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RESEARCH AND DEVELOPMENT

Contract No. N00014-88-C-0571

"A Cryocooler for High Acceleration Applications"

Fifth Quarterly Report

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1.0 WORK PERFORMED THIS QUARTER

An order for the heat exchanger material has been placed with our subcontractor. It was accepted on a "Product of Effort" basis due to the unique requirements imposed by this application.

We have recently received the glass-ceramic washers needed for the initial process development. The niobium alloy plates are at a vendor being processed by laser drilling to fabricate the flow passage area.

The test facility construction is completed. All feedthroughs, gas line fittings and electrical connections necessary for the heat exchanger testing have been completed.

Work in a related effort has provided valuable information regarding specific processing details which affect the brazing operation. Initial attempts to braze the heat exchanger components together were unsuccessful. Gaps developed in sections of the heat exchanger stack-up (a stack-up consists of a series of plate-spacer parts) as the braze melted. Surface tension of the molten braze sufficient to align approximately five plates together; larger stack-ups had gaps. Epoxy was cast around these units, so flow testing through the brazed unit could be performed. The flow impedance was substantially higher than expected - by roughly a factor of 300. Microscopic examination of individually brazed space-plate-spacer specimens revealed that molten braze was filling the majority of the flow passages in the plates.

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Two different methods were tried to prevent this from recurring: sputtering and e-beam evaporation of an oxide. While faster, e-beam evaporation cannot be readily monitored in our present system and therefore, gave unreliable results in the brazing process. Currently, we are sputtering a barrier layer of oxide on the heat exchanger plates. The particular oxide we are using has some drawbacks, primarily, having a low sputter yield, but does prevent the molten braze from plugging the flow passages.

2.0 WORK PLANNED FOR NEXT QUARTER

We will monitor our subcontractors efforts relating to the heat exchanger material processing. Process development pertaining to the heat exchanger fabrication will begin using components already on hand. When the actual heat exchanger material is received, the testing program can then proceed without delay.

3.0 PROBLEMS AND SOLUTIONS

There are no problems currently affecting the schedule of this effort.

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