How, When, and Where Handheld Scanners Can Be Used in Construction

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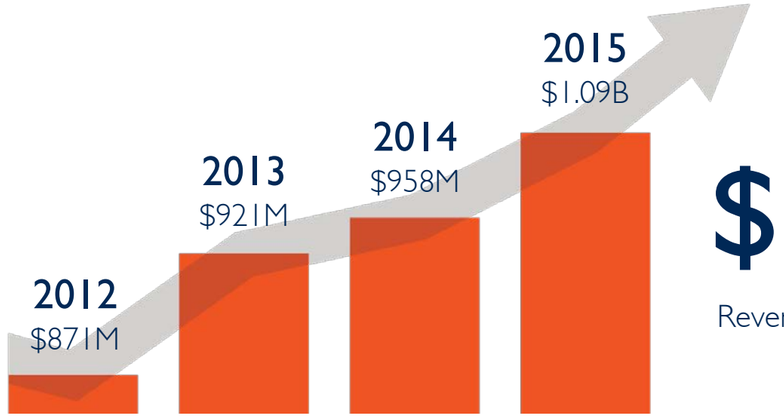
AN INTRODUCTION TO HITT

HITT

Ranked #31
BD+C Top BIM Construction Firms

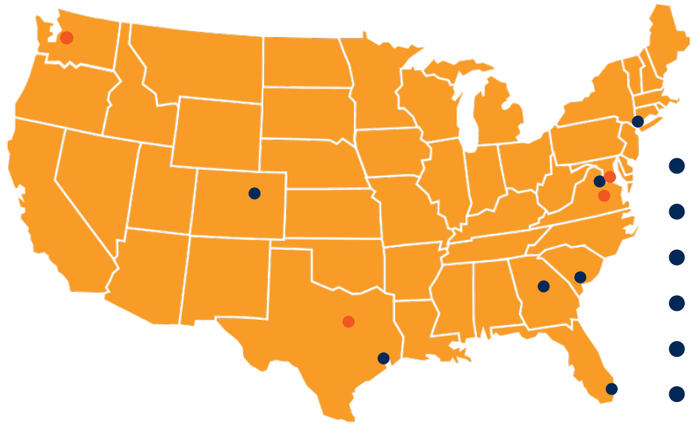
David Stone
Director of
Virtual Construction

FINANCIAL GROWTH



$1.09B
Revenue in 2015

NATIONAL PRESENCE: HITT OFFICES



- Washington, DC
- Atlanta
- Charleston
- Denver
- Houston
- New York
- South Florida
- Baltimore
- Dallas
- Richmond
- Seattle

HITT BY THE NUMBERS

68 2016 ENR Ranking

100+ LEED Projects

965 Employees

Class summary

Discuss and compare the current and forthcoming technology that may augment current scanning methods.

This class will address the following questions:

- What is a reasonable expectation from a handheld scanner and return on investment.
- What is the workflow for maximizing the scanner's use for as-built and quality assurance / quality control uses.
- How can we best capitalize on scanning at this scale.
- When is the right time to consider handheld versus other scanning technology.
- Where can this scanning method be most effective.

Key learning objectives

During this class, you will learn:

- Explore options that exist for reality capture
- Differences between handheld scanners and other methods
- Proper workflow
- Potential ROI
- Budgeting for scanning solutions

- How to make an educated decision about your needs

Technologies available for reality capture

- Laser scanners
- Li-Dar
- Photogrammetry
- Sensor (Infrared) based

Best uses for each technology

- Laser scanners / terrestrial scanners
  - Large interior and exterior as-built, static scan
- Li-Dar
  - Medium interior and exterior projects, static and dynamic
- Photogrammetry
  - Large scale, dynamic, lower accuracy, flight restrictions
- Sensor (Infrared) based
  - Small scale, dynamic, medium accuracy

Cost of implementing in-house

- Laser scanner: $50,000–$60,000
- Infrared scanner: $5,000–$6,000
- Drone photogrammetry: $3,000–$10,000
- Software to register and model point cloud: $0–$300 (Re-Cap Pro annual)

- Technology is rapidly changing and most of the above are obsolete in 3–5 years
- Do you have the manpower?
- What about service provider?

