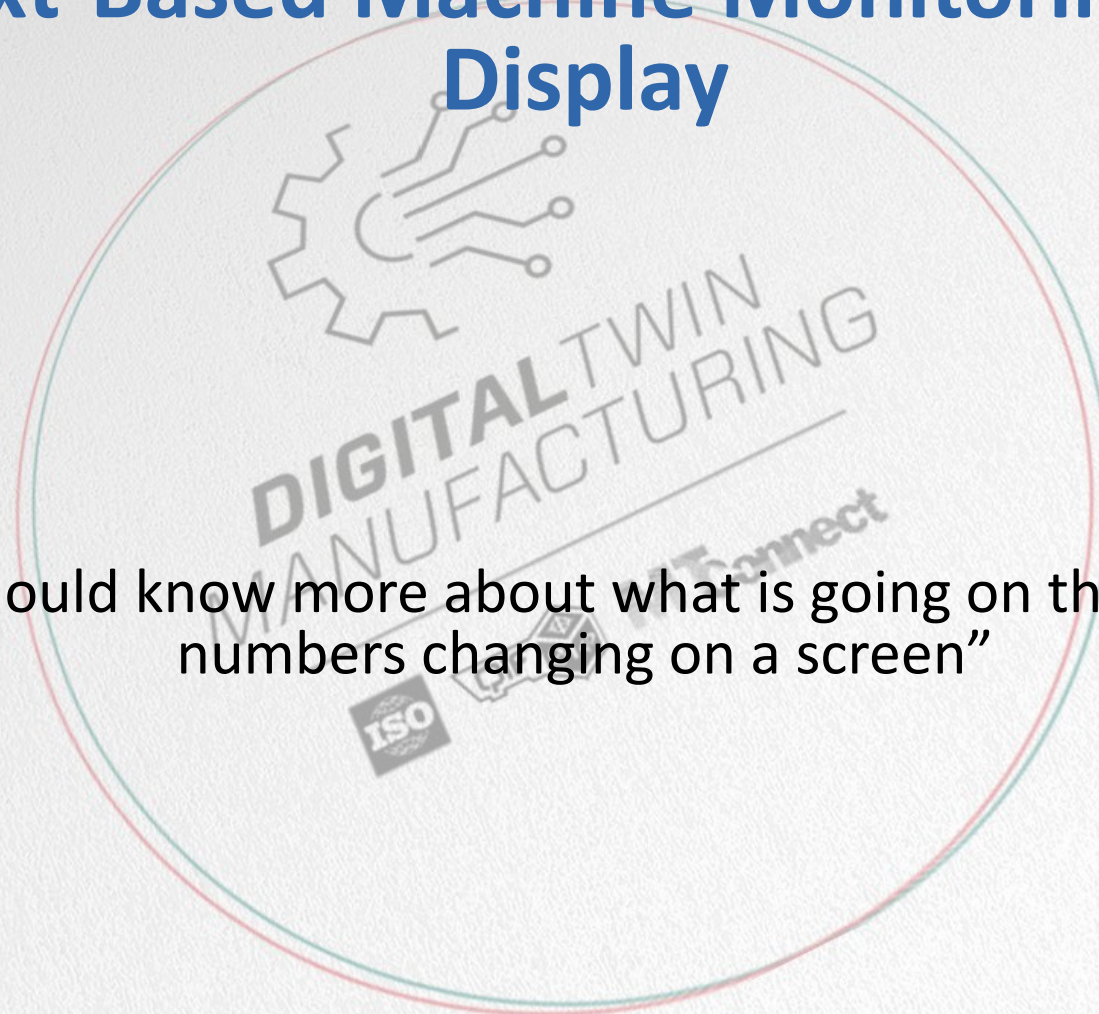# Context-Based Machine Monitoring/State Display

"Surely I should know more about what is going on than a bunch of numbers changing on a screen"

Situation/Target/Proposal

Situation

• Typically, CNC machines only receive low level process information. They are unaware of part, tolerance, and higher level process information. This limits their ability to make smart decisions during manufacturing and provide context for events that occur during manufacturing

Target

• CNCs receive information about the process they are performing, and the features they are performing them on. They also are able to display and transmit this context information, synchronized with events that occur during machining.

