FINAL REPORT
ON
DESIGN, TESTING, AND DELIVERY
OF AN
INTERACTIVE GRAPHICS DISPLAY
SUBSYSTEM

CONTRACT NO. NAS8-28436

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DELIVERY OF AN INTERACTIVE GRAPHICS
DISPLAY SUBSYSTEM Final Report (Vanzetti
Infrared and Computer Systems, Inc.)
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FINAL REPORT

ON

DESIGN, TESTING, AND DELIVERY

OF AN

INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

CONTRACT NO. NAS8-28436

WITH AMENDMENT S/A 2FFP

AUTHOR:

BRUCE HOLMES, PROJECT ENGINEER
VANZETTI INFRARED & COMPUTER SYSTEMS, INC.
607 NEPONSET STREET
CANTON, MASSACHUSETTS 02021

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PREPARED FOR:

GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA 35812

ABSTRACT

The purpose of this contract was to design an interactive graphics display system to be used in locating components on a printed circuit card and outputting data concerning their thermal values. The report which follows describes the manner in which this was accomplished in terms of both hardware and software. An analysis of the accuracy of this approach has also been included.

NASA DISPLAY
NAS8-28436
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FINAL REPORT
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I. GENERAL INFORMATION

1.1 System Description

The INSPECT System delivered to NASA consists of a scanning infrared radiometer, teletype, graphics display system, computer, television camera, and video mixer. The block diagram for the system appears in Figure 1.

The INSPECT radiometer is a standard part of the basic INSPECT System and is described in the basic INSPECT operating manual.

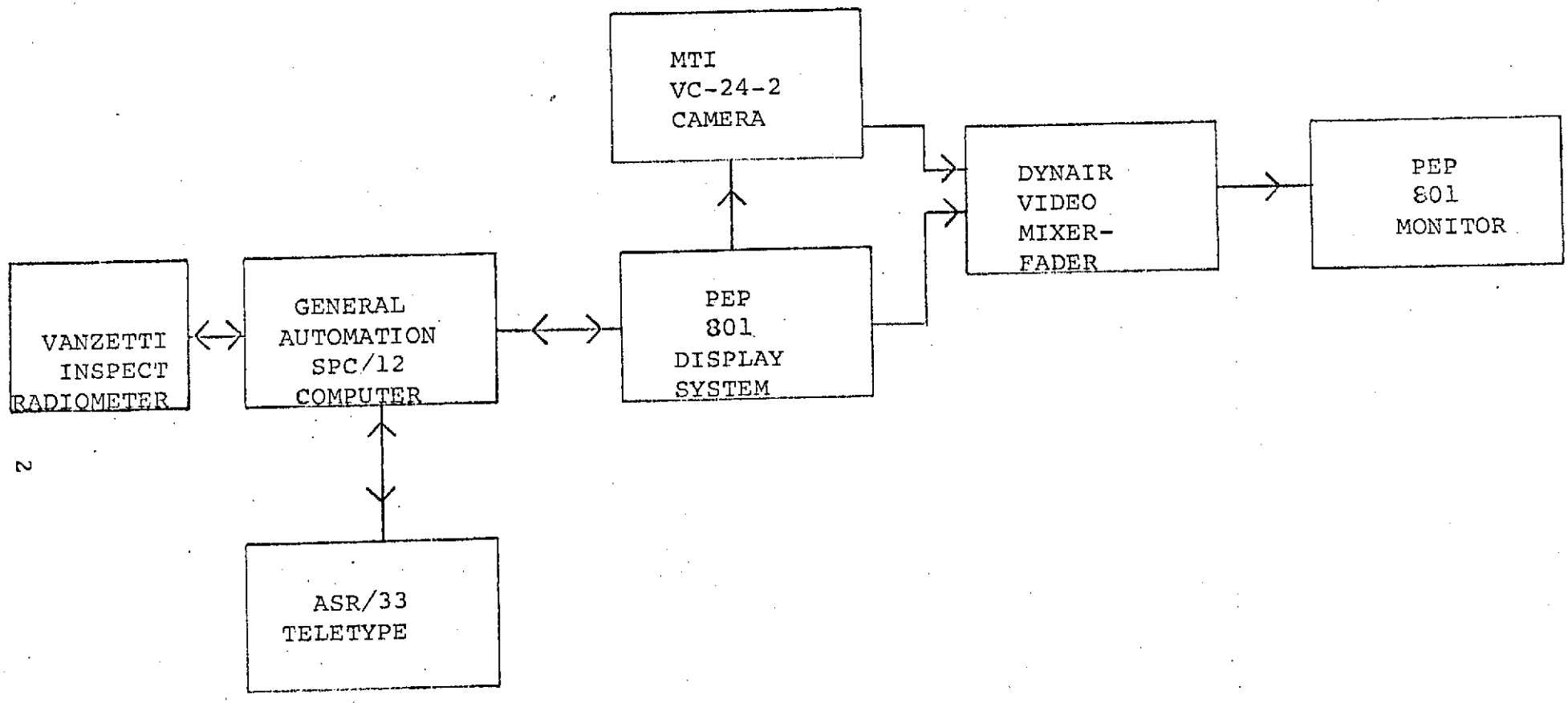
The controller in the system is a General Automation SPC/12 computer equipped with 8K words of 8- bit memory. It performs I/O functions with the radiometer, teletype, and graphic display system. It also stores and processes data concerning printed circuit boards. An interface was specially designed for communicating between the computer and display system.

The graphic display system is manufactured by Princeton Electronic Products Inc. It consists of a character and vector generator, lithicon scan converter subsystem, cursor unit, keyboard, and 17" CRT display. It provides horizontal and vertical drive and blanking signals for the TV camera. A block diagram of the PEP 801 system is shown in Figure 2.

The television camera is an MTI/Visual Educom Model VC-24-2 vidicon system. The camera is a high resolution, 1029 line system, equipped with a 1:1 aspect ratio. Camera synch is provided externally by the PEP 801 system. A Canon V10X15 15-150 mm 200m lens and 2X telextender are adjusted for the various format sizes used.

The teletype is an ASR/33 manufactured by Teletype Corporation and is a standard part of the basic INSPECT System.

The video mixer is a VS-220A Mini-Fade manufactured by Dynair Electronics. It provides a means of mixing and fading between the video outputs of the graphics generator and the television camera.



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VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.

NASA DISPLAY SYS.
BLOCK DIAGRAM

DW'N	SCALE	TOLERANCES: UNLESS OTHERWISE SPECIFIED
CH'K'D	MAT'L	FRACTIONAL ± 1/32 DECIMAL .000 ± .005 .00 ± .010

DW'G NO.
1002 A 2840

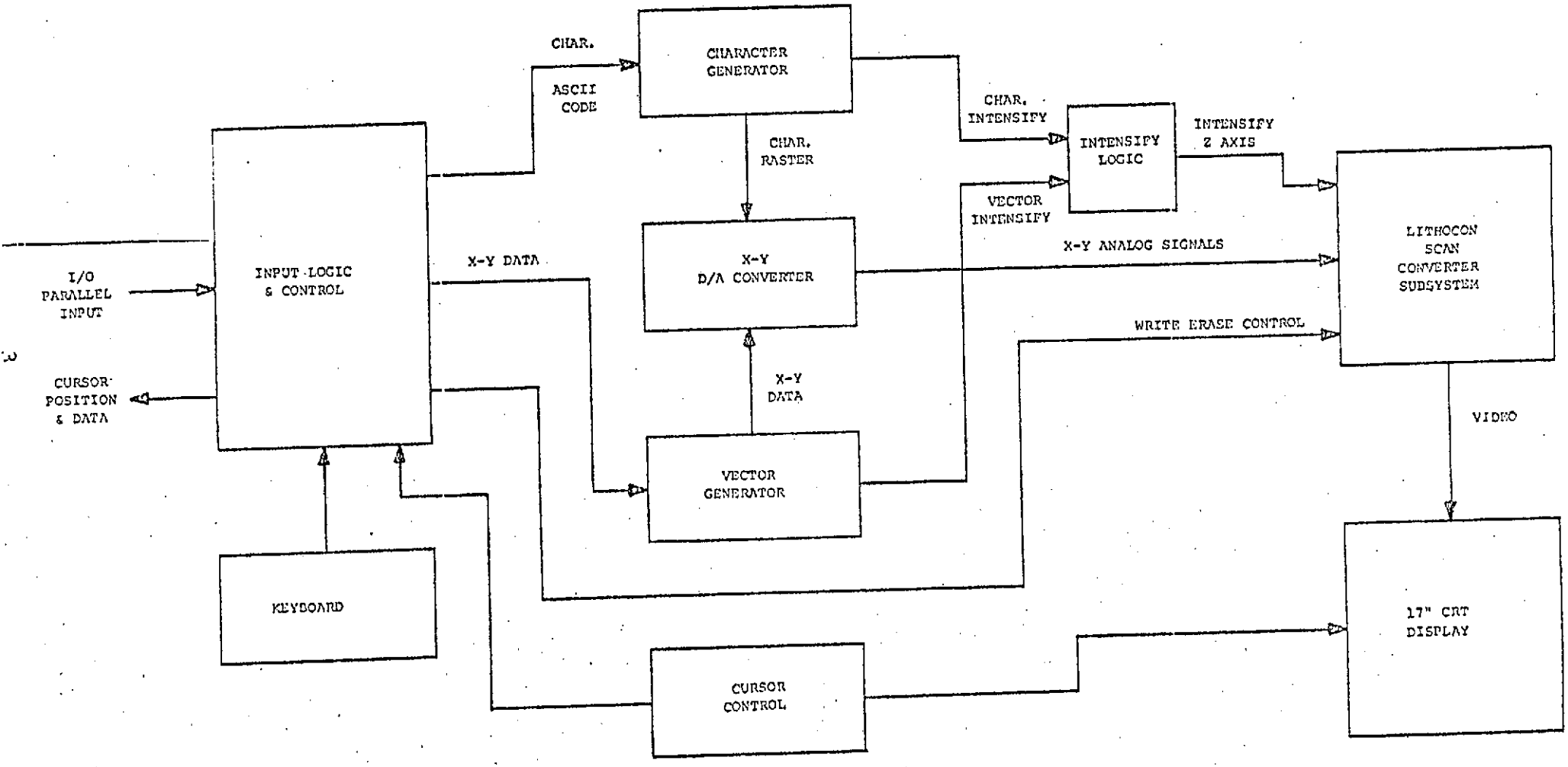


FIGURE 2

PRINCETON 801 BLOCK DIAGRAM

II MEMORY STORAGE TABLES

TITLE	MEMORY MODE	ADDRESS (OCTAL)	LENGTH (WORDS)	DESCRIPTION
CB	0	3700	4	Used as buffer for coordinates inputted from display
GC	0	3704	4	Coordinates of a grid intersection rounded off to nearest multiple of 50
MC	0	3710	4	Measured coordinates of grid intersection
RM	1	7400	256	Buffer for storing thermal values
GS	2	4000	1	Gain setting -1
CV	2	4001	1	Number of components in profile
YC	2	4002	240	Number of components on each Y-line of p. c. card
XC	2	4362	256	X coordinates
RL	2	4762	256	Radiation level
RT	2	5362	256	Radiation tolerance
C1	2	5762	256	First character of component designation
C2	2	6362	256	Second character of component designation
C3	2	6762	256	Third character of component designation
SD	2	7440	210	Sign bit inputted from A/D converter

TITLE	MEMORY MODE	ADDRESS (OCTAL)	LENGTH (WORDS)	DESCRIPTION
SC	3	4001	1	Magnification factor (1:1, 2:1, or 4:1)
YS	3	6362	256	Y-coordinates of components on schematic
XS	3	6762	256	X-coordinates of components on schematic
SD	3	7440	210	Bits 0 through 7 inputted from A/D converter

III THEORY OF OPERATION - DISPLAY INPUT AND OUTPUT

The method used for locating components is to position the PEP 801 graphics cursor over the components in the p. c. card image. This eliminates errors due to parallax since the cursor is in the same surface as the p. c. card image (C. R. T. Phosphor). Errors due to pincushion effects and other non-linearities of the display deflection system are also eliminated since the camera and display system are driven by the same source and displayed simultaneously on the monitor. The minimum resolution requirements are met since the PEP 801 resolution is .01" and the INSPECT requirement is .05".

In order to measure the coordinates of a component using the display system and camera, it is necessary to input both the location of the component and the nearest grid intersection. To find the location of the component in INSPECT coordinates, the following formula is used:

$$\text{Component Coordinates (INSPECT)} = \frac{\text{Component Coordinates (Display)} \times \text{Grid Center Coordinates (Rounded to nearest multiple of fifty)}}{\text{Grid Center Coordinates (Measured)} \times 5} \div \text{Magnification Factor}$$

Using the worst case error specified for the VC-24-2 camera as 2% of vertical dimension, the maximum error is as follows: assume a component at INSPECT Y- coordinate 55 is to be located. The grid centers are at multiples of 50 display points (or 10 INSPECT points) so the nearest grid center is at display coordinate 300. With a 2% error, the grid center will be read at 294 and the component (at 275) will be read at 269. Assuming a magnification factor of 1, the calculations are performed as follows:

$$\text{Coordinate (INSPECT)} = \frac{269 \times 300}{5 \times 294} = 54.89$$

The error is 55 - 54.89 = .11

With rounding off, the maximum allowable error is .5 resolution elements. The maximum error with 2% non-linearity is well within these limits.

IV. ACCURACY COMPARISON WITH RESULTS OF X-Y LOCATION PROGRAMMER

A reference printed circuit card was constructed for testing the accuracy of the camera/display system in its measurement of display coordinates. The model 1600 X-Y Location Programmer, designed by Vanzetti Infrared specifically for measuring component coordinates, was used to obtain the coordinates on the reference card. The data obtained by both the programmer and display system follows:

Programmer		Display		Error	
Y	X	Y	X	Y	X
15	90	14	90	-1	
15	80	15	79		-1
25	90	24	90	-1	
26	144	26	144		
27	86	27	86		
35	90	34	90	-1	
45	90	44	89	-1	-1
55	90	54	89	-1	-1
65	35	64	33	-1	-2
65	45	64	43	-1	-2
65	55	64	54	-1	-1
65	65	64	64	-1	-1
65	85	64	84	-1	-1
65	90	64	89	-1	-1
65	105	64	105	-1	
65	115	64	114	-1	-1
65	90	65	89		-1
65	75	65	73		-2
65	95	65	94		-1
65	125	65	124		-1
65	135	65	135		
65	145	65	144		-1
65	155	65	155		

(continued - next page)

Programmer		Display		Error	
Y	X	Y	X	Y	X
65	165	65	165		
65	175	65	175		
75	90	74	89	-1	-1
85	90	85	89		-1
95	90	95	89		-1
105	90	105	89		-1
115	90	115	89		-1
125	90	126	89	+1	-1
135	90	135	89		-1
145	90	146	89	+1	-1
155	90	156	89	+1	-1
165	90	166	89	+1	-1
175	90	176	89	+1	-1
185	90	186	89	+1	-1
195	90	196	89	+1	-1

Average Y Error: -0.18
Average X Error: -0.82

V. CONCLUSION

Based on the data that appears in section IV, the following conclusions can be made:

1. The average error in the X - direction is -0.82 with all errors on the negative side and a maximum error of -2. This could be improved greatly by repositioning the camera slightly (turning it counter-clockwise), using the alignment procedure in the operating manual.

2. The maximum absolute error in the Y - direction is one resolution element with an average error of -0.18.

3. After the camera is realigned to the optical center of the table the maximum error would be ± 1 resolution element in both directions.

4. Since the camera/display system has 5 times the resolution of the INSPECT System, there should be no error in the measurement of the display coordinates. The camera and display system both meet the linearity requirements of the proposal. No allowance was made for drift or misalignment of the graphics cursor of the display system, and it appears as if this is the source of the error.

5. The maximum error of $\pm$ 1 resolution element (.050") puts a limit on the usefulness of the system for measuring coordinates. While this error will not be significant with most components (capacitors, transistors, and resistors greater than 1/4 watt), caution should be exercised in measuring components whose size approaches the resolution of the system (1/4 watt resistors and small diodes).

VI. Summary of Monthly Reports

A) First Monthly Progress Report - April 12, 1972. Covering the Period March 7, 1972 to April 7, 1972.

