

Infrared Telemetrics
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March 15, 2017

Defense Technical Information Center
Attn: DTIC-O
8725 John J Klingman Rd
Fort Belvoir, VA 22060-6218

Dear DTIC-O:

Enclosed please find two (2) copies of Infrared Telemetrics's Summary Report (A003 – Topic A16-084) for Contract No. W56HZV-16-C-0149. The report includes the following documents:

- a) Form DD1423
- b) Standard Form 298
- c) Summary Report

Also, please find two (2) copies of Infrared Telemetrics's Final Technical Report (0001AC – Topic A16-084) for Contract No. W56HZV-16-C-0149. The report includes the following documents:

- d) Form DD1423
- e) Standard Form 298
- f) Final Technical Report

If you have any questions, please contact us.

Thank you for your attention.

Sincerely,

A handwritten signature in dark ink, appearing to read "Glen L. Barna". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Glen L. Barna

CONTRACT DATA REQUIREMENTS LIST (2 Data Items)						Form Approved OMB No. 0704-0188	
The public reporting burden for this collection of information is estimated to average 220 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to the Department of Defense, Executive Services Directorate (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please do not return your form to the above organization. Send completed form to the Government Issuing Contracting Officer for the Contract/PR No. listed in Block E.							
A. CONTRACT LINE ITEM NO. 0002		B. EXHIBIT A		C. CATEGORY: TDP _____ TM _____ OTHER <u>Reports</u>			
D. SYSTEM/ITEM See Item 16		E. CONTRACT/PR NO. W56HZV-16-C-0149		F. CONTRACTOR Infrared Telemetrics Inc			
1. DATA ITEM NO. A001	2. TITLE OF DATA ITEM Research and Development (R&D) Project Summary			3. SUBTITLE Summary Report			
4. AUTHORITY (Data Acquisition Document No.) See Item 16		5. CONTRACT REFERENCE C.6		6. REQUIRING OFFICE See Item 16			
7. DD 250 REQ DD	9. DIST STATEMENT REQUIRED A	10. FREQUENCY See Item 16	12. DATE OF FIRST SUBMISSION See Item 16	14. DISTRIBUTION			
8. APP CODE A		11. AS OF DATE 09/16/2016	13. DATE OF SUBSEQUENT SUBMISSION See Item 16	a. ADDRESSEE		b. COPIES	
						Draft	Final
						Reg	Repro
16. REMARKS Item D: High Speed Surface Thermocouples Interface to Wireless Transmitters Item 6: Eric Gingrich, MS-121 RDECOM-TARDEC-RTI-GVPM Item 14, Recipient Destinations: Include completed DD Form 1423-2 and Standard Form 298 with each report submission. - Eric Gingrich: eric.m.gingrich.civ@mail.mil - David Patti: david.m.patti4.civ@mail.mil - Russell Robinson, ACO: russell.robinson@dcma.mil - DTIC (mail 2 hardcopies): Defense Technical Information Center, Attn: DTIC-O 8725 John J Klingman Rd, Fort Belvoir, VA 22060-6218 - The final SBIR Phase I R&D Project Summary Report shall be submitted at http://portal.armysbir.army.mil/SmallBusinessPortal/Default.aspx 16a. The contractor shall electronically submit meeting minutes to the COR within seven (7) days of the Start-of-Work meeting and all subsequent review meetings. 16b. The COR is responsible for accepting or rejecting the meeting minutes.				Eric Gingrich, COR		1	
				David Patti		1	
				Russell Robinson, ACO		1	
				DTIC		2	
				Small Business Portal		1	
				15. TOTAL		0	6
1. DATA ITEM NO. A003		2. TITLE OF DATA ITEM Report, Record of Meeting Minutes		3. SUBTITLE Meeting Minutes			
4. AUTHORITY (Data Acquisition Document No.) DI-ADMN-81505 (20 NOV 1995)		5. CONTRACT REFERENCE C.3.2		6. REQUIRING OFFICE RDTA-RTI			
7. DD 250 REQ DD	9. DIST STATEMENT REQUIRED	10. FREQUENCY After each meeting	12. DATE OF FIRST SUBMISSION 03/15/2017	14. DISTRIBUTION			
8. APP CODE N/A		11. AS OF DATE 09/16/2016	13. DATE OF SUBSEQUENT SUBMISSION	a. ADDRESSEE		b. COPIES	
						Draft	Final
						Reg	Repro
16. REMARKS 14. Submit reports electronically to the e-mail address shown immediately below: Eric Gingrich, Contracting Officer's Representative (COR) eric.m.gingrich.civ@mail.mil 15. Total: One copy to addressee listed in block 14. 16a. The contractor shall submit meeting minutes to the COR within seven (7) days of the Start-of-Work meeting and all subsequent review meetings. The minutes will include, but are not limited to, the agenda, meeting content, and action items. The contractor shall submit the minutes electronically. 16b. Complete the reports IAW DI-ADMN-81505, Report, Record of Meeting Minutes. The COR is responsible for accepting or rejecting the meeting minutes.				Eric Gingrich, COR		1	
				15. TOTAL		0	1
G. PREPARED BY Glen Barna Glen L. Barna		H. DATE 03/15/2017		I. APPROVED BY Glen Barna Glen L. Barna		J. DATE 03/15/2017	

