

As the responsible project manager, how would you approach the process of introducing a specified new piece of equipment (such as a survey unit or microscope) or change in working practice (such as revised recording form) for use by your team, and what measures you would take to ensure that it was being used correctly and safely (documentation, training and monitoring)?

Introduction

This plan for introducing a new piece of equipment is based on a recent real-life scenario which has taken place. Cornwall Archaeological Unit (hereafter CAU) implemented photogrammetry software for undertaking survey of archaeological sites and buildings.

Software and rationale

CAU has a need for there to be an in-house photogrammetry capability. This will take the form of the introduction of a new piece of software called 3DF Zephyr. The use case for individuals has to have been considered as the software is offered in three different packages offering different features depending on price. All staff are equipped with computers that are capable of using the software.

3DF Zephyr Free	3DF Zephyr Lite	3DF Zephyr (full version)
Limited to 50 photos	Unlimited photos	Unlimited photos
One GPU used at a time	Two GPU used at a time	Unlimited GPU use
Export as mesh with JPEG texture	Export various meshes and textures	Export meshes, textures and point clouds
Basic suite of editing tools, no filters	Basic suite of editing tools and filters	Full suite of editing tools and filters
No use of control points or scaling	No use of control points or scaling	Ability to add control points and take measurements
No laser scan support	No laser scan support	Use of laser scans
No ability to export orthophotos	No ability to export orthophotos	Ability to export orthophotos
No ability to create digital surface models	No ability to create digital surface models	Ability to export digital surface models
No compatibility with GIS and CAD software	No compatibility with GIS and CAD software	Compatibility with CAD and GIS software
Continuous updates	Updated for one year after purchase	Continuous updates
Access to support forum	Access to support forum and basic email support	Access to support forum and full email support
Free	€199.00 + VAT	€4200.00 + VAT

This information has been taken from the website 3DFLOW (2025) 3DF Zephyr - photogrammetry software - 3d models from photos.

The full version of the software is also available as a recurring monthly or yearly license, however this has not been considered as the intended long-term use of the software would not be cost efficient to finance over the coming years. As can be seen from the comparison table

there are three different levels of photogrammetry software. The features have been colour coded red, yellow and green; red to show the 'worst' feature of the software, yellow to show an intermediate feature, and green to show the 'best' feature of the software.

Due to the different roles and needs of different staff members, they have been allocated the different versions of the software based on their individual use cases and in order to maintain cost efficiency.

The table below explains the allocation of the software to different staff members (the names have been fictionalised for the purposes of this assessment), and the rationale for this.

Staff member	Main activities undertaken	Software version allocated	Cost excluding VAT	Rationale
Agnes Sennen	Overarching project management, signing off reports, financial oversight	3DF Zephyr Free	€0.00	Does not undertake fieldwork and so a paid version not needed
Sam Helston	Project management of large scale excavations	3DF Zephyr Lite	€199.00	Projects involve large sites and needs to be able to put surveys together
Jimmy Zelah	Site surveys and community excavations	3DF Zephyr Lite	€199.00	Projects involve large sites and needs to be able to put surveys together
Jake Bolenowe	Historic building recording and heritage impact assessments	3DF Zephyr Free	€0.00	The need is already satisfied by another staff member
Larry Constantine	Conservation and excavation reports	3DF Zephyr Lite	€199.00	The software will be used during the conservation of finds
Cassie Minack	Heritage impact assessments and consultation	3DF Zephyr Free	€0.00	The projects undertaken do not require 3D survey
Mary Treliske	Administration	No software deployed	€0.00	Does not undertake project work very often
Ambrose Swanpool	Site surveys, watching briefs and heritage impact assessments	3DF Zephyr Lite	€199.00	The software will be used to create site surveys
Colin Falmouth	Watching briefs and finds processing	3DF Zephyr Free	€0.00	Any needs can be undertaken by another staff member
Callum Trigg (primary user)	Historic building recording, watching briefs and heritage impact assessments	3DF Zephyr (full version)	€4200.00	Undertakes frequent surveys of buildings and already has knowledge of software. Will undertake project work for others
Flo Davidstow	Excavation project management, digital	3DF Zephyr Free	€0.00	Does not undertake projects that directly need photogrammetry

	mapping and watching briefs			
Percy Brea	Planning and community projects	3DF Zephyr Free	€0.00	Does not undertake projects that directly need photogrammetry
Rupert Pool	Human remains and watching briefs	3DF Zephyr Lite	€199.00	Requires software for recording of human remains
Suzie Tehidy	Administration	No software deployed	€0.00	Does not undertake project work very often
Lauren Altarnun	Excavation site management, watching briefs and site reports	3DF Zephyr Free	€0.00	Any needs can be undertaken by another staff member
Cadence Pendennis	Site reports, digital mapping and consultation	3DF Zephyr Free	€0.00	Any needs can be undertaken by another staff member