Basic concepts concerning hardware and software were developed. A design report stating these concepts was enclosed with the monthly report. The memory of the SPC/12 computer was increased from 4k to 8k. Rewriting of the software for the INSPECT System was completed and material for construction of the display to computer interface was received. At this time it was noted that the display system ordered from Information Displays Inc. would be shipped late due to a delay in delivery of memory chip components from Signetics Memory Systems Corp.

B) Second Monthly Progress Report - May 8, 1972. Covering the Period April 7, 1972 to May 8, 1972.

Work on the display and INSPECT software was continuing, but was being held up due to late delivery of the display system (expected on May 31).

C) Third Monthly Progress Report - June 12, 1972. Covering the Period May 9, 1972 to June 7, 1972.

The writing of the display system software was completed. Completion of debugging the INSPECT System software and display to computer interface was being held up due to late delivery of the display system. Information Displays Inc. promised shipment by June 16.

D) Fourth Monthly Progress Report - July 11, 1972. Covering the Period June 8, 1972 to July 7, 1972.

Assembly of the display subsystem software was completed. The IDIgraf display system was delivered on July 16, 1972. Due to the late delivery of the display, an extension of the delivery date of the system to October 31, 1972 was requested and granted.

E) Fifth Monthly Progress Report - August 14, 1972. Covering the Period July 8, 1972 to August 11, 1972.

The display interface and display software were completed. After initial testing of the display system, it was evident that the system was defective. It was also noted that visual distortion, primarily pincushion effect, would make the system unusable for precise positioning. Search for a new display system was soon started.

F) Sixth Monthly Progress Report - September 20, 1972. Covering the Period August 14, 1972 to September 9, 1972.

All functions of the IDI display have ceased to operate properly. Assembly and testing of the radiometer and electronic control rack was completed. A meeting between NASA and Vanzetti officials was held on September 8, 1972 to discuss the different options available to meet the contractual goals. A proposal was submitted on September 29, 1972. No work was performed until approval of the contract amendment S/A 2FFP on January 12, 1973.

G) Seventh Monthly Progress Report - February 12, 1973. Covering the Period January 12, 1973 to February 5, 1973.

Software was added to the INSPECT System to make it insensitive to changes in ambient temperature. The ability to generate a P.C. card standard thermal signature quickly by entering a percentage of the radiation level previously scanned was completed. Redesign of the software to accept the new features of the system was started. Specifications for the display system, TV camera, and camera lenses were established and orders were sent out. Several methods of combining the video outputs of the TV camera and the graphics display generator to produce one image were examined. A parallel to serial interface was ordered.

H) Eighth Monthly Progress Report - March 12, 1973. Covering the Period February 6 to March 9, 1973.

Rewriting of the software was continuing. The possibility of substituting a higher resolution vidicon camera for the Plubicon camera originally proposed was being considered.

I) Ninth Monthly Progress Report - March 30, 1973. Covering the Period March 10 to March 30, 1973.

All software except the display input/output routines were written and tested. The dolly rack for housing the control electronics was ordered along with the TV camera and lens. After it became evident that General Automation could not deliver a computer to display interface on time, the decision to design a custom interface in-house was made.

J) Tenth Monthly Progress Report - May 14, 1973. Covering the Period March 30 to May 14, 1973.

Rewriting of the software was completed. Testing was postponed until delivery of the display system. Design of the computer interface was completed. Design of the mechanical fixtures for holding the TV camera, printed circuit cards, and schematic diagrams was started.

K) Eleventh Monthly Progress Report - June 21, 1973. Covering the Period May 15 to June 21, 1973.

The TV camera and display system arrived. Several problems with the display system were noted. Assembly of the computer to display interface was completed. The design of the mechanical fixtures for holding the TV camera and p.c. cards was completed and assembly had begun. A TV camera to graphics display interface was designed.

L) Twelfth Monthly Progress Report - July 18, 1973. Covering the Period June 21 to July 18, 1973.

Debugging of the object program was continuing. The computer to display interface was tested successfully. A commercially available video mixer was found for combining the output of the TV camera and graphic display generator. The materials for construction of the fixtures for holding the p.c. cards and TV camera were received and assembly was started.

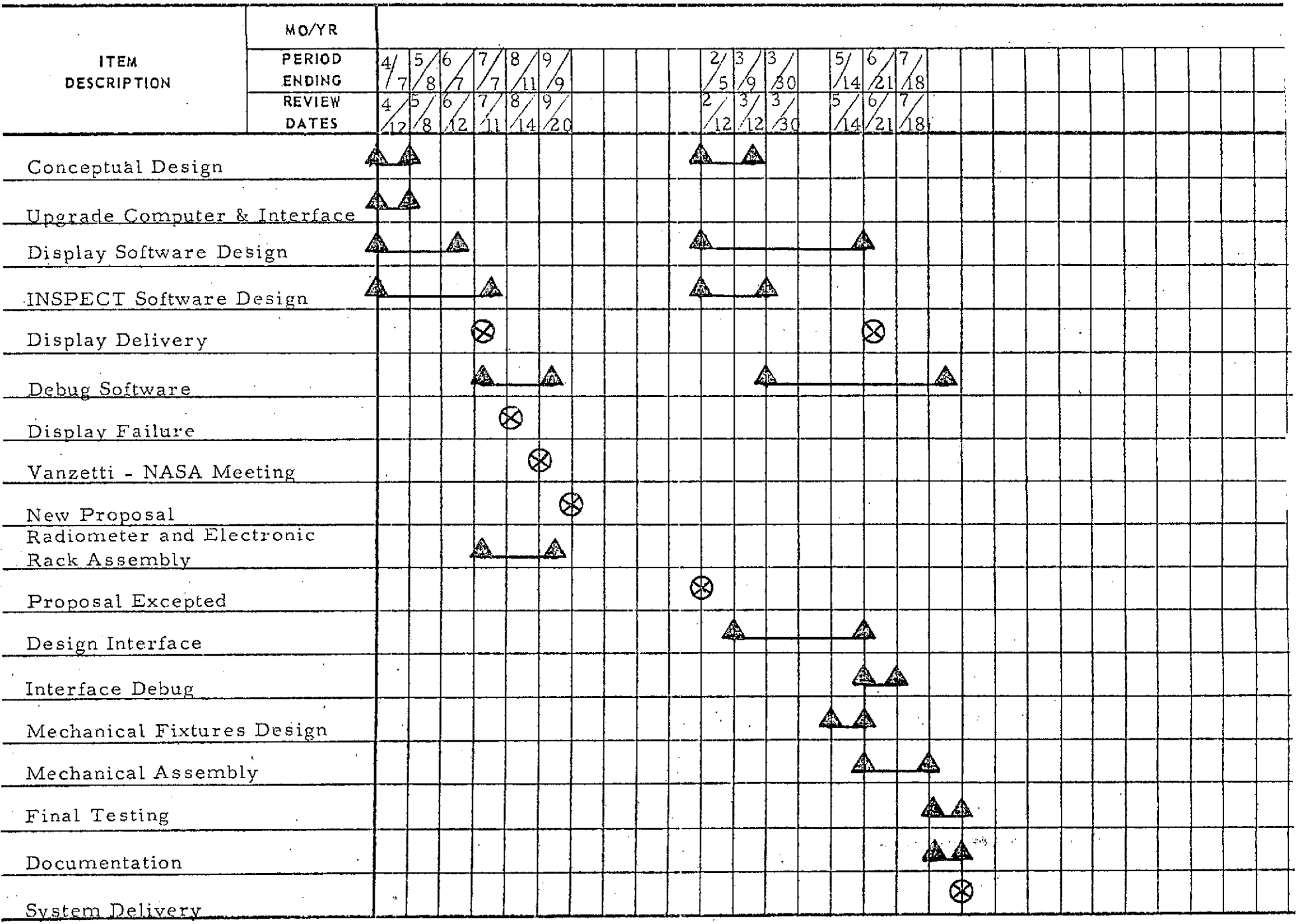
M) Work performed from July 18 until shipment on August 29, 1973.

A preliminary acceptance test took place on July 30, 1973. Final testing of the software and electronic systems was completed. The only remaining problem with the display system is the cursor drift which is caused by heat problems in the display cabinet. A field modification to correct this was performed on September 5, 1973. A draft of the final report was delivered on September 20, 1973. No comments on the report were received from the Government for inclusion in this report by the October 4, 1973 deadline.

STEMS, INC.

SCHED. CLASSN _____

RESPONSIBLE ENGR Bruce Holmes UNIT INSPECT System PROJECT Display Addition D.O. NO. _____



SYMBOLS: ▲——▲ = SCHEDULE LINE ◍ = ACTUAL START

PAGE OF ORIG DATE ISSUE NO

VII BIBLIOGRAPHY

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2. Vanzetti Infrared & Computer Systems, Inc., "NASA Display Subsystem - Supplement to INSPECT Operating Manual", August 26, 1973

3. Princeton Electronic Products Inc., "Princeton 801 Graphic Computer Terminal - Technical Description Manual", Part Number 18001-0014

4. General Automation, Inc., "SPC/12 Automation Computer Reference Manual"

VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.

NEW ADDRESS

605 Neponset Street
Canton, Mass. 02021
Tel: (617) 828-4650

FIRST MONTHLY PROGRESS REPORT

DESIGN, FABRICATION, TESTING AND DELIVERY

OF AN

INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

COVERING PERIOD FROM: MARCH 7, 1972 TO APRIL 7, 1972

AUTHOR: JAMES HALL, ASSISTANT PROJECT SUPERVISOR

MONTHLY PROGRESS REPORT: CONTRACT #NAS8-28436

DATE OF PUBLICATION: APRIL 12, 1972

PREPARED FOR: GOERGE C. MARSHALL SPACE FLIGHT CENTER
ALABAMA 35812

NASA DISPLAY
NAS8-28436
4/72

MONTHLY PROGRESS REPORT

CONTRACT NAS8-28436

SECTIONS

I	Progress on Display Subsystem to Date
II	Indication of Current Problems Which May Impede Performance and Proposed Corrective Action
III	Work to be Performed During the Next Reporting Period
IV	New Technology
V	Copy of the "Preliminary Design Report" Included with First Monthly Progress Report

I. PROGRESS ON DISPLAY SUBSYSTEM TO DATE

1. Basic concepts concerning both hardware and software have been developed. The design report outlining these concepts has been included in the first monthly report to provide NASA with an indication as to the direction taken by Vanzetti Infrared & Computer Systems, Inc. in meeting the requirements of NASA Contract #NAS8-28436.

2. The 4K additional memory for the SPC-12, as called for in Section 5 of the Design Report, has been installed.

3. The rewriting of existing INSPECT software, as called for in Section 4 of the Design Report, is completed.

4. Hardware for the display interface has been received.

According to the schedule on Pg. 35 of the Design Report, the system development is on schedule.

II. INDICATION OF CURRENT PROBLEMS WHICH MAY IMPEDE PERFORMANCE AND PROPOSED CORRECTIVE ACTION

The display terminal for this NASA Display Subsystem is being supplied to Vanzetti Infrared & Computer Systems by Information Displays Incorporated of Mt. Kisco, N. Y. On April 6, Information Displays Inc. gave notice of a delivery delay reschedule from April 21 to June 9, resulting from notice they had received from Signetics Memory Systems Company that there will be a delay in delivery of memory chip components, necessary for the assembly of the display terminal. Corrective Action: The following steps were taken in attempt to expedite an acceptable delivery of the display terminal:

A. The DCASR, Boston Contract Administration Industrial Specialist was immediately notified.

B. Copies of applicable purchase orders issued by Information Display Inc. to Signetics Memory Systems were requested, along with a written story from IDI relating the circumstances and expediting efforts made by them.

C. A telephone call was made to Signetics Memory Systems in Sunnyvale, California, to expedite the shipment of the required memory chips to Information Displays Inc. Their response was that it is likely that improvement can be made on the schedule given to IDI. They will review their production status and telephone us with an intended shipping date to IDI.

It is quite possible that the current expediting efforts will result in delivery of the display terminal soon enough to prevent it from jeopardizing our final delivery. However, it is an item of sufficient concern to necessitate our documenting it in compliance with your requirement in this portion of this report.

III. WORK TO BE PERFORMED DURING NEXT REPORTING PERIOD

Developments that should take place in the next reporting period are:

1. Writing of display software
2. Debugging the INSPECT software rewrite

IV. NEW TECHNOLOGY

There has been no new technology developed in the period covered by this report.

VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.

NEW ADDRESS

605 Neponset Street
Canton, Mass. 02021
Tel: (617) 828-4650

V. PRELIMINARY DESIGN REPORT

DISPLAY SUBSYSTEM

for

NASA INSPECT SYSTEM

CONTRACT NAS8-28436

15 MARCH 1972

I.0 INTRODUCTION

This report defines the NASA Display Subsystem in terms of operation, functional description, software design, hardware design and scheduling. The Display Subsystem will meet the requirements of NASA Contract #NAS8-28436. It should be noted that the concepts arrived at in this report are subject to change as system development progresses. These changes would arise when problems that would jeopardize system performance are encountered.

2.0 OPERATOR'S USE OF DISPLAY

The system software will be capable of displaying two formats. Format #1 (Figure 1) is the general format used in conjunction with the component input, change, add, delete, print, punch, load and exit to TTY executive routines. This format has a list of routines in the lower right corner. Flagging one of these labels with the light pen gives control to that routine. When power is turned on, Format #1 is displayed. The lower left corner is the format used to input P.C. card data. Format #2 (Figure 2) is used with schematic input and scan routines. This format is displayed when one of these routines is flagged in Format #1.

2.1 Target Position Coding

There are three operations in target position coding.

A. Locate components on a transparent card layout overlay.

B. Define component parameters after each component location.

C. After all components have been located, the CRT coordinates of each component on its schematic are defined.

2.1.1 The component input routine is used to perform the operations of A and B above. The operator flags the COMP IN label with the light pen to initiate this routine. The scale of the transparent layout overlay is now entered through the Display keyboard. If the operator has entered the number he intended, he flags the GAIN SET label to input that parameter. If the wrong scale factor was entered, the SCALE label is flagged and the scale retyped.

After entry of the gain set factor, flagging the TRANS label will start the component locating routine. A 3 x 3 dot grid will be placed at the lower left corner. The operator mounts the transparent layout in the mechanical jig provided. The operator now places the light pen on the dot grid and moves to the first component. When the center dot is at the desired location (center of component), the operator flags the TRANS label.

The designation for this component is typed on the display keyboard. If an error was made on this entry, flagging the DESIG label will allow reentry. The TRANS label is flagged and the next component is located as above. If, at this point, the radiation levels and tolerances are to be defined, their respective labels are flagged after the designation is entered. These parameters are assumed to be zero if not defined. When all components on the transparent overlay are located, the EXIT label is flagged. All components are marked on the CRT as they are located for operator reference.

2.1.2 The third operation stated in paragraph 2.1 is necessary when faulted components are to be displayed on the CRT. The schematic input routine is automatically entered on exit from the component input routine. At this time Format #2 is displayed and a 3 x 3 grid appears at the lower left. The transparent overlay describing the schematic of the unit to be tested is placed in the holding jig. The operator locates the schematic symbol by the procedure used when locating components on the transparent layout overlay (par. 2.1.1). After each symbol is located, the TRANS label is flagged, then the designation is entered through the keyboard. If correct,

the TRANS label is flagged and the next symbol is located. If the designation is in error, flagging the DESIG label will allow reentry. When all symbols have been located, a flag on the EXIT label will return to Format #1. All symbols are marked on the CRT as they are located for operator reference.

2.2 Automatic Identification of Faulted Components

This feature will display component differences at locations on the CRT corresponding to schematic symbol locations of the transparent schematic overlay. The operator loads the profile of the unit to be tested by flagging the LOAD label and placing the profile tape in the ASR-33 reader. The INSPECT will scan the board when the SCAN label is flagged. The operator places the transparent schematic overlay in the holder. The component difference detected by the scan routine will be displayed behind the appropriate component symbol. This display will continue until the EXIT label is flagged.

2.3 Display and Modification of Profile Information

2.3.1 The CHANGE label of Format #1 initiates a routine which gives the operator the capability to modify the gain set or component designation, radiation level and radiation tolerance of any component already in the profile. After

the operator flags the CHANGE label, the current gain set for that profile is displayed. At this time the gain set is redefined and the TRANS label is flagged. The operator now types the designation of the component to be changed. The parameters associated with that designation are displayed and a flag on a parameter label will allow the operator to redefine that parameter. When finished with that component, the TRANS label is flagged and the next designation can be entered. When all changes are complete the EXIT label is flagged.