17. PRICE GROUP N/A
18. ESTIMATED TOTAL PRICE

17. PRICE GROUP N/A
18. ESTIMATED TOTAL PRICE

REPORT DOCUMENTATION PAGE					Form Approved OMB No. 0704-0188	
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1. REPORT DATE (DD-MM-YYYY) 03/15/2017		2. REPORT TYPE Research and Development (R&D) Project Summary			3. DATES COVERED (From - To) 09/16/2016 - 03/15/2017	
4. TITLE AND SUBTITLE High Speed Surface Thermocouples Interface to Wireless Transmitters				5a. CONTRACT NUMBER W56HZV-16-C-0149		
				5b. GRANT NUMBER		
				5c. PROGRAM ELEMENT NUMBER		
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6. AUTHOR(S) BARNA, GLEN KEMPPAINEN, DANIEL				5e. TASK NUMBER		
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9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) US Army Tank-automotive Research Development & Engineering Center Warren, Michigan 48397-5000					10. SPONSOR/MONITOR'S ACRONYM(S) TARDEC	
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12. DISTRIBUTION/AVAILABILITY STATEMENT						
13. SUPPLEMENTARY NOTES Report developed under SBIR contract for topic A16-084.						
14. ABSTRACT Project Summary. This document contains a short overall project summary suitable for public distribution.						
15. SUBJECT TERMS thermocouple: two dissimilar metal wires connected to form a circuit, such that when heating the point where the wires connect, the wires produce a voltage per the Seebeck effect. Specifically, the speed of response of that heated junction is being investigated.						
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON	
a. REPORT	b. ABSTRACT	c. THIS PAGE			GLEN BARNA	
U	U	U	UU	4	19b. TELEPHONE NUMBER (Include area code) (906) 482-0012	

INSTRUCTIONS FOR COMPLETING SF 298

1. REPORT DATE. Full publication date, including day, month, if available. Must cite at least the year and be Year 2000 compliant, e.g. 30-06-1998; xx-06-1998; xx-xx-1998.

2. REPORT TYPE. State the type of report, such as final, technical, interim, memorandum, master's thesis, progress, quarterly, research, special, group study, etc.

3. DATE COVERED. Indicate the time during which the work was performed and the report was written, e.g., Jun 1997 - Jun 1998; 1-10 Jun 1996; May - Nov 1998; Nov 1998.

4. TITLE. Enter title and subtitle with volume number and part number, if applicable. On classified documents, enter the title classification in parentheses.

5a. CONTRACT NUMBER. Enter all contract numbers as they appear in the report, e.g. F33315-86-C-5169.

5b. GRANT NUMBER. Enter all grant numbers as they appear in the report. e.g. AFOSR-82-1234.

5c. PROGRAM ELEMENT NUMBER. Enter all program element numbers as they appear in the report, e.g. 61101A.

