LIQUEFIED METAL JET PROGRAM
AUTOMATION AND ROBOTICS RESEARCH INSTITUTE (ARRI)

R&D QUARTERLY STATUS REPORT

REPORTING PERIOD: 15 January 1995 THROUGH 15 April 1995

Sponsored by:

Advanced Research Projects Agency (ARPA)
Contract Management Office (CMO)
Liquefied Metal Jet Program (LMJP)

ARPA Order No. 9328/03

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This report covers the period from 15 January 1995 through 15 April 1995. Nozzle problems have delayed coupon fabrication on the tin system by over three months. The copper system design is 75% complete. Seventy five percent of program funding has been expended.

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LIQUEFIED METAL JET PROGRAM
AUTOMATION AND ROBOTICS RESEARCH INSTITUTE (ARRI)

R&D QUARTERLY STATUS REPORT
DATA ITEM 0002AA
15 JANUARY 1995 THROUGH 15 APRIL 1995

1.0 INTRODUCTION

This report covers the period from 15 January 1995 through 15 April 1995. The Quarterly Technical Reports are organized by the Statement of Work (SOW) listed in Section 5.0 of the proposal. These are listed as follows:

- Reports and demonstration
- Equipment
- System test and experimentation
- Test coupon evaluation
- Technology transfer.

Test and evaluation of the no lead system has identified a problem with the nozzle design. Technical progress has been delayed resulting in a schedule slip of approximately 3 months. Multiple technical solutions are being pursued. Considerable resources are being placed on this problem. Many of these resources are being provided by non-ARPA funding. The design of the copper system is progressing very well, and the detailed design is 75 percent complete.

2.0 PROGRESS DURING THE REPORTING PERIOD

- Identified and designed several nozzles for evaluation (see Table 1).
- Simple test no lead coupons were produced demonstrating line and single ball capability.
- Identified several new design options to resolve nozzle problems.
- Identified and incorporated solutions for no lead system reliability including the environmental chamber, and material contamination.
    - Redesigned and installed new environmental chamber to improve process reliability.
    - Implemented new material handling procedures to minimize contamination problems.
- Completed conceptual design of copper system and subsystems.
- Completed approximately 75 percent of detailed design of the copper system.
- Ordered long lead copper parts/materials.

3.0 PLANNED ACTIVITIES FOR NEXT REPORTING PERIOD

- In view of the contract extension, cost containment measures are being incorporated to ensure performance to budget over the extended contract. Effective April 1, 1995 a cost reduction of at least 60 percent per month is targeted.
- Produce no lead test coupons for evaluation.
- Continue testing of construction materials for copper system.
- Complete detailed design of Copper System.
- Finish ordering copper system parts.

4.0 EQUIPMENT PURCHASED OR CONSTRUCTED

Assembled/Constructed:

- Long lead materials for copper system..

Purchased

- Contract Engineering - Reavill Engineering.

5.0 NOTIFICATION OF KEY PERSONNEL CHANGES

- Rob Terrill, Texas Instruments, has replaced Elwin Whetsel as TI program manager.

6.0 INFORMATION FROM TRIPS, MEETINGS, AND SPECIAL CONFERENCES

- Program review meeting was held at ARRI by senior management and engineers from Texas Instrument Incorporated. Several issues concerning nozzle design, schedule and costs were identified. Corrections to resolve these issues are being taken..

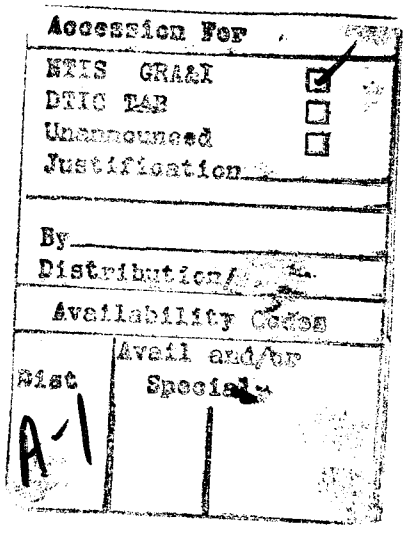

Table 1. Phase II and III Nozzle Options in Evaluation

ORIFICE OPTIONS	PRO	CON	STATUS
Bird Nozzle	1-2% work Easy change Good orifice finish	Expensive Long Lead Tin only 100 minimum	None planned for future use
EDM orifice	Easy No gaskets	Bad finish May not work We make parts	Not planned Hole too rough
Drill orifices	Easy Cheap No Gaskets	Rough hole May not work We make parts	In test
Use larger jeweled orifice	Cheap Good hole Better seal	sealing gaskets May not work We make parts 100 Minimum	On order Design in work
Use existing jewel orifice	Worked once cheap	sealing gaskets we make parts not repeatable	On hold, leaks repeatability
OTT Nozzle 316 SS punch	Work for ink Looks ok for TIn	May not work Copper unknown Made in Japan Long lead time	Prototype parts being made
Diamond wire Die orifice	Draws wire in 0.0005 "	High temp limits on Cu.	In test
Laser drilled orifice	Custom all materials	Bad holes	Not planned Bad finish Rough Hole
Modified GC Type orifice	Custom all materials	May not work No data on finish	Contacted vendors Investigating use

R & D STATUS REPORT
PROGRAM FINANCIAL STATUS
APRIL 1995

		CUMULATIVE TO DATE THRU MARCH 95 $941,112			AT COMPLETION $1,127,684		
WORK BREAKDOWN TASK ELEMENT		PLANNED EXPEND	ACTUAL EXPEND	% COMPLETE	BAC*	LRE**	REMARKS
MANAGEMENT	1.0	98,109	68,442	69.76%	98,109	98,109	
EQUIPMENT	2.0	814,187	807,340	99.16%	814,187	959,713	
SYSTEM TEST & EVAL	3.0	68,789	0	0.00%	68,789	20,855	
SAMPLE EVALUATION	4.0	107,130	0	0.00%	107,130	37,326	
TECHNICAL TRANSFER	5.0	39,469	0	0.00%	39,469	11,681	
SUB-TOTAL		$1,127,684	$875,782	77.66%	$1,127,684	$1,127,684	
FEE		71,470	65,330	91.41%	71,470	71,470	
MANAGEMENT RESERVE UNALLOCATED RESOURCES							
TOTAL		$1,199,154	$941,112	78.48%	$1,199,154	$1,199,154	

*BUDGET AT COMPLETION (BAC) CHANGES ONLY WITH THE AMOUNT OF ANY SCOPE CHANGES. (NOT AFFECTED BY UNDERRUN OR OVERRUN).

**LATEST REVISED ESTIMATE
BASED ON CURRENTLY AUTHORIZED WORK:

(1)	IS CURRENT FUNDING SUFFICIENT FOR THE CURRENT FY? (EXPLAIN IN NARRATIVE IF "NO").	YES
(2)	WHAT IS THE NEXT FISCAL YEAR'S FUNDING REQUIREMENT AT CURRENT ANTICIPATED LEVELS?	0
(3)	HAVE YOU INCLUDED IN THE REPORT NARRATIVE ANY EXPLANATION OF THE ABOVE DATA AND ARE THEY CROSS REFERENCED?	NO