The standard profile can be generated using the change routine. The operator proceeds as above, entering the standard profile radiation levels and tolerances. This process assumes that the target position coding of paragraph 2.1 has been completed.

2.3.2 Deleting components from the profile can be accomplished simply by flagging the DELETE label of Format #1. The operator enters the component designation and that component data is erased. Deleting more components requires flagging the DELETE label before each designation entry.

2.3.3 Adding components is accomplished by flagging the ADD label of Form #1. This procedure is the same as the

component input and schematic input operations of paragraphs 2.1 and 2.2.

2.4 Other features are the PUNCH label, which will punch a complete profile tape when flagged: The LOAD label, which will load a complete profile tape when flagged; The TTY label, which will allow use of the teletype as in the old INSPECT software; The PRINT label, which will print the profile information, if flagged in Format #1 or the component difference results of the scan routine if flagged in Format #2.

3.0 FUNCTIONAL DESCRIPTION

This section states the major problems encountered in fulfilling the requirements of the NASA Display Subsystem Contract #NAS8-28436 and the philosophy behind their probable solution. The considerations of this section specified the operation described in Section 2.

The major areas of concern are:

1. Correlating physical position on CRT to position on the P.C. board.
2. Locating the position of a component on the transparent overlay with the light pen.
3. Tolerances and requirements on both the layout overlay and the schematic overlay.

4. Mechanical problems associated with interfacing the transparent overlay to the display.
5. Communication between the display light pen and keyboard and the SPC-12.
6. Calibration of deflection circuits in the CRT.
7. Problems of data input and output in terms of software.

3.1 The correlation of positions on the CRT to the positions on the P.C. board is a function of the display characteristics and the operating requirements of the INSPECT. The INSPECT has a maximum card size of 8" by 12" and uses a .05" window, i.e. components must be located to .05" accuracy. The IDIgraph display has a variable usable area (optimum is 10" square) with 1024 resolution elements in both X and Y. If the usable area is expanded to 10.24" square, then in 10" of CRT distance there will be 1000 resolution elements, or 5 resolution elements over.05" of CRT distance. This means that every fifth resolution element will correspond to a particular window of the INSPECT, i.e. position on the P.C. board. Considerations that led to Format #1 are the 8" maximum dimension of the INSPECT and the 10" maximum dimension of the display. Format #1 uses a maximum card size of 8" x 10". When scaling is used, every tenth, twentieth or fortieth element is used instead of every fifth.

3.2 Locating a particular point with the light pen poses a problem because the light pen must see an illuminated point. It then makes available the address (in the refresh memory) of the word that lit that point. The computer uses this address to determine which resolution element was illuminated. Because the resolution of the light pen is .1" diameter, it was decided to use the following tracking approach to locate points.

A 3 x 3 dot grid with .05" spacing between dots is displayed. A light pen hit on any of the periphery dots of this grid will cause a new grid to be displayed with the center dot of the grid at the resolution element of the light pen hit. As the light pen is moved, this grid will track to the component of interest. The computer has the resolution element address of the center dot and therefore the position of the component.

3.3 Tolerances and requirements of the layout overlay are shown in Figure 6a. Tolerances and requirements of the schematic overlay are shown in Figure 6b. In addition to Figure 6b the schematic overlay drawing should provide at least .4" spacing between component centers in the horizontal direction and .2" spacing in the vertical direction. Lines on both overlays should be no greater than .01" thick.

3.4 The mechanical interfacing problem of the transparent overlays has not been solved as of this time. The next monthly report to NASA should contain this solution.

3.5 The communication problem between the SPC-12 and the display equipment is caused by the fact that the display keyboard is a peripheral to the display and is not directly accessible to the SPC-12. Therefore, data from the keyboard must be entered into the display refresh memory and then transferred to the SPC-12. The light pen, however, is on line with the computer. It can be used to call routines and control operations (as outlined in Section 2), better than the keyboard.

3.6 In all CRT display systems there is some drift in the deflection circuits causing drift in positioning of points on the CRT. A calibration aid to correct for this drift is incorporated in both transparent overlays. The procedure is to simply align the boarder marks of the overlay with the boarder marks displayed in the appropriate format, using the horizontal and vertical controls on the display.

3.7 When considering software, the question of controlling the INSPECT through the display is foremost. Due to the nature and operation of the display, the existing INSPECT

software would be cumbersome when inputting and changing data. To make the display simple to use, the existing software will be rewritten in the following areas:

1. Input data in random order.
2. Input schematic symbol position data.
3. Change any parameter except X and Y component locations.
4. Add omitted components.
5. Delete components, if necessary.
6. Punch and Load profile tapes containing schematic symbol data.
7. Interface the INSPECT package to provide control to either the display executive or the TTY executive.

The software which will concern the display only and which requires writing from scratch is as follows:

1. Display I/O package
2. Light pen interrupt processor
3. Cursor manipulation package
4. Grid generator with scaling compensation
5. Various output control routines for particular messages and component data

4.0 SOFTWARE DESCRIPTION

New software for the NASA Display Subsystem will be as listed in Table 1 and existing INSPECT routines that will need some reorganization are shown in Table 2. The flow chart of Figure 3 shows the basic logic and organization of the display software. The following is a description of this basic logic.

4.1 Initializing

When power is turned on, the automatic restart feature of the SPC-12 executes the display executive. The first operation is to output Format #1 (Figure 1) to the display, using the display output routine. The light pen interrupt routine when flagged, initiates the display input routine which reads the 12 bit of the memory address register. The display executive then decides what was called. (The address of the refresh memory corresponds to a label on the screen. By knowing the address, the computer knows the label).

4.2 Component Data Input

On entry into the component input routine, the cursor move subroutine puts the cursor on the character space following the scale label. The light pen interrupt

routine searches for an LPF. The operator now types the scale (1, 2, 4, 8) on the display keyboard. When the operator is satisfied with the value, he flags the gain set label and enters the gain set through the keyboard. When the operator is satisfied with this value, he flags the transmit label with the light pen. (NOTE: If the operator should type the wrong value for any parameter, he flags that parameter label with the light pen and reenters the correct value).

The dot generator routine places a 3 x 3 grid on the screen with the center (more intense) dot defining the address of interest to the computer. The operator places the light pen on the grid and moves toward the component of interest. The grid generating routine places a new grid on each LPF with the center at the previous LPF address. When the center of the grid is at the point of interest, the operator flags the transmit label. The input control routine decides whether the LPF was a transmit or a request for a new 3 x 3 grid. If transmit was flagged, the X and Y position is stored and displayed through the display output routine.

All previously defined components are marked on the screen by the component display routine. The cursor move routine is called on to position the cursor on the character following the component designation label. The light pen

interrupt routine now looks for an LPF. The operator can input 3 characters through the display keyboard. If the next LPF is on a parameter label, the cursor will be positioned so that parameter can be typed in. The transmit LPF will cause the defined parameters to be stored in the SPC-12. The component location routine is re-entered to define the next component. If the exit label is flagged, control is transferred to the schematic input routine. Data is stored by the INSPECT routines in the appropriate sectors of memory.

4.3 Schematic Data Input

On entry into the schematic input routine, the format of Figure 2 is displayed. A 3 x 3 dot grid is generated as in the component location routine. The operator moves the light pen to the schematic symbol and flags the transmit label. At this time the cursor move routine places the cursor so that the component designation can be entered and the LPI routine is executed. A flag on the designation label allows the designation to be retyped. A flag on transmit label stores the data and re-enters the symbol location routine. An exit flag returns control to the display executive. Designation parameters are used to reference schematic symbol locations to component error output. After each locating, all located symbols are marked for operator reference.

4.4 Scan

On entry into the scan routine, Format #2 is displayed. The INSPECT scan routine collects data. The component difference routine of the INSPECT software calculates the component deviation, then calls the display section. The error data is correlated with symbol location data, then displayed. All components are handled in the same way. When all data is out, the light pen interrupt routine waits for a label flag. The print label causes error data to be put out on the teletype. The exit label returns control to the executive which erases scan output.

4.5 Punch and Load

The profile tape will contain two additional blocks over the old INSPECT System. These blocks will contain the symbol locations associated with the schematic error display. The punch and load routines simply pass the number of characters and the starting memory address to the General Automation utility routine.

4.6 Change

The change routine will allow the operator to make changes to any of the component parameters. When the change label is flagged, the cursor move routine enables the operator to enter the component designation. The component parameters

are displayed at this time. A light pen flag on any of the labels except X and Y will allow the operator to retype that parameter. When transmit is flagged, the routine will move to input the next designation. At this point of board definition the X and Y coordinates should be right. This routine allows fast defining of parameters after zero level has been entered. Redefining schematic symbol data will not be necessary, since this is only used to set up the symbol position table.

4.7 Add

The add routine enters the component input routine without resetting memory and component counters. Exit is direct to the schematic input routine so this identification will not be overlooked.

4.8 Delete

On entry into the delete routine, the cursor is located so that component designation can be entered. The operator types the component location and flags the transmit label. This eliminates all data about that component.

4.9 Print

The print routine prints all standard profile data on the teletype for hardcopy records. If the print routine is flagged immediately after the scan routine, the error data will be printed on the teletype.

5.0 HARDWARE DESCRIPTION

Hardware to be added to the INSPECT for the NASA Display Subsystem will include:

1. 4K of SPC-12 computer memory
2. Information Displays IDIGraf with keyboard, light pen, memory address option, 2000 character additional memory, and protected fields option.
3. A parallel interface as described below.

The parallel interface requires the following control signals to and from the display:

Control Signals from Display:

1. Send next word - goes to a logical "0" when the IDIgraf can accept a data word.
2. Transmit next word - goes to a logical "0" when a character is available on the output.

Control Signals to Display:

3. Data ready - must go to a logical "0" when a character is available on the input.
4. Acknowledge - must go to a logical "0" when the transmitted character is accepted.
5. Master clear - goes to logical "0" to clear refresh memory

The interface will consist of an eight-bit register for output from the computer, a twelve-bit register for input to the computer, a General Automation "F.I.T." to provide

hardware control to the computer and interrupt logic to distinguish between radiometer, display I/O or light pen interrupts. Figure 4 gives the interface schematic. Note that the display has a 12-bit memory address register and an 8-bit data output register supply data to the computer. These are "wire OR-ed" into one 12-bit cable to the interface.

Description

Data Output from the SPC-12

When the display I/O routine is initiated, a DCPO- is generated by the FIT. This will inhibit interrupt coming from the radiometer or the light pen and enable interrupts from the display I/O. To output data the program will wait for an interrupt from the SEND NEXT WORD line of the display. On receipt the program will send the data word of interest to the I/O bus and cause the FIT to generate a strobe pulse which will load the I/O bus data into an output register. (This operation is identical to that which loads the DAC buffers used in power supply control.) The strobe will initiate a delaying one-shot that strobes the DATA READY line of the display. This moves the contents of the output register into the display. An additional gate is supplied to prevent this data from being strobed to the radiometer.

Data Input to the SPC-12

Refresh memory data coming into the SPC-12 is loaded

into an input register by a strobe from the TRANSMIT NEXT WORD line of the display. This line also generates an interrupt to the SPC-12. The program will execute an input statement causing a strobe to be sent to the input gates. Data is transferred. This strobe is also sent to the ACKNOWLEDGE line of the display. An additional gate is needed to inhibit the input gates of the INSPECT I/O interface.

When light pen, memory address information is required, the light pen flag routine sends a DC P2-pulse to the interrupt logic. This will inhibit the radiometer and display I/O interrupts and enable the light pen to interrupt. On receipt of the LIGHT PEN FLAG signal, the routine will generate a LIGHT PEN ACKNOWLEDGE pulse. This causes the 12-bit memory address to be gated to the output. Memory address information is brought in by the same method as refresh memory data.

When I/O with the radiometer is necessary, a DC P1-pulse is generated by the FIT to inhibit all display interrupts and enable the radiometer interrupts.

TABLE I

NEW SOFTWARE FOR DISPLAY

Memory for Storage	Memory Requirements
Schematic	767
Formats	300
Routines	
Light Pen Interrupt	40
Cursor Locate & Move	100
Exec. time - 1. Normal 12ms 2. Worst case 1.2s	
Display Exec.	125
Display I/O	115
Dot Generator	300
Exec. Time - 9ms/grid	
Cal. Cursor & Input Para.	120
Load & Punch	25
Comp. Control & Store	100
Schematic Control	150
Scan	150
ADD	25
DELETE	50
CHANGE	50
PRINT	100
DISPLAY LOCATED ITEMS	100
TOTAL	2,618

TABLE II

INSPECT SOFTWARE REWRITE

ROUTINES

Error Type-out

Error Calculations

Input Routine

TTY Exec.