5e. TASK NUMBER. Enter all task numbers as they appear in the report, e.g. 05; RF0330201; T4112.

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14. ABSTRACT. A brief (approximately 200 words) factual summary of the most significant information.

15. SUBJECT TERMS. Key words or phrases identifying major concepts in the report.

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Report Type:	SBIR Phase I Final	Topic Number:	A16-084
Report Date:	March 15, 2017	Contract Number:	W56HZV-16-C-0149
Performance Period:	September 16, 2016 – March 15, 2017	Award Amount:	\$99,368.85

Sponsoring Agency:

US Army Tank-Automotive Research Development & Engineering Center (TARDEC)
Warren, Michigan 48397-5000

Title

High Speed Surface Thermocouple Interface to Wireless Transmitters

Summary of Phase I Results

The purpose of this SBIR was to determine which type of thermocouple junction construction responded most quickly to a standard, constant input created by a pulse from a laser.

A complete plot of the results of each type of test appears in Figure 1.

The conclusion was that nearly all of the junctions tested were fast enough to respond to a surface temperature change on the crown of a diesel piston.

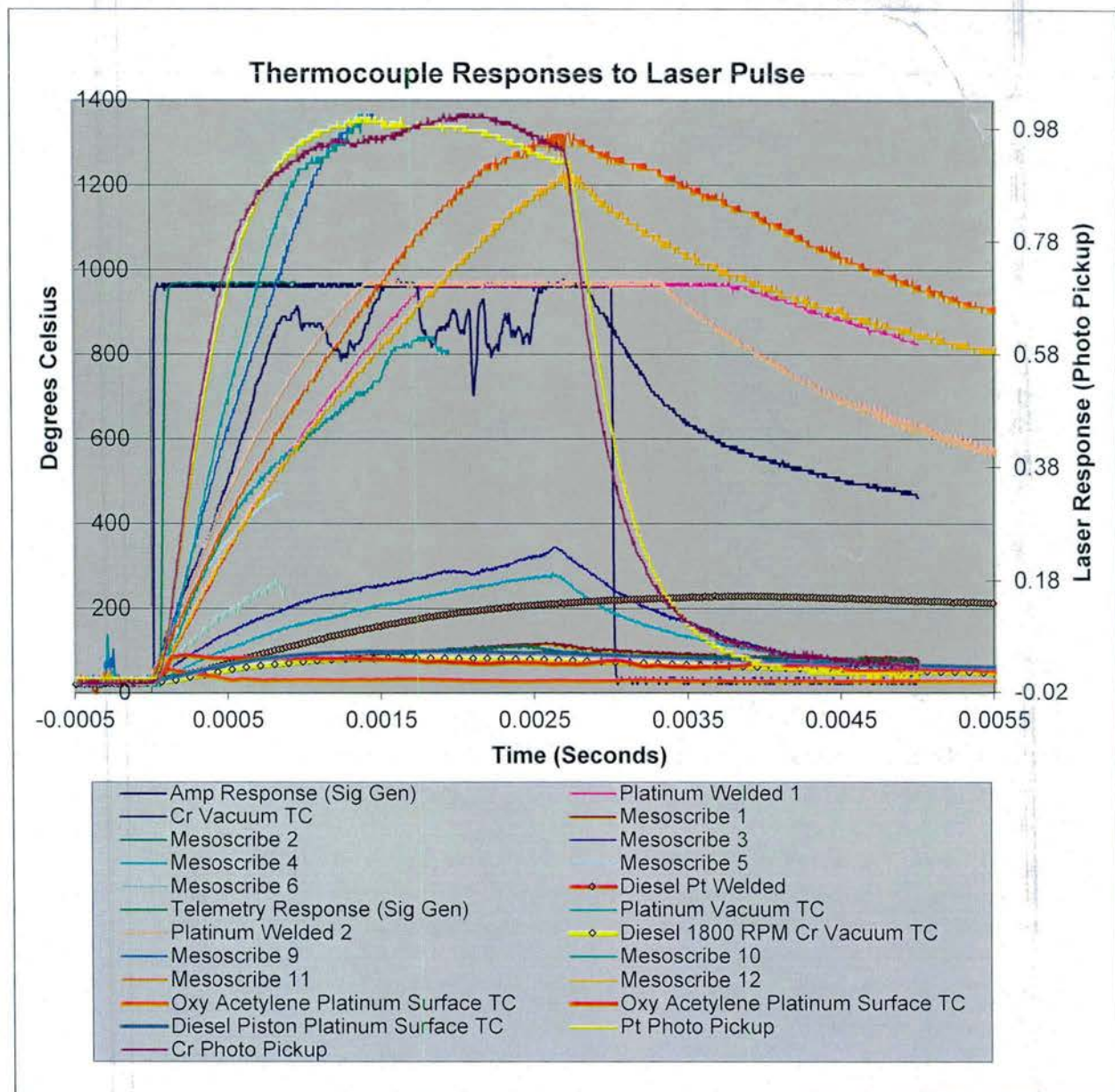


Figure 1. Overall Comparisons: Thermocouple Responses to Laser Pulse

Description of the Technology Being Developed

Infrared Telemetrics (IRT) tested various types of thermocouple junctions to determine which type detected a temperature change the fastest. The circuit construction types were:

1. Various types of MesoScribe K-type plasma-printed thermocouples;
2. Michigan Technological University chrome vacuum deposition junction on a J-type thermocouple;
3. MTU platinum vacuum deposition junction on a J-type thermocouple; and
4. IRT platinum welded junction on a J-type thermocouple. IRT used a laser welder to create the platinum junction.

The environment for the tests had to be accurately reproducible from thermocouple to thermocouple. IRT used the laser welder to provide this environment. The machine was set to a

specific energy density, duration, and focus. Each thermocouple junction was tested with a laser pulse at that constant setting. See Figure 1 for the test results.

The Anticipated DoD and Non-DOD Customer

The accurate measurement of thermocouple data will prove to be a valuable diagnostic tool in any extreme temperature environment. The thermocouple captures temperature changes, in locations that are inaccessible, at the crucial moments in the process to the engineer, scientist, artist, mechanic, or technician. Here is a partial list of potential customers, their needs, and the implementation.

