



NSRP Task 2 DED-AM Shipyard Spec

DED-AM Shipyard Equipment
Specification &
Commercialization

GENERAL DYNAMICS
NASSCO

AUSTAL

Ingalls
Shipbuilding

EWI

iMS NAVUS

EWI Test Bed System

Starting Point

- First system of its kind

R&D System

- More hardware than a production system
- Smaller build volume than production system

Adapted to EWI Facility

- “Diving Board” to reduce system height
- Existing X-Axis rail system



EWI Test Bed System

R&D Experience to be harnessed:

Build Strategies

- High Skew Propeller Build

PowerMill Experience & Improvement

- Not to be understated!
- Software is the key to making these systems accessible

Installation & Calibration

- Laser Alignment for Calibration of Digital Twin for reduced commissioning time



Shipyard Spec System

Clean Slate

- New installs for shipyards – freedom of specification

Increased Build Volume & Capacity

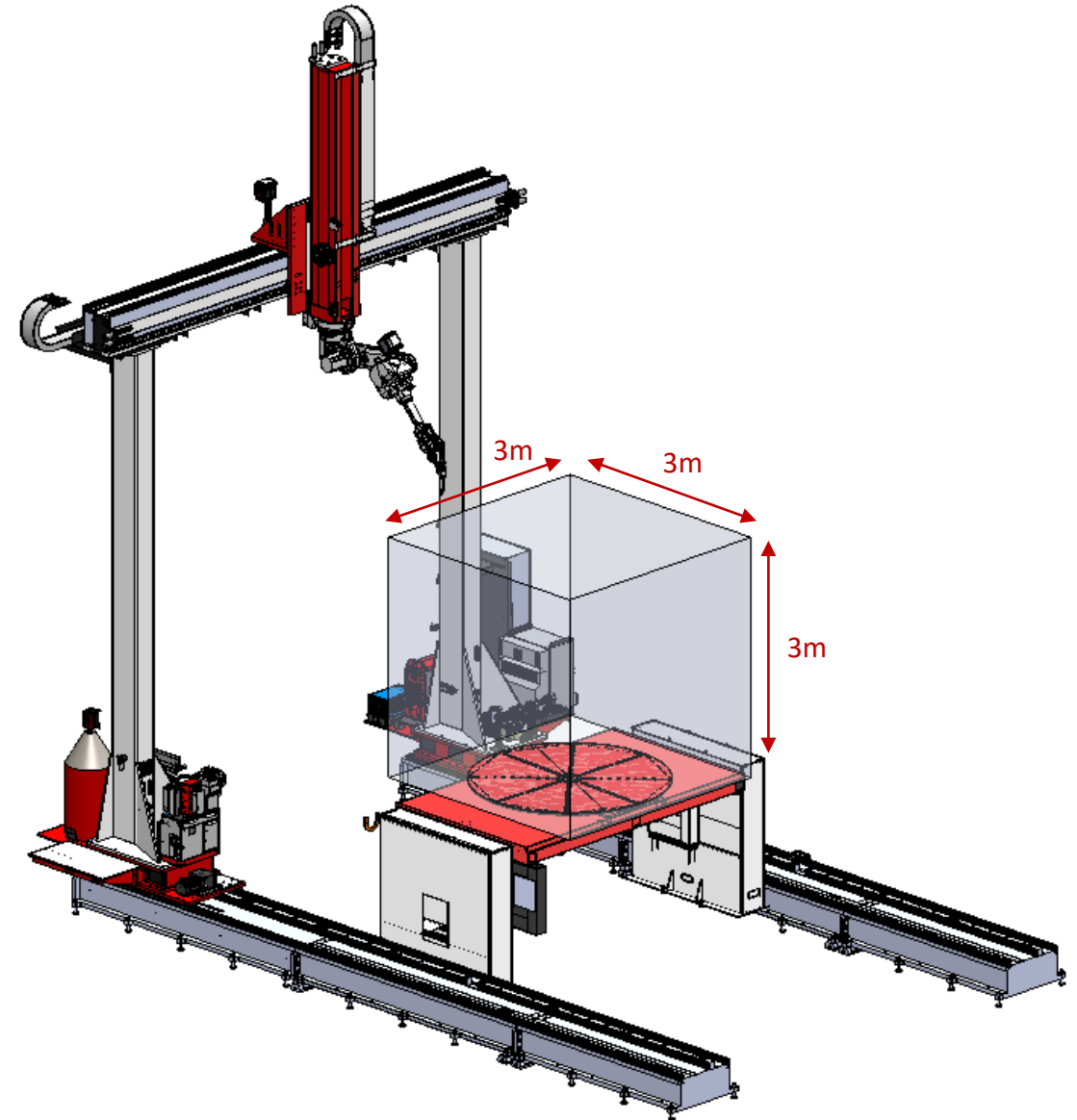
- Significantly upsized positioner
- 3m x 3m x 3m (27m³) build volume with a maximum payload of 15,000kg

