Advancing Technology into the Built Environment

Dave Little, Gallegos Corp.
Presented by:
AGC Specialty Contractors Council

Moderator
Ryan Howsam – FMI
Almost two-thirds of respondents expect more change in how construction is put in place over the next 5 years than in the last 50 years combined.

Source: 2018 AGC/FMI Industry Risk Survey
One of the few remaining Industries to Digitize

- **$4.34B**
  - Total funding in ConTech since 2009

- **478**
  - Funding deals in ConTech since 2009

Source: CB Insights, JLL Research
A year ago we mapped the construction technology landscape uncovering 3 clusters of innovation...

Construction phase focus ~1000 firms

Source: McKinsey
A year later, picture looks very different with exciting movement
All project lifecycle phases ~ 2400 firms

Source: McKinsey
Our Presenters:

Richard Lopez – Hensel Phelps
Peter Busciglio – Hensel Phelps
Chris Porter – Trimble Site Services
Nick Lauer – MTech Mechanical
Mike Bishop – Intermountain Electric
To Earn CEUs for this Session

Participants must:
1. Check in with attendance proctor at the door.
2. Attend at least 95% of the session.
3. Complete the post-program evaluation.
4. Complete a brief assessment with a score of 75% or greater.

The Associated General Contractors of America (AGC) has been accredited as an Accredited Provider by The International Association for Continuing Education and Training (IACET). In obtaining this accreditation, AGC has demonstrated that it complies with the ANSI/IACET Standard which is recognized internationally as a standard of good practice. As a result of their Accredited Provider status, AGC is authorized to offer IACET CEUs for its programs that qualify under the ANSI/IACET Standard.
Learning Objectives

By the end of this session, participants will be able to:

1. Identify technologies that specialty contractors are using.
2. Discuss how to increase productivity.
3. Describe how innovative changes can be adopted within your own organizations.
4. Analyze how technological changes improve the overall jobsite.
Using the AGC Mobile App

Click “Session Evaluation” at the top right within the session description, then click “Evaluate This Session.”

We welcome your feedback!
Augmented & Virtual Reality Design Review

What’s the Vision?

Peter Busciglio
How to review the vision of the Project Design with the Owner and/or Team Partners through Augmented Reality/Virtual Reality

1. Collaborate with the authoring teams and their models to add materials to the various models

2. Utilize those models with various Software to add realism
   Enscape / HoloLive

3. View those models in an Augmented/Virtual Reality environment
   Oculus Rift / HoloLens
Collaborate with the Team to plan the Design
Add Materials to the Revit Model

Once the Design Team finalizes the design, it can be applied to the materials in Revit and to view in an Augmented & Virtual Reality Environment.
View the model in Enscape with VR
View the model in HoloLens with AR
Into the Future...
Unmanned Aerial Vehicle

How Can UAV’s Assist in Design, Production and Safety?

Richard Lopez
Welcome to the FAADroneZone

Fly sUAS under Part 107

I need to register my small unmanned aircraft for recreational, commercial, governmental, or other purposes under Part 107. Each drone must be registered at a cost of $5.00, and registration is valid for a period of 3 years. Also, see this option to apply for a waiver/authorization, or reporting an accident under Part 107.

Fly Model Aircraft under Section 336

I need to register my small unmanned aircraft to fly with an aero-modelling club and following all requirements of the Special Rule for Model Aircraft.

Register a drone that weighs 55 lbs or more.

Where do I register my Unmanned Aircraft?

Register your aircraft using this website if it weighs more than 0.55 lbs. (250 grams) and less than 55 lbs. (25 kg).

Register an unmanned aircraft that weighs 55 lbs (25 kg) or more.
**dji INSPIRE**
- Ultimate power
- Pro-grade image quality

**dji PHANTOM**
- Best all-around
- 5-way collision avoidance

**dji MAVIC**
- Ultimate portability

*Kit cost = ~$9,800 +
Kit cost = ~$5300
Kit cost = ~$2000
Drone Flight Request
Jobsite requests hardware and training of operator

Operator Remote Pilot101.com studies/passes 107 exam

Equipment is ordered, assembled, registered with FAA

Aircraft & operator are added to corporate insurance policy

Flight Director delivers hardware and conducts training

Flight Planning Pilot Briefings Owner Briefings

Field operator conducts first flight

Use MEO sUAS portal to manage projects, people, and equipment
OPERATIONS MASTER CHECK LIST

- SITE SURVEY
- RISK ASSESSMENT
- OPERATIONS BRIEF
- AIRSPACE ASSESSMENT
- ATC COORDINATION
- WEATHER FORECAST
- FLIGHT AUTHORIZATION
Flight Planning & Logging

• Using the digital logbook, pilots can store essential records and easily generate reports to improve business operations and meet regulatory requirements.

• Planning a flight with an intuitive map and toolkit. Call attention to specific areas for pilots by adding hazard notifications or points of interest.

• Analyze airspace and identify airport contact zones, restricted areas, and temporary flight restrictions.
AERIAL DATA MANAGEMENT

Plan, Capture, and Process

Store Imagery and Data in Dashboard

UAS Deliverables
Outdoor High Accuracy Augmented Reality

Why Should I Consider Augmenting My Reality?

