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Journey to the Center of BIM: Fluor's EPCV Digital Transformation

John Attebury
Fluor | BIM Manager

Jaroslaw Szczepanek
Fluor | Structural SME

W. Scott Carlson
Fluor | Project Information Manager

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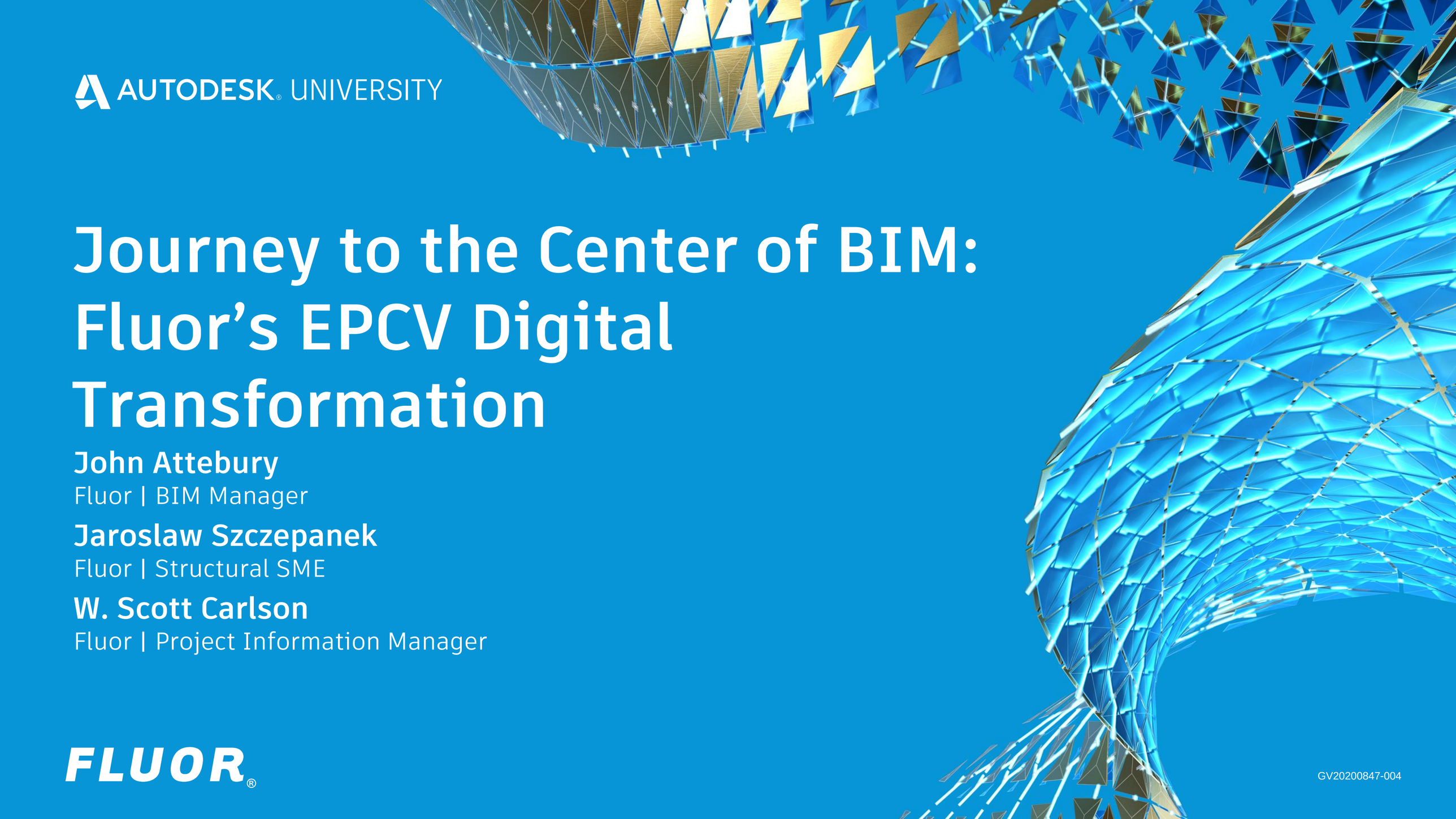
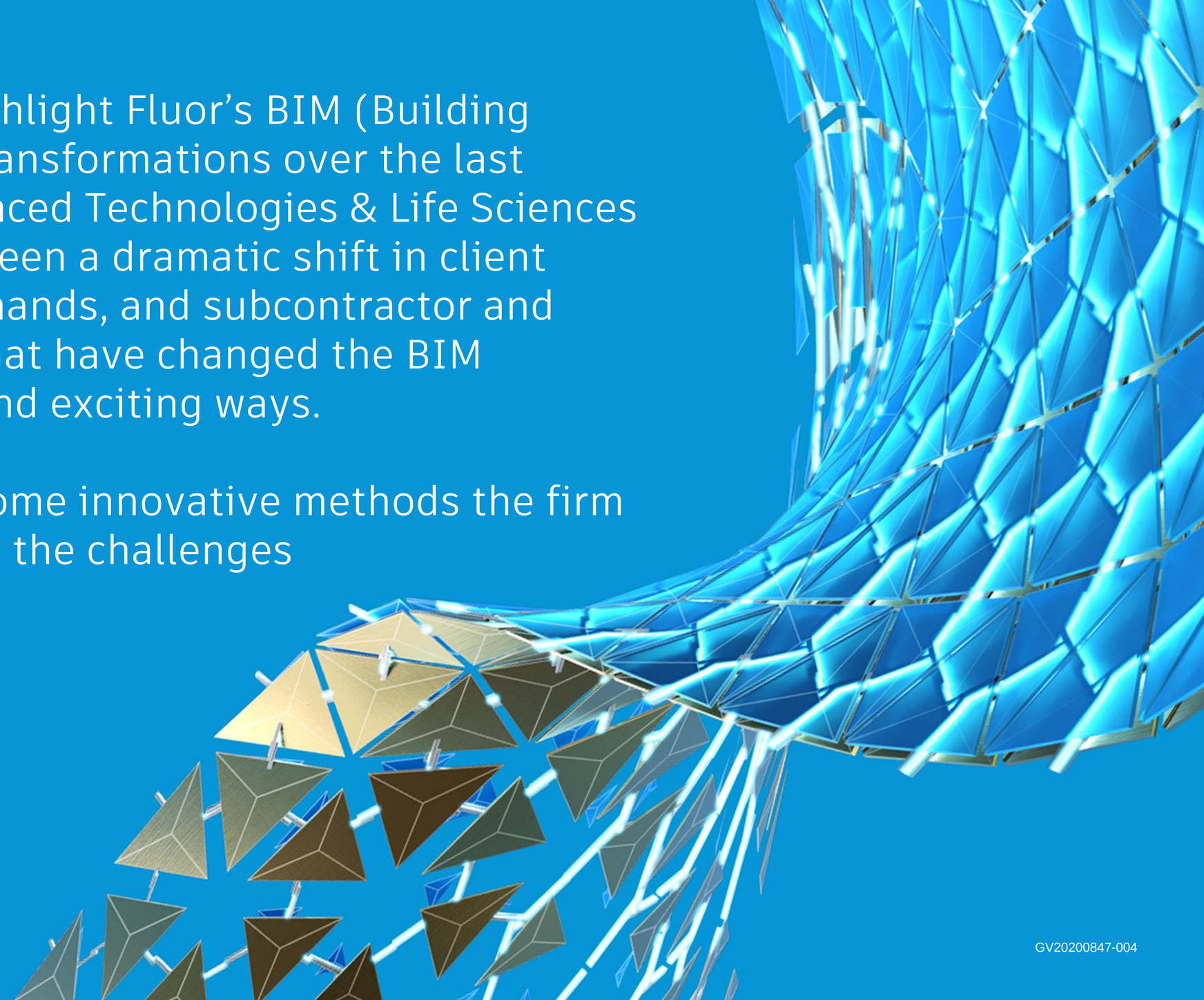


GV20200847-004

This Industry talk will highlight Fluor's BIM (Building Information Modeling) transformations over the last 10 years within the Advanced Technologies & Life Sciences (ATLS) sector. Fluor has seen a dramatic shift in client expectations, EPCmV demands, and subcontractor and supplier sophistication that have changed the BIM landscape in some new and exciting ways.

Fluor will walk through some innovative methods the firm has implemented to meet the challenges facing the industry.



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About the speaker

John Attebury

John has been the BIM Manager at Fluor since 2016 responsible for the development, implementation, and support of BIM execution for Fluor's ATLS operations.

John has over 15 years of experience in BIM execution and extensive knowledge in the implementation of BIM processes and the utilization of BIM technology to support project execution. John has over 25 years of construction management experience with a focus on pre-fabrication and installation processes.

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About the speaker

Jaroslaw Szczepanek

Jaroslaw (Jarek) is a Senior Structural Design Supervisor and Fluor Subject Matter Expert (SME), Discipline Application Specialist (DAS), and Innovation Catalyst. He has over 20 years of experience from conceptual engineering through FEED to EPCM with Energy & Chemicals and ATLS. Jaroslaw is focused on data-centric execution, digital transformation, BIM, IPD, Lean construction, and BIM/Plant/CAD software.

About the speaker

W. Scott Carlson

Scott has been a Principal Project Information Manager with Fluor since 1988 and is responsible for the planning, deployment, implementation, and support of platforms for the execution of EPCmV projects for multiple industries. Scott has extensive execution experience in all phases of work in the ATLS industries.

Executive Overview

- **A global,** publicly traded **engineering, procurement, construction (EPC), and maintenance** company
- **Designs, builds,** and **maintains** capital-efficient facilities for clients on six continents
- Delivers **comprehensive solutions** for clients in the energy & chemicals, government, advanced technologies & life sciences, infrastructure & power, mining & metals, and operations & maintenance market sectors
- **Global execution platform** serving clients in over **60** countries
- **#181** on the 2020 **FORTUNE® 500** list
- Revenue of **$14.3 billion** in 2019
- More than **45,000** employees executing projects globally
- **108**-year **Fluor** legacy

Fluor Corporate Headquarters | Dallas, Texas

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Advanced Technologies & Life Sciences

Serves the biotechnology, pharmaceutical, medical devices, advanced materials, and manufacturing industries.

- **Consulting and feasibility studies**
- **Fit-for-purpose design**
- **New venture start-up**
- **Research and development laboratories**
- **First-of-a-kind commercialization**
- **Design-build-validate services**
- **Worldwide FDA-licensing experience**
- **Regulatory compliance**
- **Process engineering**
- **Project management**
- **Mid- to large-scale projects**
- **Refurbishment of existing facilities**

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Advanced Technologies & Life Sciences Worldwide Projects

Novo Nordisk API Facility
Clayton, North Carolina

Frito-Lay Alliance
Multiple Locations, United States and Canada

Solvay S.A. Adhesives Expansion
Wrexham, Wales

Shire Biologics Facility
Covington, Georgia

Stora Enso Consumer Board Mill
Beihai, Guangxi, China

CSL Behring Building 4 Replacement Project
Kankakee, Illinois

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Safety Performance

We promote a caring, preventative culture where no one gets hurt – through an uncompromising focus on safety in the workplace.

