



<b>CONTINUATION SHEET</b>	<b>Reference No. of Document Being Continued</b> <b>PIIN/SIIN</b> W56HZV-04-P-1007 <b>MOD/AMD</b> P00001	<b>Page</b> 2 <b>of</b> 6
<b>Name of Offeror or Contractor:</b> ROCHESTER INSTITUTE OF TECHNOLOGY		

SUPPLEMENTAL INFORMATION

1. Modification P00001 adds the requirement for test and evaluation of 8 sets of prototype planetary gears and gear pins. As a result of this action, the contract is modified as follows:
  - a. CLIN 0001AB is added to the contract in the amount of \$20,800 to fund the cost of the test.
  - b. New paragraph C.2.6 adds the prototype testing requirement to the contract.
  - c. Section G is revised to add the appropriations data for CLIN 0001AB.
2. As a result of this action the total contract amount is increased by \$20,800 from \$38,981 to \$59,781. All other terms and conditions of the contract are unchanged.

\*\*\* END OF NARRATIVE A 001 \*\*\*

CONTINUATION SHEET

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 PIIN/SIIN W56HZV-04-P-1007 MOD/AMD P00001

Name of Offeror or Contractor: ROCHESTER INSTITUTE OF TECHNOLOGY

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT										
0001AB	<p>SUPPLIES OR SERVICES AND PRICES/COSTS</p> <p><u>SERVICES LINE ITEM</u></p> <p>NOUN: PLANETARY PROTOTYPE TEST                      PRON: T142T5814K PRON AMD: 01 ACRN: AB                      CUSTOMER ORDER NO: M9545004MPR4BY3</p> <p><u>Inspection and Acceptance</u>                      INSPECTION: Destination ACCEPTANCE: Destination</p> <p><u>Deliveries or Performance</u></p> <table border="0"> <tr> <td>DLVR SCH</td> <td>PERF COMPL</td> </tr> <tr> <td><u>REL CD</u></td> <td><u>QUANTITY</u></td> </tr> <tr> <td>001</td> <td>0</td> </tr> <tr> <td></td> <td><u>DATE</u></td> </tr> <tr> <td></td> <td>30-DEC-2004</td> </tr> </table> <p style="text-align: right;">\$ 20,800.00</p>	DLVR SCH	PERF COMPL	<u>REL CD</u>	<u>QUANTITY</u>	001	0		<u>DATE</u>		30-DEC-2004				<p>\$ 20,800.00</p>
DLVR SCH	PERF COMPL														
<u>REL CD</u>	<u>QUANTITY</u>														
001	0														
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MOD/AMD P00001

**Name of Offeror or Contractor:** ROCHESTER INSTITUTE OF TECHNOLOGY

## DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

C.1 BACKGROUND: The Contractor, Rochester Institute of Technology, has a grant through the Office of Naval Research to apply Asset Health Management (AHM) technology to USMC fleet of Light Armored Vehicles (LAVs) in order to develop diagnostic (current health) and prognostic (predictive) capabilities to extend the useful life and reduce maintenance manpower. The USMC has identified the LAV planetary drives as a top performance degrader and candidate for AHM technology. Due to the high failure rate on the planetaries and the critical effect of the failure on the function of the vehicle, the USMC has implemented an operating procedure requiring periodic stops and manual inspection of the oil sight glass and temperature of each planetary. The purpose of this effort is to define the failure modes and assess if they can be monitored automatically by an on-board system.

C.2 STATEMENT OF WORK: The contractor shall identify the primary and secondary failure modes for the planetary drives by: interviewing vehicle maintainers; reviewing the fleet investigation performed by Naval Surface Warfare Center - Carderock, failure analysis of failed planetaries; and failure modes effect analyses. The contractor shall perform the following tests and address the results in its final report:

C.2.1 OIL COMPARISON: The objective is to determine what, if any, reduction in planetary operating temperatures and vibration might result from using a high-grade synthetic lubricant.

- a) Run a high-load test on two healthy planetaries while recording vibration and temperature vs. time, for however long it takes their temperatures to stabilize.
- b) Drain the oil out of one gearset and replace it's oil with a group 4 synthetic.
- c) Drain the oil out of the other gearset and replace with fresh, standard mineral oil.
- d) Re-run the high-load test

C.2.2. TEMPERATURE MEASUREMENT OPTIONS: The objective is to determine if external-mount temperature detection is feasible for this application and to determine the influence of brake actuation on planetary temperature.

