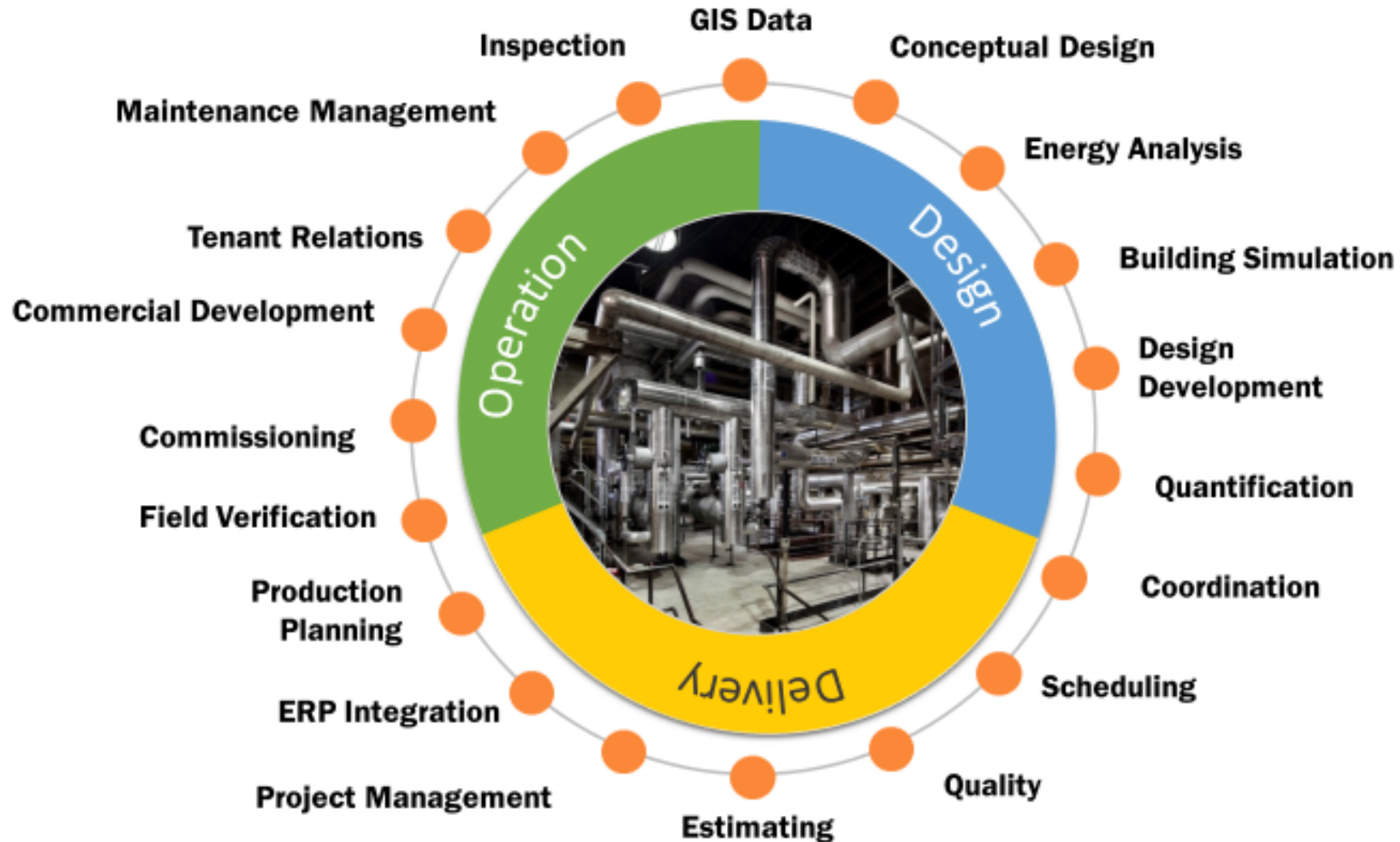


# Emerging Technologies Shaping a Data Driven Environment

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Peter Nelson | Jacobs



# Emerging Technologies



# Agenda

## 1. Importance of BIM

## 2. Reality Capture

- LiDAR
- UAVS
- 360 Cameras

## 3. Modeling

- Point Cloud to BIM
- Coordination
- Viewing

## 4. Cloud Based Data Analytics

- Digital Twin
- Smart Cities

# BIM Data Process

## Design Model

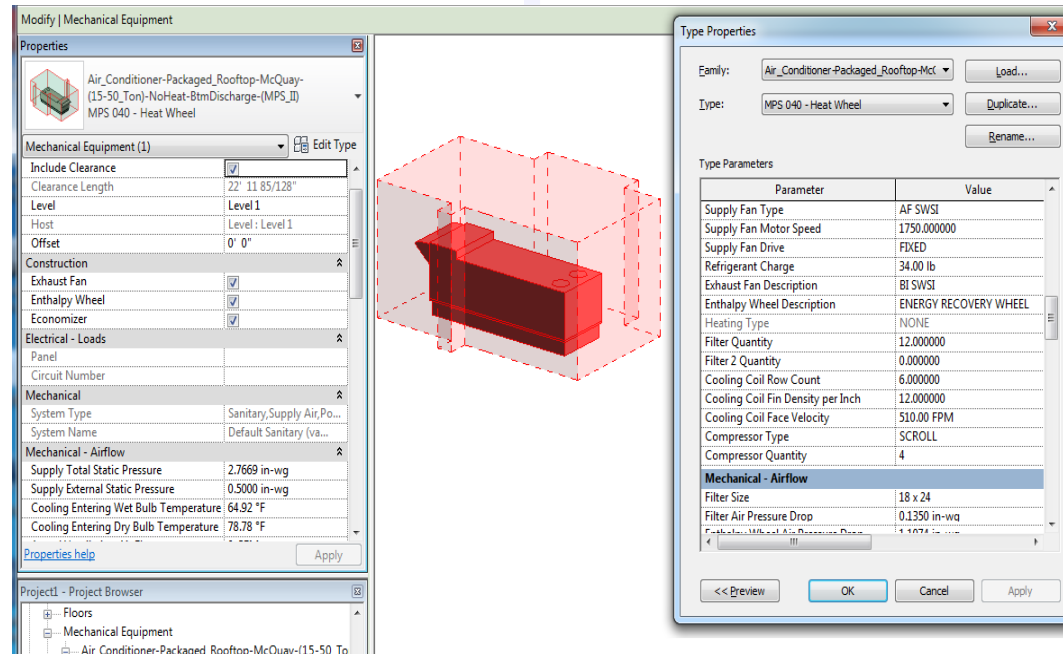


- Engineering data
- Manufacturer data
- Tag assets per owner specs
- Identify maintenance\clearance issues