Compare the technology

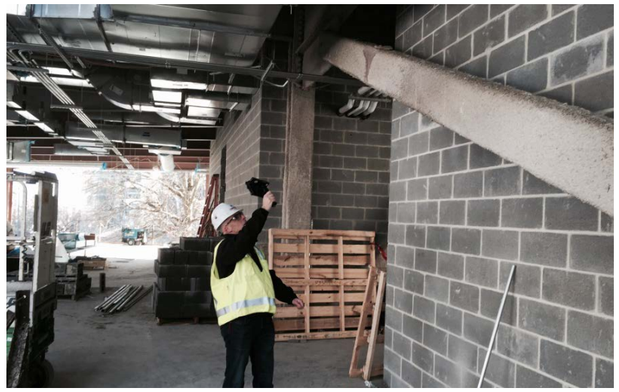
	Infrared scanner	Laser scanner	Li-Dar	Drone photogram.
Accuracy	Medium	High	High	Low
Range	Short	Long	Medium	Short / Long
Cost	$	$$$$	$$$	$$
Learning curve	↗	↗↗↗	↗↗	↗↗↗↗
Mobile / flexible	✔	✔ ✔	✔ ✔	✔ ✔ ✔
Potential use				
Small projects	✔ ✔ ✔	✔	✔ ✔	✘
Large projects	✘	✔		✔
Interior / exterior	Interior	Both	Both	Exterior

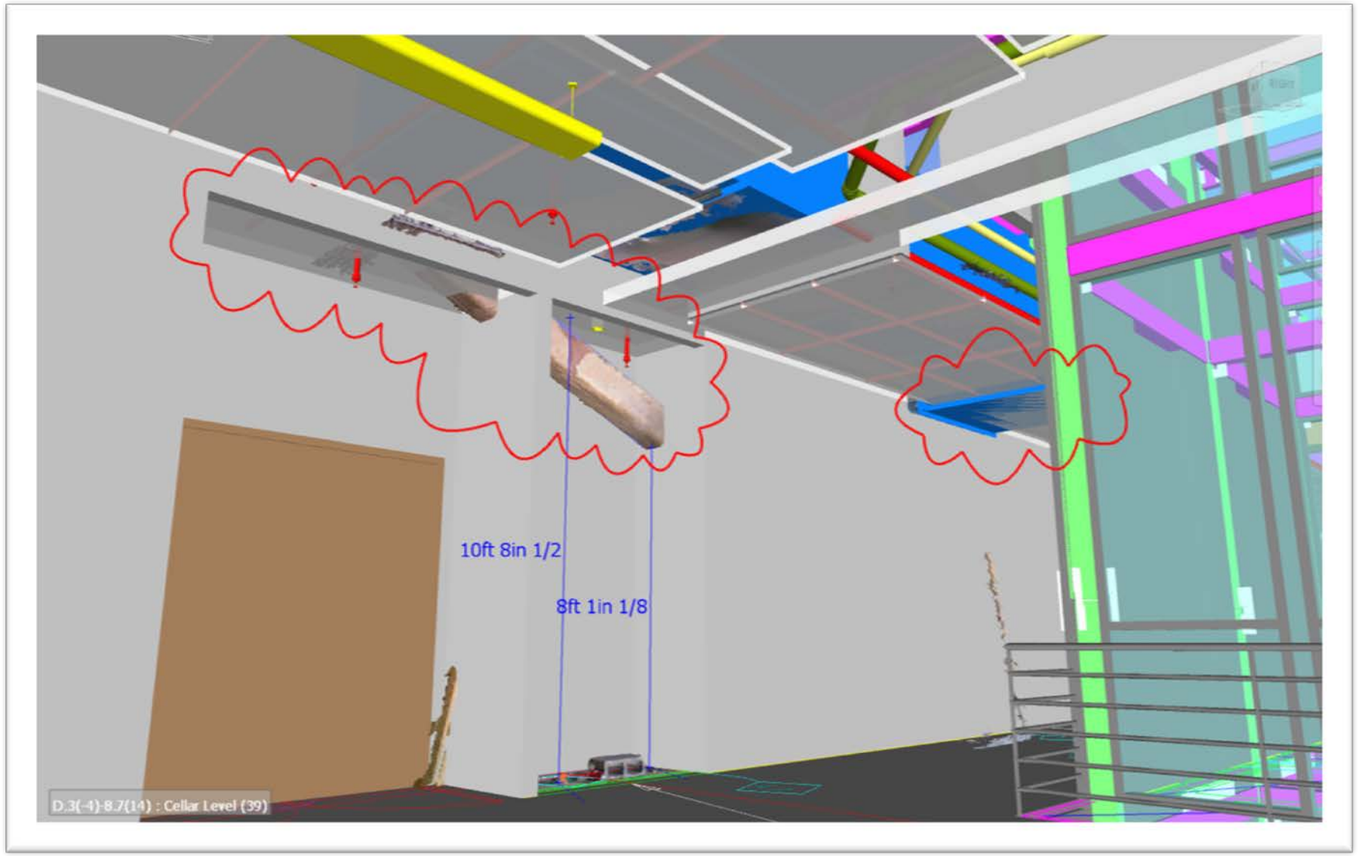
What do I need for handheld scanning?