Delete

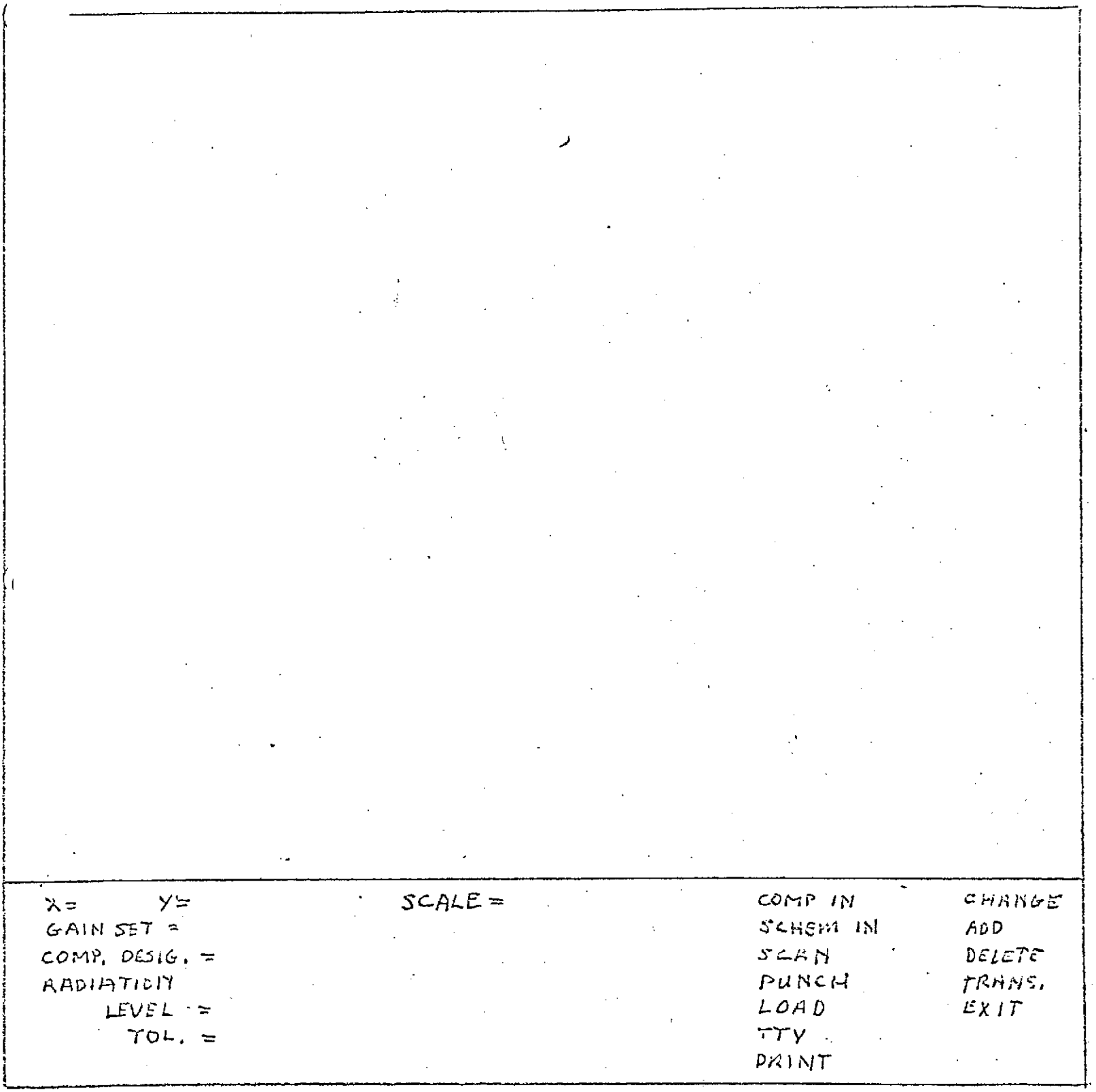


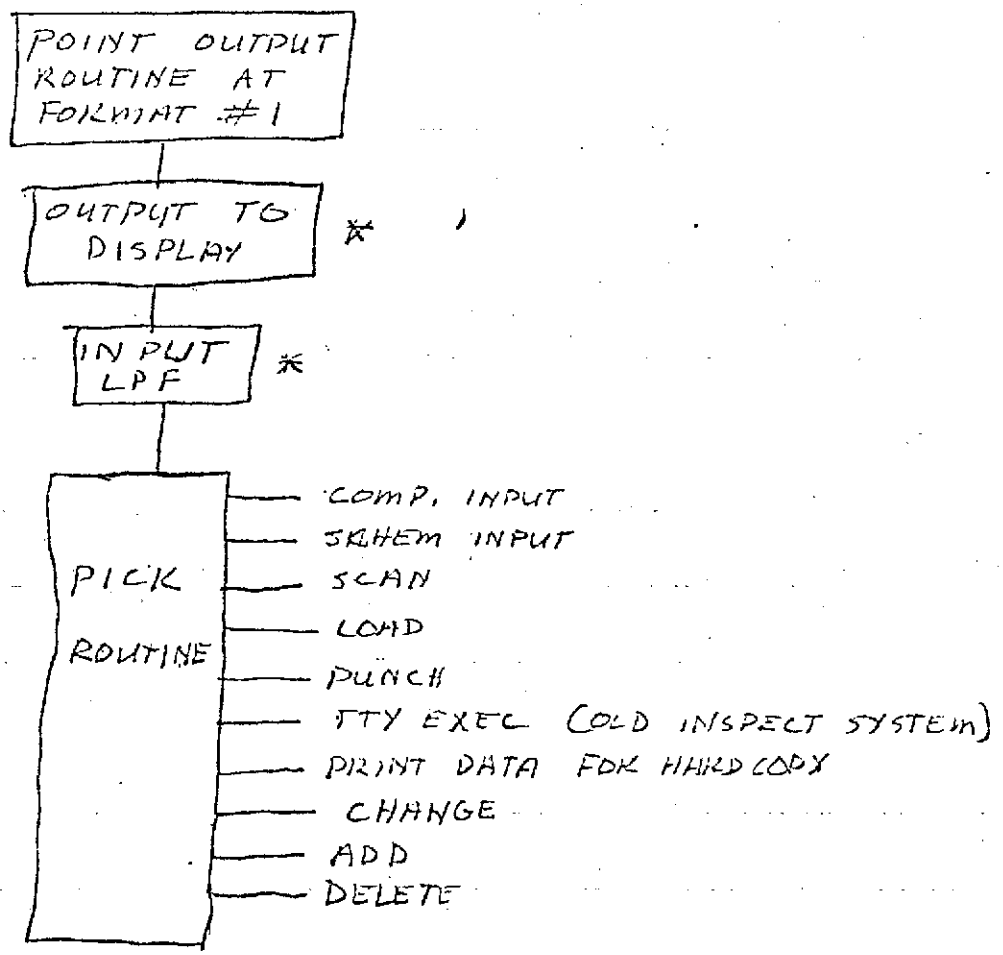
FIG. # 1
FORMAT # 1

DESIG ___
EXIT PRINT TRANS.

FIG, # 2
FORMAT #2

FIG. 3

DISPLAY EXECUTIVE



* DESIGNATES A SUBROUTINE

FIG. 3 (CONT'D)

NASA DISPLAY
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COMPONENT DATA INPUT

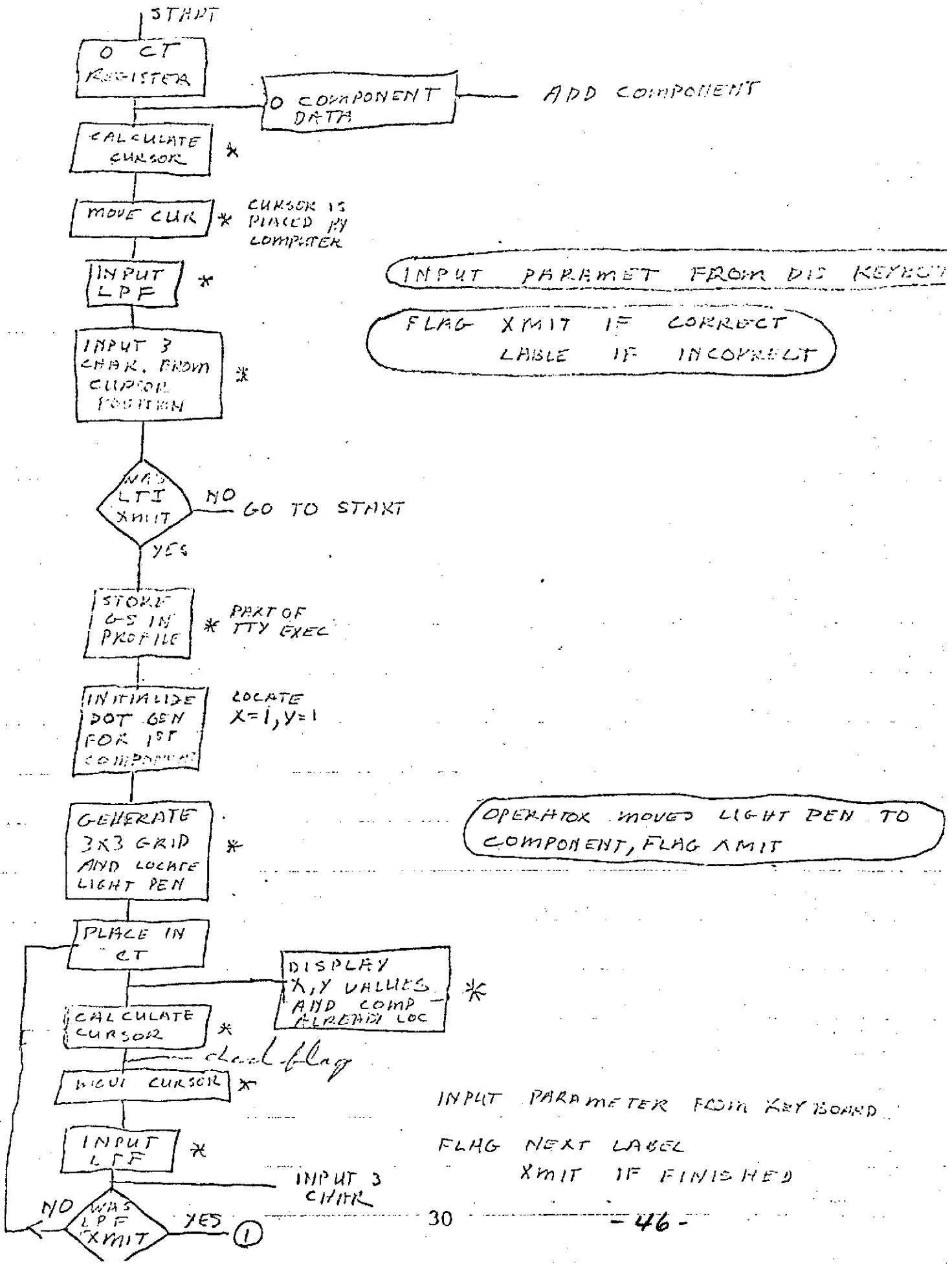

FIG. 3 (CONT'D)

NASA DISPLAY
NAS8-28436
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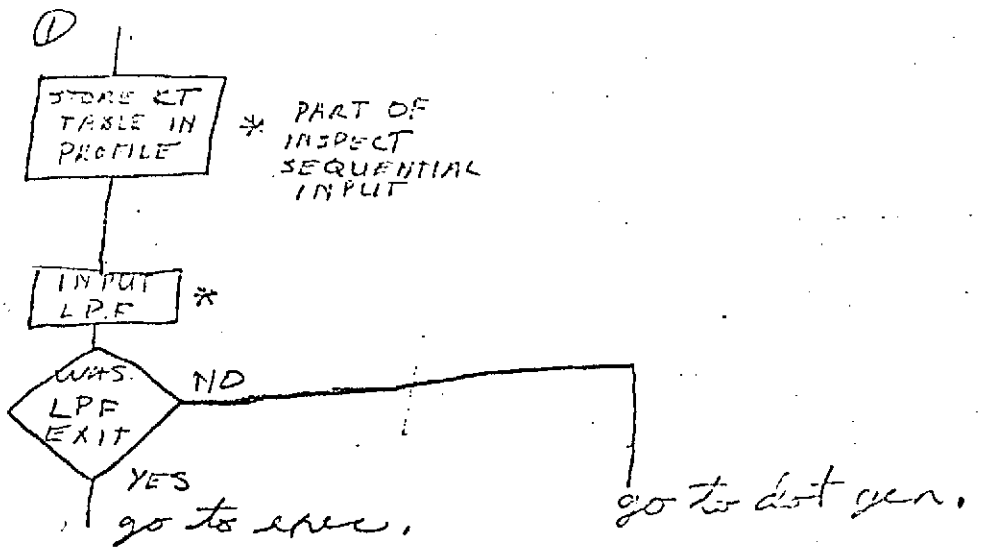
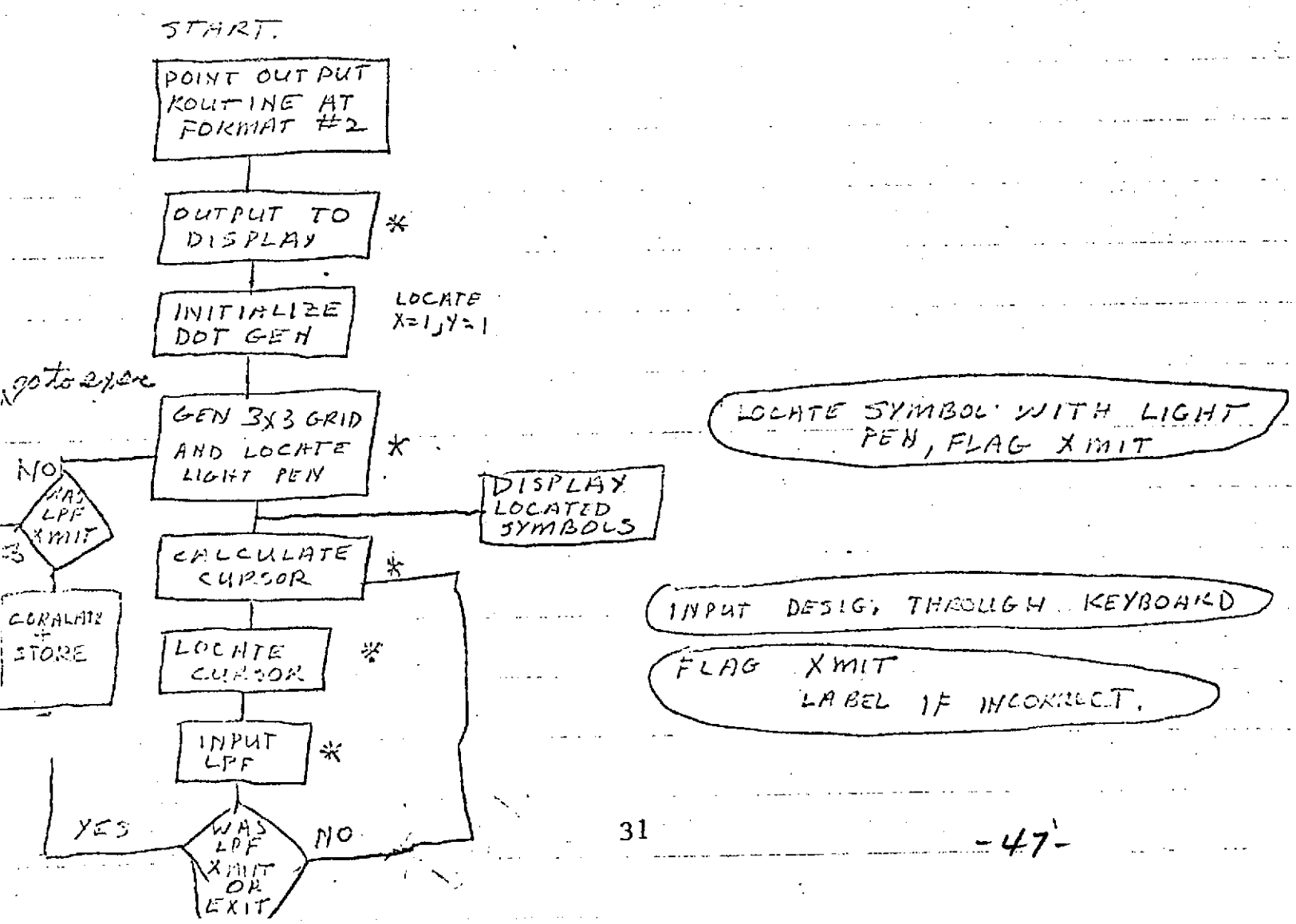


SCHEMATIC DATA INPUT.



SCAN

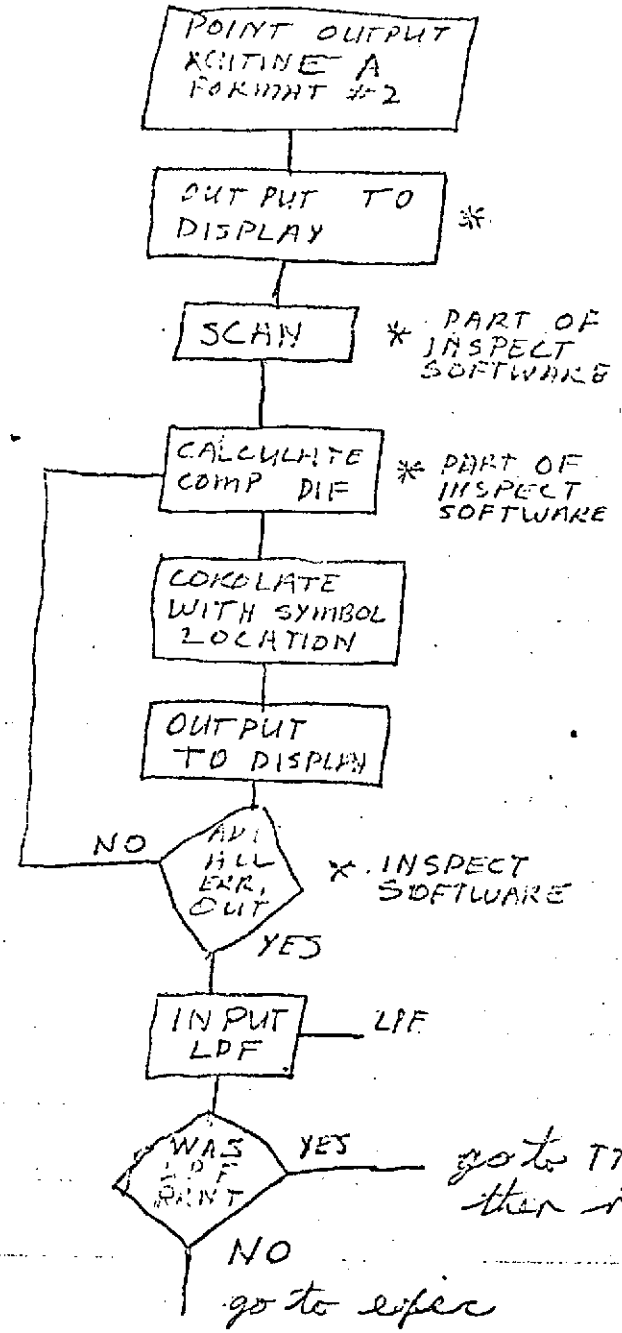

POINT OUTPUT ROUTINE A FORMAT #2
OUT PUT TO DISPLAY
*
SCAN
* PART OF INSPECT SOFTWARE
CALCULATE COMP DIF
* PART OF INSPECT SOFTWARE
COORDINATE WITH SYMBOL LOCATION
OUTPUT TO DISPLAY
NO
ANY ALL ERR. OUT
* INSPECT SOFTWARE
YES
INPUT LPF
LPF
WAS LPF ERR
YES
go to TTY EXEC and output error data then return to LPF
NO
go to exec