- **Fluor's HSE Management System establishes a common framework for employee actions to ensure global consistency in HSE practices. The implementation of this integrated, consistent company-wide approach to HSE provides:**
  - Competitive advantage through reliability and reduced risk
  - Efficiencies in work execution
  - Greater opportunities to provide solutions to HSE challenges
  - Improved HSE impact tracking
  - Life Critical℠ activity requirements, which address activities that pose the highest risk of serious injuries
  - Recognition of projects and offices through the HSE Star Award Program

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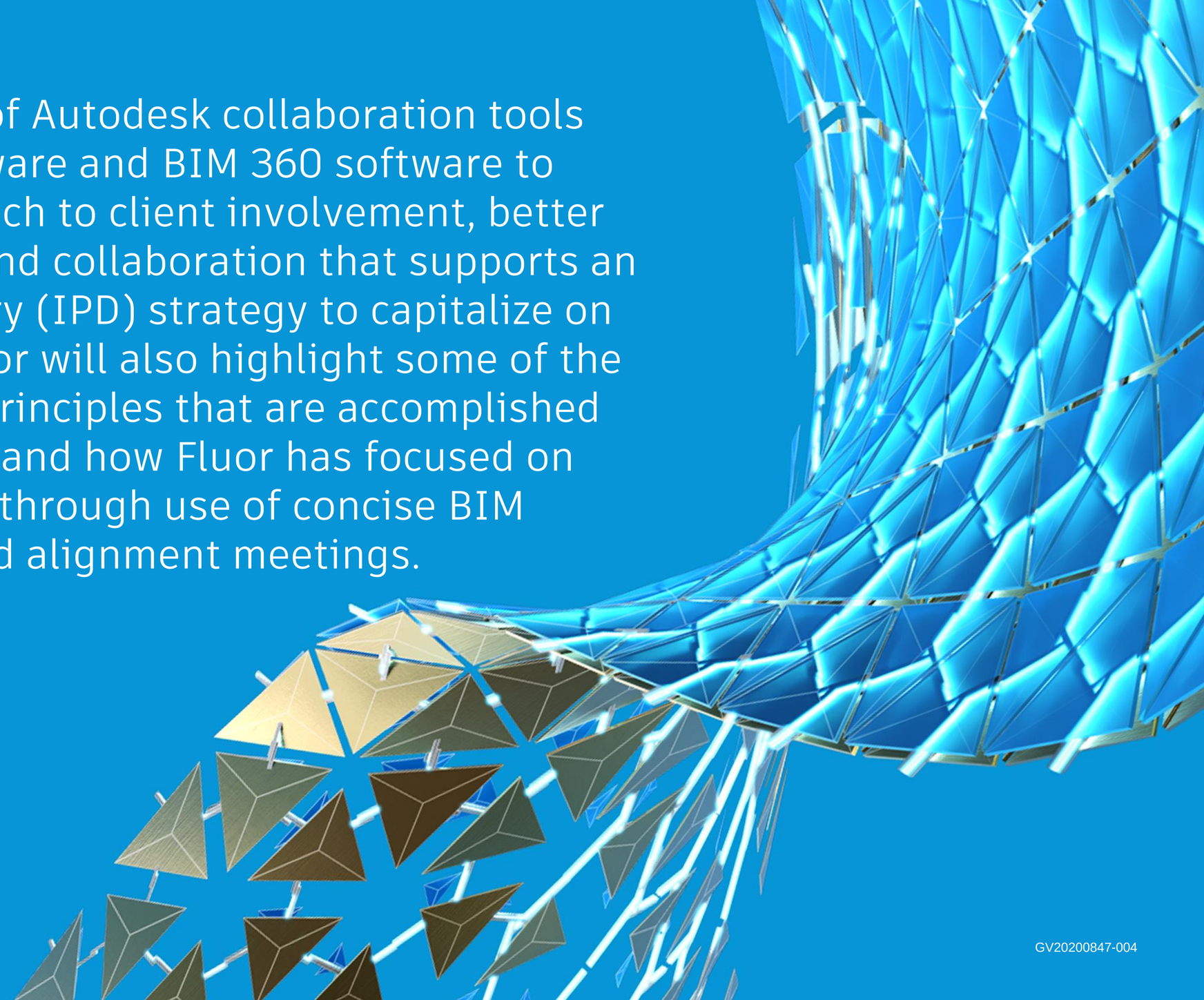
The focus will be on use of Autodesk collaboration tools such as Navisworks software and BIM 360 software to support a focused approach to client involvement, better BIM data management, and collaboration that supports an integrated project delivery (IPD) strategy to capitalize on worldwide resources. Fluor will also highlight some of the industry lean execution principles that are accomplished utilizing the BIM process and how Fluor has focused on up-front team alignment through use of concise BIM execution plans (BEP) and alignment meetings.



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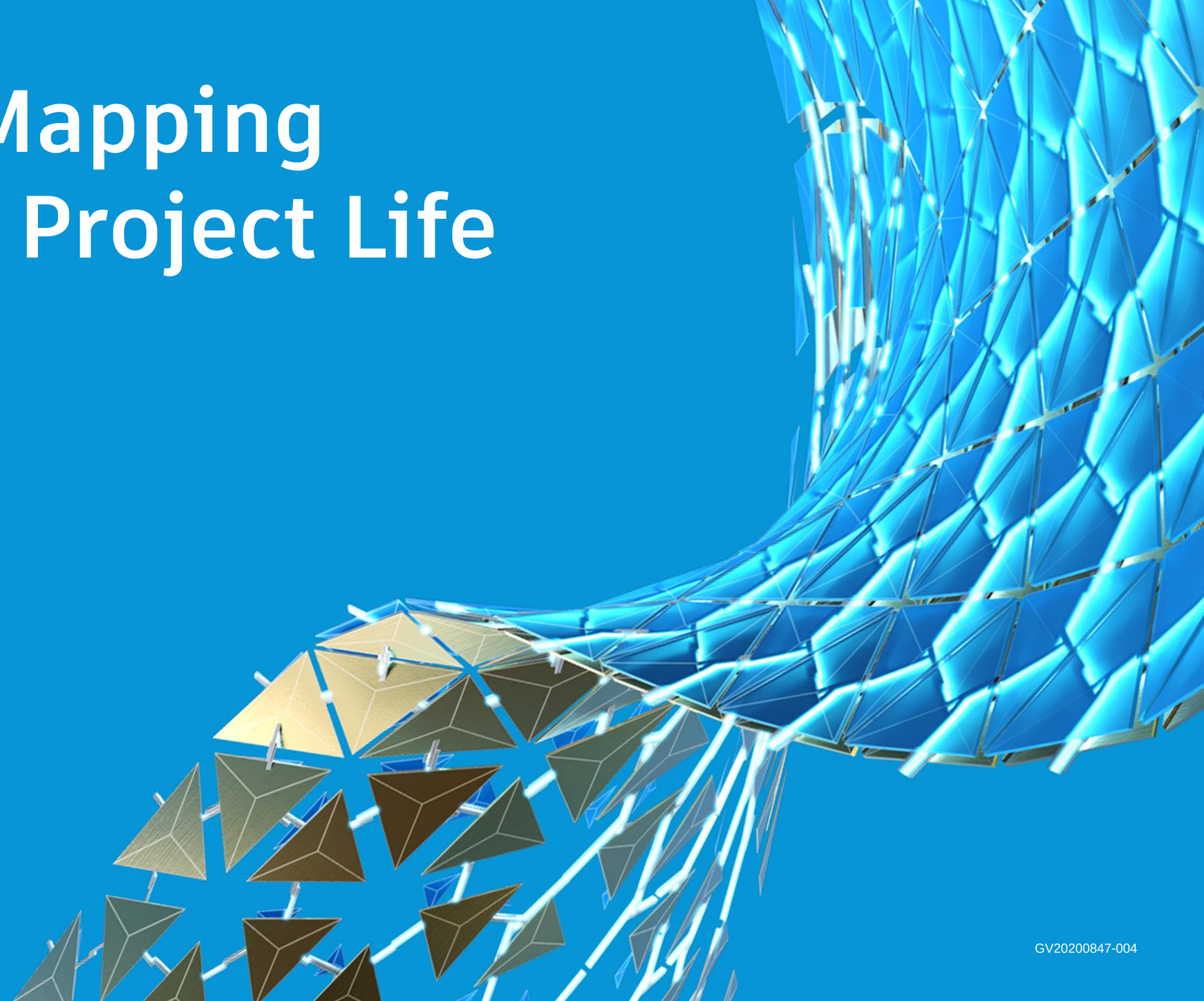
BIM Data Mapping to Support Project Life Cycle



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DATA-driven Digital Transformation in Fluor

1960
Fluor's Draft App

1970
CAD
Computer Aided Design

1984
3D CAD
GE Calma

1994
PDS 3D
Plant Design System

2005
Smart 3D
NextGEN 3D Data-Centric Information

2010
BIM
Building Information Modeling

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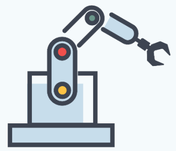
DIGITAL TRANSFORMATION

