# GPDIS 2023
# MBSE Workshop

## MBSE – Electrical
## Wire Harness Engineering

James Carr

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# Presenters Bio



## James Carr

- 20+ years of industry experience
- Focus on Product Data Management (PDM) and Product Lifecycle Management (PLM)
- MBSE technical team
- Pre-sales, implementation, training and support
- Computer Science education
- Inceptra ~20 years

# Agenda



- Current Challenges
- Proposed MBSE Solution and Benefits
- Overview of End-to-End Process
- Conclusion

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- Current Challenges
- Proposed MBSE Solution and Benefits
- Overview of End-to-End Process
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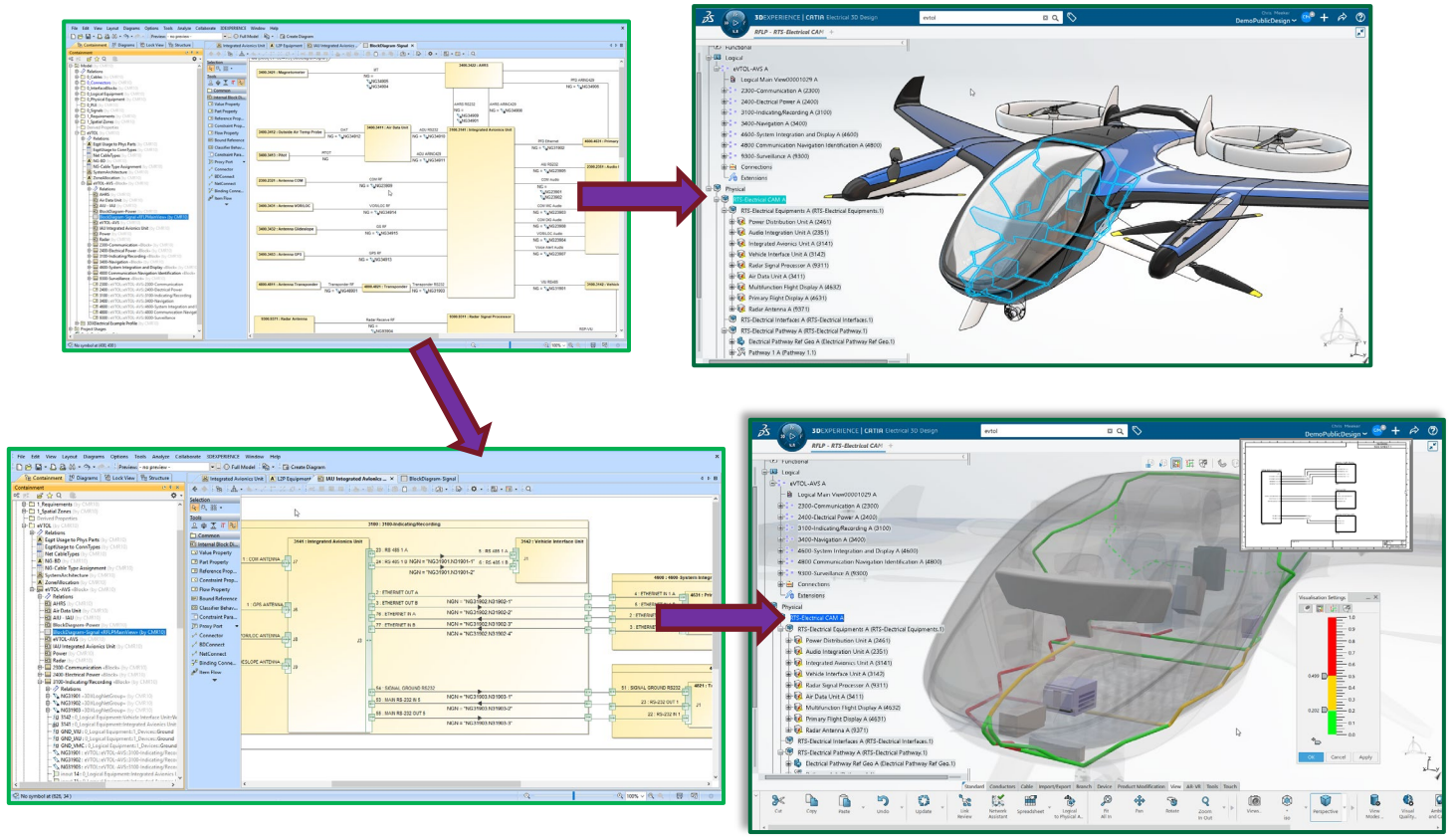
# Overview



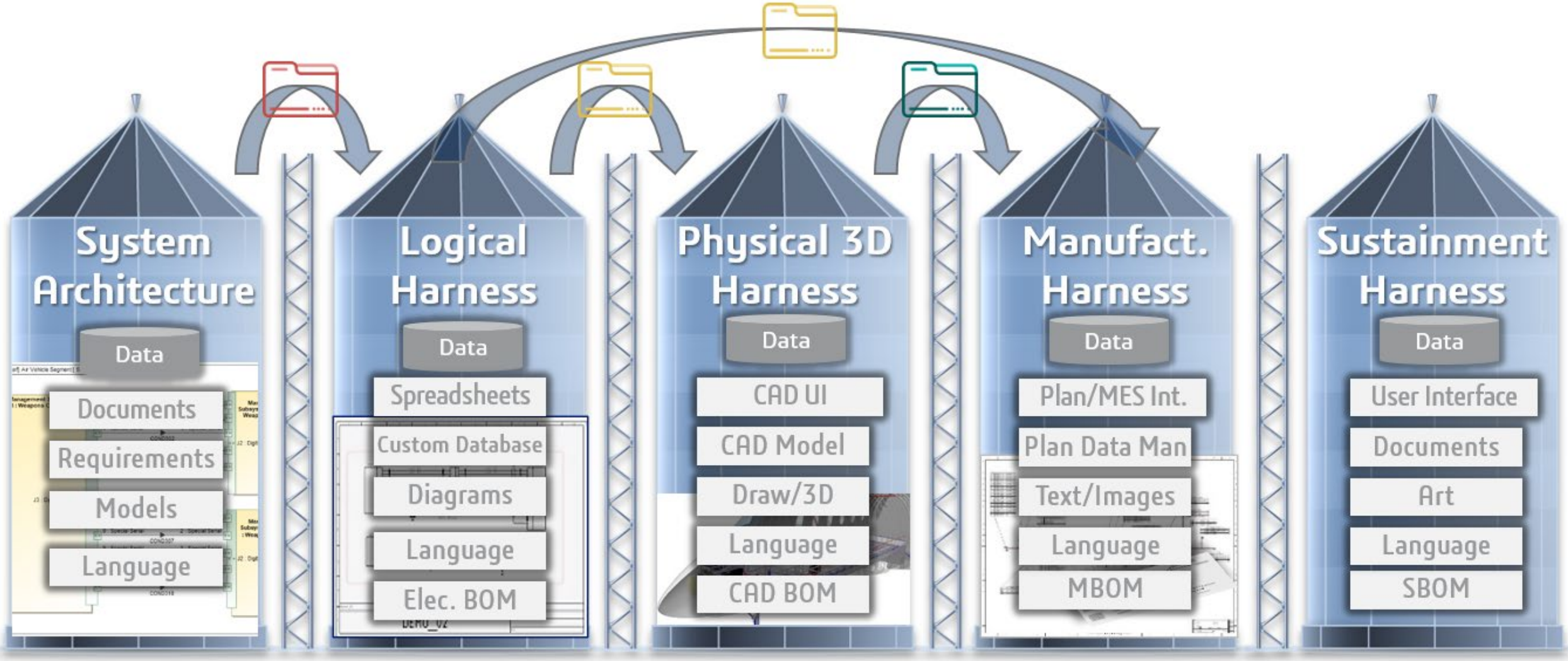
End-to-end process for model-based wire harness engineering, from requirements and system definitions to logical and physical engineering.