FIG. 3 (CONT'D)

NASA DISPLAY
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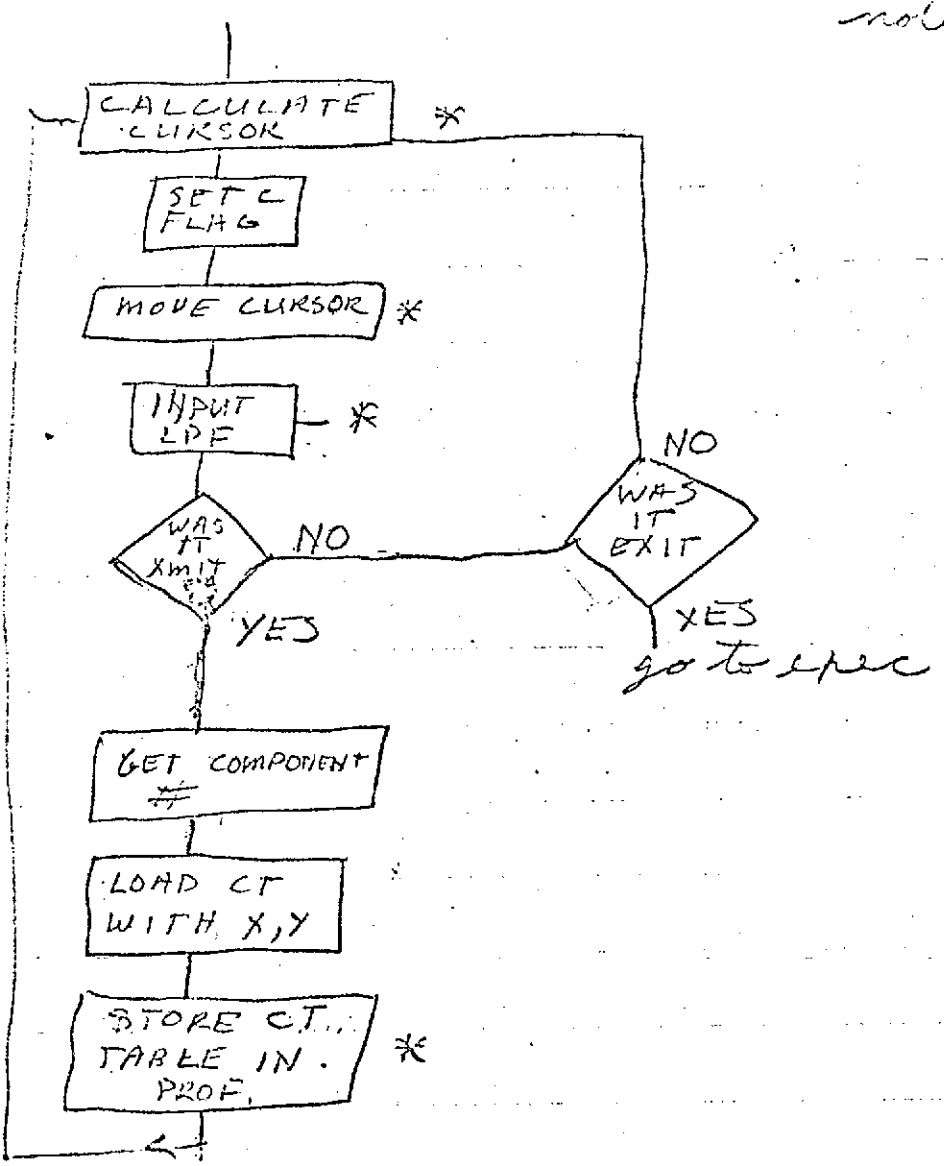
CHANGE

note:



ADD

GO TO ADD COMP

FIG. 3 (CONT'D)

NASA DISPLAY
NAS8-28436
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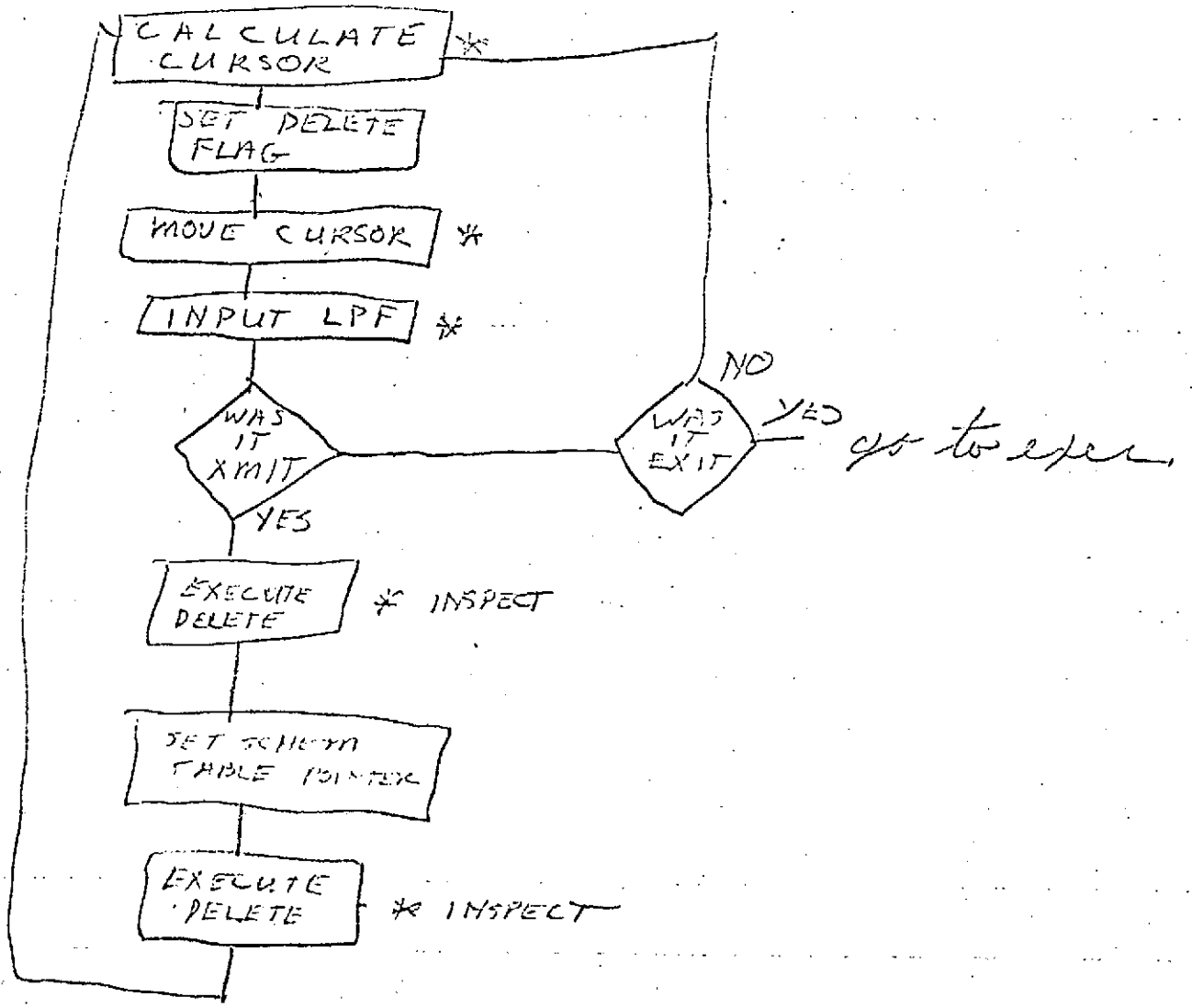
DELETE



VANTEL

...FRARED & COMPUTER SYSTEMS, INC.

FIGURE

RESPONSIBLE ENGR _____ UNIT _____ PROJECT NASA DISPLAY D.O. NO. _____

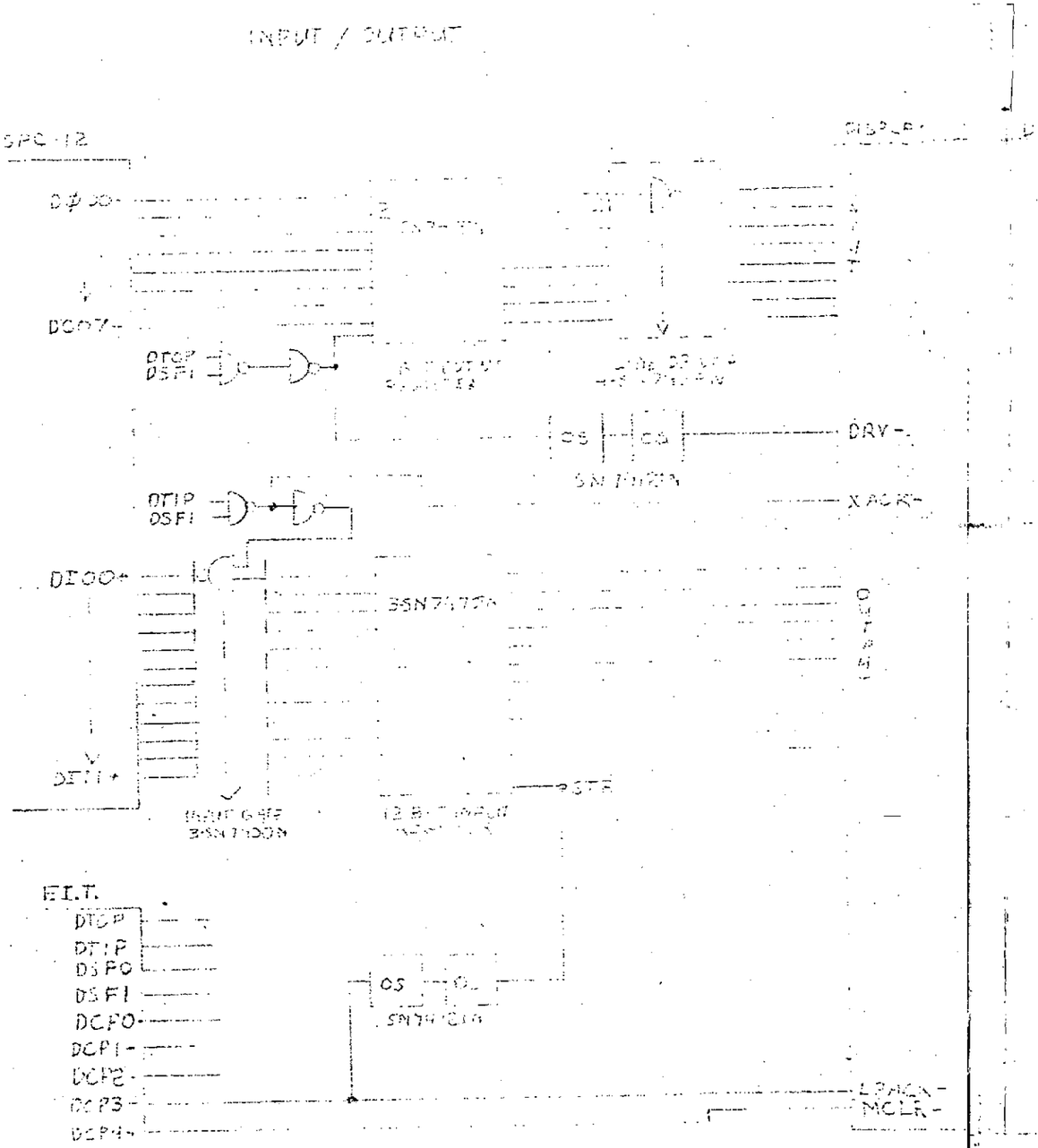
ITEM DESCRIPTION	MO/YR	MAR 7	APRIL	MAY	JUNE	JULY	AUG	SEPT 6
	PERIOD ENDING							
	REVIEW DATES							
DISPLAY DELIVERY								
MEMORY INSTALLATION								
INTERFACE HARDWARE								
DISPLAY SOFTWARE WRITE								
INSPECT SOFTWARE REWRITE								
DISPLAY SOFTWARE DEBUG								
INSPECT SOFTWARE DEBUG								
INTERFACE ASSEMBLY								
INTERFACE DEBUG								
SYSTEM DEBUG								
DESIGN REPORT								
MONTHLY REPORT								
FINAL REPORT								
MANUAL								
OVERLAY PREPARED								
OVERLAY DELIVERED								

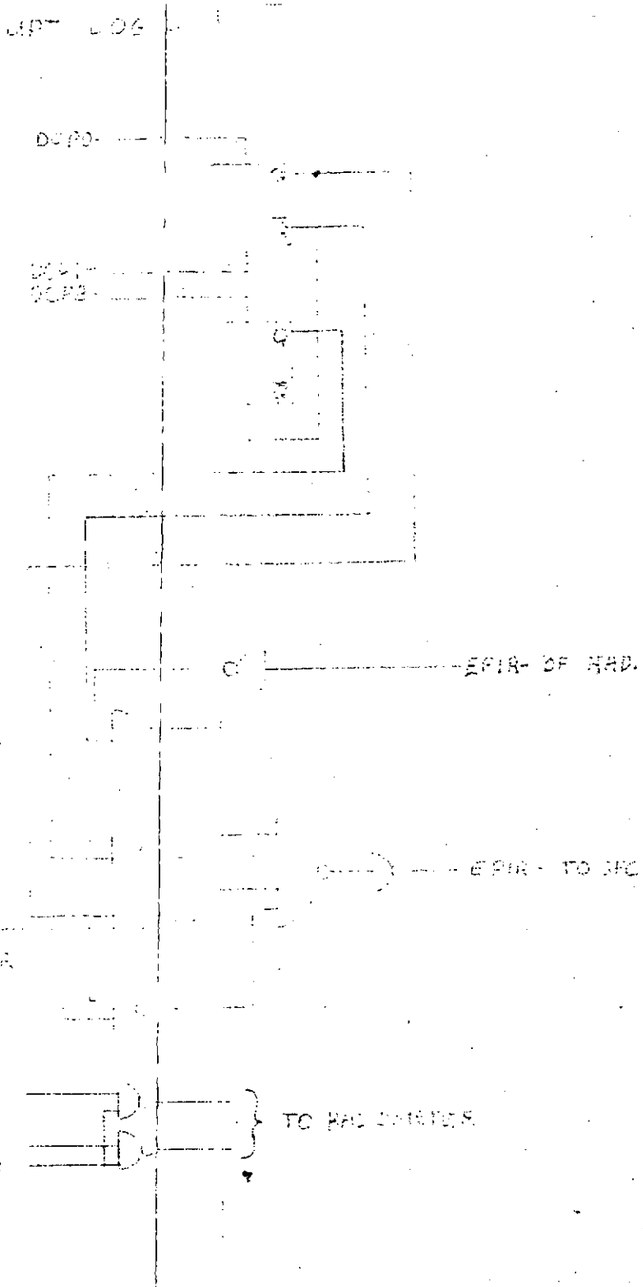
35

151

Δ Δ = SCHEDULE LINE ○ = ACTUAL START

= OF ORIG DATE ISSUE NO.