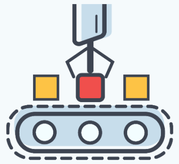


Technology

Communication

Data

Internet of things



Automation

AI

Networking

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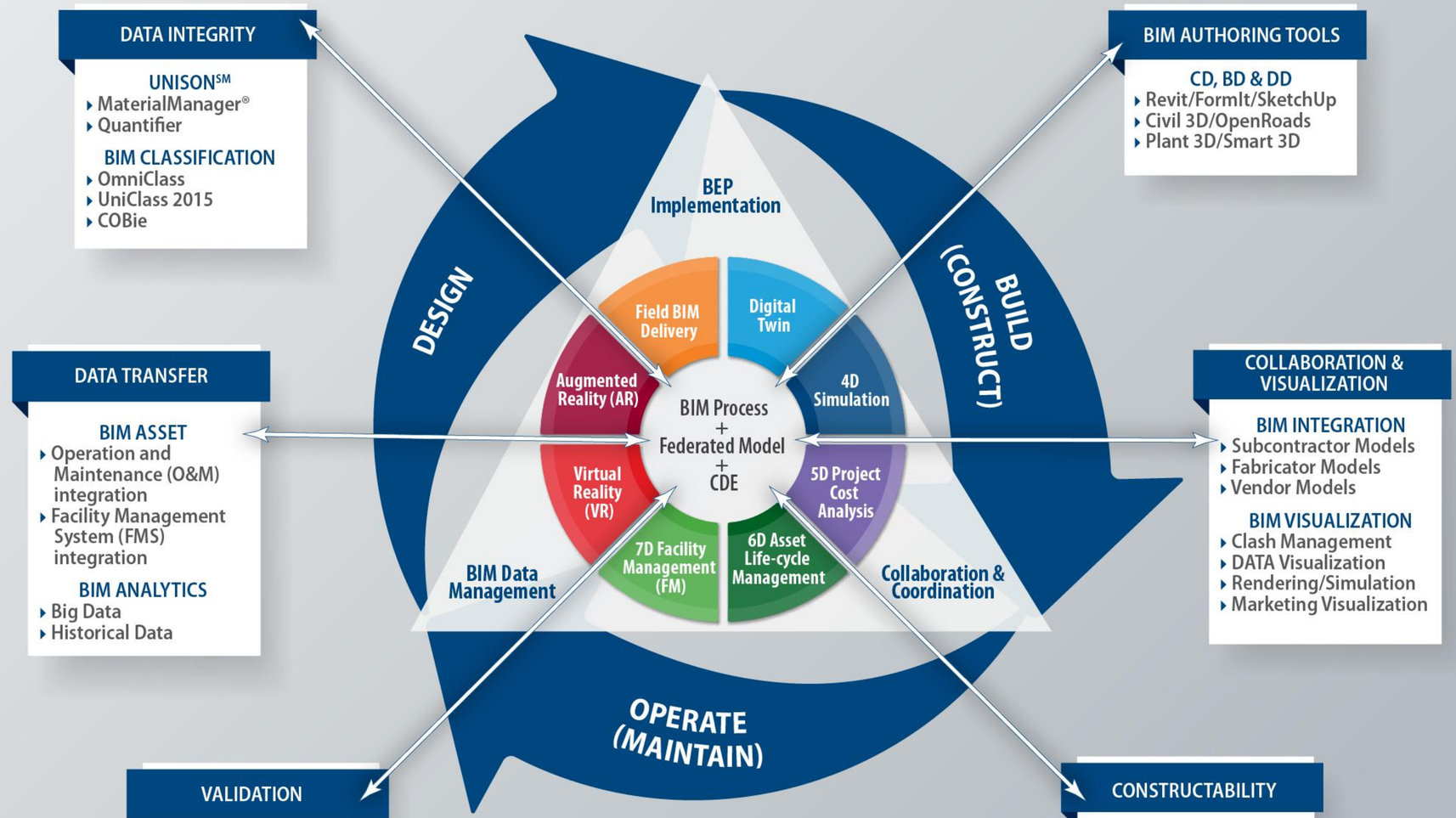
ATLS BIM Project Life-cycle Data Flow



DATA INTEGRITY

UNISON℠
- MaterialManager®
- Quantifier

BIM CLASSIFICATION
- OmniClass
- UniClass 2015
- COBie

BIM AUTHORING TOOLS

CD, BD & DD
- Revit/FormIt/SketchUp
- Civil 3D/OpenRoads
- Plant 3D/Smart 3D

DATA TRANSFER

BIM ASSET
- Operation and Maintenance (O&M) integration
- Facility Management System (FMS) integration

BIM ANALYTICS
- Big Data
- Historical Data

COLLABORATION & VISUALIZATION

BIM INTEGRATION
- Subcontractor Models
- Fabricator Models
- Vendor Models

BIM VISUALIZATION
- Clash Management
- DATA Visualization
- Rendering/Simulation
- Marketing Visualization

VALIDATION
- Field Forms/Checklist
- BIM Database Tracking

CONSTRUCTABILITY

BIM FIELD MOBILITY
- Field Capture (Safety, Quality, Issues)

CD (Concept Design)
BD (Basic Design)
DD (Digital Design)
BEP (BIM Execution Plan)
CDE (Common Data Environment)
LOD (Level of Development)

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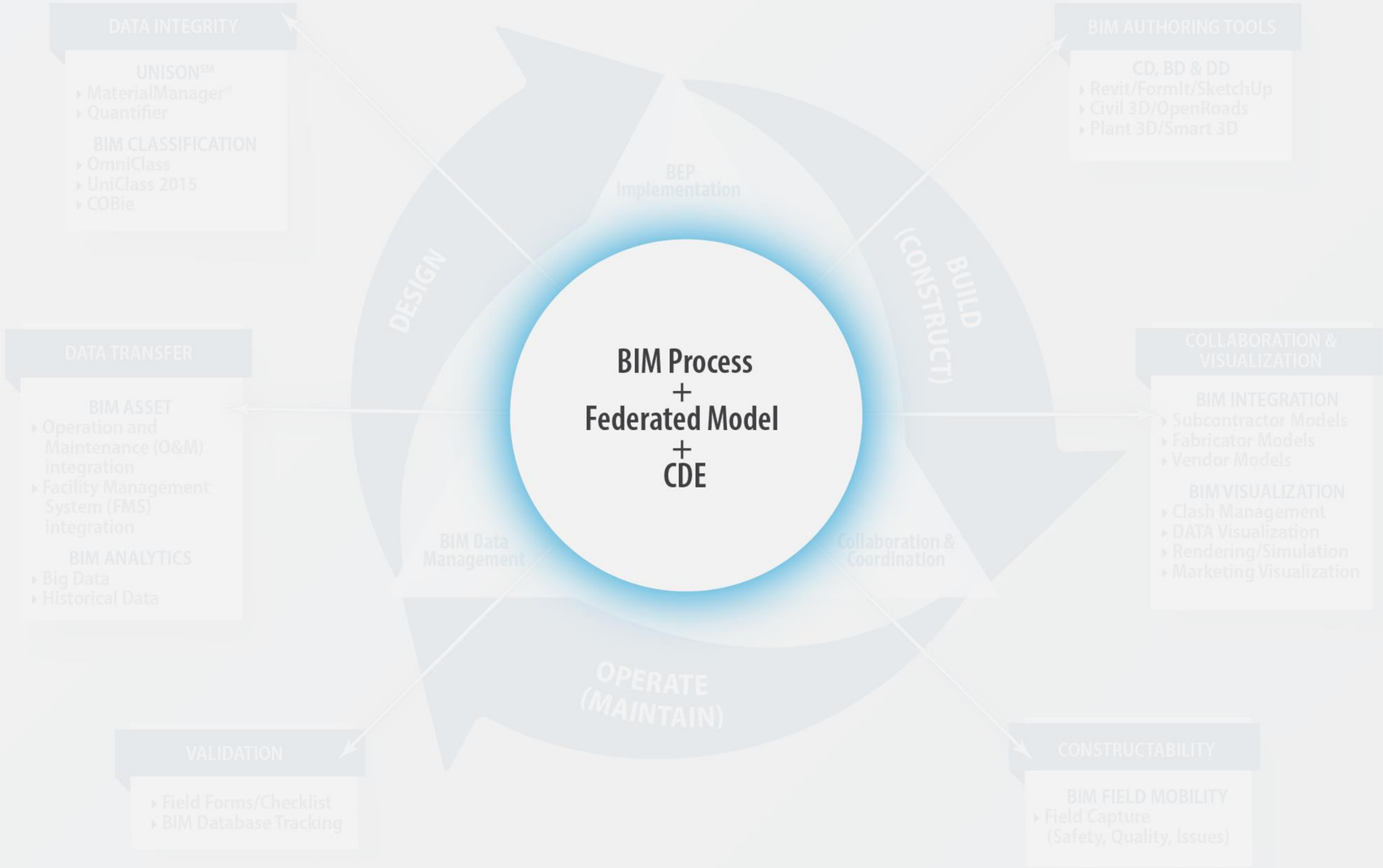
ATLS BIM Project Life-cycle Data Flow



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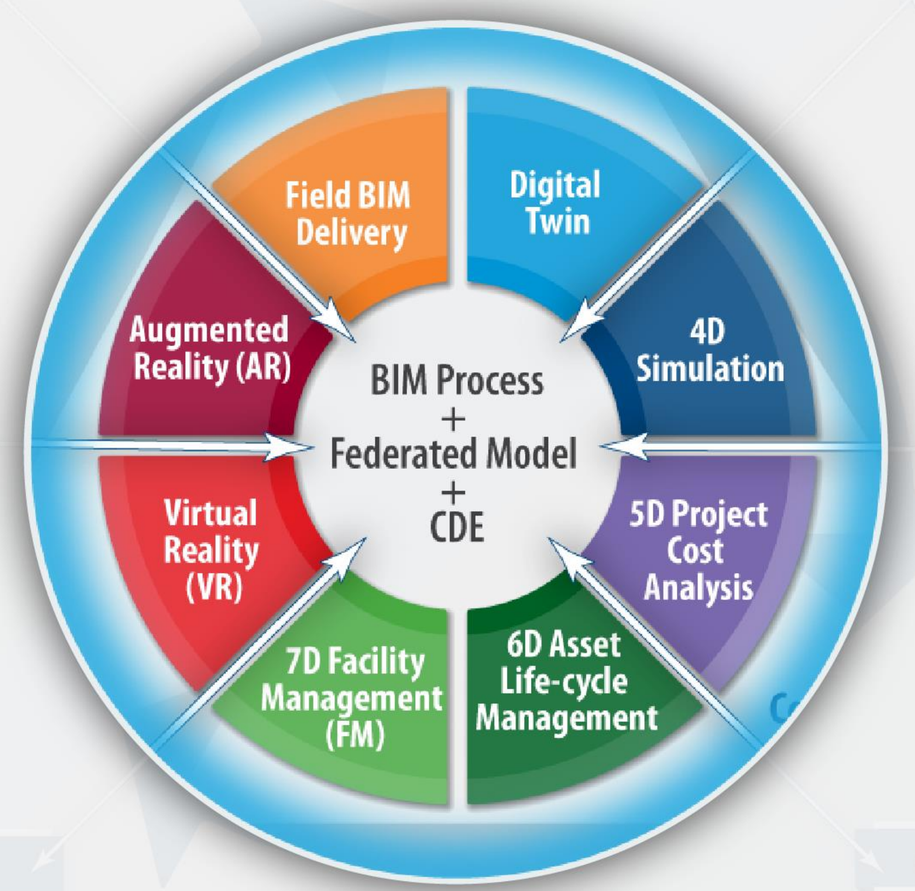

