Innovation Builds Innovative Projects

Massachusetts Building Congress

Watson Hall | 01.17.2024



AGENDA

Introductions
 Tools of the Trade
 Complicated Problems Require Complex Solutions
 The Future of Technology in Construction

An Introduction to BOND Building

Building

BOND

PRESENTATION TEAM



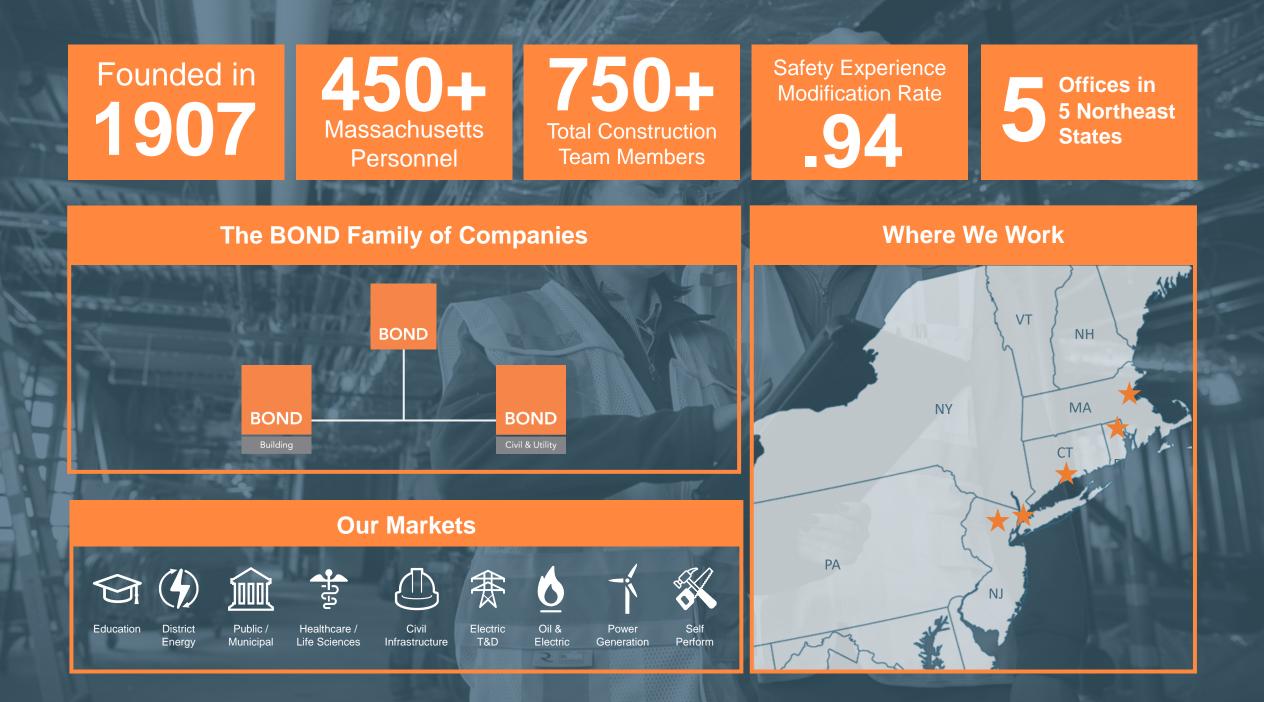
SEAN DOYLE, CM-BIM, ASSOC. DBIA Director Of Integrated Design

- Responsible for integrating BOND as a resource through all phases of design
- Wentworth Institute of Technology Alumni (B. Arch '14)
- Started at BOND as a co-op before becoming a fulltime employee (11 years)



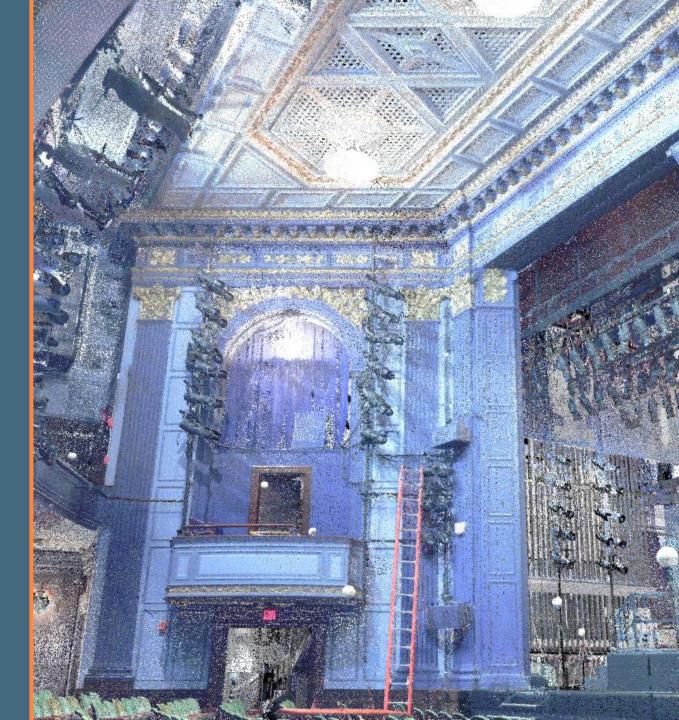
STEVE LIECHTI, LEED AP BD+C Project Executive – District Energy