- Scanner / tablet + base software
- Light attachment
- Rod + extension kit (optional)
- Targets, April tags
- Measuring tape, blue tape, pen
- Clean up software
- Software to generate a BIM or solid model
- Coordination software

Case study #1—Coordination

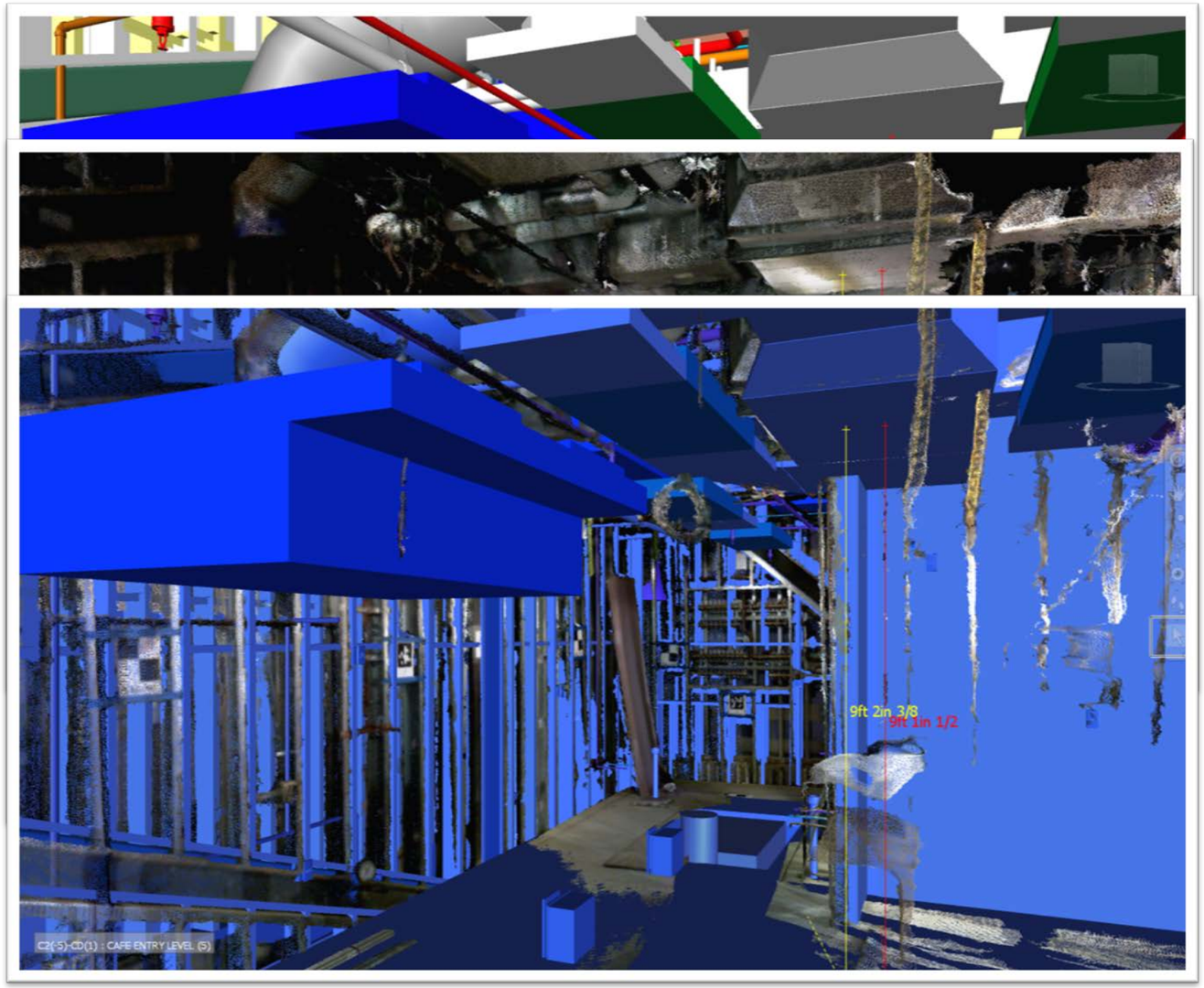
- Coordination
  - Scanning
  - Scanned as-built
  - Overlay w/ as-built
  - Overlay w/ MEP/FP model
  - Overlay w/ arch.
  - Overlay w/ clouded issues





