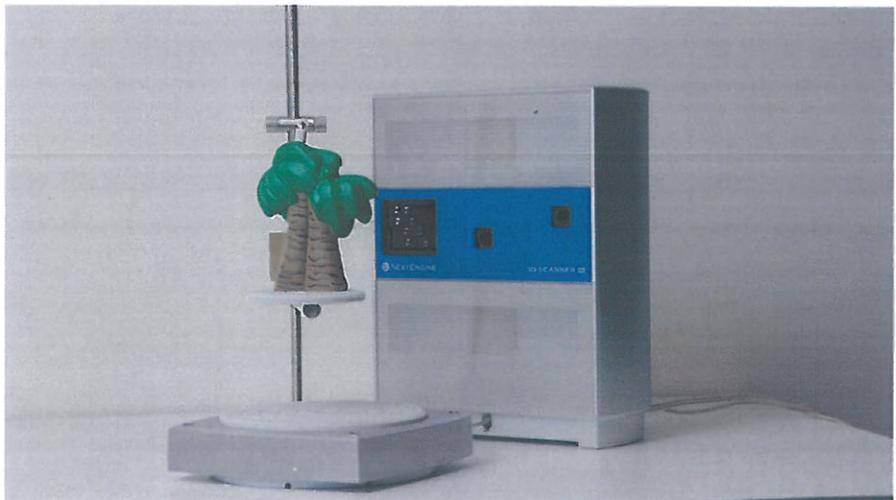


User Training Manual

NextEngine 3D Scanner

ARC SPACESHOP



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National Aeronautics and
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Moffett Field, CA

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I. Introduction

This document is for the user qualification training of the NextEngine 3D Scanner located at the Ames SpaceShop facility on the 2nd floor in Building 220. Before a user operates the machine, he/she must have signed the required documentation as described in the "SpaceShop Standard Operating Procedures". For additional information, please see a SpaceShop staff member.

II. NextEngine 3D Scanner

The NextEngine 3D Scanner is a machine that allows users to scan objects and convert them into a digital format. The machine consists of a rotating stand (AutoDrive) where objects can sit, a Part Gripper for the object, and the actual scanner device, which has a flash, camera, and laser to detect depth (Figure 1).

The specifications of the scanner are as follows:

- Rotating stand able to rotate the object 360 degrees.
- Laser beam, which is about 1/1000th the brightness of a laser pointer.
- Scans can output as STL, OBJ, VRML, XYZ, or PLY files.

