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RC20768-L

ReCap 360 Pro – What's New & Advanced Topics

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Learning Objectives

- Learn how to use ReCap 360 Pro to create a textured mesh from a point cloud selection.
- Learn how to use ReCap 360 Pro to register UAV or handheld scan data to a project.
- Learn how to use ReCap software's OEM tools to automate reality-computing workflows.
- Learn how to handle common pitfalls in advanced ReCap workflows.

Description

This session will demonstrate the latest developments in ReCap 360 Pro software, focusing on features released since last year (2017 product year). Topics will include the Scan to Mesh service; import of CAD geometry via Navisworks; registration of unmanned aerial vehicle (UAV) and handheld point clouds; the use of ReCap software's OEM tools for advanced workflow integrations; and advanced presentation tools, including high-resolution image export. We will cover in depth new features and workflows with real-world project data. The second part of the session will cover advanced workflow how-to topics pulled from our community forum and idea station.

Your AU Expert

Ryan Frenz is the Senior Software Development Manager for Autodesk's ReCap Product Group. In this role he oversees the day-to-day engineering effort for the ReCap 360 software product line, including user experience, software development, and quality assurance. Ryan has over 12 years of experience building software products for the Reality Computing industry. He is an accomplished software architect and possesses in-depth knowledge of the processes, workflows, and goals of the Reality Capture industry.

Introduction

The mission of the ReCap product team is to continuously deliver value to our subscribers. To serve this mission we try to release new feature updates on a regular cadence. Our goal is to improve the software at least once per quarter (three months).

As a result, a lot has changed in ReCap since last year's Autodesk University hands-on lab. Today we'll take a quick tour of the highlights, and touch on some other interesting bits, in the form of four lab exercises. The following exercises are based on the latest version (2017 Update 4, or 3.1.1) of ReCap 360 Pro.

What's New

So, what's changed since this time last year? Last year's hands-on lab used version 2.2 of ReCap 360 Ultimate. Since then there have been 5 updates shipped to subscribers. Below is a list of these updates and their highlights:

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3.0.0 / March 2016: Mesh Creation, new UI theme

3.0.1 / April 2016: ReCap OEM, Limit Box Improvements

3.0.2 / June 2016: Unassigned Region Tools

3.1.0 / October 2016: CAD Import, Expanded Registration, View Customization & Export

3.1.1 / November 2016: CAD Import improvements, Video controls

The below exercises will touch on all of these and a bit more. Let's get started!

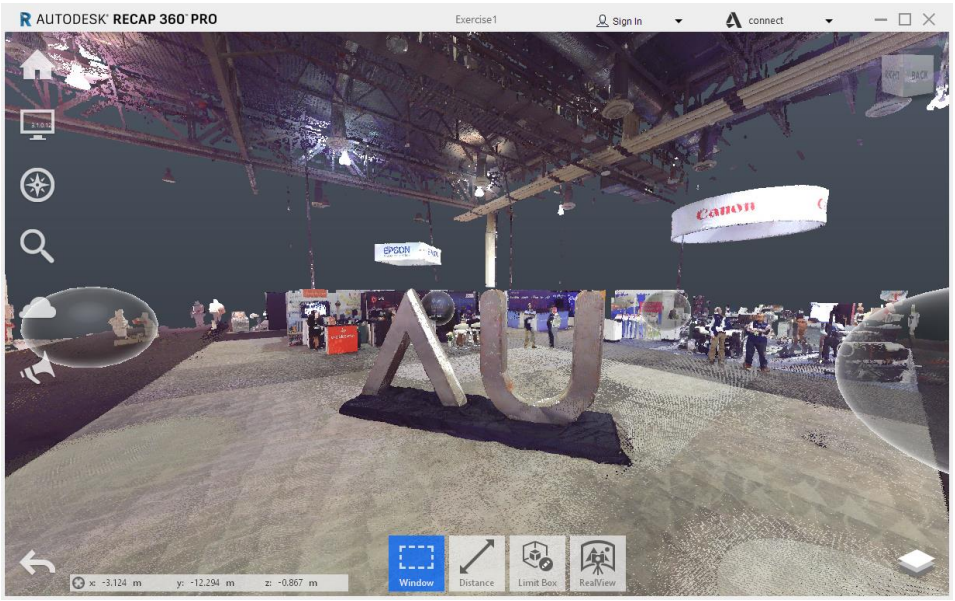
Exercise 1: Mesh Creation

First released with the 2017 launch (March 2016), ReCap 360 Pro's 'Object Mesh' feature allows the user to create a high-resolution, photo-textured mesh of a selected area of the dataset. This feature is critical for many hybrid projects, where laser scan data may be captured not only for existing condition information, but also for creating assets to be used in the design or layout processes.

Also covered in this exercise are key improvements to the Limit Box tool.

To get started, let's load the dataset for this Exercise.

Task 1: Load 'Exercise1.rcp' and enter the 3D view.



Data Preparation

Preparing data for Mesh Creation is very straightforward and quite similar to preparing data for other workflows. Usually this includes:

- Isolating the asset or object of interest using the navigation tools and limit box.
- Remove unwanted data by selecting/clipping/hiding or adjusting scan visibility.

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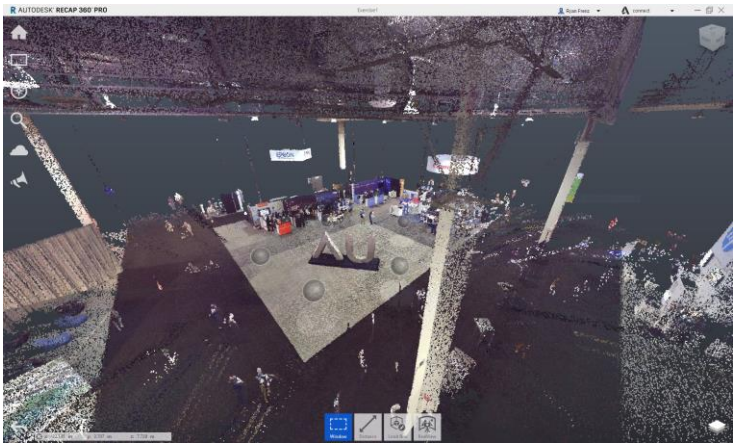
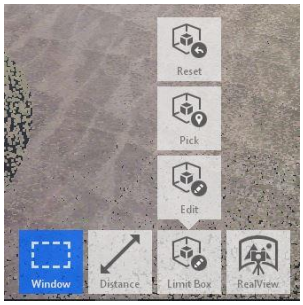
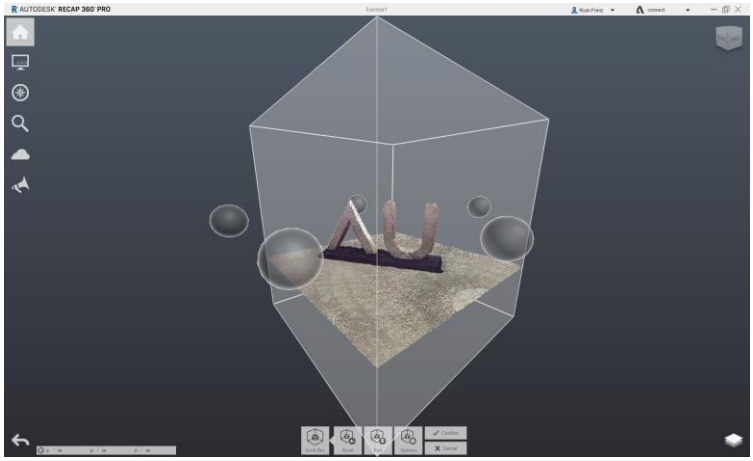
Version 3.0.1 (March 2016) includes a key change to the Limit Box tool. The 'Pick' option of the tool can now be accessed at the top-level menu. This allows the user to quickly reduce the limit box about a picked point, without starting the full-scene Limit Box tool.

