Dallas/Fort Worth International Airport

Terminal Renewal & Improvement Program (TRIP)

International Facility Management Association
Airport Facilities Council Presentation
Spring Conference

May 13, 2015

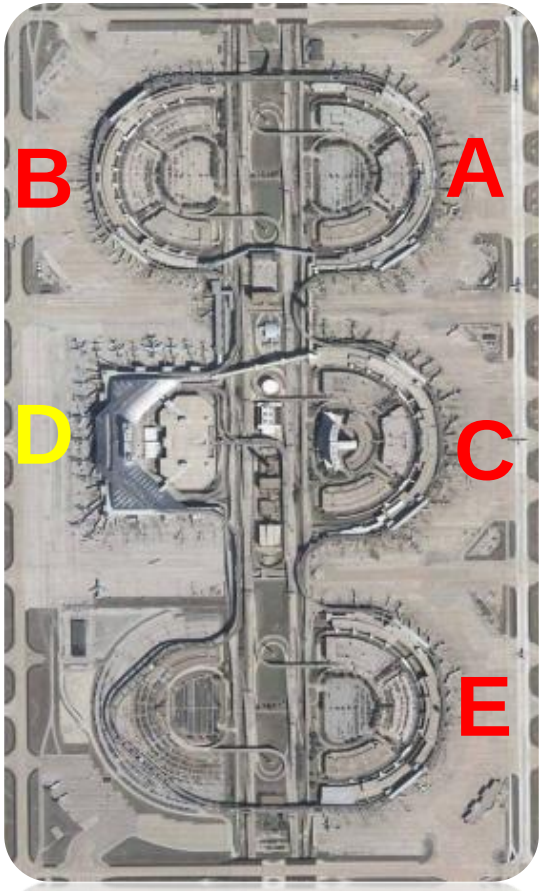
TRIP Purpose and Need

- Entering new era in Airport's lifecycle that requires a new long-range vision
  - Aging Infrastructure
    - 35-40 year-old Terminal Systems
    - Maintenance costs high
  - Changes in Aviation Industry
    - Focus on operational efficiency and cost reductions
    - Enhanced security requirements
    - Increase non-airline revenue generation
    - Provide access to technology
  - Competitive Landscape
    - Repeal of Wright Amendment in 2014
    - Other hub airports have already begun their airport renewal programs

DFW International Airport
- 18,000 acres
- 7 runways
- 6 million ft^2 terminal space

TRIP Scope

- Terminals – A, B, C & E
  - Complete replacement of MEP and data systems
  - Consolidation of Concession areas
  - Re-orientation of Security Check Points
  - Enhanced Terminal entries
  - Replace interior finishes
- Baggage Handling Systems
  - Terminal B partial replacement
  - Terminal E full replacement
  - System rehabilitation in Terminals A & C
- Landside
  - Construction of DART and FWTA Rail Stations
  - Parking Garage repairs
  - Replacement garage at Terminal A



