AUTODESK UNIVERSITY

# Connecting Substation P&C Drawings to Mesh Models with an iPhone/iPad Lidar


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Ameren


**Ameren Service Map**

# Ameren Subsidiaries

- ## Ameren Missouri
  - 1.2 million customers in central and eastern Missouri, including the greater St. Louis area.
  - Generating capacity is approximately 10,800 megawatts (MW).
    - 1 Nuclear Facility, 4 Coal-fired Facilities, 8 CTG's, 3 Hydro Electric Facilities, 5 Renewable Facilities and 2 Wind Facilities.

- ## Ameren Illinois
  - Ameren 1.2 million customers in more than 1,200 communities, with a service territory spanning 43,700 square miles.
  - Delivery system includes approximately 4,500 miles of electric transmission lines and 46,000 miles of distribution lines.

- ## Ameren Transmission
  - Operates as a transmission-owning member of the Midcontinent Independent System Operator, Inc. (MISO), a regional transmission organization serving a 15-state region and parts of Canada, including the service territories of the Ameren utilities.

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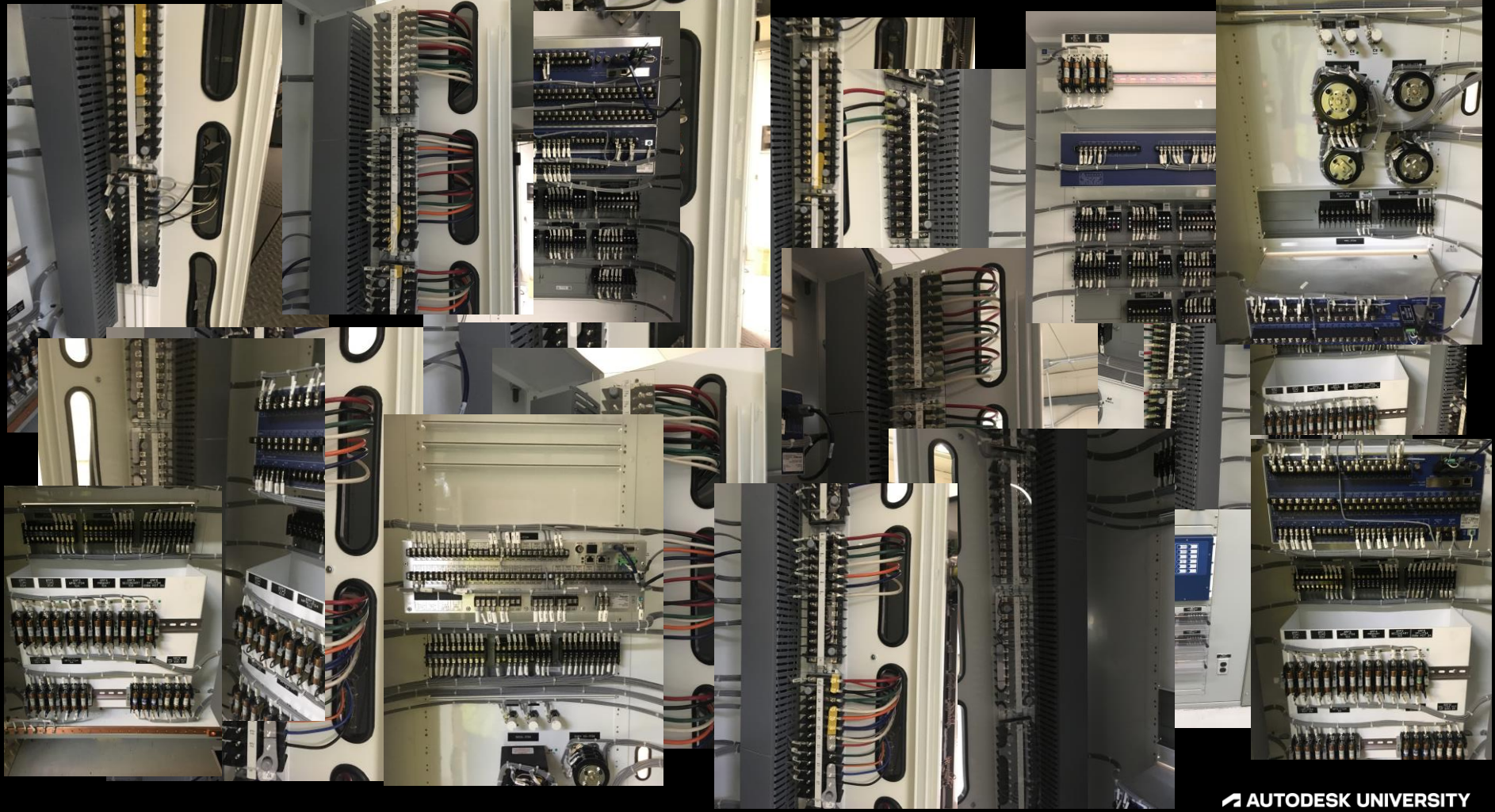
# 2015



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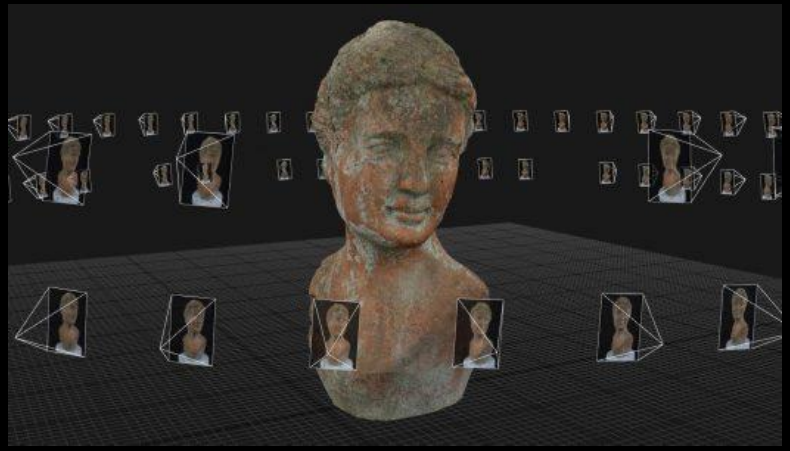
# Photogrammetry




