SECOND QUARTERLY REPORT

(Phase C)

THIN-FILM PERSONAL COMMUNICATIONS AND TELEMETRY SYSTEM (TFPCTS)

Contract No. NAS 9-3024

Submitted to

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
Houston, Texas

MELPAR, INC.
7700 Arlington Boulevard
Falls Church, Virginia 22046

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Phase C

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For the period of June 24, 1967 to September 24, 1967

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1. INTRODUCTION

This report for the 2nd quarter of Phase C is submitted in compliance with Contract NAS 9-3924 between NASA, Houston and Melpar, Inc. The objective of this contract is to design and construct a thin-film personal communication and telemetry system. During Phase C, the objective is to package two transceivers using the modules developed in Phase B of the program.

Two modules were delivered during this quarter, an RF amplifier and an IF amplifier. This reduces the number of deliverable Phase B modules to two, a VOX module and a 2nd IF amplifier module. The VOX module is ready for delivery but a 2nd IF amplifier remains to be fabricated.

The RF portions of the transmitter and receiver are being fabricated for use in the final package. The transmitter and receiver subassemblies are as described in the previous report except that they are slightly larger in the 3" dimension.

Although there have been a number of problems associated with the fabrication of the 2nd IF amplifier, four of these modules have been evaluated and the performance has been excellent. In all cases the failures have been due to poor bonds or chromium capacitor plates.

The delays incurred to date will effect the final delivery date by two to three months. The major problem areas in the past were poor delivery of masks, lack of control in the capacitor deposition

process and more recently there were problems in bonding chip transistors. Solutions have been found for each of these problems and progress is now being made toward packaging the final items.

2. TECHNICAL DISCUSSION

In previous reports, all of the circuit and system design has been outlined except for the VOX circuit. This circuit has been completed and will be explained in this report. In addition, the problems encountered with the 2nd IF amplifier will be explained.

2.1 VOX Circuit

The purpose of the VOX (Voice Operated Switch) circuit is to turn the transmitter off except when the operator is talking. This mode of operation is applicable to the simplex system only. A signal from the audio amplifier is used to trigger the VOX to the on condition. A schematic of the circuit is shown in Figure 1. The circuit is a conventional Schmitt trigger with a diode detection circuit at the input. When the input signal reaches a peak of 1 volt, the circuit turns on. When the input falls below the threshold level, the detector circuit discharges slowly, producing a delayed turn off. The output of the circuit is used to bias the RF modulator so that the transmitter is essentially turned off except when voice excited. The thin-film mask drawings are given in Figures 2 through 4. There were no problems in fabricating this circuit and there are a sufficient number available for the remainder of this project.

