



Technology Investments To Transform Your Business

Kyle Holmes

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Sponsors

- ▶ **Stuart Price, Lee Company**
- ▶ **Jon Baumgarten, Trane Nashville**



Topics

- ▶ **The Technology Challenge**
- ▶ **Construction Technology**
 - ▶ Simple – timekeeping, 3D BIM, hanger fab, onscreen t/o
 - ▶ Moderate – web accounting, document control, points
 - ▶ Complex – fab by manufacturer, real-time productivity
- ▶ **Service Technology**
 - ▶ Technician Tools for Efficiency and Quality
 - ▶ Digital Workflows for Startup/Cx, Warranty and Service
 - ▶ Providing Value Added Customer Deliverables



The Technology Challenge in Three Words:

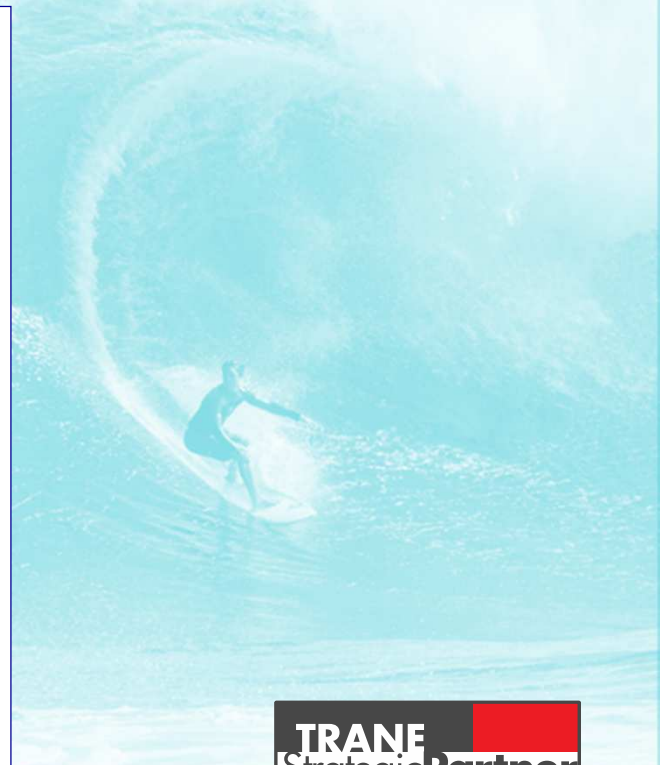
PROVING

TRUE

VALUE



We have a term for technology with no business value:



Proving True Value Challenges

- ▶ We rarely build the same project twice
- ▶ We compare apples to oranges
- ▶ We forget about opportunity cost

- ▶ Technology that **SAVES LABOR**, especially **FIELD LABOR**, is usually a good investment



Not here to endorse a product

**Here to give you some ideas for
investments**

**Screenshots are NOT product
endorsements**



SIMPLE THINGS

Timekeeping

3D Modeling

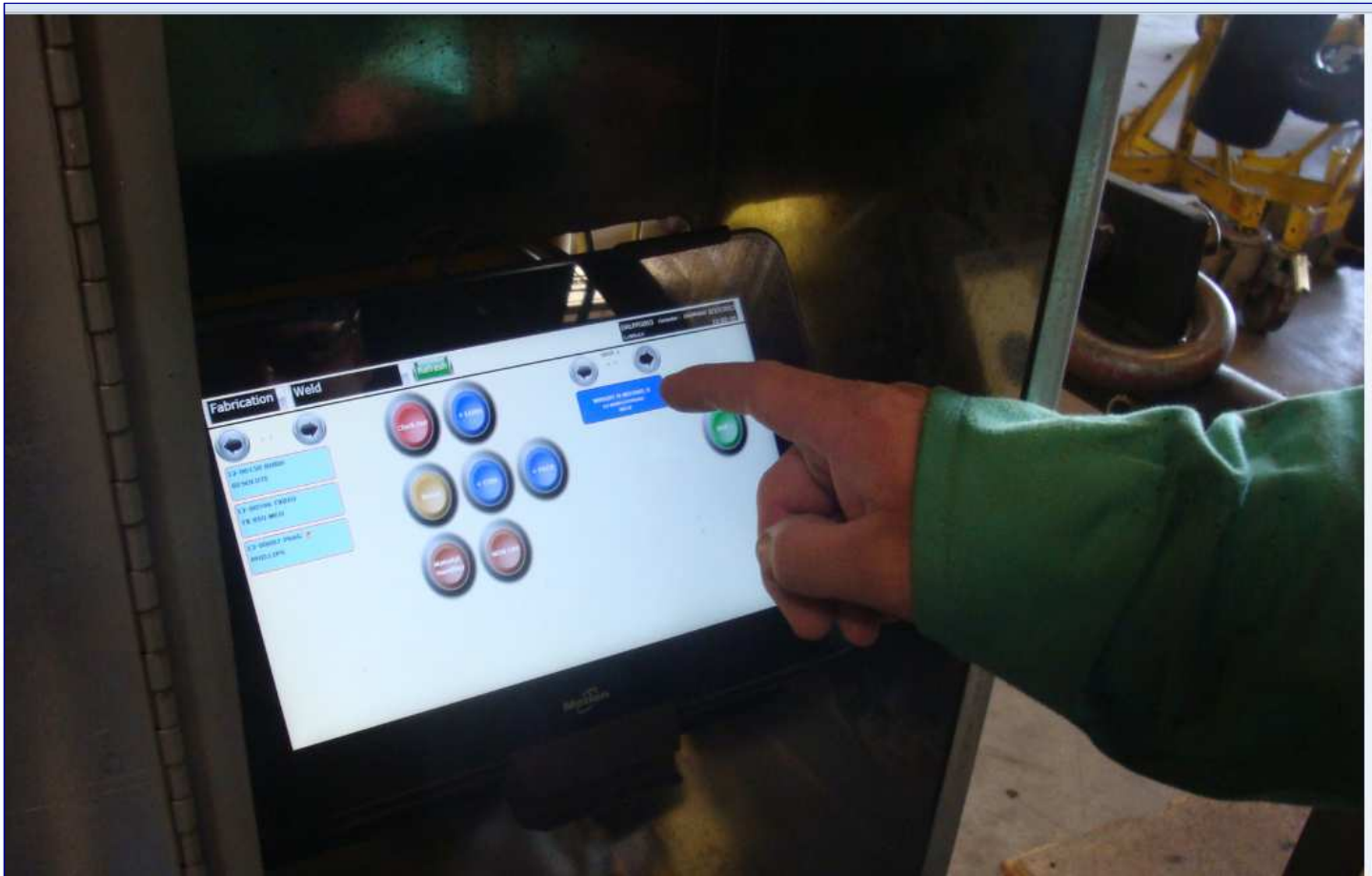
Hanger fabrication

Onscreen takeoff



Upgrade your timekeeping

- ▶ **How much time is spent:**
 - ▶ COLLECTING timesheets
 - ▶ APPROVING timesheets
 - ▶ REVISING timesheets
 - ▶ PROCESSING timesheets in payroll
- ▶ **Develop a level 1, level 2 method**
- ▶ **Organize levels around your departments**



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Strategic Partner
PROGRAM

Time Card Approval Form

Start Date 1/18/2016 Select Job Select Approval Select Dept

EmployeeID	Employee	Mon Jan 18	Tue Jan 19	Wed Jan 20	Thu Jan 21	Fri Jan 22	Sat Jan 23	Sun Jan 24	Total	L1	L2	Supervisors
A4373	ALMANZA ROBERT S	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	TRAMMELL JOHN, BASHAM JOHN
A9822	AMOS KARL DWIG	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	BECK JAMES
A5528	ARCHER TOBY G	8	8	9	9	8			42	<input type="checkbox"/>	<input type="checkbox"/>	REYNOLDS BRIAN
B5689	BARNES KENDALL G	8	8	8	8	0			32	<input type="checkbox"/>	<input type="checkbox"/>	REYNOLDS BRIAN
B8070	BASHAM JOHN A	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	HOLMES KYLE
B1162	BECK JAMES ELLI	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	HOLMES KYLE, BASS VICKI
B7249	BLUEIII DONALD R	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	REYNOLDS BRIAN
B6090	BRUNDAGE MIKE	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	REYNOLDS BRIAN
B3737	BURKETT BRYON L	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	REYNOLDS BRIAN
B4138	BUTLER SCOTT E	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	REYNOLDS BRIAN
B2188	BUTLER TIMOTHY LEE	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	BECK JAMES
C8822	CHRISTENSEN JACK D	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	BASHAM JOHN
C4662	COLVIN MONTE ALAN	9	8	8	8	7	8	6	54	<input type="checkbox"/>	<input type="checkbox"/>	STEWART JOHN
C1836	COSTLOW CLINT L	10	10	10	10	8	6		54	<input type="checkbox"/>	<input type="checkbox"/>	REYNOLDS BRIAN
C2960	COX WILLIAM J	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	BASHAM JOHN
D8097	DAVILA MARK A	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	TRAMMELL JOHN, BASHAM JOHN
D2659	DONALDSON RANDALL D	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	REYNOLDS BRIAN
D3144	DOSS DONALD	8	8	8	8	8			40	<input type="checkbox"/>	<input type="checkbox"/>	REYNOLDS BRIAN

Recorded By Date Shift Pay Type Total Job Cost Code Control Number



Do not try to replace your accounting system

Timekeeping software can generate reports that can help find errors before they become booked in accounting

Just “feed” payroll more efficiently than this...





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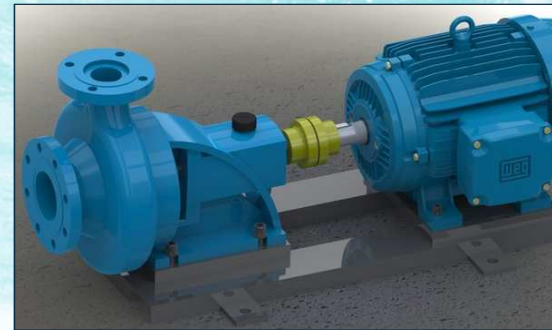
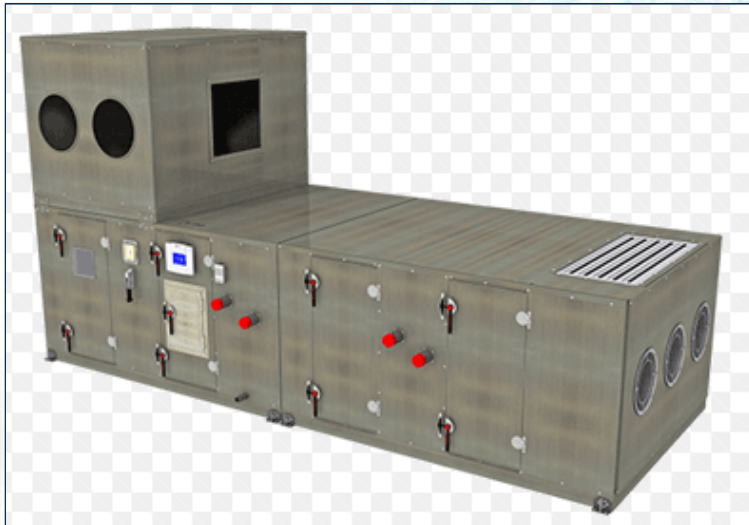
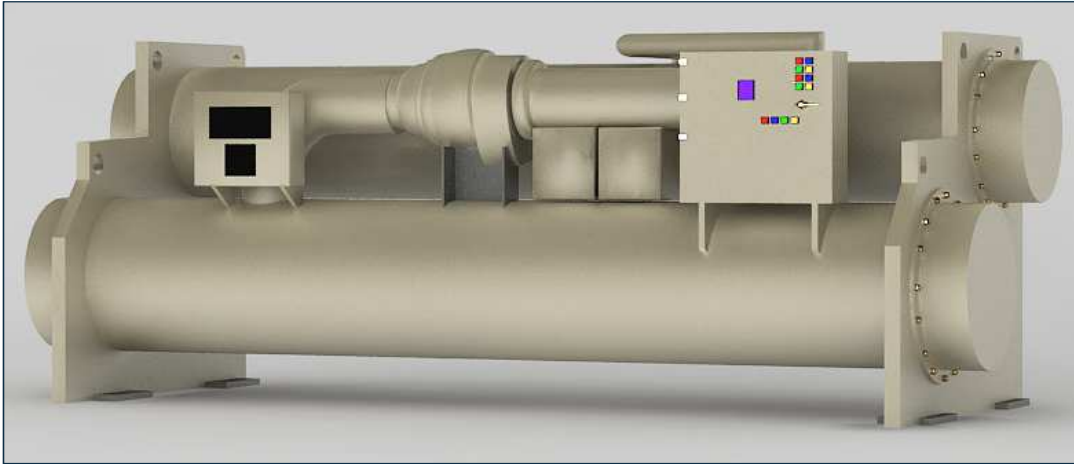
Start 3D modeling of work (BIM)