Reduced Hardware

- Single weld system with established capabilities

Benefit from EWI R&D

- Improved training, shorter learning curve



Shipyard Spec System

Inverted Robot Posture

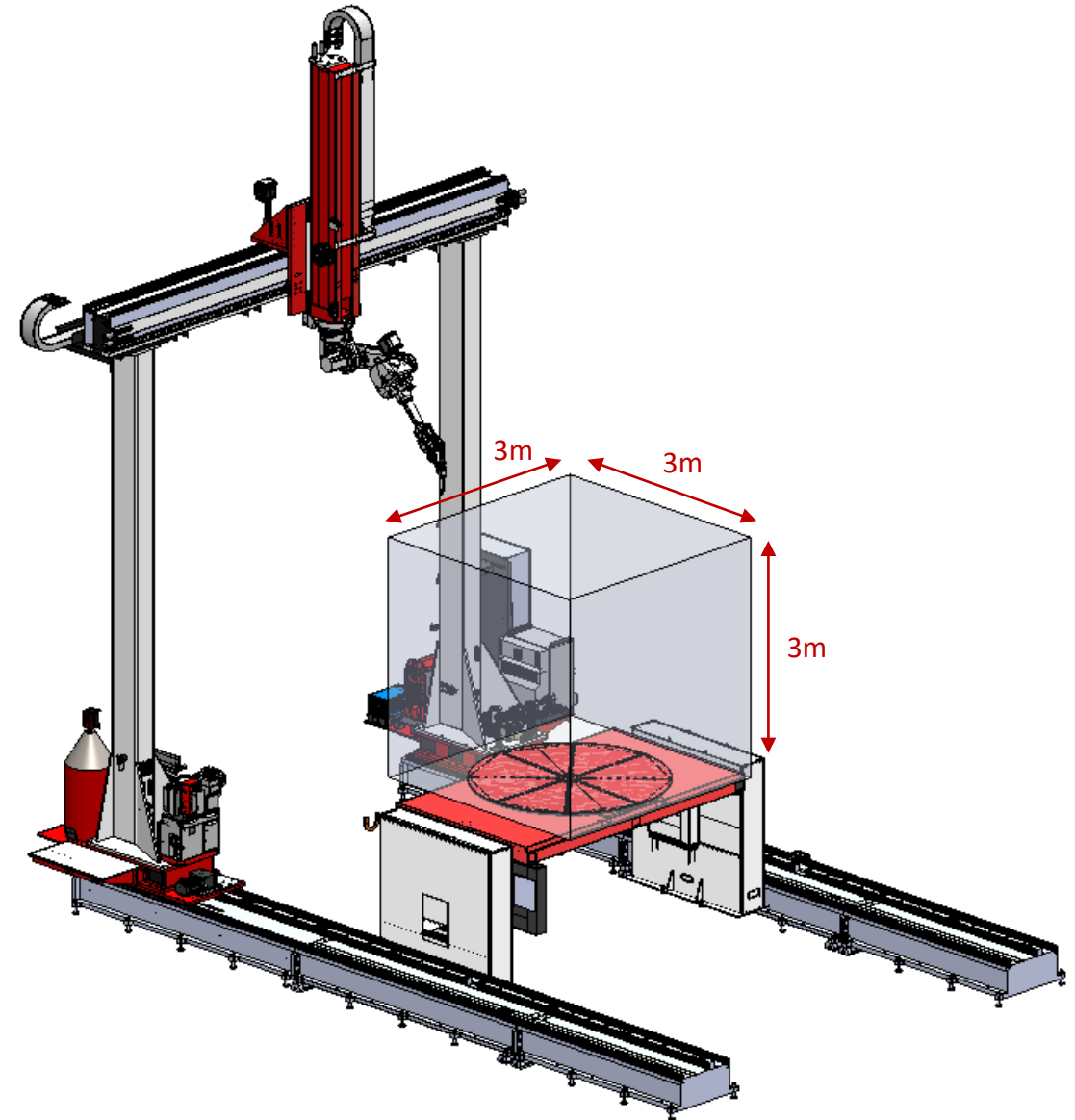
- Facilitated by fewer install site limitations on system height
- Improved freedom of movement for the robot

Carriage Mounted Equipment

- No overhead wire spool, coolers, etc.
- Eliminates safety considerations for operators & maintenance personnel

