

**OMIC R&D TECHNOLOGY BOARD**  
**Software Tool for Accurate Cycle Time Prediction and Simulation of**  
**Part Programs**  
**Request for Proposals**

**1.0 Project Information**

- **Project Title:** Software Tool for Accurate Cycle Time Prediction and Simulation of Part Programs
- **Project Type:** Joint General Project
- **Project Description:** The objective of this project is to develop a **software module** that can accurately predict the “true” machining cycle time for a given part program. Accurate prediction of machining cycle time is critical for streamlined process planning and optimization of part programs. Currently available CAM systems predict and simulate machining cycle-time based only on the tool-path length and user desired feed/speed. This prediction does not consider real acceleration/deceleration, axis jerk, smoothing commands, interpolation commanded, axis position, etc., capabilities of the machine tool and the characteristics of the numerical control (NC) unit. As a result, **CAM system predictions** are typically incorrect – significantly shorter - especially if the original part program contains densely segmented short linear moves. This is because behavior of the machine tool is not considered in CAM systems. This machine characteristics must be considered in order to provide an accurate cycle-time prediction so that **part programmers** can calculate cycle times accurately and better plan processes and **optimize** them.

This project proposes to develop a software module, which can be used to accurately predict cycle times of 2 and 2.5d machining part programs from CL/APT part programs by considering characteristics of the machine tool. This will **eliminate** the need for lengthy air cutting procedures and help reduce overall process planning effort.

Furthermore, it will be used by path-planners as a virtual testing and part-program optimization tool. The software system will be designed so that it would be connected to commercial CAM systems such as Vericut.

- **Project Outcomes:** This project will develop a **software module** to predict machining cycle times from part programs. The software module will accept part programs in CL/APT source file format consisting of 2-2.5D linear and circular geometries, including capabilities of the machine tool and the numerical control unit. It will simulate time-domain machine (TCP) motion (position, feed profiles) and compute cycle time accurately.

Acceleration/deceleration and jerk capacity of machine tools and NC system architecture are critical. If those specs are known from machine specs, they will be used to predict cycle times accurately. If they are not known, an identification procedure will be developed for the end user. This procedure will identify NC system behavior for different interpolation modes. A machine tool data-base may be created for easy usage.

This software system will be a new and original capability for OMIC. This kind of technology does not exist. Such software-based developments target a larger audience and it is general. When realized, OMIC can easily showcase its contribution to larger manufacturing community. Furthermore, CAM system makers such as Vericut may show great interest in such a capability.

- **Project Duration:** 12-16 months

## 2.0 General Information for All Proposals

- **Eligibility:** All faculty at OMIC R&D Research institutions and OMIC R&D technical staff.
- **Performance Period:** The Performance Period of the proposed work must be appropriate for the content given above in the Project Information sections. Requests for excessive or unjustified performance periods can be reason for proposal rejection by the OMIC Technology Board.
- **Award Amounts:** The funding requested must be appropriate for the content given above in the Project Information sections and consistent with any limitations given there. In all cases requested funds must be fully justified. Requests for excessive or unjustified funding can be reason for proposal rejection by the OMIC Technology Board.
- **Proposal Format, Content and Details:** All proposals must strictly follow the template given below and include all required sections
- **Submission Deadlines: Monday June 3, 2019**
- **How to Submit:** Send proposals by email to the OMIC R&D Project Manager, Ally Imbody <[alicia.imbody@oit.edu](mailto:alicia.imbody@oit.edu)>
- **Proposal Review Process:** Proposals will be reviewed and award decisions made by the OMIC Technical Advisory Board. The Board encourages collaboration between OMIC's university research partners in response to this RFP when collaboration will provide the best value for achieving the desired Project Outcomes. Evaluations will be based on the following criteria:
  - Soundness of the proposed methodology
  - Demonstrated subject-matter expertise of proposed staff
  - Cost/reasonableness of proposed budget
  - Timeline/adherence to proposed schedule
  - Past performance (if applicable)

Technology Board members will evaluate each eligible proposal submitted using a five-point scale where: 1- poor, 2-deficient, 3-acceptable, 4-superior, 5-outstanding. Evaluators will assign a default score of 3 for Past Performance if no information is available. All scores will be averaged by the Tech Board chair and a decision made based on the highest overall score.

- **Informational Contact:** Questions are to be directed to the OMIC Project Manager, Ally Imbody <[alicia.imbody@oit.edu](mailto:alicia.imbody@oit.edu)> by **Monday, April 29, 2019**. Consolidated questions will be sent to the Technology Board Chair and responses will be provided to all research partners by **Monday, May 6, 2019**.

- **Performance Requirements:** The PI and institution awarded the project will be expected to progress the work expeditiously to meet all of the progress milestones shown in their proposed schedule (see section two below).
- **Project Termination:** The Tech Board reserves the right to cancel the project at any time.