## Construction

- Manage issues\checklists
- Attach equipment manuals\cutsheets
- Commissioning
- As-built model is maintained
- Training videos

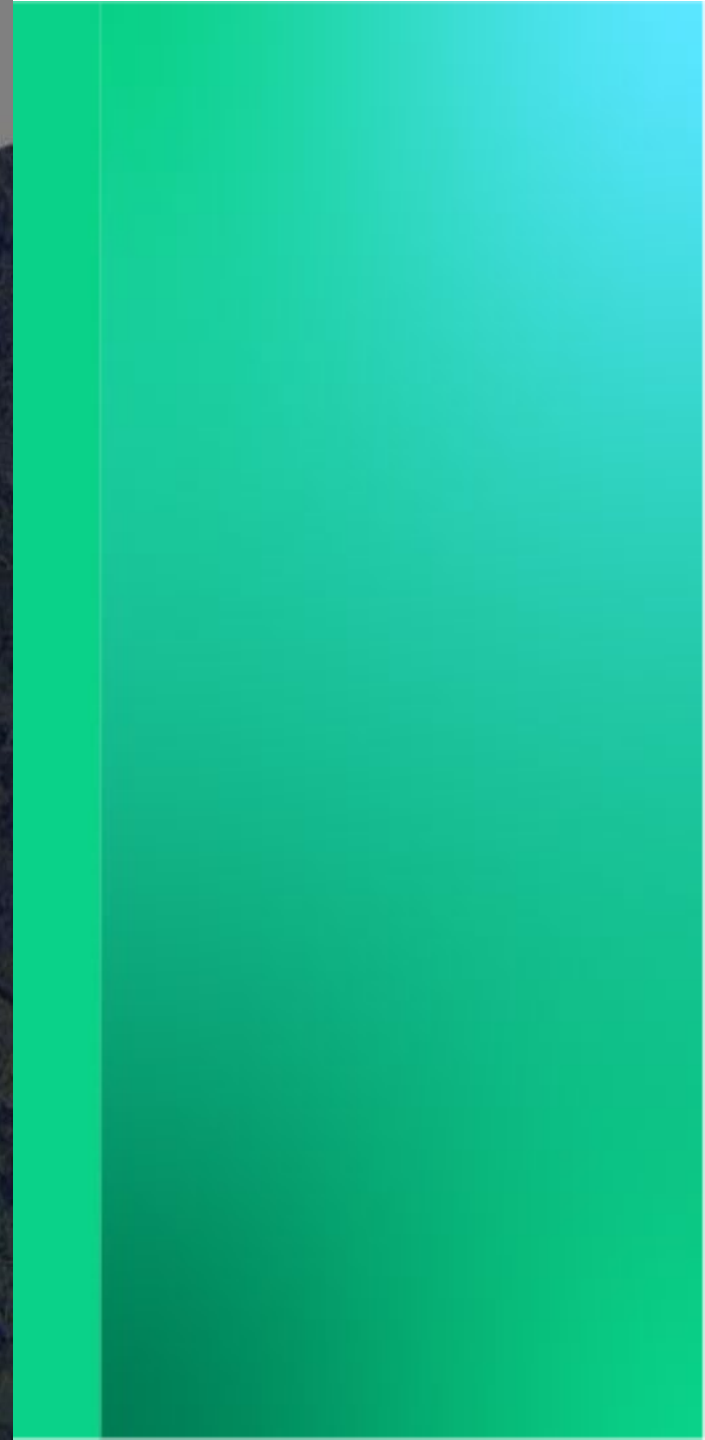


## Operations Maintenance



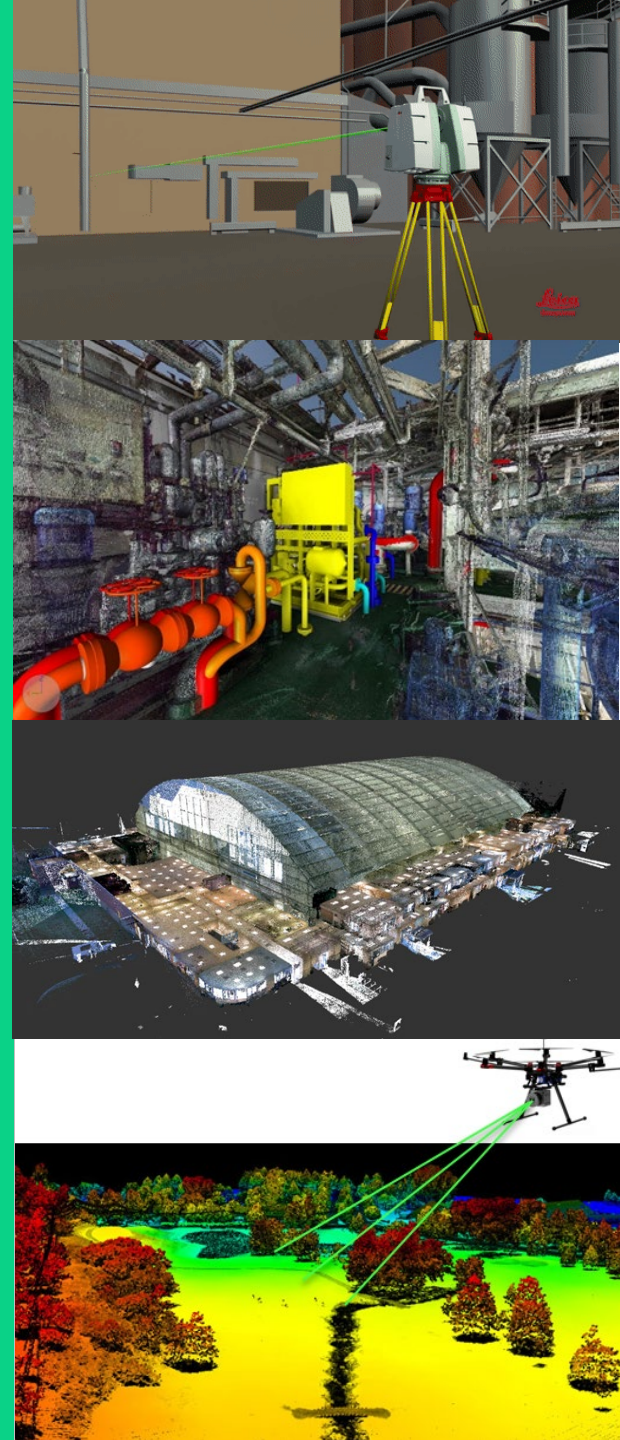


# Reality Capture Technology



# LiDAR

- **Light Detection and Ranging (LiDAR)** is a surveying method that measures distance to an object using laser light pulses.
- Methods of Collection: Terrestrial scanner, airborne scanners