- Project Executive at the Commonwealth Fusion Systems Project
- Has played a critical role in many of BOND Building's largest and most complex projects
- Began Career at BOND as MEP Manager before moving to Project Management track (12 years)



TECHNOLOGY CENTRIC

- For 15 years, BOND has been on the Cutting Edge of Construction
 - Technologies and Processes
 - Early adopter of Virtual Design & Construction and BIM Coordination
 - Innovator on BIM & Coordination
 Standards
 - First CM in the Northeast with a dedicated Geospatial survey team (BBC's Reality Capture Team)



BOND BUILDING + WENTWORTH

24% of BOND Building employees with Degrees from WIT (Including Craft Labor)

Notable BOND Building Wentworth projects:

- 610 Huntington
- 555 Huntington
- Ira Allen

- 525 Huntington
- BOND Virtual Design & Construction Lab

10 of 12 of BOND Building's Integrated Design Service staff are Wentworth Grads
 5 of the 10 are two-time coops turned full time employees on Graduation



CAREERS IN CONSTRUCTION TECHNOLOGY

Jobs in Construction Technology (VDC/Reality Capture/Digital Practice) can come from a wide range of degrees:

- Architecture
- Construction Management
- Engineering
- Facilities Management
- Interior Design

Best of both worlds with an equal parts balance being office based and field based

Allows employee to work on multiple projects in multiple sectors (healthcare, energy, academic, etc)

Interpersonal Skills

- Critical Thinking
- Problem Solving



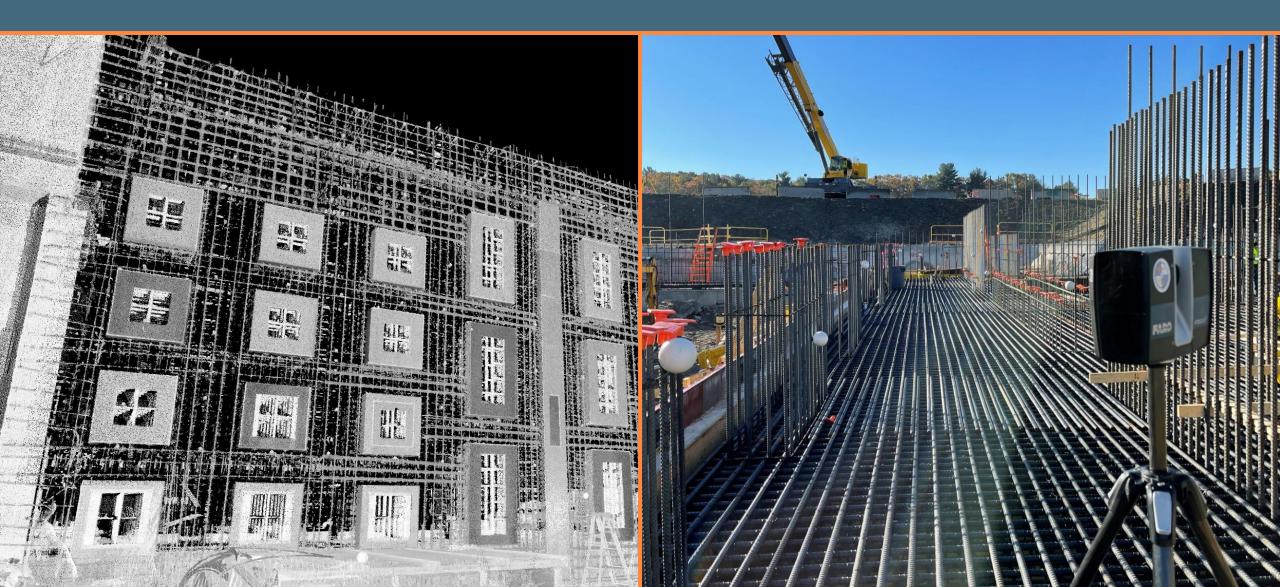
Tools of the Trade

BOND Building

TOOLS OF THE TRADE: TOPCON GTL-1200



TOOLS OF THE TRADE: 3D LASER SCANNING



TOOLS OF THE TRADE: SIMULTANEOUS LOCATION AND MAPPING SCANNER (SLAM)



RIGHT TOOL FOR THE JOB



Terrestrial Scanner

Detail: Medium Speed: Medium Precision: Medium Deliverables: Medium



SLAM Scanner

Detail: High Speed: Fast Precision: Low Deliverables: Slow



Hybrid Scanner

Detail: Low Speed: Slow Precision: High Deliverables: Real-Time

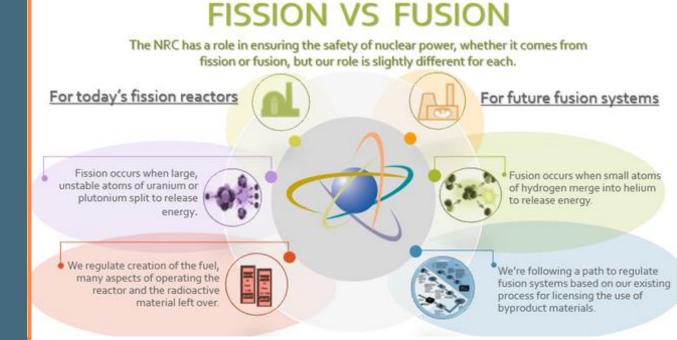
Complicated Problems Require Complex Solutions