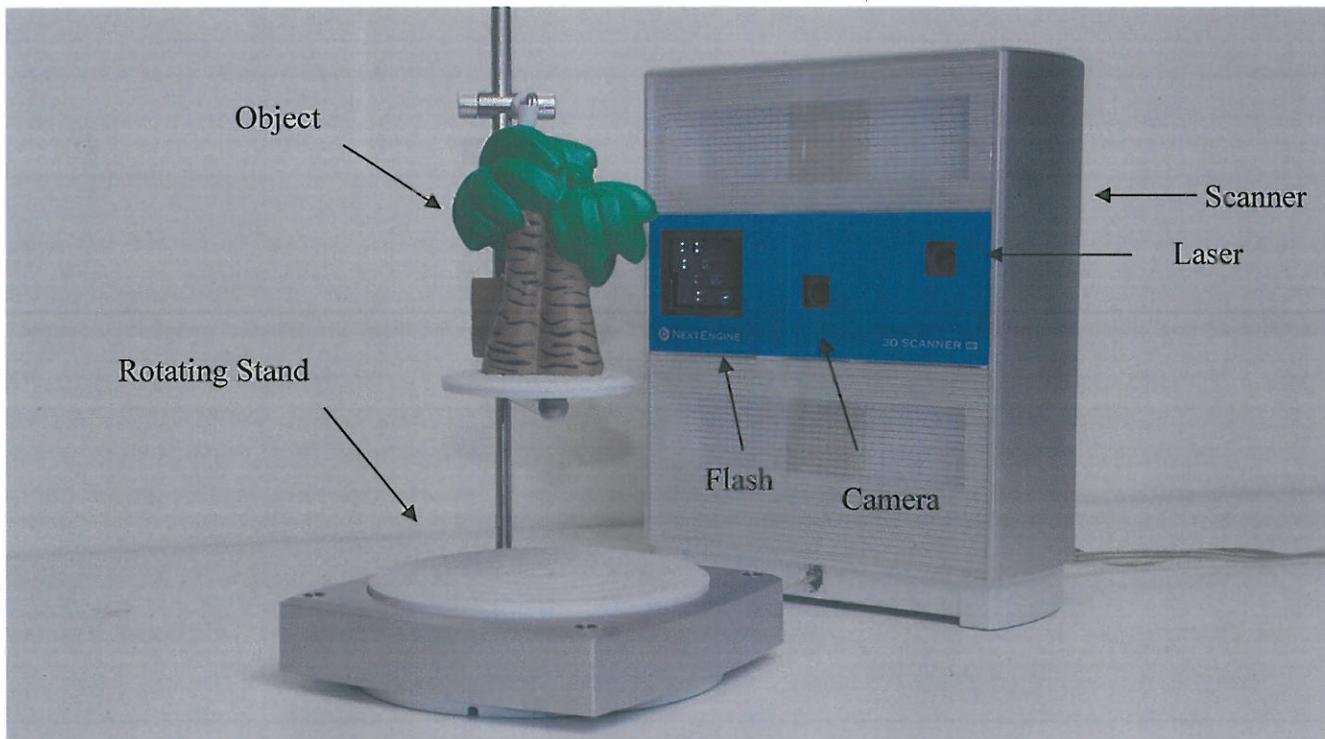


Figure 1: NextEngine 3D Scanner

III. Safety Precautions

a. NextEngine 3D Scanner Safety

SHALL...

- You **SHALL** notify SpaceShop staff prior to running any job operation.
- You **SHALL** wear closed-toe shoes at all times.
- You **SHALL** wear eye protection when working with tools and processes and when working with chemicals, metal shards, wood chips or sawdust.
- You **SHALL** clean up your space after every job session, and leave 10-15 minutes for cleanup prior to shop closure.
- You **SHALL** make sure the rotating stand screws are securely fastened before the scanning process begins.
- You **SHALL** always point the scanning device away from you as the scanner uses a Class 1 laser and could potentially harm your eyes when directly looking at the laser.
- If you need to prepare any black, reflective, or transparent objects, you **SHALL** only use the following:
 - Paint pens: washes off most objects with water. Test on small area first.
 - Powder: Talc composition
 - Spray Powder: Magnaflux Spotcheck SKD-S2 Developer works well.
 - Other spray alternatives: foot powder spray or white hairspray can be used as well

SHALL NOT...

- You **SHALL NOT** use the machine with a damaged AC adapter, power cord, of power-plug or with a loose electrical outlet.
- You **SHALL NOT** modify the electrical power cord, nor subject it to excessive bends, twists, pulls, binding, or pinching, nor place any object of weight on it.
- You **SHALL NOT** leave a machine unattended while in operation.
- You **SHALL NOT** work alone while in the SpaceShop.
- You **SHALL NOT** remove the NextEngine 3D Scanner from the table unless you are given permission by a SpaceShop staff member to do so.

IV. Step-by-Step Tutorial

a. Tools Required

- NextEngine 3D Scanner
- AutoDrive Platform
- Computer with ScanStudio Software
- Object to be scanned

b. Getting Started

1. **CHECK** the scanner to make sure the power cord and USB cable are plugged into the printer and scanner.
2. **PUT** your model on the Rotating Stand platform (Figure 2).

NOTE: The dials that are attached to the long beam can be loosened or tightened to secure the object in place.