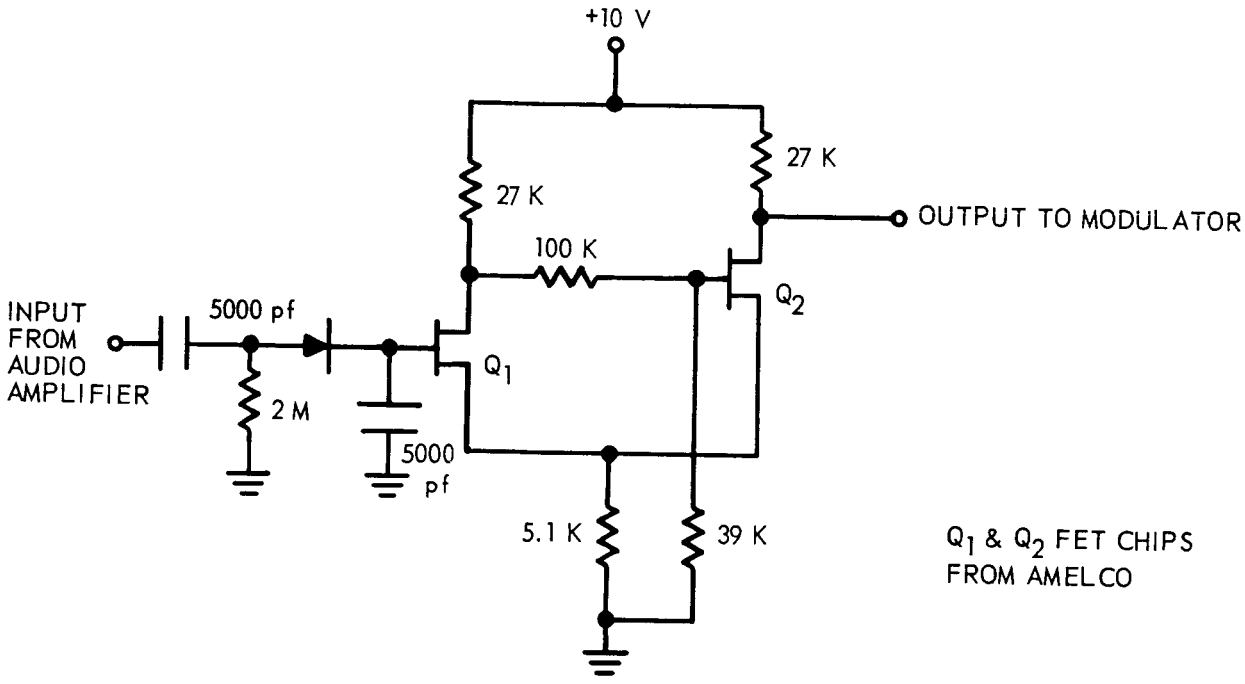
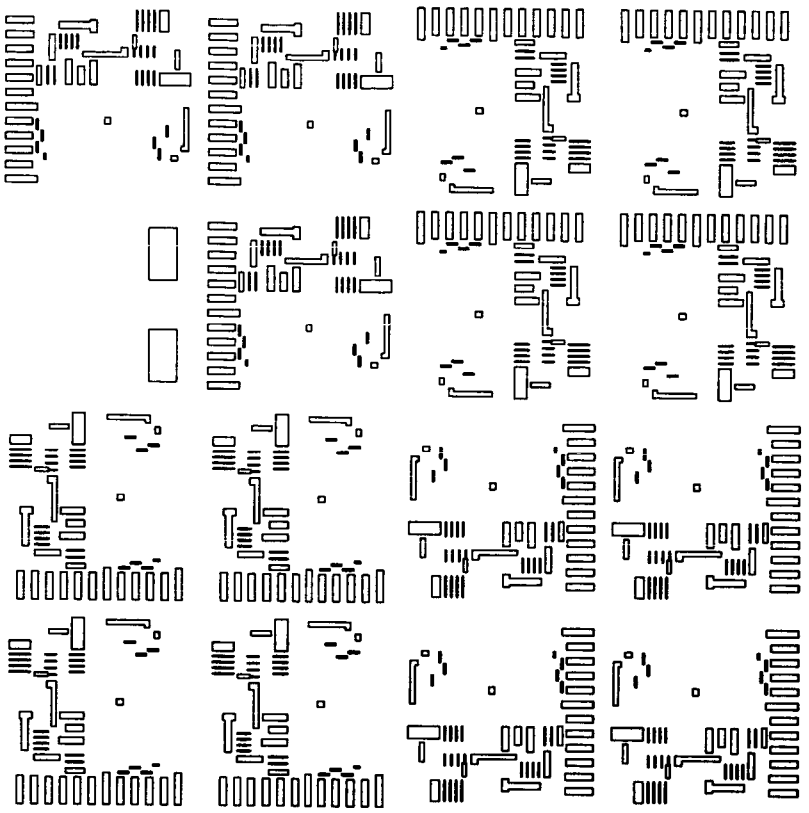
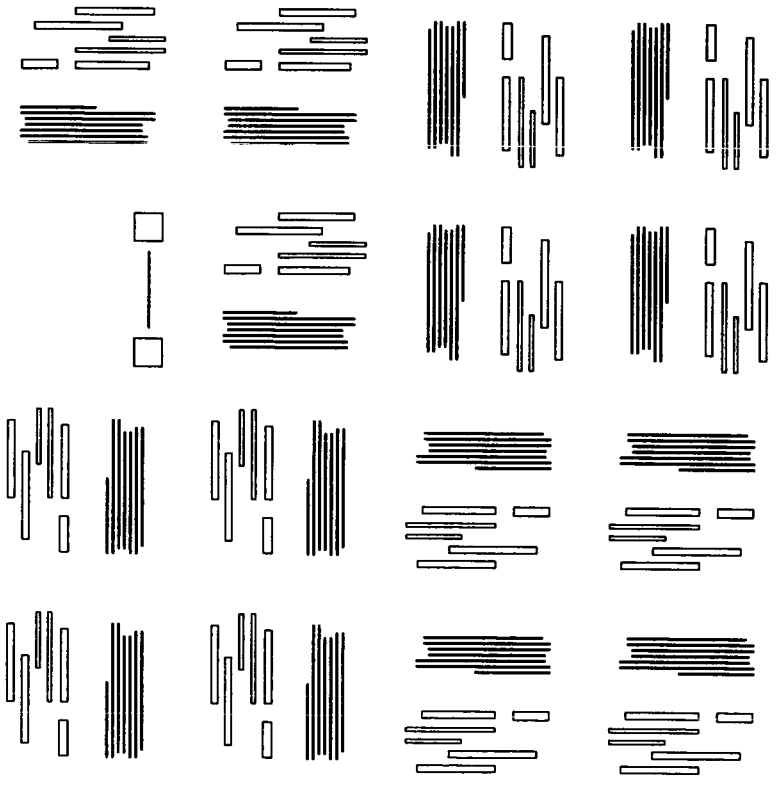