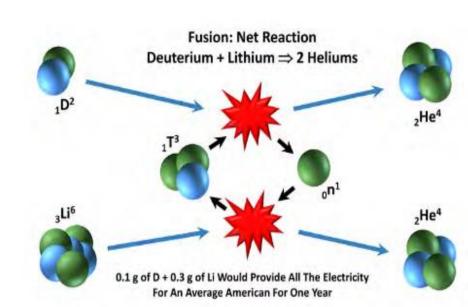
INTRODUCTION TO CFS

- Why is fusion critical to our energy future?
 - Fusion is the process by which light elements combine to form heavier elements releasing enormous amounts of energy. It is the ultimate source of energy in the universe, powering the sun and the stars and creating all the elements of the periodic table.





A fusion power plant would consume small amounts of deuterium and lithium while producing helium and an enormous quantity of energy. The reaction on the top takes place in a hot plasma, the reaction on the bottom occurs in the blanket, which surrounds the plasma. The other products, tritium and neutrons are continuously recycled. (Graphic by Martin Greenwald)



INTRODUCTION TO CFS

- CFS Founded in 2018, spun out of MIT
- Built as "fusion first" in an entrepreneurial startup
 - No short cuts by adapting existing organizations
 - Science and simulation is not enough
 - Construction, demonstration and commercialization required
- Largest fusion company in the world
 - ~500 FTE + ~150 collaborators and contractors, 1600+workers
 - We are one of the most diverse fusion outfits
 - Forbes Best Startup Employer 2021, 2022, 2023
- From a large variety of backgrounds
 - Plasma physics, including leaders from nearly all major tokamaks
 - Engineering from aerospace, military, manufacturing
 - Strong partnerships to major Labs and Universities
- Processes and procedures to get it done
 - "Build the machine to build the machine"





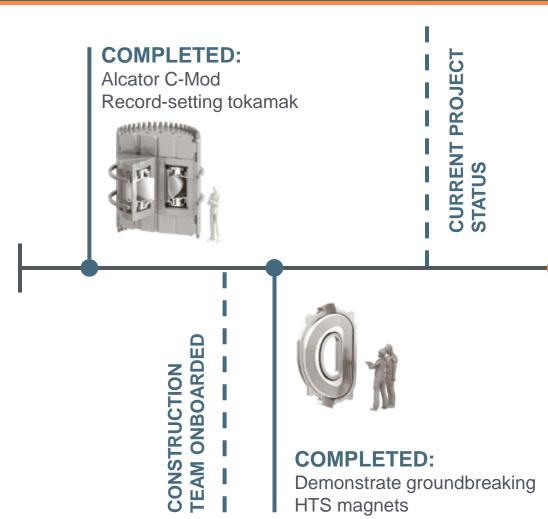
Strong Partners

PSFC Plasma Science and Fusion Center Massachusetts Institute of Technology



Massachusetts Institute of Technology

RISK RETIREMENT IN CONCRETE STEPS



LAUNCH:

SPARC Q>1

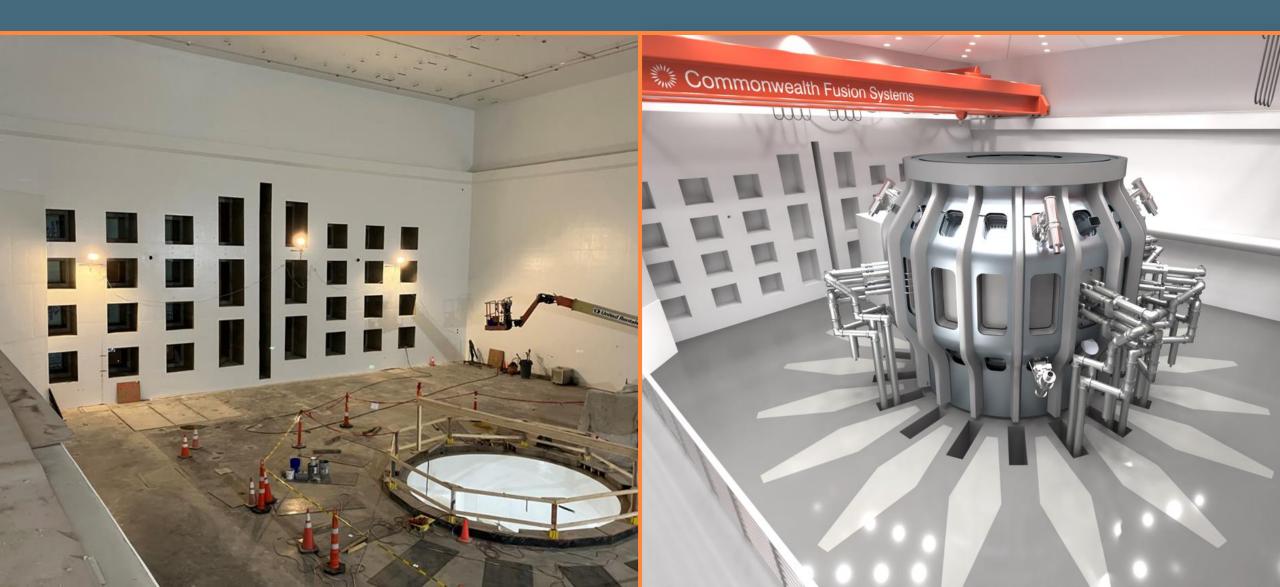
the first time

EARLY 2030s: ARC deployed ~400 MW

Carbon-free commercial power on the grid

CONSTRUCTION UNDERWAY for 2025 Achieve net fusion energy Commercially-relevant net fusion energy for

COMMONWEALTH FUSION SYSTEMS

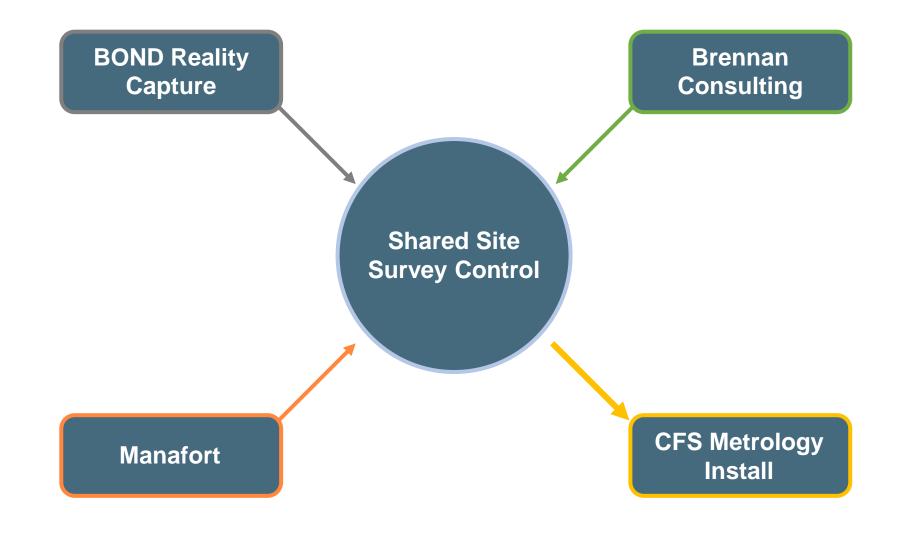


PROJECT CHALLENGES: PROJECT CONTROLS – CRITICAL START

- Site Survey Control setup early was paramount
- Multiple survey teams from multiple vendors working in the same space
- Recurrent documentation meant control needed to be preserved and easily accessible
- Layout, install, verify, repeat, all the way from foundations to Tokamak install by the CFS team