X-Axis Rail System

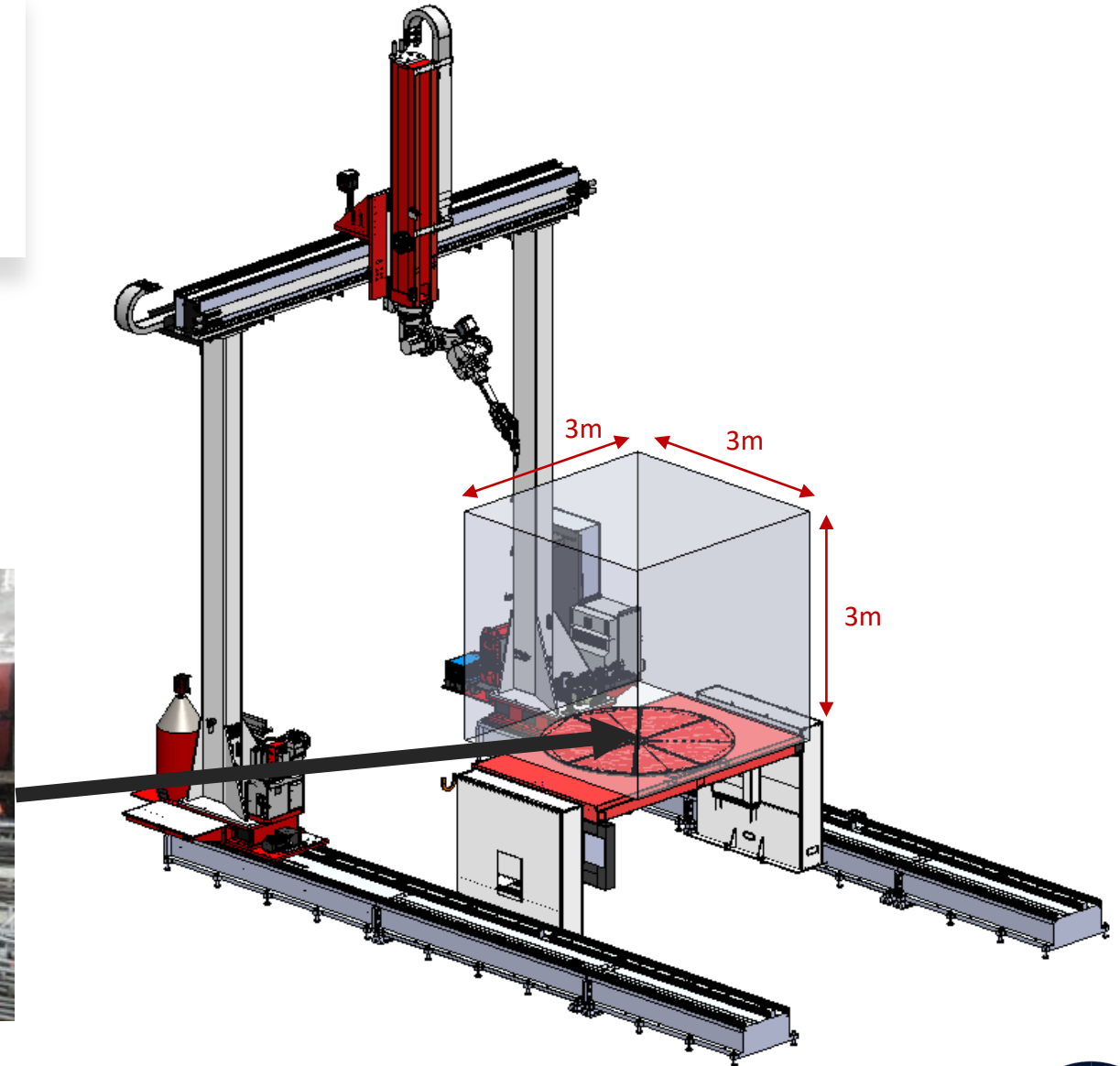
- Freedom to specify a preferred comparable type that best suits the shipyard environment