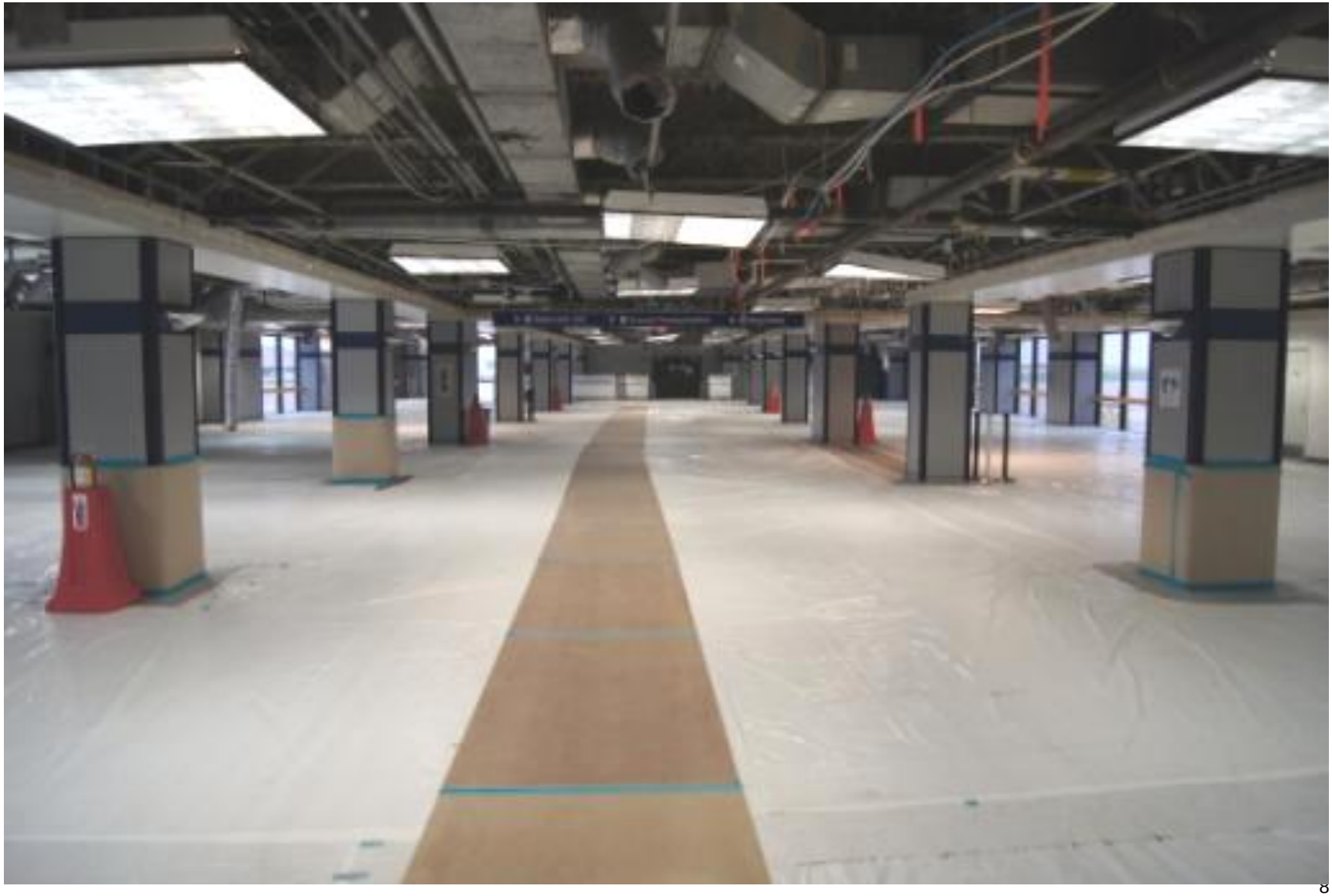
Terminal Experience

In-Line Concourse View

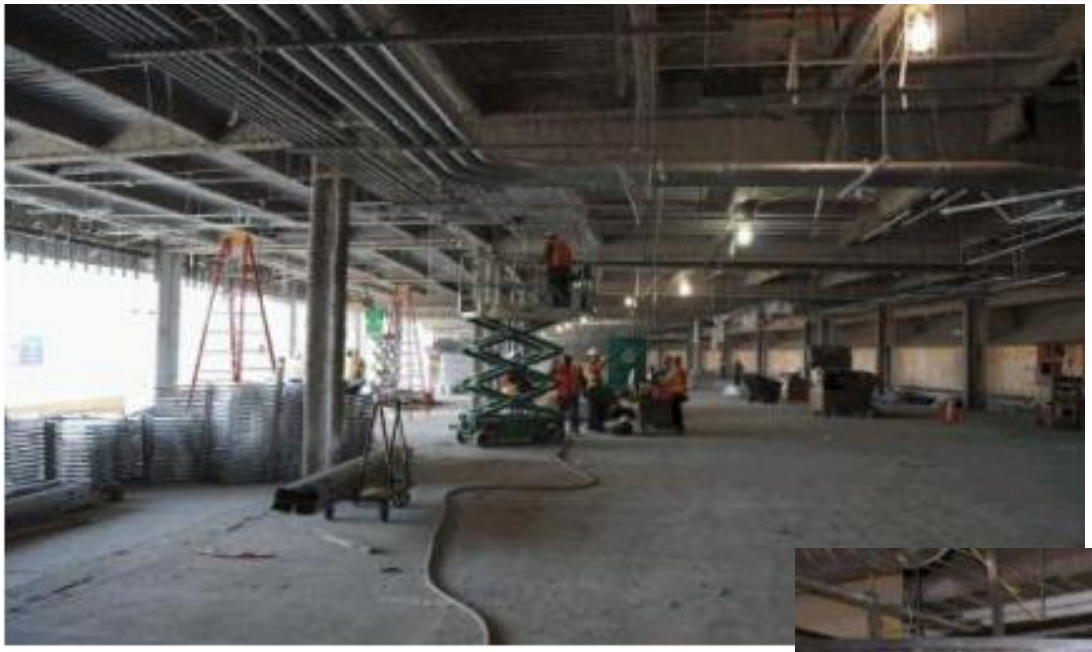
Example Skylink Ceiling

Progress Photos

Terminal E Satellite Reactivation



Progress Photos



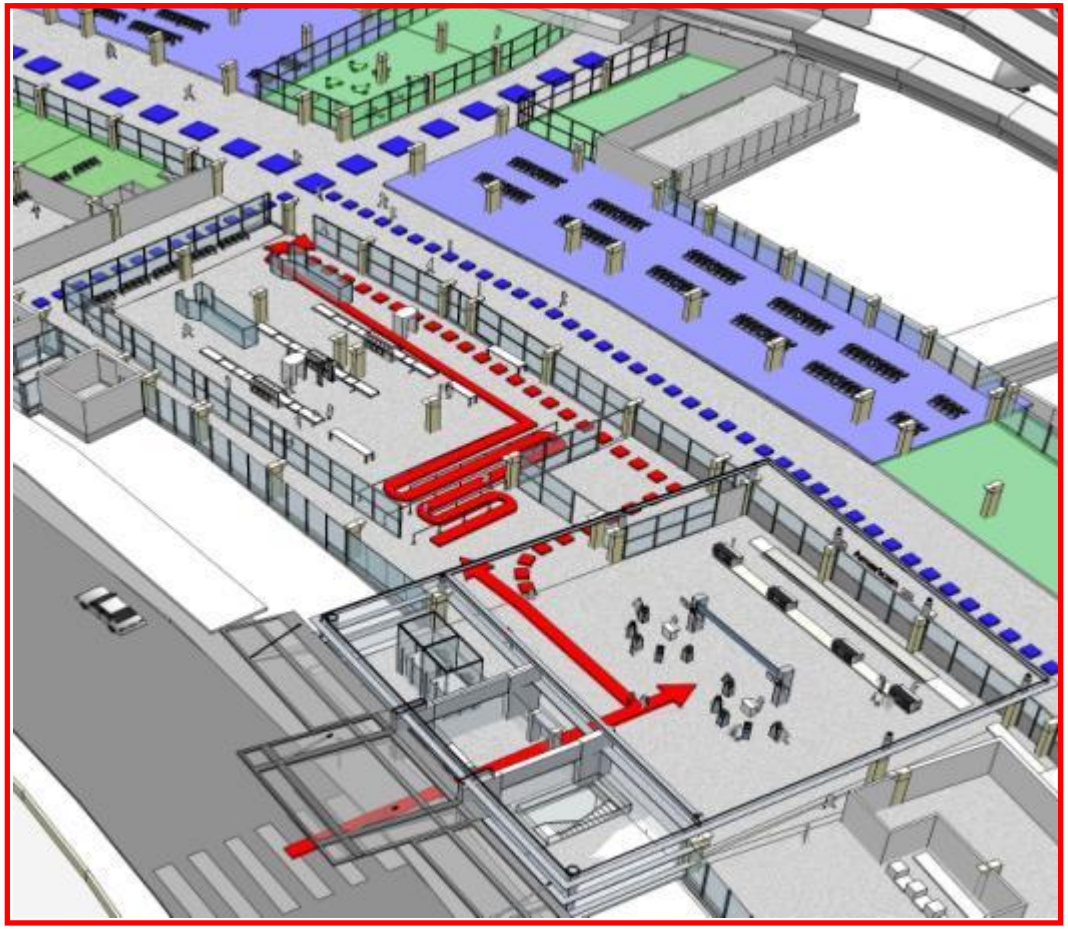
B/C Infill - MEP's in ATO Hall

Terminal E Satellite - Lower Level Club Framing & Utilities

Ticketing Hall

- Incorporate more self-service technologies
- Provide premium check-in
- Increase passenger flows
- Create sense of space with higher ceilings and better lighting
- Self serve bag tagging and belt delivery

Reconfigured Ticketing Hall and Security Checkpoint

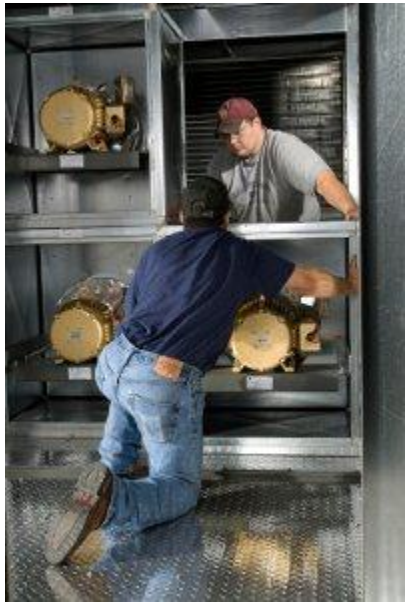


Security Checkpoint

- Consolidate and expand checkpoints
- Rolling out improved technology to improve passenger flow
- Incorporate TSA future technology requirements
- More queuing space
- Longer divestment and recomposition areas