Proposal

• Define and publicize standard methods for transmitting this information, **using presently available infrastructure**, at machines

Anticipated Results

Benefits

- End users
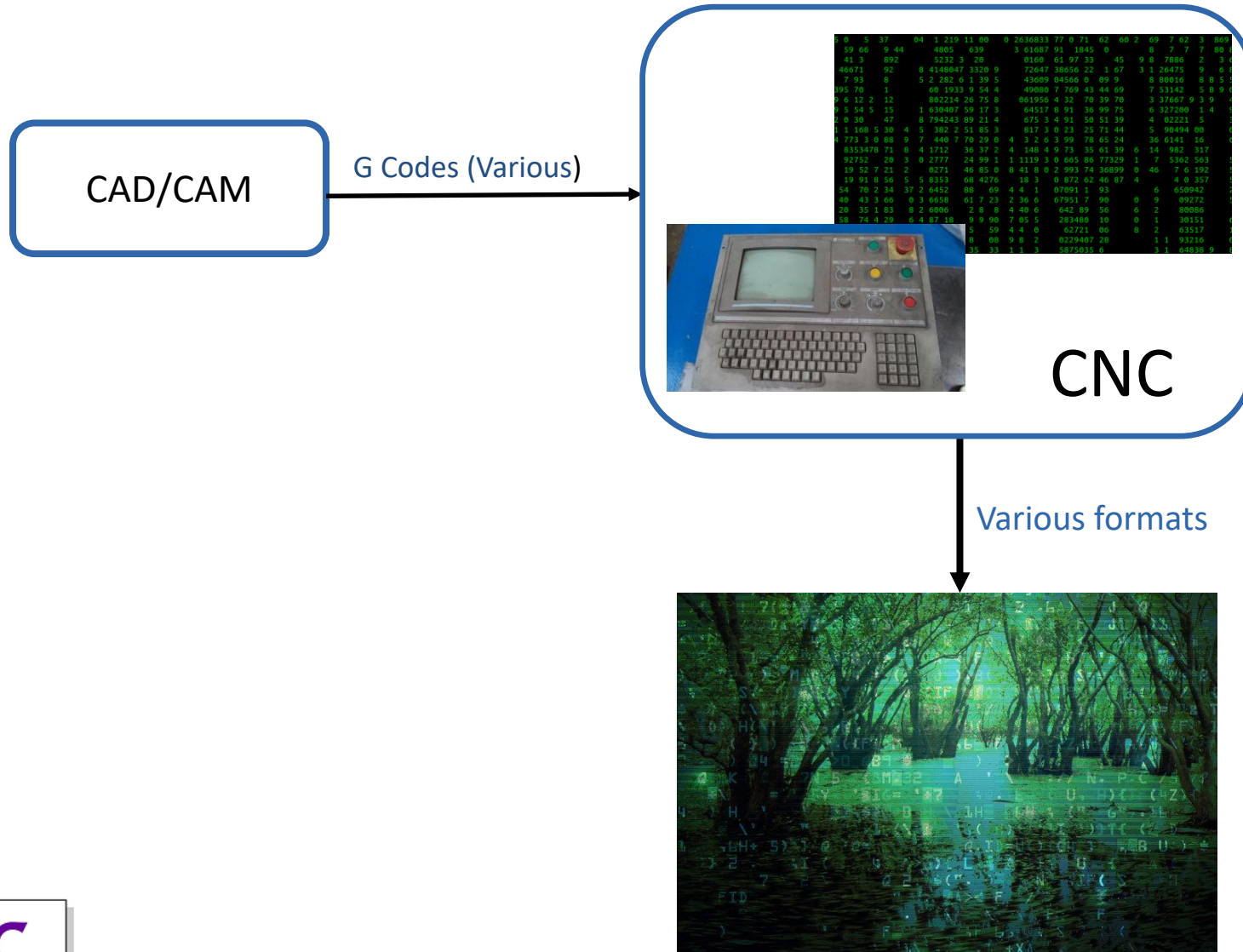- Equipment suppliers
- Technology suppliers

Impacts

- On machine GD&T
- Improved user interfaces
- Provides context for manufacturing events

Enables

- Disruptive technologies
- Data analytics
- Manufacturing Operations Management (MOM)
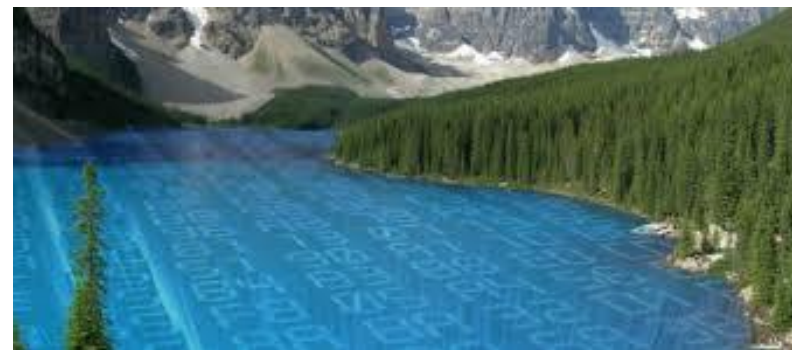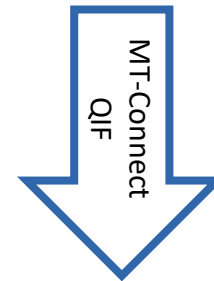- Smart adaptive control