SURVEY CONTROL: CRITICAL

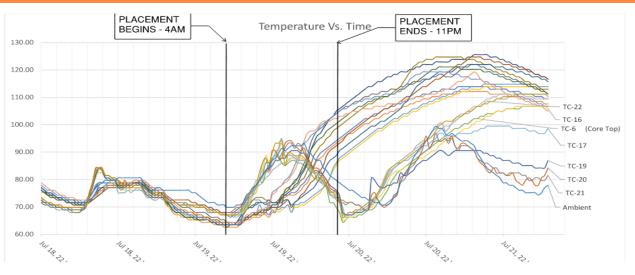


SURVEY CONTROL: CRITICAL



PROJECT CHALLENGES: STRUCTURAL BEHEMOTH



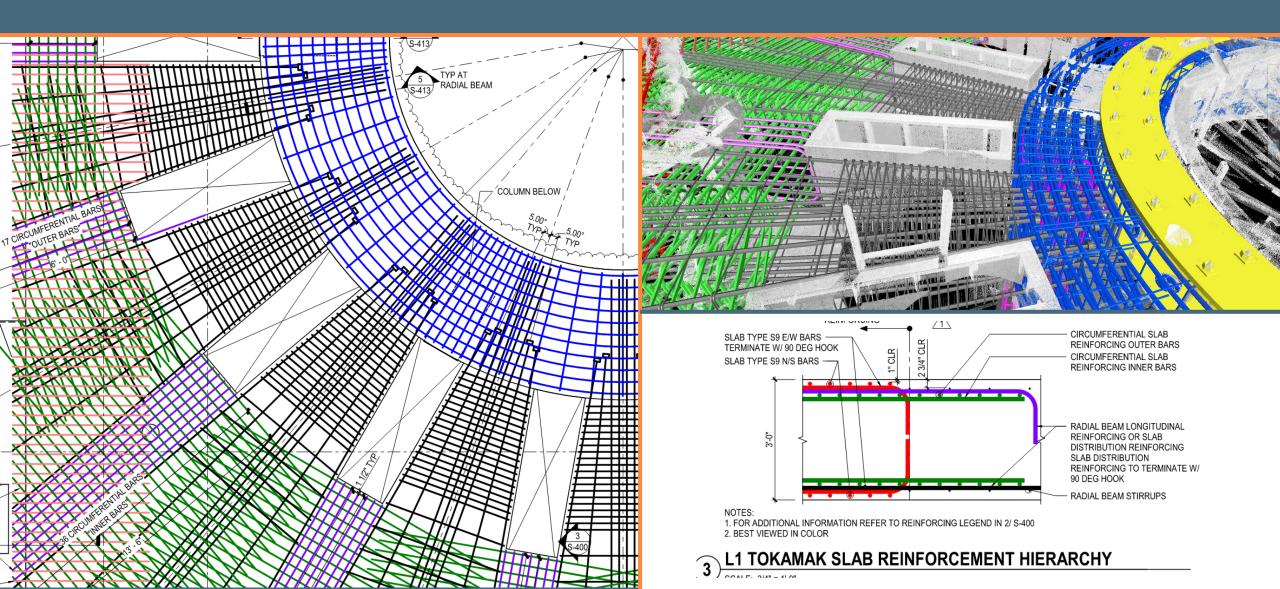






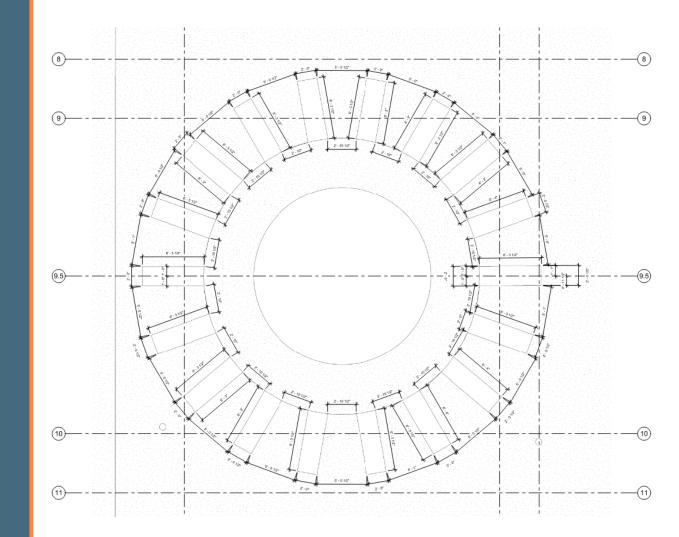
PROJECT CHALLENGES: STRUCTURAL BEHEMOTH

Thornton Tomasetti

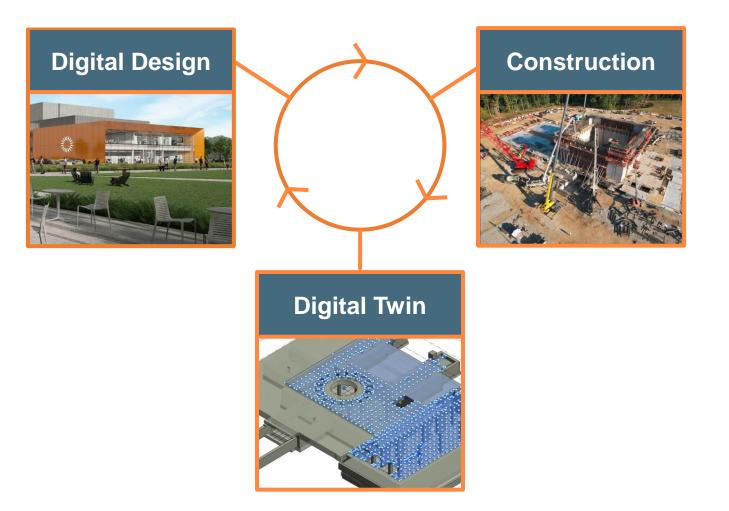


PROJECT CHALLENGES: INSANE DESIGN / CONSTRUCTION TOLERANCE

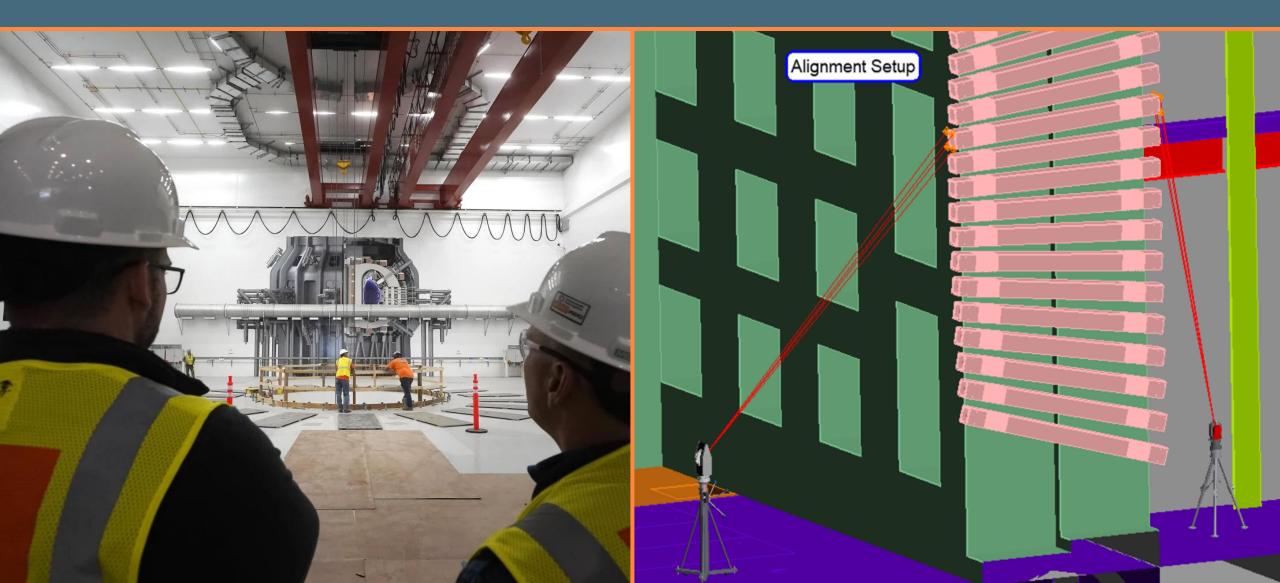
- Constant updates of the design model to record as-built condition allows design modification all the way through installation
- As-builts of in-wall rebar and cooling/monitoring piping from the chiller plant
- Verification of sleeve locations for wall and slab penetrations to verify width, height, and location – update the design models accordingly
- Documentation of structural openings in the slab around tokamak core to verify and update MEP routings to the equipment
- All Documented through a frequently updated digital twin of the space



