(2)

MONOLITHIC INTEGRATION

OF

SEMICONDUCTOR AND SUPERCONDUCTOR COMPONENTS

DARPA/ONR Contract No. N00014-90-C-0226

Honeywell Sensor and System Development Center
10701 Lyndale Avenue South
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4 September 1990 - 31 December 1990

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2.0 PROGRAM SUMMARY

The goal of the program is to develop transistor technology compatible with high transition temperature superconductor technology so that transistor pixel switches can be integrated with YBaCuO superconducting microbolometers in the same silicon substrate. A 4x4 matrix-addressable superconducting microbolometer array will be delivered at the completion of the program.

3.0 PROGRAM STATUS

Milestone Details (See attached Program Schedule). Late arrival of the contract contributed to the slippage. An effort will be made during the next quarter to catch up to the schedule.

4.0 ACCOMPLISHMENTS (for 4 September 1990 to 31 December 1990)

Task 1.0: Vendor Selection

A consultant has been identified to perform calculations modeling the performance of transistors at low temperature, in order to determine the doping profiles needed for the transistor switches at each pixel. Mary Weybright, a graduate student in electrical engineering at Stanford University working under the direction of Prof. James D. Plummer, will be performing this work.

Monolithic transistors from a potential vendor, ECI of Santa Clara, CA, have been tested after being subjected to 700° C for one hour. This heat treatment did not change the device performance at room temperature.

Task 2.0: First Fabrication Run

Task 2.1: Film Development

Dr. Michael Ameen, a Senior Research Associate in Prof. Angus Kingon's research group at North Carolina State University, visited Honeywell in December 1990 to discuss ion beam sputtering of high T_c superconducting films. The North Carolina State ion beam sputtering system is very similar to the one being used at Honeywell. At North Carolina State, superconducting YBaCuO films have been grown in-situ using a BaF_2 target as a source of barium. No fluorine is found in these films. The high stability of BaF_2 makes it extremely attractive for use as a source of barium for reproducible YBaCuO film growth.

Honeywell is building a system to deliver ozone to the ion beam sputtering chamber to provide more efficient oxidation of the YBaCuO films during growth. It is expected that this will allow the growth of high quality in-situ YBaCuO

superconducting films at temperatures low enough that the transistors embedded in the substrate will not be damaged. The system will be operational no later than 1 March 1991.

Task 2.2: Mask Design

Work on this task has not begun.

Task 2.3: Vendor Electronics

Work on this task has not begun.

Task 2.4: Integrated Device

Work on this task has not begun.

Task 2.5: Device Evaluation

Work on this task has not begun.

Task 3.0: Second Fabrication Run

Work on this task has not begun.

Task 4.0: Third Fabrication Run

Work on this task has not begun.

5.0 PROBLEM AREAS/ISSUES

- Performance of transistors at low temperature must be adequate for good switching performance.
- Transistors must survive the high growth temperature of the YBaCuO films.
- Growth of high quality YBaCuO films must be achieved at temperatures sufficiently low to allow survival of the transistors. YBaCuO films must exhibit sharp superconducting transitions and smooth morphology.

6.0 CORRECTIVE ACTION

- Utilize calculations of transistor performance to optimize low temperature performance.
- Install ozone delivery system to lower the growth temperature of the YBaCuO films.

7.0 GOALS FOR THE NEXT PERIOD (1 January 1991 to 31 March 1991).

- Complete the transistor design calculations for the first fabrication run.
- Begin fabrication of the silicon substrates with embedded transistors for the first fabrication run.
- Install the ozone delivery system, and optimize in-situ YBaCuO film growth using ozone.

8.0 PUBLICATIONS

8.1 Papers Published in Refereed Journals

None

8.2 Papers Published in Conference Proceedings

None

8.3 Presentations

a. Invited

None

b. Contributed

None

The following paper was presented at the DARPA Second Annual High Temperature Superconductors Workshop, Sheraton Tara Hotel and Resort, Danvers, MA, October 3-5, 1990.

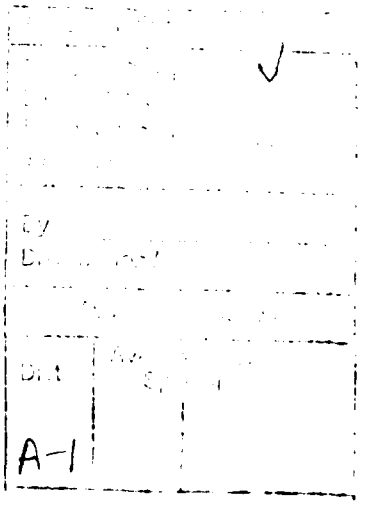
B.R. Johnson, C-J Han, T. Ohnstein, B.E. Cole and P.W. Kruse, "Monolithic Integration of Semiconductor and Superconductor Components."