Situation

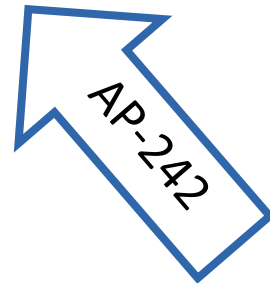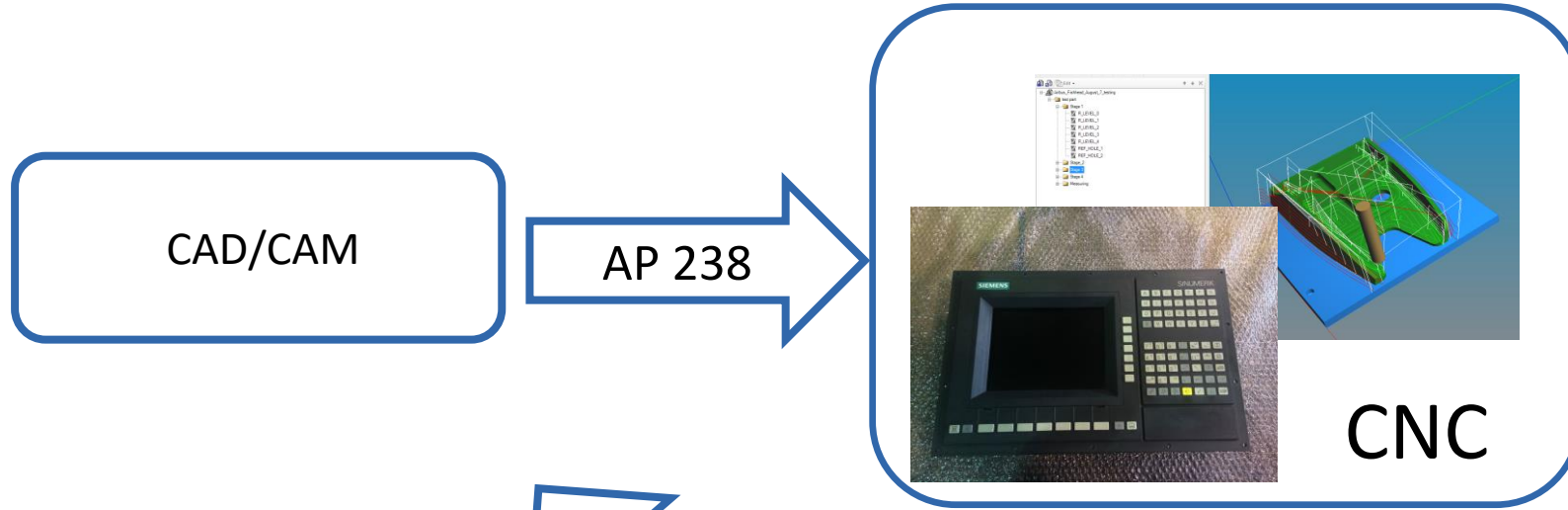CAD/CAM → G Codes (Various) → CNC

Various formats → Data Swamp

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Target

CAD/CAM

AP 238 →

CNC

AP-242

MT-Connect QIF

Data Lake

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Proposal

CAD/CAM → Enhanced CL-File → Combiner
CAD/CAM → Part/Process Information → Combiner