Dashboard
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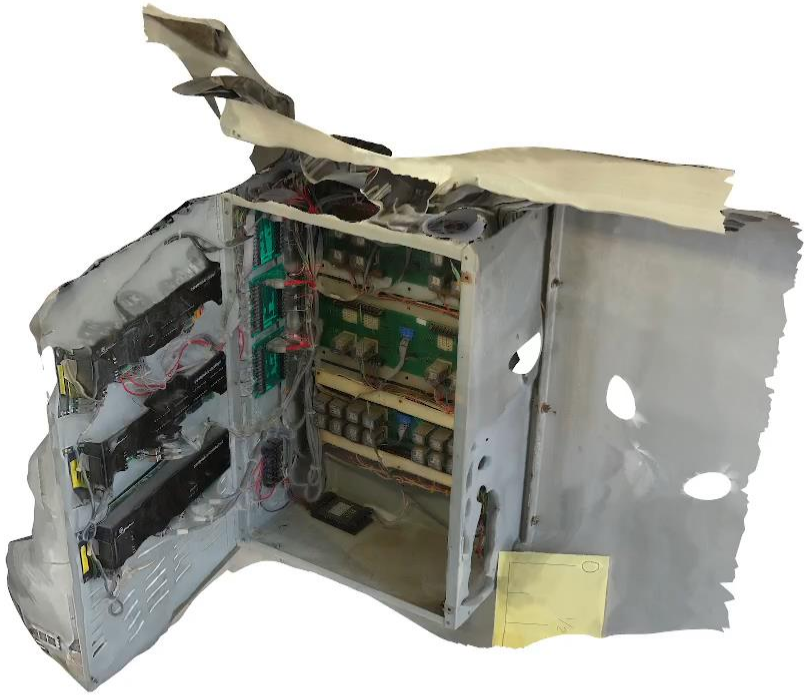
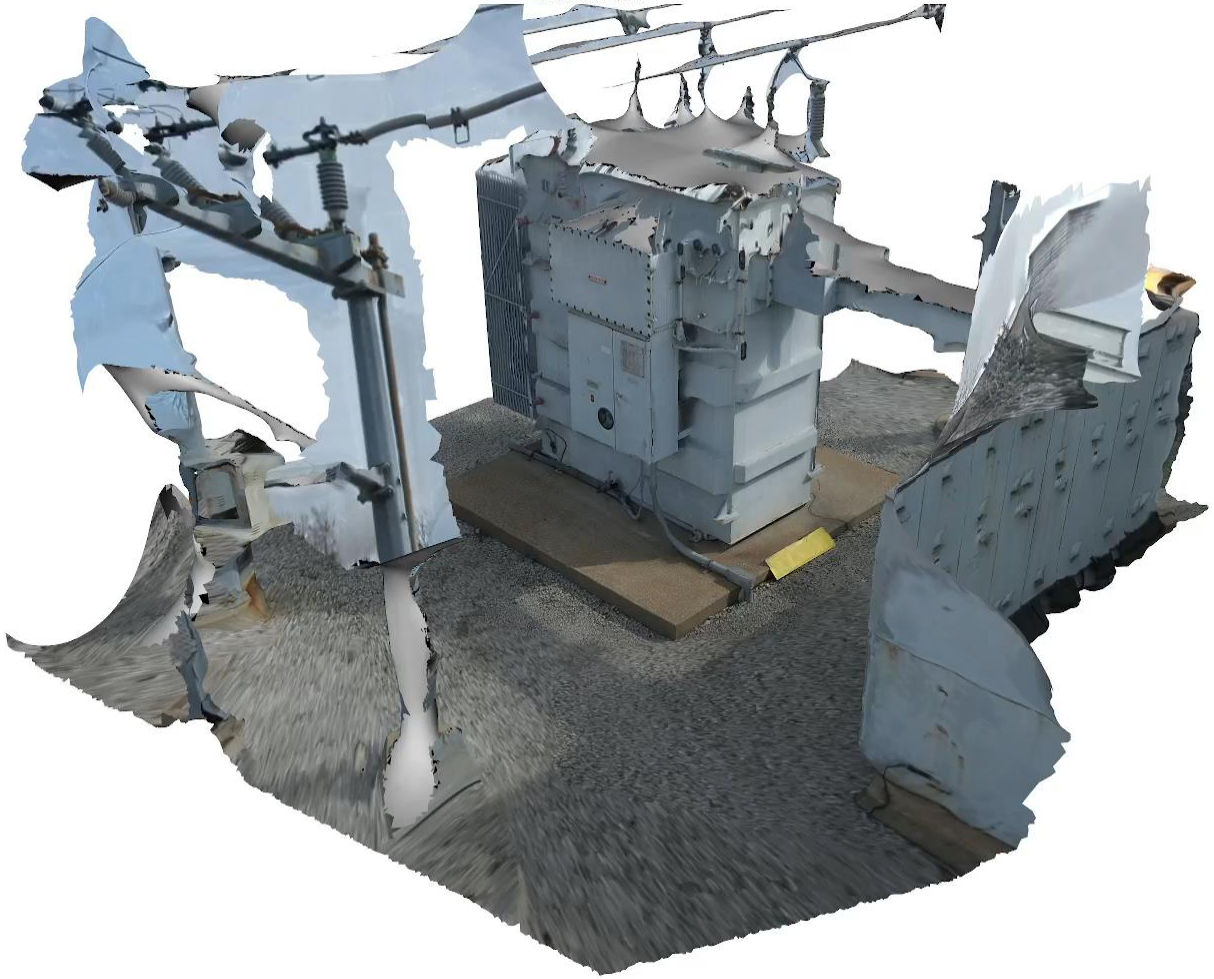
jack test 3.rcm - ReMake
Sign In

# Art  vs. Science

# Art vs. Science

# Art vs. Science





# Converting photos to 3D models

INNOVATION

:: BY AMEREN JOURNAL STAFF ::

Ameren Missouri co-workers are experimenting with new 3D technology that could improve processes for a number of work groups throughout Ameren.

