Business Transformation

Leveraging Technology for the Future
Defending Skilled Trades for 25 Years
WHY ME?

- 20 YEARS – Information Technology Services
- DevOps Engineer – *Software Development Lifecycle*
- SaaS Design
- API’s
- Cloud Solutions
- RFID

**CONSTRUCTION IT**

- IT Director
- Safety Committee Member
- Director of Media - JBKnowledge

- Hospitality, Ski Resorts, & Health Care
- Skier & IRONMAN enthusiast
IN THE LAST 15 YEARS, 52% OF THE FORTUNE 500 COMPANIES HAVE DISAPPEARED

1955 vs. 2015
Average life expectancy 75 years vs. Average life expectancy 15 years
Constructing the Foundation

- DISRUPTION
- LEADERSHIP
- THE TECHNOLOGY
- THE PEOPLE
- THE PROCESS
“Disruption is a business model change where segments of an industry cannot adapt.”

Brett Young
Leadership

Astro Teller – CEO of X
You win by continuing to play the Game!
The digital currency of the future
BIM
BIM is Still Not a Priority

- 28% We do NOT bid on projects involving BIM
- 24% We have a BIM department
- 22% We have employees on staff that can work within BIM
- 36% Number of active projects that involve BIM

Source: 2018 JBKnowledge ConTech Report
BIM & VDC

- Concrete Foundation for the Technology Ecosystem
- Communication, Collaboration, & Planning
- Construct-Able BIM
- Prefabrication and Modular Construction
- Safety
- Design Consultant
Project Virga – Data Visualization
Generative Design

Generative Design:
- Goals & Constraints
- Form Synthesis
- Optimization
VIRTUAL, AUGMENTED, & MIXED REALITY
Virtual Reality Use Cases

- Design and Visualization of space
- 50% of people cannot visualize 2D plans in 3D without assistance
- More iteration in design translates to less rework in the field
- Less Man Hours = Safer Site
- HAPPY CUSTOMERS

- Training and Simulation
- Hours on the tools with less waste and risk to train
- Creates physical Muscle memory
- Simulate difficult or risky procedures
- Simulate Jobsite conditions and create collaboration with team members
Augmented Reality Use Cases

- Verification
- Documentation
- Collaboration
- Visualization
Stratus Ordering from the model

1. Prefab Assemblies are defined
2. Models are sectioned into Levels and Areas
3. Orders are sequenced within a Plan
4. Tasks are tracked as Orders are processed
Reality Capture

1. Upload Your Design File
2. Scan & Upload
3. See The Result
Faro S150 & S350
Leica BLK 360
Photogrammetry
When it all comes together
ROBOTICS
Robotics

Boston Dynamics
INTERNET OF THINGS

Connecting People and Equipment
Fundamentally change the Jobsite

- Respond to safety incidents instantly
- Devices and People Communicating real-time for safety and efficiency
- Creating Data for visual and machine learning Analysis
Telematics
Spot-r by Triax

- Telematics
- Monitor Employee position onsite and Automatic Headcount
- Automatic Slip Trip and Fall Notification
- Safety Alerts
- Flag Hazards
- Remote Call for Help
- Evac Tag
Connected Tools
EVOLVING APPLICATIONS

The first step to transforming your company
Manual Process Are Still Prevalent

Nearly half of all contractors surveyed still process daily reports manually.

More than half of all contractors still process time cards manually.

Source: 2018 JBKnowledge ConTech Report
Daily Reports
RESULTS

⚠️ Connector Too Long
The self-retracting lanyard was too long and the worker hit the ground.

⚠️ Minor Injury
Broken ankles, severe strains in legs and back.

⚠️ Try Again
Choose a connection device that minimizes your fall distance.

Timer
Push the worker off the edge.

Next

Harness Hero

MBA simcoach GAMES
RocketBook

- Digital Paper
  - Email
  - Cloud Services
- Same Workflow different result
- Remove the noise but achieve the results
- Pen and Paper
- Reusable
Pictures, Video, Media from any device

Single Platform for Machine Learning and Artificial Intelligence

Vinnie was a Foreman on a project with a Video on his phone worth 4 Million Dollars

Vinnie.AI
DADO Becomes Google for your Construction Info

DADO solves both problems by automatically indexing synced construction platforms, and providing a simple voice-powered search for the field.

