Enabling CNC-RP in PSU’s IE FAME Lab

Overview
In this project, CNC-RP capability has been installed and developed in the Penn State IE FAME Lab. An analysis must be done in order to determine the tolerances that can be achieved with this process. Furthermore, limitations will need to be determined as far as features and structures that can be built with this particular method. After finding the limitations of this process, this CNC-RP capability will be applied to the DARPA Adaptive Vehicle Make (AVM) competition.

Objectives
There were two main objectives of this project. The first objective was to upgrade one of the current FAME Lab CNC machines into a CNC-RP capable machine in support of the DARPA Adaptive Vehicle Make (AVM) competition. The second objective was to analyze the CNC-RP process capabilities by comparing sample part specifications to as-designed specifications including the dimensions of the machined parts.

Approach
- Obtain software from Iowa State University to be used in conjunction with MasterCAM at Penn State University
- Run software on computers to ensure compatibility of software with Penn State University machines
- Design rotational axis fixture and create Bill of Materials (BoM)
- Secure available CNC machine in the Penn State University Industrial Engineering FAME Laboratory and install required equipment
- Manufacture and test parts provided by the sponsors
- Analyze part dimensions comparing those measured on the sample part to those measurements called out in the part drawing file

Outcomes
- In this project, CNC Rapid Prototyping (CNC-RP) capability has been installed on the VF3 CNC Milling Center in the Penn State FAME Lab.
- The test runs have produced a 99% complete part in 8 hours.
- In this process, feed rates could achieve 100% however, 25% rapid movement is recommended to prevent the CNC machine from crashing.
- Even though machining time is longer than standard machining practices, the time between model to machining is lowered from at least a week to 8 hours and overall reducing time to market.