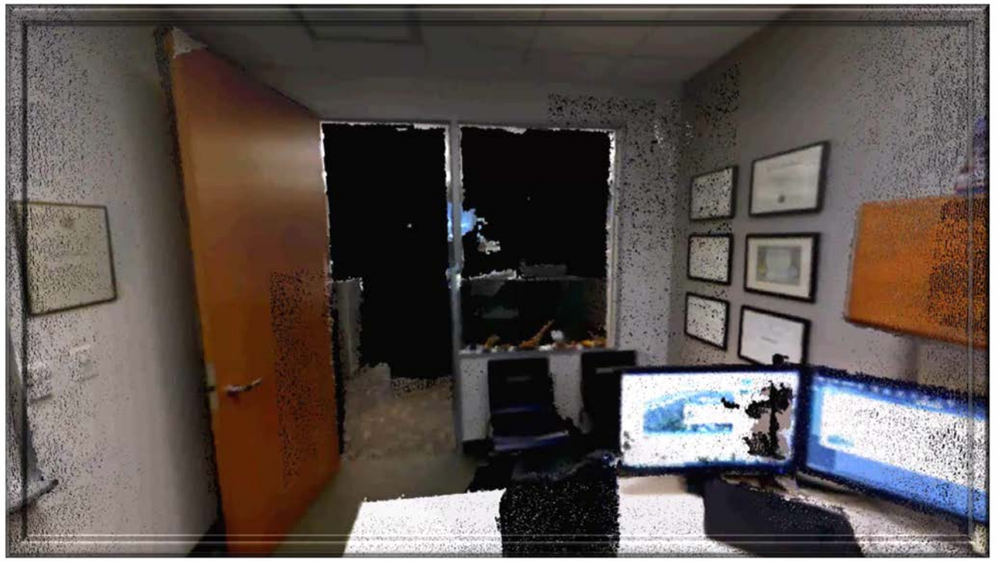
Case study #2—Coordination

- Museum café
  - 550 SF (33’x17’)
- Scan / processing time
  - 3 Hour
- Results
  - Accuracy +/- 1 inch
  - Verified duct installed as coordinated
  - Concluded design changed