9.0 FINANCIAL

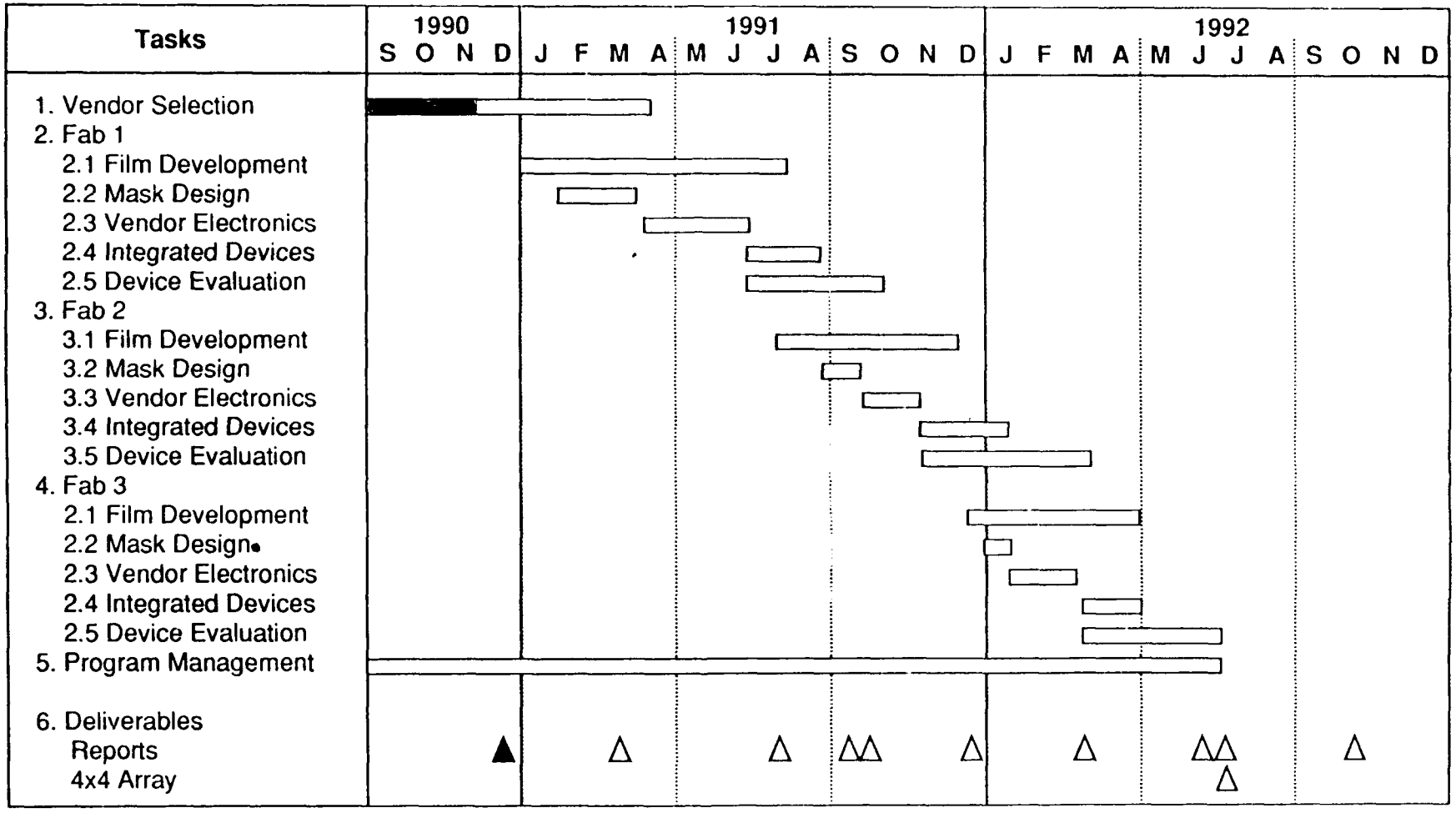
A.	Funding Authorized	$300,000
B.	Funds Expended or Committed (Week ending 30 December 1990)	$ 21,714
C.	Additional Funds Required to Complete Contract (by 30 June 1992)	$540,308

Statement "A" per telecon Dr. Wallace Smith. Office of Naval Research Code 1131F

VHG 1/24/91



Program Schedule



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