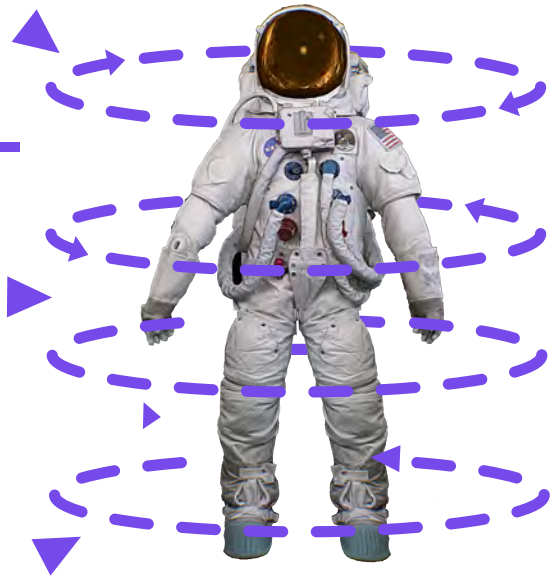
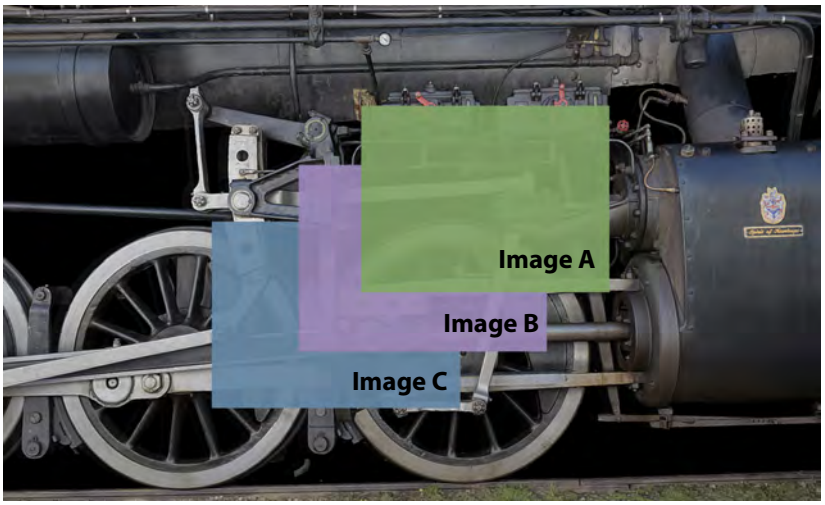
The Arc/k Project

PHOTOGRAMMETRY 101

YOUR CAMERA IS YOUR SCANNER

Photogrammetry uses a specific photography technique that allows software to analyze the way an object appears across overlapping images taken from many angles to create a 3-dimensional digital model of the subject. The procedure involves taking many photos of your chosen subject, and requires shooting into every possible angle, nook and cranny of your subject. Below is a brief description of the photogrammetry basics, but practice will be your best tool.





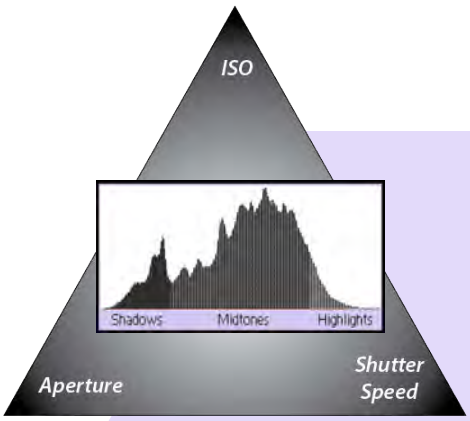
Try to overlap your images by 65-75% (that is: at least about 2/3rds) so the computer can see that it's the same object in both shots just from a different angle and position--it's that difference that generates the data!

(But here's where mindfulness and concentration comes in: this technique can be difficult to do without allowing motion blur or excessive gaps in your coverage to reduce the quality of your results. Pay attention!)

1. **You will be shooting many photos from many angles and many heights...**
   a. Take images of subject from 3-6 different levels or heights: low, medium, and high circling around the object from below and above, too, if possible at roughly 15° intervals (about a footstep).
   b. Simple objects: plan to shoot 100 images or more, complex objects or vast areas can require 1000s.

2. **Each image should overlap the previous one by 2/3 or more.**

3. **Camera settings: (This requires a balancing act of three crucial variables--use the histogram to tell if you're in the ideal range.)**
   ISO: as low as possible: 100-500 are excellent, higher as needed.
   Aperture: minimum of an f/7, higher is better.
   Shutter speed: as low as you can while not letting motion blur occur.