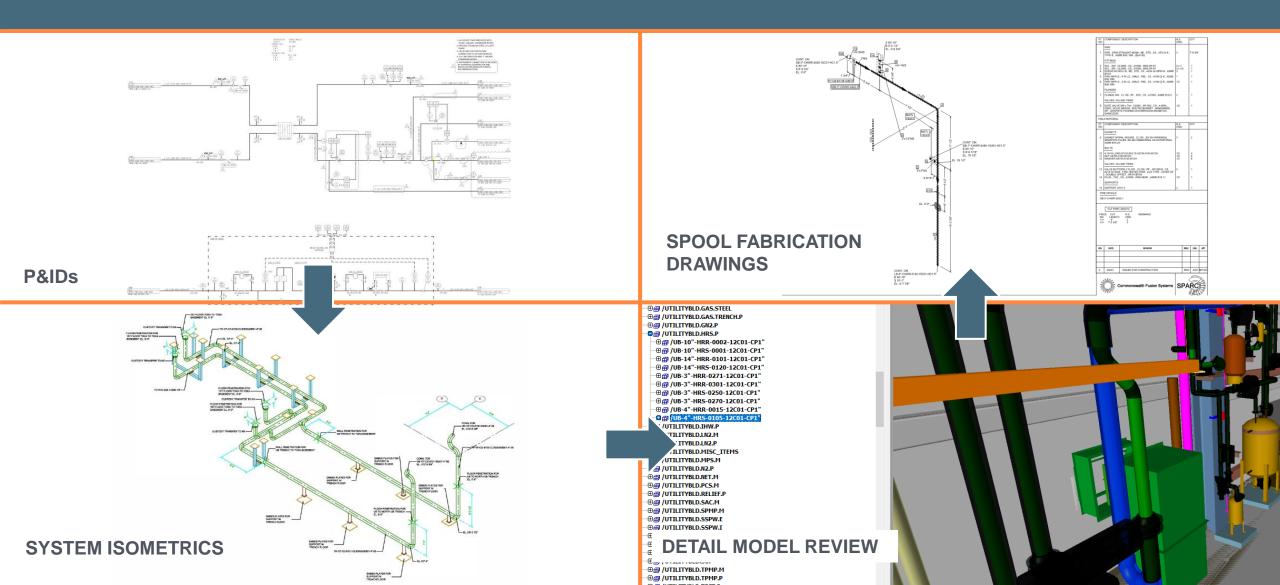
PROJECT CHALLENGES: DESIGN WHILE BUILDING



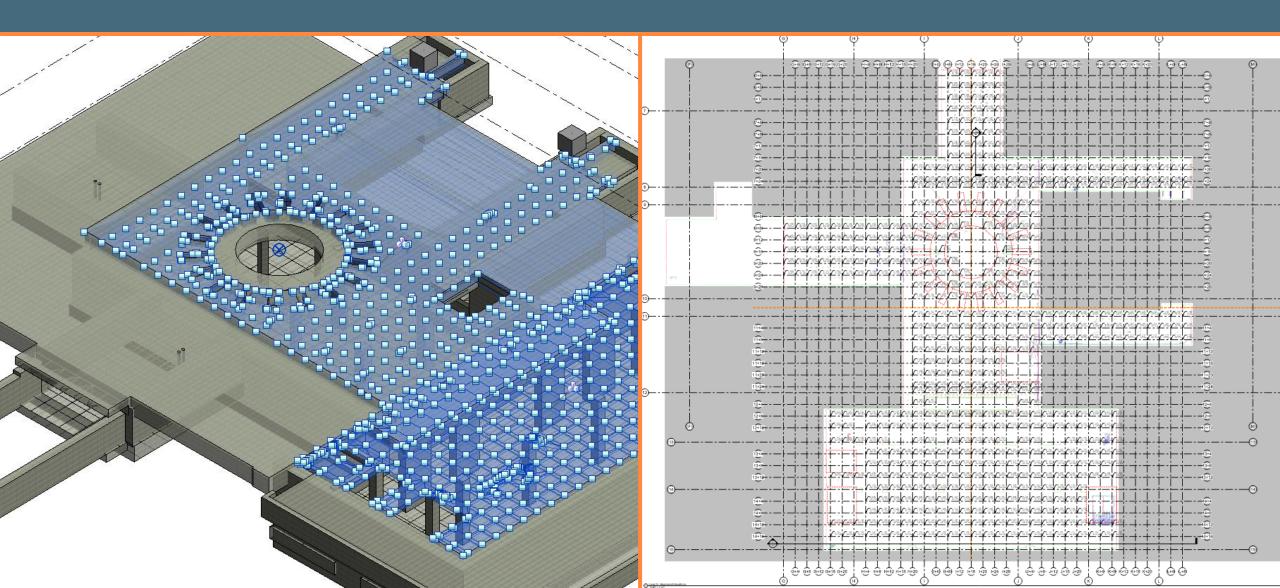
TOKAMAK INSTALLATION: METROLOGY



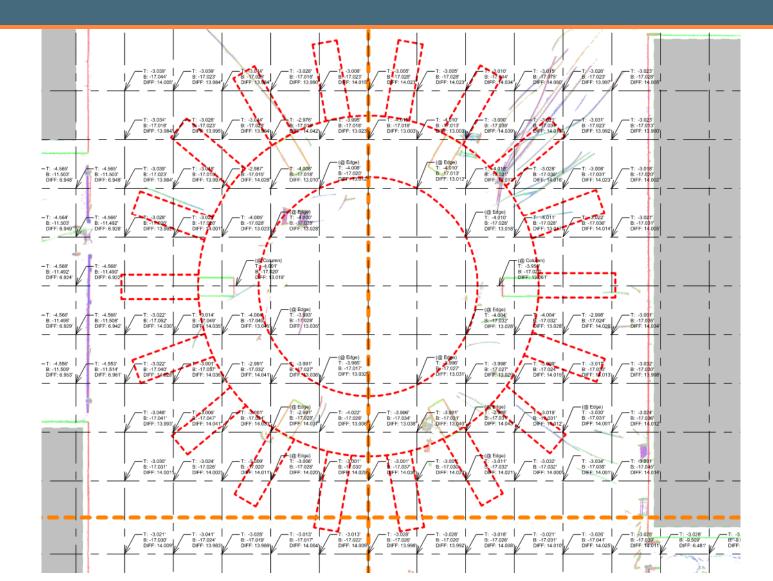
