

PROJECT SUMMARY

INTELLECTUAL MERITS

This Small Business Innovation Research Phase II project has the objective of completing the innovation of a commercially-attractive abrasive slurry jet (ASJ) cutter for almost all materials. It is known that ASJs will cut metal as much as five times faster, with the same or better quality, than the conventional abrasive waterjet (AWJ). While the ultra-high pressure (UHP) ASJ is very attractive, it has never been practical because the life of the nozzles has been limited to a few minutes. Our objective is to eliminate nozzle grit erosion by fluid dynamic means. In Phase I of this project, we have demonstrated by simulation experiments in an air model, and by computational fluid dynamics (CFD), that our goal should be achievable in Phase II. The leading manufacturer of plasma-arc metal cutting equipment, Hypertherm, Inc. has agreed to commercialize the UHP ASJ, providing of course that it continues to be commercially attractive.

This proposal reviews the results of Phase I research; then lays out the Phase II program. A Phase IIB is expected which will commence with the testing of alpha prototypes in actual field applications such as the fabrication of metal, composite and ceramic components and structures.

BROADER IMPACTS

The advent of the ASJ cutter will open up a new, proprietary business of several hundred millions dollars/year providing a product competitive in world markets. This project will also advance the technology of high-velocity, two-phase flow by using CFD to reduce slurry erosion in the nozzle and by establishing cutting rates higher than the conventional abrasive water jet (AWJ). It will provide opportunities for college undergraduates Interns, and Externships for local K-12 teachers, through NSF's REU and RET programs. Synergy Innovations Inc. (SII) has a history of involvement of women and minorities (SII has, on the Phase I of this overall project and on a just-completed NIH Phase II SBIR project, employed four (4) undergraduate women (Dartmouth College); one being Native American and one being Asian). SII disseminates results of its research through its patents, journal papers, industrial advertising and by commercializing its unique products. SII's mission is to generate new companies, new high-value jobs and new products, which all strengthen the US economy. The greater society will benefit through the economic activity, the knowledge, and new products and processes that will be enabled by or generated from this technological innovation.

KEY WORDS

abrasive-jet cutting, abrasive-slurry jet, nozzle-erosion control, multi-phase flow.

TOPIC: Manufacturing Innovation **SUBTOPIC:** A7