AFRL

ISMAR 2021:
AR Standards as Tools

William (Bill) Bernstein, PhD
Materials and Manufacturing Directorate, Air Force Research Laboratory
Wright-Patterson Air Force Base, Ohio

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Industry 4.0 ~ Smart Manufacturing

• Combines advanced manufacturing services with digital infrastructure
• Represents a **fourth industrial revolution** taking advantage of the ubiquity of digitalization
• Promotes interconnectivity, information transparency, and decentralized decision-making
Conceptual Framework for Industrial Augmented Reality

Real-world capture → Machine-readable 3D representation → Domain-specific models (Devices, People, Spaces, Plans, Materials) → 3D rendering → AR presentation systems
Industry 4.0 Standards Activities

Challenge:
Harmonizing Industry 4.0 standards at scale

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Augmented Reality Standards Activities

**Challenge:**
*Harmonizing within AR and across to I4.0 standards at scale*

EPR funded an AR standards landscape paper. Find it here: [https://www.epri.com/research/products/3002010514](https://www.epri.com/research/products/3002010514)
Example:  
Design and Inspection Data in AR
Design Data | STEP + PMI

Standards:
- ISO 10303 series
- ASME Y14.5
- ASME Y14.41

Product Manufacturing Information (PMI)
Datums and DRFs are data structures used to help define the geometric controls implied by a GTol. This is how Features, Datums Features, and GTols are linked.

Standards:
- ASME Y14.5
- ASME Y14.41
- ISO 23952
Visualizing in AR using the Industry 4.0 standards
STEP P21 File

NIST SFA/ NIST STP2X3D

X3D File

Import Script
Unity

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Viewing Inspection Results (QIF) on geometry (STP) in AR
Example:
Spatially orienting manufacturing equipment
Merging geospatial and manufacturing representations

**OGC IndoorGML**
- Standard for describing **indoor spaces**
- Open **XML**-format
- Provides **semantic** and **geometric** representation of indoor spaces

**MTConnect**
- Standard **semantic vocabulary** for manufacturing equipment
- **Structured, contextualized** data
- No proprietary format

- Creating **IndoorGML-data** from **workshops**
- 3D-visualization for IndoorGML-data and combining it with data from MTConnect
- Creating a standardized way of creating **geospatial representations** of workshops with a relationship to actual machine data
Tested IndoorGML with the NIST SMS Test Bed
Big Picture Takeaways: Standards as Tools
Big Picture Takeaways

• Industrial AR workflows require flexibility

• Standards as tools can provide that flexibility

• Working across standards uncover value (e.g., interoperability)

• Use what’s already out there!
Questions?

William (Bill) Bernstein, PhD
william.bernstein@us.af.mil