To use the 'Pick' tool:

1) Identify the object/area of interest (get it on the screen with a clear view).
2) In the 3D view, hover on 'Limit Box' in the main toolbar.
3) Select 'Pick' from the sub-menu.
4) Click on the object or area of interest. The limit box will be set with the picked point in the center, at a size based on the view distance.







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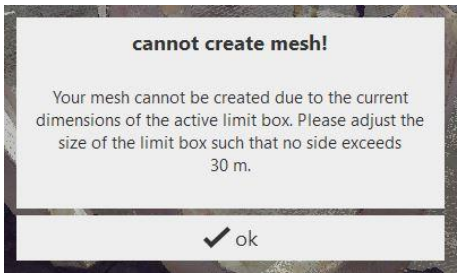
Task 2: Navigate to find the object of interest and use the 'Pick' Limit Box tool to quickly set the limit box about the object. Then, use the other Limit Box tools to adjust the box as desired.

Some important notes about the limit box and Scan-to-Mesh: the Scan-to-Mesh service is a free, Beta service available to ReCap 360 Pro users. This cloud-based workflow has an operating cost that's roughly defined by the size of the area and the processing time required to create the mesh. While the service is Beta and free of charge, ReCap enforces a limit to the size of the area sent to the service. As of October 2016, this limit is that the box must be no more than 30m (~100ft) on its longest edge.

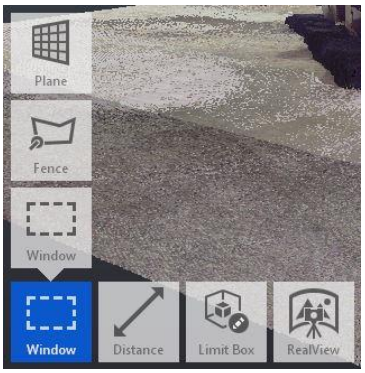


Before or after the Limit Box is defined, you are free to use ReCap's other editing tools for removing unwanted points. *Note: the Beta service currently only supports Clipping.*

To clip unwanted points:

1) In 3D view, choose a selection tool from the main toolbar (usually 'Rectangle' or 'Fence').
2) Click points to define the selection.
3) Choose 'Clip Inside' to clip the points inside the selection, or 'Clip Outside' for the opposite.

To reset clipping, choose 'Unclip All'.



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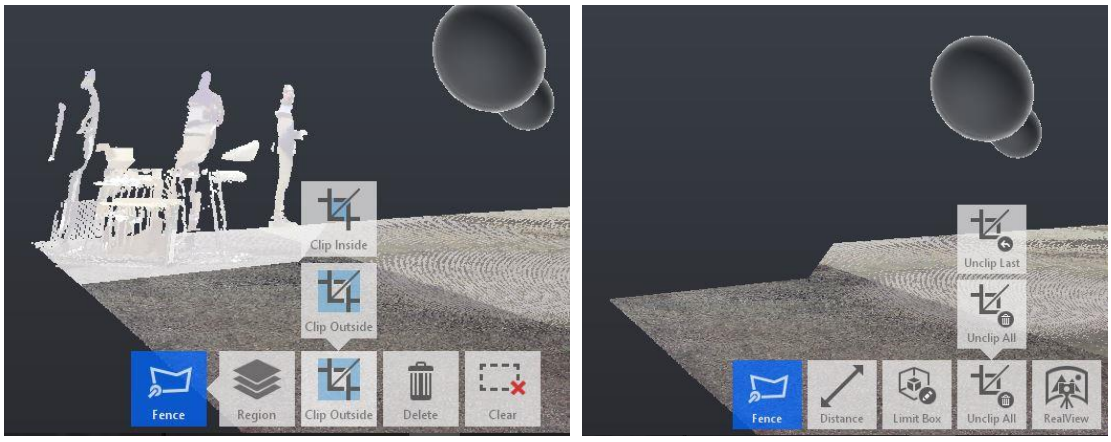
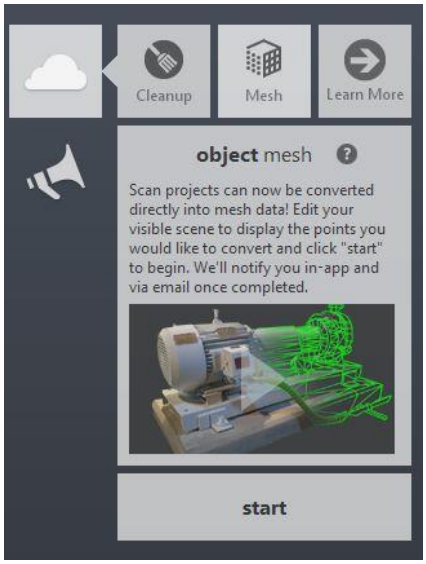
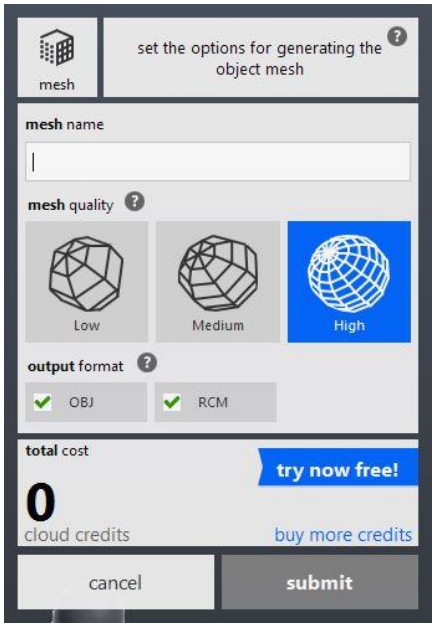


Task 3: Select some unwanted points (using the Rectangle or Fence tools) and hide them using 'Clip Inside'.

Submitting the Mesh Job

Once the data is isolated and any cleaning applied (via clipping), you're now ready to request the mesh. This is available from the Data Services menu on the left-hand side of the screen. Hover on the 'Mesh' option and choose 'Start'. ReCap will check that the size of the request is acceptable and that the necessary files are synchronized to your cloud storage. Then you will see the Mesh Options dialog.





The Mesh Options dialog provides a few options for your job:

- *Mesh Name*: choose a name for the final output
- *Mesh Quality*: Low is approximately 1-2cm resolution. Medium is approximately 0.5-1cm. High is 2-3mm. You should choose the resolution that best matches the quality of your sensor.