VANZETTI INFRARED & COMPUTER SYSTEMS, INC.			NASA DISPLAY INTERFACE SCHEM.
DW'N	SCALE	TOLERANCES: UNLESS OTHERWISE SPECIFIED FRACTIONAL ± 1/32 DECIMAL .000 ± .005 .00 ± .010	DW'G NO. 1002B2800
CH'K'D	MAT'L		

FOLDOUT FRAME

-52-

FOLDOUT FRAME

2

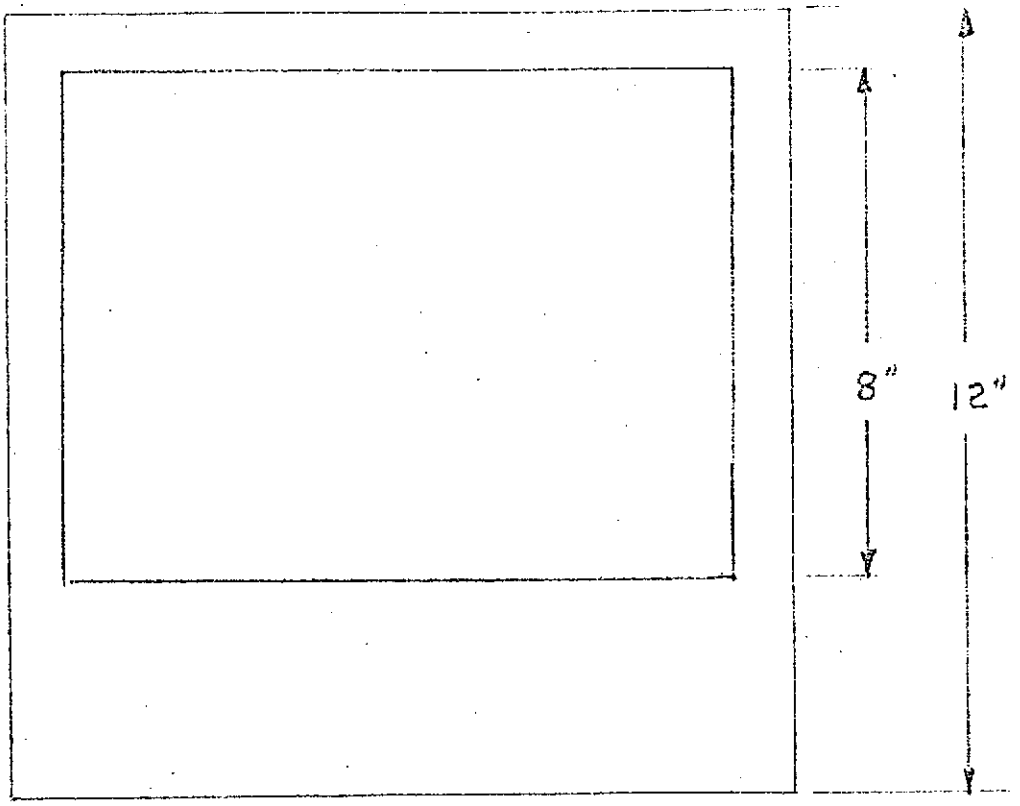
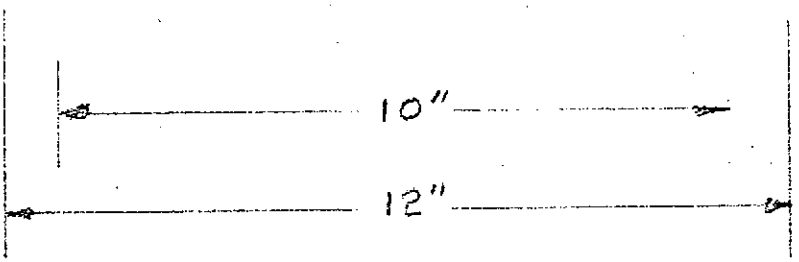


FIG. 6A



ALL TOLERANCES ARE ±.01"

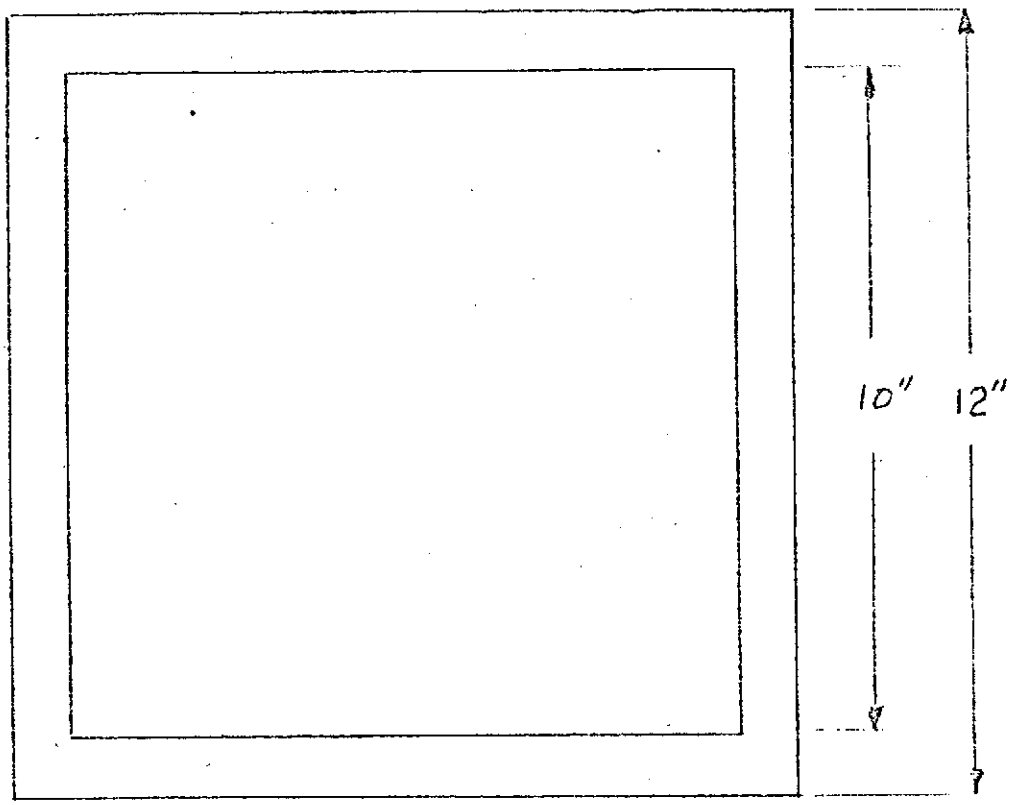


FIG. 6B

VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.

NEW ADDRESS

605 Neponset Street
Canton, Mass. 02021
Tel: (617) 828-4650

SECOND MONTHLY PROGRESS REPORT

DESIGN, FABRICATION, TESTING AND DELIVERY OF AN INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

COVERING PERIOD FROM: APRIL 7, 1972 TO MAY 8, 1972

AUTHOR: JAMES HALL, ASSISTANT PROJECT SUPERVISOR

MONTHLY PROGRESS REPORT: CONTRACT #NAS8-28436

DATE OF PUBLICATION: MAY 8, 1972

PREPARED FOR: GEORGE C. MARSHALL SPACE FLIGHT CENTER
ALABAMA 35812

NASA DISPLAY
NAS8-28436
5/72

MONTHLY PROGRESS REPORT

CONTRACT NAS8-28436

SECTIONS

I	Progress on Display Subsystem to Date
II	Indication of Current Problems Which May Impede Performance and Proposed Corrective Action
III	Work to be Performed During the Next Reporting Period
IV	New Technology

I. PROGRESS ON DISPLAY SUBSYSTEM TO DATE

1. As stated in the last monthly report, the display software was to have been nearly completed in the period covered by this report. This task is approximately 75% complete and on schedule.

2. The debugging of the INSPECT software rewrite is approximately 50% complete and slightly behind schedule. This aspect of the program is being held up by the IDIgraph display late delivery.

II. INDICATION OF CURRENT PROBLEMS WHICH MAY IMPEDE PERFORMANCE AND PROPOSED CORRECTIVE ACTION

The delay in shipment of the display terminal to us from Information Displays, Inc. continues to be the only item of current concern in this category. Signetics Memory Systems Company in California is in the process of a make-up production cycle to yield the remaining type of memory chip required by Information Displays Inc. to enable them to begin final testing on the display terminal. Signetics Inc. has scheduled shipment of this memory chip to IDI for early during the week of May 19. If this schedule is realized, we expect IDI to be able to make shipment to us by May 31.

Although this situation remains a definite concern as a possible cause for delay of contract, it is still too soon to be certain. We should have a better basis for a more definite opinion by the time the next monthly progress report is written.

III. WORK TO BE PERFORMED DURING THE NEXT REPORTING PERIOD

1. Finishing up the INSPECT software debugging.
2. Assemble and debug the display interface.
3. Begin display software debugging.

It should be noted that progress at this point depends on the delivery of the IDIgraph.

IV. NEW TECHNOLOGY

There has been no new technology developed in the period covered by this report.

VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.
607 NEPONSET STREET
CANTON, MASSACHUSETTS 02021
TELEPHONE (617) 828-4650

THIRD MONTHLY PROGRESS REPORT

DESIGN, FABRICATION, TESTING AND DELIVERY OF AN INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

COVERING PERIOD FROM: MAY 9, 1972 TO JUNE 7, 1972

AUTHOR: JAMES HALL, ASSISTANT PROJECT SUPERVISOR

MONTHLY PROGRESS REPORT: CONTRACT #NAS8-28436

DATE OF PUBLICATION: JUNE 12, 1972

PREPARED FOR: GEORGE C. MARSHALL SPACE FLIGHT CENTER
ALABAMA 35812

NASA DISPLAY
NAS8-28436
6772

MONTHLY PROGRESS REPORT

CONTRACT NAS8-28436

SECTIONS

I	Progress on Display Subsystem to Date
II	Indication of Current Problems Which May Impede Performance and Proposed Corrective Action
III	Work to be Performed During the Next Reporting Period
IV	New Technology

J. PROGRESS ON DISPLAY SUBSYSTEM TO DATE

1. The Display Subsystem software writing has been completed. This item is on schedule.

2. The INSPECT software is approximately 75% debugged. The hold-up in this area is the late delivery of the IDIgraf.

3. The Display Interface debug also is held up by the late delivery of the IDIgraf.

4. The Display Software debug area is completely dependent on the delivery of the IDIgraf and is behind schedule.

II. INDICATION OF CURRENT PROBLEMS WHICH MAY IMPEDE PERFORMANCE, AND PROPOSED CORRECTIVE ACTION

The only item of current concern in this category remains to be the delivery of the Display Terminal to us from Information Displays, Inc. As previously reported, the cause for delay has been that Information Displays, Inc. was unable to get shipment of critical memory chip components, due to production difficulties experienced by their supplier, Signetics Memory Systems, Inc. Early during the week of June 9, the last required item of these memory chips was received at Information Displays, Inc. and we are now informed that the Display Terminal is assembled and in the process of final testing and debugging. IDI has promised shipment to us by June 16 from Mt. Kisco, New York.

Although this delay places us in a circumstance of disadvantage regarding our delivery schedule, it is felt that there is reasonable possibility that we can still meet the original contract delivery date. After we have the Display Terminal in our facility to work with, a more educated opinion will be possible regarding our delivery date capability.

III. WORK TO BE PERFORMED DURING THE NEXT REPORTING PERIOD

All areas of work that are behind schedule from the last reporting period will be performed as soon as possible. These include:

1. Finishing up the INSPECT software debug.
2. Debug of the Display interface.
3. Begin Display software debug.

In addition, items to be worked on during the next reporting period are:

1. Complete system debug.
2. Preparation of overlays.

It should be noted that progress on all the above work areas depend on the delivery date of the IDIgraf.

IV. NEW TECHNOLOGY

There has been no new technology developed in the period covered by this report.

VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.

607 NEPONSET STREET
CANTON, MASSACHUSETTS 02021
TELEPHONE (617) 828-4650

FOURTH MONTHLY PROGRESS REPORT

DESIGN, FABRICATION, TESTING AND DELIVERY

OF AN

INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

COVERING PERIOD FROM:	JUNE 8, 1972 TO JULY 7, 1972
AUTHOR:	JAMES HALL, ASSISTANT PROJECT SUPERVISOR
MONTHLY PROGRESS REPORT:	CONTRACT #NAS8-28436
DATE OF PUBLICATION:	JULY 11, 1972
PREPARED FOR:	GEORGE C. MARSHALL SPACE FLIGHT CENTER ALABAMA 35812

NASA DISPLAY
NAS8-28436
7/72

MONTHLY PROGRESS REPORT

CONTRACT NAS8-28436

SECTIONS

I	Progress on Display Subsystem to Date
II	Indication of Current Problems Which May Impede Performance and Proposed Corrective Action
III	Work to be Performed During the Next Reporting Period
IV	New Technology

I. PROGRESS ON DISPLAY SUBSYSTEM TO DATE

Initial assembly of the Display Subsystem software has been accomplished and areas requiring slight modifications have been determined.

The IDIgraf was delivered on July 6, 1972. As a result, no progress was made in areas outlined in the last report dated June 12, 1972.

II. INDICATION OF CURRENT PROBLEMS WHICH MAY IMPEDE PERFORMANCE, AND PROPOSED CORRECTIVE ACTION

The Display Terminal, which we had noted in the previous reports as an overdue, outside vendor item, was delivered to our plant on July 6, 1972. Due to the long delay in delivery of this item, we requested a contract amendment to extend our delivery due date to October 31, 1972. This request was granted.

We are not aware of any problems which may impede performance.

III. WORK TO BE PERFORMED DURING THE NEXT REPORTING PERIOD

Work will be done on program areas in the sequence listed below in the next reporting period:

1. Display interface debug.
2. Intermediate assemblies of Display software.
3. Begin Display software debug.
4. Preparation of overlays and mechanical interface.
5. INSPECT software debug.

A copy of the revised schedule is included in this report.

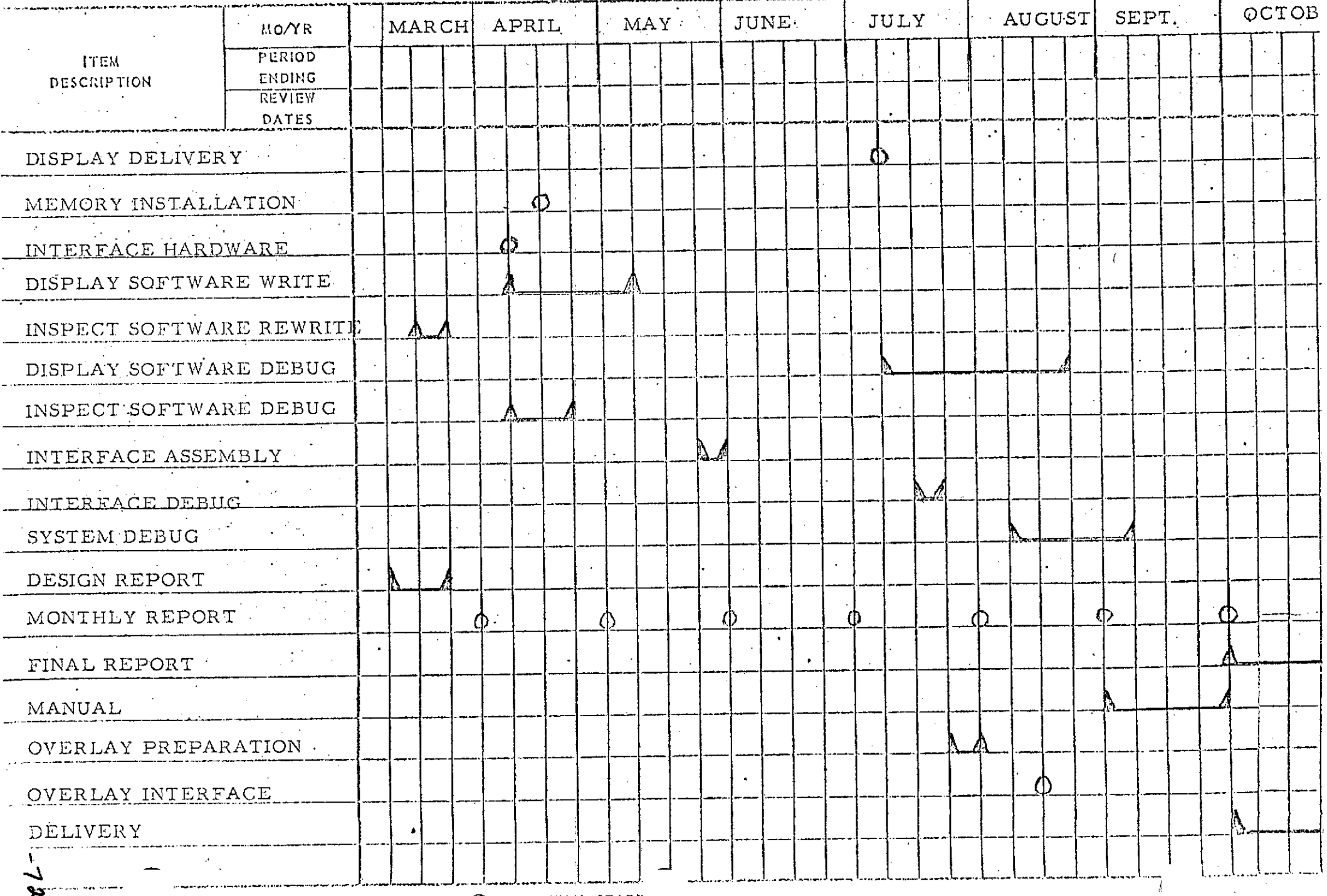
IV. NEW TECHNOLOGY

There has been no new technology developed in the period covered by this report.