- ▶ An accurate model is a **DIGITAL MOCKUP**
- ▶ The endgame of BIM is **FAB**

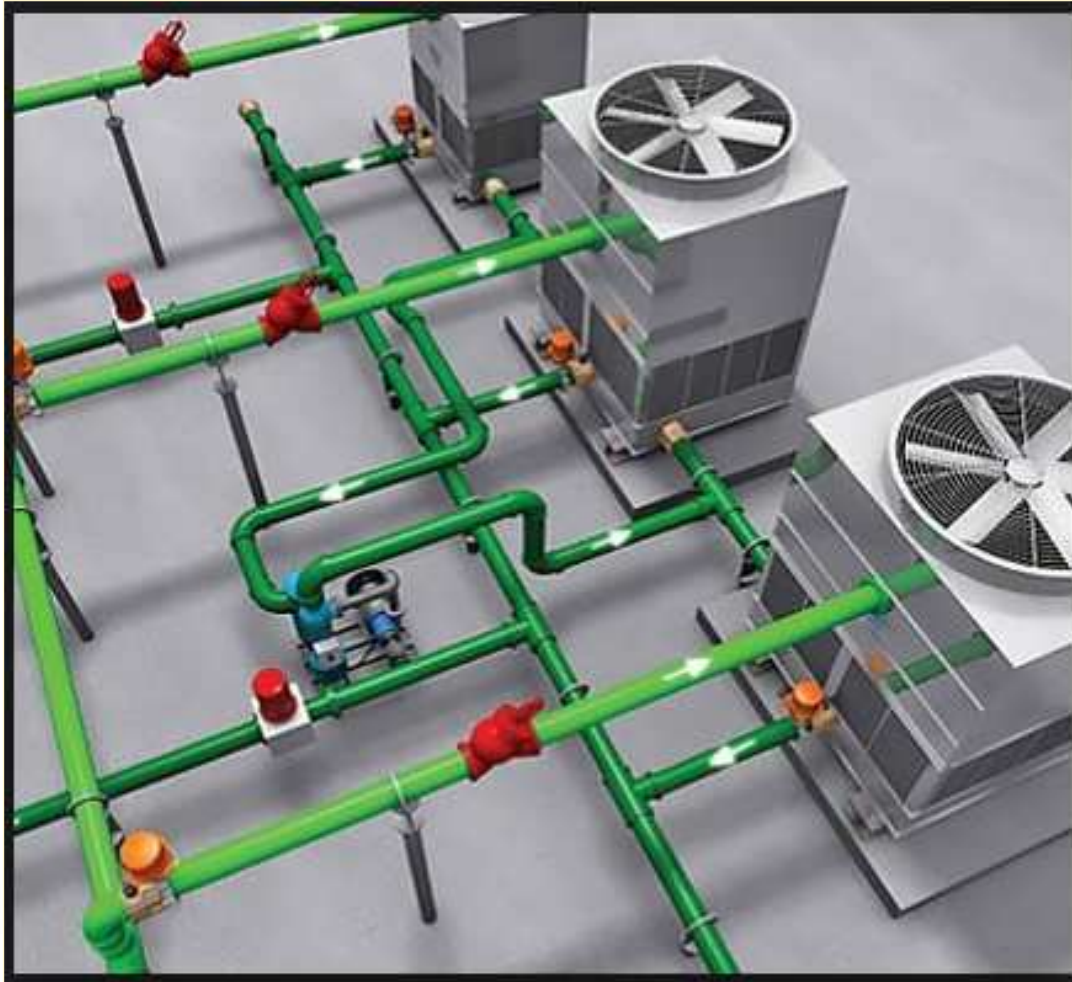
▶ Model	what you	Submit
▶ Buy	what you	Model
▶ Fab	what you	Buy
▶ Install	what you	Fab
▶ Audit	what you	Install

▶ Think about **NODES** and **DISTRIBUTION**





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**Most of your
field labor RISK
occurs
between
equipment**

**Many FAB
opportunities
exist with small
items**




Fabricating Hangers



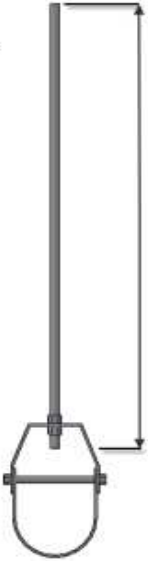
Hanger Fab can be BIM or non-BIM

JOB NAME: _____
 JOB NUMBER: _____
 FLOOR: _____
 AREA: _____
 SYSTEM: _____
 MATL. COST CODE: _____
 DATE NEEDED: _____



CLEVIS HANGER ORDER FORM

TAG: _____



ROD LENGTH
 _____ 2' - 0"
 _____ 2' - 6"
 _____ 3' - 4"
 _____ 5' - 0"
 _____ 10' - 0"
 _____ OTHER

ROD SIZE _____

HANGER SIZE _____ (in)

GALVANIZED
 BLACK
 COPPER CLAD

_____ QTY.

JOB NAME: _____
 JOB NUMBER: _____
 FLOOR: _____
 AREA: _____
 SYSTEM: _____
 MATL. COST CODE: _____
 DATE NEEDED: _____



UNISTRUT TRAPEZE HANGER ORDER FORM

TAG: _____



ROD LENGTH (ft) _____
ROD SIZE (in) _____

7/8"
 1-5/8"
 OTHER

_____ (in)

WEB UP
 WEB DOWN

ASSEMBLED
 NON-ASSEMBLED

UNISTRUT
 SINGLE UNISTRUT
 BACK TO BACK UNISTRUT

_____ QTY. _____

EXT. _____ (in)

_____ (in)

PLAIN _____
GREEN _____
GOLD ZINC _____
GALVANIZED _____

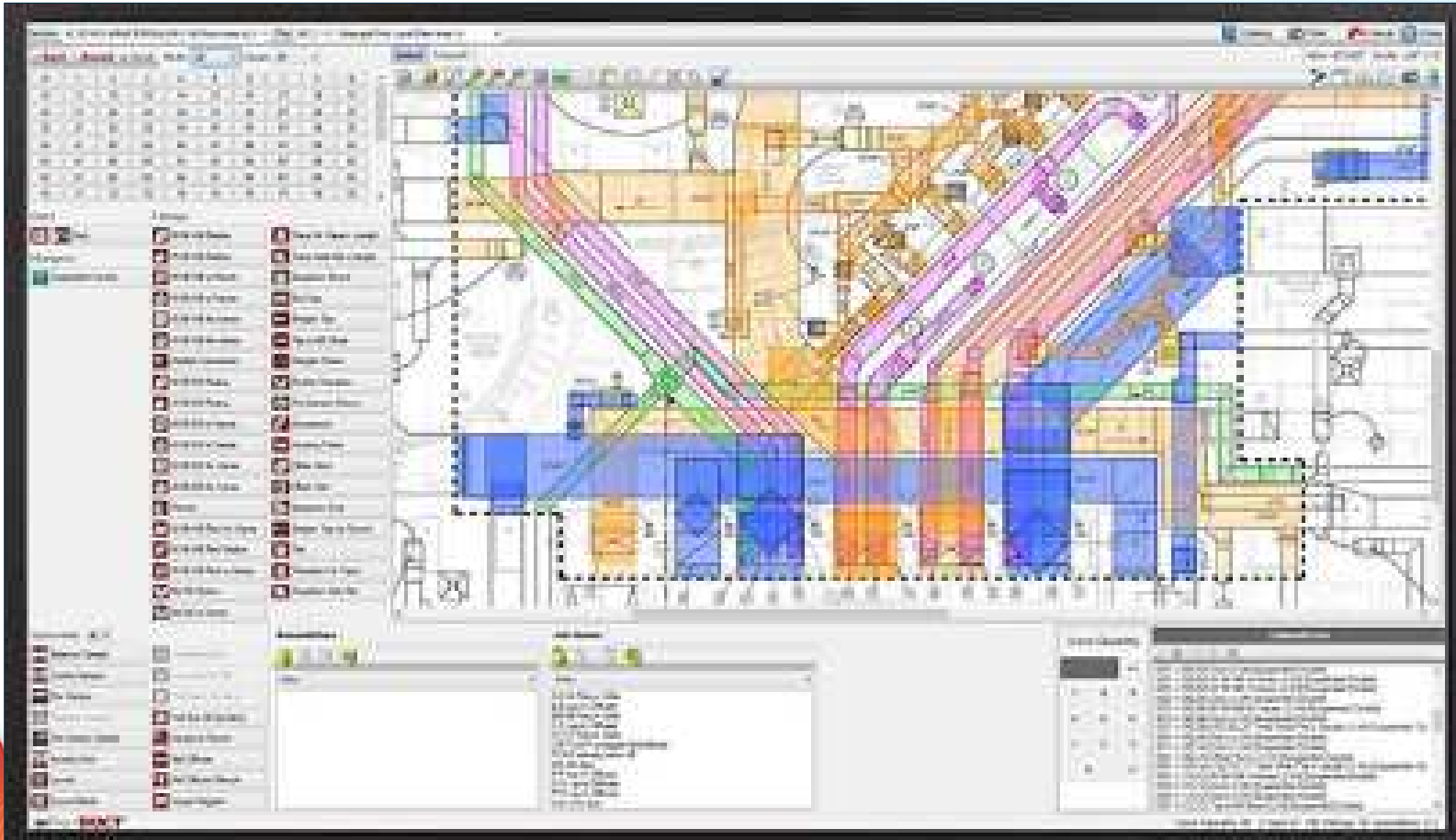
_____ CENTER/CENTER OF RODS (in)

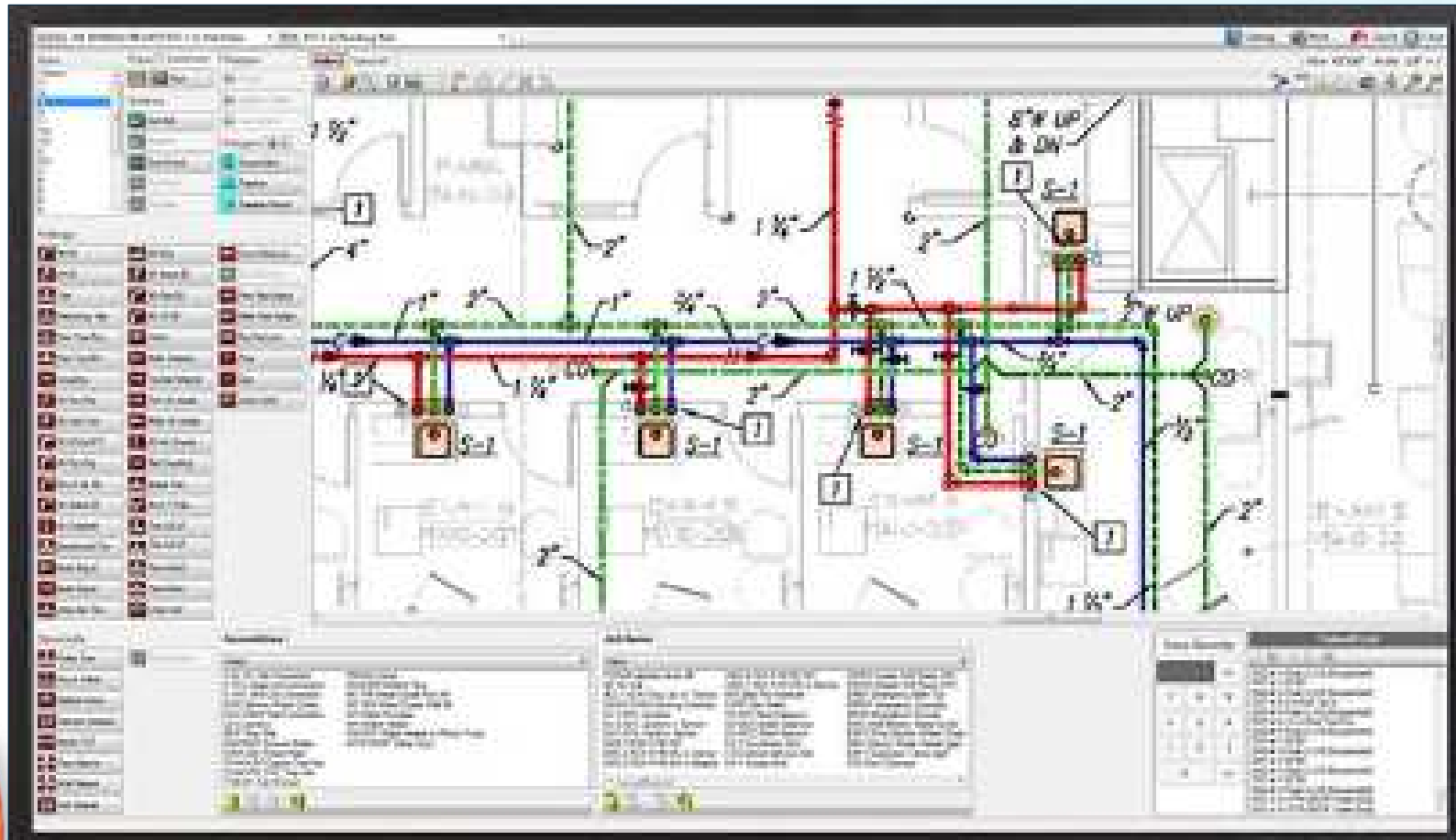


Onscreen Takeoff

- ▶ **Estimating has become alchemy**
 - ▶ Breakout worksheet is longer than MEP narrative
- ▶ **Paper plans for bidding are rarely provided**
- ▶ **Onscreen takeoff helps OPS & SALES**
 - ▶ OPS can run their own reports and breakouts
 - ▶ Sales can convey more scope than competitors