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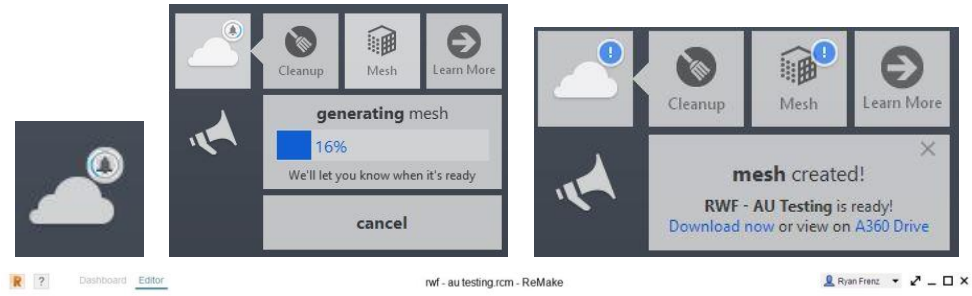
- *Output Format*: RCM is the native ReMake format. OBJ is a general interchange format compatible with many other products (including Autodesk software like 3D Studio Max and Inventor). ReMake is also able to convert either format to a number of others.

You'll also notice a 'Total Cost' field. Since the service is still Beta, this will always be '0', but is subject to change in the future.

Set your desired options and click 'submit' to send the request to the service.

Task 4: Submit a mesh request to the service for processing.

You'll see the Data Services menu change to reflect that you have a job in progress. The status of the job can be checked from there. Otherwise, you're free to use the application however you'd like (other than submitting another mesh). You can even close it & come back or work with another project. You will get a UI notification in the main menu when the job is complete, in addition to an email to the address registered with your Autodesk 360 account.



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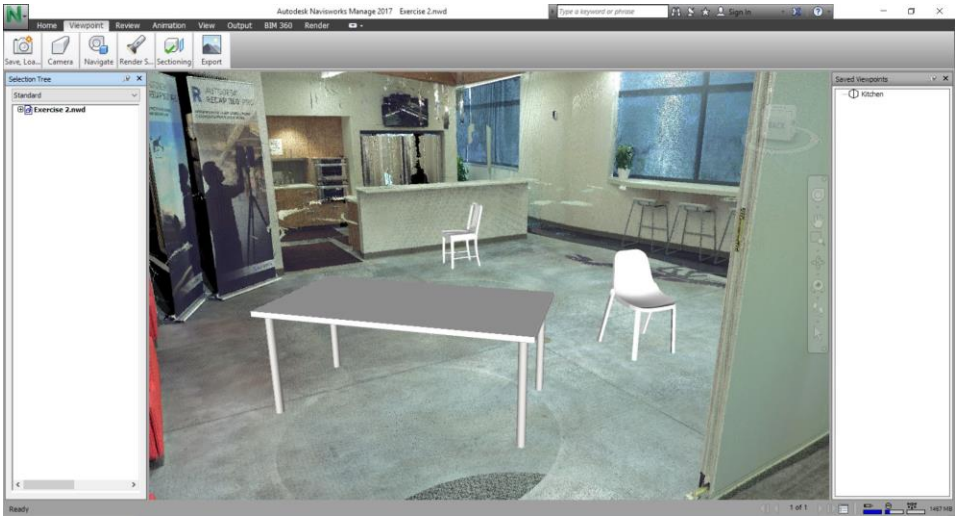
Exercise 2: CAD Import

New in ReCap 3.1 (October 2016), users of ReCap 360 Pro can attach design data in the form of NWD (Navisworks) files to a ReCap project for review in RealView. This is a key feature for retrofit and new designs inside existing sites and structures.

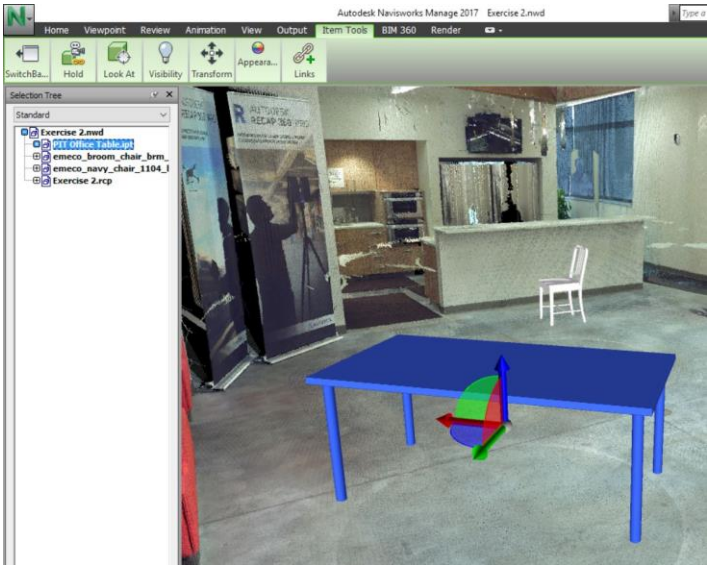
Also covered in this exercise are new features for viewing intensity in RealView and exporting high-resolution images.

To demonstrate, we'll show a simple example of visualizing some furniture in an existing space. Let's start by practicing how we coordinate the datasets together in Navisworks Manage.

Task 1: Load 'Exercise 2.nwd' in Navisworks Manage 2017.



Notice the table and chairs are situated in the kitchen. Each object can be transformed independently using the 'Item Tools' toolbar. Select 'Transform' and 'Move' or 'Rotate' as desired. This will enable the triad tool for manipulating the object. Try to put the table in the center of the empty space and the chair under its long edge.



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Task 2: Translate/rotate the CAD geometry to fit as desired in the point cloud.

Feel free to change colors or other properties of the data as desired. Once the design data is where you want, save the NWD. We can now attach it to ReCap for review in RealView.

Task 3: Launch ReCap & load 'Exercise 2.rcp'.

Once loaded, enter RealView and navigate to a scan that sees the kitchen (use the Overview Map if necessary). The Navisworks model can be attached via the Main Menu or by clicking on the 'Attached Projects' header in the Project Navigator.

Task 4: Attach 'Exercise 2.nwd' and view it in RealView.

That's it! The Navisworks model is now shown in any RealView which can see it. You can hide/show, remove, or attach other models from the Project Navigator. *Note: currently ReCap supports viewing only one Navisworks model at a time.*

If you need to change the CAD data, you can modify & re-save the NWD and update ReCap by clicking the 'refresh' button on the Project Navigator entry (or just reload the RCP). Projects can also be detached by clicking the 'X' on the appropriate row of the Project Navigator.

Now that we have an interesting model in RealView, let's use this data to practice some other useful features. One highly-requested feature is to view the Intensity measurements inside RealView. This is now available as a Display Mode (same as in 3D view, although it shows grayscale data only).

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Task 5: Try switching between Intensity and RGB modes in RealView.

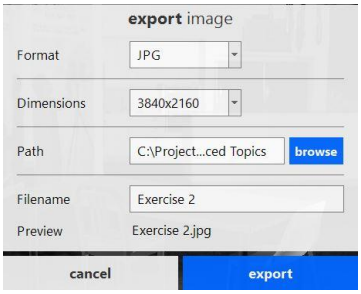
Along with these and other visualization tools, ReCap Pro now contains the ability to export a high-resolution image of the current view (3D or RealView). The image omits the UI, menus, etc, but contains all annotations and other scene objects. As such, it's much better than a screenshot.

You can export an image at any time via the Main Menu.

Let's use these features to take some screenshots of our coordinated Navis model in RealView.

Task 6: Create view states showing CAD geometry + RealView in RGB and Intensity modes.

Task 7: Export a screenshot of one of your view states.