**Jack Hopson**, supervisor, Mechanical Design & CAD Development, Energy Delivery, Ameren Missouri, has recently begun using Autodesk's ReCap 360 reality capture software to create accurate and detailed 3D-imaged models using standard photographs.

This image of a switchgear panel was generated with the ReCap 360 3D software. ReCap 360 creates three dimensional models to improve the way Ameren co-workers design, maintain and repair many infrastructure components.

Using almost any type of camera, co-workers take pictures of a room, substation, or vault they want to capture, in a complete 360-degree circle. They snap between 50 and 250 pictures, or about every 5-10 degrees. The software then combines and manipulates the images into one 3D imaged model.

Hopson recently used the software to create a 3D image of the interior switch gear at the Chouteau substation. Multiple pictures were taken of the interior of the switch gear and specific wiring panels. When the pictures were completely modeled, the finished product allowed viewers to manipulate the image for different views and to zoom in to read labeling.

This method records the equipment at that moment in time and allows co-workers to complete field verifications via computer. The image model can be imported into an intelligent model or even be 3D printed.

"I see a number of ways that this technology could potentially be used at Ameren," says Hopson. "Right now we're still experimenting, but I'm excited to see how it might shape our design strategy in the future."

Hopson says substation design is another potential area that could benefit from the modeling. He recently started a pilot with Autodesk to create a typical 2-unit substation in 3D design. Traditional substation design requires designers to manipulate several different "views" of the design. When changes need to be made to the design, designers have to change each individual view, which can take days. However, with intelligent 3D models, each view of the design can be updated at one time, reducing the time to hours.

Another benefit to 3D technology is improving safety. With 3D modeled images of underground vaults, crews can view the vault in great detail prior to completing any work or repairs. In addition, they can take the images with them on mobile devices, allowing them to identify problems and make necessary equipment repairs.

# As-Built Workflow

## PROS

Mesh Model of Asset

## CONS

Art vs. Science

Post Processing of Photos

File Size

# 2020


LiDAR Scanner

# Art  vs. Science

# Art vs. Science

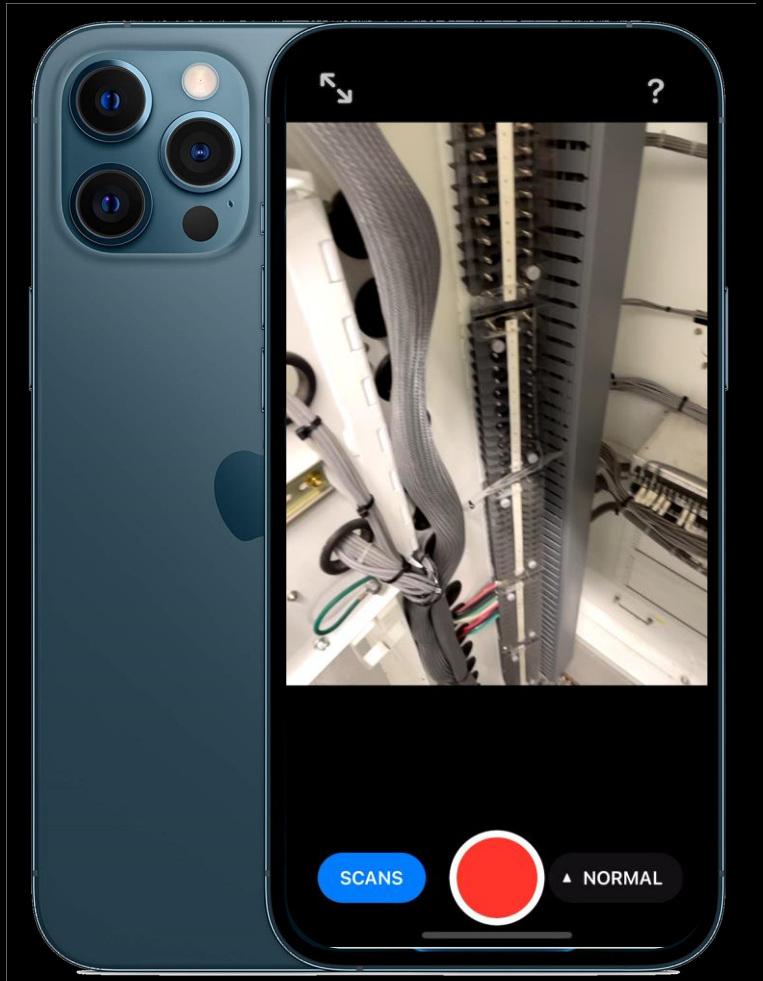
iPhone 12 Pro
256GB Capacity
A14 Bionic Chip
6GB RAM

iPad Pro (11”) (3rd Generation)
128GB Capacity
Apple M1 Chip
8-core GPU w/ 4 Performance Core
8GB RAM