MODERATELY COMPLEX THINGS

Web based accounting

Network based document control

Points work



Web-Based Accounting Data

- ▶ **Project Managers provide value when they PREDICT COST NOT SPENT YET**
- ▶ **Accountants provide value when they ORGANIZE COST ALREADY SPENT**
- ▶ **Your accounting system should provide a non-labyrinth way for OPS to see CTD**









Element	Original Estimate	Change Orders (ABX)	Estimated Cost	Forecasted Cost	Cost to Date	Cost to Complete	+/- Forecast vs Estimate	Committed *
1 - Install Labor	\$466,481	\$31,852	\$498,333	\$531,442	\$215,564	\$315,878	\$33,109	\$0
1 - Other Labor	\$266,544	\$5,826	\$272,370	\$283,253	\$124,787	\$158,466	\$10,883	\$0
2 - Material	\$277,728	\$18,299	\$296,027	\$287,361	\$145,464	\$141,897	(\$8,667)	\$26,802
3 - Equipment	\$450,035	(\$26,136)	\$423,899	\$423,899	\$5,689	\$418,211	\$0	\$196,313
4 - Subcontractor	\$183,551	\$127,685	\$311,236	\$293,690	\$12,004	\$281,686	(\$17,547)	\$123,256
5 - Other Expenses	\$131,631	\$25,863	\$157,494	\$178,598	\$115,326	\$63,272	\$21,104	\$20,881
7 - Contingencies	\$37,590	\$9,400	\$46,990	\$8,108	\$0	\$8,108	(\$38,882)	\$0
8 - Allowances	\$152,750	(\$152,750)	\$0	\$0	\$0	\$0	\$0	\$0
9 - Sales Tax	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	\$1,966,311	\$40,040	\$2,006,351	\$2,006,351	\$618,834	\$1,387,517	\$0	\$367,252



15-00660 Cost Codes

Enter search text Trade System Material Area Search Clear

Cost Code	Original	Current	Forecast	Actual	Remaining	Variance
Total: 6	\$70,315.10	\$86,246.26	\$86,246.26	\$9,853.18	\$76,393.08	\$0.00
 02-150-000-000-1 Set Equip	\$4,314.20	\$4,314.20	\$4,314.20	\$305.34	\$4,008.86	\$0.00
 02-160-000-000-1 Test/Flush	\$10,504.60	\$10,504.60	\$10,504.60	\$0.00	\$10,504.60	\$0.00
 02-230-060-100-1 CHW CSWld	\$28,983.58	\$5,765.34	\$5,765.34	\$9,547.84	(\$3,782.50)	\$0.00
 02-230-061-200-1 CHW CSGrv	\$23,218.24	\$62,367.64	\$62,367.64	\$0.00	\$62,367.64	\$0.00
 02-233-050-100-1 CD CuSid	\$1,608.02	\$1,608.02	\$1,608.02	\$0.00	\$1,608.02	\$0.00
 02-233-050-200-1 CD CuSid	\$1,686.46	\$1,686.46	\$1,686.46	\$0.00	\$1,686.46	\$0.00
Total: 6	\$70,315.10	\$86,246.26	\$86,246.26	\$9,853.18	\$76,393.08	\$0.00




This is all READ-ONLY data, easy to get

15-00660 Cost Code Detail

02-150-000-000-1 - Set Equip

	Original	Current	Actual	Forecast	Variance
Estimate	\$4,314.20	\$4,314.20	\$305.34	\$4,314.20	\$0.00
Hours	110.00	110.00	9.00	110.00	0.00
Crew Rate	\$39.22	\$39.22	\$33.93	\$39.22	\$0.00

Change Orders

	Date	Estimate	Hours	CrewRate
 P0013	12/22/2015	\$4,314.20	110.00	\$39.22



Network (or Cloud) Based Doc Control

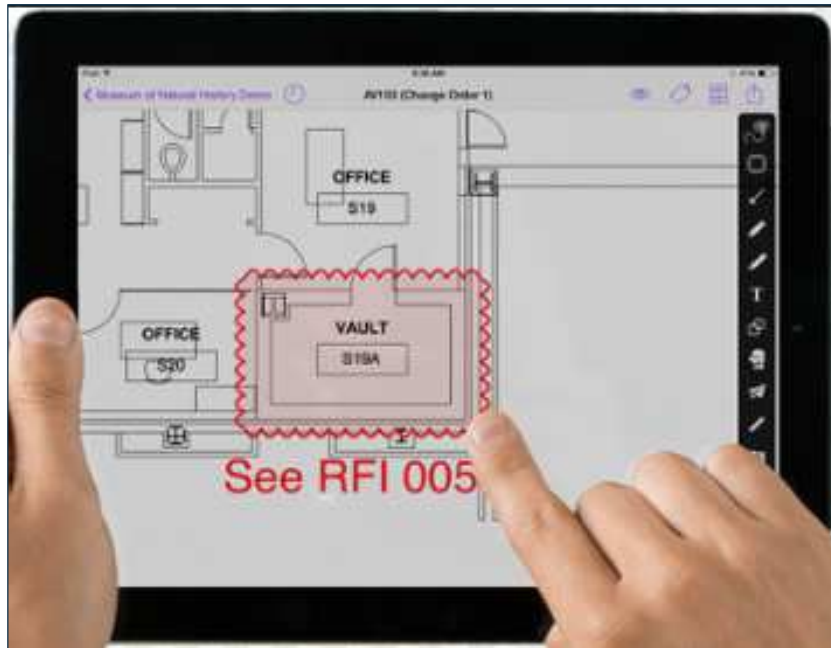
We do NOT live in a paperless society



- ▶ Contract documents
- ▶ Submittals
- ▶ RFI's
- ▶ Shop drawings



Mobile access is ICING on the cake



Easy revision history IS CAKE

1999009.00 - AESC New (Product Management ONLY) - Newforma Project Center

ACTIVITIES Current Project: 1999009.00 - AESC New

DOCUMENT CONTROL - AESC NEW (PRODUCT MANAGEMENT ONLY) (1999009... Refreshed 2 minutes ago)

Manage Record Document

All Record Documents (37) Filter All Columns: CLEAR

Discipline	Number	Title	Revision	Scale	Size	Type
Arch	A2.1	Arch First Floor Plan	P01	1/8" - 1/0"	30 x 42	Plan
Arch	A2.2	Arch Second Floor Plan	P02	1/8" - 1/0"	30 x 42	Plan
Arch	A2.3	Arch Third Floor Plan	P02	1/8" - 1/0"	30 x 42	Plan
Arch	A2.4	Arch Fourth Floor Plan	P02	1/8" - 1/0"	30 x 42	Plan
Arch	A2.5	Arch Fifth Floor Plan	P02	1/8" - 1/0"	30 x 42	Plan
Arch	A2.6	Arch Sixth Floor Plan	P01	1/8" - 1/0"	30 x 42	Plan
		Arch Seventh Floor Pl	P01	1/8" - 1/0"	30 x 42	Plan
		Arch Eighth Floor Plan	P01	1/8" - 1/0"	30 x 42	Plan
		Arch Roof Plan	P01	1/8" - 1/0"	30 x 42	Plan

Selected Record Document:

- Open with Newforma Viewer
- Modify
- View form
- Delete
- Add Revision
- Issue Selected Record Document

Document Control:

- Add a Record Document
- Create Document Control Report
- Import Spreadsheet
- Export to Spreadsheet
- Import from Spreadsheet

COMMON OPERATIONS

REVISION HISTORY

Summary of All Revisions

Revision	Issue Date	Recipient	Description	EMAIL LOG (0)	RELATED ITEMS (1)	SUPPORTING
P01	10/15/2010	Bob Batch				
P02						

You can use it to open any previous revision of a record document since each revision is linked to its source file in the project.

- Milestones
 - 25% DD
 - A2.2.pdf
 - 50% DD
 - A2.2.pdf

Newforma PROJECT CENTER

Connected to B010

Newforma Confidential

Points work – locating items from models



Excellent way to improve layout:

- ▶ Penetrations
- ▶ Inserts
- ▶ Hangers
- ▶ Critical equip.

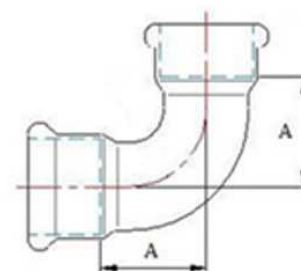
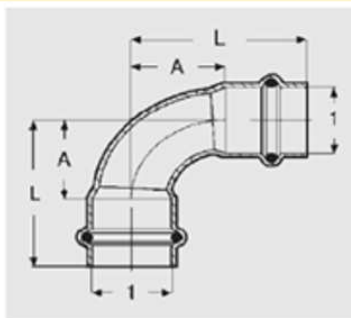
VERY COMPLEX THINGS

Manufacturer-Specific 5D Fabrication

Real-Time Productivity Tracking



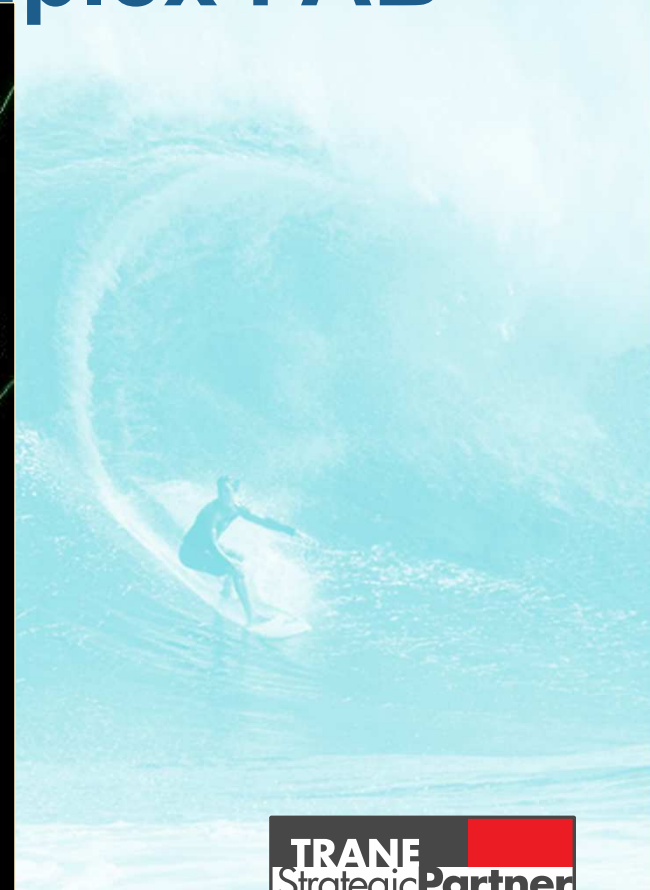
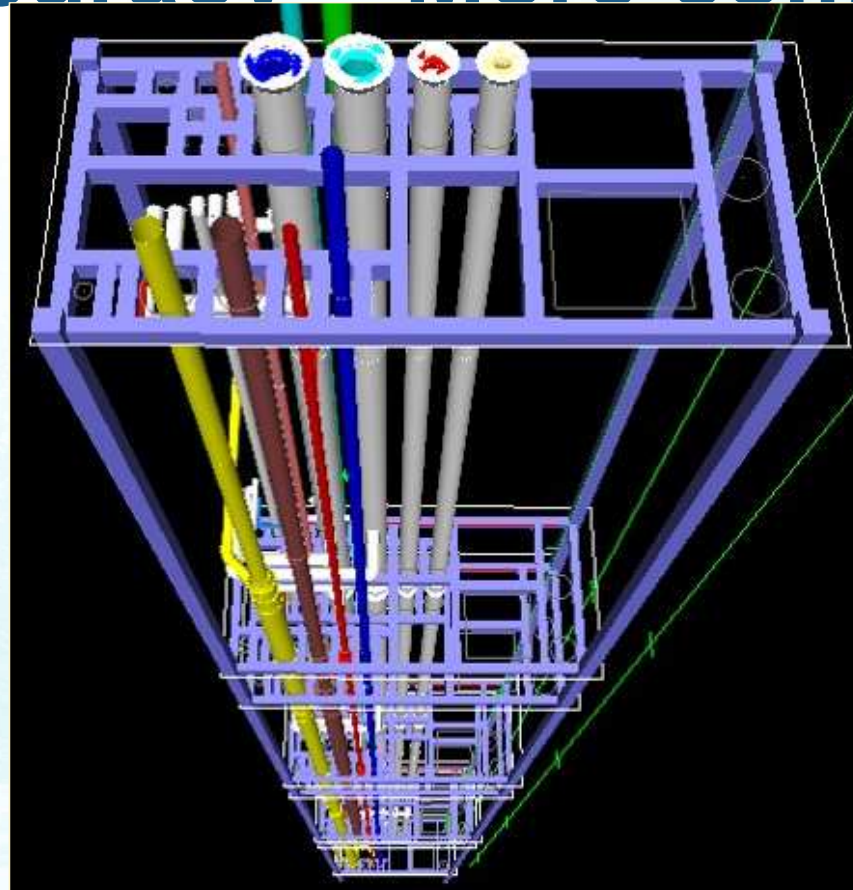
5D = You can BUY what you MODEL