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Exercise 3: Expanded Registration

Since its initial release in 2014, ReCap has grown into the industry-leading tool for aggregating all types of point clouds into the Autodesk environment. However, until now, the ability to natively register (stitch) data from multiple capture sources has been limited. New in ReCap 3.1 (October 2016), users can now combine terrestrial (e.g. tripod-based) laser scan data with 'unstructured' point clouds from sources like UAVs (via photo-to-3D reconstruction), vehicle-mounted scanners, and handheld devices using structured light or similar measurement systems. This process is data-based, allowing these data sets to be combined into the same coordinate system without artificial markers or external software & processes.

Also covered in this exercise are view customization and video/animation export.

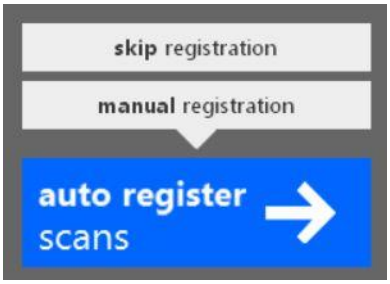
To get started, we'll load a project containing two tripod scans of a stairwell.

Task 1: Load 'Exercise 3.rcp'.

Once a network of one or more tripod/structured scans is established, unstructured scans can be stitched the network using the normal registration tools. You can import the example (from a handheld scanner) by selecting 'Import' from the Main Menu and browsing to or drag/dropping the file 'HandheldScan001.dp'.

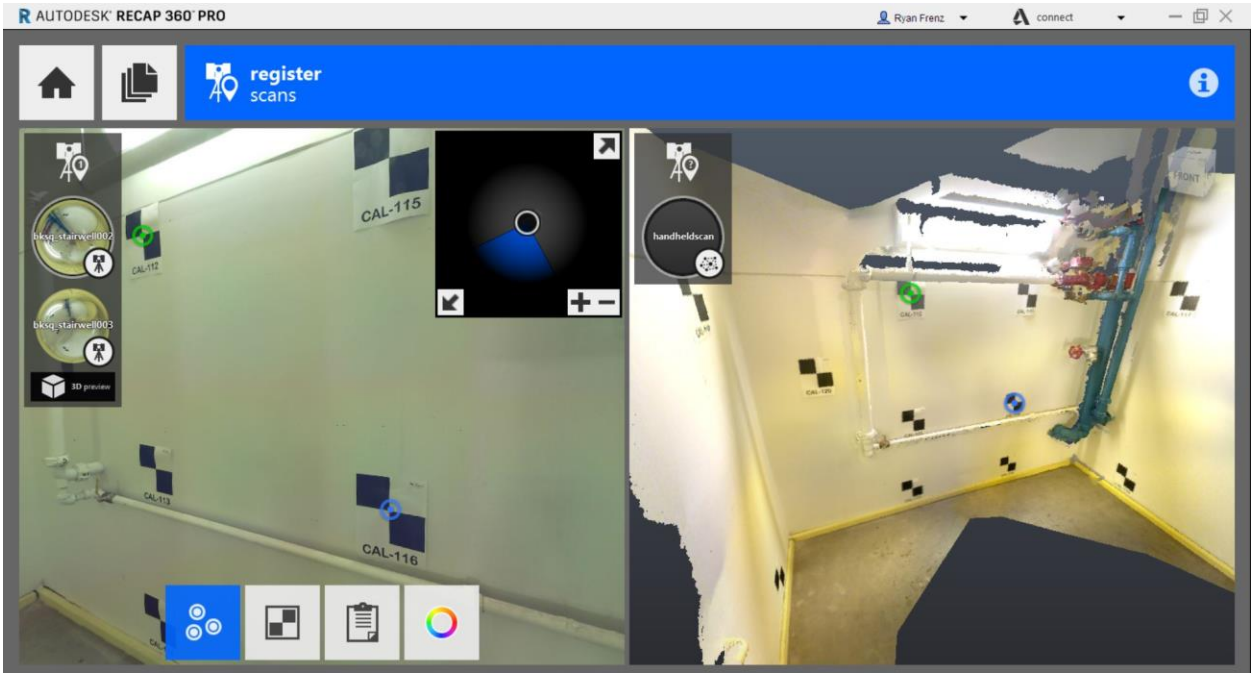
Task 2: Import 'HandheldScan001.dp'.

You'll first be prompted for some import settings. Just keep the defaults and click 'Import Files'. The scan will quickly import, at which point you can choose to register it. The default registration mode ('auto register') is not yet supported for unstructured scans. To manually register, place your mouse over the button in the lower-right and choose 'manual registration'.



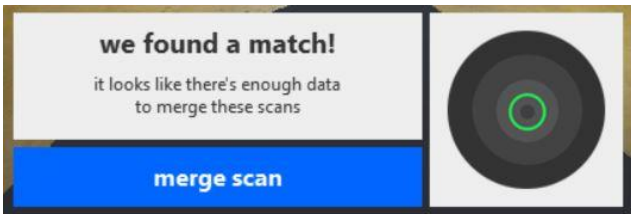
This will transition to the standard registration interface, with the existing scans on the left, and the new one on the right. Notice that, since the new scan was not collected from a fixed position, the right-hand pane is a full 3D view instead of RealView.

Stitching the new scan is quite similar to the registration you're used to – except you'll be using ReCap's 3D navigation controls to manipulate the right-hand view. As usual, you'll stitch the scan by choosing a good scan on the left and identifying three pairs of points in both panes.