HVAC Equipment and Systems

- AHUs designed around Temptrol FANWALL (2.0 Hybrid)
  - Uses multiple smaller higher-efficiency fans driven by VFDs
  - FANWALL motors run closer to their peak efficiency at partial conditions than larger single motor fans



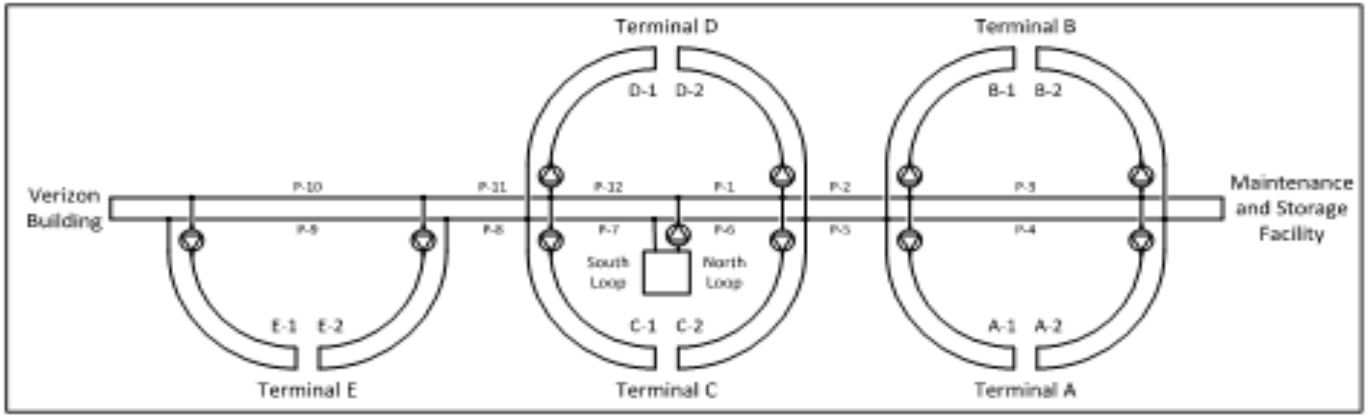
www.temtrol.com

Hydronic System

- New hydronic pump rooms and equipment
- New heating (10”) and chilled water (14”) main piping
  - Full size hydronic pipe runs full length of terminal
  - Lower pressure drop
  - Increased capacity

Hydronic System (continued)

- In 2011, Texas A&M Energy Systems Laboratory (ESL) was engaged by TRIP to model the hydronic heating and cooling system
- Primary Study Objective:
  - Determine most energy efficient CUP pump strategy
- Results and Conclusions:
  - Tertiary Pumps in a dual feed arrangement will save approximately $20,000 per year in operating costs (based on data at time of study)



Dual Feed, CUP+Tertiary Pump

Natural Gas

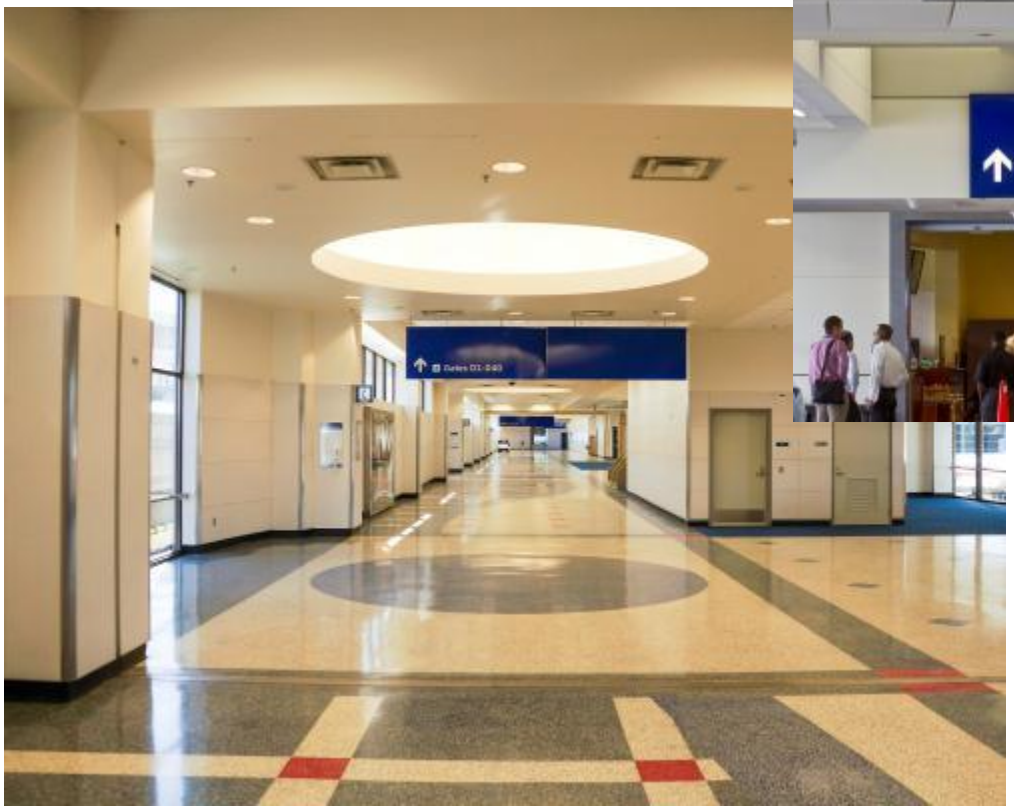
- Before TRIP, Terminals A, B, C and E do not have natural gas
- Mainly used for concessions cooking operations
- Thermal expansion

Electrical

- Lighting
  - LED Lighting
    - More light output
    - Lower energy usage per fixture
  - High-efficiency T5 fluorescent fixtures
    - T5 fixtures use roughly half the energy of the old style T12 fixtures.
  - Daylighting
    - Lighting can be dimmed in areas where natural light is available
  - Occupancy Sensor
    - Turns lighting off while an area is unoccupied
  - Lighting Control System

Lighting Examples

LED Back-lit Signage



Concourse Lighting Design

Electrical - Power Factor (PF) Correction Capacitor

- New Main-Tie-Main in each Oncor Vault
- Cost savings on electrical utility bill with new PF correction system
- Oncor customers incur a penalty if the power factor is below 95%.
- Prior to TRIP, Terminal B Vault D had a power factor of 83%
  - TRIP implemented Power Factor Correction on all new Main-Tie-Mains
  - After PF correction, Vault D is at a 95% PF
- The increase to 95% PF on Vault D resulted in a cost savings of $13,260 for FY2014
- TRIP is adding PF capacitors on all 17 of the new Main-Tie-Mains:
  - Estimated savings per year of 17 PF correction units is $225,000/yr

Plumbing/Fire Protection

- New below grade grease interceptors
- Heat trace on grease waste lines
- New fire protection: Dry and wet systems
- Nitrogen generators
- New valve rooms and headers for domestic water
  - Stainless steel
  - Galvanized
- Condition of existing under slab cast-iron sanitary lines
  - As you would expect for 30+ year old sanitary lines
  - Dig up and replace? Costly!
  - In-situ rehab? Pipe burst, etc.