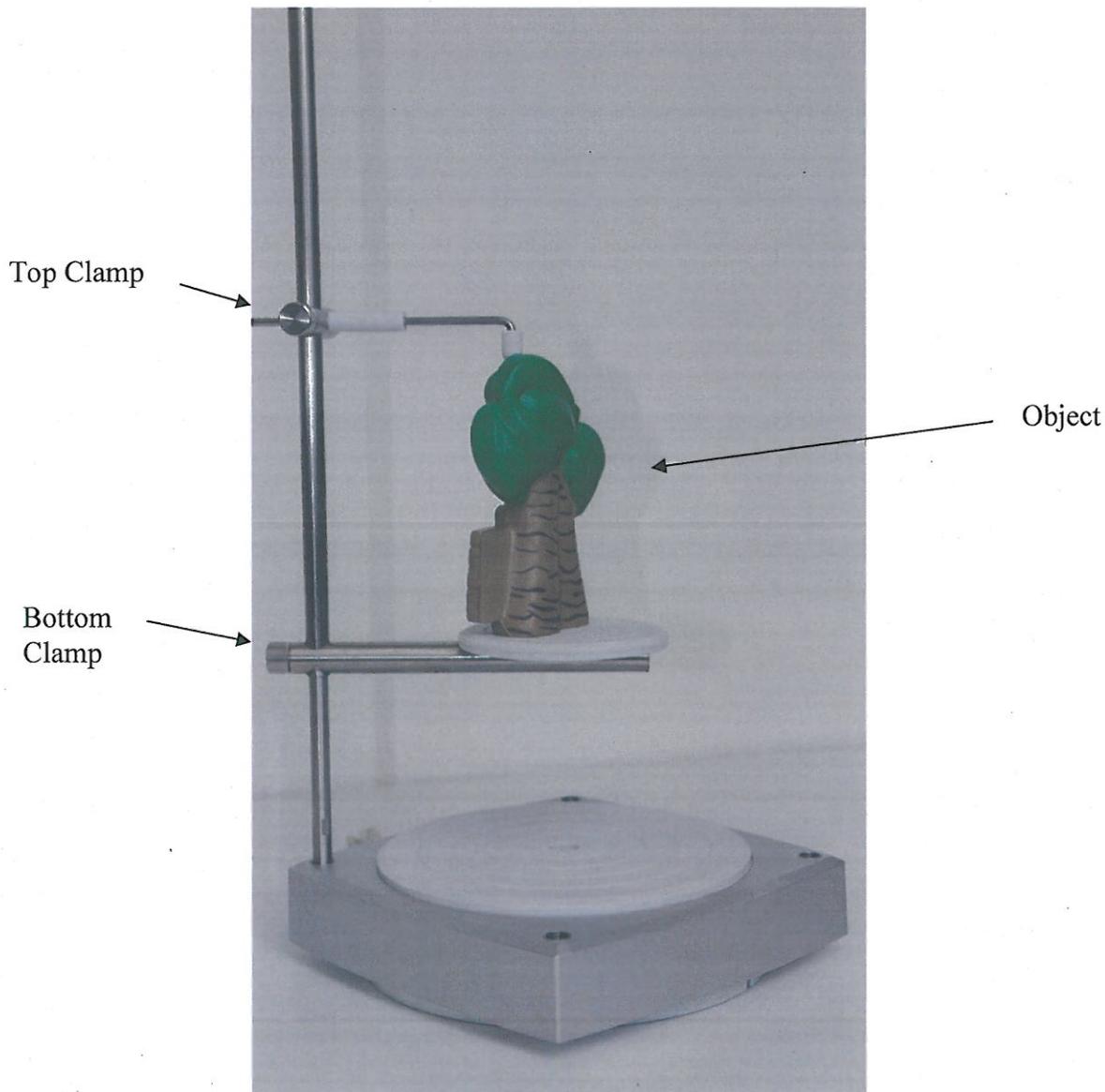


Figure 2: 3D Scanner Stand

3. Open the **SCANSTUDIO** software located on the desktop of the computer.



Figure 3: ScanStudio Desktop Icon

4. The software loads (Figure 4).

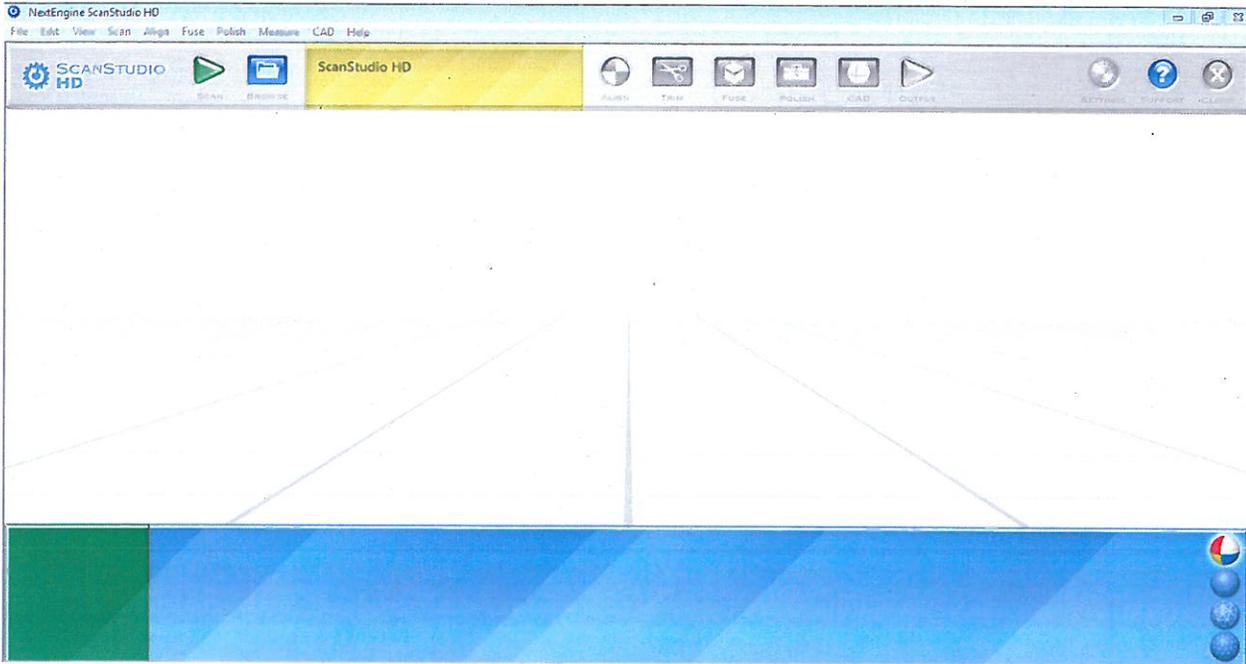


Figure 4: ScanStudio Start Screen

5. Click **SCAN** located on the top menu (has a play button next to it).

NOTE: The scanner flash will turn on, and the Scan screen will appear, showing both the scan options and the object on the platform. If the object does not appear in the camera view, use the platform clamps to orient the object into the camera view (Figure 5).

