

## ABSTRACT

### DESIGN OF AN AUTOMATED WELDING PROCESS FOR *SYNERGY MFG.*

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This senior project involves a partnership with a local off-road parts manufacturer called Synergy Mfg. Synergy is experiencing a rapid increase in demand that is difficult to meet with their current processes. Because of this issue, Synergy is exploring automation in order to decrease their cycle times and increase their production output. More specifically, this report concentrates on automating a manual welding process that has a lengthy cycle time which causes Synergy's difficulties with meeting demand. Due to time constraints, this project focused on the automation of a welding process for only one part that Synergy produces. This part contains intricate weld patterns that result in a prolonged cycle time. In addition to this, the only automation resource available is a Fanuc 50iD ARC Mate welding robot. This particular robot is used widely in production and will establish a conclusive baseline for most automated welding equipment.

A fixture was first developed and produced that is compatible with the available welding robot. Because the development of a fixture involves many other considerations and variables, this project was divided into two. The first project of developing a welding fixture was completed by Joe Hanacek and can be referenced if more information regarding the fixture is needed. This report is a continuation of Hanacek's project.

Moving forward, a program was written and numerous parts were welded. From this trial production run, it was found that the automated cycle time resulted in a 30.2% improvement compared to the manual cycle time. Along with this improvement, the cost of labor was decreased but not eliminated because the robot used in this project still required an operator but not a skilled welder. After further analysis, it was determined that with the ideal conditions, implementing a robot welder may potentially increase Synergy's yearly output by 43.1% and require a payback period of roughly 52 weeks.

It was concluded that implementing a welding robot will ultimately help Synergy's difficulties with meeting demand. The recommendations with this conclusion involve professionally manufacturing a fixture rather than using the rough prototype involved in this project. The rough prototype lead to many defects due to incomplete construction and lack of clamping force needed to securely hold the part. Also, most of the welds in the trial production run were visually inspected and passed but did not undergo any thorough break tests. It is recommended that Synergy conducts break tests on the welds in order to verify the weld strengths.