Figure 1. Schematic of Voice Operated Switch

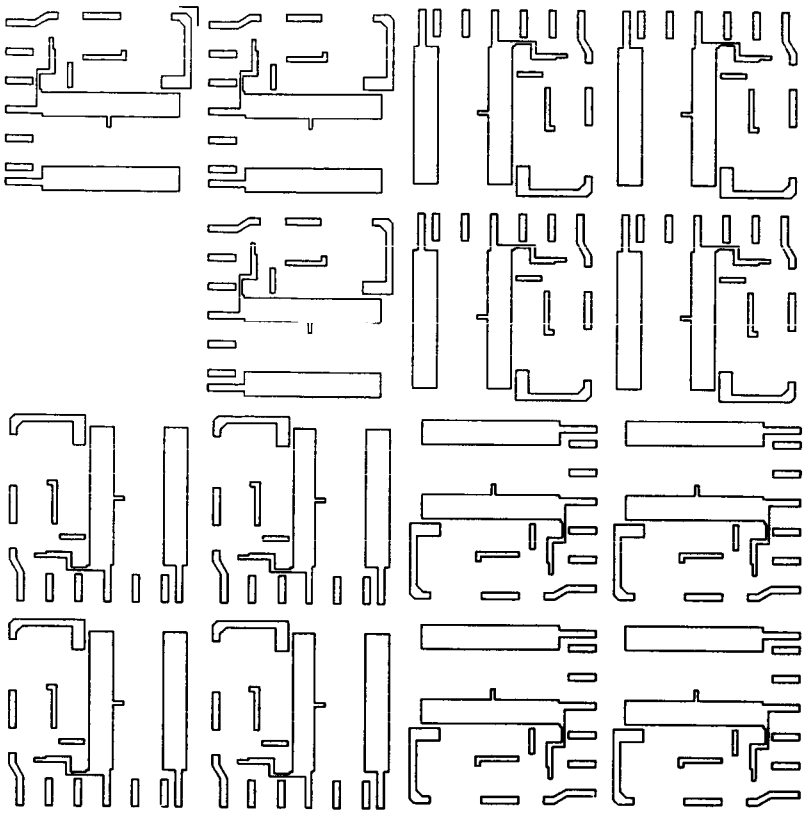


(a) TERMINALS AND RESISTOR TRIM BARS

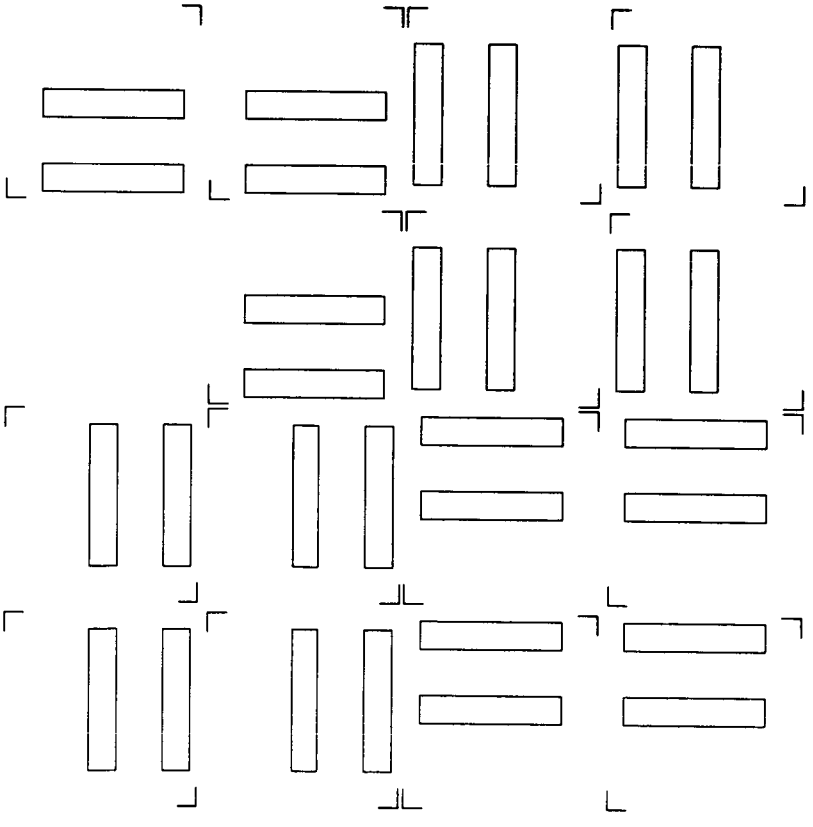


(b) RESISTORS

Figure 2. VOX Circuit Deposition Masks

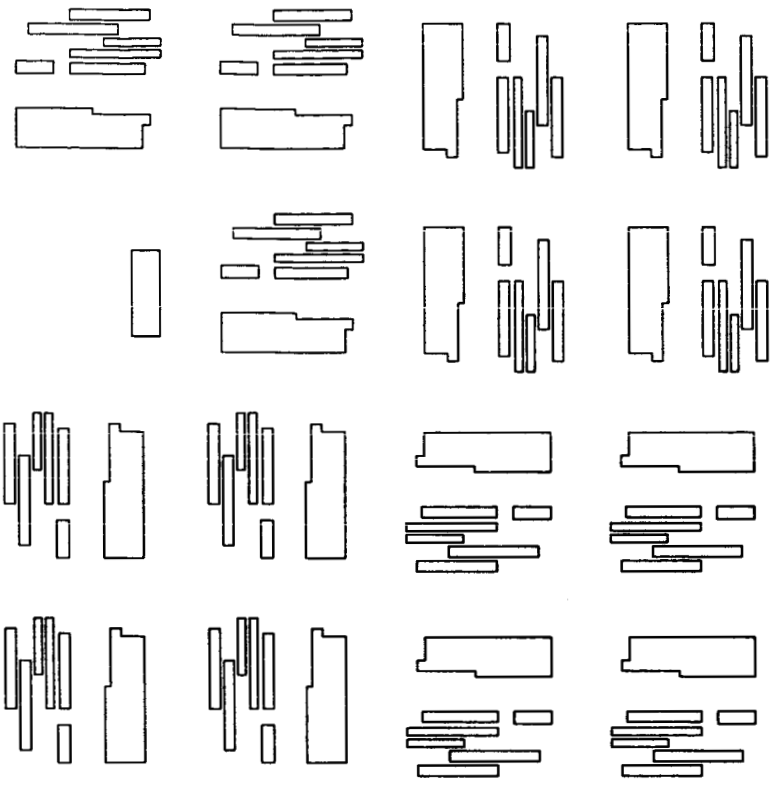


(a) LOWER CAPACITOR PLATES AND CONDUCTORS

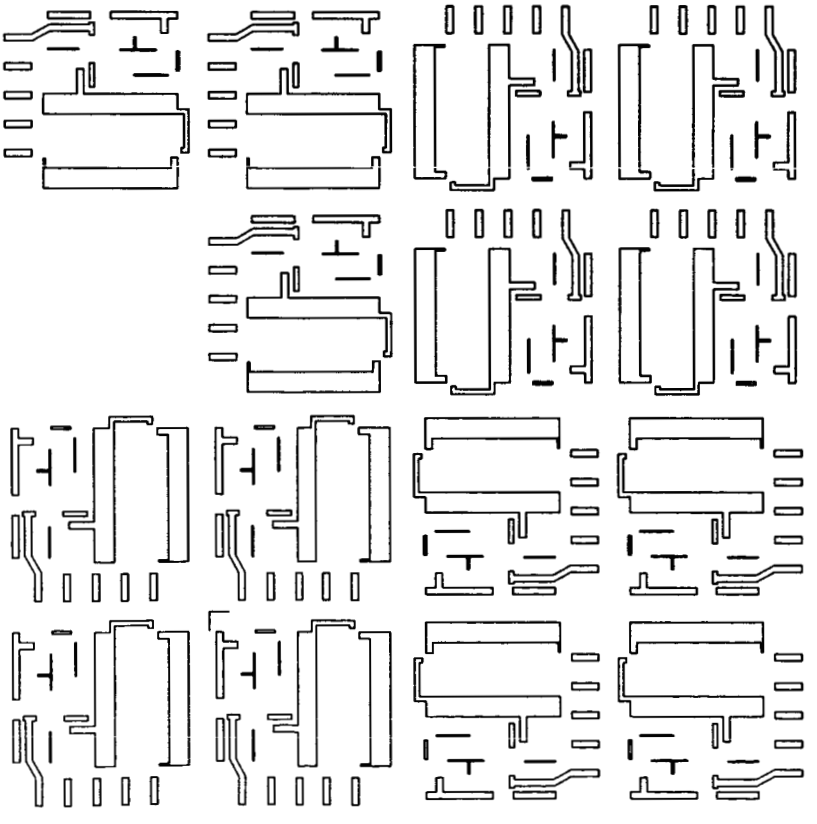


(b) CAPACITOR DIELECTRIC

Figure 3. VOX Circuit Deposition Masks



(a) RESISTOR PROTECTIVE COAT



(b) UPPER CAPACITOR PLATES AND CONDUCTORS

Figure 4. VOX Circuit Deposition Masks

2.2 2nd IF Amplifier

Because of the number of transistors being used for the project, the decision was made to purchase the Amelco field-effect transistors in chip form. Previously, the transistors were ordered in the conventional TO-18 package and then removed for mounting on the substrate. In the TO-18 package, the transistor is mounted on a metal tab which can also be used as the gate connection on the substrate. Circuits processed in the past were mounted with the molytabs and a wire was welded from the molytab to the substrate connecting tab. The process was changed to accommodate the chip transistors by applying silver epoxy to the substrate and mounting the chip on the epoxy. This resulted in a satisfactory electrical connection until the modules were potted. After potting, the epoxy joints became intermittent, noisy and in some cases open.