All managed in a single, integrated platform which provides full traceability and PLM tools such as configuration and change management.



# Challenges with legacy approach for wire harness engineering



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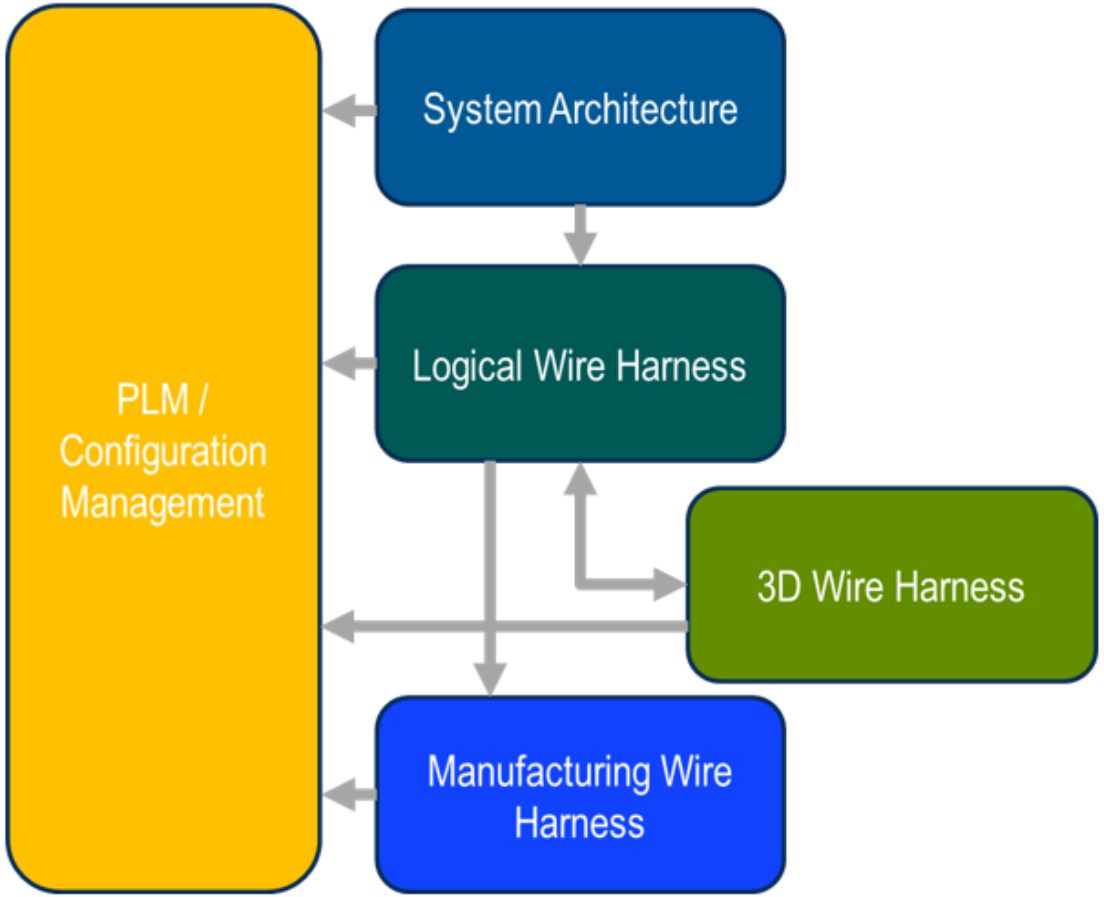
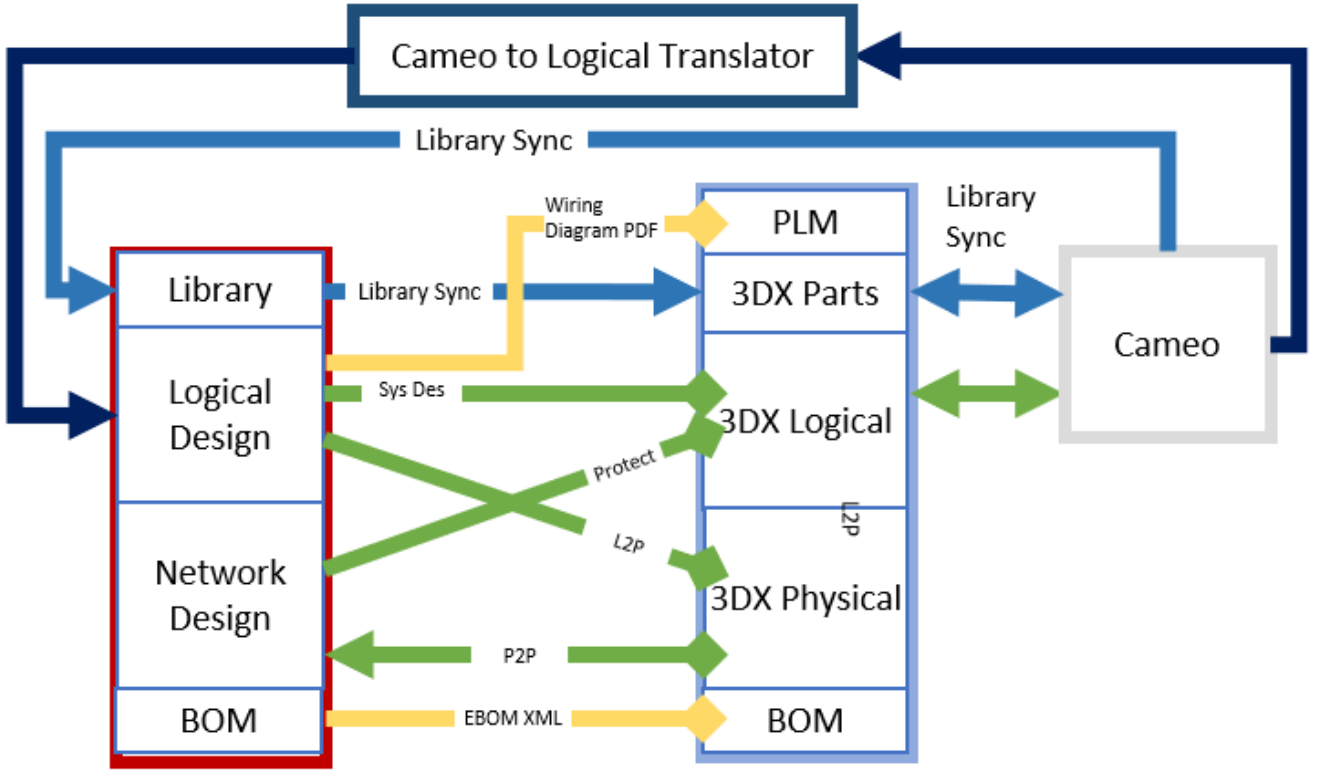
# Challenge with legacy approach for wire harness engineering