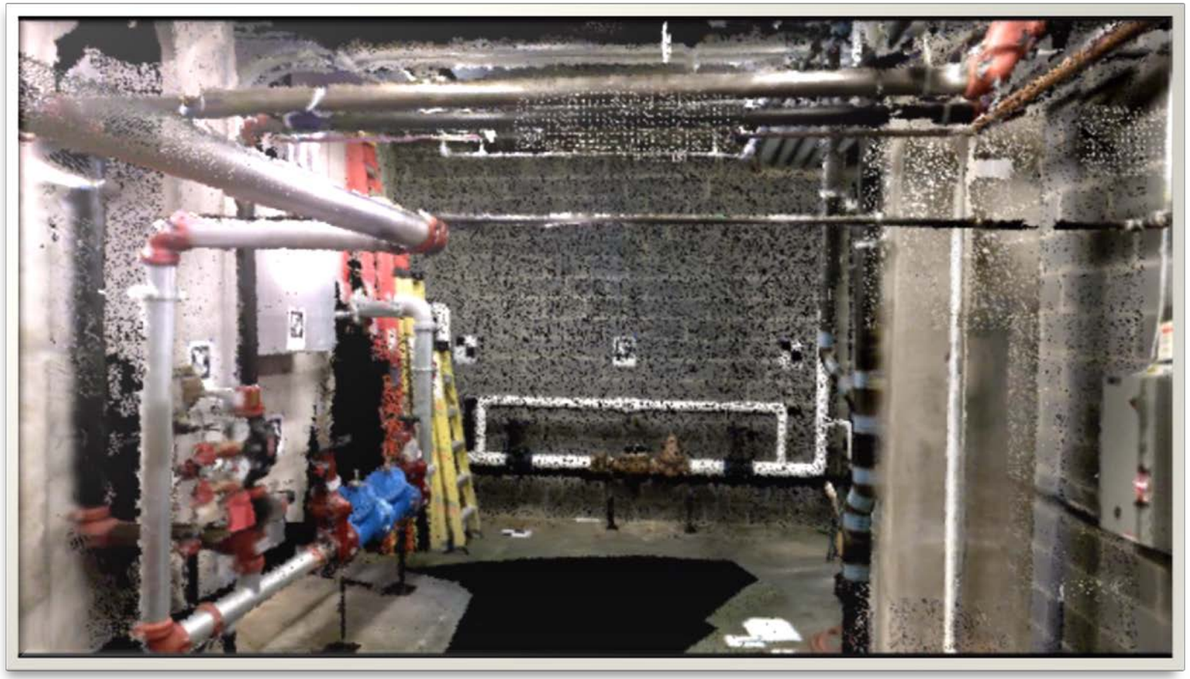
Case study #3 — As-Built

- Office (actually two similar offices)
  - 140 SF (10’x14’)
- Scan time
  - 45 minutes
- Processing time
  - 45 minutes
- Accuracy
  - +/- 1/2 inches



Case study #4—As-Built

- Pump room
  - 400 SF (16’x26’)
- Scan time
  - 1 hour
- Processing time
  - 1 hour
- Accuracy
