


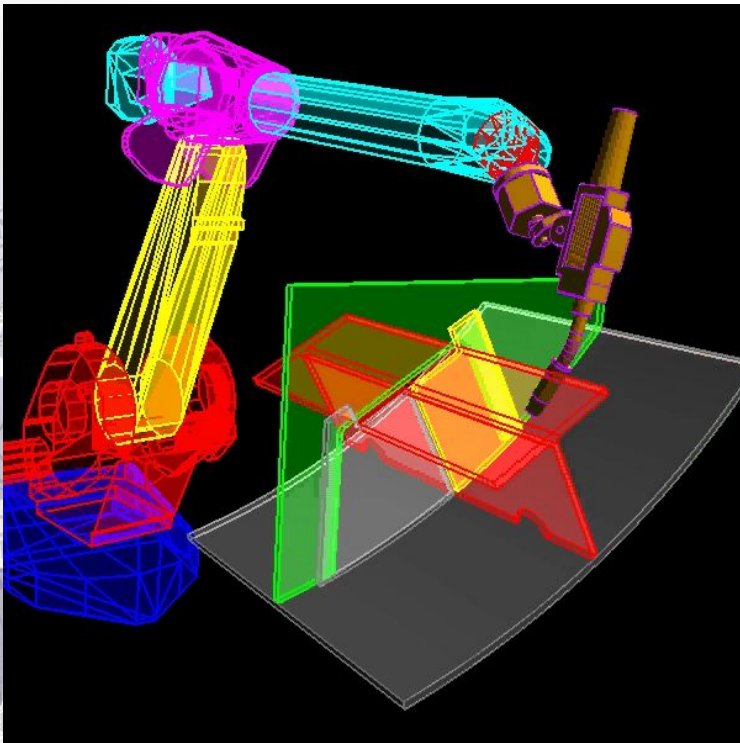


AutoGen Functional Enhancements

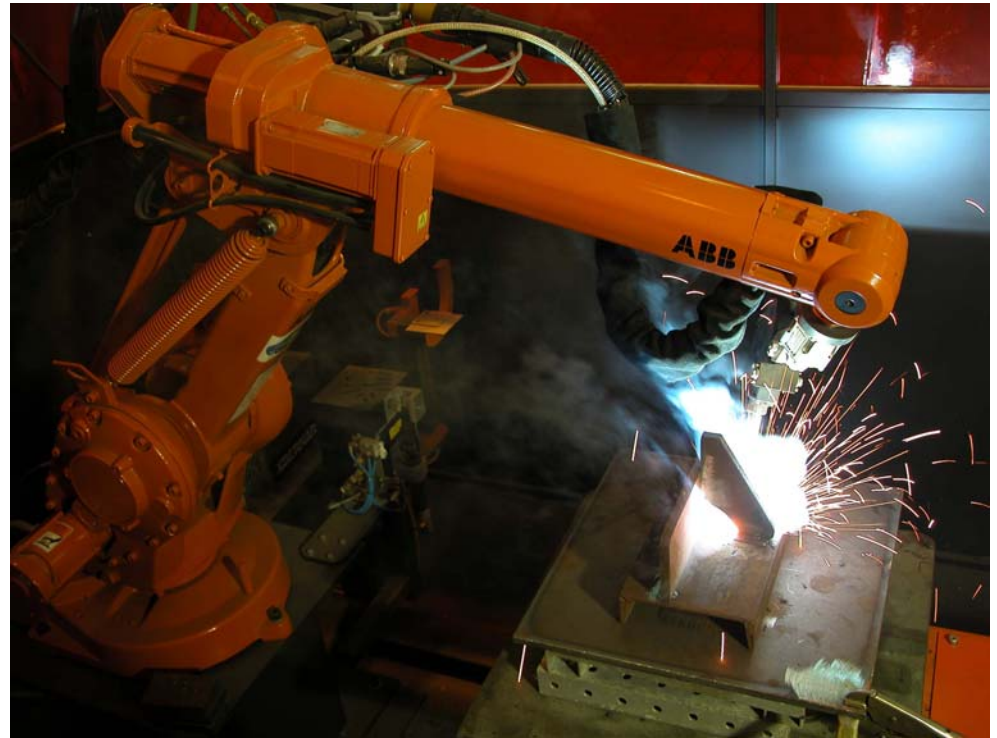


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AutoGen

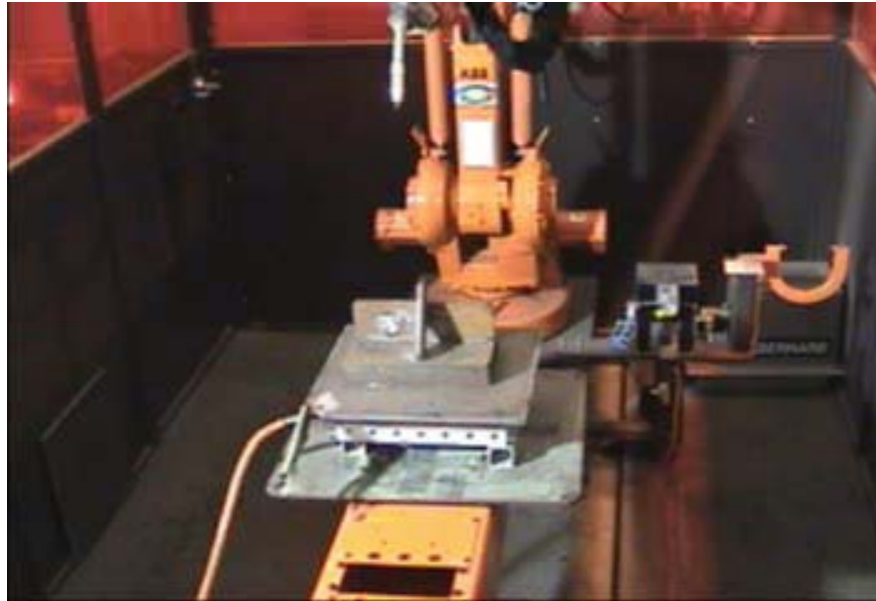


Visualizer



1st Welding Demo 12/03

12/03 Welding Demonstration at UNO





Functional Development

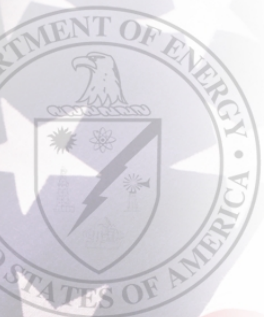
- **Opportunities for improvement exceeds current resources**
- **A number of areas for improvement will be presented**
- **Request input from TAB to help set development priorities**





AutoGen Development Options

- **Robot**
 - **Improve motion planning algorithms**
 - **Robot base placement for part geometry/position**
 - **Free space motion planning**
 - **N-DOF inverse kinematics solution for robot free space and weld path planning**
 - **Explore the command of robot in joint space**
 - **Improve capability to generate continuous weld paths**
 - **Development testing at SNL Robotics lab**





AutoGen Development Options

- **Workcell**

- **Create and document calibration procedure**
 - Reconcile differences between model and reality
- **Automated part location and orientation**
- **User input to work cell definition/layout**
 - Move, modify, add, delete tables or other obstacles
 - Select parts, cells, faces, edges





AutoGen Development Options

- **Welding**
 - Support multiple pass welds
 - Interface to the weld procedure database
 - Support parts with weld joint preparations
 - Beveled Tee-Joint
 - Multiple joints, etc.
 - Define additional welding positions
 - Enhance bead connections



AutoGen Development Options

- **Production Process Integration and Optimization**
 - Graphical user interface front end
 - Used as a component of other applications for weldability aspects
 - Use of multiple robots and partition of work
 - Support weld concatenation and sequencing
 - Minimize number of starts and stops
 - Optimum start and stop locations
 - Automated or user selected

Path Forward

- **Near term development priorities will be driven by needs of Electric Boat**
- **Commercialization priorities will be established in the next 60 days**