# Terrestrial LiDAR Systems

- **LiDAR** uses laser light pulses to detect objects in real space
- **Terrestrial Lidar Systems**
  - Capture high-dynamic range imagery
  - Geo reference scans into BIM models
  - Augment your data capture with geo tags



# Airborne LiDAR

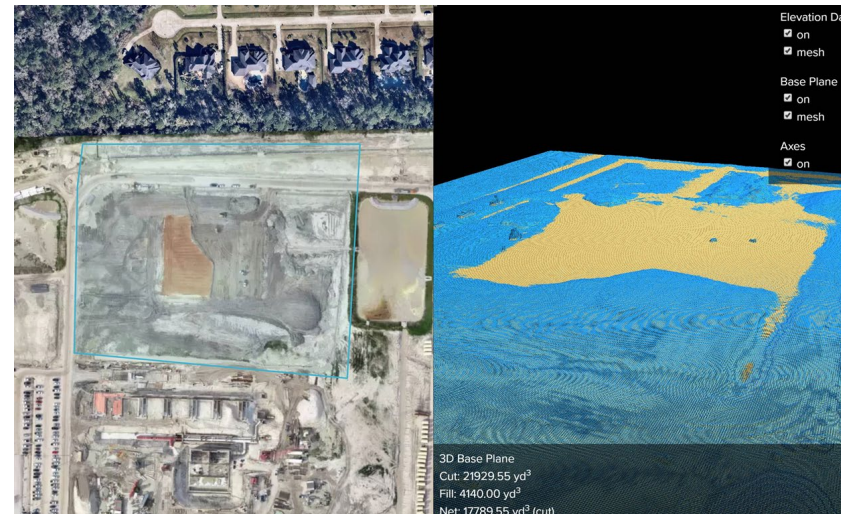
- UAS provide ability to cover large areas in short amount of time compared to terrestrial solutions
- Most UAS's on the market today have an integrated GPS so positioning is embedded into the dataset
- Because of the distance from the area of interest, the model doesn't have as high detail as terrestrial dataset and struggles with some types of surfaces (trees, water, etc)





# UAV Reality Capture

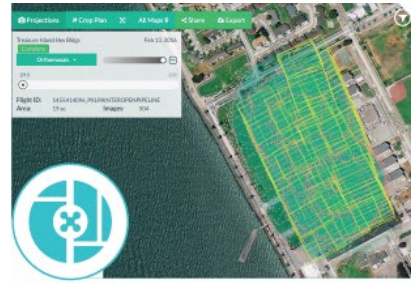
- Progress photo/video
- Install validation - QA/QC
- Site logistics and planning
- Volumetrics and QTO





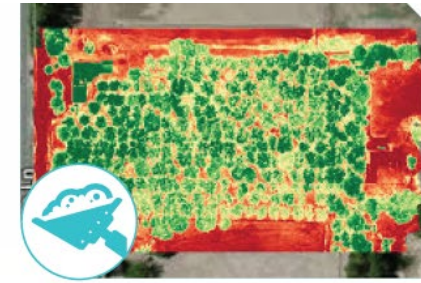
# UAS Use Cases

- Building inspections
- Imagery and video for real time monitoring
- Damage assessment after severe weather events
- As-built/construction record documentation
- Volumetric measurements (e.g. stockpiles)
- Land surveying and/or aerial imagery
- Inspection of hazardous areas
- Environmental assessments (e.g. wetlands, habitat/nesting)
- Construction/post-construction monitoring



## 3D MAPPING

Using applications such as **Pixel 4D** and **DroneDeploy**, we quickly create 3D maps that help assess the extent of the disaster zone.



## DEBRIS ANALYSIS

The drone is able to leverage technologies such as **LIDAR** and **GPS** to accurately inventory and measure field debris for cost estimates.



## INSPECTIONS

Drones are the most **cost-effective** way to inspect towers, bridges, structures, and other hard-to-reach elements **within minutes**.



## SURVEY

Before we send a field crew and inspectors into a site, drones help **minimize risk** by identifying **safe zones** for access and staging.



## GAIN CONSENSUS

With the ability to **live stream** drone video feeds, FEMA and PA TAC staff can provide **real time** input on decisions.



## DOCUMENTATION

**Project Worksheets** document site conditions with meaningful, **geo-referenced**, high-resolution photos, including video logs.

# 360 Photos & Videos

- The fastest and easiest way to document construction site progress
- View projects as if you were on-site
- Capture a complete record of your construction site to share with your team and your clients
- Improve workflow, collaboration, and transparency with a digital replica of your job site