  - +/- 1 inches



Post scan work flow

Terrestrial scanner

- Scan
- Register / clean (mesh)
- Create solid / BIM model
- Coordination

RECAP

CLEAREDGE3D EdgeWise BIM Suite

AUTOCAD

REVIT

NAVISWORKS

Handheld scanner

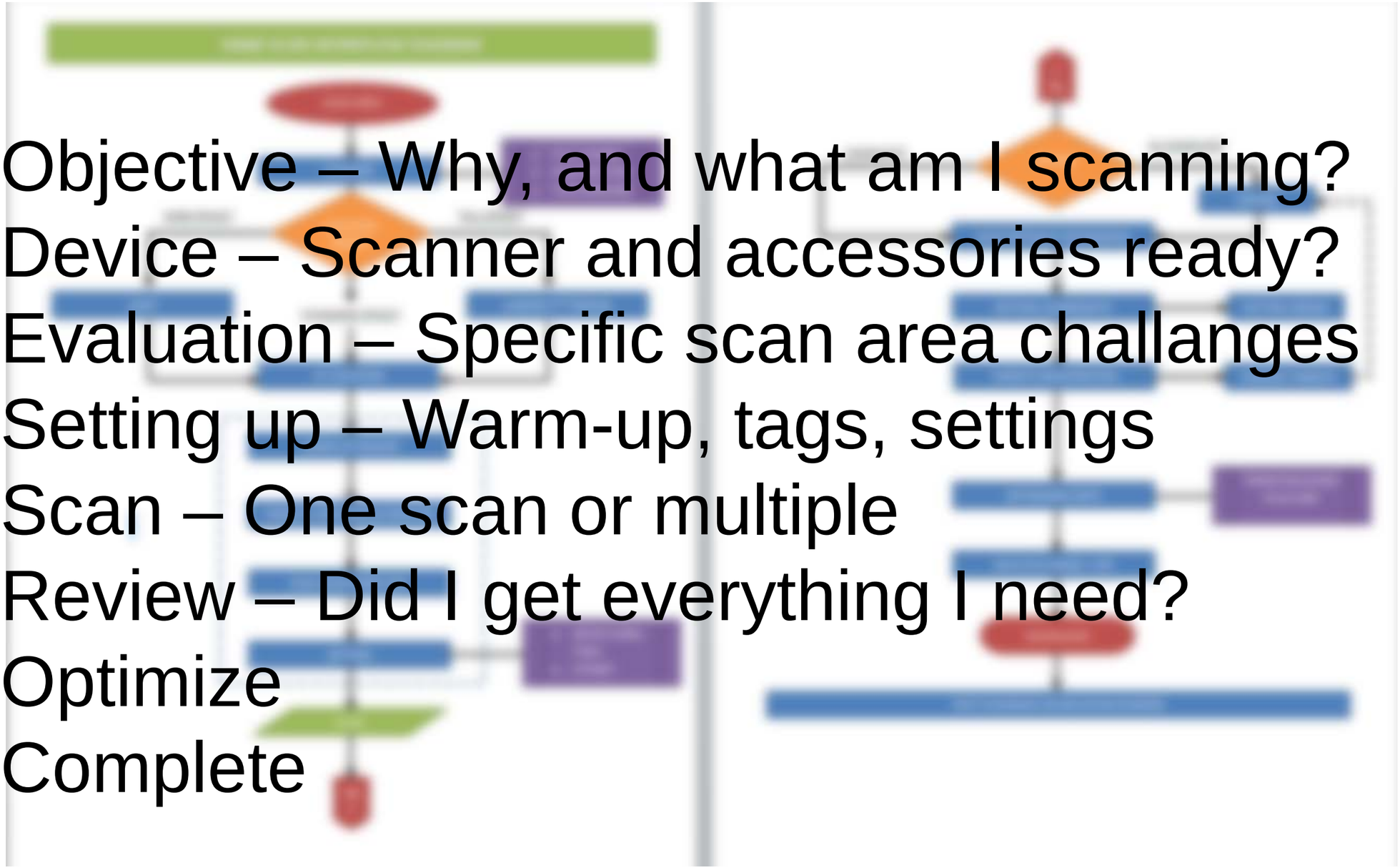
- Scan / quarry
- Crop / clean
- Create solid model (optional)
- Coordination