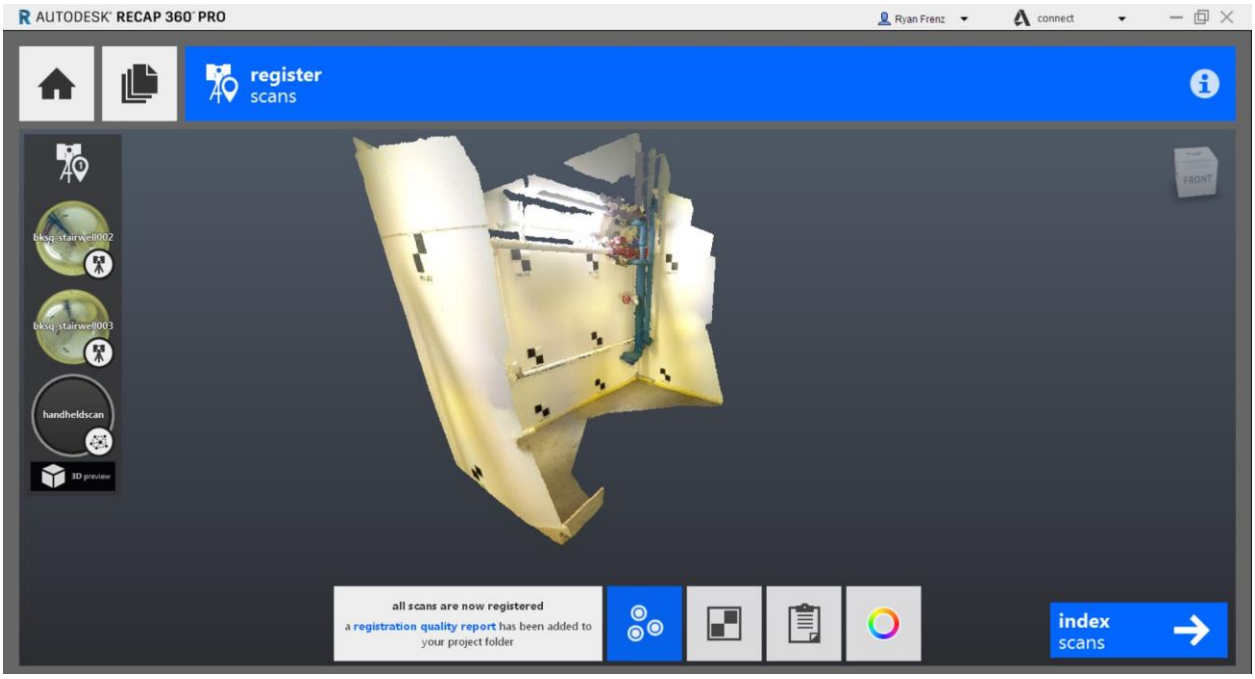


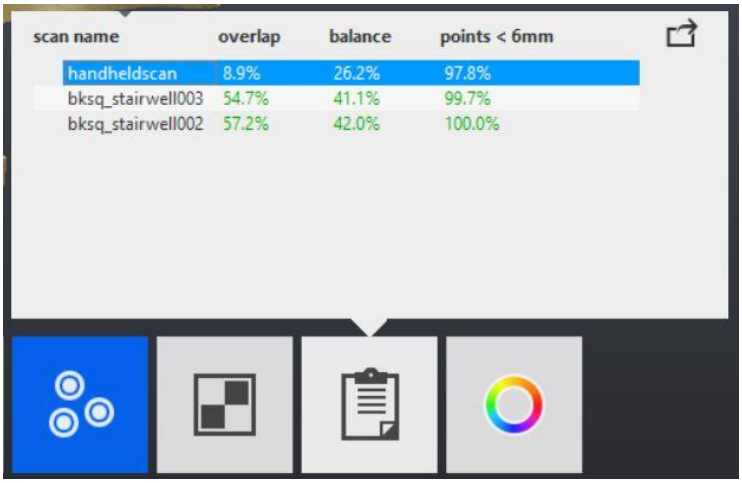
Task 3: Stitch the point cloud to the network by selecting three correspondence pairs.

Once the third point pair is selected, ReCap's engine will generate a suggested registration. If successful, you'll be prompted to merge the scan. If the suggestion failed, adjust the point pairs as necessary (tip: rotate the 3D view to make sure you picked the desired point!). Your point pairs don't have to be perfect – although due to the additional degrees of 'freedom', you should try to get as close as possible for best results.



Once you have a good suggestion, merge the scan. If the statistical results are satisfactory, the scan will automatically move to the left, completing the registration. You can check the specific results via the 'clipboard' icon at the bottom of the screen.





To complete registration, click 'index scans' at the bottom-right. This will finalize the new scan and allow you to launch the completed project.

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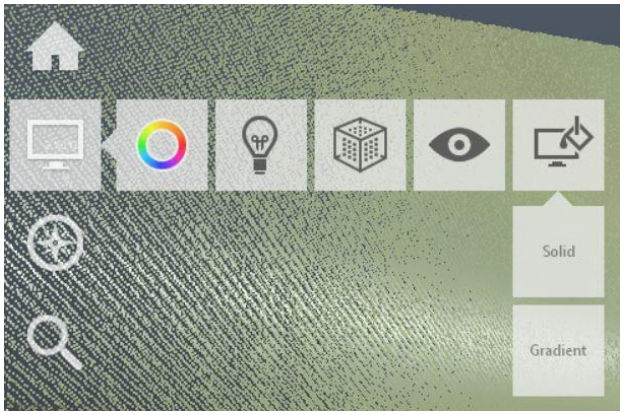
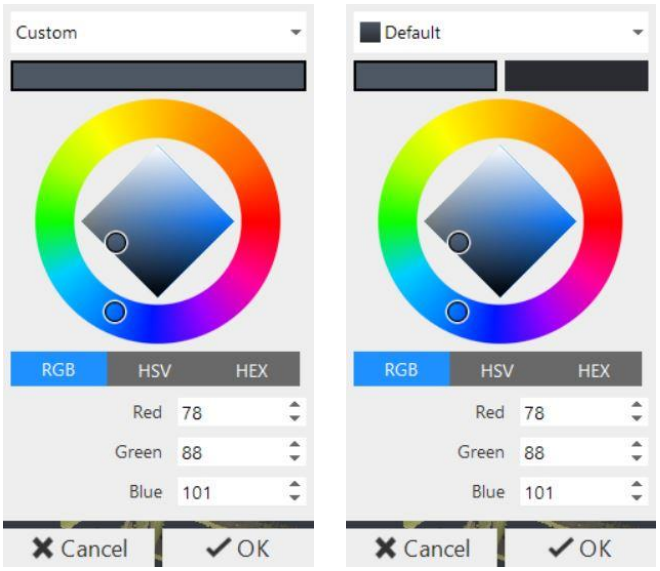
Task 4: Review results, finish registration, and enter the main 3D view.

Congratulations! You've successfully registered the handheld scan to your tripod scans. The combined scans are now ready to work with in the main ReCap app as usual. We'll now practice some examples of working with 3D data – specifically, customizing your views and creating a video.

As of version 3.1, ReCap 360 Pro now contains the ability to customize the background of the 3D view. This allows the user more control on the visual appearance of the view. To customize the background, select 'Change Background Color' from the Display menu. To use a solid color, click 'Solid', or 'Gradient' to select a top/bottom gradient transition.



The 'Solid' option allows for a number of presets, or a custom RGB, HSV, or Hexidecimal color. Similarly, the 'Gradient' option allows the same but with two colors, applying a transition between them from top to bottom.



These custom settings are fully compatible with all 3D view tools, including View States. View States can be created at any time by clicking the '+' in the View States menu in the Project Navigator.

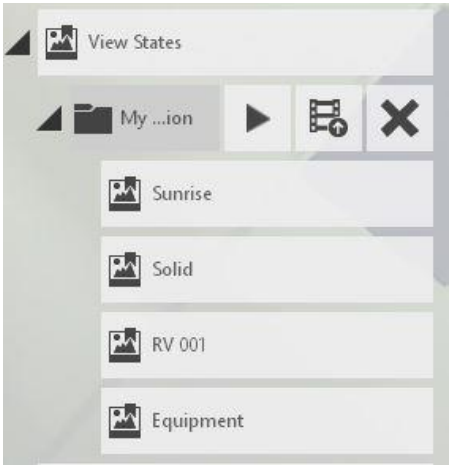
Task 5: Choose a Background Color preset and create a View State.

Task 6: Create a custom Background Color and create another View State.

To demonstrate, we'll now create a video from a set of View States. View States can be organized into groups for communicating/sharing with different project roles or sub-teams. To create a View State group, simply click + drag the first View State on top of the second. From there, more View States can be added to the group by dragging them anywhere in the new folder. Drag & drop is also used to set the order of View States in a group.

Task 7: Create a sequence of View States and group them in a logical order. Include some View States from both 3D and RealView.

Once you've created your ordered group of View States, we can create a Video from them. These tools are available from any View State parent item (group folder or top-level header) in the Project Navigator. The 'Play' button allows you to preview the animation live inside the application. The 'Export Animation' button allows you to configure the animation for export to a video file. The only difference between the 'preview' and the final animation is that the live preview will include decimation during navigation in 3D (the point density/appearance may change while the camera is moving). The final rendered animation will not include this.