- What is proposed as this




- Really looks like this

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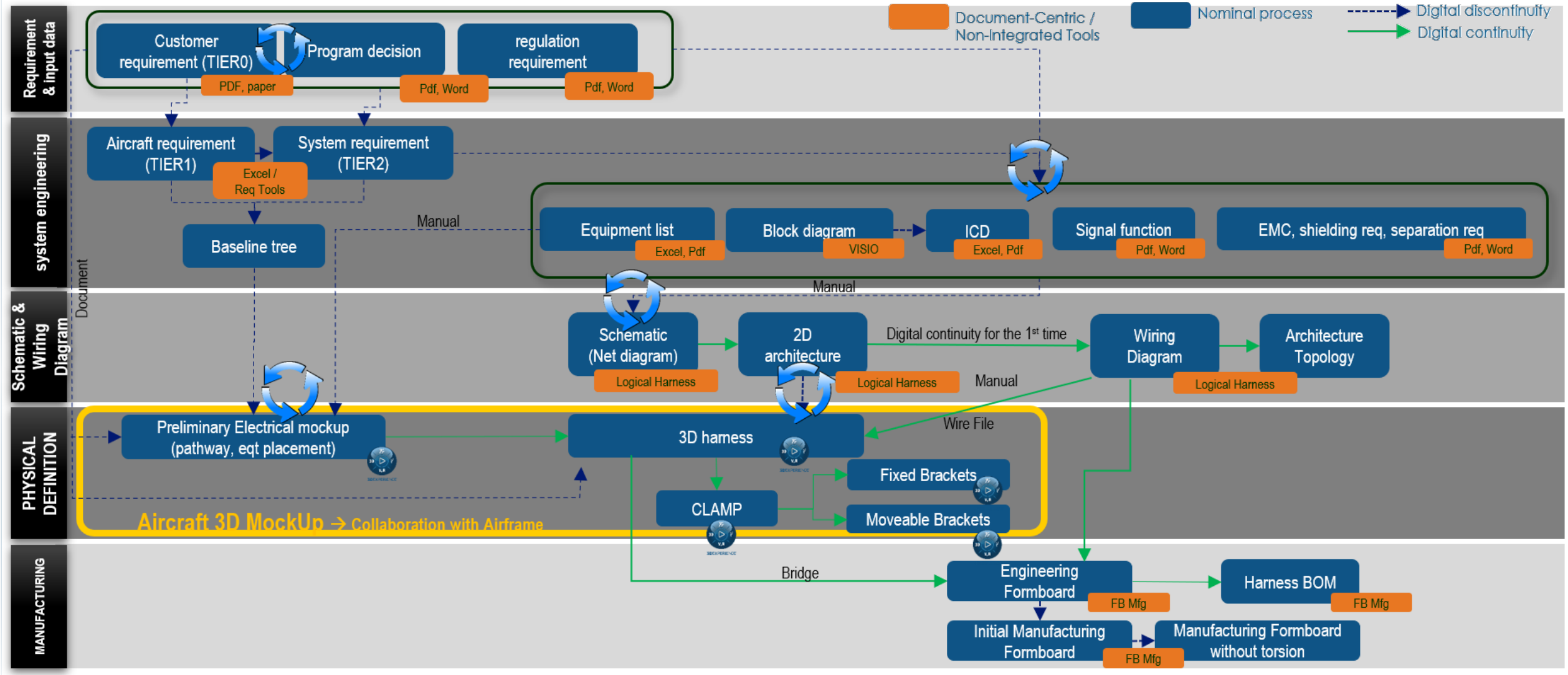
# Typical As-Is Process



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# Schematic Development: Typical As-Is Process

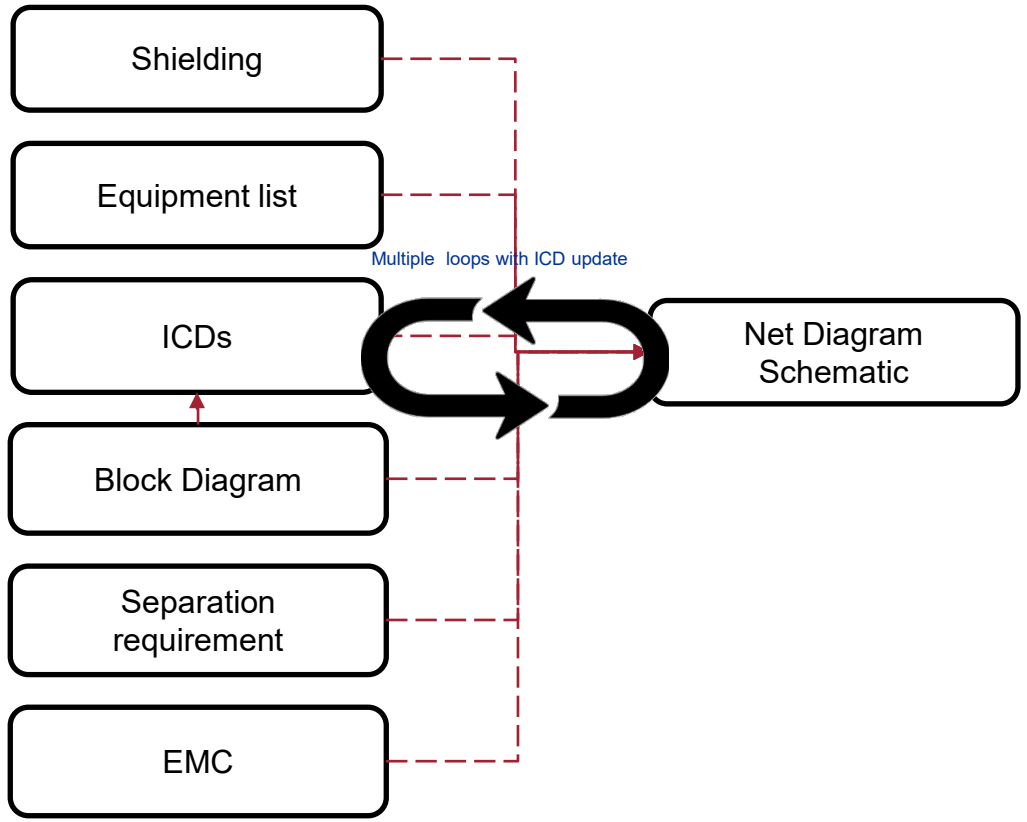


## Input Data

- ICD
- Equipment list
- Block Diagram
- Signal function
- EMC
- Separation requirement
- Shielding requirement