TRIP Technology

Building Information Modeling

- Engineers are designing in 2D
- Contractors are modeling in Revit (3D)
- All models are integrated in Navisworks
- Clash detection in model minimizes field conflicts
- Allows for off-site fabrication
  - Cost savings
  - Speeds installation
  - Cleaner / Safer site

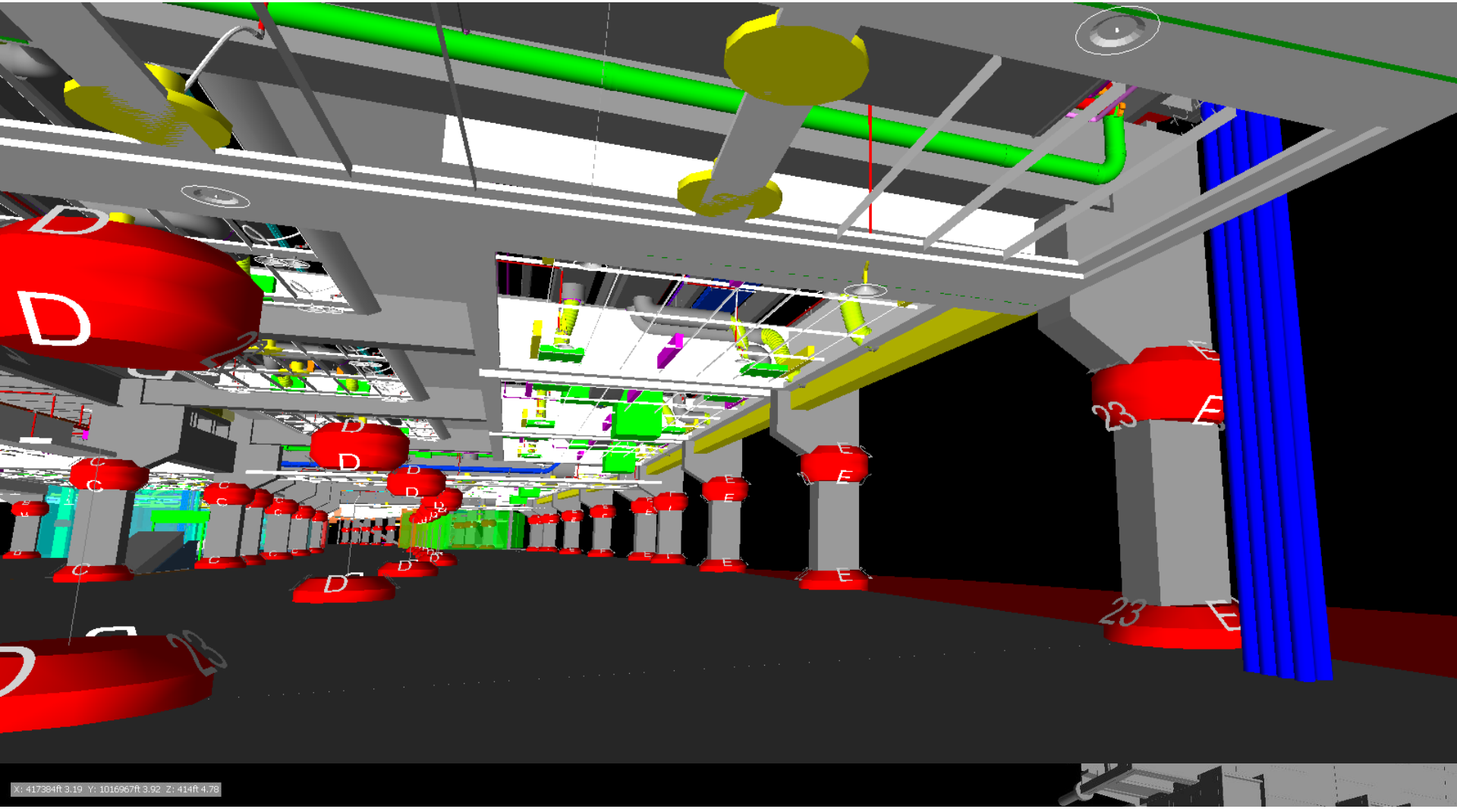
Electronic Plan Tables

- Almost Paperless during design
  - Paper Consumption reduced by 90%
  - Cost savings of approx. $8 M
  - Utilizing Bluebeam on all reviews
  - Drawings are available in real time
- iPads being used in field in place of paper plans