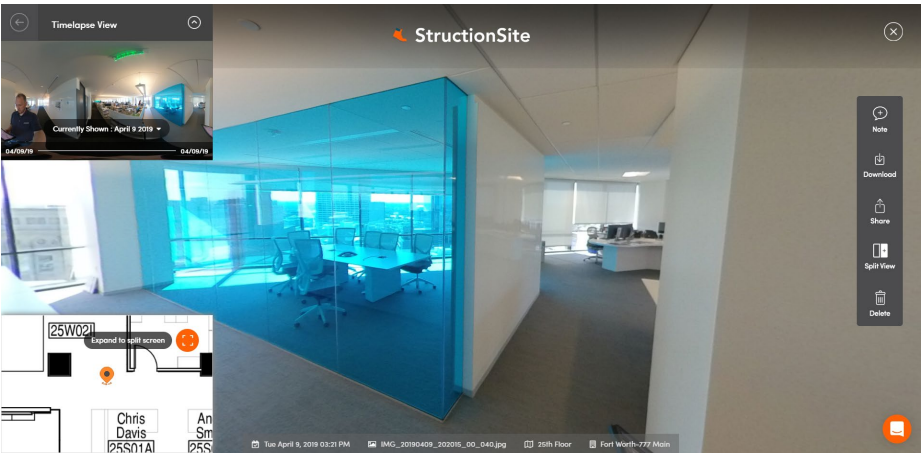
# 360 Camera Workflow



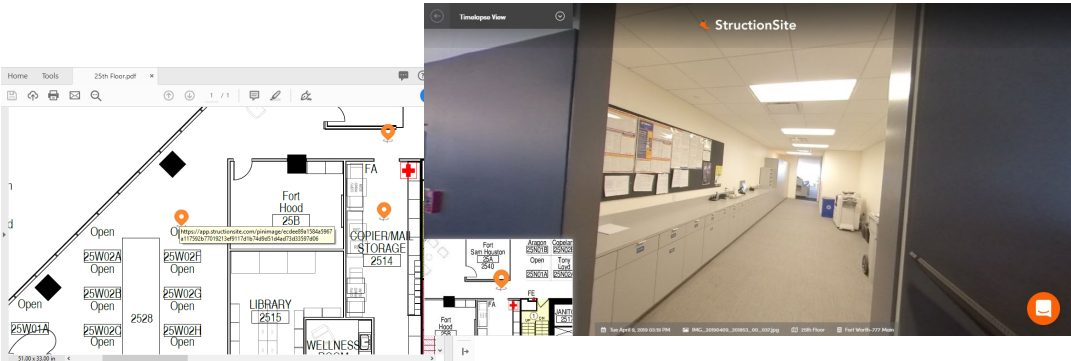
360 Photos



Upload to  
Cloud Platform



Cloud Based Dashboard



PDF with Linked Panos

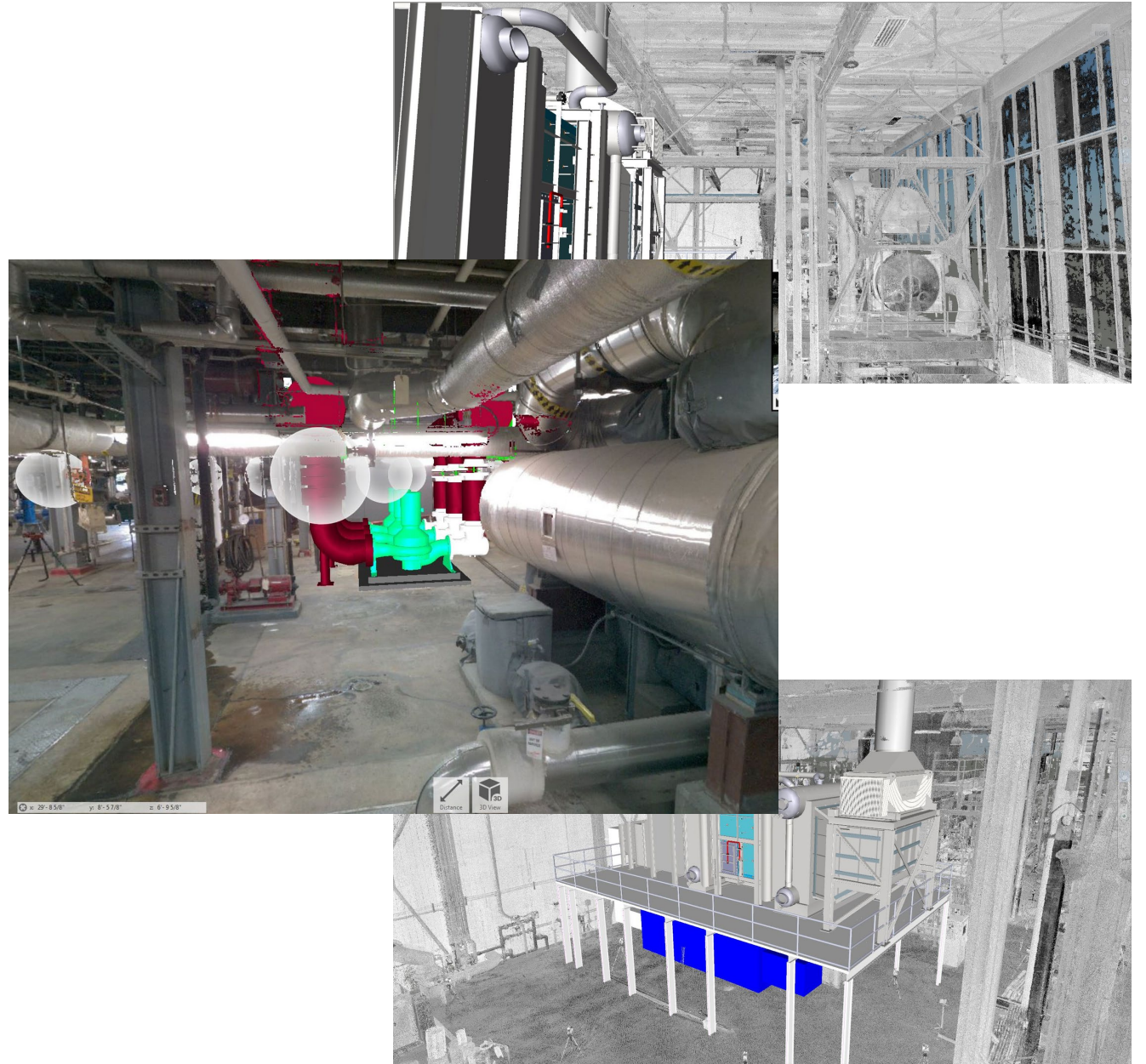


# Modeling



# Point Cloud

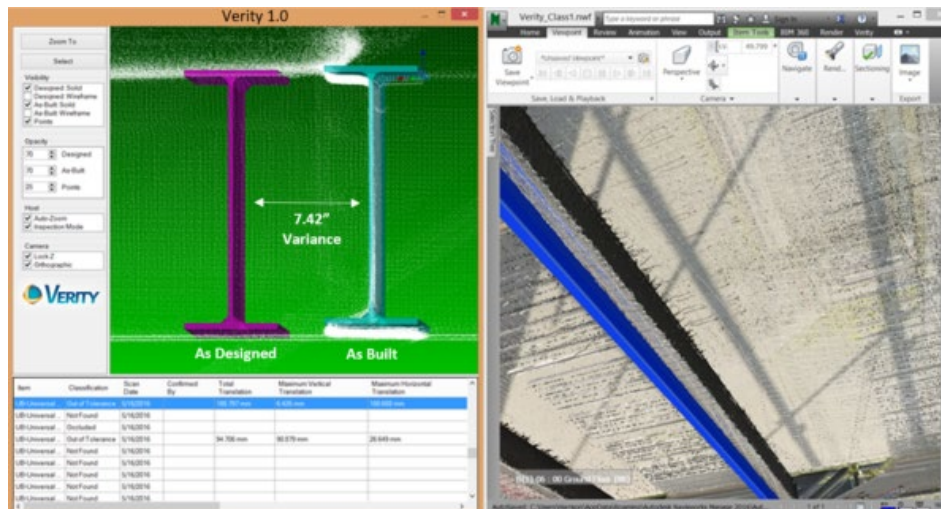
- A set of data points in space produced by LiDAR scanners
- 3D representation in a digital space
- Integrate 3D models into point cloud space
- Advantages
  - Collaborate between teams
  - Optimize on-site time
  - Renovation assessments
  - Develop accurate project budgets
  - Reduce cost
  - Reduce rework