DESIGN WHILE BUILDING: DIGITAL TWIN



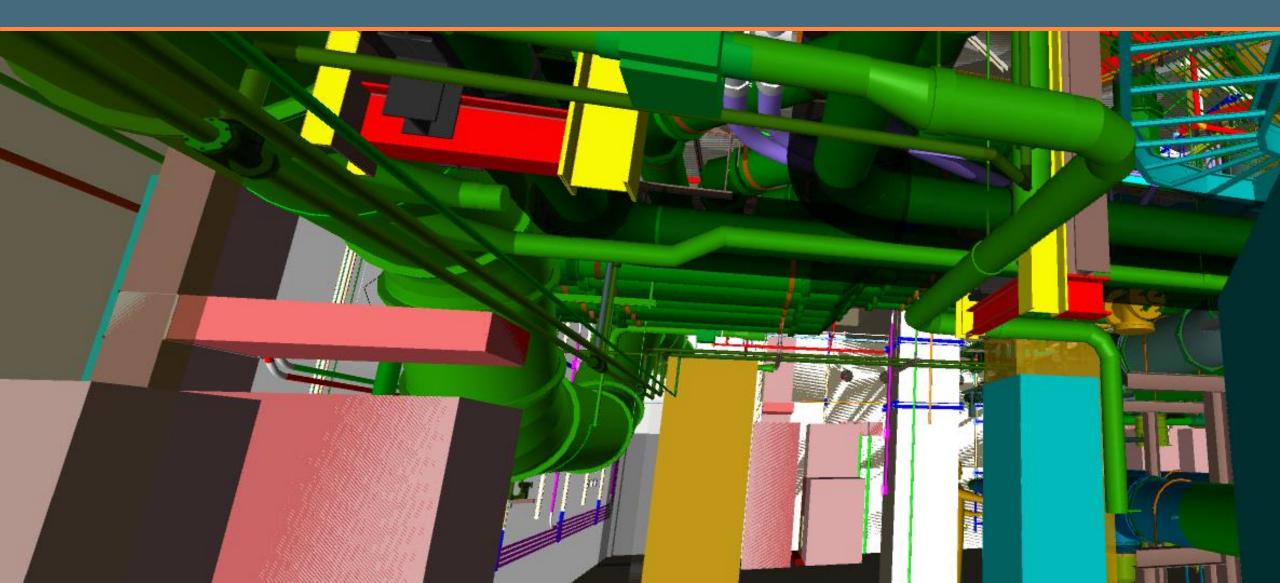
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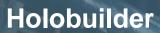
COLLABRATIVE DESIGN