Elbow 90° C x C Close Rough						
Stock Code	Size	Material	A		L	
			(in)	(mm)	(in)	(mm)
	1					
77317	1/2"	Copper	0.748	19.0	1.496	38.0
77322	3/4"	Copper	1.039	26.4	1.945	49.4
77327	1"	Copper	1.323	33.6	2.228	56.6
77332	1-1/4"	Copper	1.654	42.0	2.677	68.0
77337	1-1/2"	Copper	1.984	50.4	3.402	86.4
77342	2"	Copper	2.551	64.8	4.126	104.8

Part Number	Size	Box Quantity	Master Pack	Approx. Net Wt.	Dim. A
61440	1/2	10	100	0.1100	0.7100
61445	3/4	10	150	0.1900	0.9800
61450	1	10	50	0.3000	1.3400
61455	1 1/4	1	40	0.4400	1.8400
61460	1 1/2	1	25	0.7600	2.0700
61465	2	1	10	1.9300	2.6200
62020	2 1/2	1	3	6.5200	3.3900
62025	3	1	2	7.2400	3.9700
62030	4	1	1	12.6900	4.1700

Model accuracy = More complex FAB

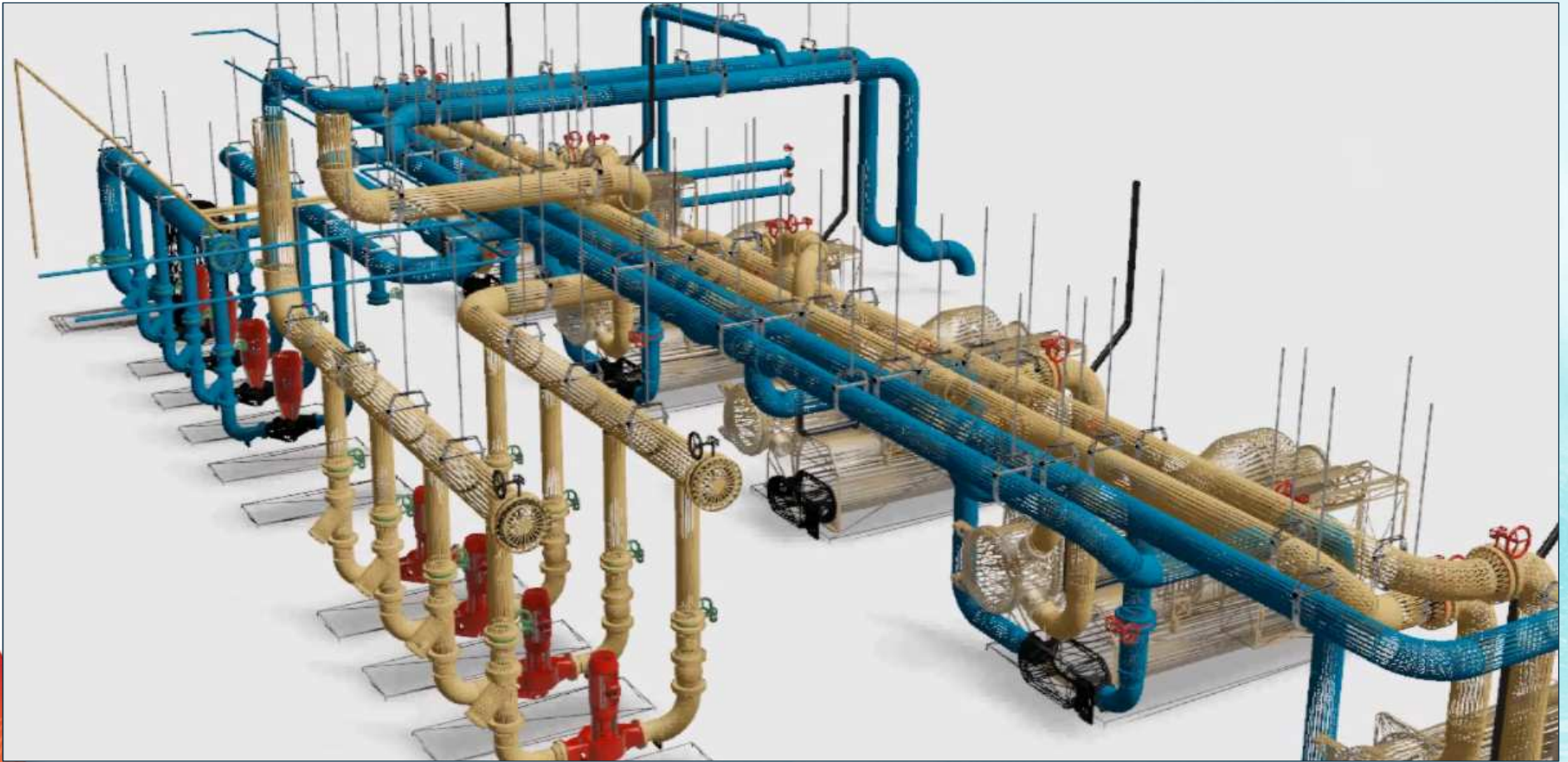


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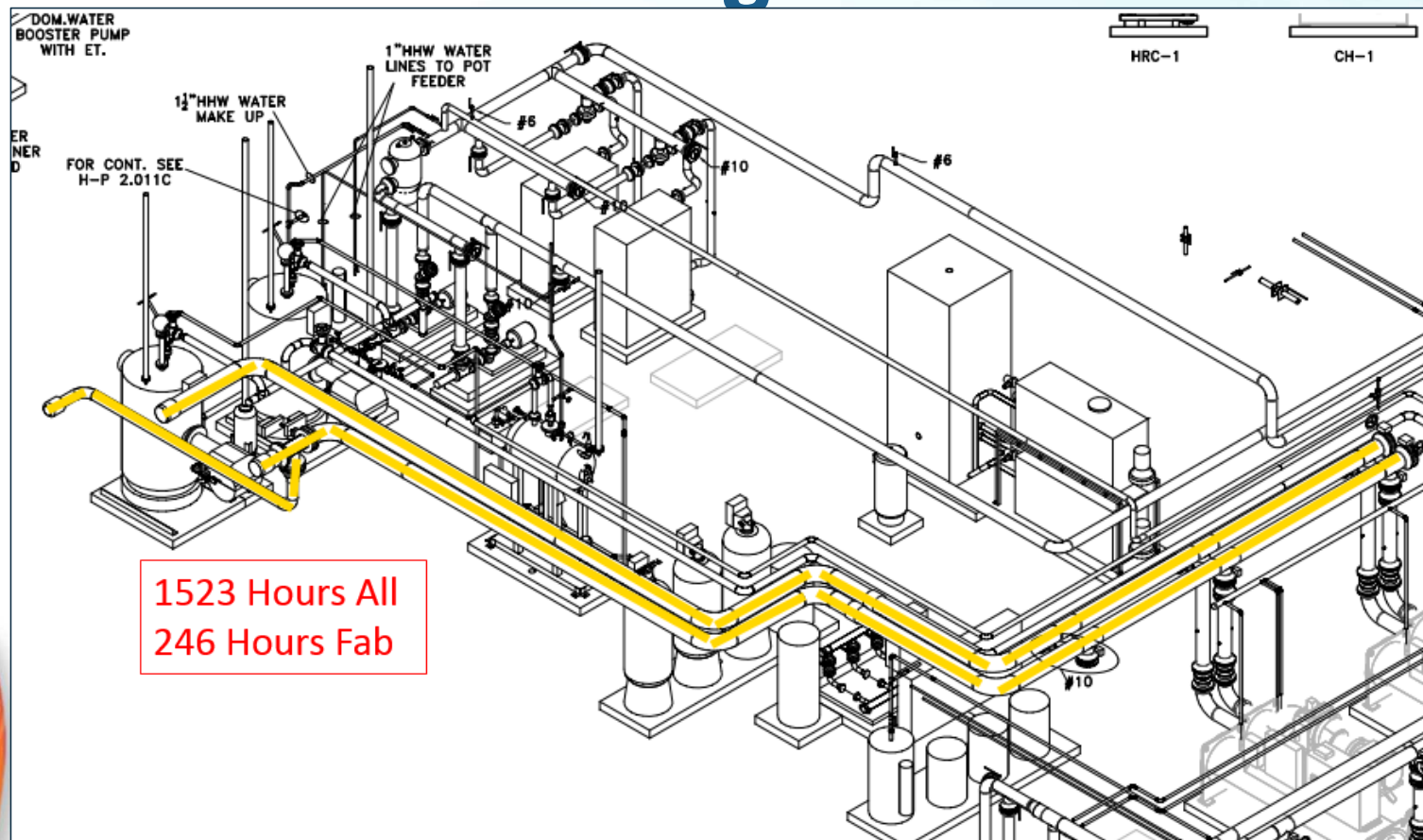
True 5D BIM is a DIGITAL MOCKUP



Mockup = Planning = Profit



True 5D BM can give LABOR data



True 5D BM can give LABOR data

The screenshot displays a 5D BIM software interface with four main views:

- View 1 (Top):** A 2D shaded view of a pipe fitting with dimensions: C=Ø 5.8", H=Ø 11.16", and A=Ø 1.8".
- View 2 (Bottom):** A 2D wireframe view of the same pipe fitting.
- View 3 (Isometric):** A 3D perspective view of the pipe fitting.
- Edit Product List:** A table listing components with columns for Name, D1) Pipe..., D19) Right..., D2) Pipe L..., D5) Branc..., D6) Branc..., Order, Weight, and Id.

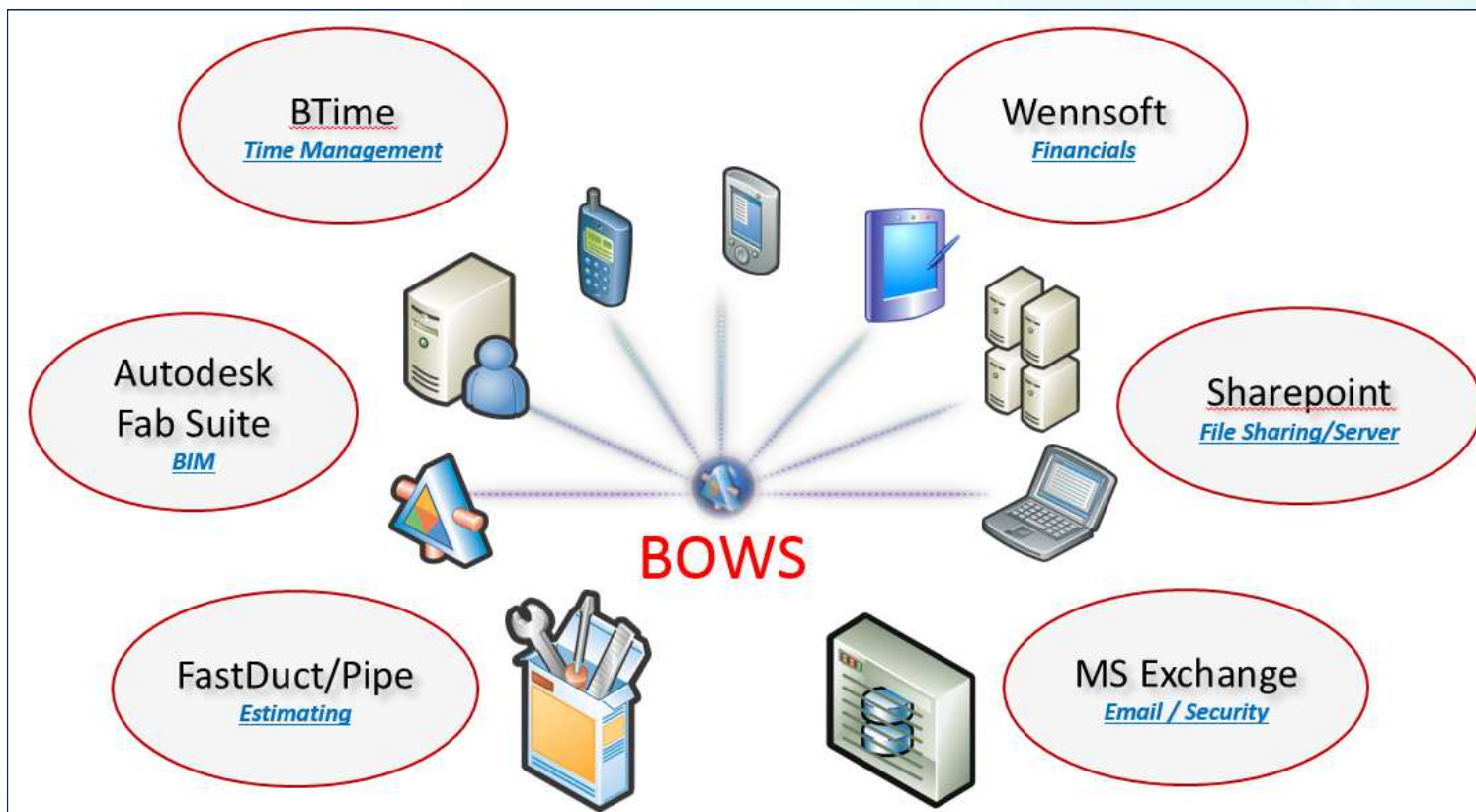
The 'Edit Product List' table contains the following data:

Name	D1) Pipe...	D19) Right...	D2) Pipe L...	D5) Branc...	D6) Branc...	Order	Weight	Id
3/4x3/4x1/4	0.3/4"	0.3/4"	0.25/32"	0.1/4"	0.3/4"	111R	0.1350	012EK1180
3/4x3/4x3/8	0.3/4"	0.3/4"	0.25/32"	0.3/8"	0.11/16"	111R	0.1310	012EK1178
3/4x3/4x1/2	0.3/4"	0.3/4"	0.23/32"	0.1/2"	0.15/32"	111R	0.1120	012EK1176
3/4x3/4x5/8	0.3/4"	0.3/4"	0.25/32"	0.5/8"	0.17/32"	111R	0.1530	012EK1174
3/4x3/4x1	0.3/4"	0.3/4"	1.1/2"	1"	0.17/32"	111R	0.2020	012EK1172
1x1/2x1/2	1"	0.1/2"	1.5/32"	0.1/2"	0.11/16"	111R	0.1830	012EK1236
1x1/2x3/4	1"	0.1/2"	1.7/16"	0.3/4"	0.5/8"	111R	0.2200	012EK1235
1x1/2x1	1"	0.1/2"	1.23/32"	1"	0.21/32"	111R	0.2900	012EK1234
1x3/4x3/8	1"	0.3/4"	1.1/8"	0.3/8"	0.21/32"	111R	0.2700	012EK1228
1x3/4x1/2	1"	0.3/4"	0.29/32"	0.1/2"	0.11/16"	111R	0.1830	012EK1226
1x3/4x3/4	1"	0.3/4"	1.1/2"	0.3/4"	0.5/8"	111R	0.2200	012EK1224
1x3/4x1	1"	0.3/4"	1.15/32"	1"	0.21/32"	111R	0.2900	012EK1222
1x1x3/8	1"	1"	1"	0.3/8"	0.13/16"	111R	0.1830	012EK1216
1x1x1/2	1"	1"	0.11/16"	0.1/2"	0.11/16"	111R	0.1830	012EK1214
1x1x5/8	1"	1"	1"	0.5/8"	1"	111R	0.3190	012EK1212
1x1x3/4	1"	1"	1"	0.3/4"	0.5/8"	111R	0.2200	012EK1210
1x1x1-1/4	1"	1"	1.13/16"	1.1/4"	0.25/32"	111R	0.4050	012EK1208
1x1x1-1/2	1"	1"	1.1/2"	1.1/2"	1.5/32"	111R	0.6800	012EK1206

A red box highlights the '0.78 MCAA hours' value for the component with ID 012EK1214.



5D data allows automation & metrics



Field orders FAB via Internet

Add New WorkOrder Wizard

General information related to the work order must initially be entered.

1 - General

Who is making this work request?
 Requested By Me I am requesting on behalf of:

What job is this work request associated?
 UNT Student Union

Cost Codes: All required Cost Codes are setup correctly

What role are you for this job?

Specify the contract or shop drawing information that will be used as the default when adding line items with specifications (optional)
Shop Drawing Number: or Contract Drawing Number:

Enter the date that the order is due on site.
 Authorized for Overtime

Specify a short descriptive reference name for the order.

Next ➔

Add New WorkOrder Wizard

Select the specification item below for fabrication items associated with modeled system requests, then Press Add New Item to add a new line item.

3 - Line Items

Supply Air | 4wg | Galvanized | Wrap 2" Foil
Entire Subsystem Service Exposure U.N.O. | Entire Subsystem Service Loca

No Specification

Supply Air | 4wg | Galvanized | Wrap 2" Foil
Entire Subsystem Service Exposure U.N.O. | Entire Subsystem Service Location U.N.O. | Variable Volume (w/terminal units) | None

Supply Air | 2wg SD | Galvanized | Wrap 2" Foil
Entire Subsystem Service Exposure U.N.O. | Entire Subsystem Service Location U.N.O. | Variable Volume (w/terminal units) | None

Return Air | 2wg SD | Galvanized | Wrap 2" Foil
Entire Subsystem Service Exposure U.N.O. | Entire Subsystem Service Location U.N.O. | Constant Volume (wo/terminal units) | None

Exhaust Air General | 3wg SD | Galvanized | No Liner
Entire Subsystem Service Exposure U.N.O. | Entire Subsystem Service Location U.N.O. | Constant Volume (wo/terminal units) | None

Previous **Next**



Field orders FAB via Internet

Add New WorkOrder Wizard

Enter shipping instructions that may be required to inform distribution prior to delivery.

5 - Shipping Instructions

Review Shipping Address for Job:
**5400 Clear fork Main
Ft Worth TX - 76109**

Enter any special shipping instructions below:

MAKE SURE YOU CALL MY CELL AT 214-587-9559 WHEN THE TRUCK LEAVES THE SHOP

DRIVER MUST MAKE SURE TO HAVE PROPER PPE WHILE ON SITE!

[← Previous](#) [Next →](#)

Add New WorkOrder Wizard

Submit the work order to the shop for fabrication. You may duplicate this order by selecting the duplicate order checkbox once the order is submitted successfully.

6 - Summary

[Submit Order](#)

General

[Edit](#)

Requested By	
Job	12-00270 - Forest Park Med Ctr Ft Worth
Shop Labor Cost Code	07-730-703-000-1
Material Cost Code	07-730-000-000-2
Driver Cost Code	07-730-705-000-1
Order Type	Field Order
Date Due OnSite	3/20/2014

Shipping Instructions

[Edit](#)

MAKE SURE YOU CALL MY CELL AT 214-587-9559 WHEN THE TRUCK LEAVES THE SHOP

DRIVER MUST MAKE SURE TO HAVE PROPER PPE WHILE ON SITE!

[← Previous](#)

Streamline Shifts, Shipping, QAQC

Standard Shift Setup

Calendars

- Shift Scheduler
- SM WorkOrder Scheduler
- PI WorkOrder Scheduler
- PG WorkOrder Scheduler
- Shop Calendar Exception Dates
- Shift Template Setup
- Standard Shift Setup
- Employee List

Shift Name	Total	Non Sups	Rate	Capacity (lbs)
Shift 1	35	31	32.86	13950
Shift 2	8	8	31.38	3600
Shift 3	0	0	0.00	0
Total	43	39	32.58	17,550

Shift 1

- ANTONIO AZ-CHAY - (68C70)
- ANTHONY ARMSTRONG - (68P40)
- HENRY BROWN III - (68JF)
- THEODORE BUNN - (68A70)
- CHRISTOPHER CANNIZZARO - (68J)
- MICHAEL CALLOWAY - (68J)
- CHRISTOPHER COLLINS - (68P40)
- MARCUS DYESS - (68F7)
- RANDALL DONALDSON - (68F6)
- TREVOR DEAN - (68A50)
- BRYAN DOYLE - (68P40)
- ADAM ENYART - (68A50)
- RUSSELL EDMONSON - (68P40)
- GERARDO GONZALEZ - (68C56)
- ISAIAH GARCIA - (68P40)
- KEITH GOFFNER - (68C44)
- DONALD HEDGE - (68A60)
- DAMON JACKSON - (68J)
- SAMUEL JOLLEY - (68P48)
- DENNIS KRUSE - (68C53)
- LONNELL KARRIEM - (68C45)
- RICKEY LAMON - (68J)

Navigation: Lists, Queues, Catalog, Distribution, Purchasing, **Calendars**, Shop Time, Jobs and Projects, Reports, Contacts, Settings



Productivity Software Tracks Orders

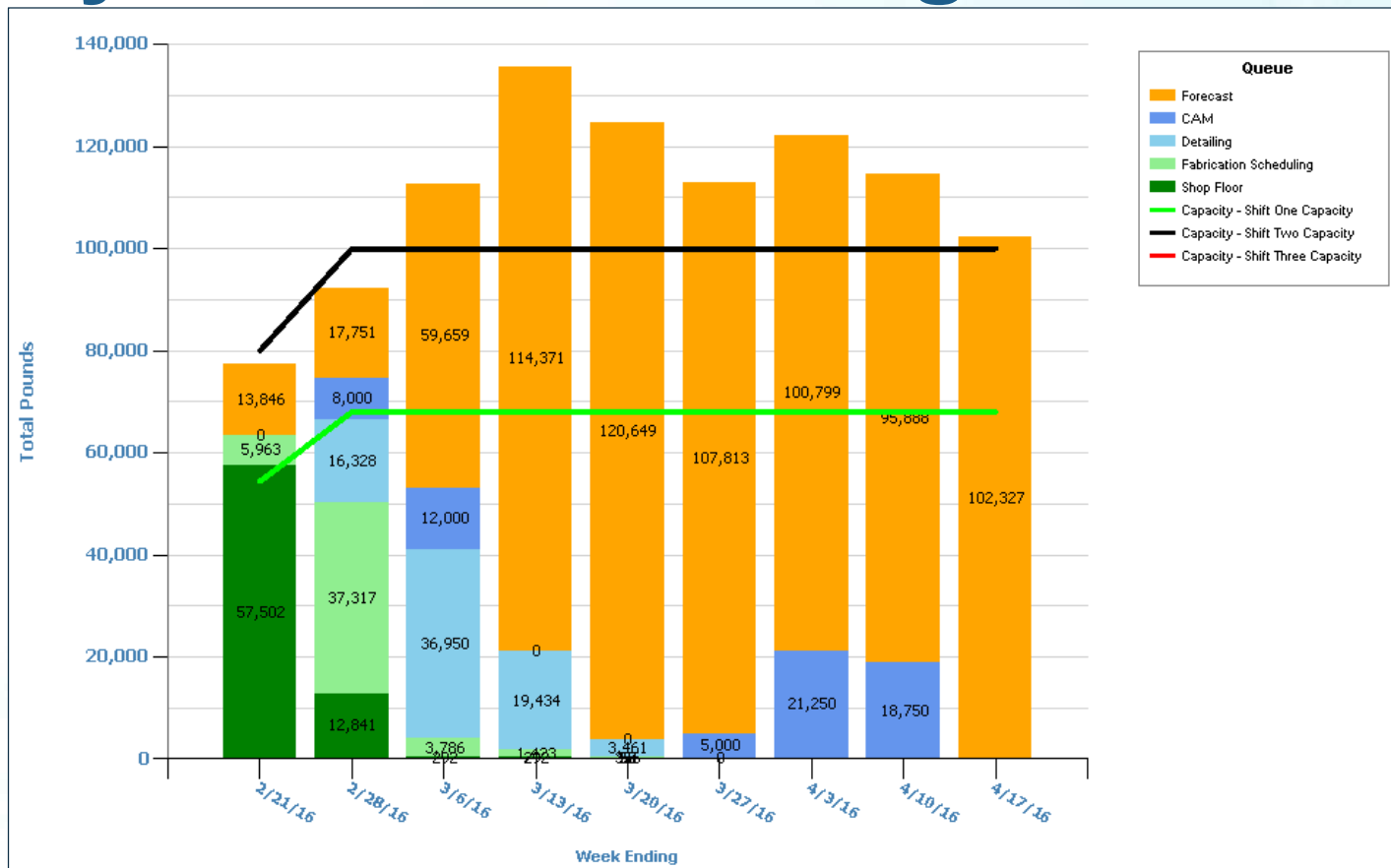
Sheet Metal Shop Performance

CAM / Fax: ALL IndirectTime: True
 Coordination: True Fabrication: True Packing: True Distribution: False
 From FAB Complete Date: 12/30/2013 To FAB Complete Date: 1/5/2014

Material Type	Cut Type Category	Job Number	Control Number	Material Cut Type Hours	Category Extended Weight	Lbs/Hour
<input checked="" type="checkbox"/> _INDIRECT				271.31	-	-
<input checked="" type="checkbox"/> ACCESSORY				28.40	2,271.32	79.98
<input checked="" type="checkbox"/> ANGLE IRON				35.49	3,762.33	106.01
<input checked="" type="checkbox"/> GALVANIZED				694.96	62,662.03	90.17
	<input checked="" type="checkbox"/> MISC ACCESSORIES			0.73	64.16	87.89
	<input checked="" type="checkbox"/> RECT STRAIGHT			214.54	35,541.27	165.66
	<input checked="" type="checkbox"/> RECT STRAIGHT LINED			11.13	2,260.61	203.11
	<input checked="" type="checkbox"/> RECTANGLE FITTINGS			364.39	16,370.37	44.93
	<input checked="" type="checkbox"/> RECTANGLE FITTINGS LINED			75.42	6,124.05	81.20
	<input checked="" type="checkbox"/> ROUND FITTINGS			25.30	753.44	29.78
	<input checked="" type="checkbox"/> SPIRAL STRAIGHT			3.45	1,548.13	448.73
<input checked="" type="checkbox"/> LINER				11.22	1,091.27	97.26
<input checked="" type="checkbox"/> STAINLESS				7.46	13.17	1.77
			Grand Total	1,048.84	69,800.12	66.55



Holy Grail = Predicting Future Demand



Now... Where Do I Go From Here?