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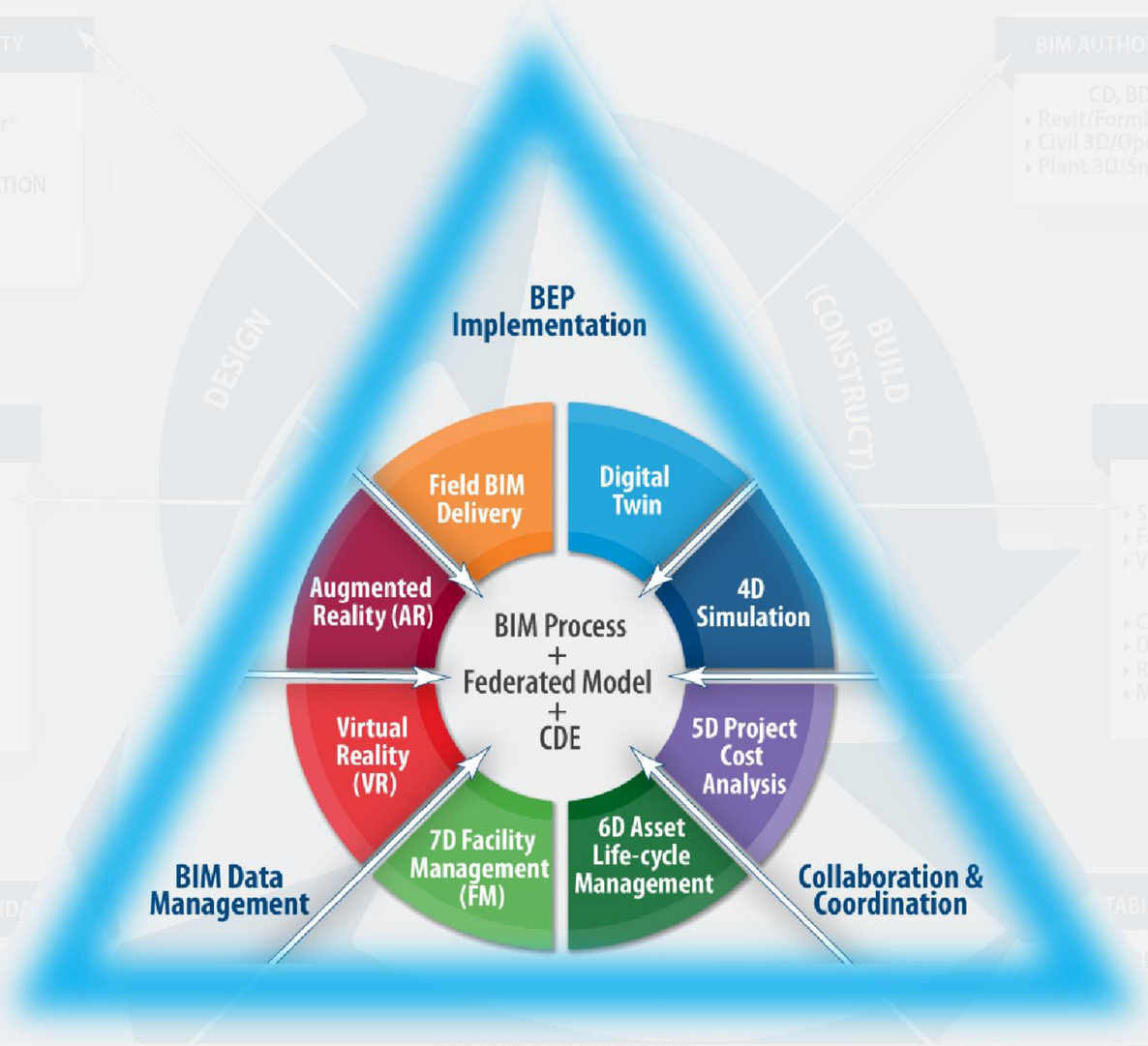

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ATLS BIM Project Life-cycle Data Flow

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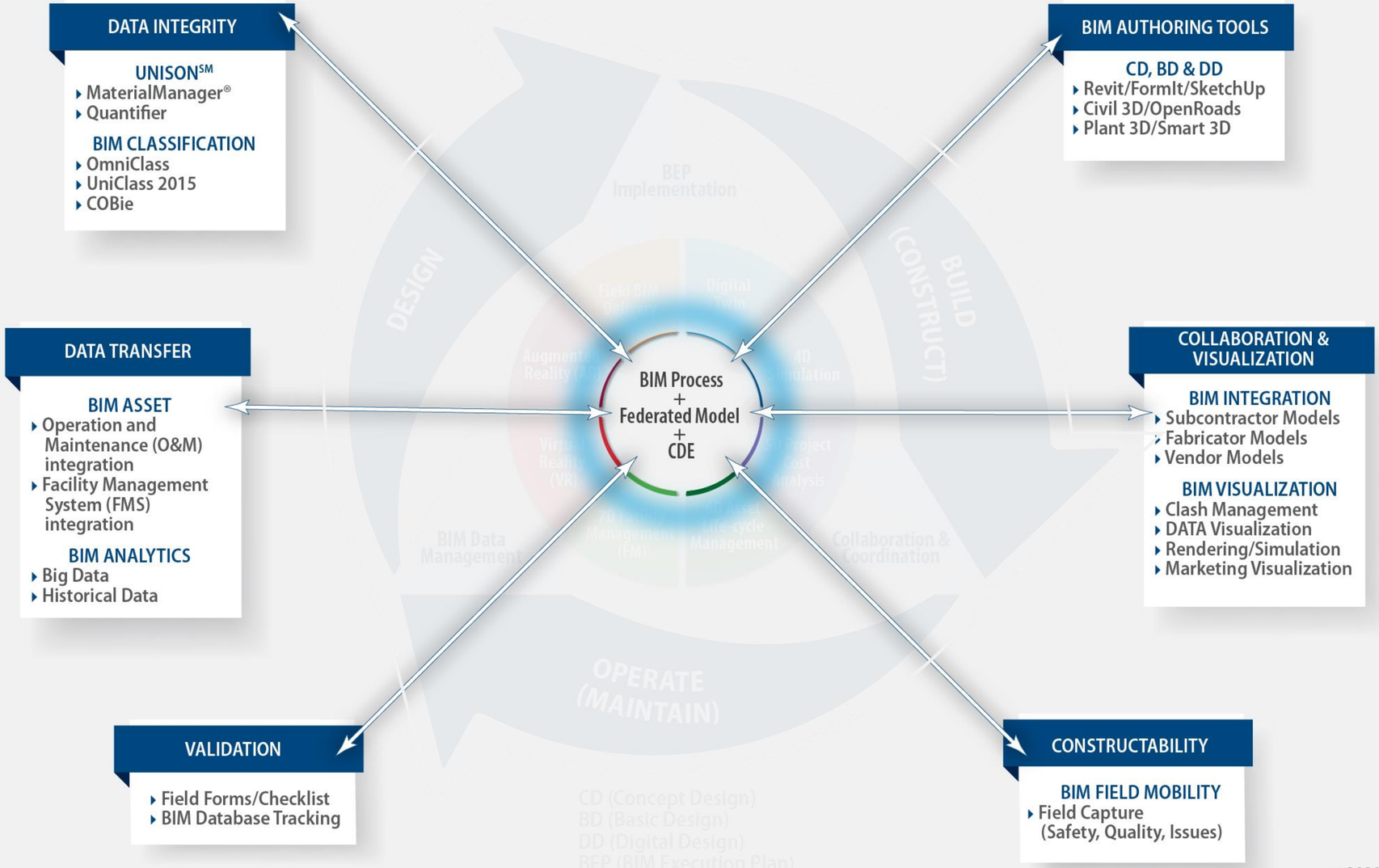

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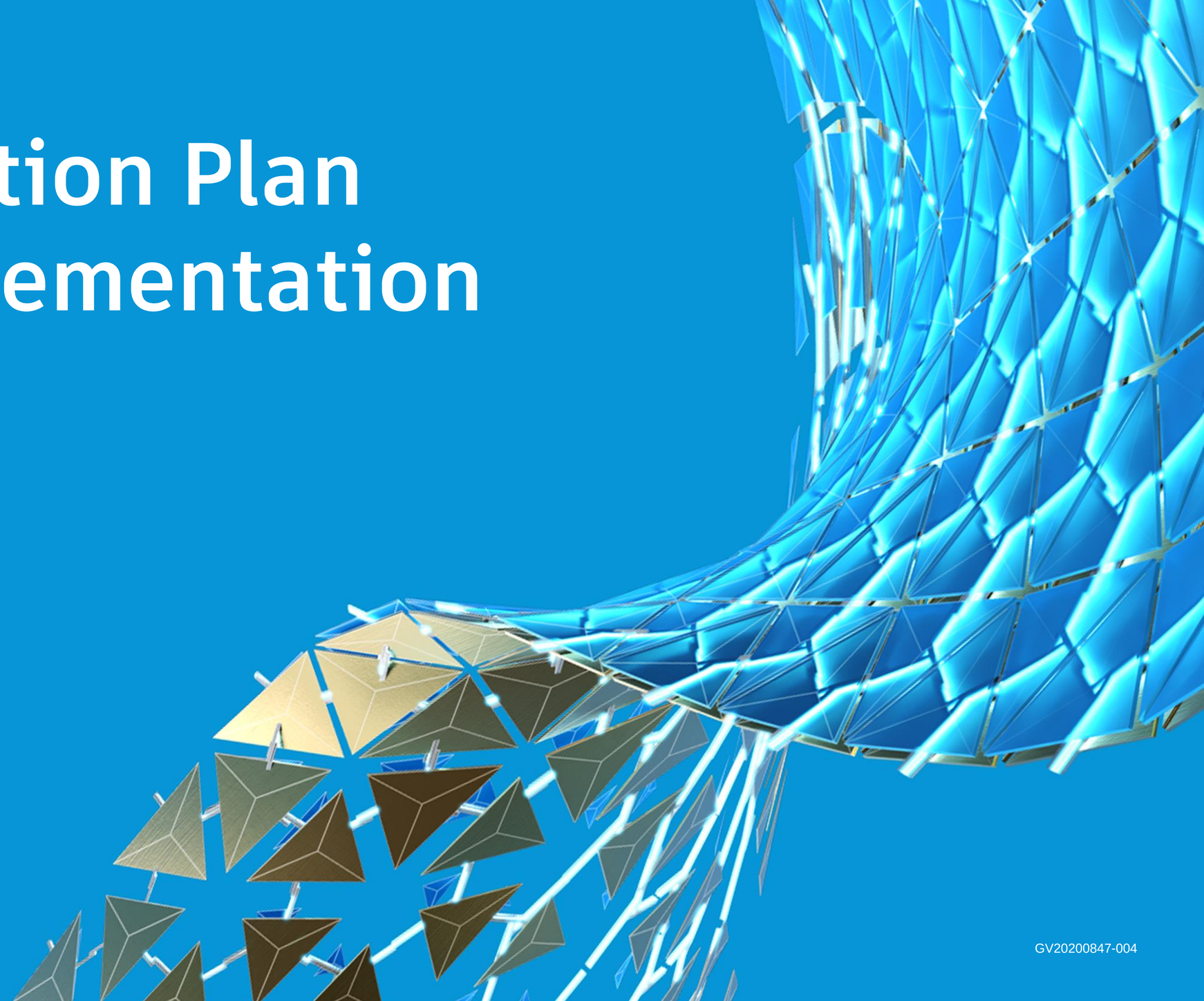
BIM Execution Plan (BEP) Implementation



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The BEP is a vital component to the success of BIM on a project.