Shipyard Spec System

Identified Shipyard Builds

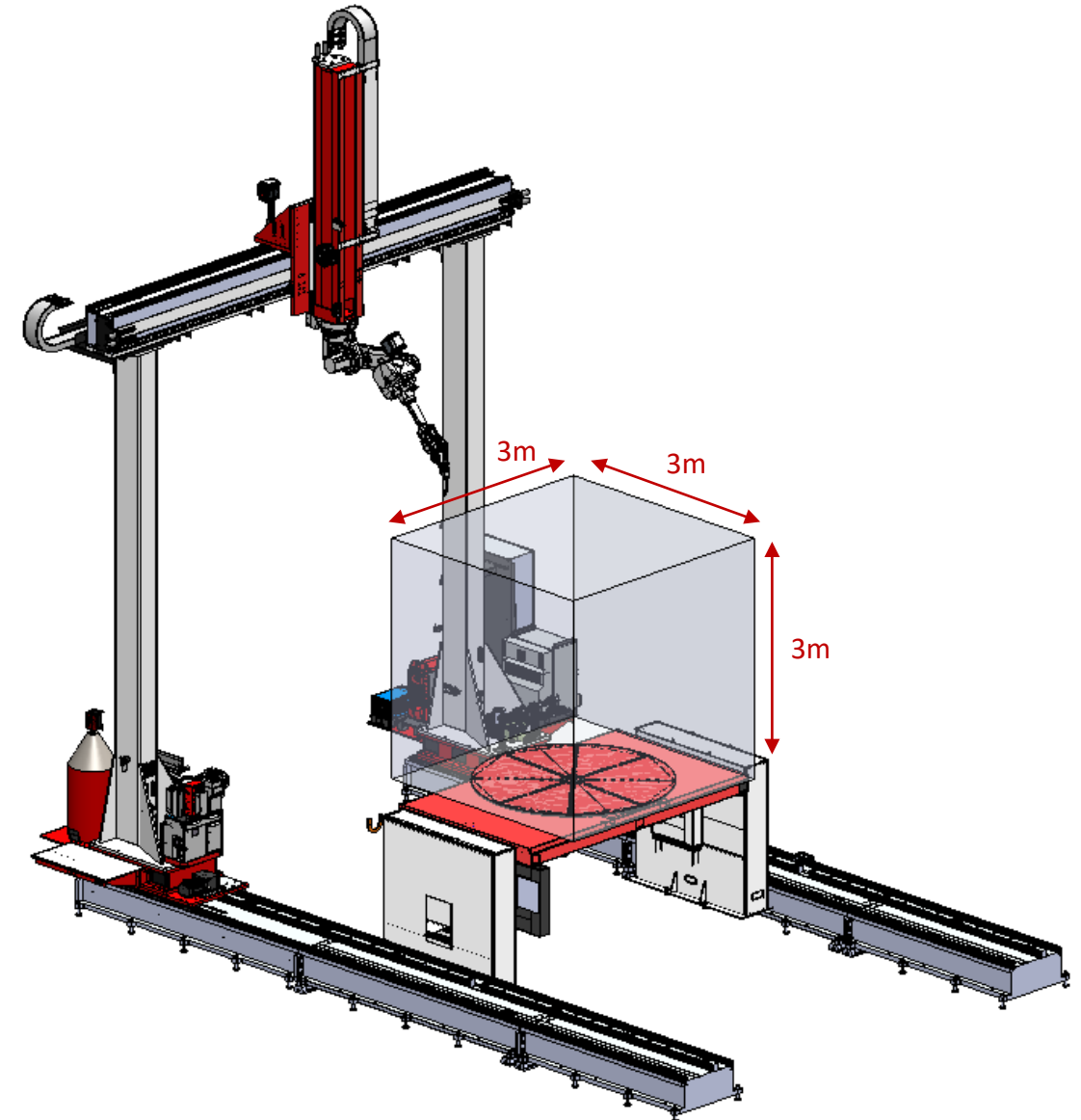
- Medium Stem Castings
- Stabilizing Planes
- Trolling Propellers



Shipyard Spec System

Build Category Capabilities

<p>1 – Linear 2.5D extrusions – walls and bricks</p>	<p>2 – Surface of revolution – buckets</p>	<p>3 – Features – on cylinders, planes and arbitrary bases</p>	<p>4 – Surface coating – patches and single layers</p>	<p>5 – Coaxial features – 360deg</p>
<p>6 – Blades and blisks – varying X section</p>	<p>7 – Multi axis sweep – varying X section tubes</p>	<p>8 – Non adaptive repair</p>	<p>9 – Adaptive repair</p> <p>Future Application</p>	<p>10 – Artisan</p> <p>N/A</p>