# 3D Scanner App


Ameren
AUTODESK
BLUES
VISITOR

# iPhone 12 Pro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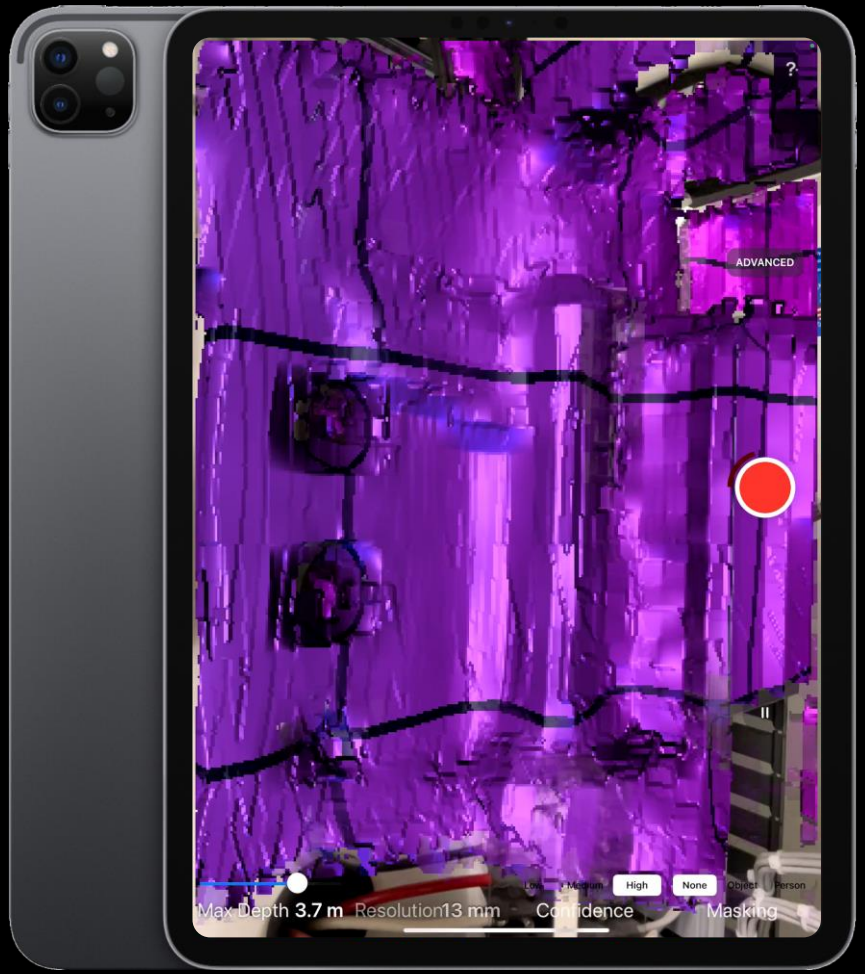
SCANS
NORMAL

# iPad Pro (11”) (3rd Generation)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Medium
High
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Object
Person
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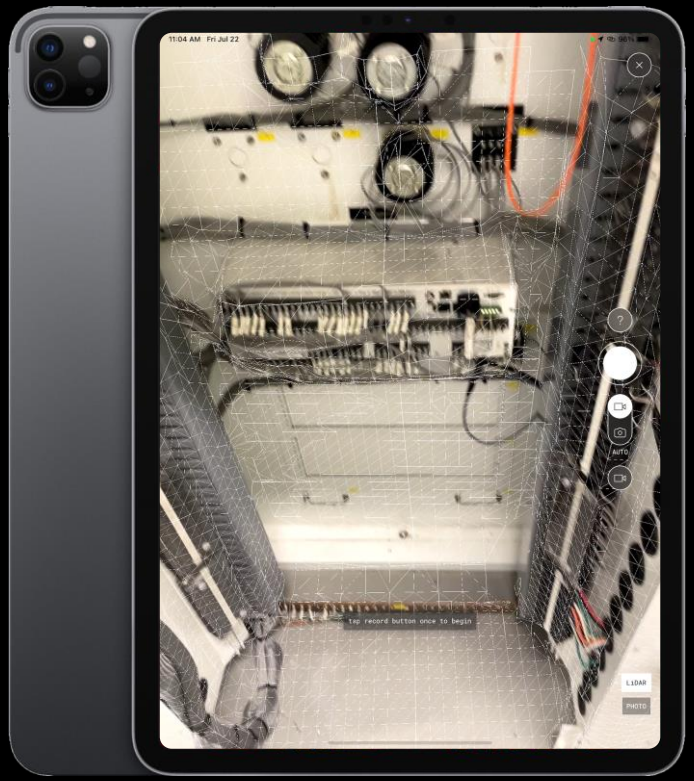
Resolution 13 mm
Confidence
Masking