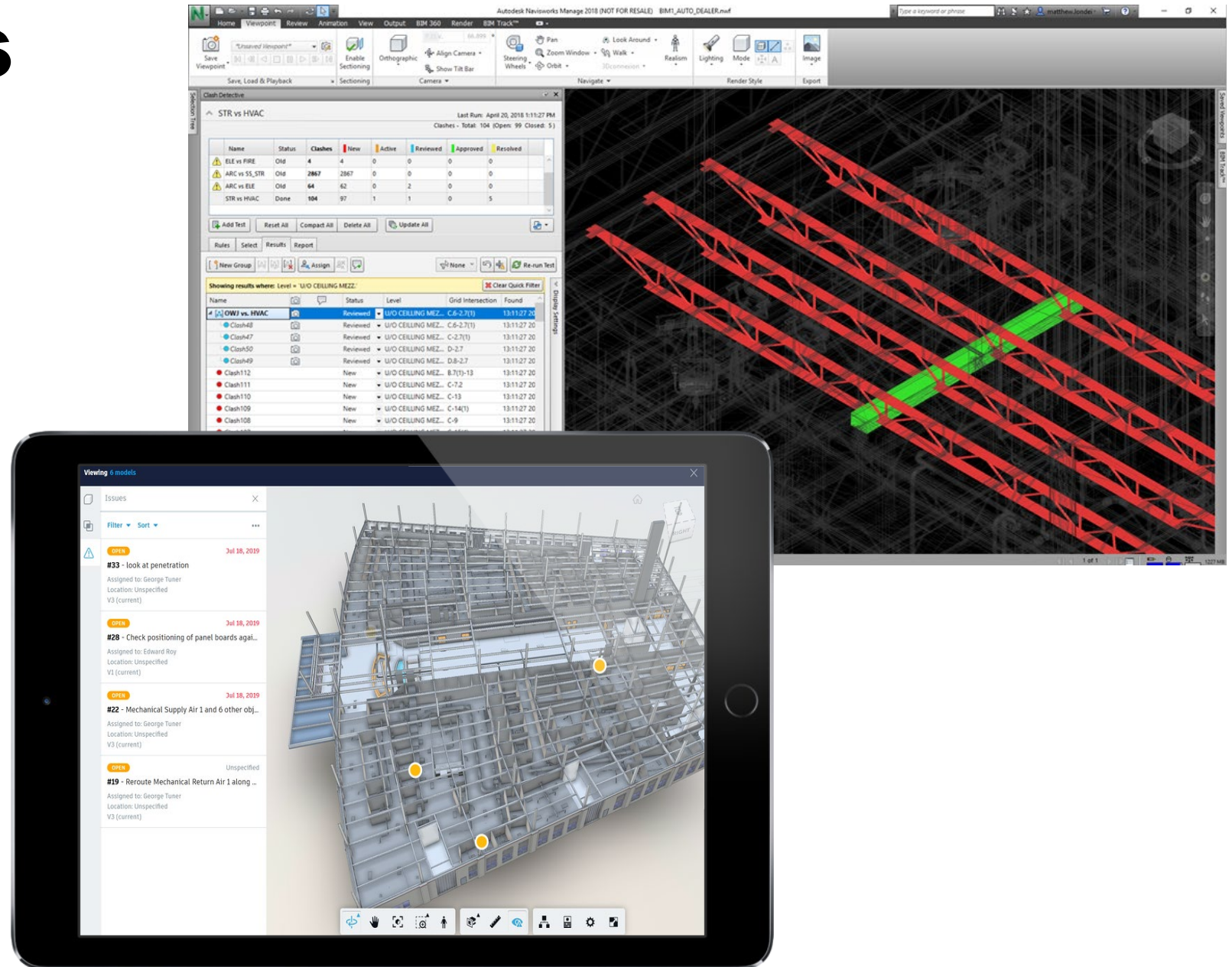
# Point Cloud to BIM

- Fully integrated with Revit
- Reduce modeling time by up to 70%
- Export mode to multiple BIM platforms
- Built-in catalogs
- AISC catalog



# Navisworks

- Clash detection
- Coordination
- Mobile access
- Revit clash integration



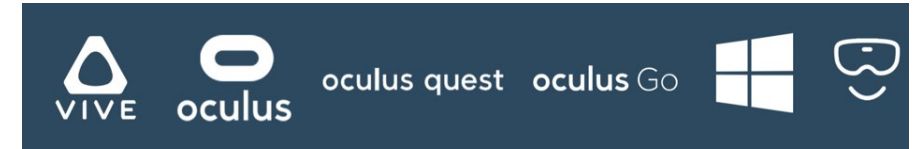
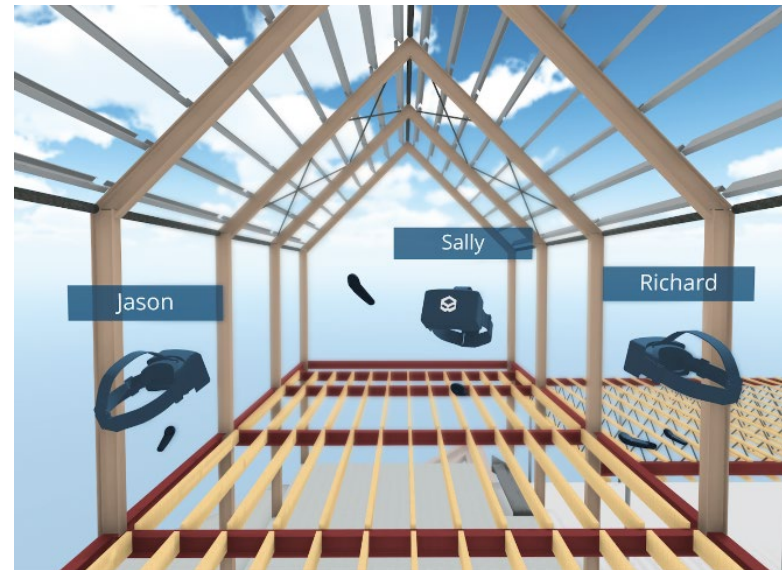
# **Viewing Technologies**





# Virtual Reality

An artificial environment created with software and presented to the user in a fully immersive way via a headset using sight and sound.



# Augmented Reality

Technology that works on computer vision based recognition algorithms to augment sound, video, graphics and other sensor based inputs on real world objects using the camera of your mobile device or headset.