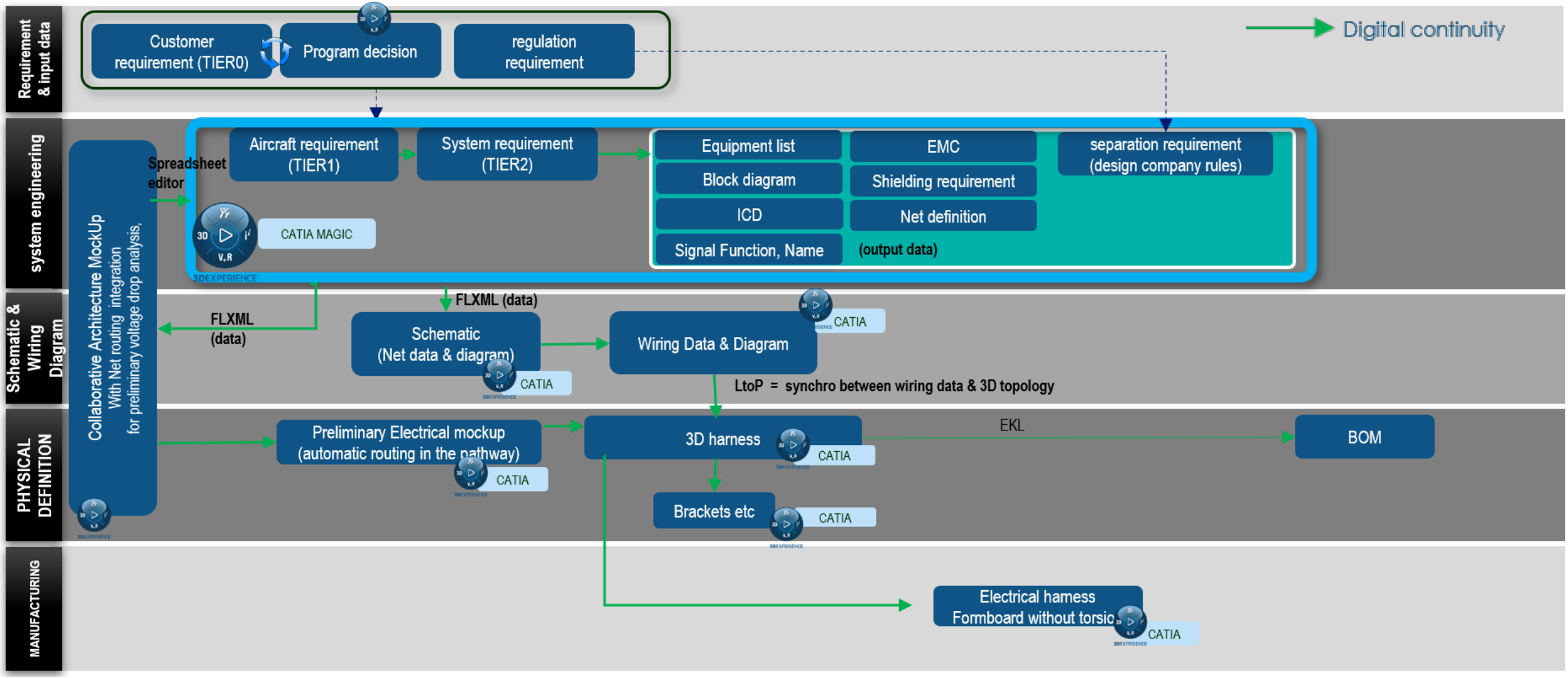
## Output Data

- Schematic
  - Type of wire
  - Minimum wire gauge
  - Signal type, name
  - Grouping
  - shielding



# Model Based Electrical Process



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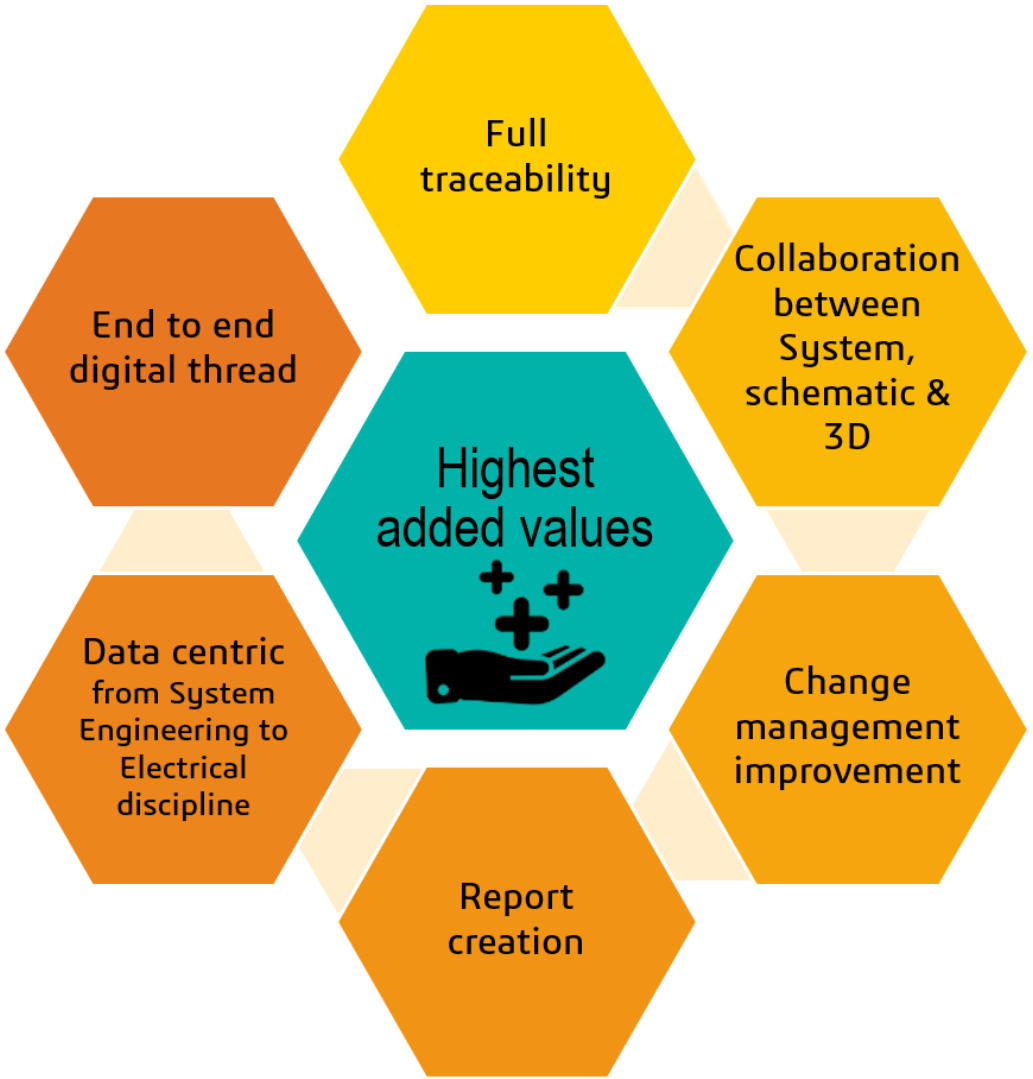
# MBSE-Electrical: Highest Added Values





# Agenda



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- Proposed MBSE Solution and Benefits
- Overview of End-to-End Process
- Conclusion

# END-TO-END MODEL-BASED WIRE HARNESS ENGINEERING

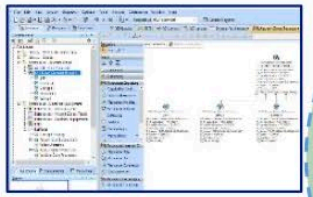
Aircraft Zoning

Equipment Space Allocation

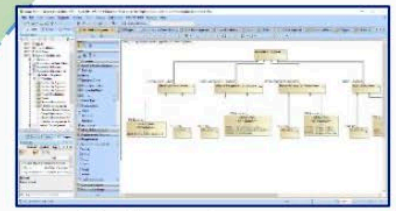
Electrical 3D Pathways

R P F L

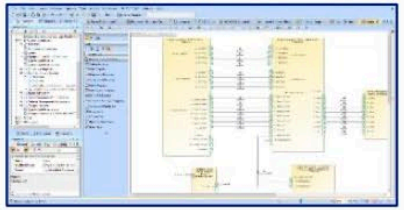
1 2 3



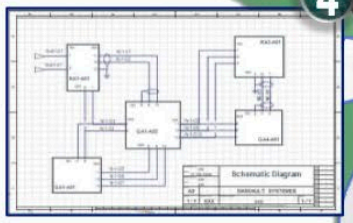
Systems References



Equipment usage within Architecture



Block Diagrams and Electrical Connectivity



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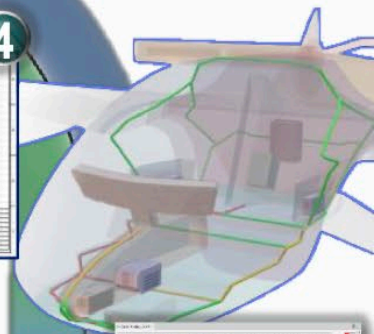
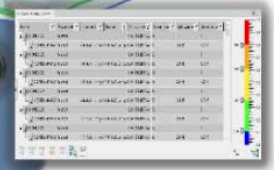
Net Data and Diagram generation





