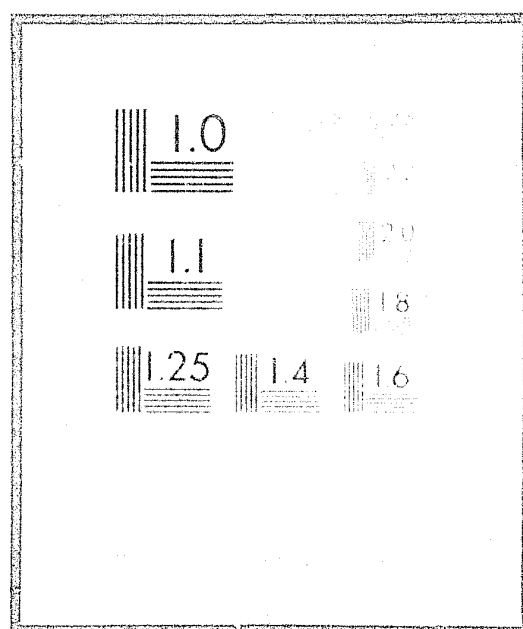


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METREK DIVISION

MTR-7328
Vol. III

The Video Telephone in Criminal Justice: The Phoenix Project Volume III Technical Characteristics

ROBERT G. PFEFFERKORN

AUGUST 1976

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MITRE

MITRE Technical Report

MTR-7328

Vol. III

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AUGUST 1976

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Department Approval:

Wamp L. Harg

MITRE Project Approval:

Barbara E. List

EXECUTIVE SUMMARY

The Phoenix Video Telephone Network comprises 17 video telephone stations located in seven criminal justice agencies in Maricopa County (Phoenix) Arizona. The 17 station sets comprise various combinations of 13 specific types of equipment.

All stations use a standard push button telephone coupled with a Western Electric Company Display Unit, which is a solid state, black and white video monitor and camera on a "lazy susan" base. Seven stations use zoom lens transmitters for graphics and evidence transmission. Two stations, located in courtrooms, use 23 inch monitors for large screen display to juries and court officials.

Hardcopy units for making permanent records of displayed images are used in 8 stations. Video tape recorders for making recordings for test purposes are used in the Superior Court and Justice Court stations.

The video network consists of full duplex 4.5 MHz coaxial cable and microwave radio connected through the central exchange of the local telephone company. Stations dial-up each other for face-to-face conversations. A three-way conference bridge is also included as part of the network.

The equipment differs from past Bell System video telephone equipment by featuring a commercial television compatible 525-line image with twice the resolution of previous equipment. The high quality and user acceptability of the equipment for conversational purposes are well established. Tests were run in Phoenix to establish the capability of the equipment for reproducing graphics and to assess the usability of the results for police purposes.

The findings indicate that the graphics reproduction capability is marginally satisfactory but the degree of satisfaction varies with the type of material being displayed.

Other documents available from the Phoenix Video Telephone Project are:

The Video Telephone in Criminal Justice: The Phoenix Project

Volume I - Summary of Applications and Findings, W. A. Eliot et.al., The MITRE Corporation, August 1976

Volume II - Analysis of Applications, L. L. Stine, L. G. Siegel, The MITRE Corporation, August 1976

Volume III - Technical Characteristics, R. G. Pfefferkorn, The MITRE Corporation, August 1976

Visual Communications Program: Site Evaluation and Recommendation, T. Kornreich, K. Levin, The MITRE Corporation, September 1974.

Video Technology in The Courts, Genevieve Coleman, The MITRE Corporation, June 1976.