Chris Porter
Trimble UAV/Drones
Trimble Stratus - UAV Cloud Processing
Stratus UAV - Cut / Fill Mapping
Stratus UAV - Cross Section
Stratus UAV - Aerial Survey

Point Cloud showing Aerial Photo Locations
Trimble Connect
Trimble Connect

Diagram showing Trimble Connect as a platform connecting MEP Engineer, Architect, GC/CM, Structural Engineer, Trimble MEP designer, SketchUp, and Tekla.
Integrating GNSS and Augmented Reality
Hardware
- Trimble Catalyst Antenna
- ARCore capable phone
- Custom Bracket

Software
- ARCore Technology
- Trimble Connect Cloud
- SiteVision Application
- VRNow and RTX
Trimble Connect
Site Vision
Data Services

- Convert 2D drawings to 3D model
- Optimize 3D model for visualization
- Supplemental Content
  - Equipment
  - Site Logistics
  - Site Context
3D Constructible Model
How Does BIM Support Fabrication in a Successful Project?
BIM and Prefab

- BIM is the framework for our coordinated model and key to effective prefabrication.
- Prefabrication and BIM to support it is the reality of current construction, but it carries costs and risks to participants.
- We need to recognize the difference between a coordinated model and drawings to build our trade sub-systems.
- Rework ruins budgets and rushing guarantees rework.
Who are the BIM clients?

**External**
- Owner
- Architect / Int Design
- Engineer of Record
- General Contractor
- Subcontractors

**Internal**
- Preconstruction
- Engineering
- Project managers
- Trade field managers 3x
- Trade fab shops 3x
The false promise of a coordinated model

- Many projects require a coordinated model as the end product of the BIM process.

- Design firms are driven by document releases and their software model as the sole platform.

- Do the documents support constructability or are they “diagrammatic in nature”?

- Competitive pricing creates a trade-off when poor background models risk cost overruns down the road.
Politics of competitive pricing vs. design-assist/design-build

*Preconstruction is the first line of defense when setting up for success.*

- How do designers and GC’s ensure that documents are ready? Are they open to feedback?
- Are subcontractors able to evaluate model status and price accordingly?
- How are we compensated for BIM rework in design-assist projects?
- What constitutes change?
Preliminary Design to Coordination

- Steel or Concrete Model is fleshed out.
- MEP partners are brought on board and provide input.
- Backgrounds are locked down.
- Civil documents are complete.
- Specification Set is released.
Above the surface:

- Cost History
- Customer expectations
- Arch/structural backgrounds
- Clash detection
- The “Coordinated Model”
Coordination to fabrication process

Below the waterline:
- Field reviews
- Completed shop drawings and labels
- Spool drawings
- Buildable components for our key internal client, our field staff.
Coordination to Fabrication

- Coordinated model (timer starts)
- Submittal drawings out for approval
- Field Review (5 days)
- Field markup and spool drawings (5 days)
Coordination to Fabrication

- Shops, hangers and spools completed by CAD (5 days)
- Field review (5 days)
- Finalized by CAD (5 days)
- Prefabrication (5 days)
- Material to jobsite
Our BIM product to the field

---

### Spool-SCM

<table>
<thead>
<tr>
<th>TAG</th>
<th>Qty</th>
<th>LG(M)</th>
<th>SIZE</th>
<th>DESCRIPTION</th>
<th>END1</th>
<th>END2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>0</td>
<td>5/8&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>5</td>
<td>3/4&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1 1/2&quot;</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>2</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>6</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>6</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>6</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>9</td>
<td>6</td>
<td>6</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>6</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>11</td>
<td>5</td>
<td>6  3/4&quot;</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>12</td>
<td>3</td>
<td>6  3/4&quot;</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>13</td>
<td>3</td>
<td>6  3/4&quot;</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>14</td>
<td>3</td>
<td>6  3/4&quot;</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>15</td>
<td>6</td>
<td>6</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>2  3/4&quot;</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>17</td>
<td>5</td>
<td>2  3/4&quot;</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>2  3/4&quot;</td>
<td>6&quot;</td>
<td>60 PVC 600 PLUS QUICK-LOC</td>
<td>90°</td>
<td>90°</td>
</tr>
</tbody>
</table>

---

**Diagram: Hot Water Pump - Discharge**

---

**100th Annual AGC Convention**

---

**100 Years**
UCHealth Steadman Hawkins Clinic – Denver
Mechanical Room ISO
UCHealth Steadman Hawkins Clinic – Denver  DHW, Snowmelt, and RO skids
UCHealth Steadman Hawkins Clinic – Denver
DHW and HHW Pump skids in place
Keys to Success

• Correlate Design, BIM and Construction Schedules
• Accurate information from the start
• Just-in-time installation
• Measured results – basis for improvement
• Resulting in a quality product for client
Augmented and Virtual Reality

Where are we Going?

Mike Bishop
We are going to change the way we see.

**Virtual Reality (VR)**

**Mixed Reality (MR)**

**Augmented Reality (AR)**

**Reality Spectrum**
Poll

Who here is actively using AR/MR?

Who here plans to use AR/MR within the next two years?

Who here uses BIM?
First Steps to AR/MR – Have a digital model
AR/MR uses in Construction

- QA/QC
- Internal design review
- Owner/GC Design visualization
- See new design in existing space
- View coordination model in field
- Review hidden content
- Facilities Maintenance

AR/MR allows for a better feel for the space

- Instructional applications
- Sales and marketing
Scaled Down Design Review
1:1 Field Alignment
Quality Control and Quality Assurance
MR/AR/VR
Scanning
AI
Robotics
Drones
Layout

BIM
capture
visualize
produce

Fabrication
AI
Robotics
Questions?
AGC GROUPS:

Business Development Forum
https://www.agc.org/connect/agc-groups/business-development-forum

BIMForum
https://bimforum.org/

Safety & Health | Associated General Contractors
https://www.agc.org/industry-priorities/safety-health

Specialty Contractors | Associated General Contractors
https://www.agc.org/connect/agc-groups/specialty-contractors