INFRARED & COMPUTER SYSTEMS, INC.

REVISED SCHEDULE

RESPONSIBLE ENGR _____ UNIT _____ PROJECT _____ D.O. NO. _____



△ = SCHEDULE LINE ○ = ACTUAL START

PAGE OF ORIG DATE ISSUE NO. ID NO.

VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.
607 NEPONSET STREET
CANTON, MASSACHUSETTS 02021
TELEPHONE (617) 828-4650

FIFTH MONTHLY PROGRESS REPORT

DESIGN, FABRICATION, TESTING AND DELIVERY

OF AN

INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

COVERING PERIOD FROM:	JULY 8, 1972 TO AUGUST 11, 1972
AUTHOR:	JAMES HALL, ASSISTANT PROJECT SUPERVISOR
MONTHLY PROGRESS REPORT:	CONTRACT #NAS8-28436
DATE OF PUBLICATION:	AUGUST 14, 1972
PREPARED FOR:	GEORGE C. MARSHALL SPACE FLIGHT CENTER ALABAMA 35812

NASA DISPLAY
NAS8-28436
8/72

MONTHLY PROGRESS REPORT

CONTRACT NAS8-28436

SECTIONS

I	Progress on Display Subsystem to Date
II	Indication of Current Problems Which May Impede Performance and Proposed Corrective Action
III	Work to be Performed During the Next Reporting Period
IV	New Technology

I. PROGRESS ON DISPLAY SUBSYSTEM TO DATE

After performing the following steps:

1. Display interface debug;
2. Intermediate assemblies of display software;
3. Begin display software debug;

as outlined in the last monthly report, the IDIgraf display terminal showed major problems as stated in Section II of this report. As a result, no further progress was made.

II. INDICATION OF CURRENT PROBLEMS WHICH MAY IMPEDE PERFORMANCE, AND PROPOSED CORRECTIVE ACTION

We have experienced serious problems with Information Displays Inc. and the display terminal which they shipped to us intended for use on this NASA contract. We feel that this particular display terminal is unacceptable and that we should return it to IDI and select a suitable display from another manufacturer, subject to the approval of NASA.

This conclusion was reached because of the following reasons:

1. Poor delivery and communication performance on the part of IDI during the experience of this order.
2. Inherent component and operational defects in the new unit.
3. Visual distortion characteristic in this display terminal.
4. a. Poor documentation in that which was furnished.
   b. Lack of standard documentation which should accompany equipment in this category.
   c. Poor warranty policy.

Summary

1. Poor Past Performance

Past performance of IDI concerning this IDIgraf display terminal has been very poor. On September 2, 1971 our letter of intent to purchase an

II. INDICATION OF CURRENT PROBLEMS (CONT'D)

IDIgraf display terminal was sent to IDI. On January 20, 1972 the letter of intent was reaffirmed and a delivery date of April 7, 1972 was promised by IDI. On February 25, 1972 our formal purchase order #480 was sent to IDI. On March 9, 1972 IDI informed us that delivery would be delayed to April 21, 1972. On April 6, 1972, IDI notified us that delivery would be delayed to June 9, 1972. Delivery was finally made on July 6, 1972. During this four-month period, we found it necessary for us to be the constant initator of communications with IDI, in order to keep informed of the status of this delay situation. Eventually, it became necessary for us to reluctantly request a delivery extension on our NASA contract.

2. Defective - Inoperative Under Normal Conditions

The display delivered was defective. The graphics mode of operation was not operating under normal conditions. Upon informing IDI of the problem, IDI said that they do not provide a field warranty service and that the rate they charge for field service is $300.00 per day. For warranty service at their plant the freight both ways would have to be borne by the customer.

Coincidentally, their field service engineer had just completed a job in our area and we requested that he come to our plant. His diagnosis was that

II. INDICATION OF CURRENT PROBLEMS (CONT'D)

this display has some defective memory chips and a basic heat problem. He recommended that we run the display with the sheet metal enclosures removed to get rid of the heat problem. He would not state verbally or in writing that IDI would fix this heat problem for sure. He had also mentioned that other IDIgraf display pterminals showed similar defects. Vanzetti Infrared & Computer Systems feels this display terminal is not reliable.

3. Visual Distortion

The IDIgraf display terminal does not have the capability of painting straight lines over its entire specified usable area. This problem is inherent in CRT deflection systems and is known as the pincushion effect. This effect makes the IDIgraf totally unusable for precision location routines as called for in the NASA contract.

Since IDI had informed us that their unit would fulfill our application prior to our ordering, we feel that IDI should have delivered a unit that would not produce the pincushion effect. This problem is correctable. However, IDI has stated that they will not correct it without being paid additional money in the approximate amount of $5,000.00, and there would be a substantial delivery delay for the performance of this.

II. INDICATION OF CURRENT PROBLEMS (CONT'D)

4. Extremely Poor Documentation

Operation and/or Maintenance Manuals were not included. Schematics are available for analog circuitry, but not for the digital circuitry. There is no formal warranty from IDI and without proper documentation we could not service this unit. Field failure would mean prohibitive expenses, resulting from repair bills from IDI.

For the above reasons Vanzetti Infrared & Computer Systems, Inc. feels that the IDIgraf display terminal should be returned and the order cancelled. A new display will be chosen, pending NASA's approval.

III. WORK TO BE PERFORMED DURING THE NEXT REPORTING PERIOD

An engineering change order will be generated and submitted to NASA for approval. This change order will include:

1. Specification of a new display terminal that will better meet the NASA contract requirements.
2. Specification of interface and any other additional equipment.
3. Specification of additional software rewrite.
4. Revised schedule

A purchase order for equipment will be placed and work started on additional software as soon as NASA's approval is received.

IV. NEW TECHNOLOGY

There has been no new technology developed in the period covered by this report.

VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.
607 NEPONSET STREET
CANTON, MASSACHUSETTS 02021
TELEPHONE (617) 828-4650

SIXTH MONTHLY PROGRESS REPORT

DESIGN, FABRICATION, TESTING AND DELIVERY

OF AN

INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

COVERING PERIOD FROM:	AUGUST 14, 1972 TO SEPTEMBER 9, 1972
AUTHOR:	JAMES HALL, ASSISTANT PROJECT SUPERVISOR
MONTHLY PROGRESS REPORT:	CONTRACT #NAS8-28436
DATE OF PUBLICATION:	SEPTEMBER 20, 1972
PREPARED FOR:	GEORGE C. MARSHALL SPACE FLIGHT CENTER ALABAMA 35812

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MONTHLY PROGRESS REPORT

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SECTIONS

I. PROGRESS ON DISPLAY SUBSYSTEM TO DATE

A limited amount of effort was further expended in trying to get the IDI system to work. The final result was further breakdown of the electronics, so that now only a tiny, stationary dot appears on the center of the c. r. t., which will not respond to any of the keyboard controls.

As a consequence, several new avenues were surveyed, in order to find a suitable way to fulfill our contractual commitments.

Final testing of following items which were added during previous months:

A. Non-linear amplifier

B. Shaft encoder

C. Separate electronic console rack

D. Calibration source

II. MEETING AT MARSHALL SPACE FLIGHT CENTER

On September 8, 1972, a meeting was held at the offices of the Quality Assurance Branch of NASA-MSFC. Attending the meeting were:

Mr. Leon Hamiter, Branch Chief

Mr. J.H. Belcher, Jr.

Mr. John Berkebile

The above three individuals were representing NASA.

Dr. Riccardo Vanzetti, representing Vanzetti Infrared and Computer Systems, Inc.

Several different options and changes were discussed, on how to meet the contractual goals and on some new system capabilities that could be added to it in order to make its operation more complete, easier and faster.

A proposal offering the system changes discussed at the meeting will be submitted by Vanzetti Infrared and Computer Systems, Inc.

III. PLAN OF WORK FOR NEXT REPORTING PERIOD

Preparation of the proposal mentioned in Section II will be the next task to be accomplished.

No labor nor material will be charged against the contract for this task.

IV. NEW TECHNOLOGY

There has been no new technology developed in the period covered by this report.

VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.
607 NEPONSET STREET
CANTON, MASSACHUSETTS 02021
TELEPHONE (617) 828-4650

SEVENTH MONTHLY PROGRESS REPORT

DESIGN, TESTING, AND DELIVERY

OF AN

INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

CONTINUATION OF WORK ON CONTRACT NO. NAS8-28436
AFTER APPROVAL OF CONTRACT AMENDMENT S/A 2 FFP.

COVERING PERIOD FROM: JANUARY 12, TO FEBRUARY 5, 1973

AUTHOR: BRUCE HOLMES, PROJECT ENGINEER

DATE OF PUBLICATION: FEBRUARY 12, 1973

PREPARED FOR: GEORGE C. MARSHALL SPACE FLIGHT CENTER
ALABAMA 35812

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MONTHLY PROGRESS REPORT

CONTRACT NAS8-28436

SECTIONS

I	Progress on Display Subsystem to Date
II	Indications of current problems which may impede performance and proposed corrective action
III	Work to be performed during the next reporting period
IV	New Technology
V	Appendix

I. PROGRESS ON DISPLAY SUBSYSTEM TO DATE

1. SOFTWARE DEVELOPMENT

a. The addition of Software to make the INSPECT SYSTEM Insensitive to Temperature Gradients between P.C. Card Carriage and detector chamber has been completed.

b. The ability to Generate Profiles quickly by entering a Percentage which will be applied to the component Radiation level previously Scanned has been completed. This result combined with the Level Scanned make up the P.C. Card Standard Thermal Signature.

c. The executive and Hard Copy output routines have been rewritten to accomodate the additional requirements of the Display Subsystem.

2. HARDWARE DEVELOPMENT

a. Specifications for the Graphics Display Terminal to be supplied by Princeton Electronic Products Inc. were established. The system was ordered on January 23, 1973 and a formal confirming Purchase Order was sent out on February 5, 1973. Delivery is expected within 120 days.

b. The Lenses for the Television Camera are being selected. The possibility of using a single Lens with Electronically Driven Zoom capability is being considered.

c. Specifications for the Television Camera are being established.

d. A search is in progress for a Television Camera to Graphics Display Interface. A Video Mixer with a Bandwidth of 30 MHZ operating at a 1029 Line Rate is required, but a commercially available Model hasn't been located yet. Two methods of mixing the required Video Signals are also currently available in-house but the amount of spacial resolution that is lost using these systems will have to be determined experimentally.

e. Recent enhancements to the Signal Processing Circuits of the INSPECT System have reduced the Systems overall susceptibility to external noise. This results in improved repeatabilty of the Scanned Data.

f. The exact operating procedures and forms of Displaying the output are being considered.

Due to the fact that the small size characters (.08" x .16") by the Graphics Terminal cannot be made visible in the corners of Display Monitor by any State-Of-The-Art Technique, the decision to use the normal size characters (.12" x .23") was made. It is planned to Display one Character on every component as an indication of its Thermal Value (Either Absolute or Relative Deuiation from a Standard.) A Graphical Display is given in the Appendix showing how this might look with the worst case component Density blown up 20 times actual size. The component density used in this Display was three In-line Diodes .06" x .09" in size spaced .05" apart.

g. The Parallel - to - Serial Interface required to connect the display to the computer was ordered on January 23, 1973 from General Automation Inc. delivery is expected in 30 days.

II. INDICATION OF CURRENT PROBLEMS WHICH MAY IMPEDE PERFORMANCE AND PROPOSED CORRECTIVE ACTION.

The list of routines and memory requirements for controlling the INSPECT and Display Systems in Figure 3, Page 23 of Justification for Engineering change proposal, does not contain a Data Space of 512 words of memory which is required for storing the X-Y Locations of the components on the Schematic Diagram. This Data area is required for switching between output Display of component Layouts and Schematic Diagrams. Elimination of the Scan Delay and Blink Control routines will save approximately 300 memory locations. The other 200 locations can be gained by possibly modularizing some of the Software.

III. WORK TO BE PERFORMED DURING THE NEXT REPORTING PERIOD.

a. Completion of part of the rewriting of the Scan, Edit, and utility routine packages.

b. Ordering the Television Camera and Lenses

c. Ordering or designing a Television Camera to Graphic Display System Interface.

d. Finalize Operating Procedures and the form of the output Display.

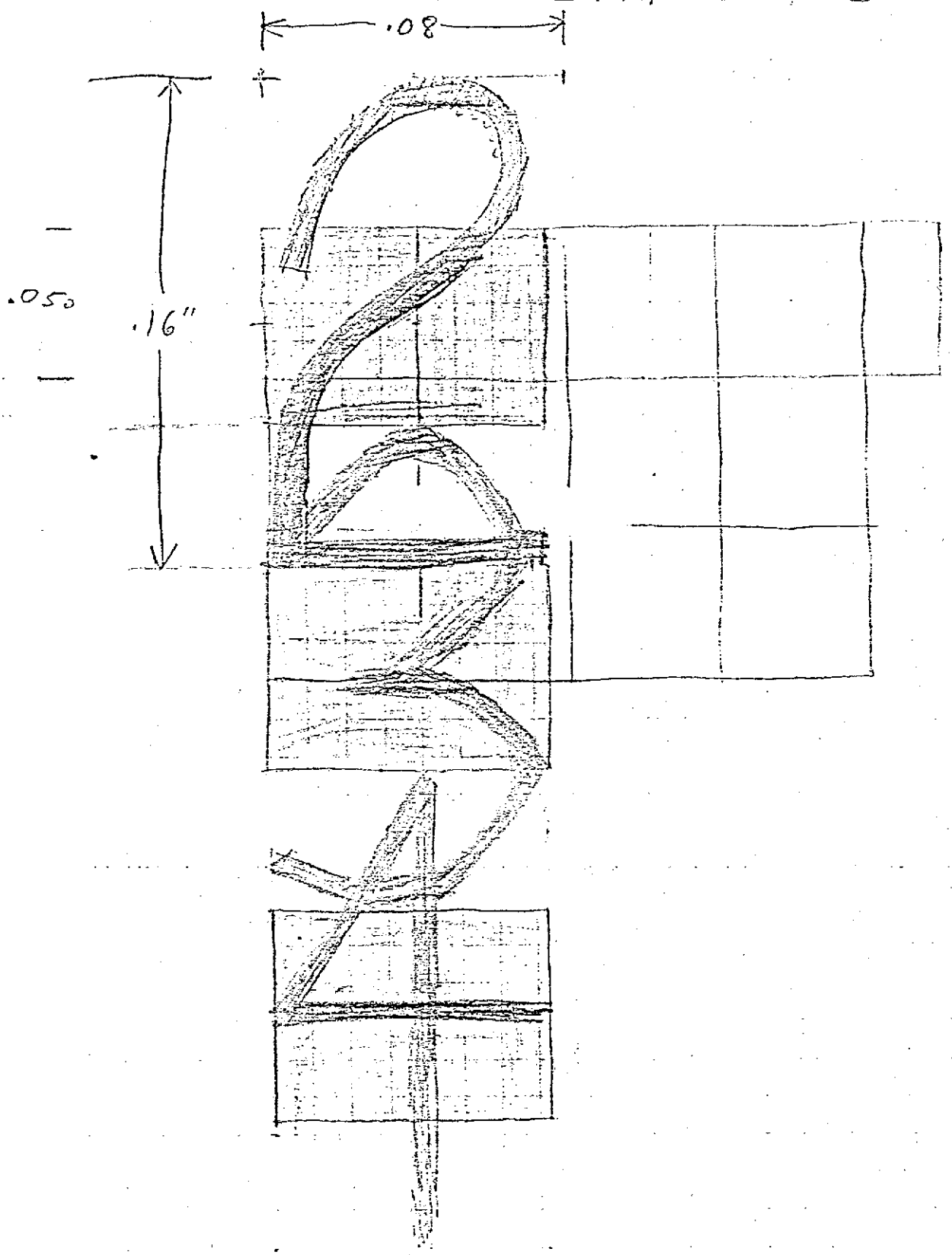
e. Select a Dolly Rack for housing all the equipment.