Polycam

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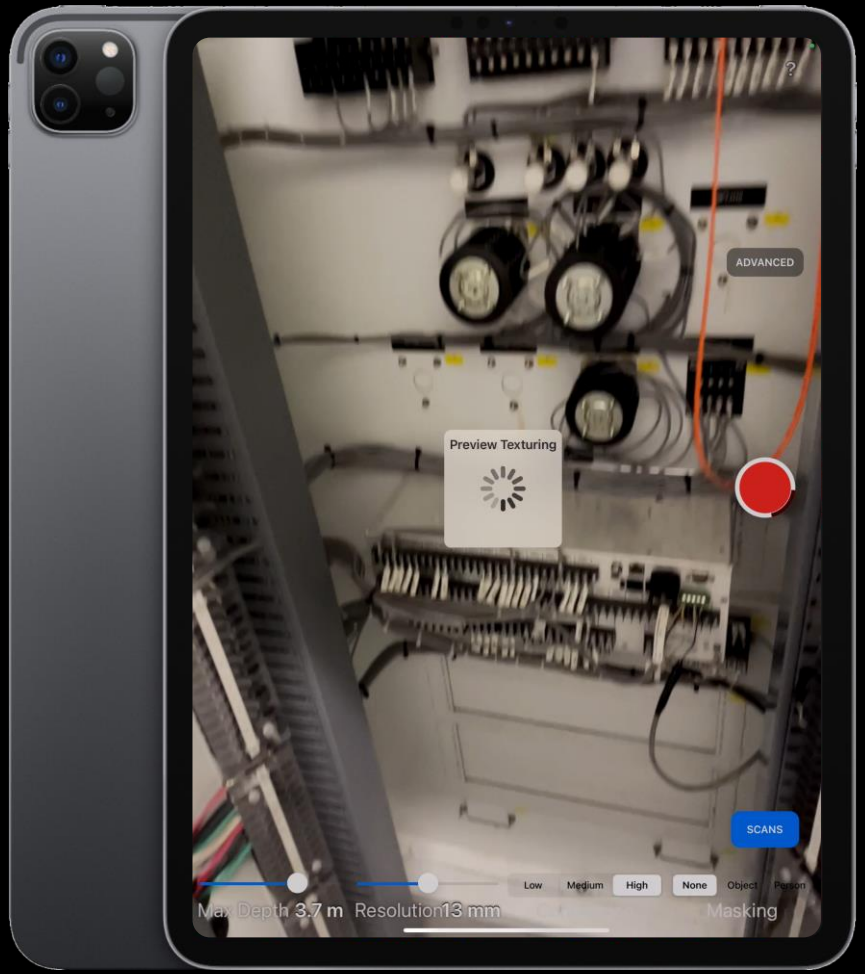
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Preview Texturing
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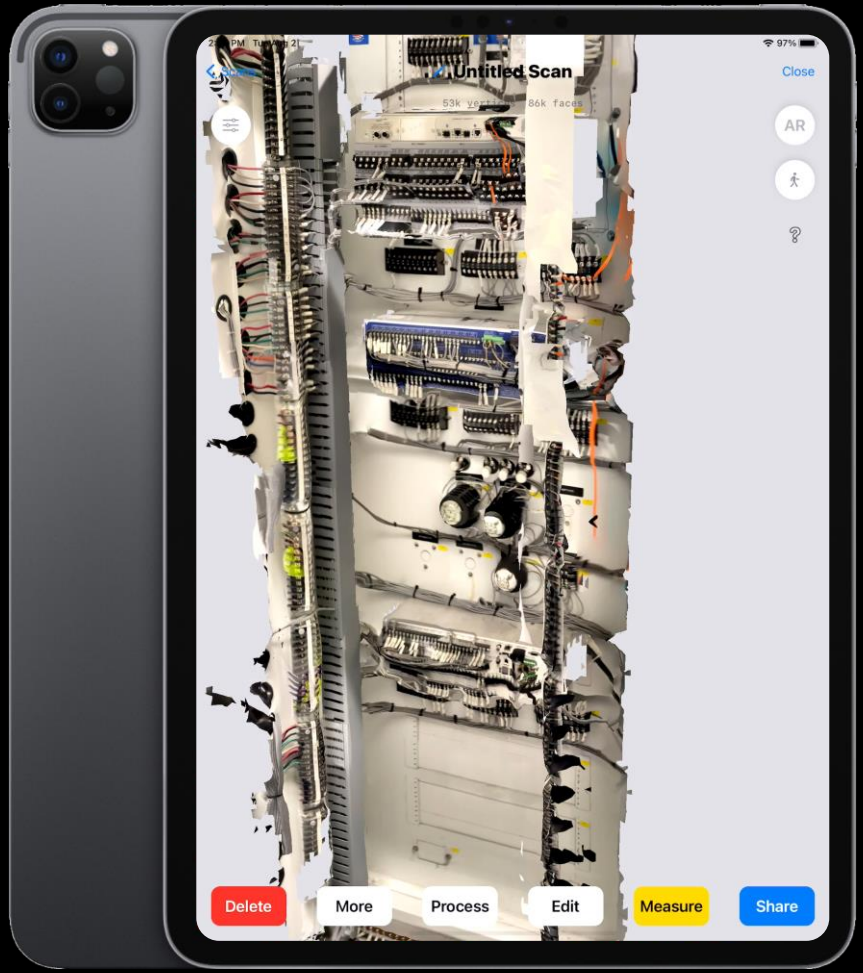
Person
Max Depth 3.7 m
Resolution 13 mm
Masking




AUTODESK
Construction Cloud

FBX


AUTODESK
Construction Cloud


A
FBX

Files - Autodesk Build

acc.autodesk.com/build/files/projects/fb1d0c32-eafd-4323-a296-89f0526bdeef?folderUrn=urn%3Aadsk.wipprod%3Afs.folder%3Aco.rZcpuCcSTnC-bcUig9nwwg&viewModel=detail&moduleId=folders

AUTODESK Construction Cloud

Build | OOH Demo | Jack Hopson

- Home
- Sheets
- Files
- Issues
- Forms
- Photos
- RFIs
- Submittals
- Meetings
- Schedule
- Assets
- Reports
- Members
- Bridge
- Settings

# Files

## Jack, manage your project's files here

Organize your files with folders and permissions, search files and folders, share with anyone.

Take the tour | Learn More | Register for course

Folders | Holding area

Deleted items | Settings

- Project Files
  - Dana's Data Set
  - Distribution Design
  - Pole Designs
  - Site Design
  - Vault Designs

Upload files | Export | Search and filter

| Name | Description | Version | Synced with Bridge | Markup | Size | Last updated | Updated by | Review status |
|---|---|---|---|---|---|---|---|---|
| Dana's Data Set | -- | -- | | -- | -- | Jul 15, 2022 12:59 ... | Jack Hopson | -- |
| Distribution Design | -- | -- | | -- | -- | Jul 8, 2022 4:27 PM | Jack Hopson | -- |
| Pole Designs | -- | -- | | -- | -- | Jul 8, 2022 3:36 PM | Jack Hopson | -- |
| Site Design | -- | -- | | -- | -- | Jul 8, 2022 3:37 PM | Jack Hopson | -- |
| Vault Designs | -- | -- | | -- | -- | Jul 8, 2022 3:36 PM | Jack Hopson | -- |
| 10 34 20.dwg | | V2 | | | 28.3 MB | Jul 8, 2022 10:35 AM | Jack Hopson | |
| 10 34 20.dwg.idw | | V1 | | | 83 KB | Jul 19, 2022 3:44 PM | Jack Hopson | |
| Untitled_Scan_12_16... | | V1 | | | 13.4 MB | Aug 3, 2022 2:31 PM | Jack Hopson | |
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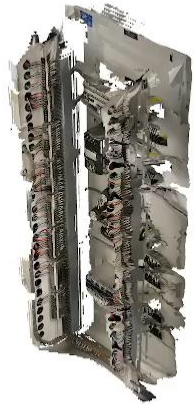
Showing 9 items