Dot3D

InfiPoints™

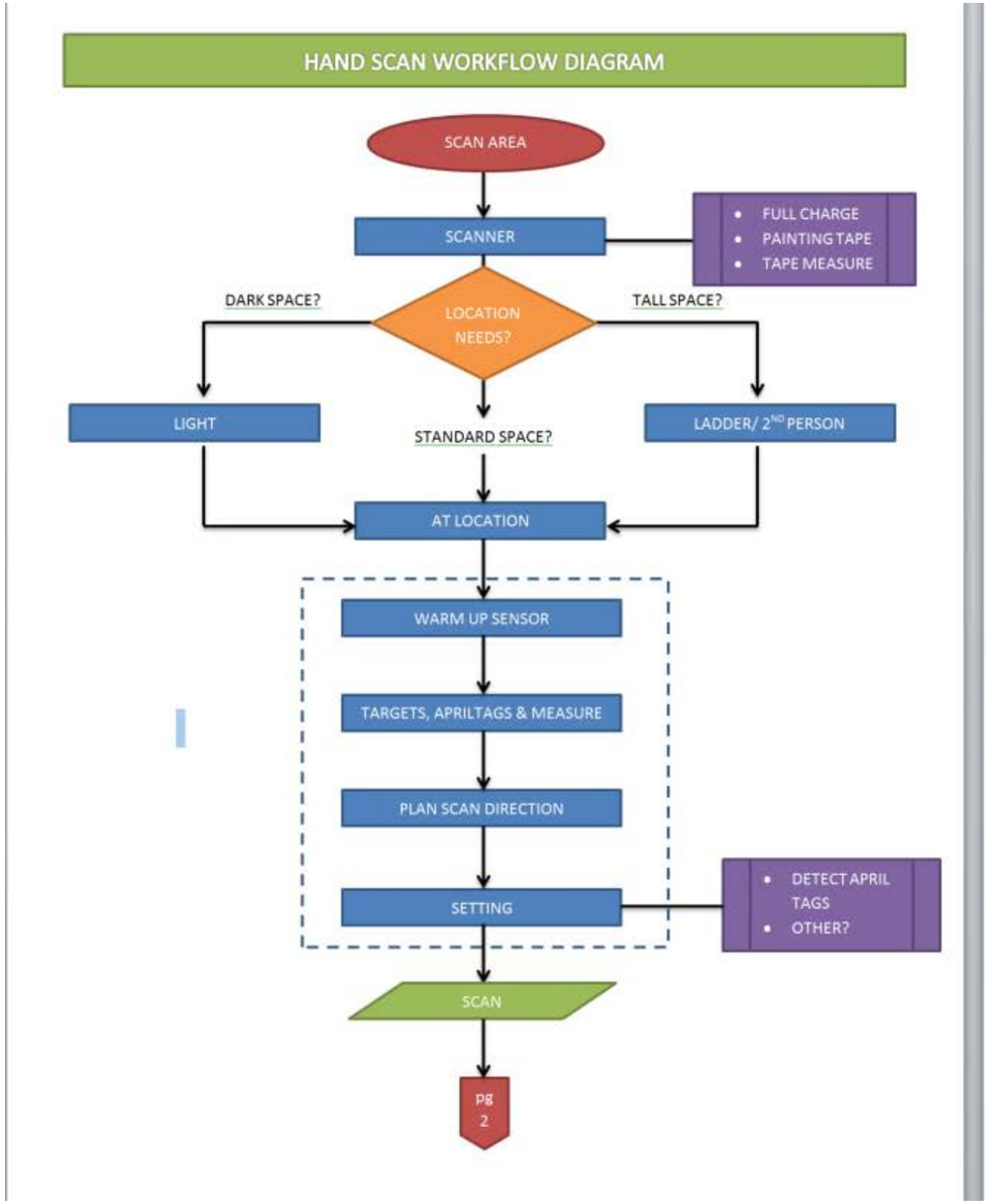
NAVISWORKS

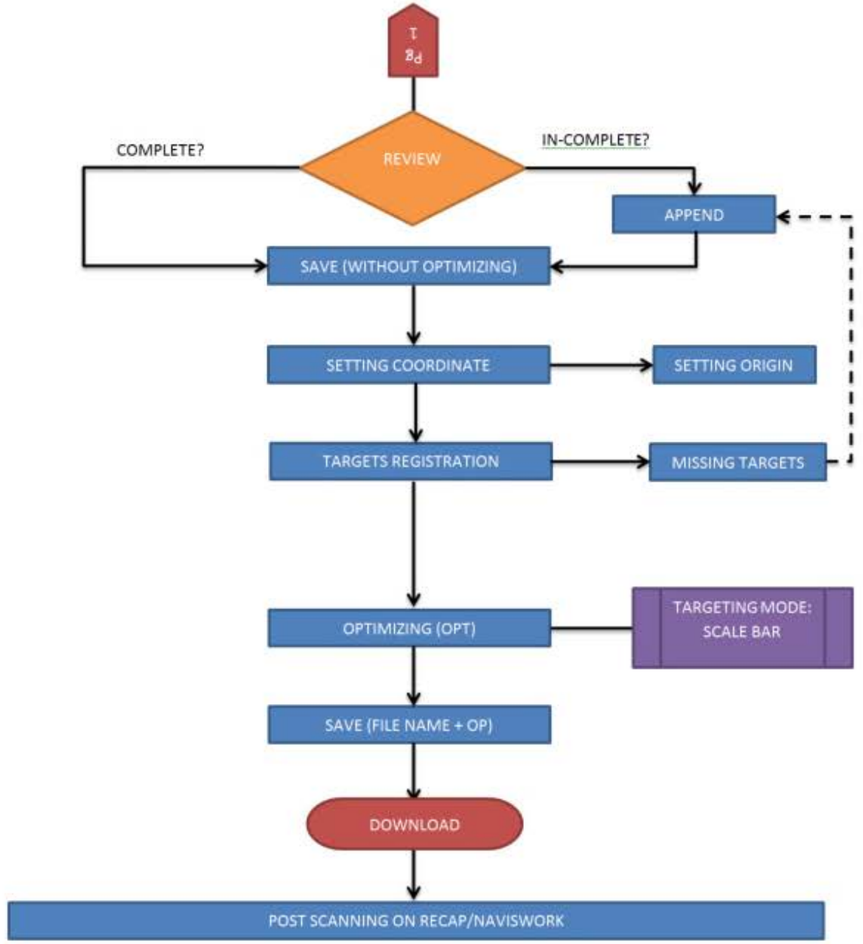
Scan Work Flow



- Objective – Why, and what am I scanning?
- Device – Scanner and accessories ready?
- Evaluation – Specific scan area challanges
- Setting up – Warm-up, tags, settings
- Scan – One scan or multiple
- Review – Did I get everything I need?
- Optimize
- Complete