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Net routing in 3D topology

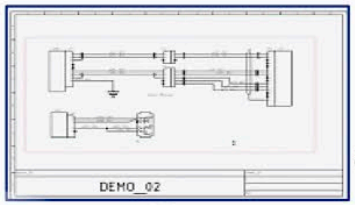
R&M / Sustainment

MBSE for MANUFACTURING

SID (SBOM)

MID (MBOM)

EID (EBOM)



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Wiring Data and Diagrams

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3D Harness detailed definition

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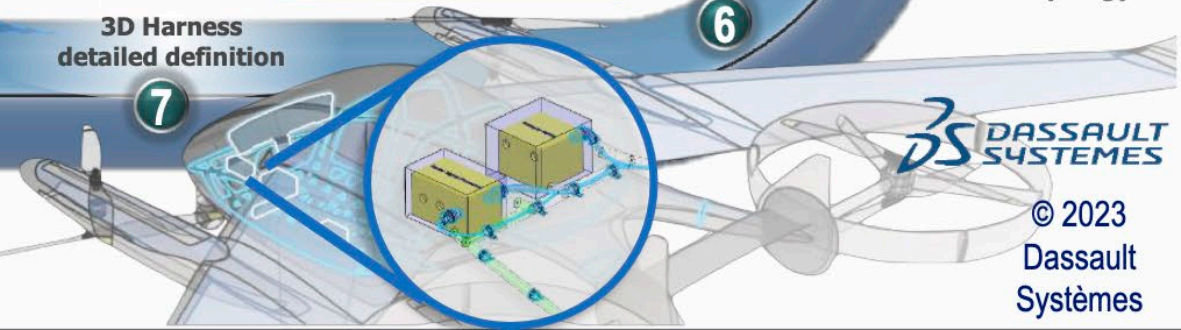
Harness Manufacturing Model



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# Meet Today's Demo Team

**Systems Engineer**
Master Equipment Specialist

**Systems Engineer**
Logical Systems Architect

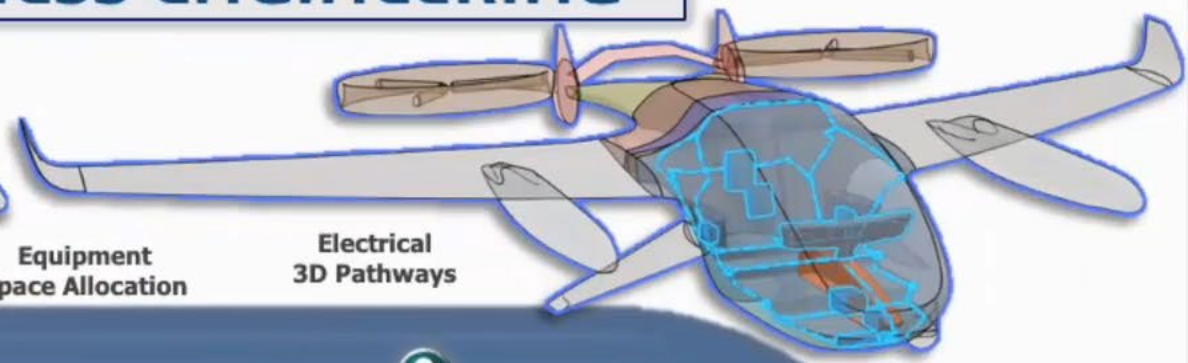
**Systems Engineer**
3D Systems Routing

**Electrical Engineer**
Avionics Specialist

**Electrical Engineer**
Detailed Wiring Data/Diagrams

**Harness Engineer**
3D Harness Design & Mfg Prep

# END-TO-END MODEL-BASED WIRE HARNESS ENGINEERING



Aircraft Zoning

Equipment Space Allocation

Electrical 3D Pathways

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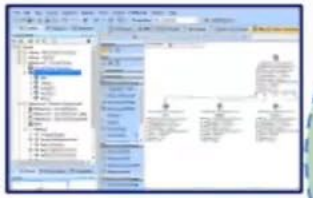
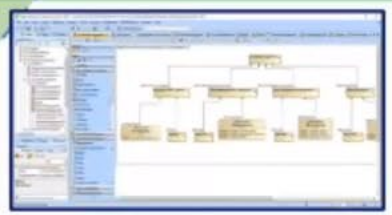
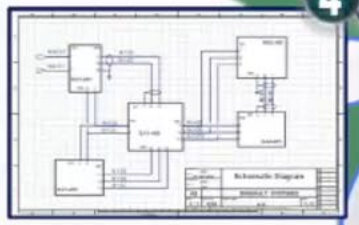


Systems References

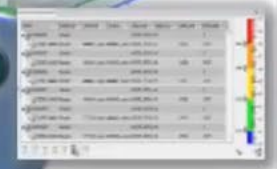


Equipment usage within Architecture

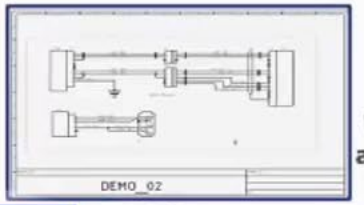
Block Diagrams and Electrical Connectivity



Net Data and Diagram generation



Net routing in 3D topology




Wiring Data and Diagrams

R&M / Sustainment

MBSE for MANUFACTURING

SID (SBOM)

MID (MBOM)

EID (EBOM)

Harness Manufacturing Model

3D Harness detailed definition

## Step 2:
## Define System Architecture in System Model and 3D

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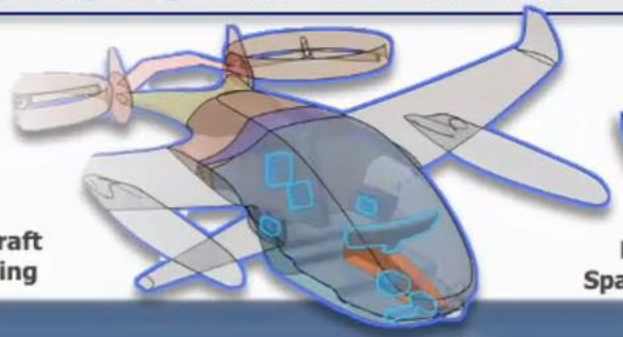
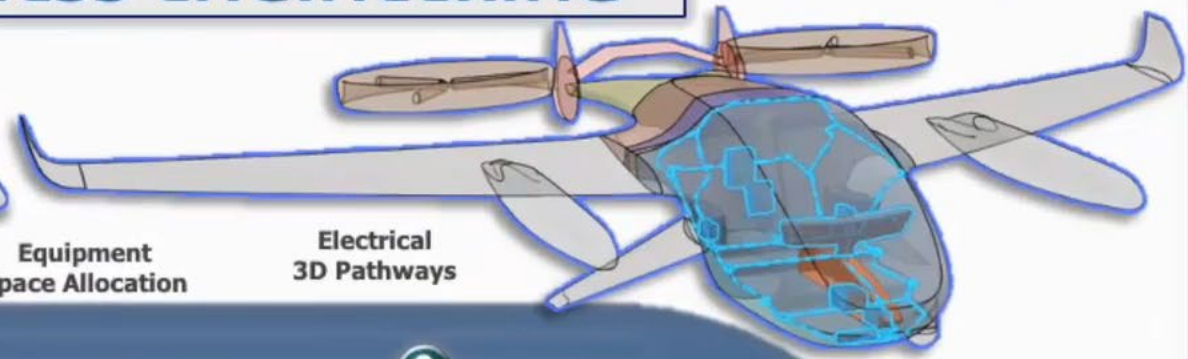
# END-TO-END MODEL-BASED WIRE HARNESS ENGINEERING