Combiner → Enhanced G-Code → CNC

Subprograms **State Registers**

CNC

MT-Connect

Data Lake
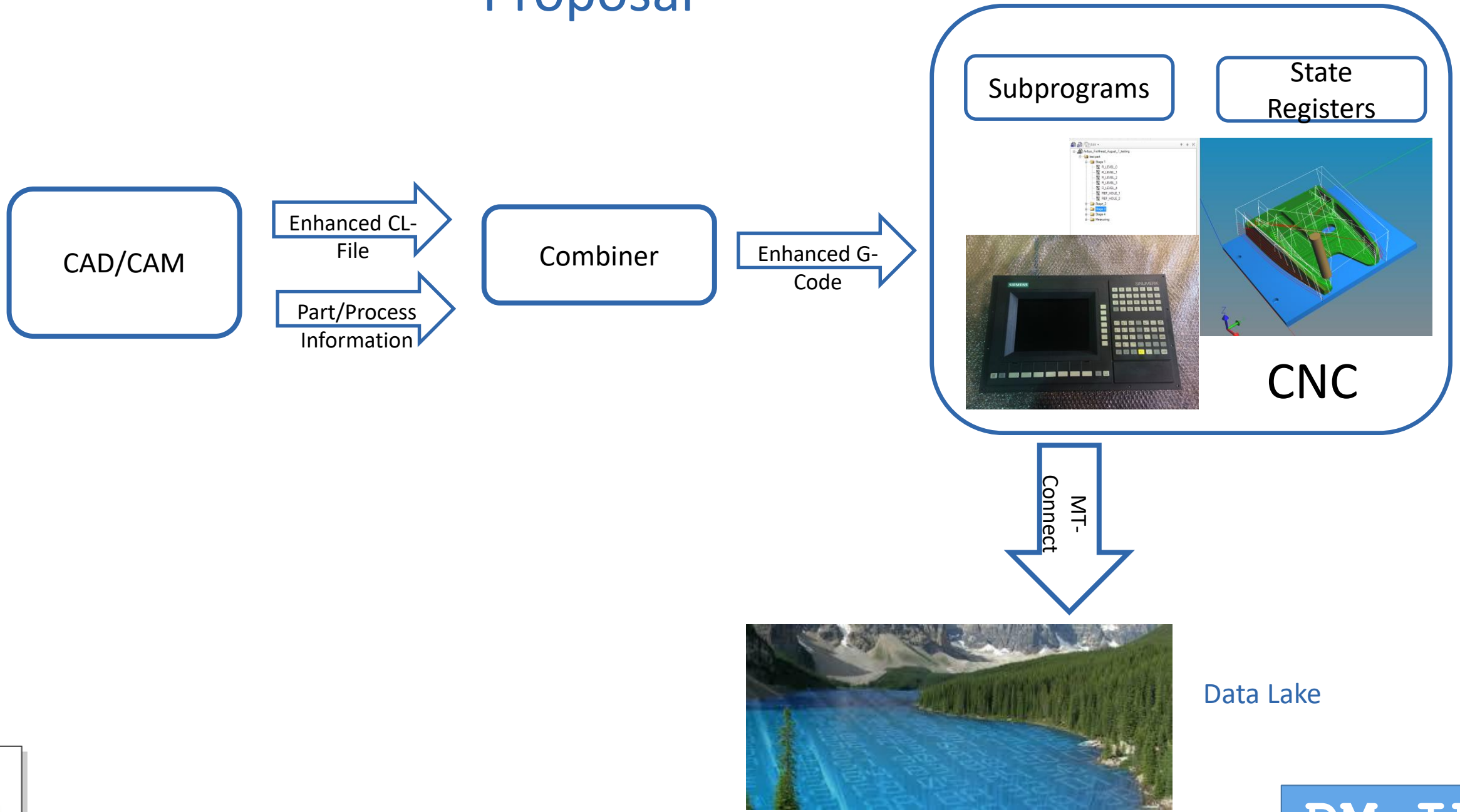
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Major Tasks

- Define and implement Combiner inputs for targeted CAD/CAM systems

- Define and implement enhanced G-Code inputs for targeted CNCs

- Define and implement CNC resident subprograms and state registers for targeted CNCs

- Select, define and implement MT-Connect tags for CNC data export

- Develop example enhanced user screens for targeted CNCS

Notional Schedule

- Initial Team Formation/Recruitment   (Q4 2018)

- Scope Defined (Q1 2019)

- Combiner Definitions (Q3 2019)

- CNC Input Definitions (Q4 2019)

- CNC Output Definitions (Q4 2019)

- Enhanced User Screen Examples (Q1 2020)

- Testing/Revision (Q2 2020)

- Documentation Complete (Q3 2020)

- Enhancements and Implementations (Ongoing)

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Key Deliverables

- Documentation for all defined objects

- Sample code for extraction/use of all defined objects

- Sample code for enhanced user screens

- Publicity for all efforts/deliverables

Key Contributors

Leader: OMAC

End-Users: Boeing, Airbus, Pratt & Whitney, GE

Technology Providers: DMG/Mori, Hyundai/Wia, Siemens, Fanuc, Heidenhain

Contact: David Odendahl, Boeing

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