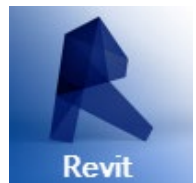
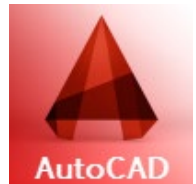
# Augmented Reality: Hololens

- On-site design collaboration
- Install validation - QA/QC
- Measuring
- Scaling
- Third party integration
- Track issues
- Facilities and maintenance

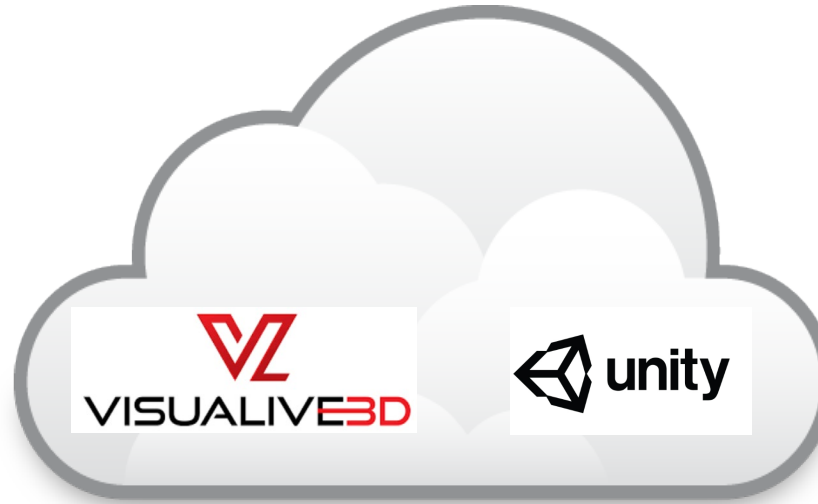
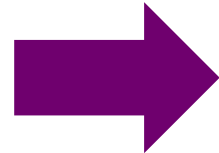