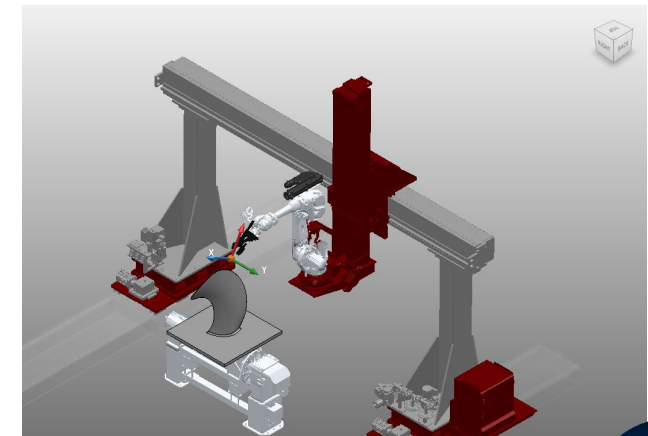
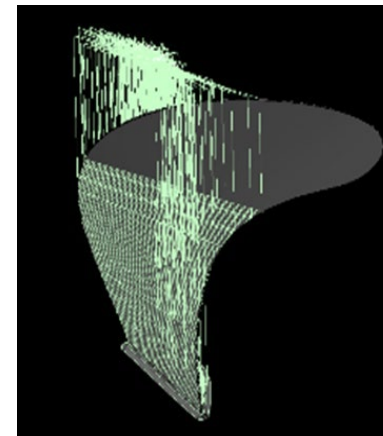
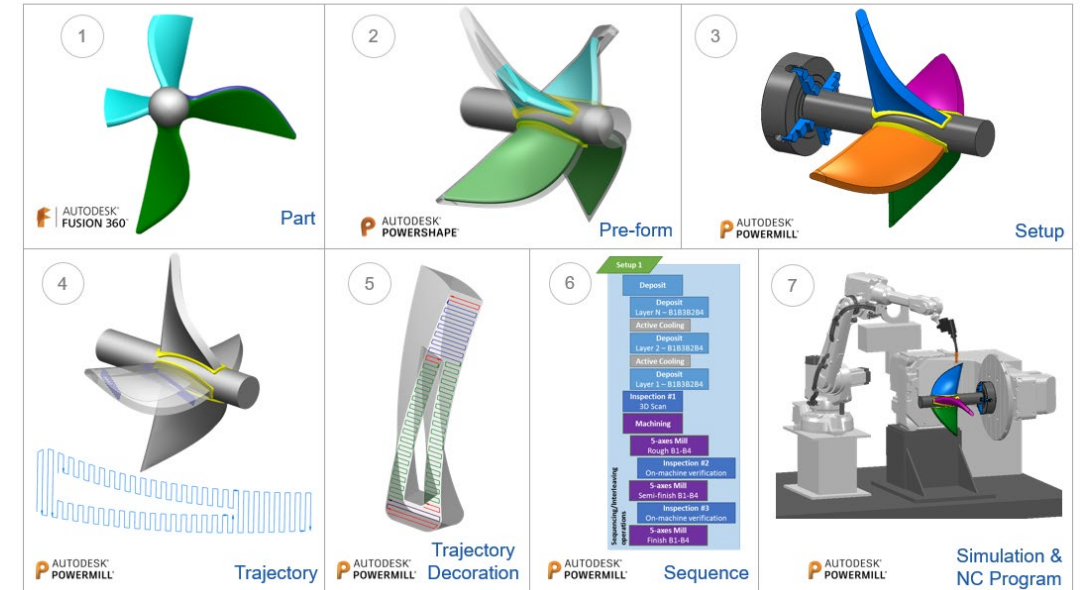


Shipyard Spec System

Standardized Software Package

- Autodesk PowerMill Ultimate Suite
- CAD Software Agnostic
- Windows 10 (64-bit)
- ABB Robot Studio (Optional)

Part Programming Workflow



Shipyards Spec - Evolution

Identification of Shipyards Needs:

Operator Training

- Starting point for operator training
- Simpler system to test new product introductions