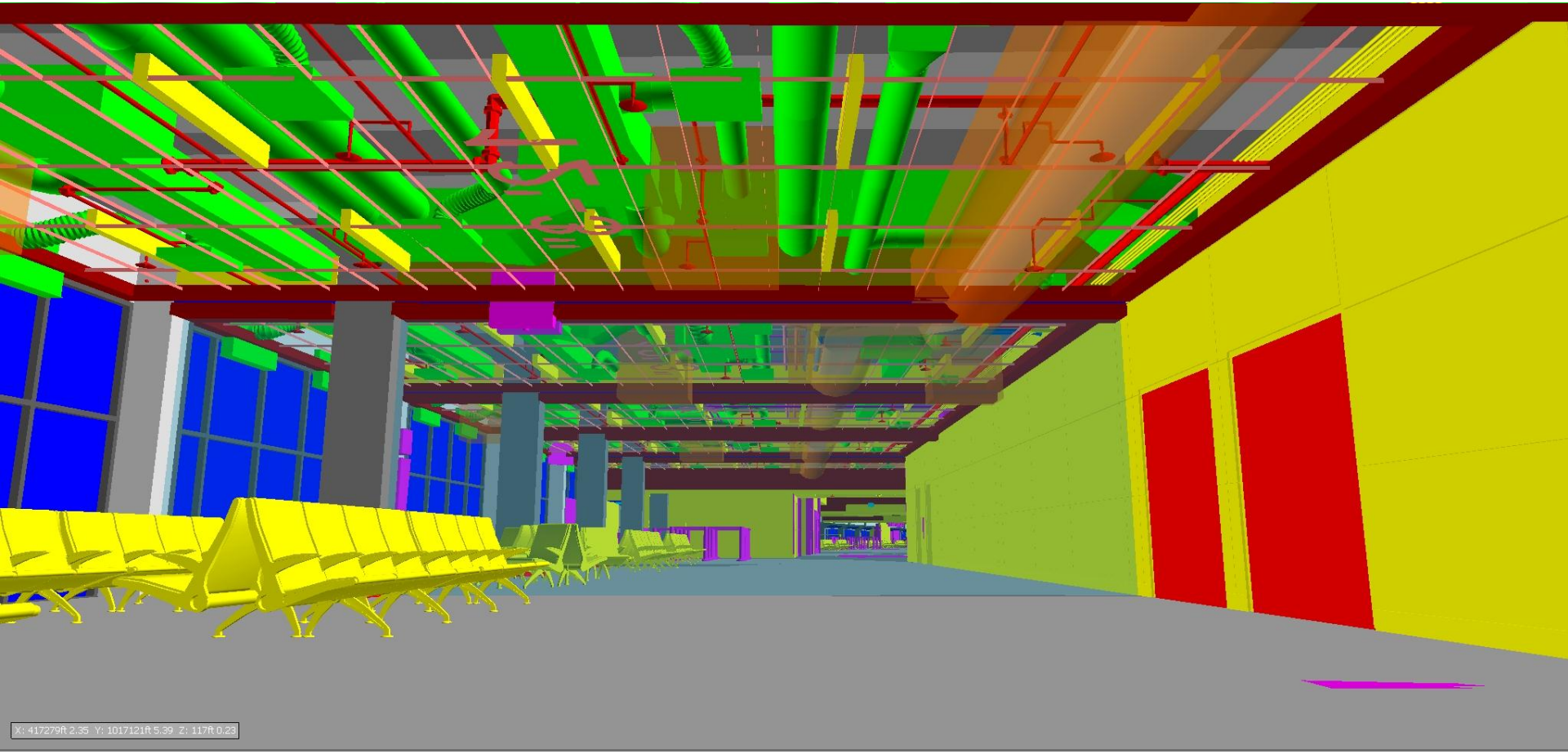
Building Information Modeling (BIM)

- Is BIM Important?