The decision has been made to deploy one full version of the software to a staff member who will be the primary user, five copies of the lite version to staff who use it less frequently, and eight copies of the free version. Two staff members (the administrative team) will not receive any software but they will be involved in the monitoring of the deployment and training. The total cost of this will be €5195.00 excluding VAT, approximately £4432.

Measures to ensure the software is used correctly

Implementation and project workflow

An example project workflow has been designed to help users implement the software and photogrammetry capabilities into new projects.

1. New project		
2a. Assessment of whether the project would benefit from photogrammetry?	2b. Yes – follow steps below.	2c. No – refer to existing project workflow.
3a. Inclusion of time for photogrammetry in output and fieldwork.	3b. Refer to existing project workflow and incorporate the following points.	
4. Undertake fieldwork and collecting of photogrammetry data on site using cameras and/or drones. Remember to include control points for drone imagery.		
5a. Transfer data to network and file images for each model separately (see section in this document for filing convention).	5b. Process data in 3DF Zephyr.	
6. Generate the following outputs:		
7a. Orthophotos	7b. DSMs	7c. 3D model
8a. Export orthophoto and DSM GeoTIFF files into ArcGIS		8b. Upload 3D model to sketchfab/ADS if required
9a. Produce scaled images to include in report		9b. Provide model to client
10. Complete and send report to client		
11. Retain data for 3 years in line with organisation policy		

When the staff member has determined a use or requirement for photogrammetry in their project, and there is sufficient financial resources to do so, they should use the above workflow, along with the data management plan further in this document to implement photogrammetry into their project. Newcomers to the process need to be aware of what can and cannot be done with photogrammetry, and what can and cannot be produced from it – and the rationale for doing so. The below is a starting basic guidance to assess whether a project is suitable for photogrammetry and not intended as a guide on how to undertake it. That will be expanded upon during the training.

- Suitable candidates for photogrammetry include small objects, buildings and landscapes.
- Objects which are thin do not reproduce well in photogrammetry. For example railings, metal sheeting, wires, thin timber partitions, doors, or both sides of a coin.
- Anything see-through will cause erroneous artefacts in the model, and will probably have to be manually removed from the model (increasing the production time and reducing accuracy). For example windows and water.
- Due to the steep angle of building roofs, they often do not reproduce well.
- If you can't get at least two photos of something, it won't be reproduced.

The following products can be created. These products need to be considered so that you can decide whether photogrammetry is useful for your project.

- Geo-rectified and scaled orthophotos of landscapes (when coupled with GPS data).
- Geo-rectified and scaled digital surface models of landscapes (when coupled with GPS data).
- Orthophotos of building elevations – these can be used to produce elevation drawings, some reference measurements will need to be taken on site.
- Orthophoto cross sections of buildings – these can be used to make floorplans and sectional elevations, (when coupled with site measurements) but note that the time on site and the processing time for full building interiors is often very long. Large buildings would require too much processing power and would not be possible to survey with this method.
- Create images which might not be possible in reality, such as an image of a ceiling, wall or floor that can't be captured in one photograph due to its size or objects/building elements obscuring it.
- To save time recording complicated sections and surfaces during excavations, such as walls or cobbled surfaces, by creating an orthophoto instead of a hand drawing (but a sketch with reference measurements, or relevant GPS data must be provided).
- Images of objects/surfaces with light cast over its surface at any angle – this can be used to highlight and reveal details like graffiti and carvings, or on landscapes to reveal earthworks.
- The 3D model itself is not particularly useful – but the above products are all created from it. The model can be uploaded to Sketchfab or ADS for public viewing but on its own does not provide much useful information, rather it is the data discussed above that can be lifted from the model that provides useful diagnostic information and records.