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BIM Kickoff and Alignment

- Bring all the key BIM players together
- Communicate the BIM goals
- Define what BIM data is important
- Who will supply what key BIM data
- When they will supply it
- In what format
- Define BIM deliverables
- Future BIM alignments with new BIM participants during the project

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Goal of the BEP is Implementation

TO GET EVERYONE FOCUSED ON THE SAME GOAL

WITH A UNIFIED EFFORT

SO EVERYONE KNOWS THEIR PART

vs.

BIM Maturity Levels

0 BIM Level 0

- 2D Drawings
- Output paper prints

1 BIM Level 1

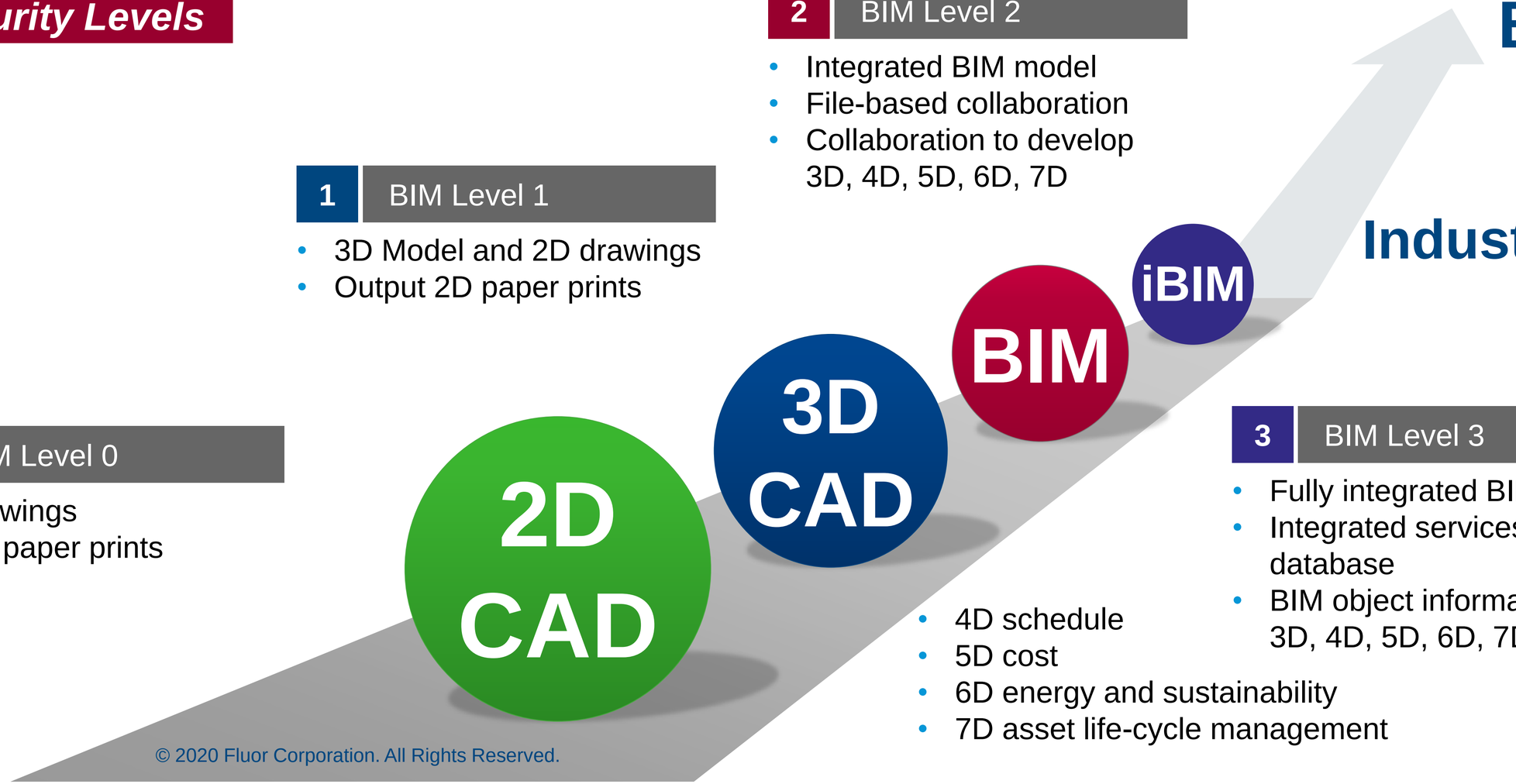
- 3D Model and 2D drawings
- Output 2D paper prints

2 BIM Level 2

- Integrated BIM model
- File-based collaboration
- Collaboration to develop 3D, 4D, 5D, 6D, 7D

3 BIM Level 3

- Fully integrated BIM model
- Integrated services database
- BIM object information 3D, 4D, 5D, 6D, 7D, etc.



- 4D schedule
- 5D cost
- 6D energy and sustainability
- 7D asset life-cycle management

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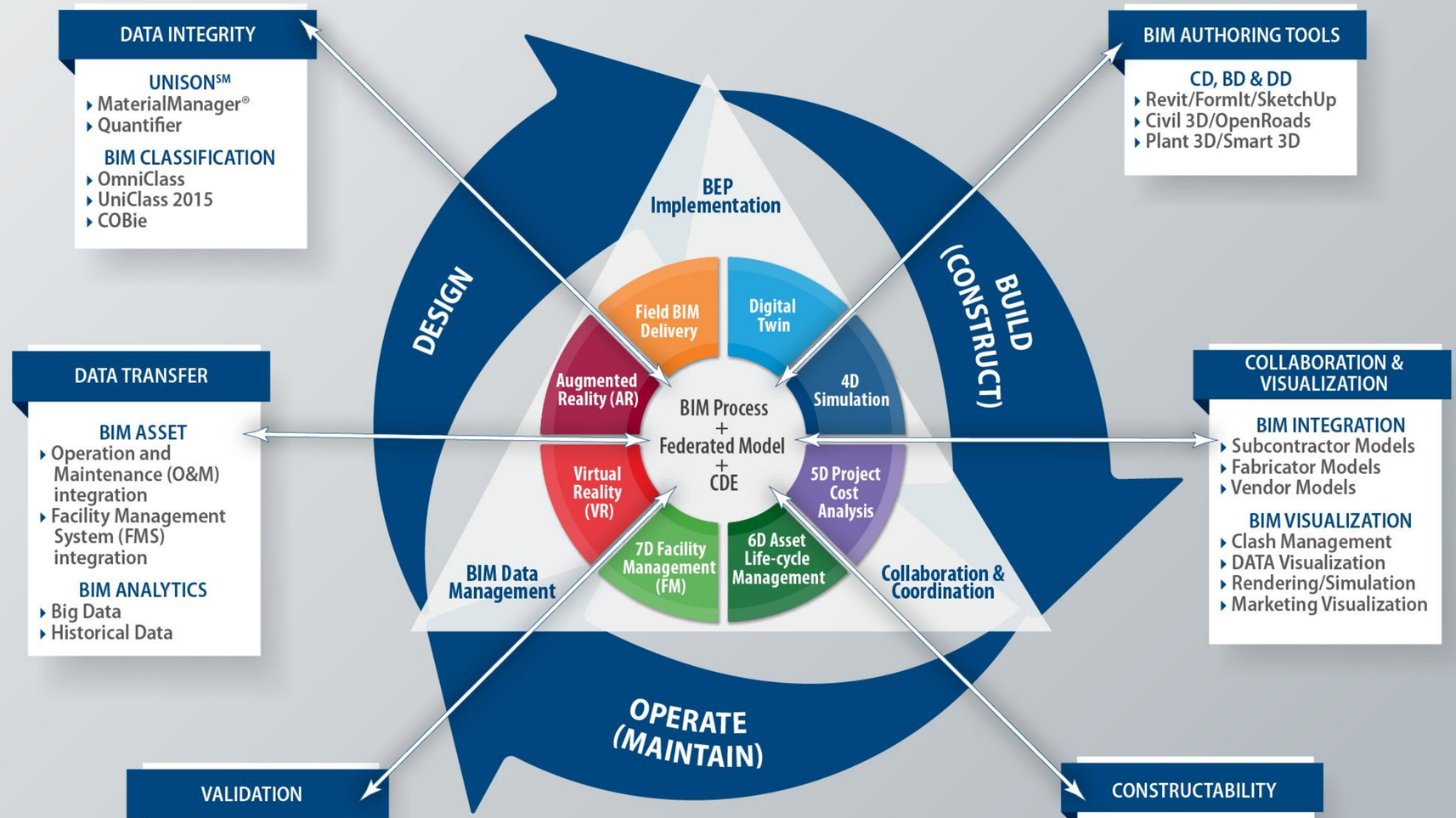
ATLS BIM Project Life-cycle Data Flow



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BEP Development and Implementation

- BEP purpose and basic project specifics
- Specific BIM goals and BIM uses
- BIM deliverables and requirements
- Roles and responsibilities
- Level of development (LOD) according to AIA
- Level of information Need (LOIN) according to ISO 19650
- BIM data requirements
- Hardware and software requirements
- BIM information exchanges
- BIM collaboration procedures

- Collaboration strategies
  - Trade participants
  - Model partitions/construction works areas (CWAs)
  - Design review coordination/documentation
  - Model content management
  - Model handover requirements
  - Clash prevention and clash detection
  - Coordination sign-offs (release for fabrication plan)
- Isometric plan
- Quality control