Aircraft Zoning



Equipment Space Allocation



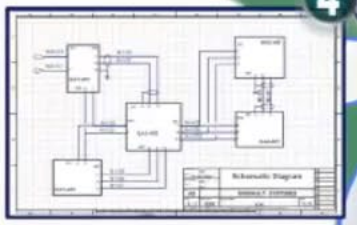
Electrical 3D Pathways

1 2 3

Systems References

Equipment usage within Architecture

Block Diagrams and Electrical Connectivity



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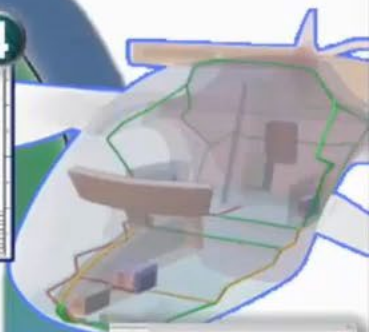
Net Data and Diagram generation



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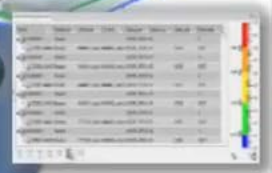
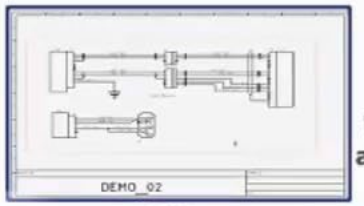


Net routing in 3D topology

R&M / Sustainment

MBSE for MANUFACTURING

SID (SBOM)




Wiring Data and Diagrams

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Harness Manufacturing Model

3D Harness detailed definition

7

EID (EBOM)

## Step 3:
## Define Electrical Connectivity & 3D Pathways

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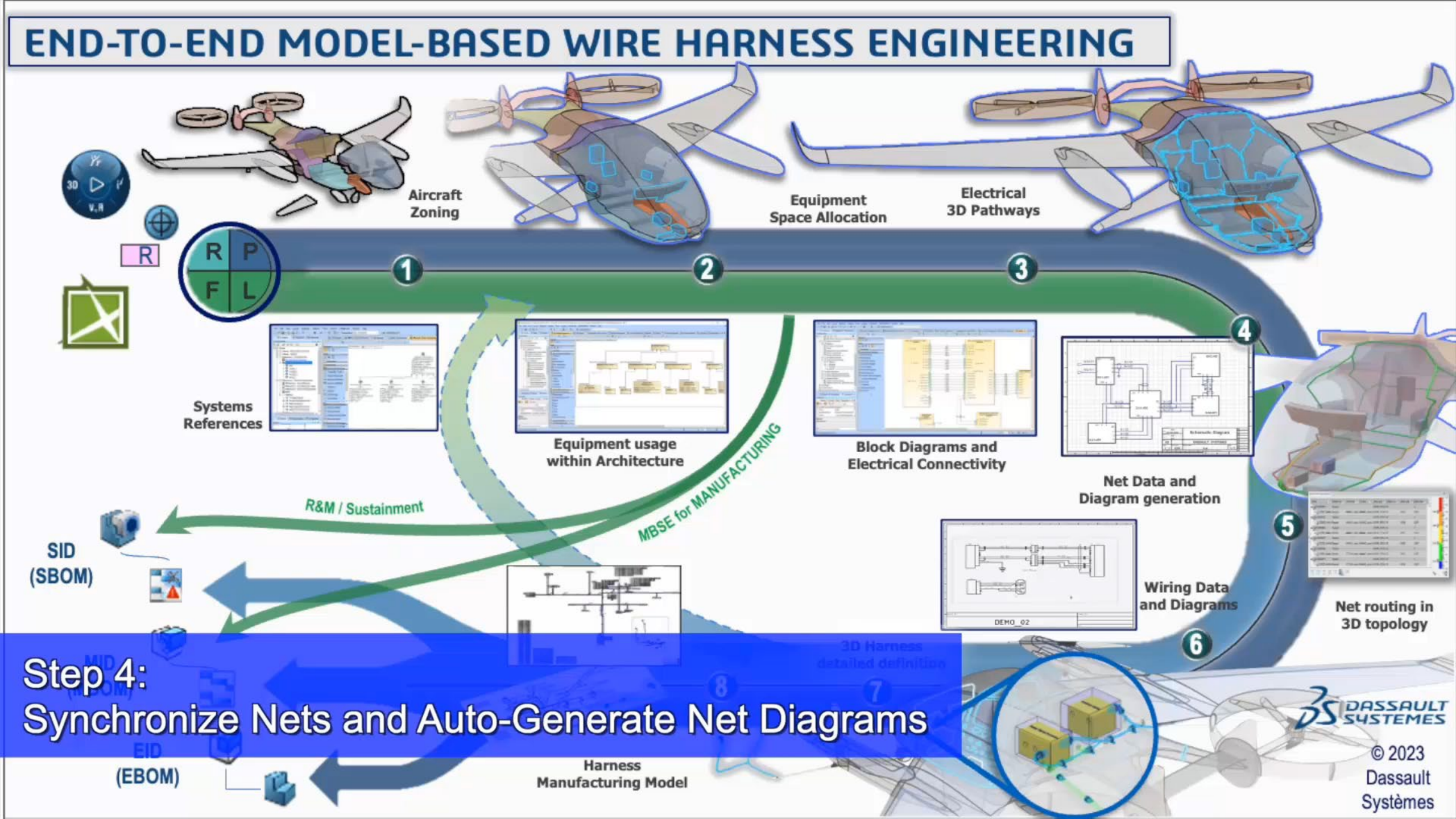



# Step 4:
# Synchronize Nets and Auto-Generate Net Diagrams

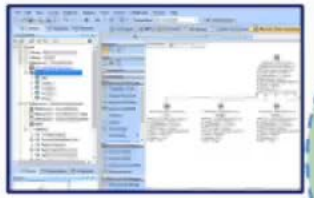
# END-TO-END MODEL-BASED WIRE HARNESS ENGINEERING

Aircraft Zoning

Equipment Space Allocation

Electrical 3D Pathways

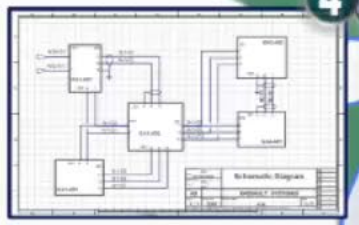
1 2 3



Systems References

Equipment usage within Architecture

Block Diagrams and Electrical Connectivity



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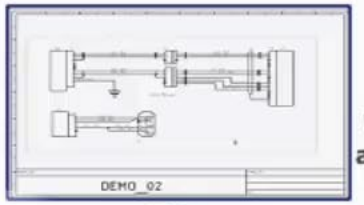
Net Data and Diagram generation

R&M / Sustainment

MBSE for MANUFACTURING

SID (SBOM)




Wiring Data and Diagrams

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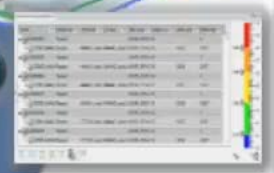