Initial training

CAU staff will be directed towards the 3DF Zephyr Tutorials web page (3DFlow, 2025b). The page gives access to a PDF manual document, but more importantly gives access to a series of tutorial videos which explain how to use the software. There are also web pages covering basic aspects of the software and more advanced elements. In addition to training, a Microsoft Teams group chat will be set up which will have all users and all involved IT technicians in order for a direct line of access to be established with internal support and to allow users to support each other.

Monitoring and documentation

A live document, based on the table below, will be maintained to keep track of the training that staff have undertaken. It will be expected that all staff members will complete some of the video tutorials and all of the basic training videos. Any staff members which have been given the full version of the software will be expected to watch all of the videos available and also complete the advanced tutorials. The following page shows the live excel spreadsheet which will be maintained by the administrative team. When staff have completed each training session they will log it in this document to record their completion. This document will be reviewed every 5 years or whenever there is a new member of staff or a change of staff member's software.

Course title		A Sennen	S Helston	J Zelah	J Bolenowe	L Constantine	C Minack	M Treliske	A Swanpool	C Falmouth	C Trigg	F Davidstow	P Brea	R Pool	S Tehidy	L Altarnun	C Pendennis
3Dflow Academy video tutorials: to be completed by all users	Basic workflow	11/05/2025		13/05/2025	13/05/2025	12/05/2025	11/05/2025		11/05/2025	12/05/2025	13/05/2025	14/05/2025	14/05/2025	14/05/2025		13/05/2025	13/05/2025
	Photography for photogrammetry	12/05/2025		11/05/2025	11/05/2025	12/05/2025	11/05/2025			12/05/2025	12/05/2025	12/05/2025	14/05/2025			14/05/2025	14/05/2025
	Masking	14/05/2025		15/05/2025	11/05/2025	12/05/2025	11/05/2025			12/05/2025	12/05/2025	12/05/2025	14/05/2025				14/05/2025
	Selection & cleaning tools	14/05/2025		15/05/2025	11/05/2025	15/05/2025	11/05/2025			12/05/2025	12/05/2025	12/05/2025	14/05/2025				14/05/2025
	Video reconstruction workflow	14/05/2025		15/05/2025	14/05/2025					16/05/2015	15/05/2025	13/05/2025					14/05/2025
	Point clouds & mesh filtering	14/05/2025					11/05/2025			16/05/2015		14/05/2025					14/05/2025
	#01. Getting started	14/05/2025								16/05/2015		15/05/2025					
	#02. Bounding box	11/05/2025								16/05/2015		16/05/2025					
	#03. Masking									16/05/2015		17/05/2025					
	#04. Multiple objects									16/05/2015							
	#05. Point cloud cleaning									16/05/2015							
	#06. Animation videos									16/05/2015							
	#07. Movie files									16/05/2015							
Base tutorials: to be completed by all users	#08. Texture unwrapping									16/05/2015							
	#09. Advanced parameters									16/05/2015							
	#10. Filters and Photoconsistency																
	#11. Understanding density																
	#12. Advanced masking																
	#13. Thin Surfaces																
3Dflow Academy video tutorials: only to be completed by users of the full version	Control points Part 1																
	Control points Part 2																
	Photoconsistency																
	Custom UVs																
	360° cameras																
	Laser scan integration																
	From high poly to low poly																
	Fixed rig workflow																
	Volume measurements																
	RTK Workflow																
	Drawing Elements																
	#A01. Control points & distances																
	#A02. Orthophoto & Orthomosaic																
	#A03. Workspace merge																
	#A04. Confidence																
	#A05. DEM generation																
	#A06. Target																
	#A07. Laser scan management																
	#A08. Sections and Contour lines																
	#A09. Shape from silhouette																
	#A10. Bundle adjustment																
	#A11. Fixed rig																
	#A12. Multispectral																
	#A13. Orthophoto																

Follow-up training

Once the software has been rolled out for six months the primary user (C. Trigg) will undertake one to one meetings with each staff member that is using the software to review their needs, uses and understanding. It is expected at this point that it will be revealed which users are actually using the software and those which are not. It may at that time be that the allocation of the five 'lite' licences may need to be reviewed. Then the primary user will evaluate the need for any users to be further trained in the use of the software – particularly focussing on the lite users as they are expected to be the most prolific users. Any need for follow-up training will be provided in-house by the primary user where possible.