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BIM Execution Checklist

I. BIM Contract Requirements (Client/Fluor)...What do we have?		Comments
Client BIM Specifications	☐	
Client BIM Contract Sections	☐	
Client BIM Reference Documents	☐	
Client provided EIR (Exchange Inf		
Client provided AIR (Asset Inform		
Client Provided BIM Execution Pla		
CM / GC provided BIM Exectution		
Other provided BIM Documents		
II. General BIM Design Set up (Projec		
BIM Responsibility Matrix		
Establish BIM Authoring Softwar		
Meet and Align with managemer		
Establish CAD standards for BIM		
Establish and publish site coord		
Set up Discipline Design models		
Support discipline model issues		
Establish and issue Model Data		
Establish strategy for modeling c		
III. General BIM Set up		
Review / Confirm BIM Budget		
Establish Model workflow (Inter		
Create the Federated NWD mode		
Develop and Issue BIM Executior		
Establish and align team with		
Establish and align team with		
Establish and align team with Ma		
Establish and set up BIM Collabc		
Set up Folder Structure for BIM		
Develop and Issue the BIM Co		
Develop and Issue the Clash Ma		
Develop and Issue BIM Field Ma		
Establish and Issue any additior		
III. BIM Collaboration / Coordination		
Implement and Train Team on BI		
Conduct and document BIM Kicko		
Implement and Administer BIM I		
Set up Folders, Roles, and Per		
Set up and manage Users		

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P - Primary, S - Secondary, A - As needed technical support

BIM Responsibility Matrix

	Fluor	Client (Name)	GC / CM (Name)	IPD Partner (Name)		
I. General BIM Design Set up (BIM Project with ENG Services)						
Establish BIM Authoring Software (BAS) design formats	☐	☐	☐	☐		
Meet and Align with management on project tagging standards	☐	☐	☐	☐		
Establish CAD standards for BIM Authoring Software (BAS)	☐	☐	☐	☐		
Establish and publish site coordinates for model alignment	☐	☐	☐	☐		
Set up Discipline Design models (coordinates and data content)	☐	☐	☐	☐		
Support discipline model issues	☐	☐	☐	☐		
Establish and issue Model Data Requirements	☐	☐	☐	☐		
Establish strategy for modeling of existing facility (Laser scanning, integration with GIS)	☐	☐	☐	☐		
II. General BIM Set up						
Collect / Review Client BIM Requirements (EIR, AIR if available)	☐	☐	☐	☐		
Review / Conduct BIM Budget	☐	☐	☐	☐		
Establish Model workflow (Internal and External) to support Federated Model creation	☐	☐	☐	☐		
Create the Federated NWD model	☐	☐	☐	☐		
Develop and Issue BIM Execution Plan (BEP)	☐	☐	☐	☐		
Establish and align team with the Level of Development (LOD) Matrix	☐	☐	☐	☐		
Establish and align team with Construction Work Areas (CWAs)	☐	☐	☐	☐		
Establish and align team with Model Data Requirements (consult Section I)	☐	☐	☐	☐		
Establish and set up BIM Collaboration Site (Example BIM 360)	☐	☐	☐	☐		
Set up Folder Structure for BIM model exchanges	☐	☐	☐	☐		
Develop and Issue the BIM Collaboration Site Work Process	☐	☐	☐	☐		
Develop and Issue the Clash Management Work Process	☐	☐	☐	☐		
Develop and Issue BIM Field Management Work Process	☐	☐	☐	☐		
Establish and Issue any additional needed Work Instructions	☐	☐	☐	☐		
III. BIM Collaboration / Coordination Execution						
Implement and Train Team on BEP	☐	☐	☐	☐		
Conduct and document BIM Kickoff Meeting	☐	☐	☐	☐		
Implement and Administer BIM Information Exchange Site (Example BIM 360, Box, etc)	☐	☐	☐	☐		
Permisions	☐	☐	☐	☐		
	☐	☐	☐	☐		

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BIM Data Management

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It is critical to align with the client and key participants up front.

Data Management Pillars

DATA INTEGRITY

- Level of Development (LOD) in project stages
- Materials definitions
- Object classification
- Attributes for data reporting and quantification

DATA TRANSFER

- BIM assets
- BIM analytics
- Model data requirements – the key document to define model data transfers based on EIR (AIR)

DATA VISUALIZATION

- Accelerates the understanding of the processes taking place in Common Data Environment (CDE)
- Asset data visualization in business analysis tools

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Common Data Environment (CDE) Development

STAGE A

WORK IN PROGRESS

(Design teams working area)

STAGE B

SHARED

(Review, coordination, and collaboration exchange area)

STAGE C

PUBLISHED

(Current officially approved model)

STAGE D

ARCHIVED

(Tracking of previous versions and revisions stored for audit purpose)

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CDE is in the center of BIM project life cycle and supports BIM data flow.

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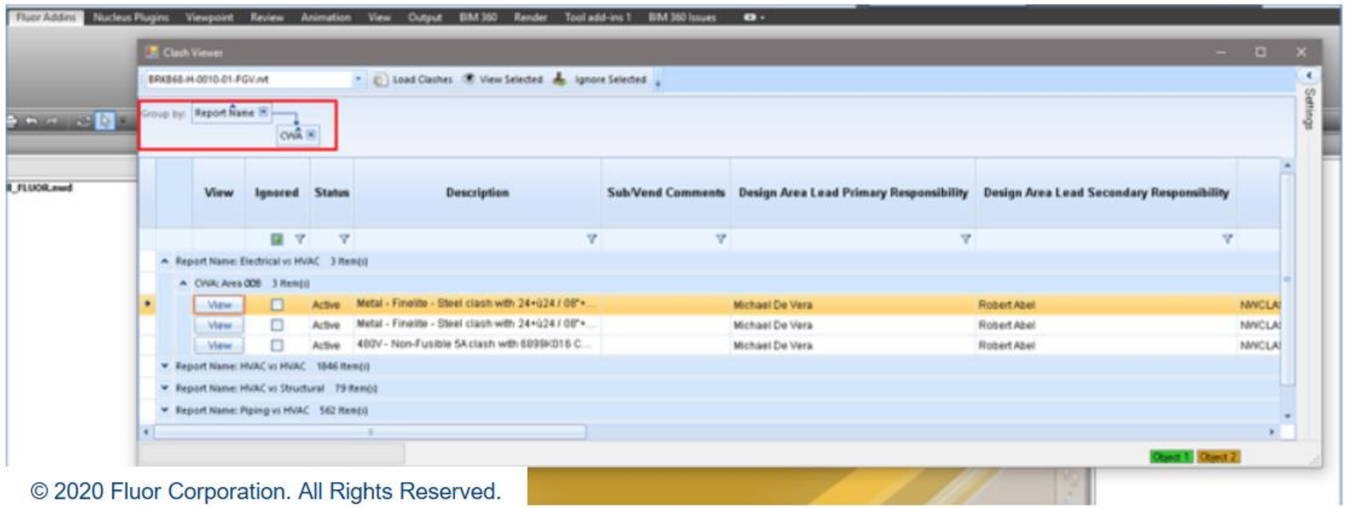
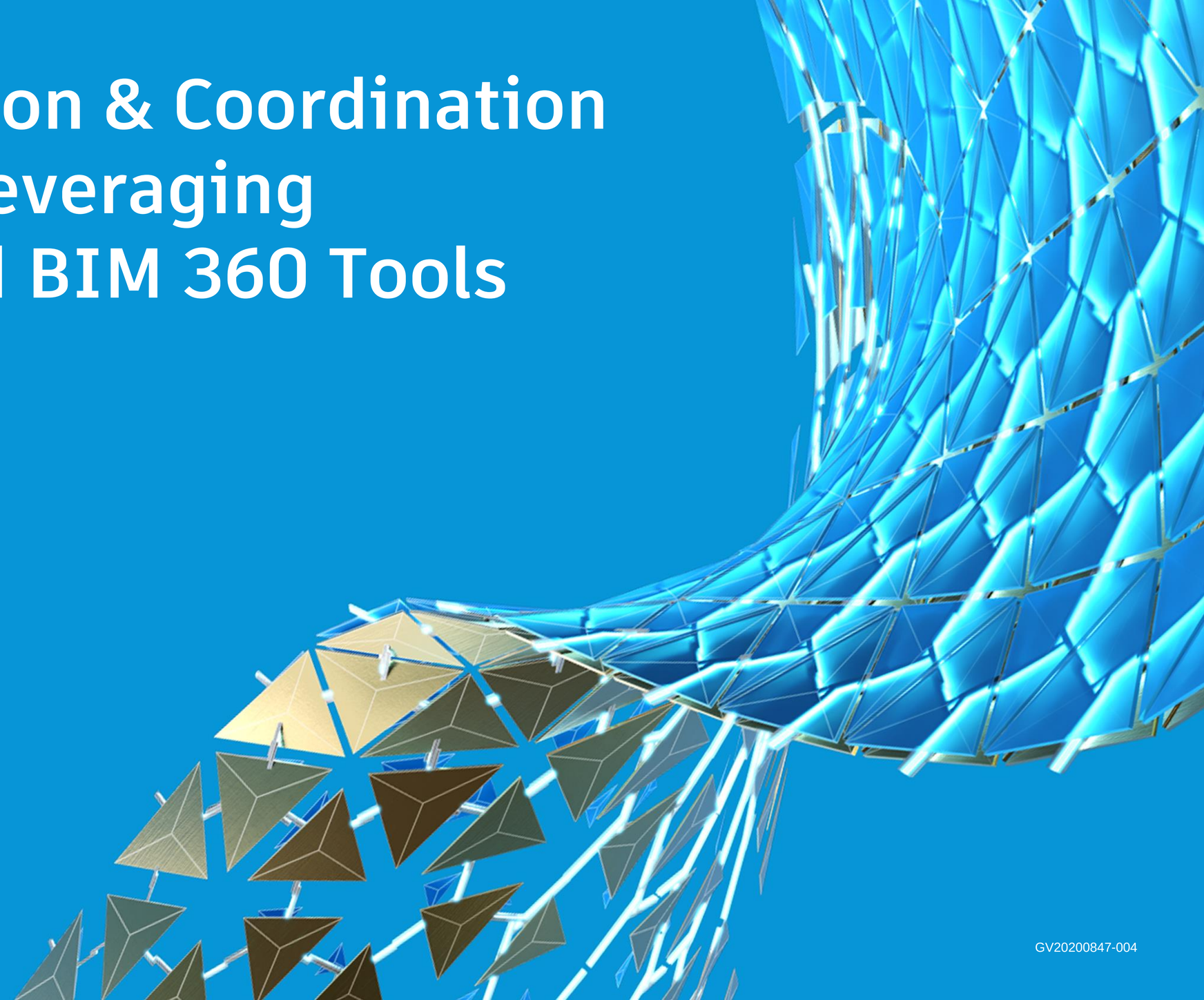
Clash Management Driven by BIM Data



- **Clash management is a vital component in BIM execution and is best supported by a solid workflow and management of the clash data.**
- **Fluor has implemented a corporate tool that allows users to interact with the clash data (both data and visualization) to provide real-time feedback.**

BIM Collaboration & Coordination Supported by Leveraging Navisworks and BIM 360 Tools



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Effective Coordination – Key Components

