

# Benchmarking and Comparison of CAD-based AR Solutions

Manufacturing and industrial companies often utilize CAD (Computer-Aided Design) software to design and manage engineering models and procedures, along with integrated PLM (Product Lifecycle Management) software offered within the same software ecosystem. The files in these software systems can be used in step-by-step instructions. For example, an AR-assisted engine assembly procedure, use a CAD model as follows:

1. Place CAD engine model on a horizontal surface
2. Install camshaft (camshaft model appears or animates in AR view over the real world parts)
3. Install crankshaft (crankshaft model appears or animates in AR view over the real world parts)
4. Animate bolt (simplified) installation (subset of bolts appear and spin to tighten in AR view)

The CAD engine model and parts should originate from within the CAD tool. As the model is used, metadata can be made on the model assembly and accompanying parts. After the assembly, and the process documented, the evidence can be exported for compliance purposes. Unfortunately, the AR authoring systems provided by CAD software companies differ widely in their features and options.

Executive Summary: The objective of this project is to evaluate multiple AR solutions available within different CAD-focused software ecosystems with the goal of benchmarking these tools and workflows, comparing them to one another, and observing which approach provides users the closest adherence to maintaining a digital thread between source engineering data and the final AR experience or content.

Categories: Tool Assessments/Comparisons and Interoperability/Standards

## Problem statement

- Many industrial software companies offer AR (Augmented Reality) authoring products, features, or export options within their software ecosystem, enabling a digital thread between engineering CAD content and AR representations. However, frequently important data or utility can be lost in the deployment to AR.
- In some platforms, the AR experience can only be consumed under a very limited set of conditions, locking the customer into the CAD software provider's AR engine.

## Desired outcomes of the research project/problem resolution

Successful completion of this project will result in the following benefit for AREA members:

- Inform AREA members of AR capabilities and shortcomings within various major CAD software ecosystems, enabling members to develop informed decisions on CAD software and/or ecosystem choices. The customer may be able to develop a work-around to the CAD software's authoring tools, or choose an alternate AR authoring system.

- Improve engineering and/or deployment workflow within existing CAD processes, improving productivity and speed of AR content and experience delivery.
- Highlight weaknesses and/or roadblocks AREA members may encounter in maintaining the digital thread for AR content, enabling members to prepare for and mitigate these factors.
- Identify areas within software ecosystems and pipelines to AR where software outside of a vendor's ecosystem can, should, or needs to be utilized.

#### Technologies of interest/focus

- Dassault Systèmes products such as CATIA, DELMIA, and 3DEXPERIENCE.
- PTC products such as Creo, Vuforia, and Windchill.
- Siemens products such as Siemens NX, Teamcenter, and Process Simulate.
- Autodesk products such as Fusion 360, Inventor, and Navisworks.
- Any other CAD software engineering platforms with AR authoring support that are found to be popular with AREA members but not already listed above.

#### Inputs

The following inputs will be required for the successful completion of this project:

- Access to and use of multiple CAD tools within at least 3 CAD-focused software ecosystems such as Dassault Systèmes, PTC, Siemens, and Autodesk.
- Access to AR-capable devices such as HoloLens, Magic Leap, Meta Quest, Apple Vision Pro, iPhone/iPad, Android devices.
- CAD models and metadata for evaluation in various software tools and in AR experiences.
- Example assembly and/or work instruction procedures for use in software CAD software, PLM tools, and in AR deployments which can be re-used for evaluation purposes.
- AREA member interview results identifying CAD tools and typical pipeline or ecosystem workflows used by members.

#### Deliverables

Successful completion of this project will result in the following deliverables:

- A detailed report comparing AR authoring solutions and features within CAD-based software ecosystems that can be utilized to generate AR applications or experiences in typical use case (e.g., procedures, work instruction, animations, metadata).
- A capabilities matrix capturing the AR authoring and delivery capabilities and CAD-based software provider ecosystem features available in deployed AR content.
- Interactive or multimedia content such as detailed comparison videos or running apps demonstrating observable differences in selected AR solutions and software ecosystems.
- A webinar and executive summary for public audiences.