Process Development

- New Production Introductions
- Weld Certification Builds

Reduced Build Volume & Capacity

- 1m x 1m x 1m (1m³) build volume with a maximum payload of 8,500kg

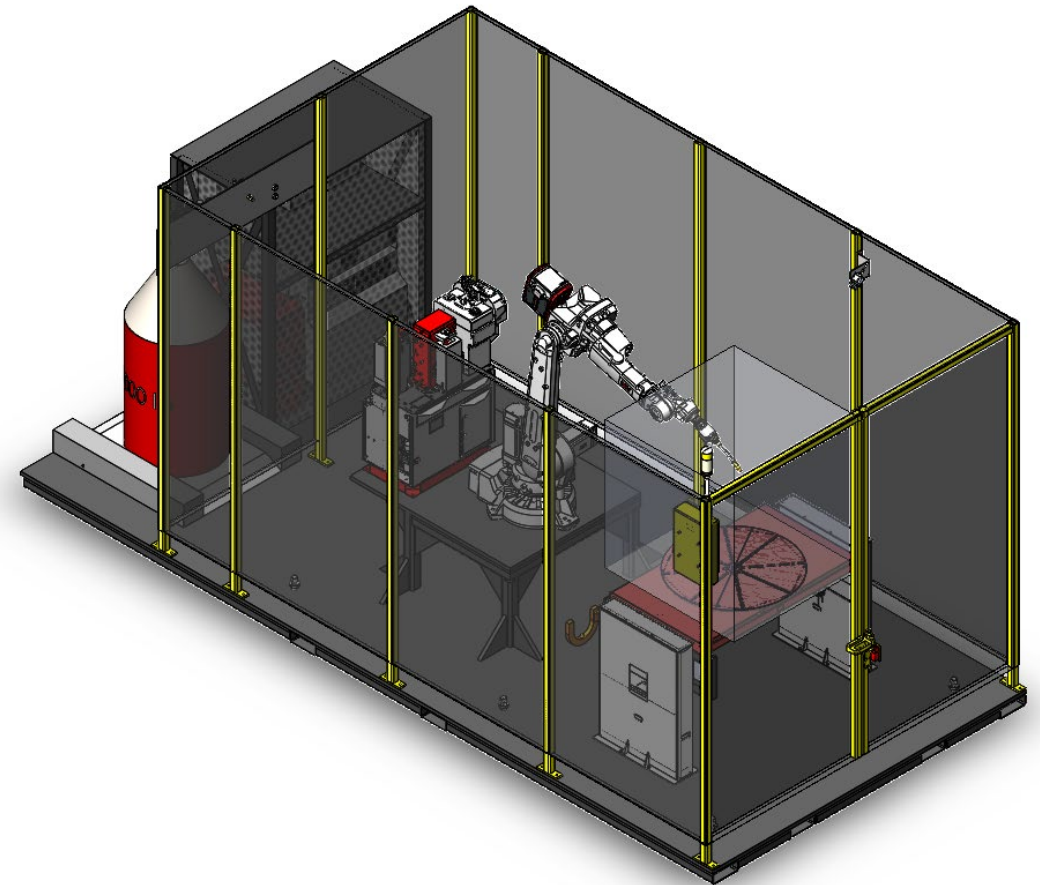
Additive Only

- Wider variety of robot options
- Automatic subtractive/cleaning by upgrade options

Mobile Self-Contained

- Facilitates placement within a dynamic environment without time consuming calibration requirements

“Type 1”



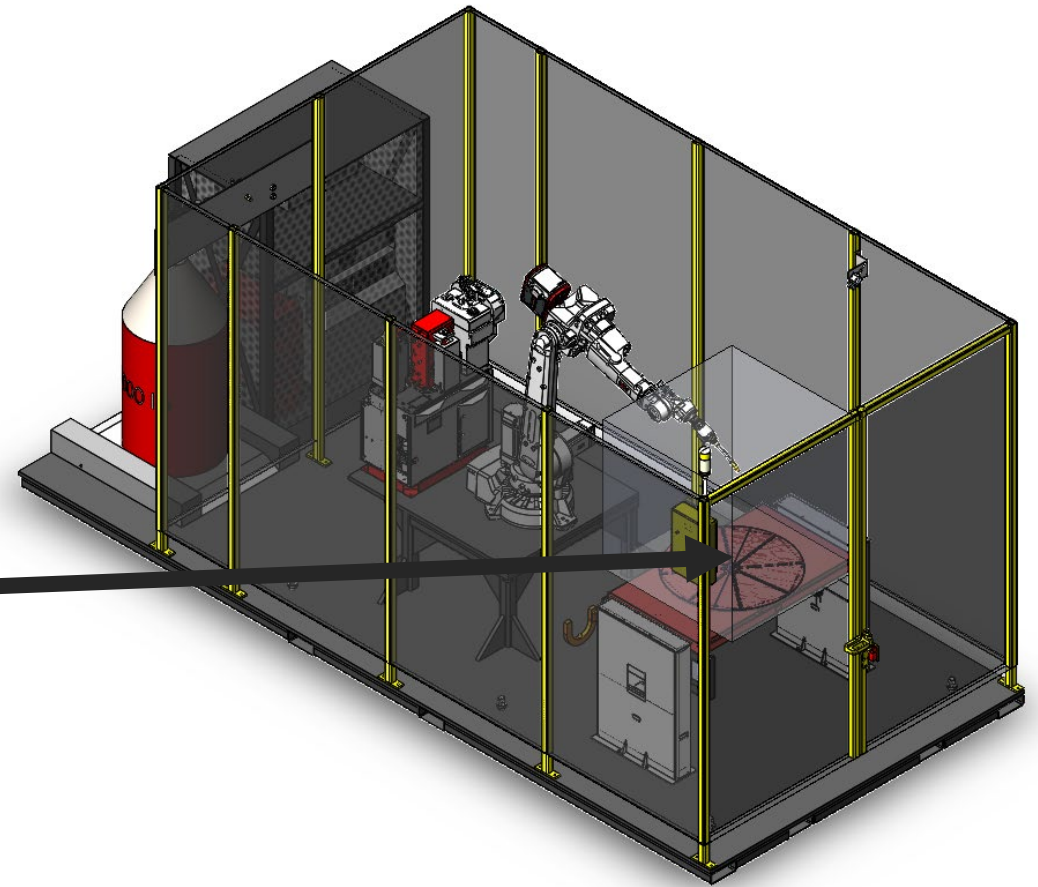
Shipyards Spec - Evolution

Identified Shipyards Builds

- Valve Bodies



“Type 1”



Shipyards Spec - Evolution

Identification of Shipyards Needs:

Full Scale “Lights Out” Production

- Shipyards Spec Additive with the addition of 5-Axis Subtractive CNC Milling

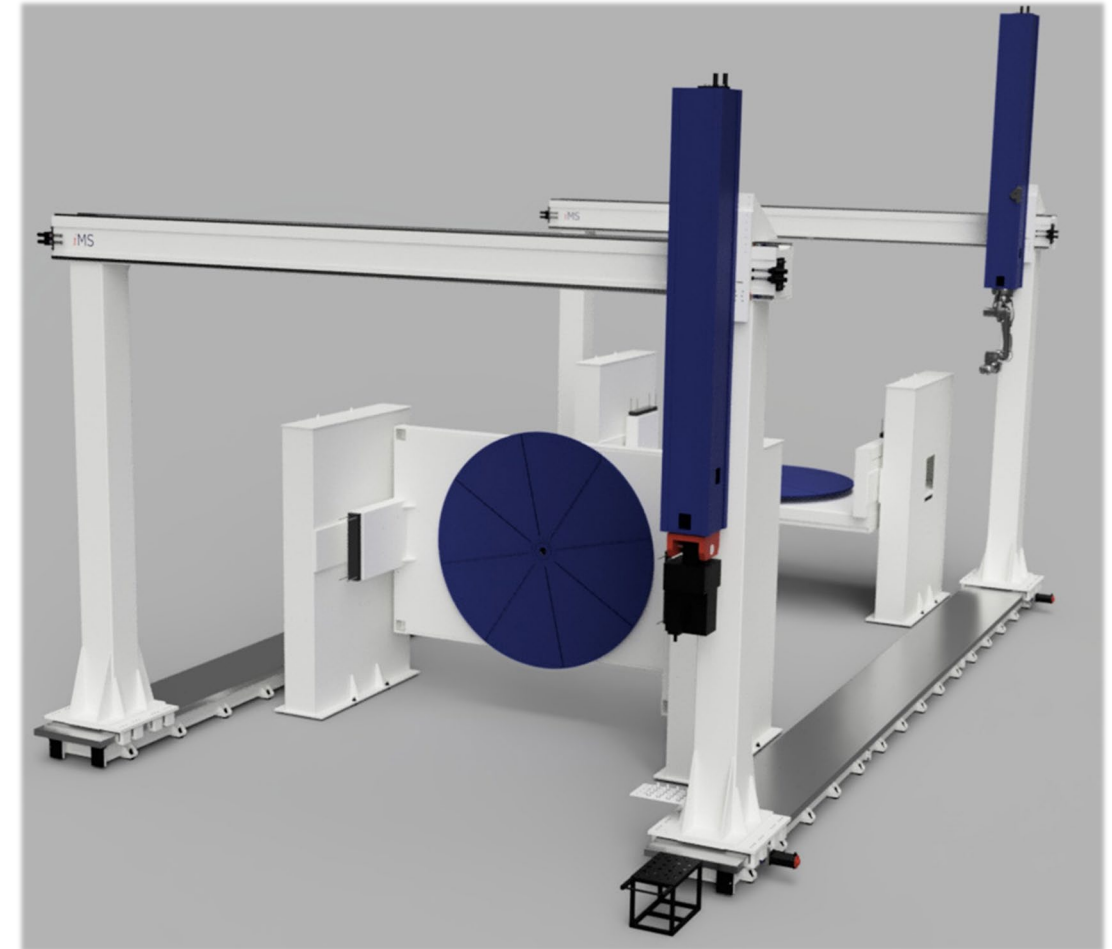
Larger Format Production

- 5m x 5m x 5m (125m³) build volume with TBD positioner payload capacities

CAD-to-Path Programming

- Streamlined design, production, and implementation process

“Type 3”