Federated Model

- Federated NWD Model represents a combined master model
- Strict and disciplined approach in management of the Federated model (organization, content, and data management)

BIM 360

- Utilization of BIM 360 to provide the collaborative environment to support all of the BIM participants

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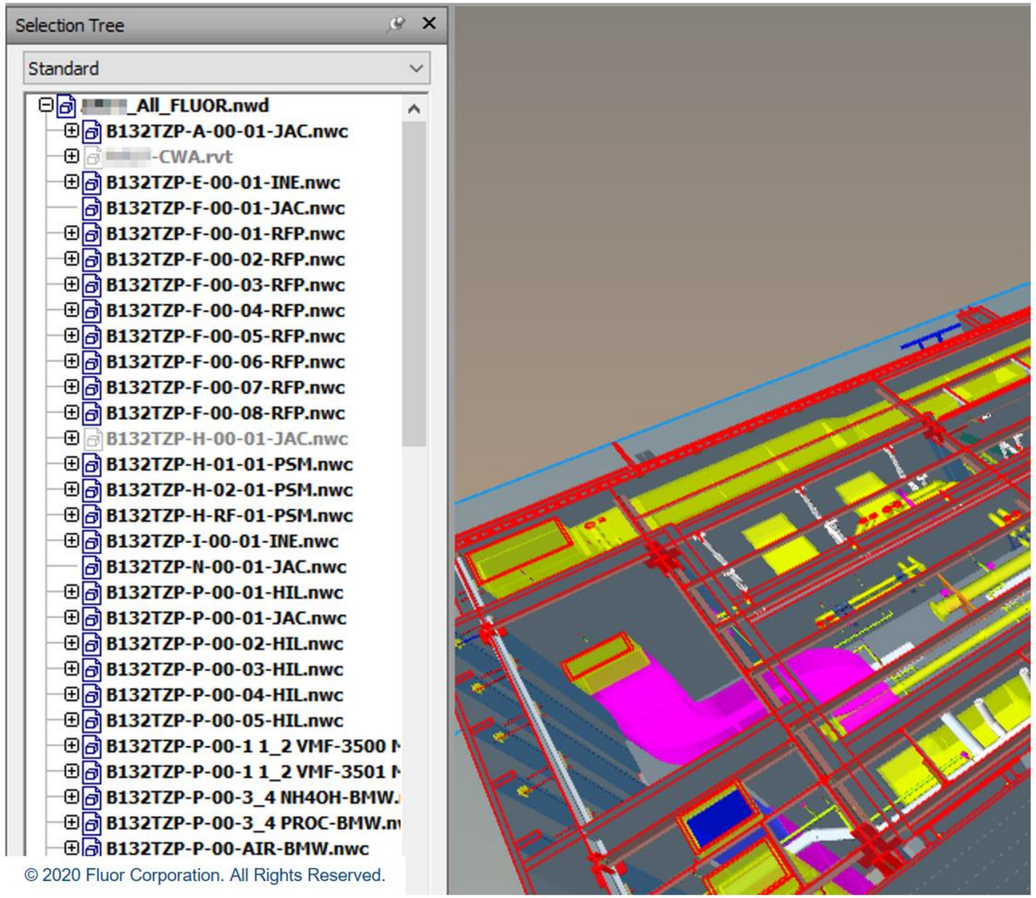
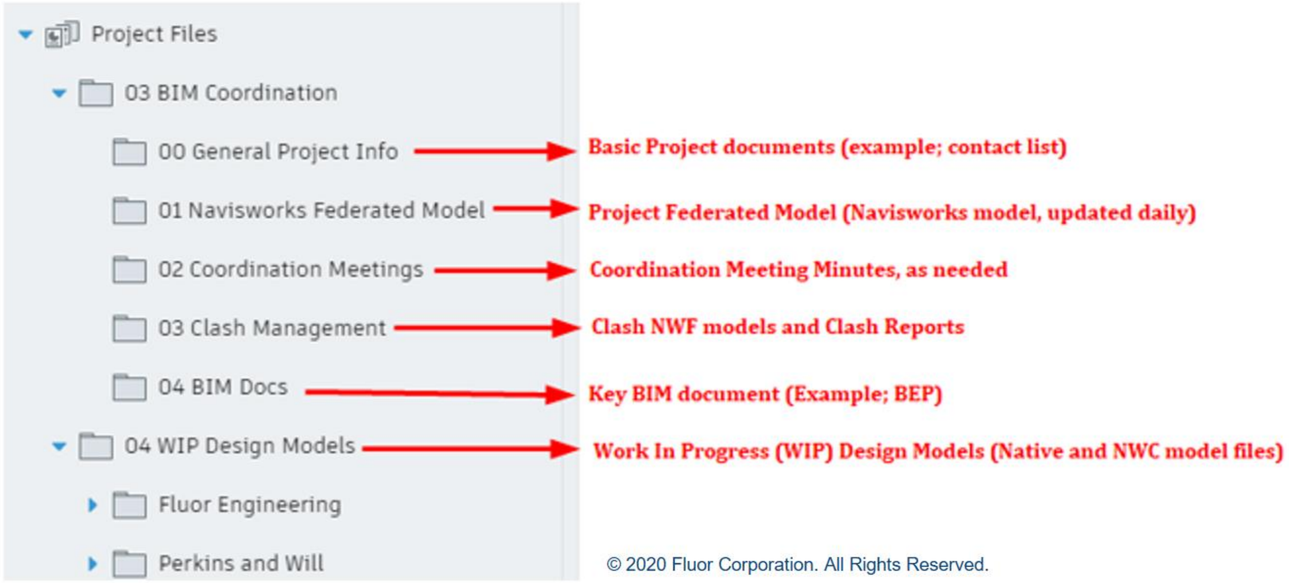
Federated Model Management

Effective management of the Federated Model

- **Establishment of a model workflow that supports timely updates**
- **Effective collaboration with the Federated Model in BIM 360**



