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Quarterly Technical Progress Report

October 15, 1998

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

DE-FG36-98GO10301

Period: 5/01/98 to 10/15/98

DOE/GO/10301--T1

Introduction

The project comprises of three main tasks. They are (1) Develop, design, and fabricate (20) sensors, (2) Develop, design, and fabricate (5) test instruments, (3) Testing and data analysis. The milestone includes 17 sub-tasks for the 52-weeks project period, starting on May 1, 1998 and ending on April 30, 1999.

As stated in the Application for Federal Assistance, Micronic intended to relocate to a new office by June of 1998. This decision was delayed, since the first partial payment was transferred on August 12, 1998. Micronic plans to relocate this November.

A second Provisional Application for a US patent has been filed.

Task 1. Develop, design, and fabricate (20) sensors

A. Finalize design sensor objective with SRI Int. and generate purchase order (Completed)

Micronic and SRI International have entered into a Non-Disclosure Agreement. Micronic issued a Purchase Order on May 26, 1988 to SRI International for \$39,990.39 to develop, design, and fabricate 20 sensors in a 6-month period. Literature and patent searches were performed to finalize the design of the sensor.

B. Develop, design and fabricate 20 sensors by SRI Inter. (50% Completed) (photograph and 2 samples enclosed for Elliott Levine)

SRI International has successfully completed the patterning of the interdigitated electrodes, the heater, and the temperature sensor. They are all made of a thin film of platinum, and deposited on the top surface of the sensor. Currently, they are evaluating the function of the heater, the electrode pair, and the temperature sensor. Lead phthalocyanine will then be deposited by the Langmuir-Blodgett method to complete sensor. The sensors will then be mounted on a header.

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

A. Purchase equipment (see attached list) (about 60% completed)

The following items were purchased: 1, 3, 4, 5, 6, 7, 8(partial), 9, 10, 12.

The following items will be purchased this quarter: 8(partial), 11, 13, 14, 15, 16(partial)

The following items will be purchased next quarter: 16(partial)

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B. Evaluate components, breadboard and simulate circuit. Purchase and test measurement system. (40% completed...avg., a, b,c,d)

a. Evaluate components ...100%

The power supply consists of a low noise and low dropout regulator, the LP2985. This will increase the battery life. The negative supply consists of a switching capacitor inverter and regulator, the LT1054. Switching regulators are not typically used in low noise circuits, however the LT1054 has been used in 14-bit circuit. A shunt regulator, the TL431 was selected as the power supply for the digital circuit, including the microcontroller. The low power microcontroller selected was the PIC 16C72 with 2K bytes of program memory and 128 bytes of RAM memory. This Risc type processor is available as an inexpensive one time programmable microcontroller, and an EPROM and mask version. The microcontroller also consists of an 8 channel 8-bit analog to digital converter. Initially, one channel will be used for the sensor current, the other for temperature measurement, using the built-in temperature sensor of the gas sensor. The heater will be driven by a regulated current source, comprising of one transistor. The platinum temperature sensor is one leg of a full bridge circuit driven by a voltage source. The amplifier selected for the temperature measurement is an instrumentation amplifier; the AD620, followed by a R/C low pass filter. Samples of all integrated circuits were obtained from the various manufacturers.

b. Breadboard circuit ...0%

c. Simulate circuit ...20%

A spice model of the sensor was made with ICAP4. The preamplifier circuit consists of an ultra low input current noise, and low voltage noise and power amplifier, the LMC6001. The opamp is inexpensive. The next stage is an anti-aliasing 4 pole Butterworth low pass filter. The opamp LT1012 was selected for the filter. A program by Burr-Brown was used to select the component values of the low pass filter. The ICAP4 program will then be used to simulate the response and validate the design.

d. Purchase and test measurement system ...(20% completed)

Labview software, an IEEE-488 card and cables were purchased from National Instrument for the data acquisition system. System requirements were finalized, including the requirement for a 12-bit analog to digital converter card for the temperature measurements of the sensor.

C. Purchase, build, and test dynamic gas-testing fixture. Machine gas detection chamber. (20% completed)

The refrigerant gases, the two stage regulators, and flowmeters will be purchased from AirProducts. The fittings will be purchased from Swagelock. The design of the gas delivery system is complete.

C. Layout printed circuit board. (90% completed)

The layout of the double-sided board included partitioning of the board into analog and digital sections. The analog and digital grounds are joined at one point. The power supplies are decoupled and isolated. Both surface mounts and dual in line packages are used.

D. Test assembler and emulator (80% completed)

The emulator was tested with a small test board. The object code for the PIC16C72 was transferred to the emulator, the registers were modified, and break points were set.