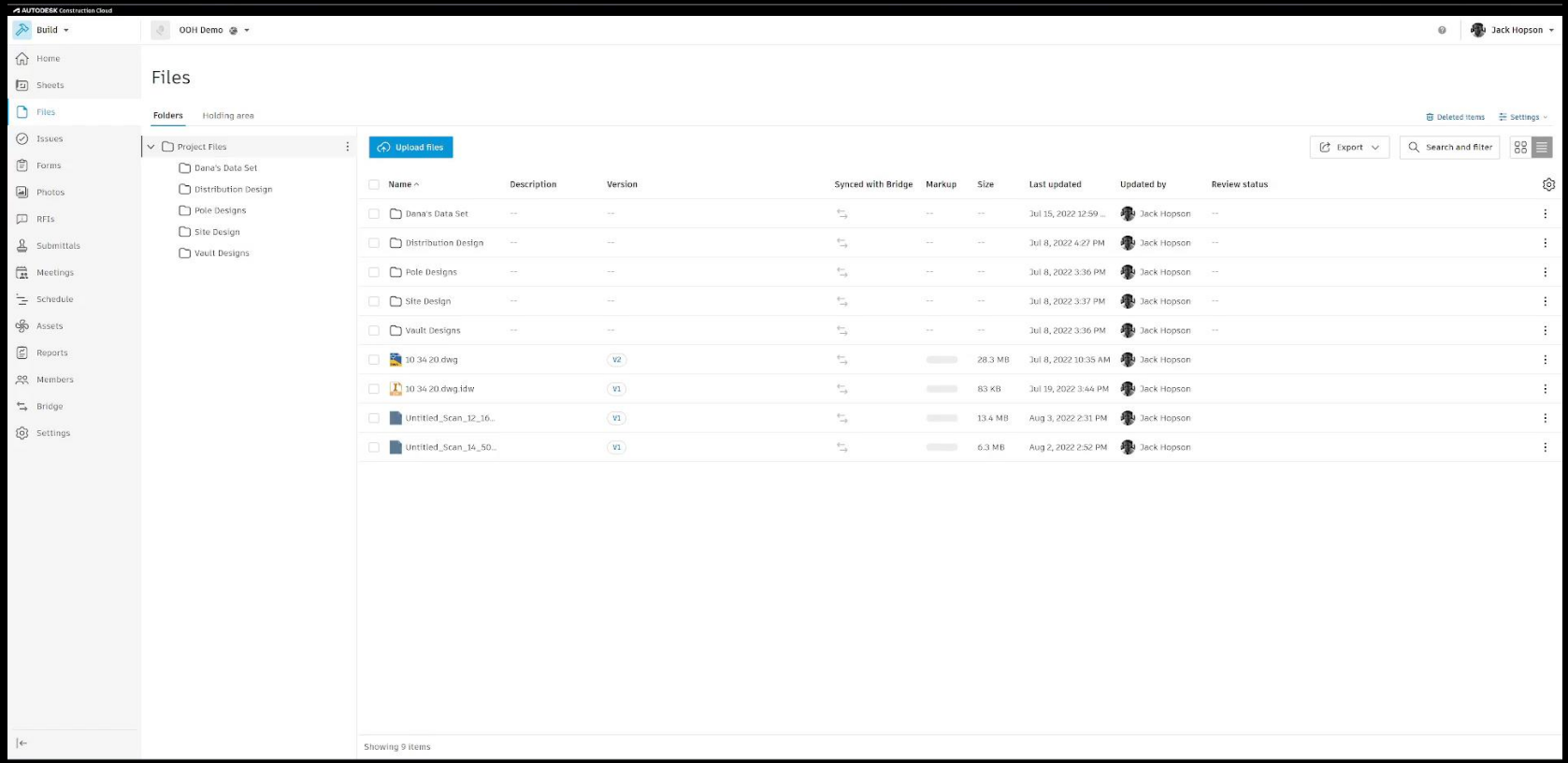
Autodesk ReCap Photo

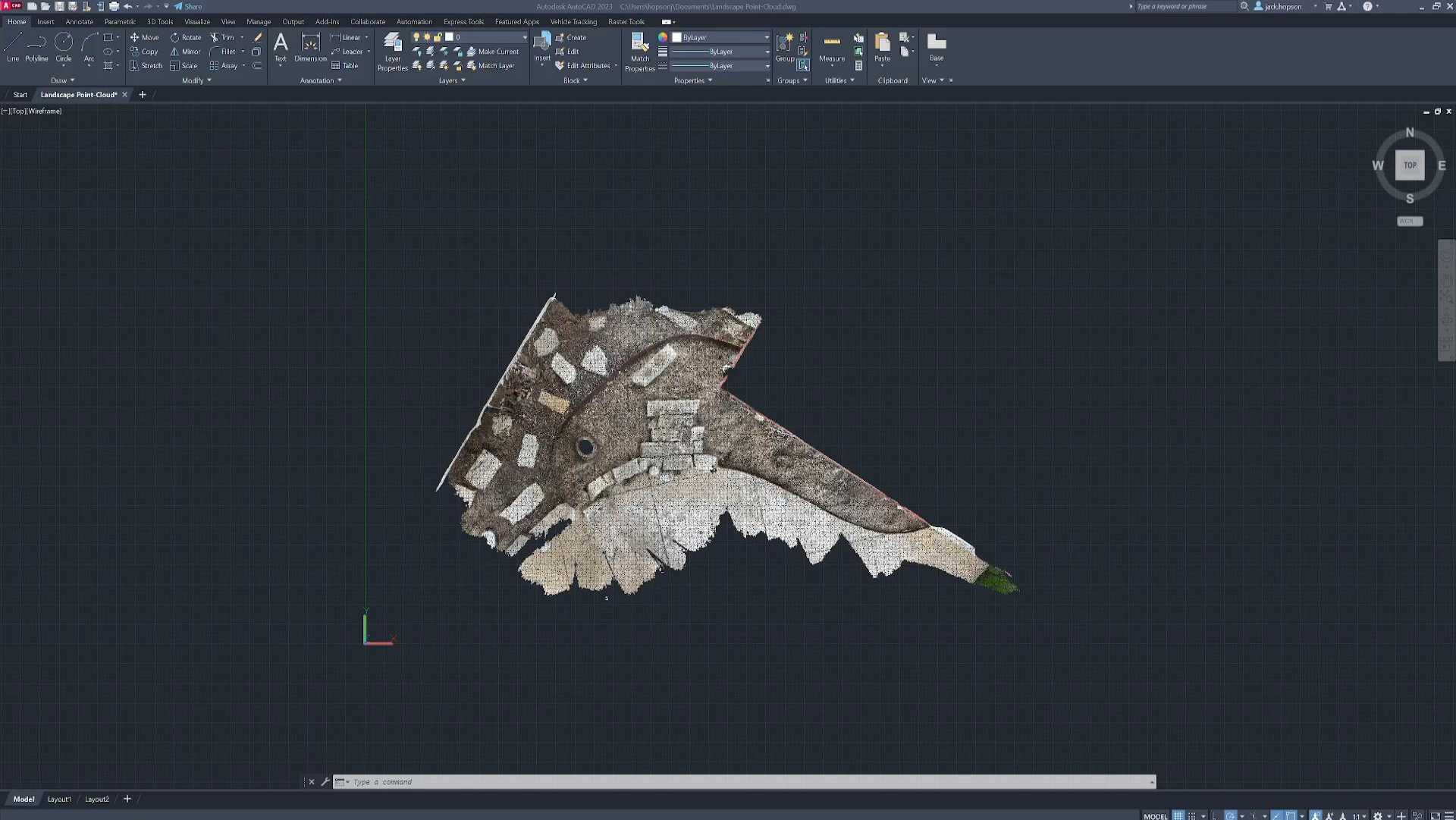


Microsoft
HoloLens


Courtesy of
AUTOMATIONFORCE

# AUTODESK Construction Cloud

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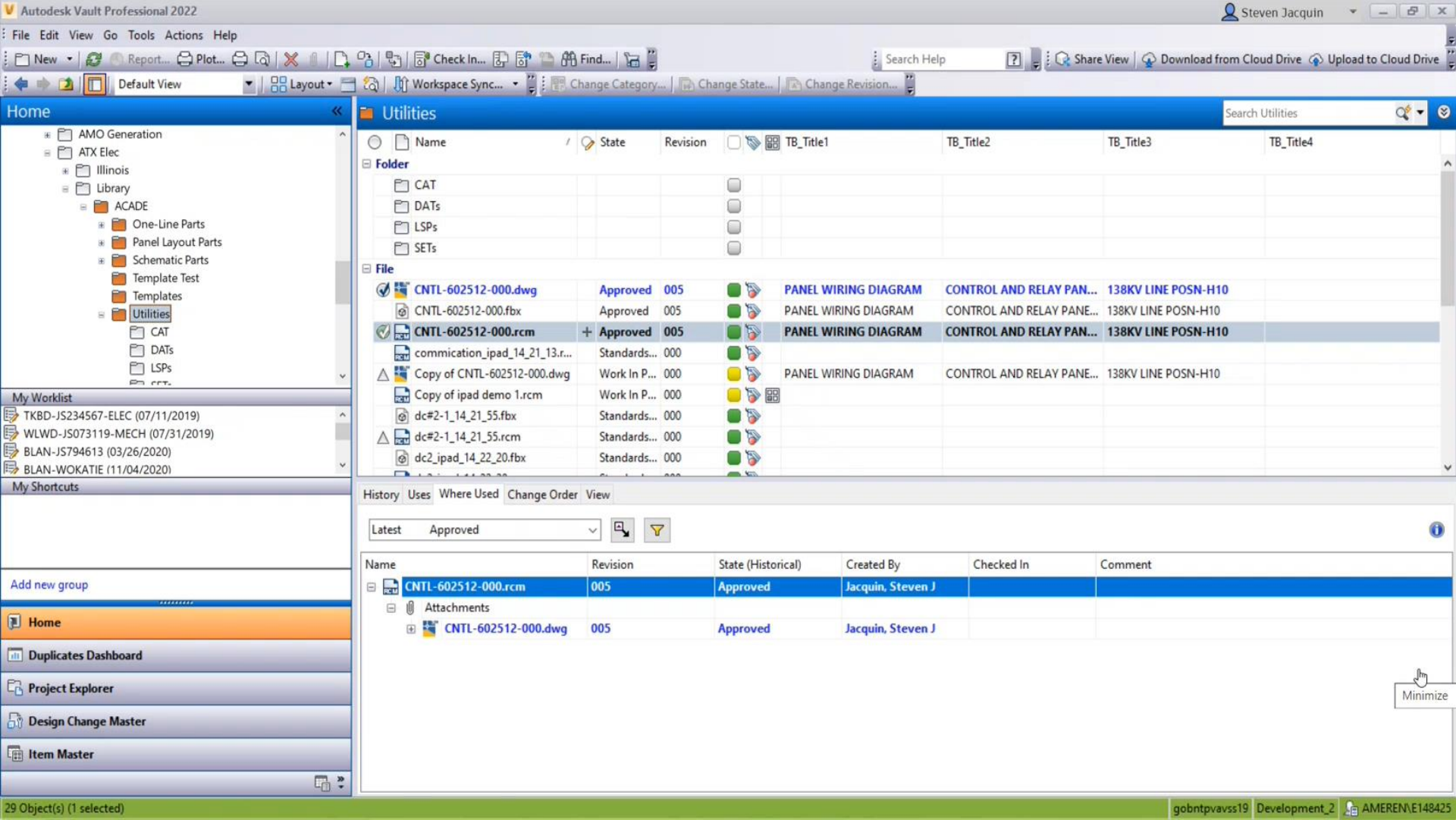
Line Polyline Circle Arc
Move Rotate Trim Copy Mirror Fillet Stretch Scale Array
Text Dimension Linear Leader Table
Layer Properties Make Current Match Layer
Insert Create Edit Edit Attributes
Match Properties ByLayer ByLayer ByLayer
Group Measure Paste Base
Draw Modify Annotation Layers Block Properties Groups Utilities Clipboard View
Start Landscape Point-Cloud*
[-][Top][Wireframe]
N W TOP E S
Type a command
Model Layout1 Layout2