- ▶ **Walk before you run**
- ▶ **Remember to focus on field labor**
- ▶ **Get buy-in from operations**
- ▶ **Talk to your peers/partners regarding consultants or vendors**



Service Technology

Jim Stagg



Proving True Value

- ▶ We are only successful if we “Build It RIGHT the FIRST Time”
- ▶ “The Customer only remembers the last 10% of the Job”
- ▶ Technology that prevents re-work and helps to create a lifelong customer is...

PRICELESS



Technician Tools for Efficiency and Quality

► Laser Pulley Alignment



Technician Tools for Efficiency and Quality

► Laser Pump Alignment



TRANE
Strategic Partner
PROGRAM

Technician Tools for Efficiency and Quality

► Laser Pump Alignment



Shaft Alignment Report

Machine Name: Anlaggning 45 Date: 2013-09-06 08:52
 Company: GTI Predictive Technology, Inc. Operator: Andersson

Notes:

Tolerances:

rpm	Acceptable		Excellent	
	Offset (mm)	Angular Error (mm/100)	Offset (mm)	Angular Error (mm/100)
2000-3000	0.07	0.07	0.03	0.04

S/N Stationary unit: 1682
 S/N Movable unit: 1663

Soft Foot Check Performed: No

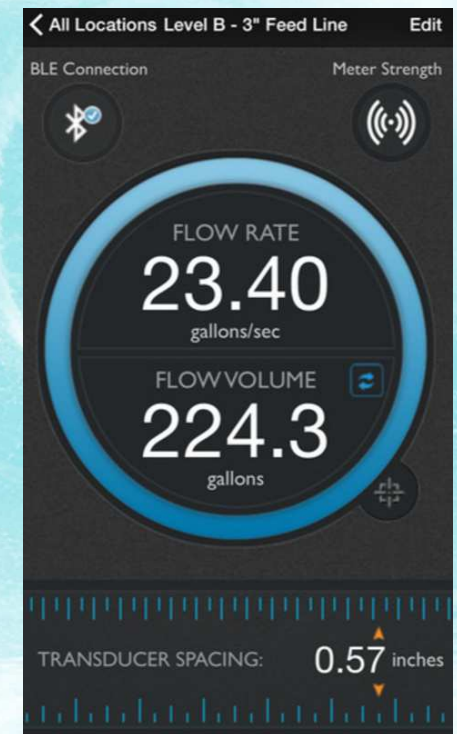
As Found	Vertical		Horizontal		As Corrected	Vertical		Horizontal	
	Offset (mm)	Angle (mm/100)	Offset (mm)	Angle (mm/100)		Offset (mm)	Angle (mm/100)	Offset (mm)	Angle (mm/100)
Offset (mm)	-0.00	0.05	1.01	-0.62	0.01	-0.02	-0.04	0.03	
Angle (mm/100)	0.05	0.05	-0.62	0.46	-0.01	-0.01	-0.01	-0.01	
Front feet (mm)	0.05	0.11	0.46	-0.12	-0.04	-0.04	0.03	0.03	
Rear feet (mm)	0.11		-0.12						

Signature: *Andersson*



Technician Tools for Efficiency and Quality

- ▶ Traditional Ultrasonic Flow Meters vs.
- ▶ Smartphone Ultrasonic Flow Meters



noncontactmeters.com

Technician Tools for Efficiency and Quality

► Digital Refrigeration Manifolds / Vacuum Gauges



fieldpiece.com



Technician Tools for Efficiency and Quality

► Wireless Multi-Meters and Accessories

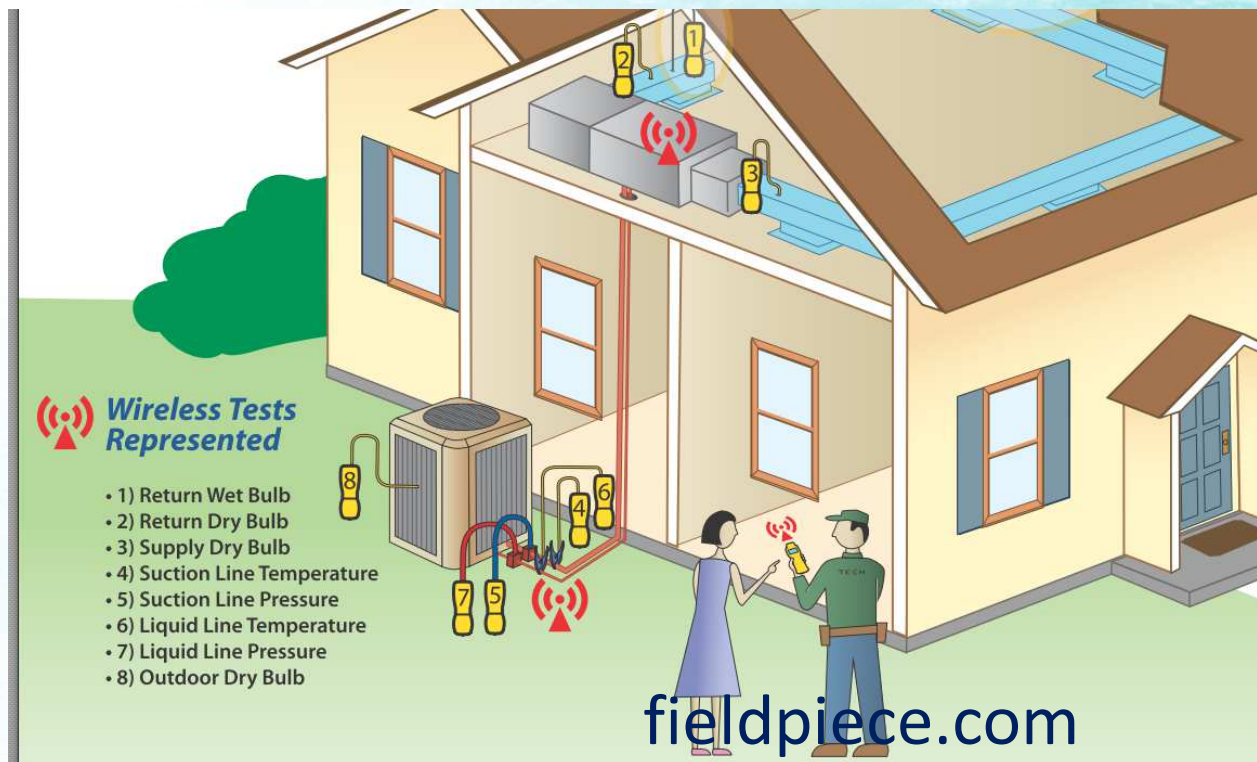


fieldpiece.com



Technician Tools for Efficiency and Quality

► Wireless Multi-Meters and Accessories



Baselines for Service Customers

For years we have been creating baselines...

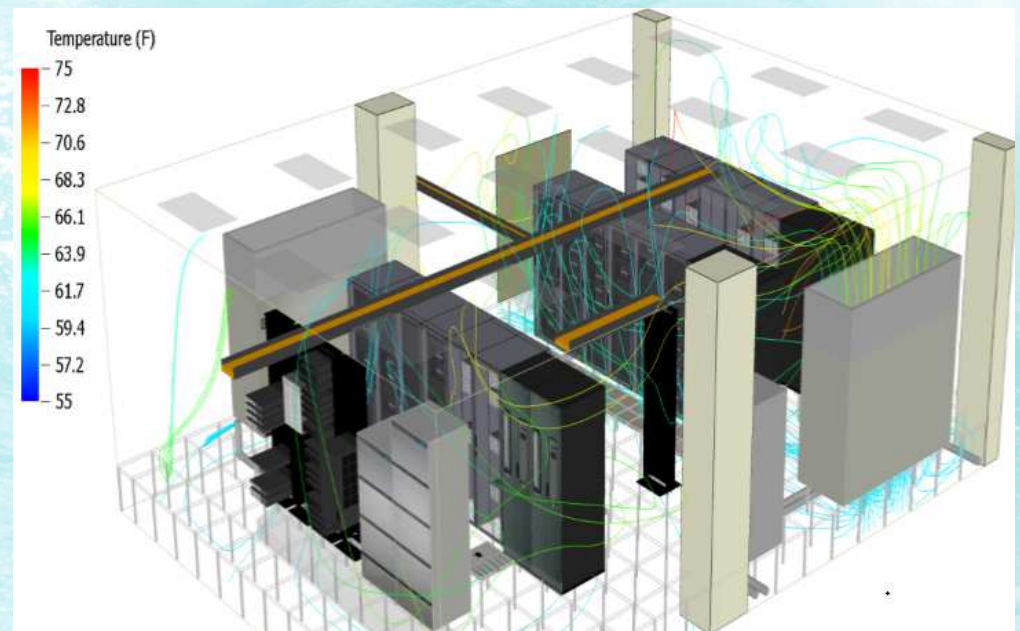
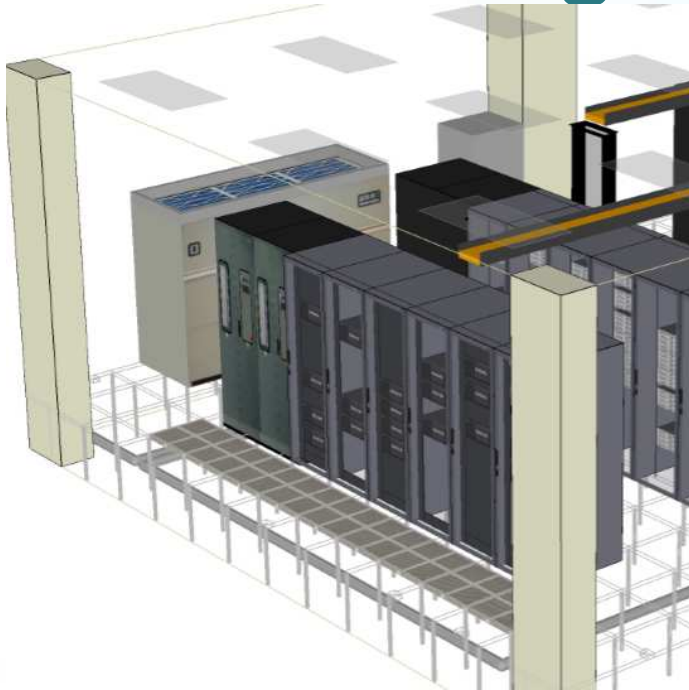
- ▶ **Vibration Analysis, Eddy Current and IR Testing**

Today's Technology is allowing us to go further...