Below is a partial list of potential customers for this technology.

Customer	Measurement Collection Location
Manufacturers of gasoline or diesel engines, automobiles, farm and mining equipment, aircrafts, spacecrafts, helicopters, rockets, and motorcycles. A very partial list of manufacturers includes BMW, Boeing, Briggs and Stratton, Caterpillar, Chrysler, Cummins, Ford, GM, Harley-Davidson, Honda, John Deere, NASA, Perkins, Volkswagen, and Volvo. Shops servicing the products of the above manufacturers may also find the temperature information useful.	In the engine: on the crown of pistons, torque converters, or other high-temperature locations On portable devices that can be left or installed at key locations within the engine
Manufacturers of stoves, ovens, furnaces, boilers, refrigerators, and freezers. Shops servicing the products of the above manufacturers.	Measure hot or cold temperatures inside the appliance, both in the destination compartment, and in the machinery generating the temperature for the destination compartment.
Manufacturers of snowmobiles, snow blowers, Zambonis, space machines, satellites. Shops servicing the products of the above manufacturers.	Measure cold temperatures inside motors and engines, or virtually anywhere
Electric power plants	Inside the mechanisms producing the power
Kiln manufacturers, artists	Inside a kiln, to measure and transmit the temperature
Volcanologists and geologists	Inside volcanos, geysers, hot springs, magma, or other geothermal environment
Oceanographers	Inside underwater steam vents to measure temperature Or use a manometer to measure pressure at depth
Astrophysicists and astronomers	On asteroids, meteors, moons, planets, or in the coronas of stars

Plans to Transition this SBIR Technology to the Customer

Marketing companies will present the high-speed thermocouple products to potential customers. Advertising venues include:

- Creating a demo video to show the potential of the thermocouples
- Trade shows

- Web site
- Facebook page
- Magazine ads

The Anticipated Application/Benefits for The Government and/or Private Sector Use

Being able to measure high-speed surface temperatures in hostile environments where wireless transmission of the data may be required will be an enormous help to engineers, scientists, and other professionals. This device aids in product development, failure analysis, and research and development work.