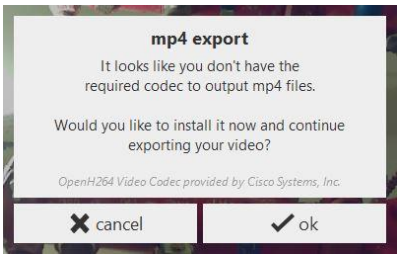


Any change to the view state group (reordering, add/remove States, etc) will also update its animation.

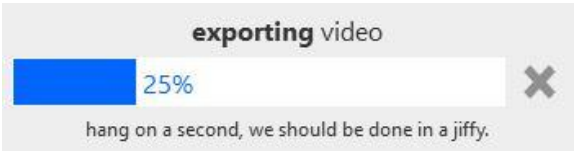
Task 8: Preview the animation of your view state group and adjust as desired.

Once the animation is ready, click 'Export Animation' to create a video. The Export Video dialog provides several options for the resulting video. ReCap supports a basic AVI format (MJPEG codec), and optionally an MP4 format with H.264 encoding. You can specify a preset resolution of 720p (1280x720), 1080p (1920x1080), or 4k (3840x2160).

Note: The H.264 codec is provided via separate in-app download for licensing reasons. If 'MP4' is not an available option, you'll need to install the codec in the app settings or use AVI.

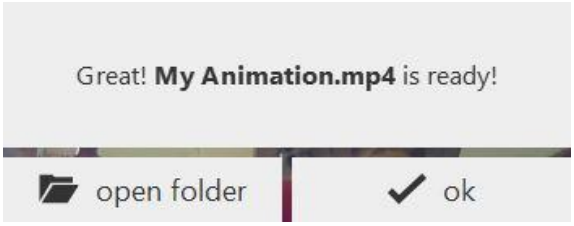


Once you've configured the export, click 'export' to render the animation to file.



Task 9: Create a video from your view state group.

Success! You now have a video of your View States to share with others.



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Exercise 4: Advanced Topics / Open Lab

We'll finish the lab by highlighting some specific features/topics that are frequently discussed in the ReCap user community. Feel free to follow along, or use the time to repeat/tinker with any of the previous exercises.

First released in the April update (3.0.1), ReCap now includes an OEM tool ('DeCap.exe') that provides a command-line interface to some ReCap operations. This tool allows power users to automate certain operations in their workflow – specifically project creation and import of notes at known coordinates.

ReCap OEM – Project Creation Basics

DeCap.exe can be found in ReCap's installation folder (usually "C:\Program Files\Autodesk\Autodesk ReCap 360"). DeCap's main feature is project creation – that is, for one or more raw scans, DeCap can import the scans and create a new, fully-indexed project from them.

To use DeCap.exe to create a project:

```
DeCap.exe --importWithLicense <Output Folder> <Project Name> <raw scan 1> [raw scan 2….]
```

This will create a new project at <Output Folder>/<Project Name>.rcp.

ReCap OEM - Options

There are several options to configure the project creation process.

--**minRangeClipping**: sets the range below which raw points are clipped/ignored (structured/tripod scans only)

--**maxRangeClipping**: sets the range above which raw points are clipped/ignored (structured/tripod scans only)

--**decimation**: sets the level of additional decimation for the final RCS point cloud

Let's give it a shot by importing 'Example 4.e57' to a new project called 'Example 4':

```
C:\Program Files\Autodesk\Autodesk ReCap 360\DeCap.exe --importWithLicense --
decimation 5 <Exercise 4 Folder> "Exercise 4" <E57 Path>
```

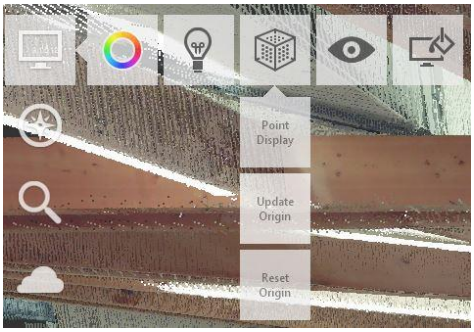
Task 1: Use DeCap.exe to create a project from the Exercise 4 raw scans.

Now you have a fresh ReCap project ready to use. Let's look at a few advanced features that you might not have seen.

One common workflow is to set a custom coordinate frame for the project. This might be required for a number of reasons:

- Aligning the dataset based on features of the environment, to fit with standards or improve the experience of working with the data later. This includes goals like aligning a specific wall or object to North, etc.
- Moving the origin of a dataset for compatibility with other products (specifically ones which don't like large coordinate systems).

ReCap 360 Pro provides tools for both requirements. For visual- or data-based alignment, ReCap provides the ability to set a user-defined coordinate system ('UCS') from the data at any time. This tool is available from the 'Display' menu and is labeled 'Update Origin'.

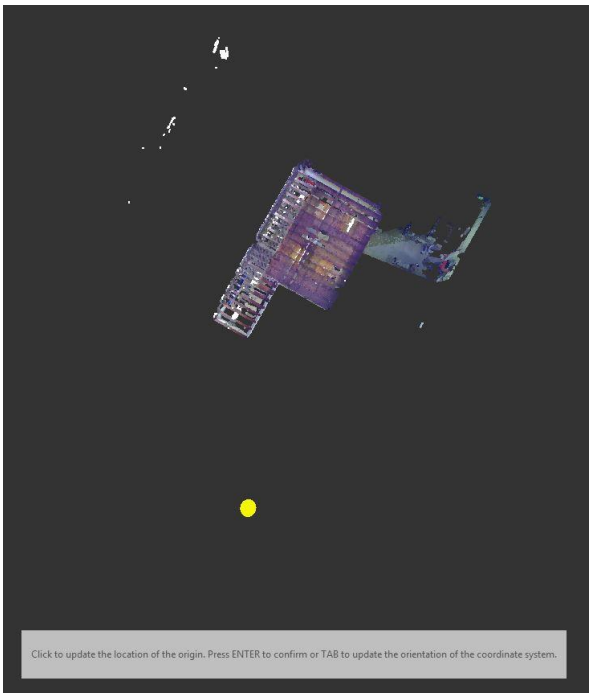


To try it out, let's load the project we just created – 'Exercise 4.rcp'. Once loaded, go to Top View. Notice that the dataset isn't aligned to any default axis – the building runs diagonally (roughly NE on the long side).

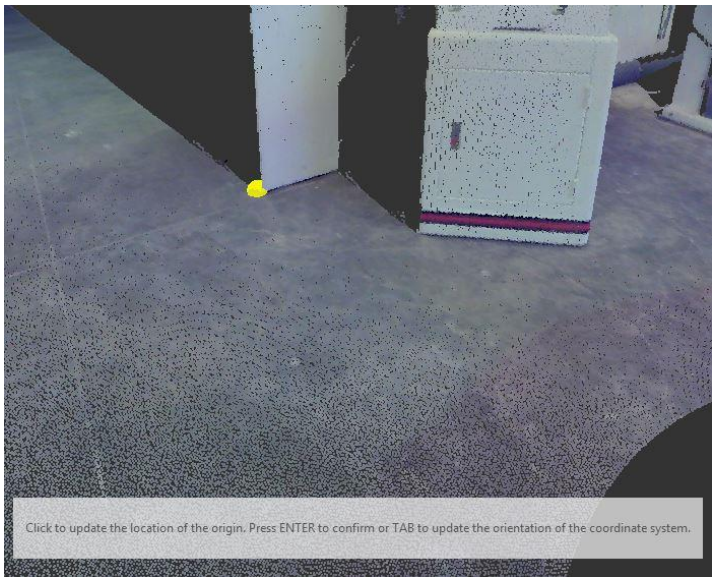
The Update Origin tool allows you to address this by creating a UCS in three steps, all optional:

- Set a new origin (0,0,0 point) by selecting a point in the 3D view.
- Define the +Z (Up) axis by selecting a plane in the 3D view.
- Define the +X (East) axis by selecting a plane in the 3D view.