“What is the insulation thickness on the heating hot water piping?”
Despite a massive increase in construction technology platforms - the life of a tradesman (and tools they have to find information) has not changed.
1. Photo Taken in Field

2. Including Notes #RFI

3. Office Response

Photo Stored in eSUB
1/10/19 11:23 AM

Field note attached to RFI
1/10/19 11:24 AM

Field note answered by office
1/10/19 11:30 AM
Data Integrations
Current State
Linear Integration

Source: Construction Progress Coalition
Future State
Common Data Environment

Source: Construction Progress Coalition
It’s All about the Data going forward
Data Silos Create Inefficiency

- $15.8B Costs of Interoperability
- 29.1% Solutions that don’t integrate
- 51.8% Manually transfer data
- 55% Claims due to inaccurate data
Two Types of Data

Unstructured Data

- 2-d Plans
- Tasks
- PDF documents
- Emails
- Photos/videos
- Most data is unstructured

Structured Data

- Numbers / Dates / Strings
- Time / Hours / Days
- Costs
- Production
- Highly Organized
- Relational Databases
- Input, Search, and Manipulate Data
Companies with the Right Data will see $430B in Productivity Gains by 2020

Source: Sage Construction Survey

Benefits of Structured Data

- **57%**
  - Want consistent, up-to-date project and financial information

- **48%**
  - Want to be warned when specific situations occur

- **41%**
  - Want forecasting, allowing them to prepare for best and worst case building events

- **14%**
  - Want online analytics to see precisely which factors are affecting profitability and by how much.
## Structured Data and Labor Efficiency

<table>
<thead>
<tr>
<th>Cost Code</th>
<th>Cost Code Description</th>
<th>Est Cost</th>
<th>Act Cost</th>
<th>Orig Budgeted Hours</th>
<th>COR Budgeted Hours</th>
<th>Total Budgeted Hours</th>
<th>Used Hours</th>
<th>% Used Hours</th>
<th>Rem Hours</th>
<th>% Complete</th>
<th>Proj Used Hours</th>
<th>Proj Rem Hours</th>
<th>% Of Eff</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-120</td>
<td>Rough Branch</td>
<td>$160,000.00</td>
<td>$48,000.00</td>
<td>2,000.00</td>
<td>0.00</td>
<td>2,000.00</td>
<td>800.00</td>
<td>40.0%</td>
<td>1,200.00</td>
<td>30%</td>
<td>2,666.67</td>
<td>1,866.67</td>
<td>75.0%</td>
</tr>
<tr>
<td>01-130</td>
<td>Rough Feeder</td>
<td>$64,000.00</td>
<td>$16,220.00</td>
<td>800.00</td>
<td>0.00</td>
<td>800.00</td>
<td>200.00</td>
<td>25.0%</td>
<td>512.00</td>
<td>40%</td>
<td>720.00</td>
<td>432.00</td>
<td>111.1%</td>
</tr>
<tr>
<td>01-230</td>
<td>Wire Pull Feeder</td>
<td>$15,000.00</td>
<td>$0.00</td>
<td>200.00</td>
<td>0.00</td>
<td>200.00</td>
<td>0.00</td>
<td>0.0%</td>
<td>200.00</td>
<td>0%</td>
<td>200.00</td>
<td>200.00</td>
<td>0.0%</td>
</tr>
<tr>
<td>01-330</td>
<td>Distribution</td>
<td>$22,500.00</td>
<td>$0.00</td>
<td>300.00</td>
<td>0.00</td>
<td>300.00</td>
<td>0.00</td>
<td>0.0%</td>
<td>300.00</td>
<td>0%</td>
<td>300.00</td>
<td>300.00</td>
<td>0.0%</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>$261,500.00</td>
<td>$64,320.00</td>
<td>3,300.00</td>
<td>0.00</td>
<td>3,300.00</td>
<td>1,088.00</td>
<td>33.0%</td>
<td>2,212.00</td>
<td>28.0%</td>
<td>3,886.67</td>
<td>2,798.67</td>
<td>60.0%</td>
</tr>
</tbody>
</table>
## Structured Data and Logs

### Request For Information Log

<table>
<thead>
<tr>
<th>ACTION</th>
<th>RFI Number</th>
<th>GC/CM No</th>
<th>GC File No</th>
<th>Owner No</th>
<th>RFI Date</th>
<th>Return By</th>
<th>Date RFI Returned</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>54</td>
<td></td>
<td></td>
<td></td>
<td>2/20/2018</td>
<td>2/28/2018</td>
<td>4 Days Left</td>
<td>Pending</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>53</td>
<td></td>
<td></td>
<td></td>
<td>2/12/2018</td>
<td>2/17/2018</td>
<td>7 Days Late</td>
<td>Pending</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>52</td>
<td></td>
<td></td>
<td></td>
<td>2/6/2018</td>
<td>2/13/2018</td>
<td>11 Days Late</td>
<td>Pending</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>51</td>
<td></td>
<td></td>
<td></td>
<td>1/30/2018</td>
<td>2/4/2018</td>
<td>20 Days Late</td>
<td>Pending</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **54**: Flood damage to main electrical room
- **53**: Need clarification regarding Switchboard AA metering
- **52**: Clarification of Exit light in rm 101
- **51**: Damage to equipment
Dashboards
Dashboards
Dashboards
Material Provenance and Supply Chain Use Case

Production of Material
- Certificates of Origin, batch number, Other Certifying Data

Transportation
- Shipment Date, Production Information

Fabrication
- Stages of production, transference of value and of components.