Net routing in 3D topology

3D Harness detailed definition

6

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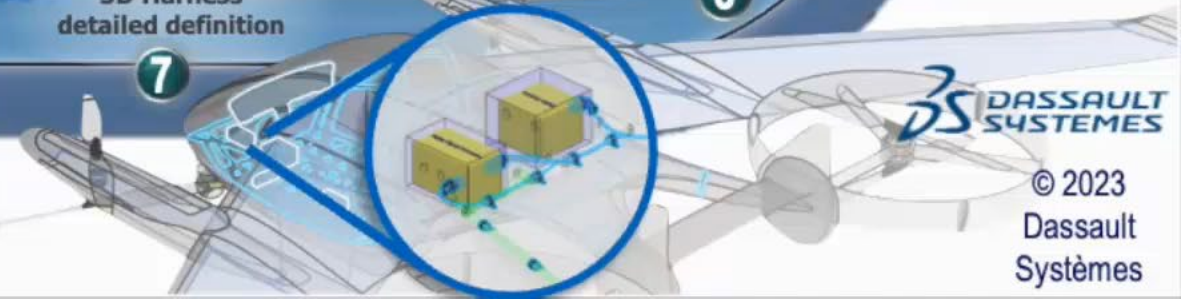

EID (EBOM)

Harness Manufacturing Model

## Step 5:
## Signal Routing / 3D Network Optimization

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# END-TO-END MODEL-BASED WIRE HARNESS ENGINEERING

Aircraft Zoning

Equipment Space Allocation

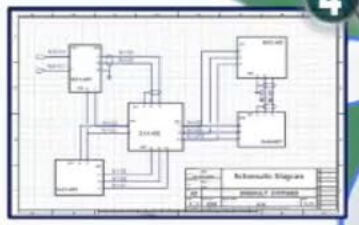
Electrical 3D Pathways

1 2 3

Systems References

Equipment usage within Architecture

Block Diagrams and Electrical Connectivity



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Net Data and Diagram generation

R&M / Sustainment

MBSE for MANUFACTURING

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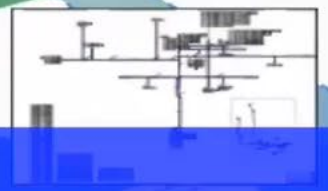
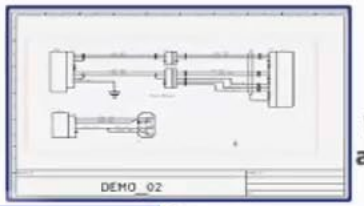
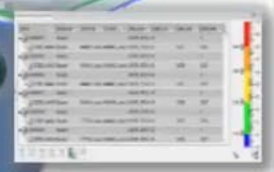




Wiring Data and Diagrams

5



Net routing in 3D topology

6

EID (EBOM)

Harness Manufacturing Model

## Step 6:
## Net to Wire Process; Detailed Wiring Data / Diagrams

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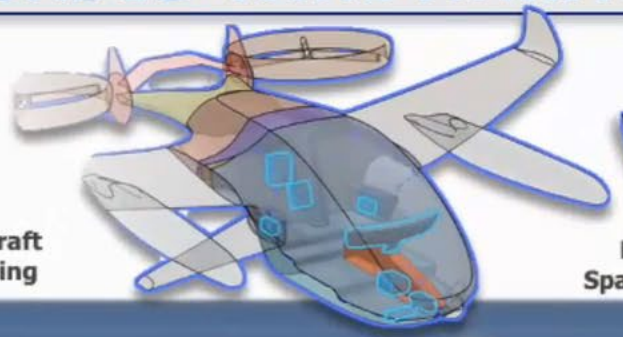
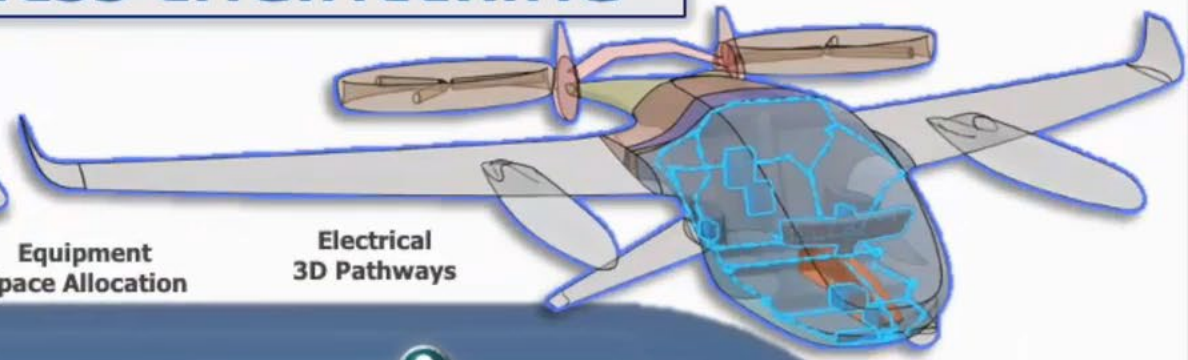
# END-TO-END MODEL-BASED WIRE HARNESS ENGINEERING

Aircraft Zoning



Equipment Space Allocation

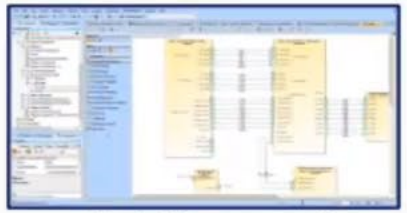


Electrical 3D Pathways

1 2 3

Systems References

Equipment usage within Architecture



Block Diagrams and Electrical Connectivity

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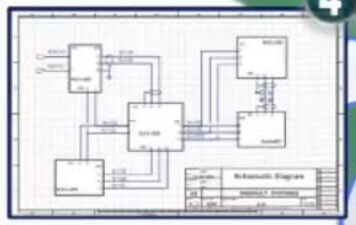
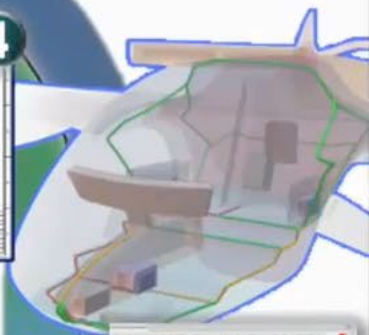


Net Data and Diagram generation



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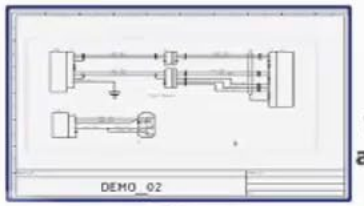
Net routing in 3D topology

R&M / Sustainment

MBSE for MANUFACTURING

SID (SBOM)




Wiring Data and Diagrams

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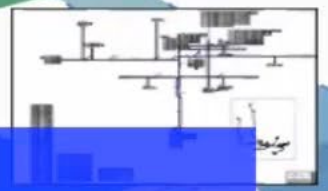

3D Harness detailed definition

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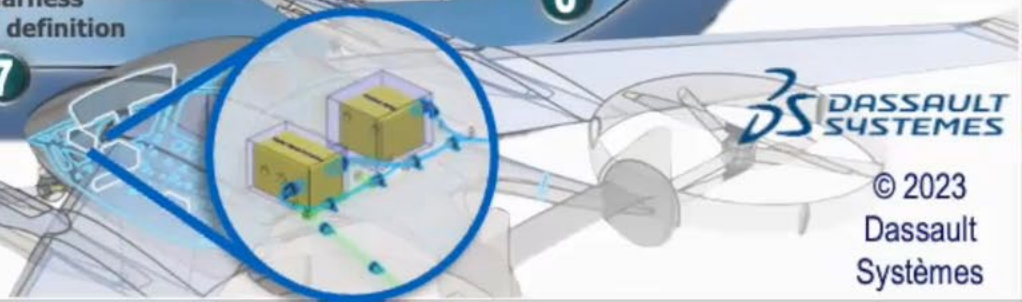
MID (MBOM)