- ▶ **Ultrasound Measurement**
- ▶ **CFD Modeling of Data Center HVAC Performance (Video)**



CFD Modeling of Data Center HVAC



BAS Analytics

- ▶ **3rd party open protocol software**

- ▶ Creates remote connectivity, monitoring and analysis beyond what building operators normally provide
- ▶ Establishes path to on-going commissioning
- ▶ Positions your team as their building experts

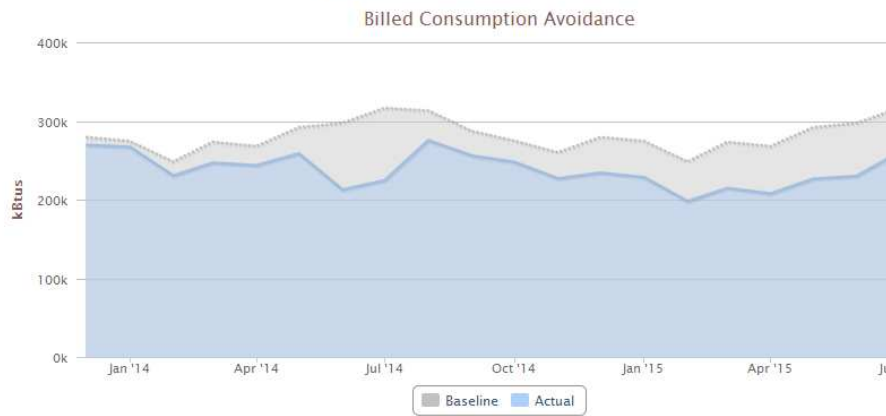


BAS Analytics

	COST AVOIDANCE	COST % CHANGE	CONSUMPTION % CHANGE	HEATING/COOLING
Weather-Normalized	\$24,877.29	-17.9% ↓	-16.2% ↓	✘
Billed	\$24,877.29	-17.9% ↓	-16.2% ↓	-

Monthly Detail [Hide / Show](#)

Select detail view: WEATHER NORMALIZED BILLED



BAS Analytics

Home Reports Dynamic Dynamic Explorer Site Explorer Help

Open Report New Report Save Save As Export

File

VAV Express * (Untitled) * PFPMB Standard Report * (Untitled) *

Summary

Drag a column header here to group by that column

Design Maximum Airflow = 800 CFM

Device	Records	Date Time Stamp	Space Temp	Occ Cool Setpt	Current Flow	Desired Air Flow	Damp Position	AHU Suppl Air Temp	Discharge Air Temp	Need More Air Flow	OSA Temp	Cooling Signal
VAV-101 Rm127B ID1204	447	7/28/2014 2:51:00 PM	76.300003...	70	582	600	41.473682...	54.124320...	59.900001...	0	95.200004...	100
VAV-102 Rm127A ID1203	447	7/28/2014 2:56:00 PM	76.400001...	70	584	600	41.473682...	53.686019...	59.799999...	0	94.5	100
VAV-103 Rm131B ID1202	447	7/28/2014 3:01:00 PM	76.5	70	579	600	41.473682...	53.686019...	59.799999...	0	95.900001...	100
VAV-104 Rm131C ID1201	447	7/28/2014 3:06:00 PM	76.599998...	70	582	600	41.473682...	53.686019...	59.900001...	0	95.400001...	100
VAV-105 Rm147 ID1205	447	7/28/2014 3:11:00 PM	76.599998...	70	579	600	41.473682...	53.686019...	59.799999...	0	94.5	100
VAV-106 Rm176 ID1207	447	7/28/2014 3:16:00 PM	76.800003...	70	581	600	41.473682...	53.686019...	59.900001...	0	92.599998...	100
VAV-107 Rm145 ID1208	447	7/28/2014 3:21:00 PM	76.800003...	70	581	600	41.473682...	53.686019...	59.900001...	0	92.200004...	100
VAV-108 Rm151 ID1210	448	7/28/2014 3:26:00 PM	76.900001...	70	581	600	41.473682...	53.686019...	59.900001...	0	92.200004...	100
VAV-109 Rm146 ID1206	448	7/28/2014 3:31:00 PM	77	70	582	600	41.473682...	54.124320...	59.900001...	0	92.599998...	100
VAV-110 Rm150 ID1213	448	7/28/2014 3:36:00 PM	77	70	579	600	41.473682...	54.124320...	59.900001...	0	92.400001...	100
VAV-111 Rm131D ID1215	448	7/28/2014 3:40:00 PM	76.700004...	70	575	600	41.473682...	53.686019...	59.900001...	0	92.000001...	100

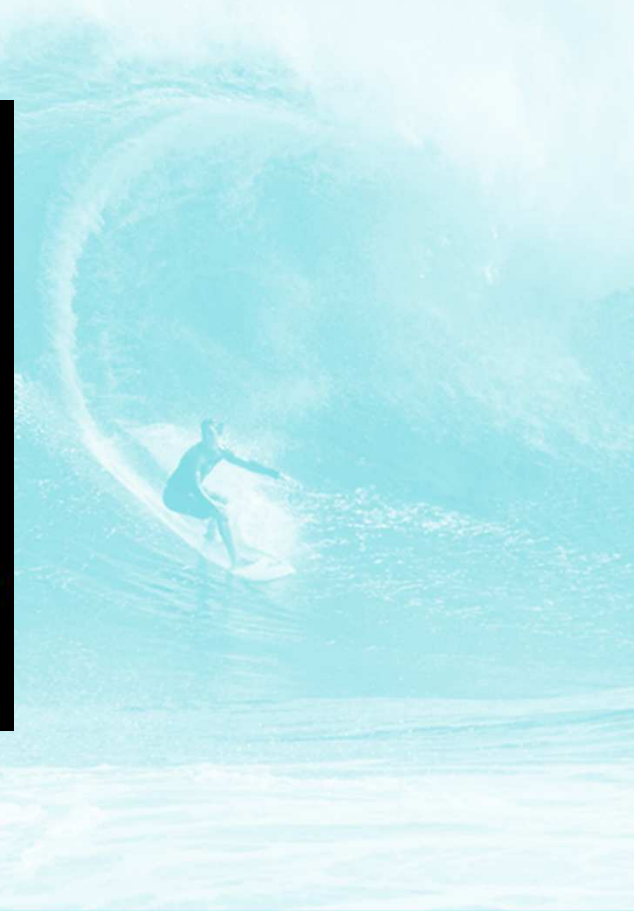
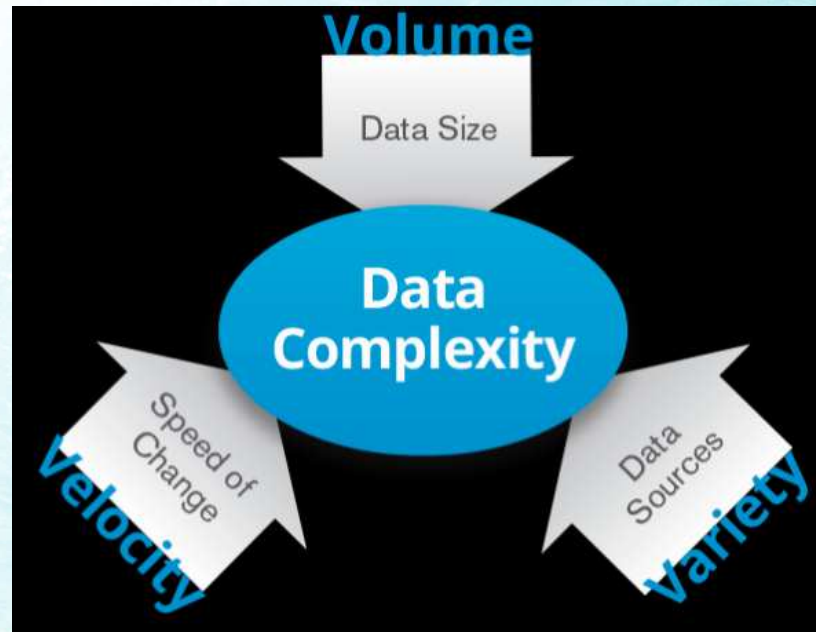
Space Temp too far from setpoint

Airflow seems okay

Damper never opens past 42%

Cooling Temps are okay

BAS Analytics



Digital Workflows for Cx and Service

▶ The Purposes of Going Paperless:

Productive

Professional

Profitable



#1 - Technology That Replaces What You Are Already Doing

▶ Cx Process Example

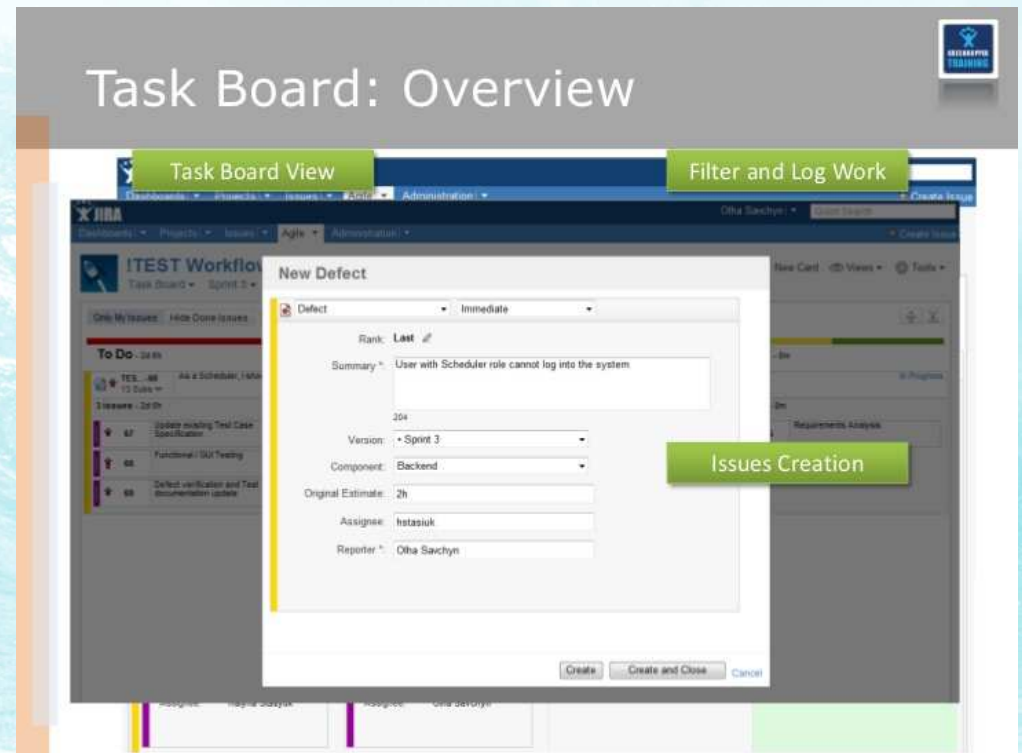
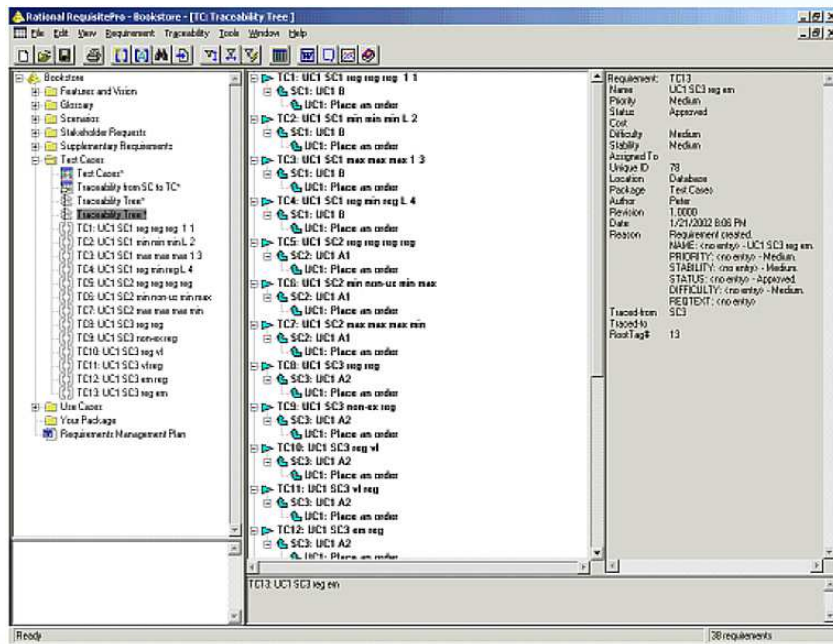
- Software for creating Cx forms and tracking activities
- Managing and documenting issues and resolutions



Cx Forms and Tracking Activities



Cx forms and tracking activities



#2 - Technology That Gets You Where You Want to Go

Defining Success

- ▶ **Service Paperwork to Digital Workflow**
 - Eliminate techs doing paperwork off-site
 - Replace technicians aging hardware
 - Reduce time & effort in handling documents
 - Increase accuracy & speed of invoicing

Field Hardware and Software Options

► Phone vs Tablet vs Laptop

- Operating systems
- Compatible
- Supportable
- Sustainable
- Customer driven preferences



Accessibility Anywhere

- ▶ **Cloud-based file management vs. specialized software**
- ▶ **Dropbox Business (video)**



Lessons Learned

▶ Know what you are giving up

- iPad initially didn't work well with MS Office

▶ Be willing to move on when problems outweigh the benefit

- Initial FTP Site Solution

▶ Understand the Life Cycle of Today

- Right answer for today and a plan for tomorrow



Creating the Culture for Success

- ▶ **Brandt “Spotlight” team**
- ▶ **Making a difference**
- ▶ **Measuring the results**





Tech Tools from Trane

Susanna Hanson




Tech Tools from Trane

- ▶ **HUB**
- ▶ **CLICK – what we are using**
- ▶ **Trane 360 new features**



Knowledge Center HUB

← → ↻  <https://hvackc.comfortsite.com/siteMCSP/categoryBrowse.do>



[Find Answers](#)

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HVAC Knowledge Center

Ask Your Question



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Show Answers: Individually Grouped by document

Browse Contents

[HVAC-KC Solutions](#)

[Other](#)

Good Example Questions

- 1 How do I measure gas pressure for packaged rooftops?
- 2 Where do I find definitions of electrical terms?
- 3 What are the basic fan laws?
- 4 What is a SEER rating and how does it impact energy costs?
- 5 How are the filters removed from the air handler?
- 6 Where do I find NEMA frame sizes and dimensions?
- 7 How does an electronic air cleaner work?
- 8 Can I update my version of TOPSS?