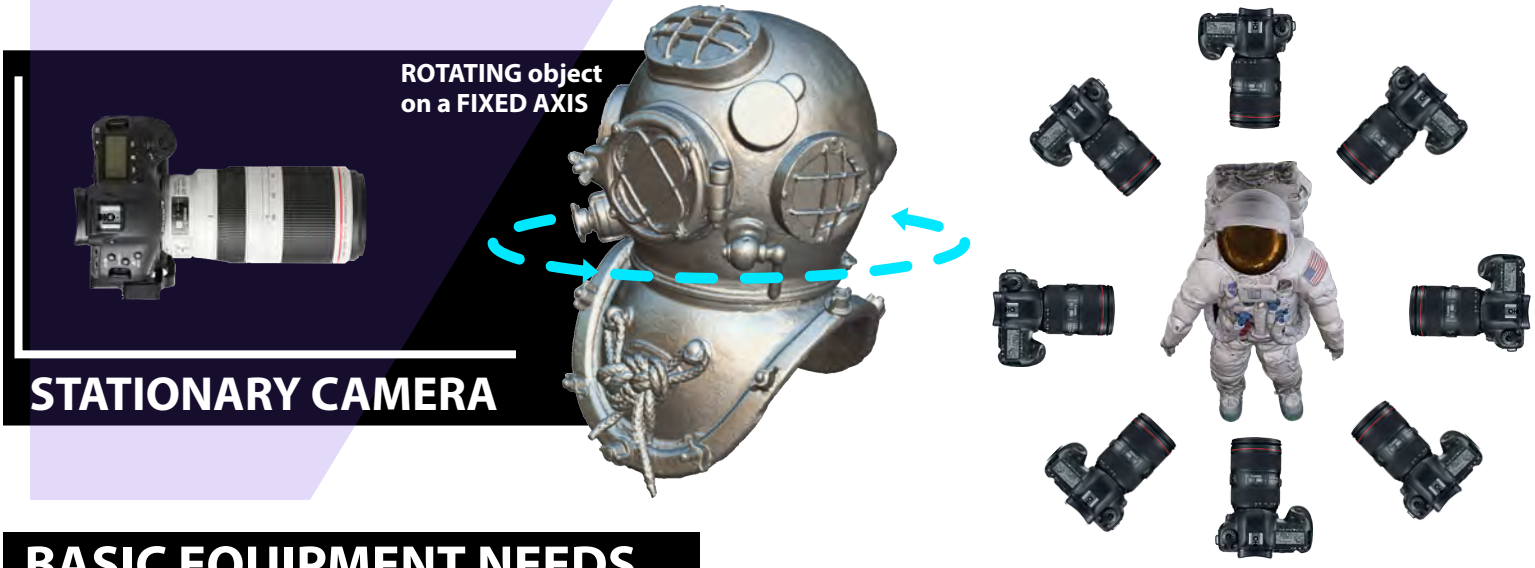


Experienced shooters: try 1/80th of a second, the heavily caffeinated will be advised to go monopod or set to 1/200th second!
If you have to sacrifice any one variable, **it should be your ISO**
(it is most important to keep focus sharp and depth of field wide.)

4. **Image format:** Ideally shoot in camera RAW files
5. **Camera lens:** Use a fixed focal lens, such as a 24mm or 50mm
6. **Camera movement:** (unless your subject is on a turntable)

ALWAYS MOVE THE CAMERA BETWEEN BETWEEN EACH IMAGE!

If you only have a telephoto lens, tape it off to secure the focal length from drifting.



BASIC EQUIPMENT NEEDS

Cameras/Lenses: Ideally you want 24 megapixels and above, and a 24 mm or 50 mm lens.
But if you do not have access to a high-end camera, you can use a cell phone camera that is 8 megapixels and above.
Best cell phone cameras: iPhone 6-8, Samsung 7 & 8.

Color Checkers: Place one in the scene close to the object, do not move it, and shoot it as part of the photogrammetry solve. Get closeups and many overlapping angles since matching color is an important part of the solve.

Scale Bars: (Objects of precisely known size can be used for scale reference in a pinch!)
Place it in the scene close to object, do not move it, and shoot it as part of the photogrammetry solve. Get closeups and many overlapping angles since matching scale is an important part of the solve. Do not place scale bars ON the object, just next to it.

SHOOTING TIPS

Lighting Your Subject:

1. Minimize shadows & glare.
2. Do not use on-camera flash if possible.
3. Overcast is best when shooting outdoors.
4. If it's sunny, try to shoot when the sun is directly above the subject.

Examples of Different Subject Matter:

1. **Landscapes**
   a. Shoot as low to the ground as possible and as high up as possible
   b. Ideally shoot 10 feet from the subject
2. **Small objects (in a studio setting)**
   a. Walk around object shooting every 10 - 15 degrees to equal a minimum of 32 images around object per level. Shoot 3 - 6 different levels / heights depending on complexity of object.
3. **Buildings / large objects**
   a. Shoot full rotations as low to the ground as possible and as high up as possible
   b. Shoot object from different distances to get the higher points
4. **Objects with limited access** (i.e. art hanging on a wall, an object you can't move, petroglyphs)
   a. Shoot with a grid pattern method (see right) and make sure you overlap your images!
5. **High Complexity objects**
   a. The more complex an object, the more photos you will need, particularly to address occlusions.

Sequence Breaks when images aren't overlapping:

Identify between each break or level by taking a picture of your hand to distinguish between these sets of images.

For more info on photogrammetry, visit our website:

www.arck-project.org