Scan Work Flow





Metrics

- Documenting as-built condition for renovation
  - Time saved: 10X faster (2–4 hrs vs. 20–40 hrs)
  - Accuracy: +/- ½” vs. NTS (Not Too Sure!)
- QA/QC – verify installation per BIM model
  - Scan vs. RTS (robotic total station)
- Communicate design issues
  - 2D detail vs. 3D scan vs. BIM

Best practices / lessons learned

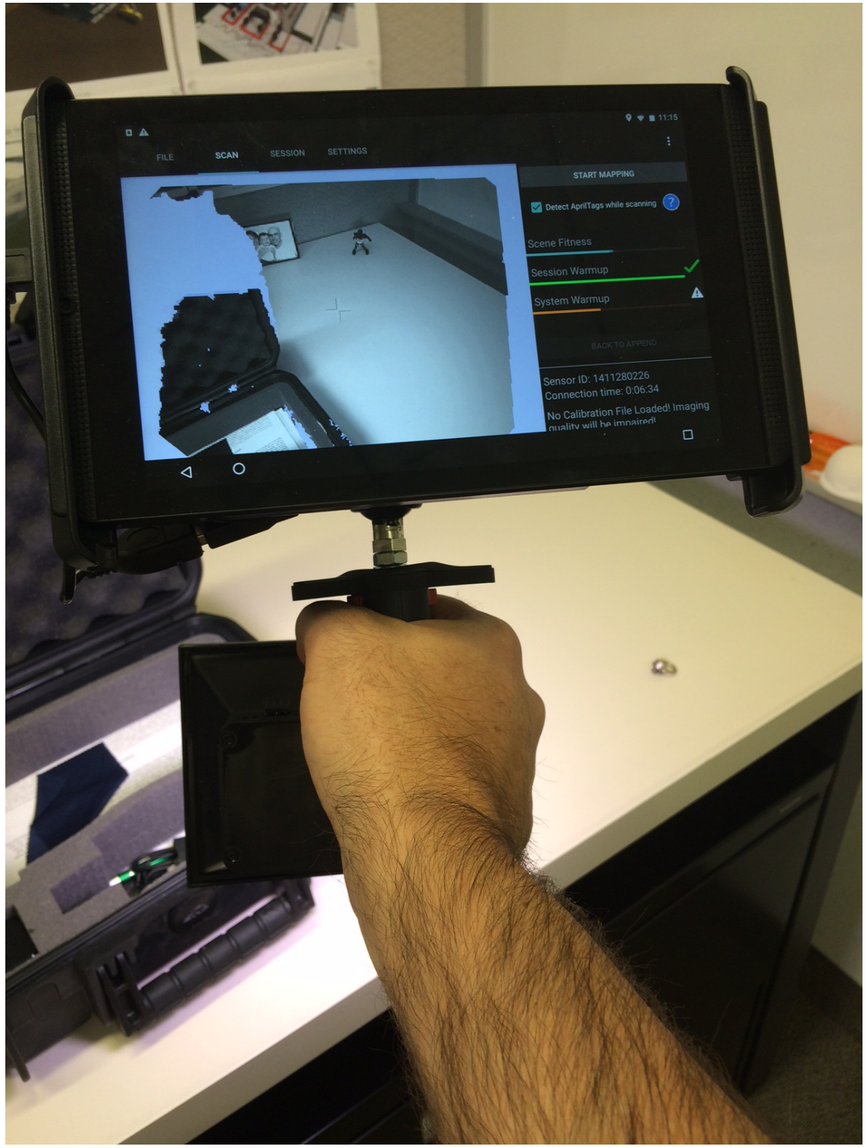
- Plan before you scan
  - Charge (unit + light), accessories, workflow
- Limit scan area – only what you need!
- Use targets and April tags
- Avoid scanning in the red zone!
  - Start new scan and append specially to previous
- Coordinates – align with a usable location





Results and takeaways for handheld scanner use

- Not ideal for
  - Large spaces
  - Floor levelness
- Best use
  - As-built up to 400 SF
  - Tight spaces
  - Interiors
  - Visual communication



How did I do?

- Your class feedback is critical. Fill out a **class survey** now.
- Use the AU mobile app or fill out a class survey online.
- Give feedback after each session.
- AU speakers will get feedback in real-time.
- **Your feedback results in better classes and a better AU experience.**