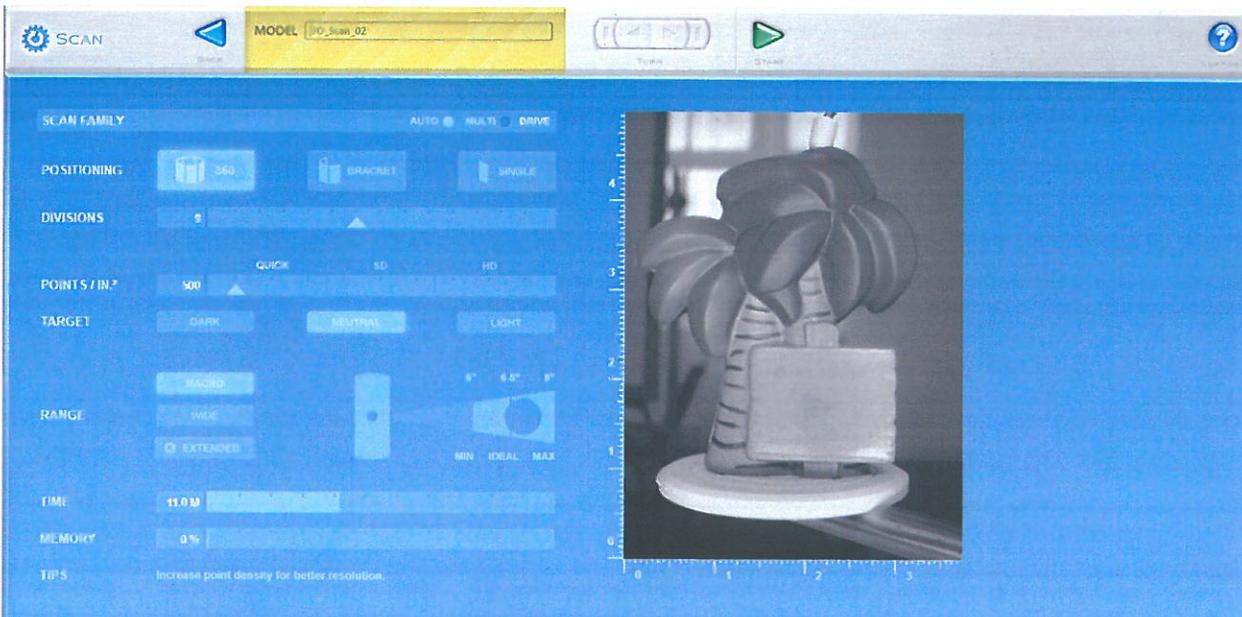


Figure 5: Scan Options

6. Create a unique file name on the top **MODEL** section to save the scan.

7. Under **POSITIONING**, choose one of the options listed.

NOTE:

- **360** means that the stand will automatically rotate 360 degrees around the object to get the entire object scanned. This is the most common scenario if a user wants to scan an entire part in one scan.
- **BRACKET** will do several images of the object while rotating the object less than 360 degrees. For example, if a user only needs a 90 degree segment of the object, a user will select "Bracket" and adjust the settings accordingly for 90 degrees.
- **SINGLE** means the scanner will take a single scan on a surface. This is good if a user needs just the surface of an object and not the entire object.

8. Under **DIVISIONS**, choose your option.

NOTE: Divisions will adjust the amount of sections in the 360 view. The more divisions you have, the more accurate the scan will be, but also the longer the scan will take.

9. Under **POINTS/IN.²**, choose your option.

NOTE: Points/in² is the resolution of the scan. Higher quality scans will have a higher points/in², but will also take longer. Lower quality scans will have a lower points/in², and will take a shorter amount of time and memory.

10. Under **TARGET**, choose your option.

NOTE: Target will adjust the lighting of the object. When you choose your options, you will see how the scan will appear on the right side. Most of the time, **NEUTRAL** will be the best option, but choose the correct setting depending on how your object appears in the image on the right side.

11. Under **RANGE**, choose your option.

NOTE: Range will need to be adjusted depending on the side of the object. For objects that are on the NextEngine platform stand, **MACRO** will produce the best scan. For larger objects, you will need to use the **WIDE** section.

12. Once you have the settings confirmed, click **START**.

NOTE: The platform and scanner will then scan the object and it will show up digitally in the *ScanStudio* software screen. The progress is shown in a green section in the top bar of the screen (Figure 6).



Figure 6: Scanning Window

13. Once the scan is complete, there will be a message in the green status bar saying "Scanning Complete".

14. **ADJUST** the scan appropriately.

NOTE: At this point, in most cases, you will need to do some editing to the scan to match the part that was scanned appropriately. This is more common in a **BRACKET** or **360** scan as there are issues with scanning the top and bottom of the object. The options on the top bar will allow you to do this (Figure 7).



Figure 7: Editing Options

- **TRIM** will be used frequently as the scanner may pick up sections that you would like to remove, such as the platform. To use this feature, select **TRIM** and use the **SELECTOR** to identify how you would like to trim the sections (by point, by circle area, by square area, by rectangle area, by polygon area, or all). Use the **DE/SELECT** options to modify your selection. Once you have verified the trim, click **TRIM** (Figures 8 and 9).