AUTODESK
Construction Cloud


V
PRO


Autodesk Vault Professional 2022
Steven Jacquin
File Edit View Go Tools Actions Help
New Report... Plot... Check In... Find...
Search Help
Share View
Download from Cloud Drive
Upload to Cloud Drive
Default View
Layout
Workspace Sync...
Change Category...
Change State...
Change Revision...
Home
AMO Generation
ATX Elec
Illinois
Library
ACADE
One-Line Parts
Panel Layout Parts
Schematic Parts
Template Test
Templates
Utilities
CAT
DATs
LSPs
My Worklist
TKBD-JS234567-ELEC (07/11/2019)
WLWD-JS073119-MECH (07/31/2019)
BLAN-JS794613 (03/26/2020)
BLAN-WOKATIE (11/04/2020)
My Shortcuts
Add new group
Home
Duplicates Dashboard
Project Explorer
Design Change Master
Item Master
Utilities
Search Utilities
Name
State
Revision
TB_Title1
TB_Title2
TB_Title3
TB_Title4
Folder
CAT
DATs
LSPs
SETs
File
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History Uses Where Used Change Order View
Latest Approved
Name
Revision
State (Historical)
Created By
Checked In
Comment
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Attachments
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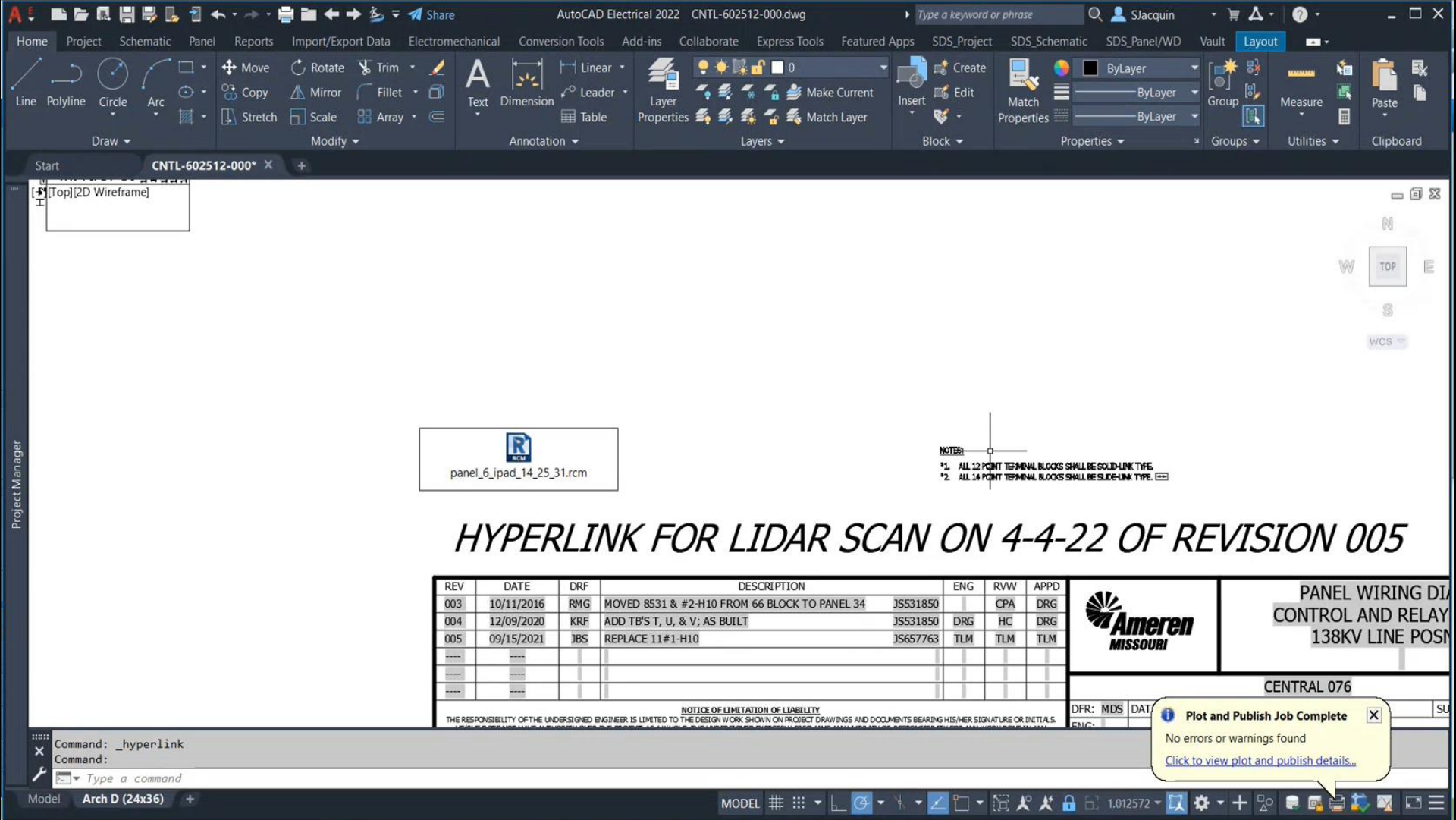
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Draw Modify Annotation Layers Block Properties Groups Utilities Clipboard
Start CNTL-602512-000*
[Top][2D Wireframe]
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NOTES:
*1. ALL 12 POINT TERMINAL BLOCKS SHALL BE GOLD-LINK TYPE.
*2. ALL 14 POINT TERMINAL BLOCKS SHALL BE SLIDE-LINK TYPE.
HYPERLINK FOR LIDAR SCAN ON 4-4-22 OF REVISION 005
REV DATE DRF DESCRIPTION ENG RVW APPD
003 10/11/2016 RMG MOVED 8531 & #2-H10 FROM 66 BLOCK TO PANEL 34 JS531850 CPA DRG
004 12/09/2020 KRF ADD TB'S T, U, & V; AS BUILT JS531850 DRG HC DRG
005 09/15/2021 JBS REPLACE 11#1-H10 JS657763 TLM TLM TLM
NOTICE OF LIMITATION OF LIABILITY
THE RESPONSIBILITY OF THE UNDERSIGNED ENGINEER IS LIMITED TO THE DESIGN WORK SHOWN ON PROJECT DRAWINGS AND DOCUMENTS BEARING HIS/HER SIGNATURE OR INITIALS.
Ameren MISSOURI
PANEL WIRING DI
CONTROL AND RELAY
138KV LINE POSN
CENTRAL 076
DFR: MDS
Plot and Publish Job Complete
No errors or warnings found
Click to view plot and publish details...
Command: _hyperlink
Command:
Type a command
Model Arch D (24x36)
MODEL

# Take Aways

iPad is preferred to iPhone

Use Autodesk Construction Cloud for file management

Technology not ready for wiring panel Art vs. Science

# Q & A


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