EID (EBOM)

Harness Manufacturing Model



## Step 7: Detailed Definition of 3D Harness

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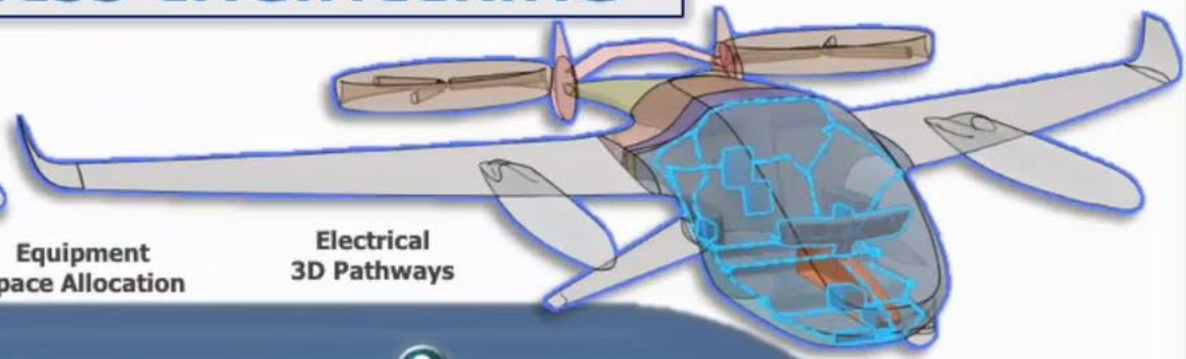
# END-TO-END MODEL-BASED WIRE HARNESS ENGINEERING

Aircraft Zoning

Equipment Space Allocation

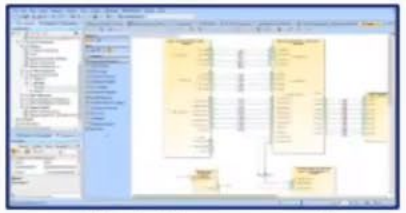


Electrical 3D Pathways

1 2 3

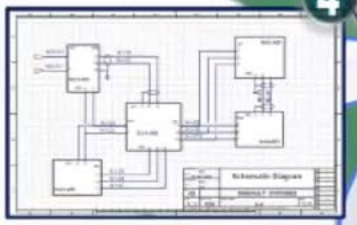
Systems References

Equipment usage within Architecture

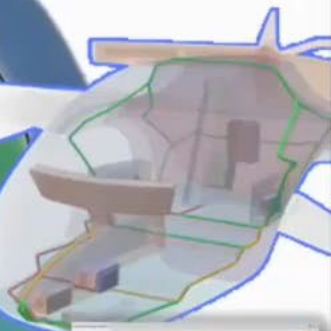


Block Diagrams and Electrical Connectivity

4



Net Data and Diagram generation



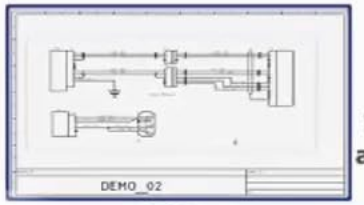
5

Net routing in 3D topology

R&M / Sustainment

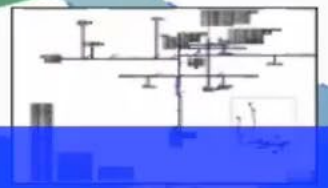
MBSE for MANUFACTURING

SID (SBOM)




Wiring Data and Diagrams

6



3D Harness detailed definition

8 7

EID (EBOM)

Harness Manufacturing Model

## Step 8: Harness Manufacturing Preparation

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# Agenda



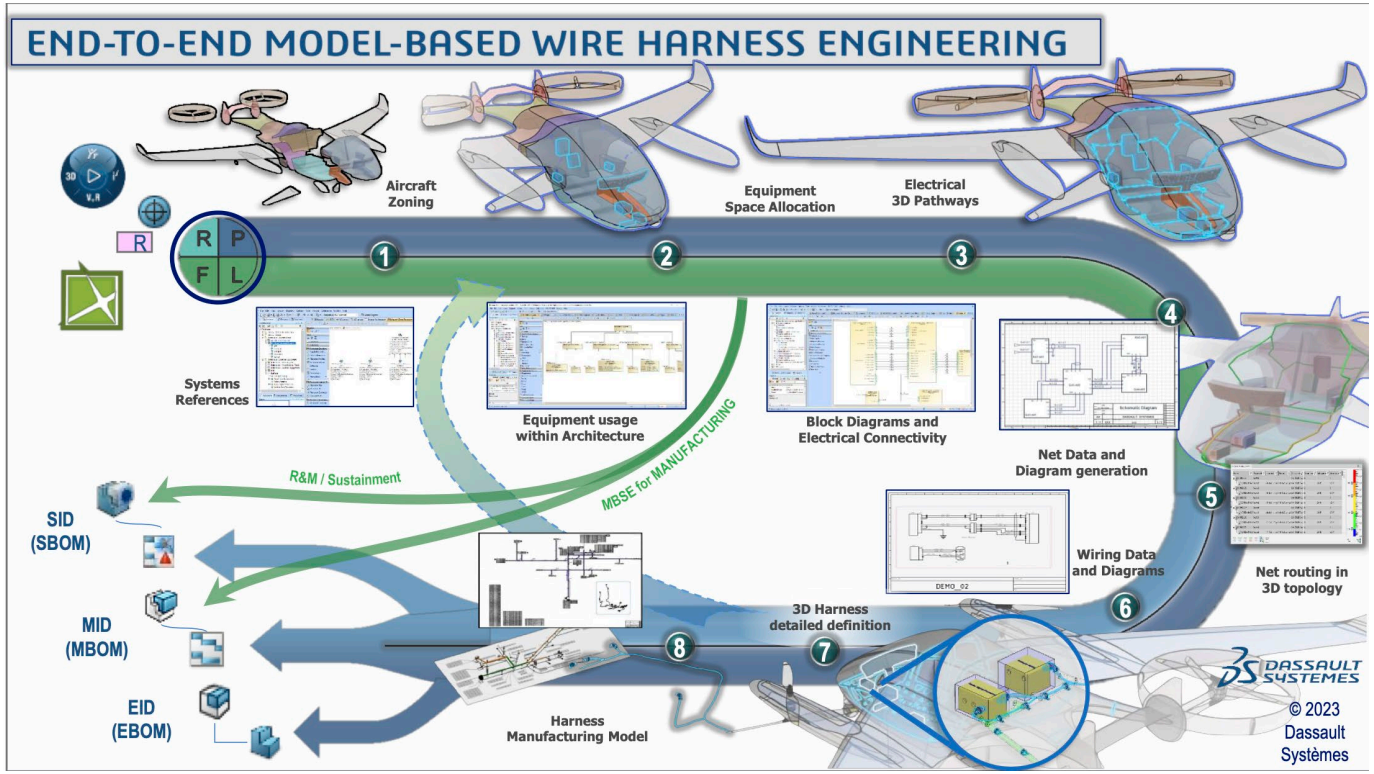
- Current Challenges
- Proposed MBSE Solution and Benefits
- Overview of End-to-End Process
- Conclusion

# Conclusion



End-to-end process for model-based wire harness engineering, from requirements and system definitions to logical and physical engineering.

All managed in a single, integrated platform which provides full traceability and PLM tools such as configuration and change management.



# Conclusion



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