Transportation
- Shipment Date, Production Information

Installation
- Installation Date, Installation Company, Installation Employee

Data Tracked in Smart Contracts to Provide Full History of Material and Products Regardless of Company or Location
Prefabrication, Modular & Offsite Construction
Where we fall down

- Stick Built - 48 Hrs/Unit
- Avg. Prefab - 30.9 Hrs/Unit
- Prefab Learning Curve
<table>
<thead>
<tr>
<th>Traditional Build</th>
<th>Prefab</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 miles walked</td>
<td>2.8 miles walked</td>
</tr>
<tr>
<td>58 hours to build</td>
<td>18 hours to build</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prefab Unit 2</th>
<th>Prefab Unit 23</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 hours</td>
<td>7 hours</td>
</tr>
</tbody>
</table>
Comparing work in the Shop to the Field

<table>
<thead>
<tr>
<th></th>
<th>Shop</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor Rate</td>
<td>$75/ Hour</td>
<td>$110/ Hour</td>
</tr>
<tr>
<td>Single Clevis Hanger</td>
<td>3 Minutes</td>
<td>10 Minutes</td>
</tr>
<tr>
<td>Single Tier Trapeze Hanger</td>
<td>6 1/2 Minutes</td>
<td>17 Minutes</td>
</tr>
<tr>
<td></td>
<td>Traditional Layout</td>
<td>Robotic Total Station</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td># of Workers on a Layout Crew</td>
<td>2-3</td>
<td>1</td>
</tr>
<tr>
<td># of Layout Crews/Project</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Hours Worked/Week</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Hourly Cost/Person</td>
<td>$75</td>
<td>$75</td>
</tr>
<tr>
<td># of Layout Points/Day</td>
<td>75</td>
<td>300</td>
</tr>
<tr>
<td>Total Cost Per Point</td>
<td>$16</td>
<td>$2</td>
</tr>
<tr>
<td>Points per Floor</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td># of Floors</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Total Project Points</td>
<td>12000</td>
<td>12000</td>
</tr>
<tr>
<td>Time to Complete Project (days)</td>
<td>160</td>
<td>40</td>
</tr>
<tr>
<td>Percentage of Time Robotic vs Traditional</td>
<td>100%</td>
<td>25%</td>
</tr>
<tr>
<td>Total Project Labor Cost</td>
<td>$192,000</td>
<td>$24,000</td>
</tr>
<tr>
<td>Upfront Equipment Cost*</td>
<td>$1,400</td>
<td>$45,000</td>
</tr>
<tr>
<td>Total Project Cost</td>
<td>$193,400</td>
<td>$69,000</td>
</tr>
<tr>
<td>*one time investment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projects per Year</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Cost per Year (One time equip purchase)</td>
<td>$1,353,800</td>
<td>$213,000</td>
</tr>
<tr>
<td>Percentage of Cost Robotic vs Traditional</td>
<td>100%</td>
<td>16%</td>
</tr>
</tbody>
</table>
Digital Transformation

YOU KEEP USING THAT WORD.
I DO NOT THINK IT MEANS WHAT YOU THINK IT MEANS.
People are Important
People are Important
10,000 Baby Boomers Retire Everyday
Who?
Millennials became the largest generation in the labor force in 2016

U.S. labor force, in millions

Note: Labor force includes those ages 16 and older who are working or looking for work. Annual averages shown.

PEW RESEARCH CENTER
"The Now Generation has become the Me Generation,"

https://www.theatlantic.com/national/archive/2013/05/me-generation-time/315151/
Boomers
New York Times, October 17, 1976: "'76 Politics Fail to Disturb Campus Calm and Cynicism."

https://www.theatlantic.com/national/archive/2013/05/me-generation-time/315151/
There they are, those preening narcissists who have to document every banal moment with their cutting-edge communications technology.

https://www.theatlantic.com/national/archive/2013/05/me-generation-time/315151/
Gen X

Newsweek, December 30, 1985: "The Video Generation."

