Quarterly Technical Progress Report

No. 5 - September 27, 1999

Electronic Refrigerant Leak Detector
Micronic, Inc. - Elie Talamas, Jr.

DE-FG36-98GO10301-002

Period: 7/1/99 to 9/30/99

Introduction

The project comprises of three main tasks. They are: (1) Develop, design, fabricate (20) sensors, (2) Develop, design, and fabricate (5) test instruments, (3) Testing and data analysis. The extended project period is from April 30, 1998 to April 30, 2000.

Task 1. Develop, design, and fabricate 20 sensors

A. Finalize the design of sensor objective with SRI Int., and generate a P.O. (QTPR #1 completed).

B. Develop, design, and fabricate (20) sensors by SRI Int. (QTPR #5, completed).

SRI completed the development and fabrication of 20 sensors. 17 sensors were received on August 2, 99. The final process included the deposition of numerous layers of a thin film by the Langmuir-Blodgett method. These sensors were then mounted on an alumina header with the leads wire-bonded to external pads. SRI was unable to connect the leads of the temperature sensor. Calibration data was available from SRI on the three sensors. The inability to monitor the temperature of the sensor during gas detection should not be a problem. Micronic tested the resistance of the heater of the sensors. The value was found higher than previously tested by SRI during fabrication. SRI proceeded to retest the heater of the three sampled sensors. However, these tests were destructive. The drive voltages versus the heater temperature calibration data were obtained. The final heater specification was received on August 18, 99.

Task 2. Develop, design, and fabricate 5 test instruments

A. Design and optimize each subcircuit.

a. Purchase test equipment (QTPR #1, 60% completed; QTPR #2, 75% completed; QTPR #3, 90% completed; QTPR #4, 92% completed; QTPR #5, 95% completed).

b. The following items were purchased (QTPR #5): 8(partial), 14 (partial), and 15 (partial). The following items will be purchased (QTPR #6): 8(partial), 13, 14(partial), 15(partial).

Evaluate components (QTPR #1, 100 % completed; QTPR #2, additional 15%, QTPR #3, additional 15%, QTPR #4, additional 15%, QTPR #5, additional 5%).

c. Breadboard circuit (QTPR #1, 0% ; QTPR #2, 75% completed, QTPR #3, 90% completed, QTPR #4, 95% completed), (QTPR #5, 98% completed).

The analog circuit design is nearly completed with the testing of the TL1761, a low drop / low noise positive voltage regulator. The subcircuit was tested for noise-drift, load and power. The MAX1771, a dc-dc converter circuit that was designed as the heater driver, was tested. The resistance of the sensor

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changed due to the deposition of the thin film. The MAX618 evaluation kit was ordered owing to the new voltage and current requirements of the heater. Several inductor samples were ordered from Sumida. A tweezer type solder iron was ordered to remove surface-mount components typically found in kits. The evaluation of the MAX618 for noise-drift, load, and power, was started.

- d. Simulate circuits (QTPR # 1, 20% completed; QTPR #2, 25% completed, QTPR #3, 40% completed), (to be completed QTPR #7).

There were no circuit simulation this quarter.

- e. Design, build, and test two bench prototypes (QTPR #1, 15% completed; QTPR #2, 30% completed, QTPR #3, 60% completed, QTPR #4, 90% completed), (to be completed Quarter #7).
- f. Test the assembler, emulator, and LCD display. (QTPR #1, 80%; QTPR #2, 100% completed).
- g. Write the code for PIC microcontroller (QTPR #1, 0%; QTPR #2, 0%; QTPR #3, 0%, QTPR #4, 0%), (to be started in Quarter #6).
- h. Purchase and test measurement system. (QTPR # 1, 20 % completed; QTRP # 2, 25% completed; QTPR #3 50% completed; QTPR #4 60% completed; QTPR #5, 95% completed).

The gas flow rate, the temperature requirements of the thin film for gas detection, and the sensing electrodes drive voltage to measure low level currents, were discussed with SRI. Labview programming continued for control and data acquisition. Labview was used to measure a simulated 100 nano-amps via the GPIB bus of the Keithly 485 pico-ammeter.

