / Close-Range Photogrammetry (using a tripod)</b>	3D documentation of large & small structures / objects MILLIMETER to CENTIMETER RESOLUTION	• Fast data collection • Flexible camera mounting systems (i.e. all tripod to reach elevated features) • Very flexible in terms of shape/number of objects being surveyed • Highly automated processing	• Requires object surface to be well lit • Processing large projects can be difficult & time-consuming, requires high powered computer • Requires setting up stations points or features for meaningful measurements	Varies greatly depending on the structure/object & conditions (ex: 20 minutes to collect 10 images of an inscribed tablet) 2-3 days to collect 50 images of the exterior of a large structure such as the Colosseum in Rome!	Varies greatly depending on the structure/object & conditions (ex: 2 hours to process 10 images of an inscribed tablet) 2-3 days to process 50 images of the exterior of a large structure such as the Colosseum in Rome!	✓	✓	✓	✓ (if high vantage point is accessible)	✓ (depending on density and characteristics of artifacts)	
<b>Low-Altitude Aerial Photogrammetry (UAV / Kite / Pole)</b>	2D or 3D documentation of expansive sites 5 CENTIMETER + RESOLUTION	• Can document very large areas in a short amount of time • Highly automated processing	• Must obtain permission to fly • If using an UAV, the pilot must be FAA qualified in the USA • Cameras have relatively short battery life	Varies greatly depending on the survey area and the flying height 2-3 days to process 50+ images	Varies greatly depending on the number of images (ex: 1 hour to process 10 images) 2-3 days to process 50+ images	✓				✓ (best option)	✓ (depending on density and characteristics of artifacts)
<b>Geophysics</b>	Documentation of subsurface features, measuring physical properties of the earth including electric & magnetic information. HECTARE SCALE	• Can gain information about features that are not visible on the surface level • Can document large areas	• Relatively time-consuming • Requires relatively high level of skill to interpret results	Varies depending on the technology / instrument being used and the density / resolution of the data that is being collected. The collection of an existing survey grid and topography (i.e. fast city) will also affect collection times	Varies greatly depending on the data collected and the experience of the technician			✓			✓
<b>Survey Grade GPS</b>	Acquisition of highly accurate 3D positions used to georeference other survey data to a globally coordinate system CENTIMETER + RESOLUTION	• Can provide absolute coordinates in remote locations • Options for relatively fast collection time • Can be used to relate very different types of data together over space and time	• All GPS requires a clear line of sight to satellites (i.e. trees and other covering can be problematic) • RTK GPS requires radio transmission access • Rapid-Static GPS does not require radio but requires longer occupation time	Rapid-Static & RTK Individual cover observations LT 1 minute in addition to least time to positions Base setup 15-30 minutes	Typically 1-2 hour per day of acquisition in the field	✓			✓	✓	✓

Publications Series, Number 12700. <http://gmv.cast.uark.edu/uncategorized/survey-options-for-gmv-technologies-summary-table/>. [Date accessed: 27 April 2013]. [Last Updated: 26 March 2013]. *Disclaimer: All logos and trademarks remain the property of their respective owners.*

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