TRIP Technology
Terminal Model



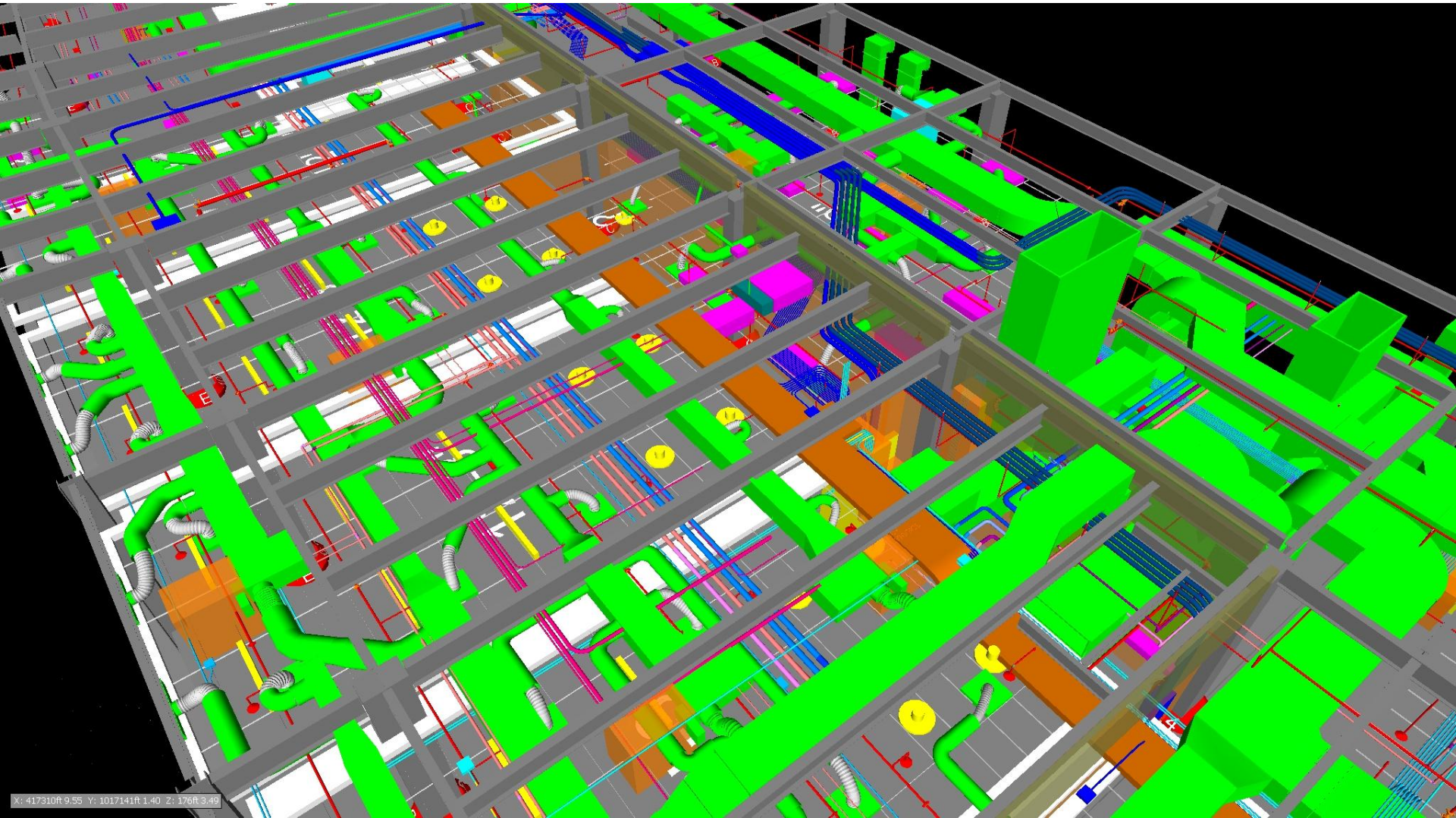
TRIP Technology
Building the Model



DFW

TRIP
(re)defining your airport

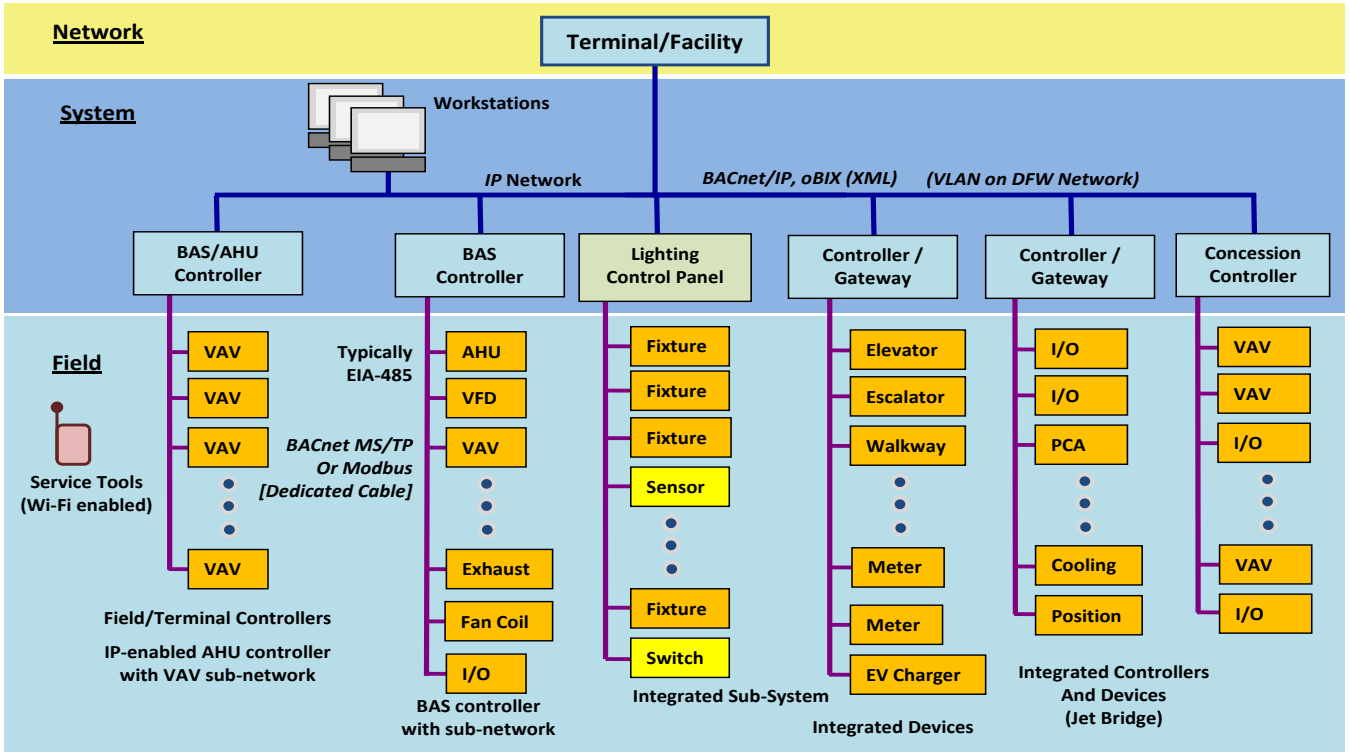
TRIP Technology
Clash Detection



Building Automation System (BAS)

- Monitors and controls energy systems within one Terminal
  - Provides near instant feedback on status of M/E/P systems
- Provide alarms and notifications of systems in need of repair
  - Properly maintained and functioning systems use less energy
- ASHRAE BACNet Protocol
- DFW Airport Controls Master Plan

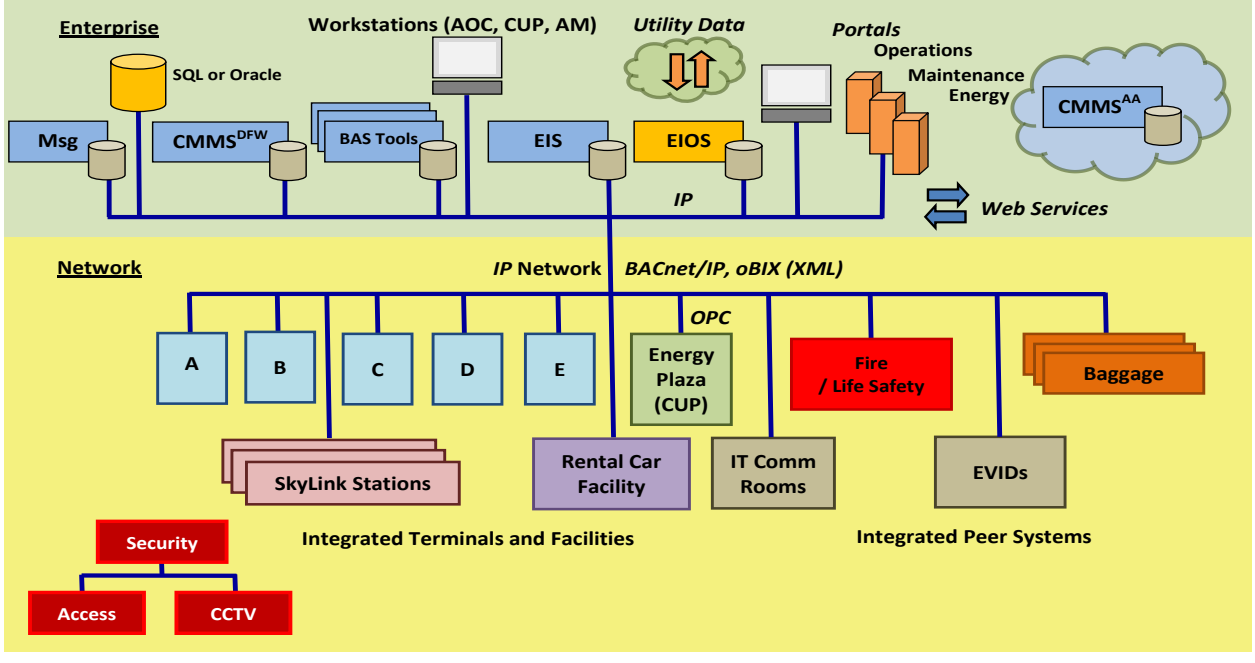
Figure 1: Terminal/facility system architecture