- B. Generate engineering drawings (QTPR # 2; 20% completed, QTPR #3, 30% completed, QTPR #4 30% completed; QTPR #5 30% completed).
- C. Generate and revise the layouts for printed circuit board fabrication (QTPR #1, 90% completed; QTPR # 2, 100% complete).
- D. Build five prototypes for bench testing. (QTPR #2, 0% completed; QTPR #3, 0% completed), (to be started Quarter #7).
- E. Purchase, builds, and test the gas delivery system. (QTPR #1, 20% completed; QTPR #2, 50% completed; QTPR #3, 50% completed; QTPR #4, 80% completed), (to be completed quarter #5).

The design and fabrication of the gas detection chamber by a precision machine shop, was completed. The chamber is large enough to contain one mounted sensor. The design included several external wire-leads for connection to the sensor under test. The detection chamber was pressurized with 10 psi of air, and tested for gas leaks. The design of the o-ring seal was accomplished with the support of Parker.

The gas dilution system included an aluminum panel mounted with three flow meters for air, nitrogen and refrigerant gases, was built. The gas dilution system will be used in its current state to test the sensors, but it will be modified to complete other tests. Swagelock connectors were used to couple the various links of copper tubing. Three pressure released-valves were calibrated and tested. The design of the gas dilution system was finalized.

Task 3. Testing and data analysis

- A. Test sensors (QTPR #2, 0% ; QTPR #3, 0%; QTPR #4, 0%), (to be started quarter #6)
- B. Test 5 instrumentation (QTPR #2, 0%; QTPR #3, 0%; QTPR #4, 0%), (to be started Quarter # 7).

Task 4. Reporting

QTPR #1, 10/15/98; QTPR #2, 1/25/99; QTPR #3, 4/24/99; QTPR #4, 7/21/99; QTPR #5 10/27/99.

Task 5. Business, Marketing, and Patent (Not Funded)

EQUIPMENT
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<u>Item</u>	<u>Description</u>	<u>Quote 6/16/98</u>	<u>Cost</u>	<u>Variance</u>	<u>Comment</u>
8.	Lab supplies	600.00	891.48a	1,234.91	Other items required
13.	Leak Std Yokogawa	1,348.00	b		
14.	Gas testing fixture	1,500.00	428.56a	1,457.80	Partial
15.	Gases-refrig, others	1,400.00	42.88	(688.32)	Partial
		<u>\$4,848.00</u>	<u>\$1,362.92</u>	<u>\$2,004.39</u>	

Notes:

- a. Items purchased for project were paid with non-project funds. \$1,252.43 will be reimbursed this quarter to Micronic. \$846.39 charged to American Express + \$406.04 paid by check, for a total of \$1,252.43.
- a. Item 13, to be purchased next quarter or gas system redesigned with additional hardware, to facilitate testing of sensor with instrument.

STATEMENT
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<u>DESCRIPTION</u>	<u>PROG. MGT</u>	<u>DIR. LABOR</u>	<u>SUBCONT.</u>	<u>TOTAL</u>
Federal share	1,362.92	6,491.82	12,237.90	\$20,092.64
Disbursement	1,362.92	6,491.82	11,771.69	\$19,626.43

Notes:

1. Direct Labor

Draw based on funded amount.

Project period (7/1/99 to 9/30/99) ...\$10,120.85...410.0hrs @ \$24.685 ...
2208 hr.(see below) – 1164 hr. (funded) = 544 hr. not funded.

2. Subcontract (SRI Int.) ... \$466.21 underbudget.

DIRECT LABOR HOURS

Based on 32hrs. / Week for 52 weeks or 1664 hr. ...extended 1 year.

Estimated additional direct labor ...May 1999 to April 2000 ... 12 months @ 132 hr./ month = 1584 hr.
@ \$24.685 = \$39,101.04 (not funded).

	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov</u>	<u>Dec</u>
Timetable	136	144	152	136	152	144	136	160
Actual	<u>46</u>	<u>109</u>	<u>119.5</u>	<u>102</u>	<u>174</u>	<u>172</u>	<u>136</u>	<u>220</u>
Cumulative	-90	-125	-157.5	-191.5	-169.5	-141.5	-141.5	-81.5

	<u>Jan</u>	<u>Feb</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug</u>
Timetable	136	136	136	(136)	(132)	(136)	(140)	(144)
Actual	<u>136.5</u>	<u>84</u>	<u>143</u>	<u>134</u>	<u>117</u>	<u>106</u>	<u>120</u>	<u>137</u>
Cumulative	-81.0	-133.0	-126.0	+8	+125	+231	+351	+488

	<u>Sep</u>	Total
Timetable	(153)	
Actual	<u>152</u>	2208
Cumulative	+640	