Figure 8: Trim Options

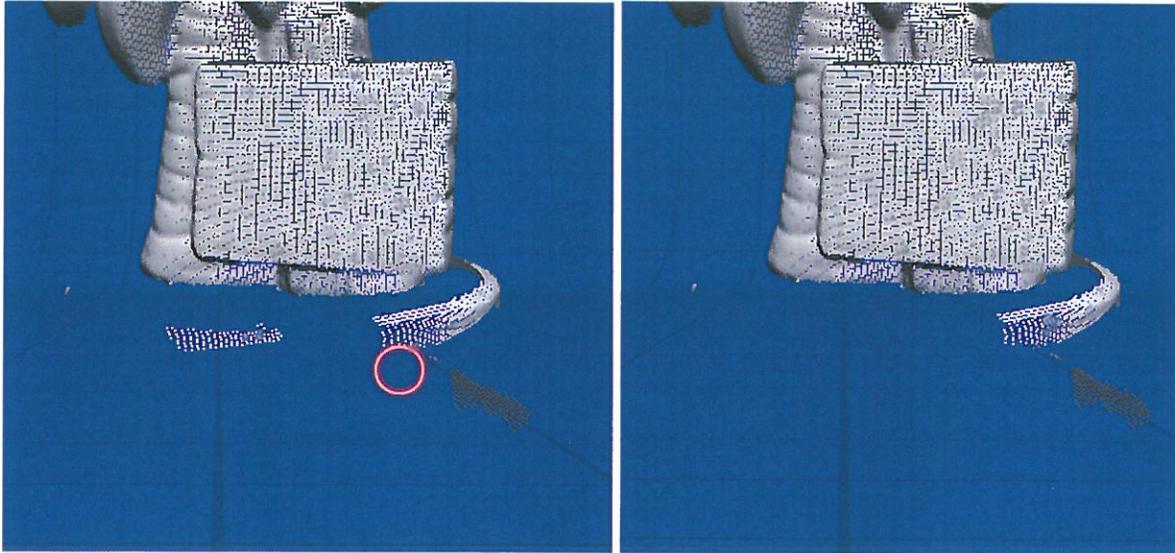


Figure 9: Scan Before Trim (Left) and After Trim (Right)

- **FUSE** allows a user to combine selected scans into one large scan. This is useful if you would like to do the top and bottom of an object as that is not normally picked up in the 360° scan. To use this feature, select **FUSE**, and then select the scans you want to fuse together at the bottom of the screen. You can modify the **TOLERANCE** at the top of the screen if needed. The **TOLERANCE** is a simplification level, so 0.00" will not simplify the data at all, and increasing the simplification will simplify your model and make the file size smaller. It will perform intelligent simplification, which keeps more points in detailed areas and fewer points in larger planes. Once complete, click **FUSE**. A new family containing the Fused parts is created. For additional features, please see a SpaceShop staff member (Figure 10).

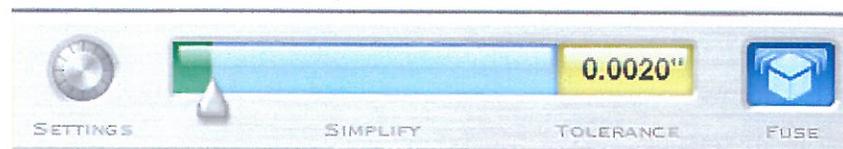


Figure 10: Fuse Options

- **POLISH** is used to do slight modifications to the scan for final output
 - i. **FILL** is used to fill holes around the 3D scan. If you select this, the software will scan the surfaces of the object. Use the **SELECTOR** to identify gaps where it should be filled, then press **FILL** (Figure 11).



Figure 11: Fill Options

- ii. **BUFF** is used to clean up a scan for higher accuracy. To use this feature, select **BUFF**, then select the area you would like to buff, then click **OK** to the window that pops open (Figure 12).



Figure 12: Buff Options

- 15. After editing the object, click the **OUTPUT** button, and then choose the file type you want.

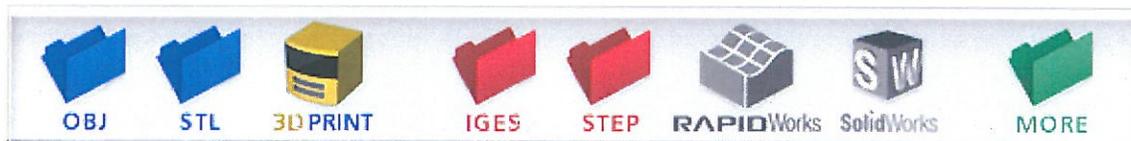


Figure 13: Output Options

- 16. Congratulations! You have successfully completed the 3D Scanner Training!

To learn more advanced techniques, such as how to edit the scan in different ways, please consult the SpaceShop Lead for more information.