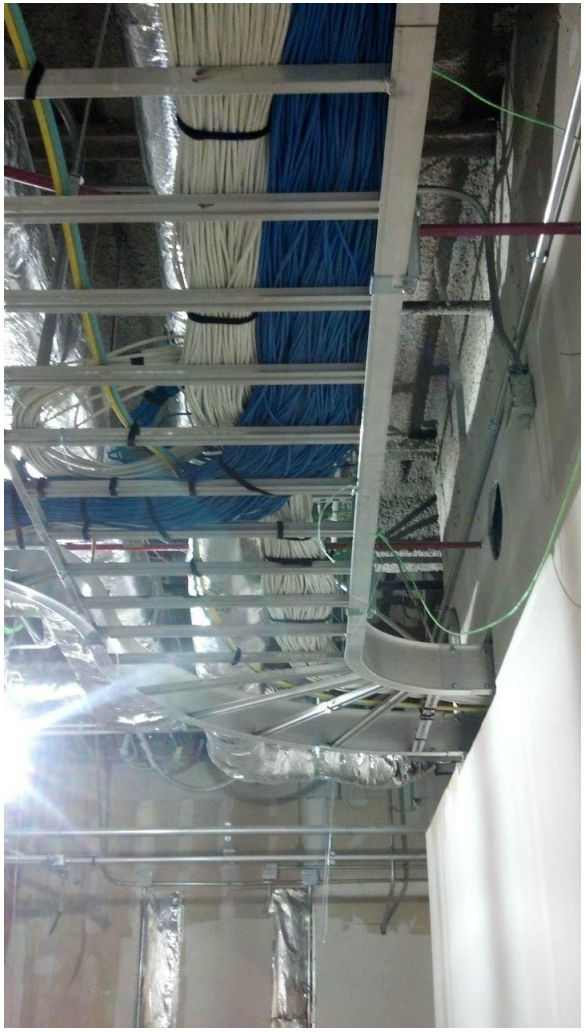
Enterprise Integration and Operation System

- EIOS sits on top of all the individual Terminal BAS
- Interfaces with DFW Infor EAM CMMS system:
  - Provides real-time maintenance and equipment failure data to ETAM
- Energy management tool
  - Demand Response
  - Energy Analytics

Figure 1: Enterprise level system architecture

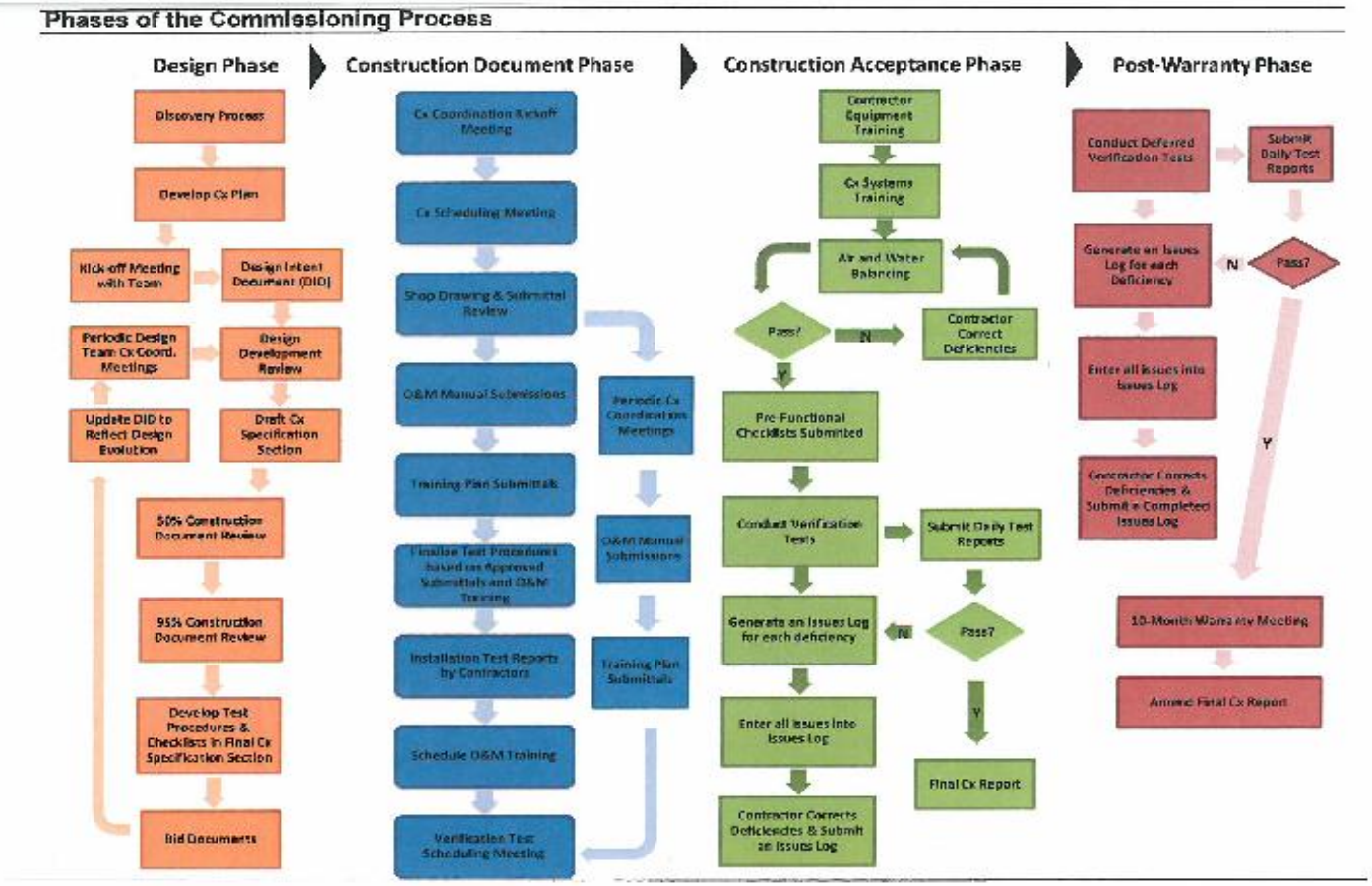


- IT is more than fixing computers!