Silicon gold preforms make an excellent bond between the chip and the substrate but the high temperature required to melt the preform causes the thin-film capacitors to short.

A 2nd IF module is now being prepared by using the original method of mounting the chips on metal tabs before mounting on the substrate. This method will be used until a method is developed for preventing the capacitor shorts at high temperature. When the bottom capacitor plate is annealed during the processing, the capacitor is capable of withstanding the high temperatures. When the bottom capacitor plate and 1st conductor pattern are deposited simultaneously,

a high temperature anneal may cause poor contacts between the 1st and 2nd conductor patterns if a good vacuum is not maintained during the process.

2.3 Deposition Schedule

As explained in previous reports, the RF circuitry is fabricated using a universal RF substrate. Approximately 50 of these substrates are required for the two systems to be delivered. Over 100 of these substrates are now available.

The 1st and 2nd IF amplifiers are also available in sufficient quantities to fabricate the final units.

The remaining modules are available in limited quantities and are now being scheduled for additional deposition runs. Except for the VCO's, a single deposition run will be sufficient for the number of modules required.

2.4 Transmitter and Receiver Fabrication

A transmitter and a receiver are being constructed. Most of the modules are now in the package and are operating. A small trimmer capacitor is used in each stage and an order for additional capacitors was placed well in advance of our requirements. The order has not been filled and is delaying the completion of the two units.

In the original RF modules, the transistors were mounted in their TO-18 packages. In the final packages, the transistors are mounted in chip form. The chips are mounted with the silicon gold preforms and because of the previously mentioned capacitor anneal,

there have been no difficulties with capacitor shorts.

3. PROJECT SCHEDULE AND OBJECTIVES

A single module (2nd IF) is required to complete the Phase B portion of the program. This task will be the top priority in the next report interval.

Efforts will be continued towards completion of the RF packages and completion of all deposition tasks.

During the next quarter, the overall package design will be finalized including the interconnecting printed circuit board.

The percentage of thin film components remains unchanged at approximately 75%.

4. PERSONNEL

Listed below are the key personnel involved with this program:

Project Leader:	J. C. Mould
Senior Engineers:	F. J. Hemmer H. L. Wilson
Engineers:	S. Muzidal J. J. Giuliani W. E. Johnson, Jr.