IV. NEW TECHNOLOGY

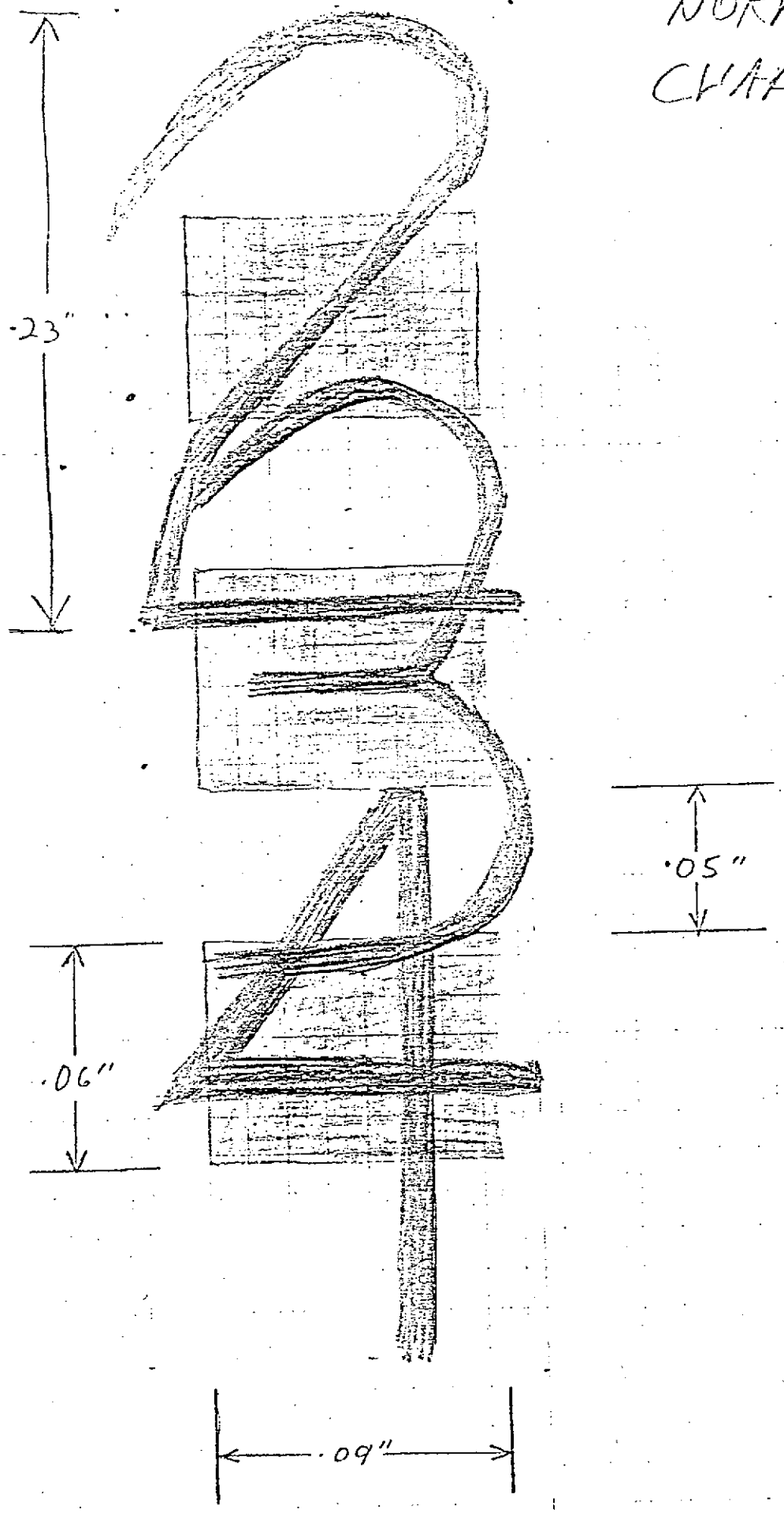
There has been no new Technology Developed in the Period covered by this report. Information concerning work done during this period can be found in Section I of this report.

V. APPENDIX

SMALL CHARACTERS



NORMAL CHARACTERS



VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.
607 NEPONSET STREET
CANTON, MASSACHUSETTS 02021
TELEPHONE (617) 828-4650

EIGHTH MONTHLY PROGRESS REPORT

DESIGN, TESTING, AND DELIVERY

OF AN

INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

CONTINUATION OF WORK ON CONTRACT NO. NAS8-28436
AFTER APPROVAL OF CONTRACT AMENDMENT S/A 2FFP.

COVERING PERIOD FROM:	FEBRUARY 6 TO MARCH 9, 1973
AUTHOR:	BRUCE HOLMES, PROJECT ENGINEER
DATE OF PUBLICATION:	MARCH 12, 1973
PREPARED FOR:	GEORGE C. MARSHALL SPACE FLIGHT CENTER ALABAMA 35812

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NAS8-28436
3/73

MONTHLY PROGRESS REPORT

CONTRACT NAS8-28436

SECTIONS

I	Progress on Display Subsystem to Date
II	Indications of current problems which may impede performance and proposed corrective action
III	Work to be performed during the next reporting period
IV	New Technology
V	Appendix I - Configuration Drawing

I. PROGRESS ON DISPLAY SUBSYSTEM TO DATE

1. SOFTWARE DEVELOPMENT

a. The executive and hard copy routines have been tested successfully.

b. The scan, edit, and utility routines packages have been rewritten and are currently being tested.

2. HARDWARE DEVELOPMENT

a. The selection of the dolly rack has been delayed until lenses have been selected and the lens to subject distance determined. Conceptual sketches of the approximate configuration are presented in Appendix I. The camera mount will be taken down and reassembled for shipment.

b. Ordering the television camera and lenses has been postponed. The camera originally selected utilizes a 30mm plubicon tube. The manufacturer now believes that a vidicon tube camera may provide better resolution at a lower cost. He will provide both types for our testing. Since delivery is on an of-the-shelf basis (30 days), no delay in the program is anticipated.

c. A video mixer is currently being designed to combine the live video from the TV camera with the output of the graphics display system for simultaneous viewing on the display monitor.

II. INDICATION OF CURRENT PROBLEMS WHICH MAY IMPEDE PERFORMANCE AND PROPOSED CORRECTIVE ACTION

The addition and deletion of several software modules has made it difficult to estimate the availability of core memory. The core memory on the SPC-12 computer is divided into four blocks of 2,000 words each. Only the first memory block is capable of communicating with the other three memory blocks and currently there appears to be approximately 350 words of memory available. The input-output subroutines for the display system will be resident in block one of memory and if enough memory is not available, a major redesign of the INSPECT software will be required.

III. WORK TO BE PERFORMED DURING THE NEXT REPORTING PERIOD

a. Testing of edit software package

b. Writing of percent output and level output software packages.

c. Partial writing of the display input-output routines and the monitor output routines pending the receival of documentation from Princeton Electronic Products Inc. and General Automation Inc.

d. Finalize configuration design and order dolly rack.

e. Order television camera and lenses.

IV. NEW TECHNOLOGY

There has been no new technology developed in the period covered by this report. Information concerning work done during this period can be found in Section I.

V. APPENDIX

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VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.
607 NEPONSET STREET
CANTON, MASSACHUSETTS 02021
TELEPHONE (617) 828-4650

NINTH MONTHLY PROGRESS REPORT

DESIGN, TESTING, AND DELIVERY

OF AN

INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

CONTINUATION OF WORK ON CONTRACT NO. NAS8-28436
AFTER APPROVAL OF CONTRACT AMENDMENT S/A 2FFP.

COVERING PERIOD FROM:	MARCH 10 TO MARCH 30, 1973
AUTHOR:	BRUCE HOLMES, PROJECT ENGINEER
DATE OF PUBLICATION:	MARCH 30, 1973
PREPARED FOR:	GEORGE C. MARSHALL SPACE FLIGHT CENTER ALABAMA 35812

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MONTHLY PROGRESS REPORT

CONTRACT NAS8-28436

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I	Progress on Display Subsystem to Date
II	Indications of current problems which may impede performance and proposed corrective action
III	Work to be performed during the next reporting period
IV	New Technology

I. PROGRESS ON DISPLAY SUBSYSTEM TO DATE

1. SOFTWARE DEVELOPMENT

a. All software exclusive of the display input-output routines and the monitor output routines have been written and tested.

2. HARDWARE DEVELOPMENT

a. The design of the configuration has been finalized and the dolly rack has been ordered.

b. The television camera and lenses have been ordered. Delivery is expected about April 15.

c. The order of the serial interface to be used to connect the display system to the computer has been cancelled due to slippage in delivery. The order of the display system has been changed to include a parallel interface. A custom parallel interface will be designed in-house. The conversion to a parallel interface will greatly increase the data transfer rate between the SPC-12 and the PEP 801. This change will not affect cost or delivery date.

II. INDICATION OF CURRENT PROBLEMS WHICH MAY IMPEDE PERFORMANCE AND PROPOSED CORRECTIVE ACTION

There are no problems at this time which may impede performance on the program.

III WORK TO BE PERFORMED DURING THE NEXT REPORTING PERIOD

a. Writing of the display input-output routines and monitor output routines pending the receival of the graphics display system hardware manual (originally promised for early Feb.).

b. Design or purchase of a video mixer for adding the video input of the graphics generator to the output of the TV camera for simultaneous viewing on the display monitor.

IV NEW TECHNOLOGY

There has been no new technology developed in the period covered by this report. Information concerning work done during this period can be found in Section I.

VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.
607 NEPONSET STREET
CANTON, MASSACHUSETTS 02021
TELEPHONE (617) 828-4650

TENTH MONTHLY PROGRESS REPORT

DESIGN, TESTING, AND DELIVERY

OF AN

INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

CONTINUATION OF WORK ON CONTRACT NO. NAS8-28436
AFTER APPROVAL OF CONTRACT AMENDMENT S/A 2FFP.

COVERING PERIOD FROM: MARCH 30 TO MAY 14, 1973

AUTHOR: BRUCE HOLMES, PROJECT ENGINEER

DATE OF PUBLICATION: MAY 14, 1973

PREPARED FOR: GEORGE C. MARSHALL SPACE FLIGHT CENTER
ALABAMA 35812

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MONTHLY PROGRESS REPORT

CONTRACT NAS8-28436

SECTIONS

I	Progress on Display Subsystem to Date
II	Indications of current problems which may impede performance and proposed corrective action
III	Work to be performed during the next reporting period
IV	New Technology

I. PROGRESS ON DISPLAY SUBSYSTEM TO DATE

1. SOFTWARE DEVELOPMENT

a. All software for the display system has been written. Testing of the object program will require the display system, which is scheduled for delivery later this month.

2. HARDWARE DEVELOPMENT

a. The television camera has been shipped and delivery is expected soon.

b. The parallel interface between the computer and the display has been designed and manufacturing will start this week. The interface cannot be tested until the display arrives.

c. The design of the mechanical fixtures for holding the printed circuit cards and schematic diagrams is being finalized.

d. Delivery of the dolly rack is expected this week.

e. The lenses for the TV camera have been delivered.

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II. INDICATION OF CURRENT PROBLEMS WHICH MAY IMPEDE PERFORMANCE AND PROPOSED CORRECTIVE ACTION

There are no problems at this time which may impede performance on the program.

III. WORK TO BE PERFORMED DURING THE NEXT REPORTING PERIOD

a. Start of the testing and verification of the software.

b. Design or purchase of a video mixer for simultaneous viewing of the output of the graphics generator and TV camera.

c. Completion of the design of the mechanical fixtures for holding the printed circuit cards and schematic diagram along with the TV camera stand.

IV. NEW TECHNOLOGY

There has been no new technology developed in the period covered by this report. Information concerning work done during this period can be found in section I.

VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.
607 NEPONSET STREET
CANTON, MASSACHUSETTS 02021
TELEPHONE (617) 828-4650

ELEVENTH MONTHLY PROGRESS REPORT

DESIGN, TESTING, AND DELIVERY

OF AN

INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

CONTINUATION OF WORK ON CONTRACT NO. NAS8-28436

AFTER APPROVAL OF CONTRACT AMENDMENT S/A 2FFP.

COVERING PERIOD FROM:	MAY 15 TO JUNE 21, 1973
AUTHOR:	BRUCE HOLMES, PROJECT ENG.
DATE OF PUBLICATION:	JUNE 21, 1973
PREPARED FOR:	GEORGE C. MARSHALL SPACE FLIGHT CENTER ALABAMA 35812

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MONTHLY PROGRESS REPORT

CONTRACT NAS8-28436

SECTIONS

I	Progress on Display Subsystem to Date
II	Indications of current problems which may impede performance and proposed corrective action
III	Work to be performed during the next reporting period
IV	New Technology

I. PROGRESS ON DISPLAY SUBSYSTEM TO DATE

A. Software Development

1. Testing of the object program has been delayed until the computer to display interface is debugged.

B. Hardware Development

1. The television camera has been received.

2. The display system has arrived. After testing the system off-line, the following problems have been observed.

    a. With display system in graphics mode the cursor creeps downward after warmup.

    b. There are spots on the Lithicon tube.

    c. There are vertical lines on the monitor caused by ringing in the video.

    d. When the cursor is magnified, a second cursor appears next to the first one.

    At this time it does not appear that any of these problems, once corrected, will interfere with either the operation of the system or the completion of the program.

3. The computer-display system interface has been assembled. Debugging the interface will start immediately.

4. The assembly of the mechanical fixtures for holding the printed circuit cards and the tv camera has started.

5. The dolly rack has been delivered.

6. The tv camera to graphics display system interface has been designed.

II. INDICATION OF CURRENT PROBLEMS WHICH MAY IMPEDE PERFORMANCE AND PROPOSED CORRECTIVE ACTION

There are no problems at this time which may impede performance on this program.

III. WORK TO BE PERFORMED DURING THE NEXT REPORTING PERIOD

A. Start of the testing and verification of the software.

B. Testing of the computer to display system interface.

C. Testing of the tv camera to display system interface.

D. Assembly of the mechanical fixtures for holding the printed circuit cards and the tv camera.

IV. NEW TECHNOLOGY

There has been no new technology developed in the period covered by this report. Information concerning work done during this period can be found in Section I.

VANZETTI
INFRARED & COMPUTER SYSTEMS, INC.
607 NEPONSET STREET
CANTON, MASSACHUSETTS 02021
TELEPHONE (617) 828-4650

TWELFTH MONTHLY PROGRESS REPORT

DESIGN, TESTING, AND DELIVERY

OF AN

INTERACTIVE GRAPHICS DISPLAY SUBSYSTEM

CONTINUATION OF WORK ON CONTRACT NO. NAS8-28436
AFTER APPROVAL OF CONTRACT AMENDMENT S/A 2FFP.

COVERING PERIOD FROM:	JUNE 21 TO JULY 18, 1973
AUTHOR:	BRUCE HOLMES, PROJ. ENG.
DATE OF PUBLICATION:	JULY 18, 1973
PREPARED FOR:	GEORGE C. MARSHALL SPACE FLIGHT CENTER ALABAMA 35812

NASA DISPLAY
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MONTHLY PROGRESS REPORT

CONTRACT NAS8-28436

SECTIONS

I	Progress on Display Subsystem to Date
II	Indications of current problems which may impede performance and proposed corrective action
III	Work to be performed during the next reporting period
IV	New Technology

I. Progress On Display Subsystem To Date

A. Software Development

1. Testing of the object program is proceeding on schedule.

B. Hardware Development

1. The computer-display system interface is operating successfully.

2. A TV camera to graphics display system interface has been purchased. This will combine the signal from the TV camera with the signal from the graphics generator to produce one image which will be displayed on the monitor. Fading between the two images is also permitted.

3. Delivery of the mechanical fixtures for holding the printed circuit cards and the TV camera is expected shortly.

II. INDICATION OF CURRENT PROBLEMS WHICH MAY IMPEDE PERFORMANCE AND PROPOSED CORRECTIVE ACTION

There are no problems at this time which may impede performance on the program.

III. WORK TO BE PERFORMED DURING THE NEXT REPORTING PERIOD

A. Completion of the Software Development

B. Elimination of Remaining Problems with Graphics Display Terminal

1. Vertical lines on monitor caused by ringing in the video

2. Invalid cursor data

C. Assembly of the Mechanical Fixtures for Holding the TV Camera and Printed Circuit Cards

D. Start of the Documentation of the System

E. A preliminary Acceptance Test will Take Place at Vanzetti Infrared & Computer Systems, Inc., Canton, Massachusetts on July 30, 1973

IV. NEW TECHNOLOGY

There has been no new technology developed in the period covered by this report. Information concerning work done during this period can be found in Section I.