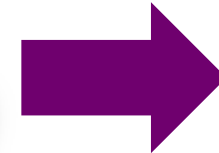
# Augmented Reality Workflow



**BIM Models**



**Cloud-Based Viewers**

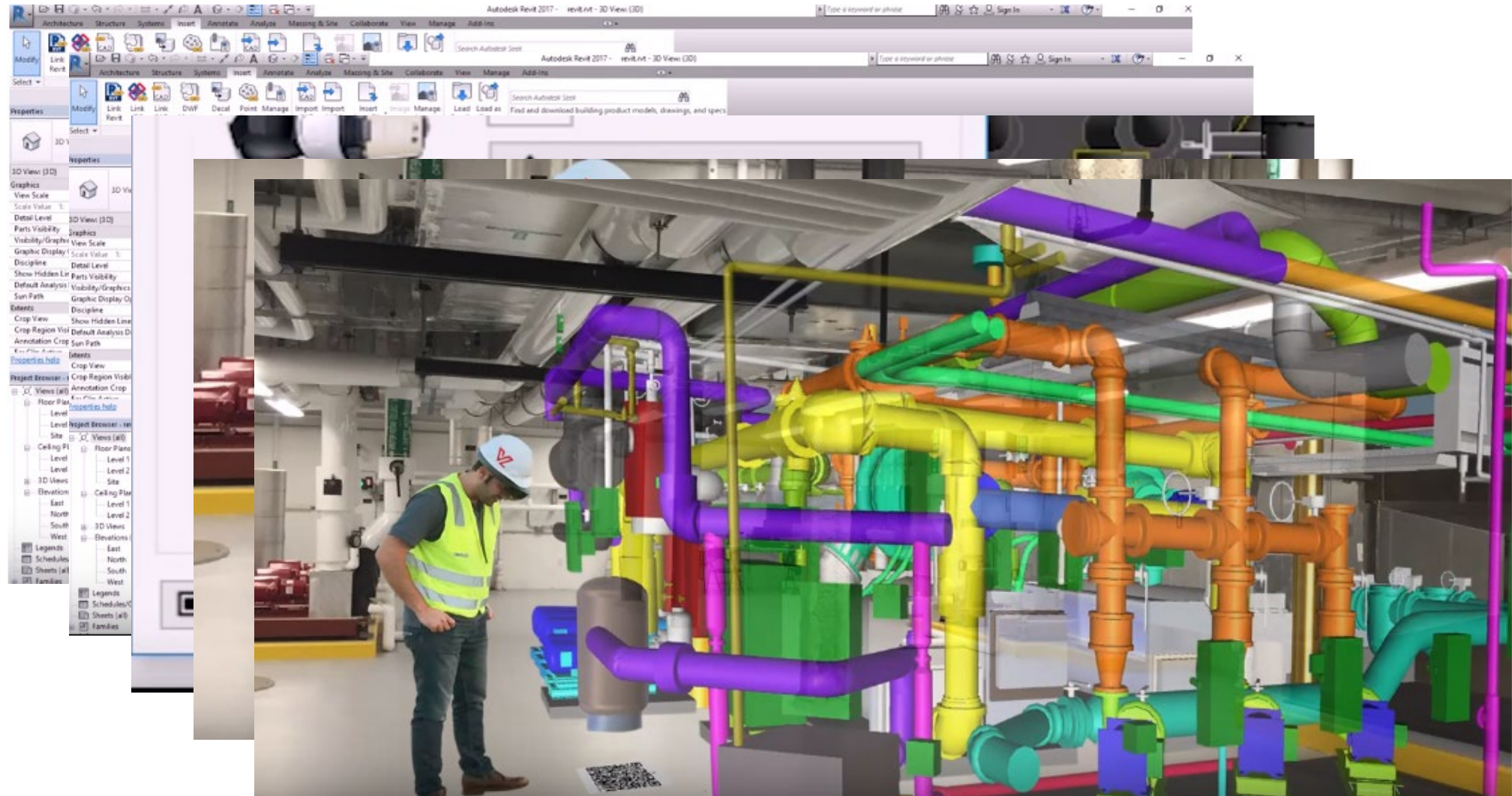


Microsoft  
HoloLens



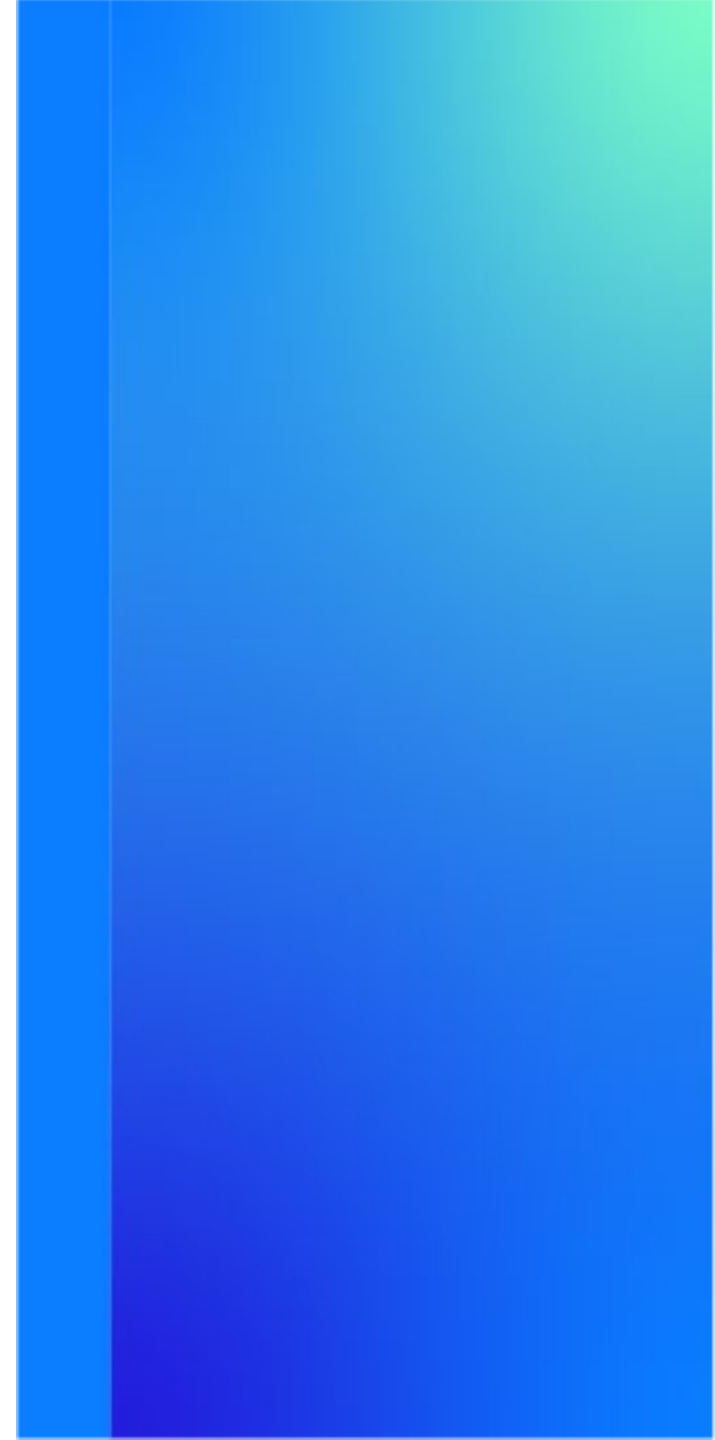
**Headsets**

# Augmented Reality: Model to Field



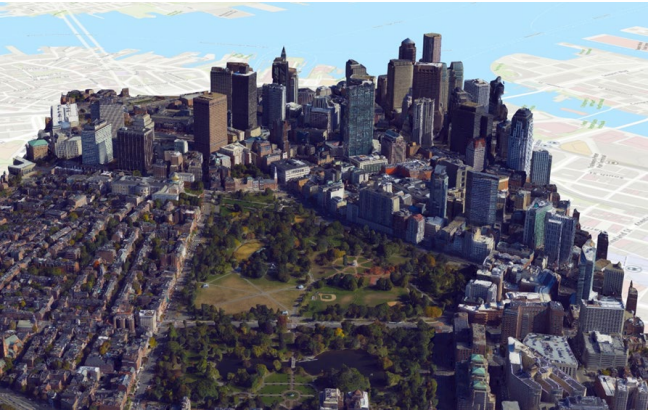


# **Cloud-Based Data Analytics**



# What is a Digital Twin?

## Physical Asset



Engineering

Data

Information

## Digital Twin



Asset Management

3D/4D visualization

Operator Training

Work Planning

Simulations

Master Planning

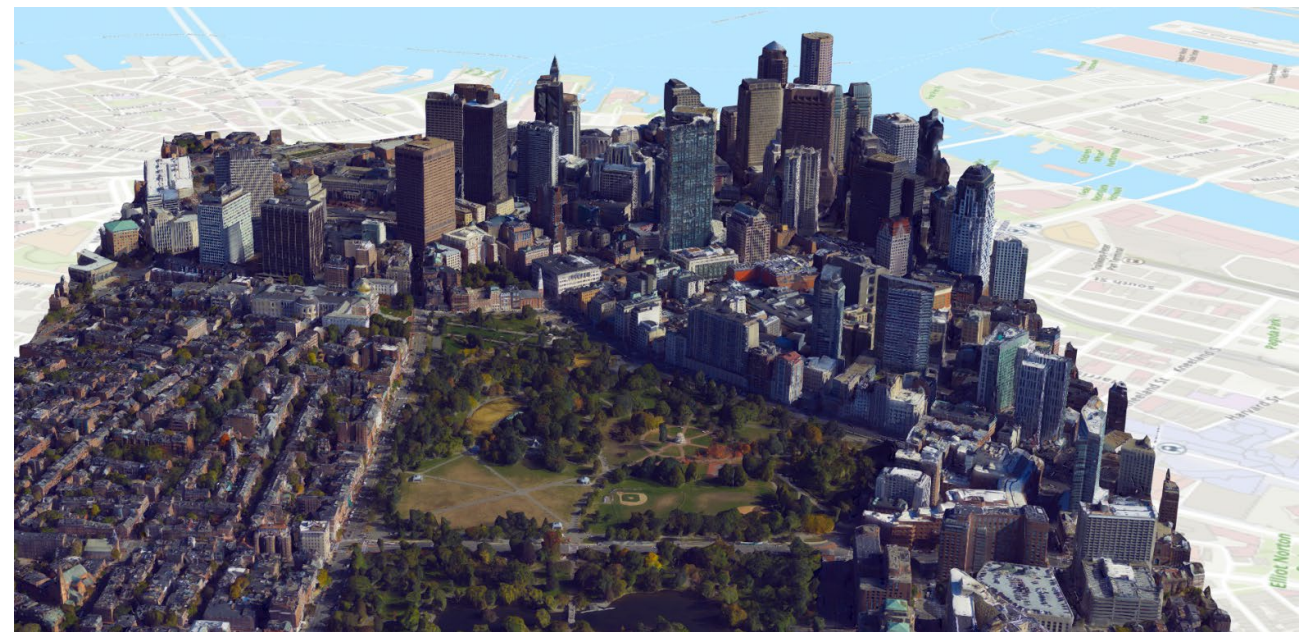
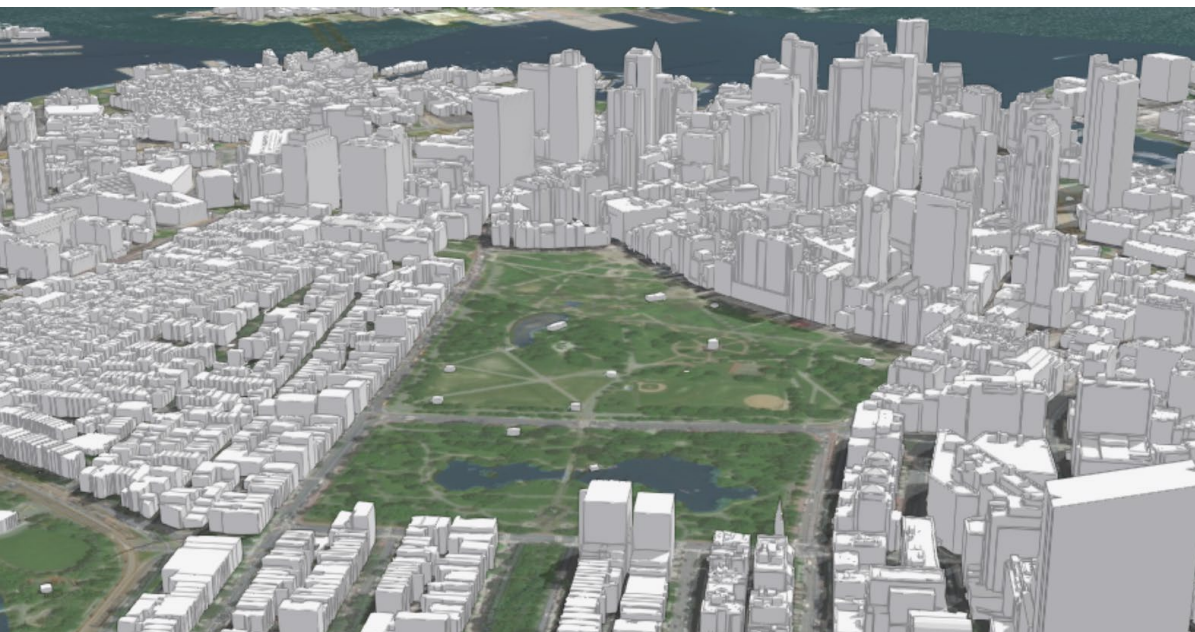
Data Analytics