- a) Temporarily install thermocouples on the external stationary surfaces of the planetary/hub assembly on one front and one rear wheel.
- b) Tap into the brake lights to provide a "brake on" signal for data collection
- c) Connect RIT internal vent-line TC probes to NSWC data collection computer
- d) Run the vehicle over a variety of operating conditions as possible (incremental steps from low to high speed, braking, turning, continuous acceleration to high speed, coast downs, where possible, traversing different terrain.

C.2.3 DYNAMOMETER VIBRATION TESTING: The objective is to determine vibration signatures of both healthy and damaged planetary components. Determine vibration-temperature relationships.

- a) Instrument the planetaries on the dyno with 3-axis accelerometers.
- b) Connect RIT TC probes and RPM counter to NSWC data collection computer
- c) Run the planetaries under a variety of speeds and loads while collecting simultaneous temperature and vibration data
- d) Repeat step (c) after inserting faults:
  - i) low oil;
  - ii) inner/outer bearing
  - iii) thrust bearing (if separate)
  - iv) planet gear bushing - loose clearance
  - v) planet gear bushing - tight clearance

C.2.4 ON-VEHICLE VIBRATION TESTING: The objective is to determine the vibration baseline of a planetary gearset on the vehicle; determine how temperature, steering, and braking influences the vibration signature; and determine to what extent driveline noise interferes with the planetary vibration signature.

- a) Install 3 axis accelerometers on planetary gearsets on the vehicle. At least one steering and one non-steering planetary should be instrumented.
- b) Tap into the brake lights to provide a "brake on" signal for data collection
- c) Connect RIT internal TC probes to NSWC data collection computer
- d) Run the vehicle over a variety of operating conditions (incremental steps from low to high speed, braking, turning, continuous acceleration to high speed, coast downs, where possible, traversing different terrain, etc)

C.2.5 FINAL REPORT: The Contractor shall submit a final report to PM-LAV @ SimekM@acom.army.mil within 60 days of contract award. The report shall identify the primary and secondary failure modes for the planetary drives and address each of the test objectives outlined in paragraphs C.2.1 through C.2.4 above. The report shall be in the contractor's format.

C.2.6 Planetary Gear/Gear Pin Analysis: The Contractor shall conduct a comparative test and evaluation of eight (8) prototype planetary gears and gear pins. The comparison is to the baseline USMC LAV configuration.

- a. Determine the maximum operating temperature for the prototype planetary gears and gear pins.
- b. Determine the failure mode for the planetary wheel drives with prototype planetary gear and gear pins.
- c. Document area for improvement and reverse engineering of the planetary wheel drives.
- d. The Contractor shall provide the test results and analysis to PM-LAV upon completion.

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CONTRACT ADMINISTRATION DATA

LINE	PRON/ AMS CD/ <u>ITEM</u> <u>MIPR</u>	<u>ACRN</u>	<u>OBLG STAT/</u> <u>JOB ORD NO</u>	<u>PRIOR AMOUNT</u>	<u>INCREASE/DECREASE</u> <u>AMOUNT</u>	<u>CUMULATIVE</u> <u>AMOUNT</u>
0001AB	T142T5814K M9545004MPR4BY3	AB	2	\$ 0.00	\$ 20,800.00	\$ 20,800.00
				NET CHANGE	\$ 20,800.00	

<u>SERVICE</u> <u>NAME</u>	<u>NET CHANGE</u> <u>BY ACRN</u>	<u>ACCOUNTING CLASSIFICATION</u>	<u>ACCOUNTING</u> <u>STATION</u>	<u>INCREASE/DECREASE</u> <u>AMOUNT</u>
Marine Corps	AB	17 451319M7KE2506785400674432DC1555B00004MPR4BY3		\$ 20,800.00
				NET CHANGE \$ 20,800.00

	<u>PRIOR AMOUNT</u> <u>OF AWARD</u>	<u>INCREASE/DECREASE</u> <u>AMOUNT</u>	<u>CUMULATIVE</u> <u>OBLIG AMT</u>
NET CHANGE FOR AWARD:	\$ 38,981.00	\$ 20,800.00	\$ 59,781.00