OMIC R&D TECHNOLOGY BOARD

CONCEPTUAL ABSTRACT

TITLE: **Additive Manufacturing for Large Molds & Repairs (Phase 2 of R2 and R7)**

RELATED ROAD-MAPPING DESIGNATION ID#: AM33 (also consolidated from AM39)

SUPPORTIVE INDUSTRY: Daimler Truck, Sugino, ATI, Oregon Tool, Silver Eagle

PROJECT TYPE: General Project

PROBLEM STATEMENT (What Are We Trying to Solve?): By most accounts, Additive Manufacturing is limited to the envelope size of the machine used in the process. However, larger parts need to be created in applications such as mold-making. For example, commercial vehicle manufacturers, such as Daimler, see AM techniques as a promising technique to create large molds such as those for truck hoods, bumpers, roof caps, and fenders. Traditional composite tooling is made by CNC milling the shapes out of large blocks of metal, modeling clay, plaster, foam or wood. This process creates a lot of waste materials and takes a lot of machine time (especially when dealing with large scale composite tooling). Composite molds that are designed to be used with carbon fiber parts often need to be made of carbon fiber to match the coefficient of thermal expansion. The research can also involve an investigation of alternate 3D printed materials that can be cost effective for carbon fiber molds. One concern may be that the printed geometry of the 3D printed molds could deviate from the design model due to: 1) the fluidity of printed material under high temperatures, and 2) the acceleration and deceleration of the printer head during printing.

PROJECT DESCRIPTION: Develop a 3D printing platform that would build large parts and not be captive to the envelope size of a machine. Early discussions during road-mapping suggested moving robotic platforms could be a viable solution. Building an actual mold would be cost prohibitive for the scale and scope of this project. However, the work should show the build of a reasonably large structure and show a reasonable representation of part related features (to be decided in partnership with the Daimler team).

With building large parts in an open environment, an inherent challenge that would have to be overcome would be to identify the position of the print head relative to the part features. Early discussions suggest that these could be reconcile by vision system or other probes. Consequently, this solution lends very well toward using AM for repairing parts. This project also demonstrates the ability to repair or build back material on a damaged part.

The new capability developed through OMIC projects at OSU, i.e. robotic controlled printer (R2) and robotic vision system (R7), will enable real-time control of the printing process to improve

the geometric accuracy. The work will monitor the discrepancy between actual and desired geometry through the robotic vision system and optimize the control parameters in real-time to compensate for the discrepancy. The expected outcome of this project will develop new hardware and software for the robotic/conventional printers (DED, WAAM, FFF) to minimize geometric errors and fix geometric problems in real-time.

Identify Related OMIC R&D Resources: Proposing researchers should use their best judgment in deciding on the optimal resources for the research. To further aid in this decision, the OMIC staff has taken the initiative to best identify on-site resources (machines, equipment, and staff) that may relate to the scope of this research. Please recognize that researchers are not limited to these resources.

- Machines and equipment at OMIC can be reviewed at: ***https://www.omic.us/explore/facility***
- OMIC Staff or SMEs

PROJECT DELIVERABLES:

- Final report
- Final presentation
- Build apparatus
- All part builds

SPECIAL NOTE: It should be recognized that this Conceptual Abstract is written based on comments collected during OMIC R&D Road-mapping workshop and based on industries need for applied research. However, researchers as SMEs, are encouraged to lend specific technical feedback to further refine the Project Description and or Project Outcomes. The proposing researcher may do so either directly to OMIC R&D, or in the submitting proposal.

UTILIZATION OF OMIC RESOURCES: Researchers are encouraged to utilize the capital and personnel resources available on the OMIC R&D campus in their proposals. Use of OMIC time and machines should be included in the Proposal funding request. If use of OMIC resources are not identified in a proposal and are requested during, the project sponsor will be responsible for requesting a costed project amendment from the Tech Board.

PROJECT UPDATE EXPECTATIONS: Researchers are required to have monthly update discussion with OMIC R&D to provide a summary update on project status. This is done by way of a user-friendly format known as the OMIC 6-Block update. Typically, these meetings are scheduled on the first Wednesday and Thursday of each month. Secondly, depending on the scope of the

project, OMIC R&D's industry Tech Board representatives are often interested in periodic project updates, and even in project participation. Researchers are required to communicate with supportive industry and facilitate communications as required.

PROJECT DURATION: It is OMIC R&D's strong preference that duration of a General Project aligns with the academic calendar cycle (July 2023 to June 2024). It is preferred that the project be completed by June 2024. Researchers are encouraged to factor in variables such as contracting, student hiring (if needed), procurement, holidays, and travel. It has been OMIC R&D's experience that a projects useful working duration is typically 9 to 10 months. Researchers are also encouraged to lend feedback, and to adjust the scope of work to best fit this preferred timeframe. Additionally, it is reasonable to even recommend phasing breakdowns to the project. In some unique circumstances, if the project is to take significantly longer than the duration of the academic year, this reasoning should be explicitly explained in the proposal.

CONTACTS AT OMIC R&D:

Urmaze Naterwalla
Head of R&D
Urmaze.Naterwalla@oit.edu

Craig Campbell
Executive Director
Craig.Campbell@oit.edu

Jen Kammerman
Research Administrative Manager
Jen.Kammerman@oit.edu