https://www.theatlantic.com/national/archive/2013/05/me-generation-time/315151/
I see no hope for the future of our people if they are dependent on the frivolous youth of today, for certainly all youth are reckless beyond words. When I was a boy, we were taught to be discrete and respectful of elders, but the present youth are exceedingly wise and impatient of restraint.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3002091/
—Hesoid, 700 BC

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3020091/
“The ME ME ME GENERATION,“ 
https://www.theatlantic.com/national/archive/2013/05/me-generation-time/315151/
Millennials: The Me Me Me Generation
Why millennials will save us all
By Joel Stein Monday, May 20, 2013
Time Magazine
https://www.theatlantic.com/national/archive/2013/05/me-generation-time/315151/
Millennials grew up in an electronics-filled and increasingly online and socially-networked world

They are the generation that has received the most marketing attention
The most ethnically diverse generation, Millennials tend to be tolerant of difference.

Having been raised under the mantra "follow your dreams" and being told they were special; they tend to be confident. While largely a positive trait, the Millennial generation’s confidence has been argued to spill over into the realms of entitlement and narcissism.
Young people are narcissist they get over themselves as they get older.

First, we show that when new data on narcissism are folded into preexisting meta-analytic data, there is no increase in narcissism in college students over the last few decades. Second, we show, in contrast, that age changes in narcissism are both replicable and comparatively large in comparison to generational changes in narcissism.

https://www.theatlantic.com/national/archive/2013/05/me-generation-time/315151/
Millennial:
“*It’s a mindset, not an age*”
They want to change the world....
Likelihood of leaving current job within the next 6 months.

- **18 to 34 years old**
  - Millennials: 51%
  - Likely to Leave Job: 32%
  - Neither Likely nor Unlikely to Leave Job: 16%
  - Unlikely to Leave Job: 11%

- **35 to 54 years old**
  - Gen-X: 69%
  - Likely to Leave Job: 20%
  - Neither Likely nor Unlikely to Leave Job: 11%
  - Unlikely to Leave Job: 6%

- **55 to 65+ years old**
  - Baby-Boomer: 78%
  - Likely to Leave Job: 10%
  - Neither Likely nor Unlikely to Leave Job: 12%
  - Unlikely to Leave Job: 8%

Source: Clutch 2016, N= 1,000 full-time employees
How do we fix it?
Back to the Basics
Barton Malow Project Director Jason McFadden
Symbiotic Mentorships
Listen, Learn, Teach
• Prepare
• Pilot Programs
• Not too long, not too short Just right
• Choose Wisely
Walker Lockard (Polk Mechanical Company. DFW, TX)

- Document Control Standards
  - Rallied stakeholders around standardization
  - Defined standards for existing infrastructure
  - Developed process & workflow with simple software stack
  - Continued training & support
- Digital Document Distribution (DDD)
  - Built & maintained lightweight dashboards for iPads
  - Trained & supported field personnel on iPads and Bluebeam
- VDC/BIM
  - Facilitating in-person, on-site feedback for coordinated shop drawings
  - Developed QR-code scanning web app for tracking installation progress on work packages (MVP only)
- Current Pilots/Research
  - Scalable DDD software
  - 360° photography
  - Model “un-siloing” (visual and information)
James Hillegas (Shook Construction Project Engineer)

- Drone Implementation
  - Currently evaluating insurance to use drones for material and site documentation
- First Pilot
- VDC/BIM
  - Pushing models into AR for QA/QC
  - Pushing models for formwork optimization (PoC)
Mikki Paradis (PDI Drywall Raleigh, NC)

- Internship in College with Drywall Company
  - Not allowed to learn the trade
  - Traditional Gender Role
- Started PDI Drywall
  - Graduated and started drywall company
  - Hired Sub’s that would teach her the trade
  - Failed during the 2008 Recession
- Consulting
  - Fell back on knowledge of technology to recover
  - Consulted with her rivals on technology adoption
- Relaunched PDI Drywall
  - Successful and growing
  - Innovative approach to materials and ecofriendly
  - Unique Company Values
- Chicks in Construction
The only thing holding you back is DECIDING to try!
Let's Try it Out

Video from Alpine Meadows Ski Resort
Safety was not Fundamentally Core to Construction

Safety
- Safety Committee
  - Diverse Company Membership
  - Toolbox Talks
  - Incident reporting
  - Awareness Training
- Creating Culture of Safety

Technology
- Technology Committee
  - Diverse Company Membership
  - Tech Talks
  - Incident Reporting
  - Awareness Training
- Creating a Culture of Innovation
Form a Technology Committee
Develop Requirements Matrix
Research & Development
Test Apps & Hardware
Pick a small Pilot Project
Get Help with Implementation & Training
Continuous Improvement