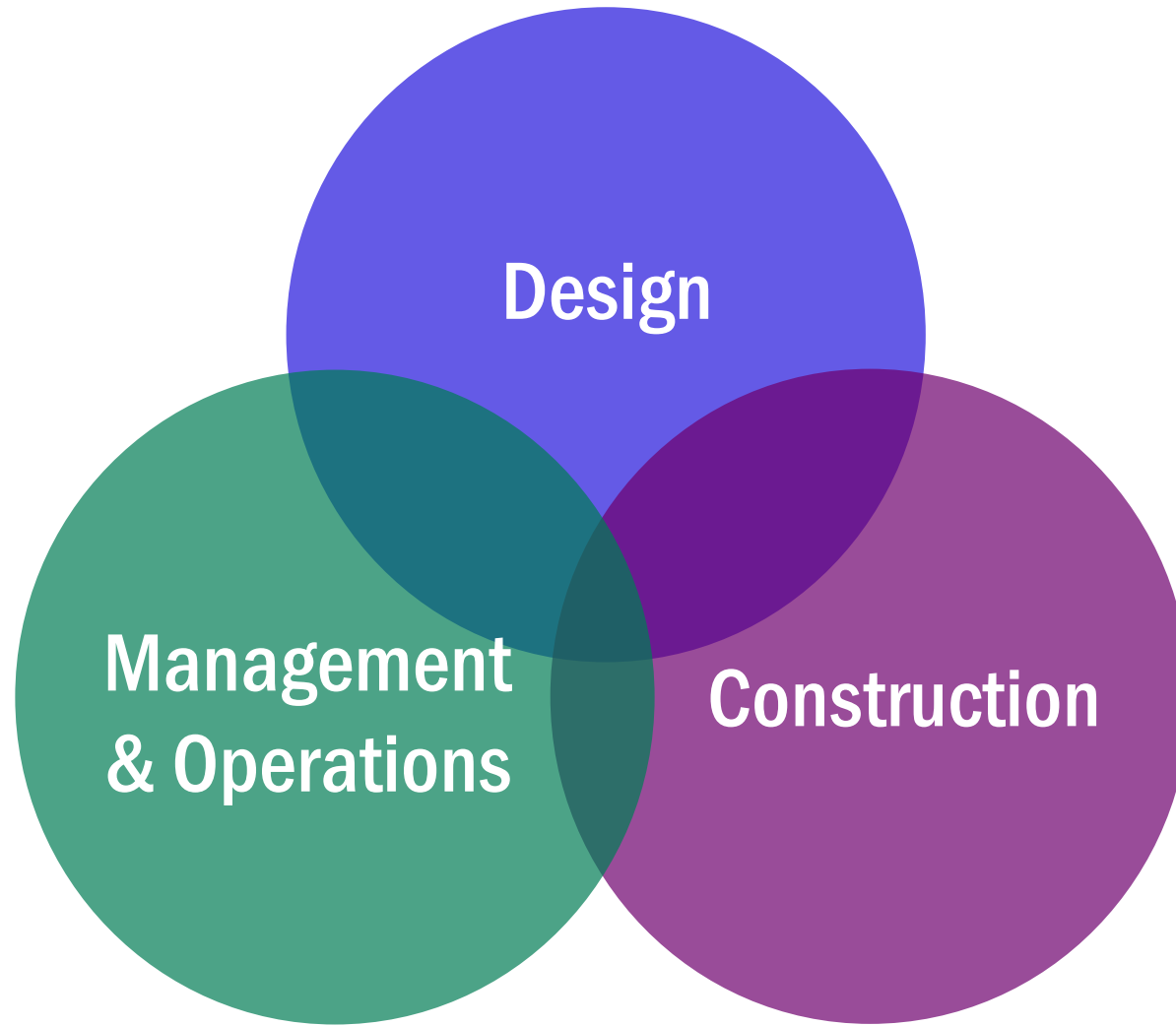
Design Coordination



# Smart Cities – 3D Digital Model

- Generate building footprints
- Produce fine elevation measurements using high resolution lidar; extrude 3D city model (ArcUrban)
- “Paint” model with oblique imagery (e.g. Autodesk 3ds Max)
- Elevated walkway and transit planning
- Architectural “sun-scaping”
- WiFi installation planning
- Open space analysis
- Smart lighting systems
- Solar load prediction





# **SMART INTEGRATION**



# Questions?

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