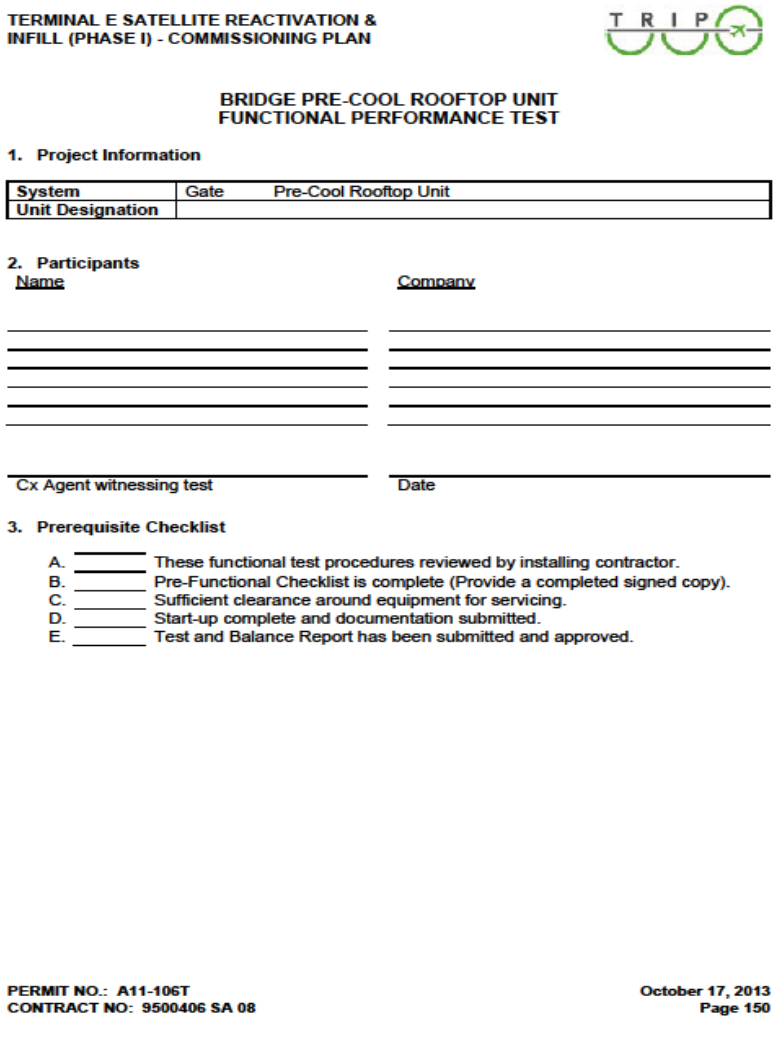
- Major coordination required!
- Many systems are network based

Commissioning Process



Functional Performance Forms

- Cx Team responsibility
- Automated Sequences
- Equipment based on specs
- Verification of the BAS
- Verification of Functionality
- No Accessibility Issues
- Equipment Maintainable
- No Sustainability issues



TERMINAL E SATELLITE REACTIVATION &
INFILL (PHASE I) - COMMISSIONING PLAN

BRIDGE PRE-COOL ROOFTOP UNIT
FUNCTIONAL PERFORMANCE TEST

1. Project Information

System	Gate	Pre-Cool Rooftop Unit
Unit Designation		

2. Participants

Name	Company

Cx Agent witnessing test — Date

3. Prerequisite Checklist

A. _____ These functional test procedures reviewed by installing contractor.
B. _____ Pre-Functional Checklist is complete (Provide a completed signed copy).
C. _____ Sufficient clearance around equipment for servicing.
D. _____ Start-up complete and documentation submitted.
E. _____ Test and Balance Report has been submitted and approved.

PERMIT NO.: A11-106T
CONTRACT NO: 9500406 SA 08

October 17, 2013
Page 150

Issues Log

- Submitted for CMAR and AE team response

DFW TRIP Commissioning Issues Log — Nov 30 2013

SA05 Terminal A Phase 1

LEGEND — Issue Type
- I — Installation
- D — Design
- E — Existing Condition
- O — Other

~~Closed~~ — Closed items to be greyed out and struckout

Issue Ref	Date	System	Description of Issue	Photo Ref	Issue Type	Response	Status Open / Closed	Resolution Verified Closure	Remarks / Notes
58	4/22/2013	AHU-1033	It was observed that only two of the AHU's associated air terminal units are tied to the AHU controls: • VAV-A-2-C-031A • VAV-A-2-D-031A RFI-0729 indicates that the remaining air terminal units were deleted from the contractor's scope of work; however, contractor stated that tenant air terminal units may be installed on the AHU-1033 duct. RFI is awaiting response from the Project Engineer. The AHU's control does not detect whether the tenant boxes are satisfied or not. Campos requests clarification if this current configuration is acceptable.		Mechanical / Electrical / Controls	Nov 25 2013 This item is to be closed out by others. This item is outside of the contract scope of work. TRIP is coordinating with DFW ITS on this issue. It is anticipated that this work will be completed by DFW ITS in 4 to 5 months (March 2014).	Pending Closure Dec 9 2013	Y	Contractor stated system installed per contract documents. Currently the DDC controls do not communicate with the concessions systems. As of 8/15/13, DFW Airport TRIP stated this may be an ITS issue. Campos requests final resolution clarification.
62	4/22/2013	FPTU-A-1-D-015A	Campos observed the gatehouse occupants were able to adjust the space temperature offset at the thermostat. Contractor was informed of the issue and thermostat was recalibrated. Campos recommends the adjustable thermostats be locked out of the configuration/offset features.		Controls	Nov 25 2013, Thermostat installed per construction documents. Alteration required by others.	Pending Closure Dec 9 2013	Y	Contractor stated system installed per contract documents. Contractor stated T-stats can be replaced with sensors only; however, direction from DFW Airport is requested. As of 8/7/13, American Airlines inspected item and requests that a non-adjustable T stat be installed instead at all typical gate house locations.

TRIP Training Topics

- Equipment Start-Up and Shut Down
- Daily Operation
- Control Adjustments
- Trouble Shooting
- Servicing
- Preventative Maintenance
- Keys
- Passwords
- Special Considerations

Monthly Closeout Mtgs.

Purpose to establish Project Closeout milestones for TRIP projects.

Necessary to accommodate Stakeholders in pursuit of Final Acceptance

Coordination of Closeout Checklists for each Project

Interdepartmental teamwork

ADE PROJECT CLOSE OUT STATUS REPORT

Project Name: TA PH1 **Date:** 4/9/2015

Contract Number: BARC 9500421 **SA #:** BARC SA-05

Permit Number: A11-158T **Page** 1 of 2

Airport Development & Engineering:

I. TCO:	No ☐	Yes ☑	**Date:**	2/21/2013
II. Substantial Completion:	No ☐	Yes ☑	**Date:**	7/16/2013
A. Final Inspections Completed	No ☐	Yes ☑	**Date:**	7/16/2013
B. Final Punch List Compiled	No ☐	Yes ☑	**Date:**	7/16/2013
III. Final Acceptance: Implementation Team (IMT)	No ☐	Yes ☑	**Date:**	
A. Test and Balance (T&B) of HVAC Systems with submittal review and approval of the Final T&B report	No ☐	Yes ☑	**Date:**	8/19/2013
B. System Commissioning (Cx) in accordance with approved Cx Plan				
i. Submittal, review and approval of Preliminary Cx Report	No ☐	Yes ☑	**Date:**	11/11/2013
ii. Submittal, review and approval of Final Cx Report	No ☐	Yes ☑	**Date:**	1/14/2014
C. Equipment Lists as required by contract	No ☐	Yes ☑	**Date:**	7/16/2013
D. Spare Parts: Including tools, test equipment and spare parts as required by contract	No ☐	Yes ☑	**Date:**	7/16/2013
i. Inventoried and delivered to location on DFW Airport designated by Owner	No ☐	Yes ☑	**Date:**	7/16/2013

Dallas/Fort Worth International Airport

Terminal Renewal & Improvement Program "TRIP"