Where there isn't the knowledge held in-house to provide the training, then a third party will be brought in to provide training. There are two certified 3DF Zephyr trainers located in the UK, these being AccuPixel Ltd located in Fleet, Hampshire and Monument Men, located in Leigh, Greater Manchester (3DFLOW, 2025c). AccuPixel Ltd would be the preferable certified trainer to use given their closer proximity to Cornwall, however the company that can provide the most timely or cost effective solution would be used. If they can provide remote training then this may be significantly more cost effective.

Data management plan

As the undertaking of photogrammetry results in a large amount of data, a Data Management Plan (DigVentures, 2019, p. 42) will need to be set out and followed in order to keep the data from becoming unwieldy, avoid unnecessary retention of data and allow the data to be accessible and straightforward to navigate. As the guidance below, which is based on the data management plan template outlined in the Dig Digital document, is for a variety of projects implementing photogrammetry, rather than a specific project, and so some sections of the plan have been omitted.

Data collection:

The data being collected is primarily photographs. These photographs should be in JPEG/JPG format and not RAW, although PNG and TIFF files can also be used. In cases of aerial drone photography, GPS data will also be collected (see separate data management plan), and in cases of buildings, sketches with annotated measurements will be taken.

The data will be collected with cameras, GPS units and paper notes.

Storage and backup:

The data, once collected, will be brought back from the site and stored in the following folder and file structure, within the project file folder:

Photogrammetry				
Photographs	Project	Exports		Additional data
This folder will contain sub folders for photographs if there is more than one model for the site,	This folder will contain the 3DF Zephyr project file and any related	3D Models	Orthophotos or DSMs	This folder will contain any additional files and data needed for the project,

appropriately identified.	supporting or temporary files			such as GPS data and scans of field notes
		This folder will contain any exported 3D models in their own folder with textures and .mtl files.	This folder will contain raster images of orthophotos and DSM files, ready for them to be taken into GIS software for scaling and georectification, if required, or into AutoCAD software.	

The data will be backed-up to the Council's network and is not to be stored locally on user's machines. Access is via the Council shared file network.

This file structure will be provided in the project folder template section of the organisation's selection of file structures that can be copy and pasted into project folders.

Selection, preservation and data sharing:

As with all files in the Council network, they will be automatically deleted after three years if not accessed or flagged for retention. Each time they are accessed the deletion clock resets to three years. Files flagged for retention will need to be manually reviewed after the 3 year period and a decision made.

File retention should be limited in order to save space. It is envisaged that site survey photography will have been archived with the Archaeology Data Service, and that the orthophotos and DSM (Digital Surface Model) images will be included in the report which will also be archived via Oasis. Any important photogrammetric models will also be made public by archiving with the Archaeology Data Service, and may have been made available online through other (non-archival) means such as Sketchfab. Therefore all photogrammetry data is not considered to be necessary for retention, as it will be securely and publicly stored elsewhere after the project end. It will be deleted if not accessed after 3 years. The costs of archiving will be considered at the project start.

Responsibilities:

During the project's life, the project manager and delegated project officers will be responsible for the data. After project completion, the report, photographic archive, and any archived 3D models will be the responsibility of the Archaeology Data Service. The report will also be held by the Cornwall and Isles of Scilly Historic Environment record. Internally, the data will be held for the 3 year retention period, where one appointed member of staff will be responsible for reviewing and retaining data from all projects.

Documentation

In addition to the policies and procedures discussed above, there are various pieces of health and safety documentation which will need to be completed. As a matter of course, Cornwall

Archaeological Unit should have completed the ClfA Health and safety checklist (n.d.), and importantly, as photogrammetry is partly a desk-based activity, there are some pieces of training and assessment that employees will need to complete.

Users will need to complete the following training modules provided by Cornwall Council, which are relevant to the photogrammetry process:

- Mandatory cyber security (to be re-taken annually)
- Mandatory introduction to workplace health and safety (to be completed every 3 years)

Completion of these modules will provide certificates that evidence their completion. This documentation will need to be stored securely within Cornwall Council guidelines and GDPR.

Users will also be required to read through the Cornwall Council *Health and safety policy statement* (2024).

In addition to these training modules, users will be required to complete a Display Screen Equipment assessment annually, which identifies any issues with a user's workspace, and flags this with their manager who can then resolve the issue. This might be by ordering new pieces of equipment or by referring the user to the occupational health team for further assessment or to provide specialist equipment.

Bibliography

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