To fix the diagonal alignment of our Top View, we really just need to do the third step. But we'll walk through each as an example. Start by selecting 'Update Origin' from the menu shown above. This will enter the tool in the first step (setting origin point) and show you the current origin point, represented by a yellow sphere.

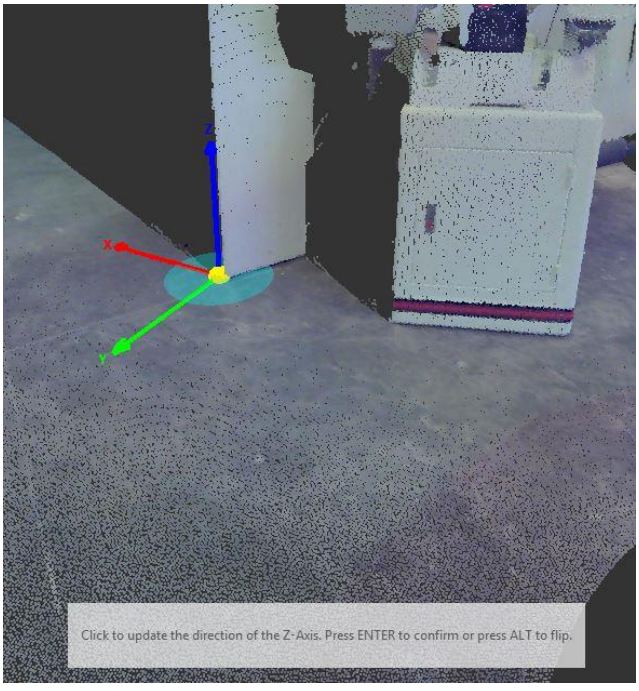


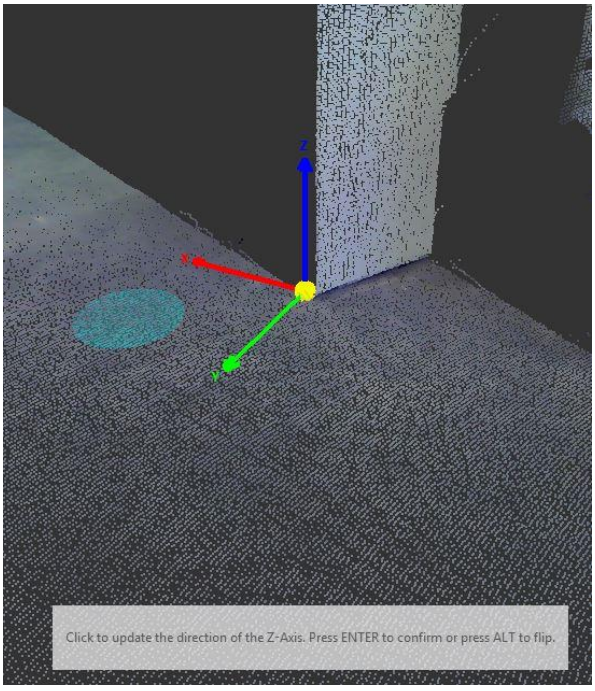
Find the area of the data you'd like to make the origin. Click the desired origin point to move the yellow sphere. If you don't need to change the origin point, just press TAB.



If all you want to do is move the origin, you can press Enter to finish the tool. To continue to setting the rotation, press TAB. This will display a 3-axis triad showing the current coordinate frame.

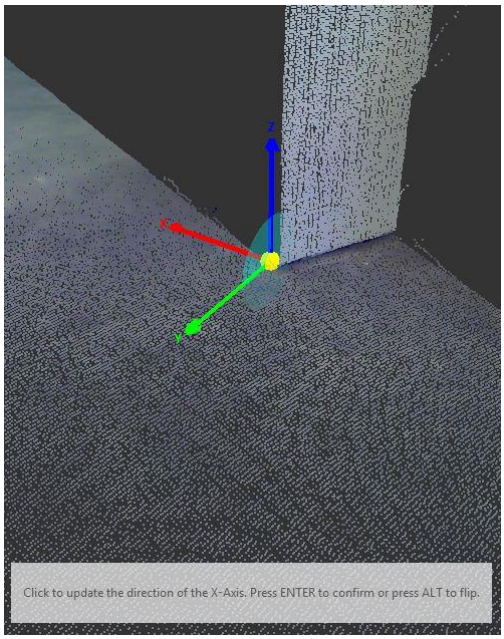
By default, the +Z/Up Axis is defined by the orientation of the raw data used to create the project (this varies depending on the source scanner/software). If you don't need to change it, just press ENTER. If you need to change it, you can do that here by selecting a point on a flat surface. ReCap will fit the data around the point to a plane and adjust the +Z axis to be perpendicular to it. Once the plane is set as desired, you can flip it 180 degrees by pressing ALT or accept it by pressing ENTER.