Images Depicting the Developed Technology

See Figure 2 for a photo containing both a MesoScribe sample thermocouple, and an IRT thermocouple.

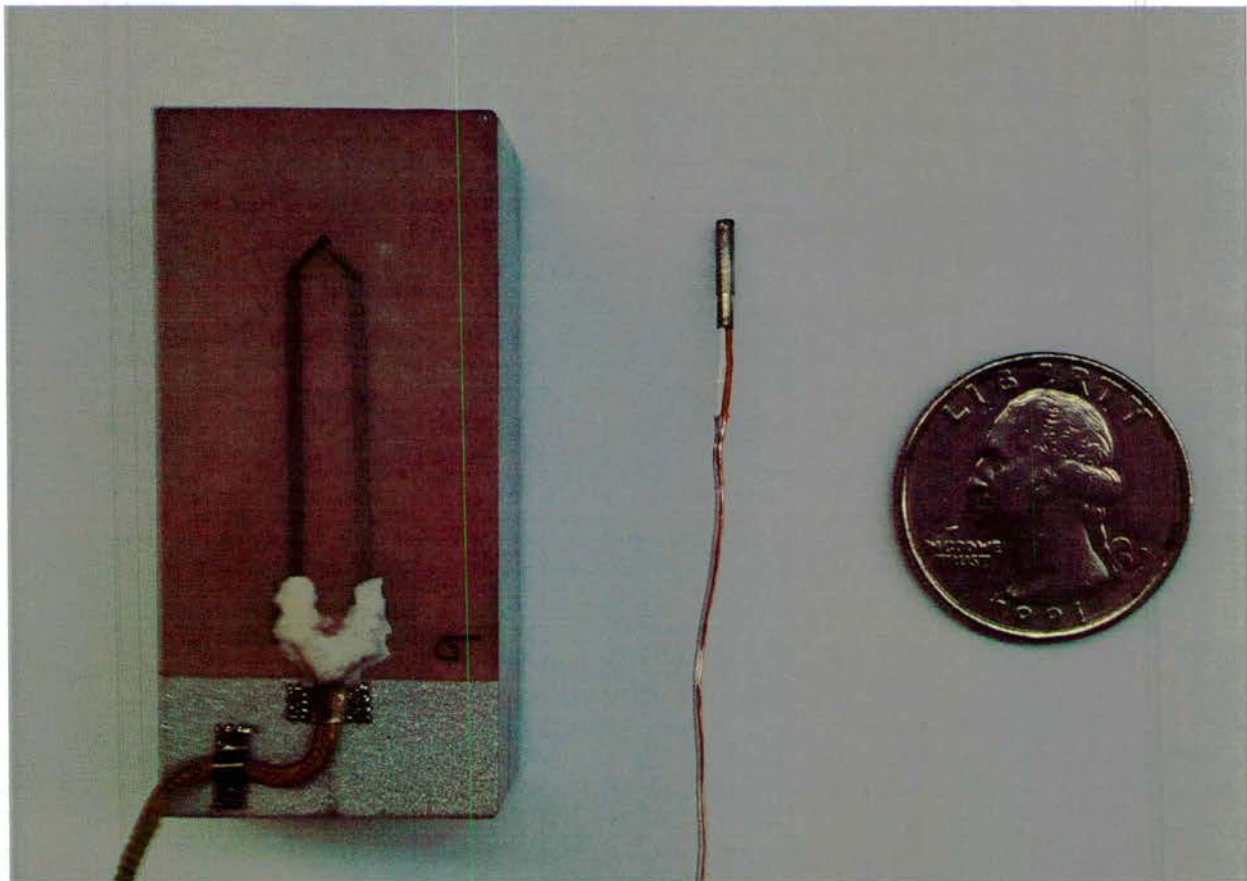


Figure 2. MesoScribe (left) and IRT Thermocouples

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