Model File Exchange Workflows

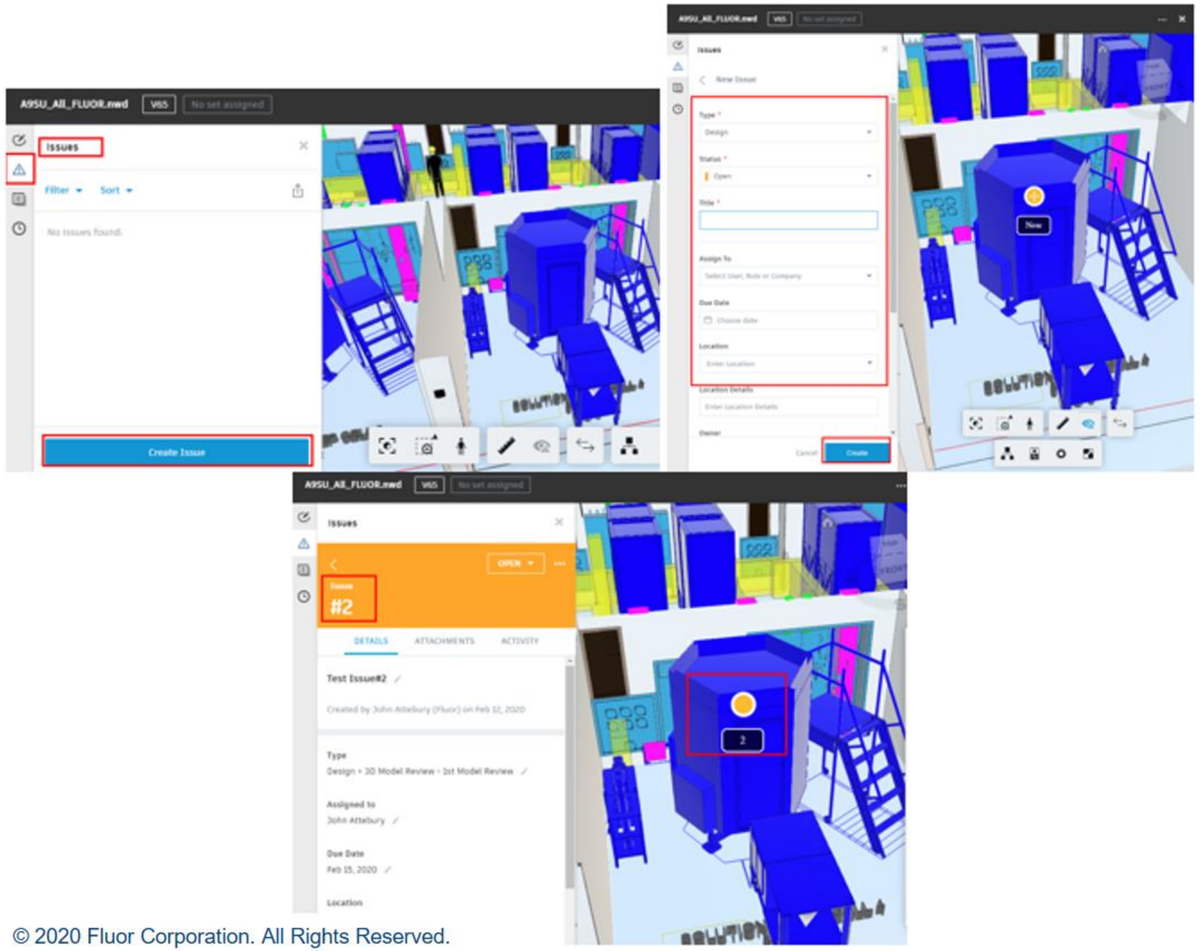


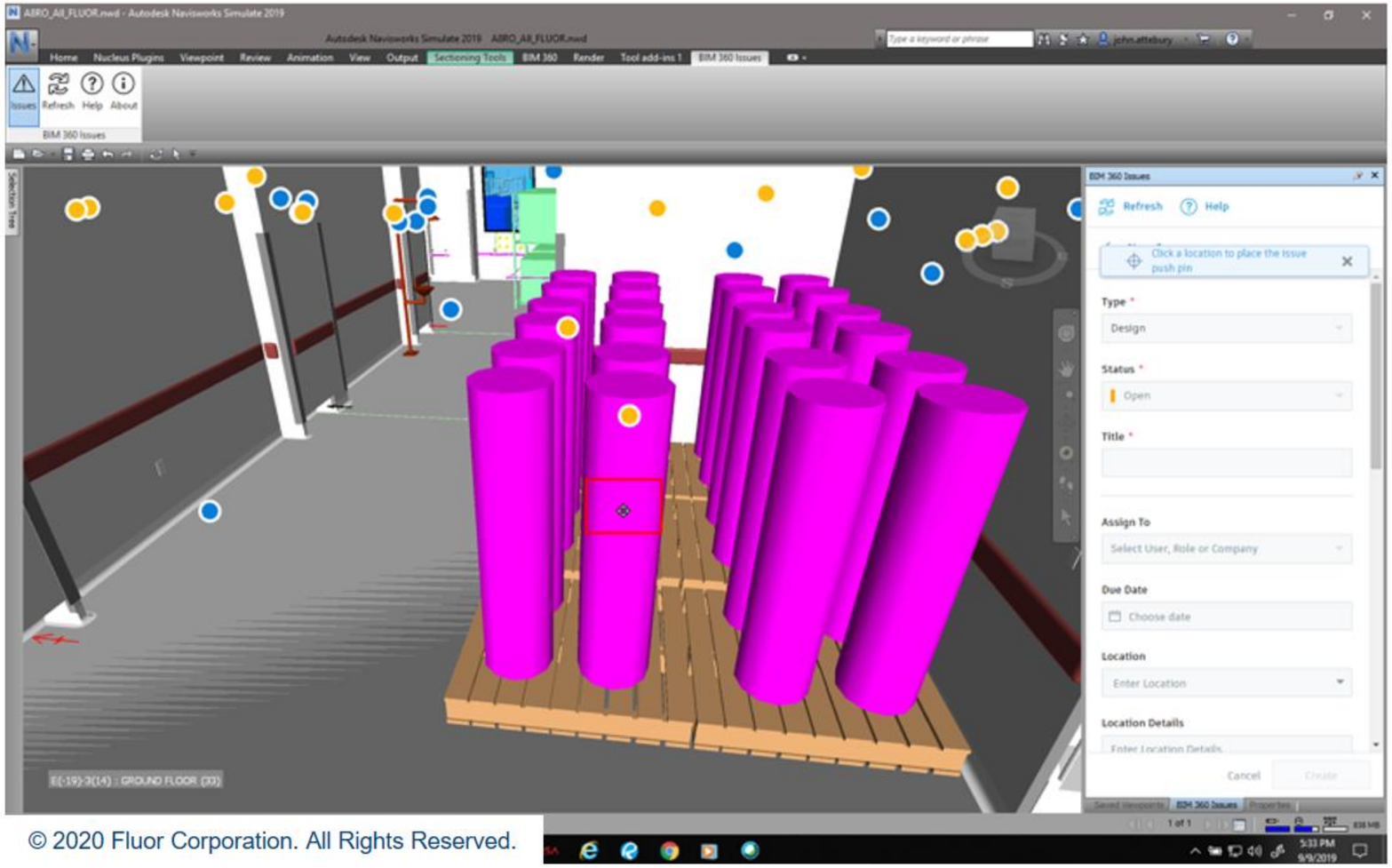
- **By setting up an organized folder structure, establishing a specific upload schedule, and utilizing web-published BIM 360 APIs (upload and download), a project team can better manage the Federated Model update process**

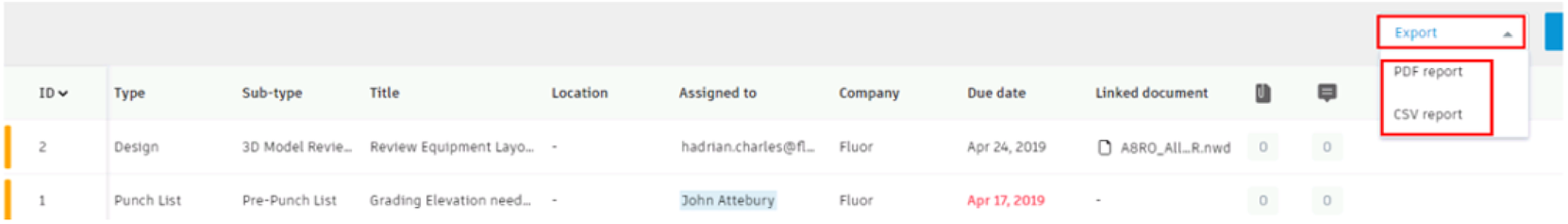
It is key that regular coordination meetings are held both during design and construction.

BIM 360 Model Review Support

- **By publishing the Federated Model to BIM 360 Docs, teams can access the model directly in BIM 360 using the large model viewer (LMV) or utilizing Navisworks (using the BIM 360 Issues Plugin).**







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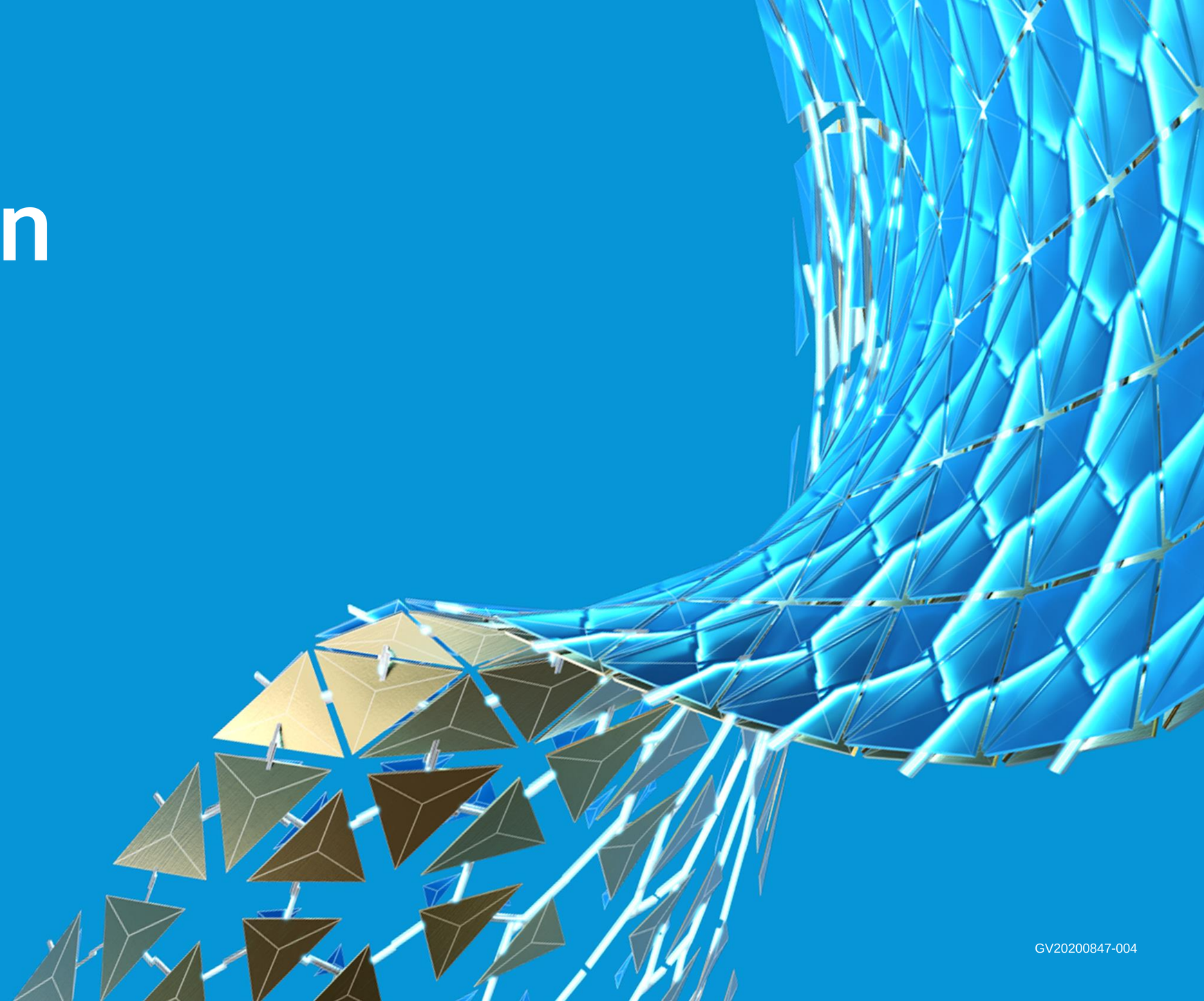
Conclusion



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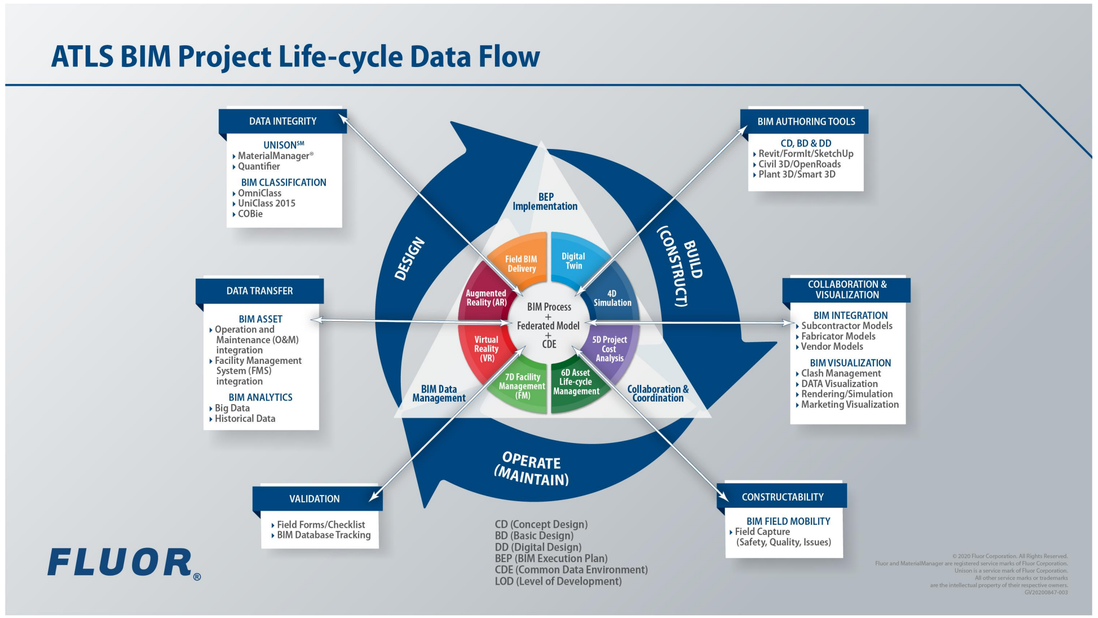
The Center of BIM wrap up!

- Over the last 10 years, Fluor has seen a movement in the industry with a focus on BIM data, the “I” in BIM, and a need to drive coordination in a more collaborative environment.
- Fluor has initiated some innovative solutions to meet these challenges.
- Fluor has implemented the use of BIM 360 to support project communication and better support BIM collaboration.
- To meet the growing needs around BIM data, it is critical that these requirements are defined early, clearly communicated to all project participants, and monitored to ensure the requirements are being met.



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