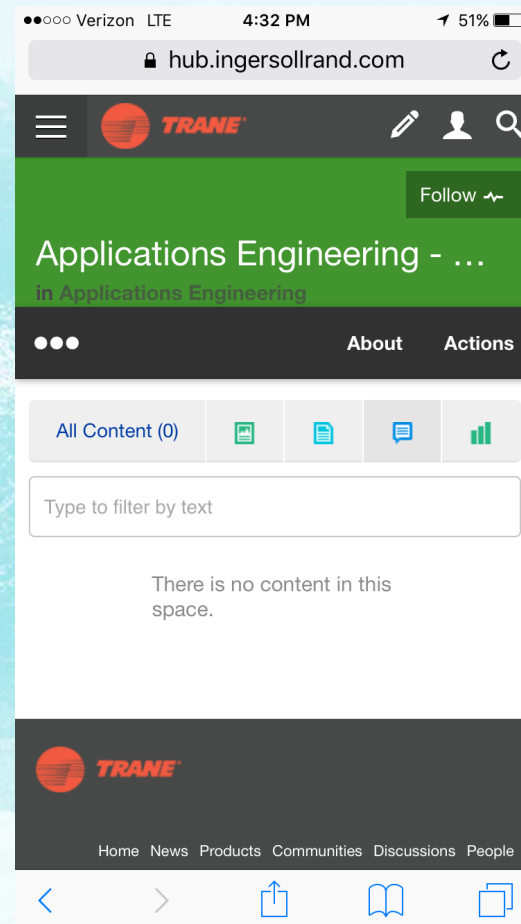
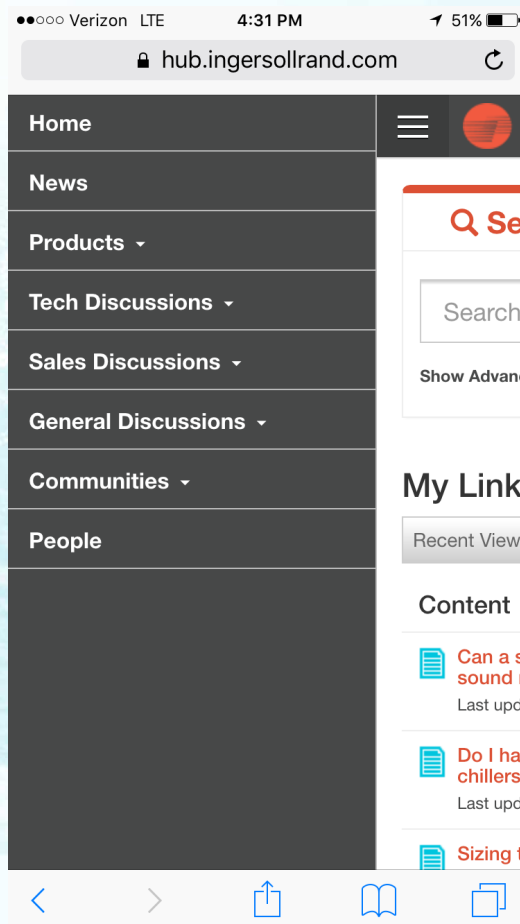
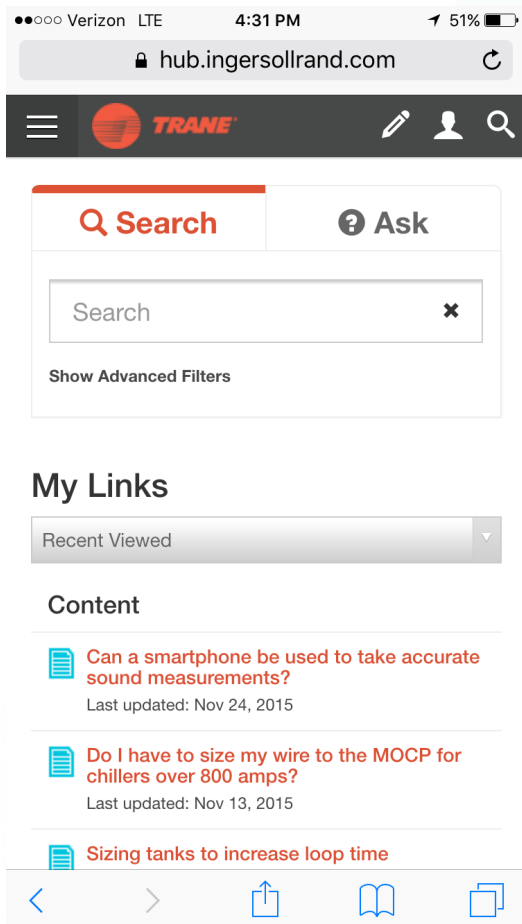
Questions? Contact the [Trane Knowledge Manager](#).

HUB

- ▶ **Social community for Trane internal and external with ComfortSite credentials**
 - ▶ Replaces Knowledge Center and Sharepoint
 - ▶ Search eLibrary content
 - ▶ Blogs, private groups, discussions (like, follow, etc.)



Mobile or Web



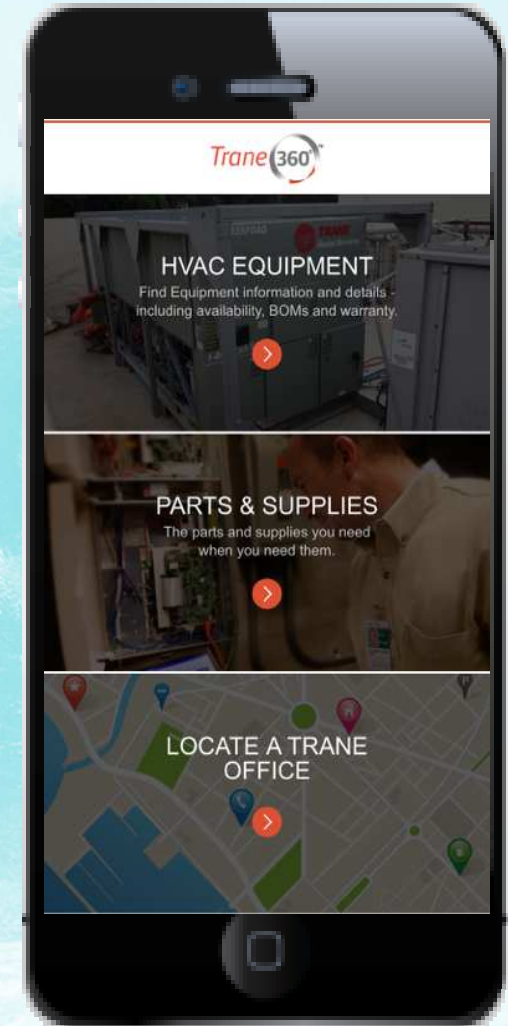
SP LinkedIn Community

- ▶ **Being developed now**
- ▶ **Here's a preview**



Trane 360 Update - New

- ▶ **Parts identification**
- ▶ **Online ordering**
- ▶ **Warranty claim initiation**
- ▶ **Technical information and documentation**
- ▶ **Training**





Other cool gadgets - now or soon



iTestMic



- class 2 mic and adapter
- app for network connection
- iOS platform only
- calibrated measurements
- at least octave/3, maybe narrowband too
- recordings of field problems

\$250

*Used with permission from
Studiosixdigital.com*

FLIR Camera and iOS/Android



\$225

- ▶ Free apps for energy auditing support
- ▶ \$3 app for presenting to a TV



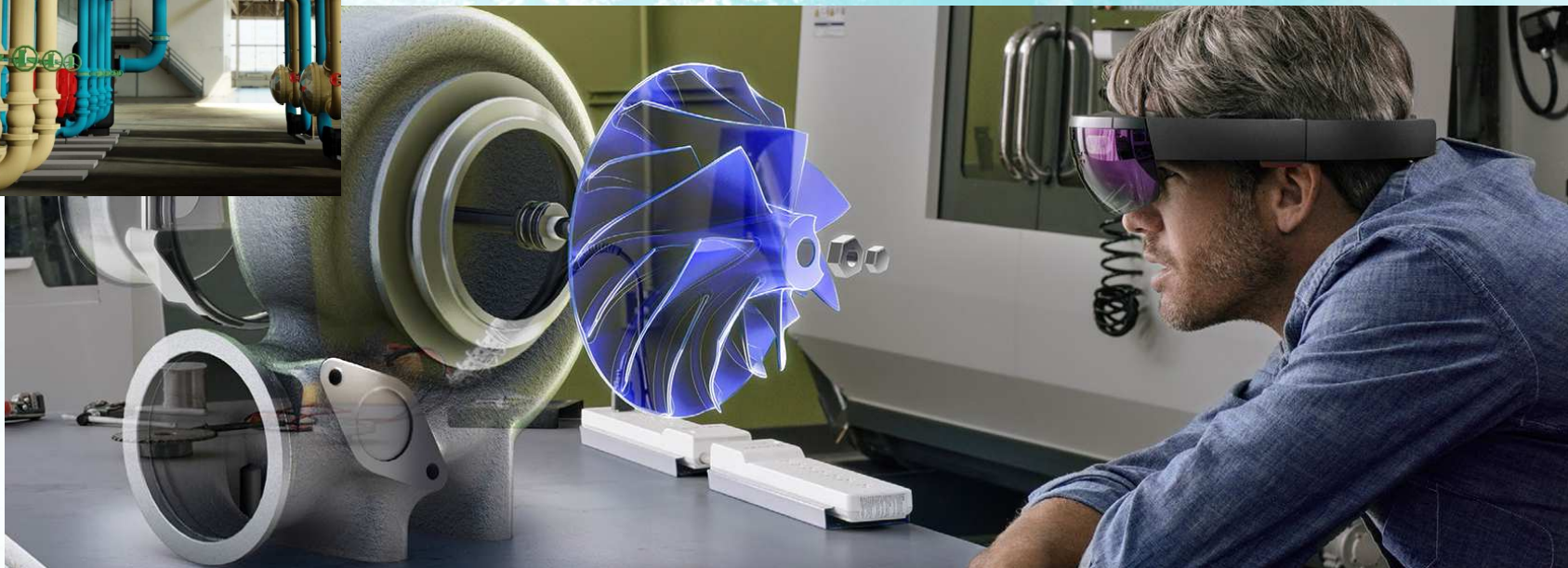
POPULAR SCIENCE
TOP TEN BEST FOR APRIL



Microsoft HoloLens



http://www.youtube.com/embed/sgFYI_JdWR0?width=853&height=480&iframe=true



Key Takeaways – Part 1

▶ Technology challenges

- Proving True Value is difficult
- Technology - value = toy
- Save field labor first

▶ Simple technology

- Upgrade your timekeeping for field and/or shops
- Start 3D modeling of work (Building Information Modeling/BIM)
- Hanger fabrication
- Onscreen takeoff for estimating

▶ Moderate technology

- Web based accounting
- Network based document control
- Points work

▶ Complex technology

- 5D modeling and fabrication that is manufacturer specific
- Real time productivity tracking
- “Holy Grail” of technology is to predict future demand more accurately

Some improvements are easy, start somewhere

Key Takeaways – Part 2

- ▶ **Use technology to eliminate rework and callbacks**
 - Laser pulley and pump alignments
 - Ultrasonic flow meters
 - Digital refrigeration manifolds / Wireless Multi-meters
- ▶ **Digital workflows**
 - Startup
 - Commissioning
 - Warranty & service
- ▶ **Baseline database**
 - Vibration, Ultrasound and IR Testing equipment
 - Building Automation System analytics – 3rd party software
- ▶ **Technology and firewall agnostic**
 - Life Cycle is short
 - Ditch what doesn't work

Culture and training drive adoption of change

Key Takeaways – Part 3

- ▶ **HUB community for strategic partners**
 - Blogs, discussions, sharing best practices
 - News, connection with peers
 - Polling to help find what works/doesn't work
- ▶ **Trane 360 new features**
 - Parts ID
 - Warranty
 - Online ordering
- ▶ **Technology becoming more affordable**
 - FLIR
 - Sound measurements
 - HoloLens is coming

Trane is becoming more tech savvy every year