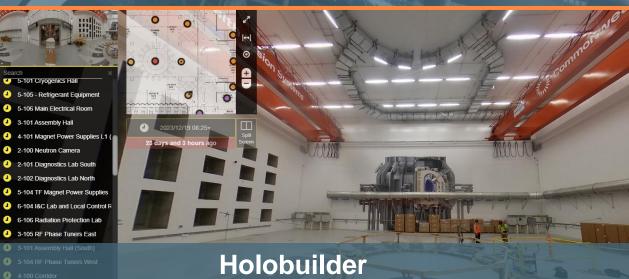
PROGRESS DOCUMENTATION



Drone









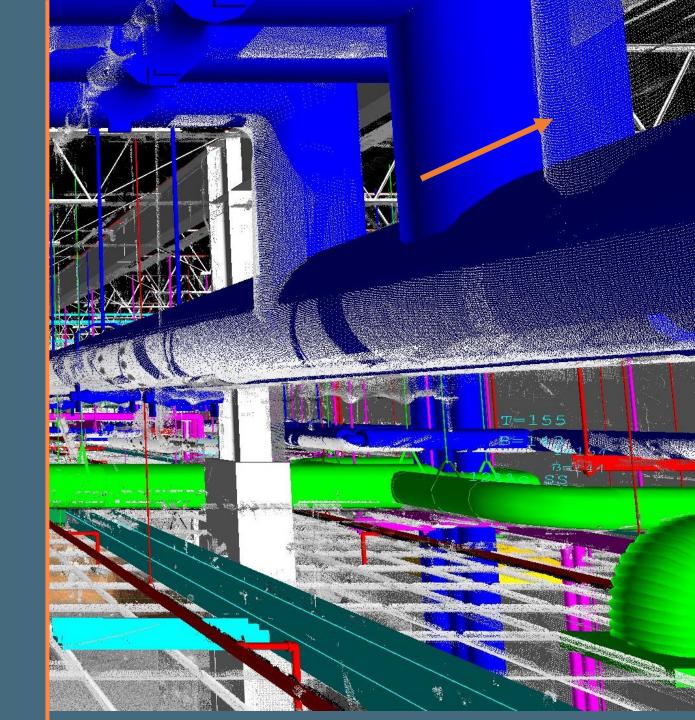


Building

BOND

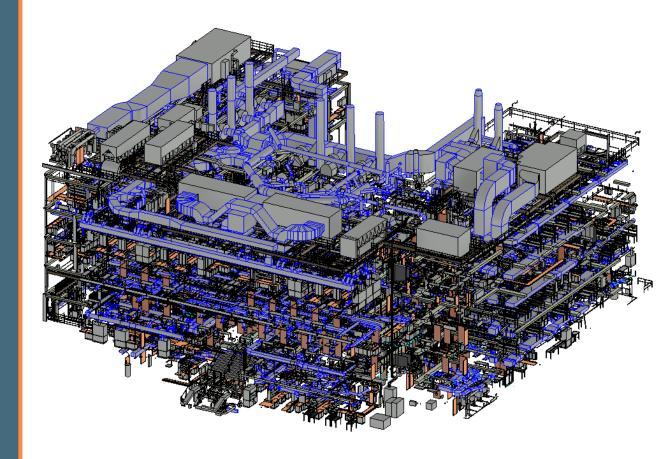
OWNER TURNOVER OF THE FUTURE

- An increasing number of institutions are requiring LOD400 As-Builts in the turnover package – set expectations early
- Soon, the federated Navis/Revit/CAD files from coordination will no longer be the standard for final closeout – they will need to be verified
- What does it take to truly meet LOD400?
 - First, a 3D geospatial survey to accurately document the as-built condition
 - Subcontractor collaboration to modify fabrication files to location and size
 - Final closeout can be hung up on review and turnover of as-built model – be proactive about this process



EARLY ADOPTION: CAMPUS INVENTORY

- Detailed as-builts allowing institutions to continue building an inventory of highly detailed/accurate 3D modeling files
- As projects move from space to space within a building, the living model becomes more complete
- More institutions are investing earlier in geospatial surveys to create or fill in gaps in existing conditions documentation
- Campus-wide inventory surveys (Arch, Structure, and MEP/FP) to retain a central repository of EC information – particularly in academia and healthcare
- Continuously updated when projects complete, a true "digital twin" which can influence the BMS and Facilities Asset Management



Questions?

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BOND