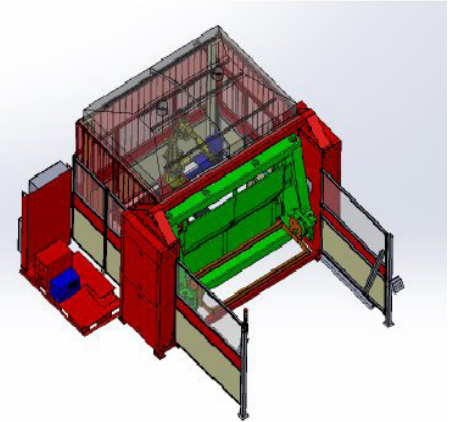
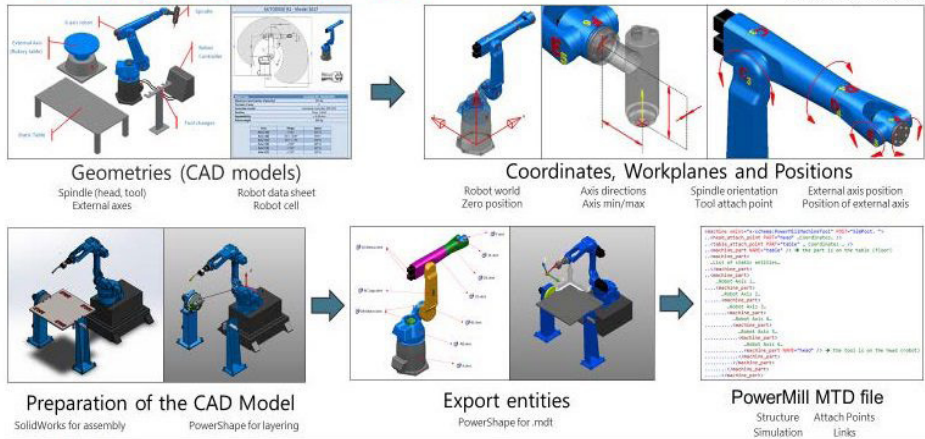


RIA Robotic DED System - Digital Twin Setup and Capability Demonstration

Building The Digital Twin



Workflow required for digital twin model and post-processor development along with Genesis System DED digital twin model.

PROBLEM

Directed energy deposition (DED) system software requires developer skills to set up digital twin system models, code CAM software post-processors, code build plan solver software, and transition simulation solutions to physical systems for metal additive manufacturing (MAM). Advanced DED software capabilities are needed to enable large format MAM using arc, laser, or electron beam welding deposition processes. Army Ground Vehicle Systems Center (GVSC) has a specific need to develop a DED procedure model database for a wide range of structural alloys and build applications. In addition, sensors and control technology are needed for lights-out thermal, dimensional, and quality management.

OBJECTIVE

The objective of this project is to enable MAM using affordable pre-engineered robotic welding systems via software integration development and to support ongoing development needed to mature large format robotic DED for Army GVSC applications. The project team seeks to convert a Genesis robotic arc welding system into a DED system using Power Mill CAM software. Development includes set up, calibration, validation, and demonstration of the post-processor functionality on site at Rock Island Arsenal – Joint Manufacturing & Technology Center (RIA – JMTC).



**AMERICA MAKES
TECHNOLOGY
DEVELOPMENT
ROADMAP**

This project aligns to:



PROCESS

**ASTM
PROCESS CATEGORY**
Directed Energy
Deposition

EQUIPMENT
Fanuc 9-Axis Welding
Robot System

MATERIAL
MIL-100S-1 and
MIL-120S-1

TECHNICAL APPROACH

EWI is converting the Genesis robotic welding system onsite at RIA – JMTC into a DED AM system using PowerMill CAM software. The CAD models for all robot cell components are being developed to design and program a functional digital twin of the physical robot cell in PowerMill's simulation tools. EWI is working with Genesis Systems to establish critical coordinates, work planes, and component positions of the digital twin system for the JMTC.

EWI is also working on-site at JMTC to calibrate the Genesis Fanuc DED system digital twin. A series of tests is being performed to calibrate the digital twin to the physical system. The team is developing and transitioning gas metal arc pulse DED wall and block procedures for two commonly used arc welding electrodes: MIL-100S-1 and MIL-120S-1. Demonstration of the DED procedure standard qualified build (SQB) using MIL-100S-1 electrode is planned with the full-scale single sided non-integrated build platform design and specimen matrix.

PROJECT START DATE

September 2, 2021

EXPECTED END DATE

June 30, 2022

EXPECTED DELIVERABLES

- Genesis System digital twin in PowerMill software
- Genesis System post-processor in PowerMill software
- One GMA-P DED procedure for steel using MIL-100S-1 electrode
- One GMA-P DED procedure for steel using MIL-120S-1 electrode
- One GMA-P DED standard qualification procedure and build for property testing at JMTC
- Final report

FUNDING

\$261,000 total project budget

(\$261,000 public funding)

PROJECT PARTICIPANTS

Project Principal:

EWI

Public Participants:

U.S. Department of Defense