E. Quarterly report (n/a)

F. Design, build, and test 2 bench prototypes. Optimize design, simulate, and validate circuit. (15% completed).

The circuit and printed circuit board design are nearly completed. The two printed circuit board will be fabricated in about 2 weeks. The circuit includes an 8-channel 8-bit analog to digital converter built-in the pic microcontroller. The circuit will be upgraded with a 12-bit analog to digital converter chip, the LTC1404. The circuit is designed for battery application.

G. Write preliminary code (0% completed)

H. Quarterly report 2 (completed).

Task 3. Testing and analysis of data

(Tasks are to be performed next quarter)

EQUIPMENT
October 15, 1998

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Period: 5/01/98 to 10/15/98

<u>Item</u>	<u>Description</u>	<u>Quote 6/16/98</u>	<u>Cost</u>	<u>Variance</u>	<u>Comments</u>
1.	Analog scope	1,665.00	1665.00	0	
2.	Computer	0	0	0	
3.	Picoammeter	1,249.00	1,257.50	8.50	S/H cost
4.	IEEE488 card	590.00	681.50	91.50	S/H cost, 2 cables
5.	Nat.Inst. Labview	995.00	1,001.50	6.50	S/H cost
6.	Keithly voltmeter	995.00	1,003.50	8.50	S/H cost
7.	Adv.Trans. emulator	887.00	887.00	0	
8.	Lab supplies	600.00	864.16a	264.16	Other items required
9.	PCB softw. Cadsoft	1,212.00	1,279.42	67.42	Fl sales tax
10.	Circuit Sim. ICAP4V	4,143.50	3,574.42	(569.08)	Sale price
11.	SRS LCR meter	1,595.00	b		
12.	HP power supply	498.15	498.15	0	
13.	Leak Std Yokogawa	1,348.00	c		
14.	Gas testing fixture	1,500.00	b		
15.	Gases-refrig,others	1,400.00	b		
16.	PCB fabrication	600.00	d		
		<u>\$16,729.65</u>	<u>\$12,712.15</u>	<u>(\$ 122.00)</u>	

Notes:

- a. Additional supplies will be needed, this and next quarter, including a solder gun for standard and surface mount integrated circuits (\$300), and a 12-bit data acquisition board and software (\$145 + \$98.00 +S/H). These items were not included in RFAR SF-270 No.001 for the period 5/01/98 to 7/31/98.
- b. Items 11, 14, 15 were not purchased in the period from 5/01/98 to 7/31/98, since initial funds were transferred on 8/12/98. They will be purchased within a month.
- c. Item 13, funds will be requested for this period, 8/01/98 to 12/31/98...SF-270 No. 002.
- d. Item 16, funds will be requested for this period, 8/01/98 to 12/31/98, and next, for fabrication of printed circuit boards.
- e. Items 3,4,5,6,12 were recently purchased. Items 3, 6 were prepaid. Items 4,5,12 were paid by my American Express Corporate Card. This affect the Net Cash In Hand since the check for items 3, 6 amounting to \$2,261.00 has not been debited to my project account. Further, items 4,5,12 will be billed by American Express in about 30 days.

STATEMENT
October 15, 1998

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<u>DESCRIPTION</u>	<u>PROG. MGT</u>	<u>DIR. LABOR</u>	<u>SUBCONT.</u>	<u>TOTAL</u>
Federal share	16,729.65	9,084.08	18,000.00	\$43,813.73
Disbursement	12,712.15	6,676.03	10,920.09	\$30,308.27

Notes:

1. Program management

Total project (5/01/98 to 4/30/99) ... \$18,932.00
Project period (5/01/98 to 7/31/98) ... \$16,729.65 ...SF-270 No.001

2. Direct Labor

Project period (5/01/98 to 7/31/98) ...\$6,676.03 ... 274.5 hrs @ \$24.685.
The project is behind schedule 150.5 hrs. for the period (5/01/98 to 10/15/98), since initial funds were transferred on 8/12/98.
Project period (8/01/98 to 10/15/98), accrued hours will be included in SF-270 No.002.

3. Subcontractor

SRI International has not billed Micronic for the period of (9/06/98 to 10/05/98).
This amount is expected to be about \$8,000, including the cost of photomasks.

DIRECT LABOR HOURS

5/01/98 to 10/15/98

Based on 32hrs. /week for 52 weeks or 1664 hrs.

	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>
Timetable	136	144	152	136	152	144
Actual	<u>46</u>	<u>109</u>	<u>119.5</u>	<u>102</u>	<u>174</u>	<u>198*</u>
Cumulative	-90	-125	-157.5	-191.5	-169.5	-115.5

*Projected hours for October 1998; actual is 91 hrs. from 10/01 to 10/15.

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