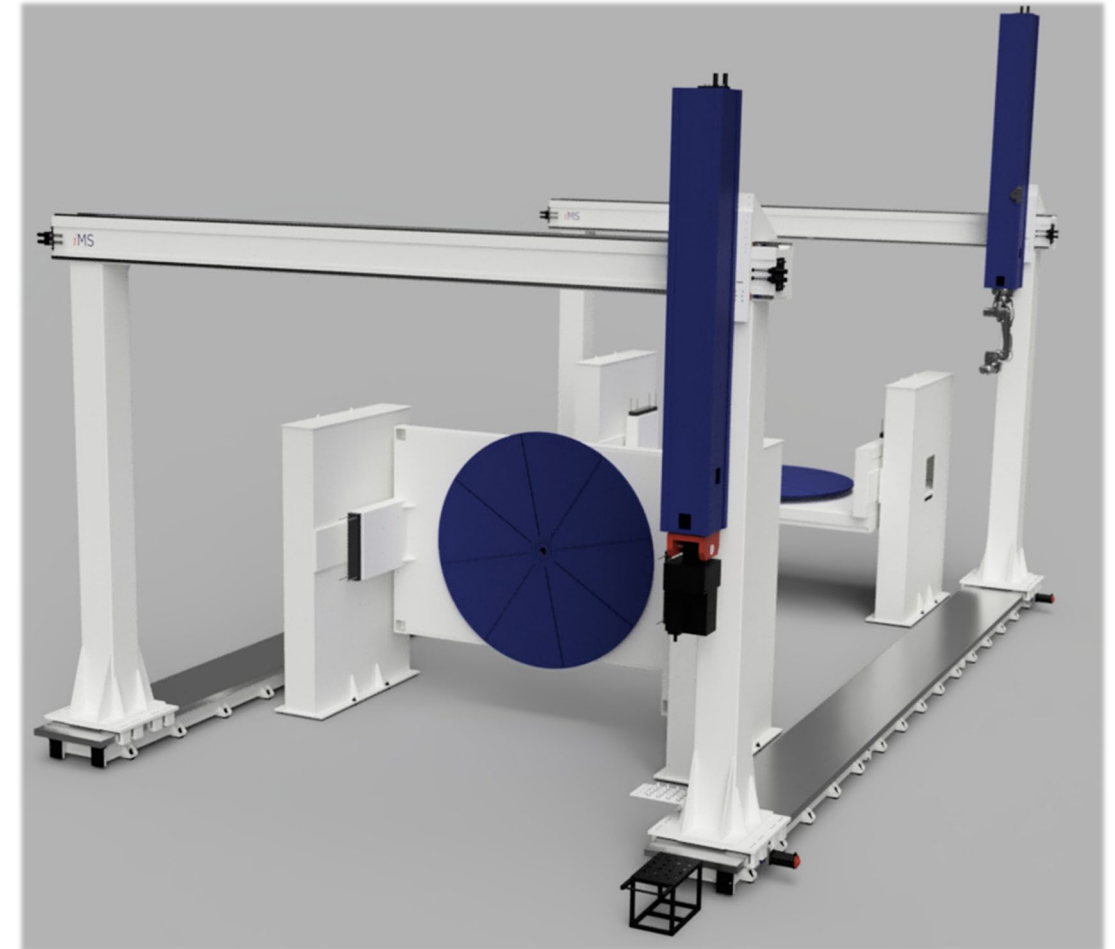
Shipyard Spec - Evolution

Identified Shipyard Builds

- Large Main Propellers
- Large Stem Castings



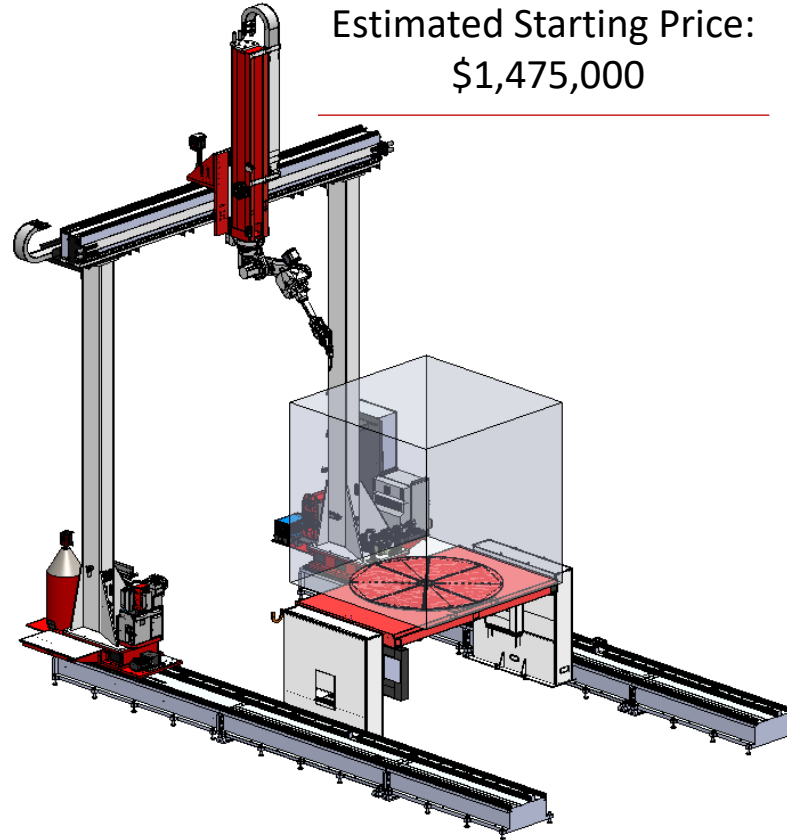
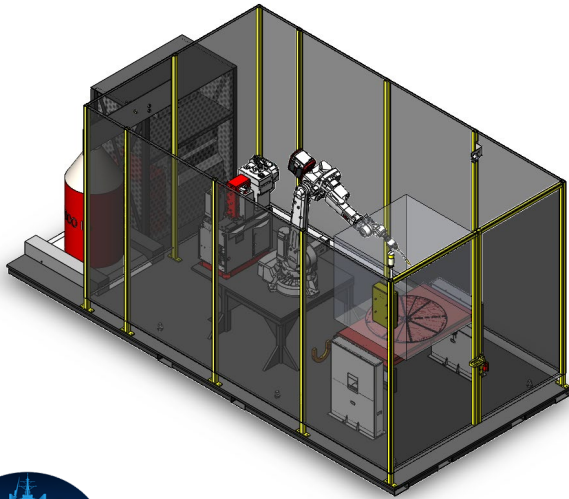
“Type 3”



DED-AM Systems Pricing

Shipyard Spec "Type 2"
Estimated Starting Price:
\$1,475,000

"Type 1"
Estimated Starting Price:
\$250,000



"Type 3"
Estimated Starting Price:
\$3,250,000