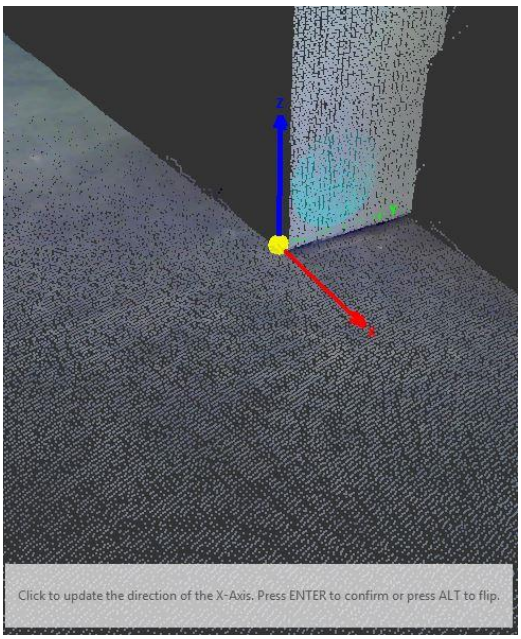




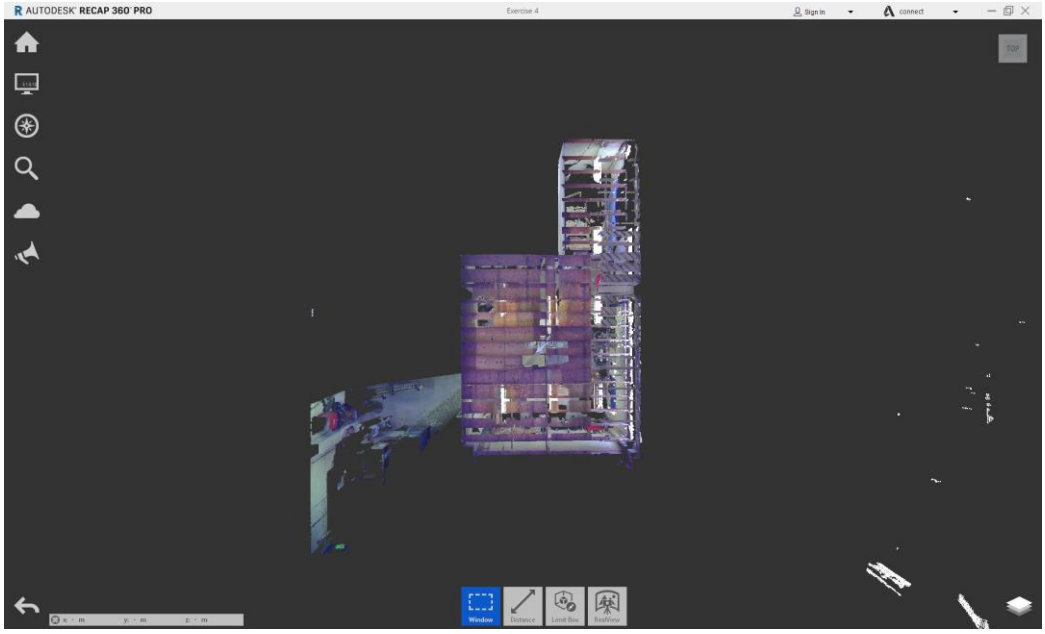
Finally you have the ability to change the +X axis in the same fashion. The triad will show the current axis about the origin point. If you don't need to change it, just press ENTER. If you need to, you can

change the axis by selecting a plane that is perpendicular to the axis you want. This will update the triad to reflect the new orientation. Once the plane is set as desired, you can flip it 180 degrees by pressing ALT or accept it by pressing ENTER.





Once the UCS is set, you can go back to Top View to see your new orientation.



You now have a top-level UCS for this project. This UCS will be included in any export operation, as well as when the project is referenced in other Autodesk products. The UCS can be reset/cleared at any time by selecting 'Reset Origin' from the same menu.

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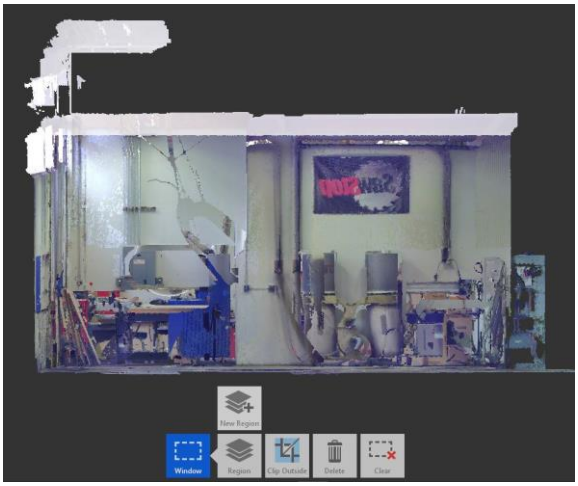
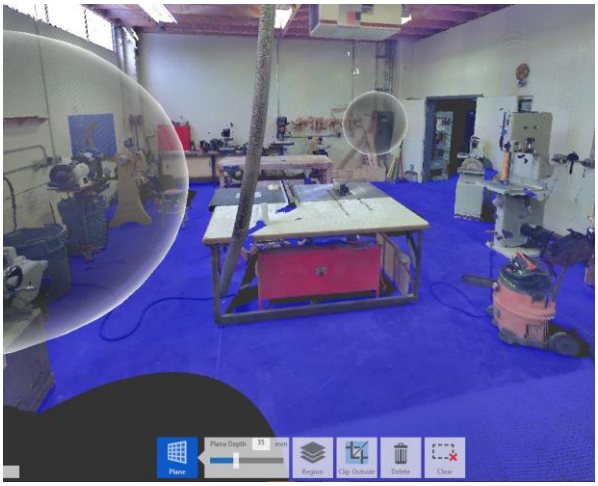
Task 2: Create a UCS that modifies both the rotation and translation of the project using the 'Update Origin' tool.

Now we'll explore some other new capabilities around working with Regions. Regions are a very useful tool for segmenting the project into logical groups based on things like classification (equipment, walls/floors/ceilings, etc) or spatial area (bays, rooms, etc). Most related workflows require working with the created Regions individually (that is, one or several at a time).

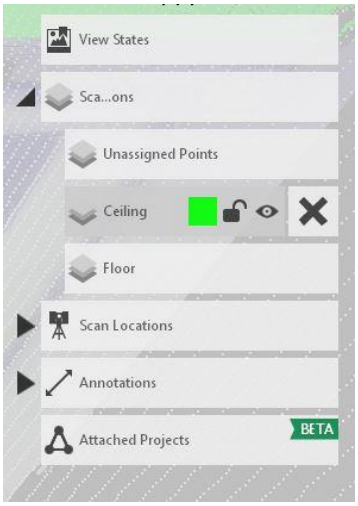
To get started, let's create some Regions. First, identify the area or object you wish to assign to a region. Then, use the selection tools (Window, Fence, or Plane) to select it. Once selected, add the selection to a region using the contextual menus near the bottom of the view.





Task 3: Use the selection tools to create 3 or more regions.

Your new regions will be visible in the Project Navigator under 'Scan Regions'. Notice also there is an entry titled 'Unassigned Points' – this is the default Region containing every point not in another region.

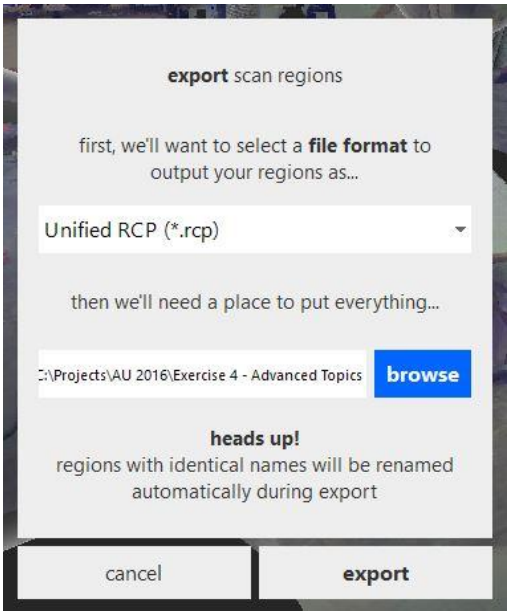


Placing your mouse on a Region in the Project Navigator will highlight it. You can change the highlight color by clicking on it in the Project Navigator row entry. Here you can also hide/show (clicking on the

'eye' icon) or isolate the Region (ALT+Click on the 'eye' icon). Hide the 'Unassigned Points' region to show only the points associated with named Regions in the project.

Task 4: Use the hide/show/isolate tools to configure region visibility.

The visibility of Regions is considered in all export operations. In many workflows, Regions are used to segment the project for distribution to different groups of people (to use in other Autodesk products). For example, mechanical system data may go to an MEP team, while structural data goes to another team. To support this, ReCap Pro allows you to export an entire group of Regions in a batch fashion (one Region per file). To use the feature, click the Export (up arrow) button on the Region Group (the default/header group, or your own custom group). You'll be prompted to choose or create an output folder and an export format. Click 'export' and you'll get one file per region.



Task 5: Export a group of Regions to Unified RCS.