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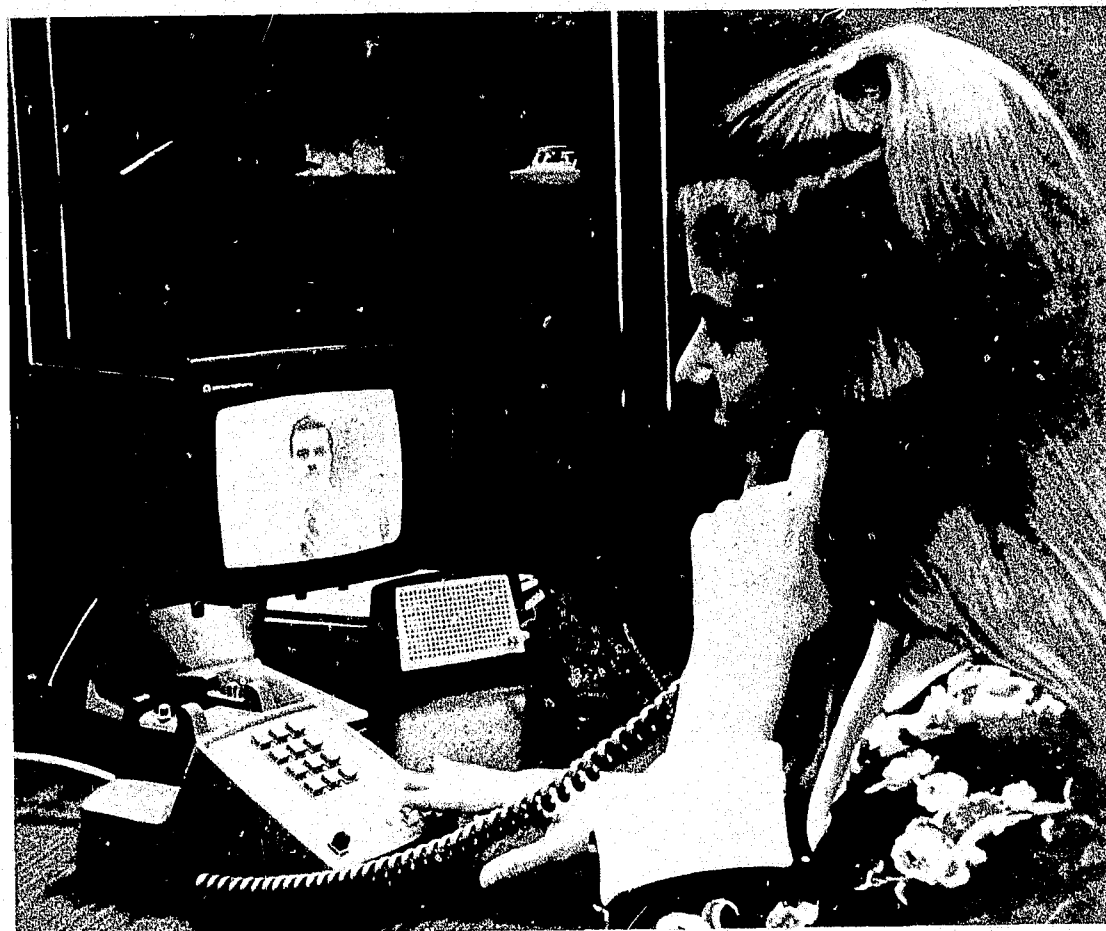


PHOTO COURTESY AMERICAN TELEPHONE & TELEGRAPH COMPANY

SECTION I

PHYSICAL FEATURES AND FUNCTIONAL CAPABILITIES OF USER STATIONS

INTRODUCTION

The general characteristics of the Phoenix Video Telephone Network and a discussion of the criminal justice agencies participating in the evaluation program are presented in Volume I of this report. This volume describes the physical features and functional capabilities of the terminal elements that were made available to system users at each of the seventeen stations in the network.

SCOPE

The description includes the physical characteristics of the visual and audio transmitters and receivers, and the terminal control units operated by users at each station. In addition, it includes the results of controlled tests of the usability of displayed images and hardcopy generated from originals of documents, fingerprints, and photographs. Not included is a description of the transmission and switching components of the system that do not interface directly with users.

It is noted in Volume II that a number of equipment changes were made during the program to improve performance. The station equipment described in this volume reflects all modifications through 30 June 1976.

DESCRIPTION OF STATION COMPONENTS

The Phoenix video telephone network comprises 17 stations linked by coaxial cable or microwave radio (4.5 MHz bandwidth). The network is centrally switched on a dial-up, first-come, first-served basis. In addition to two-way calls among subscribers, the system is designed to accommodate a three-way conference. Therefore, the operating capacity of the system in its final configuration is up to 7 two-way connections and 1 three-way connection operating simultaneously.

The 17 stations comprise various combinations of 13 terminal components as indicated in Figure 1. As indicated in Figures 2 and 3, the two courtroom stations are by far the most elaborate.

Video Transceiver (WECODU) - This transceiver, designated, Western Electric Company Display Unit (WECODU), is the basic, all-purpose video unit utilized at all of the 17 stations in the Phoenix network.

The WECODU is a self-contained, solid state, black and white video transceiver mounted on a "lazy susan" type of base (see Figure 4). Both transmitter and receiver are modularized and packaged so that they may be separated and operated as independent units.

The transmitter can accommodate various fixed focal length or zoom lenses as discussed below. The receiver displays images on a 9-inch (diagonal measure) cathode ray tube. The viewing field is approximately 7 inches wide and 5 inches high, yielding an aspect ratio of 4:3 (similar to that of a conventional television receiver).

Video Transmitters - There are two video transmitters utilized in the network, the WECODU transmitter and the 4410 Series Television Camera manufactured by Cohu Corporation.

The WECODU transmitter can be equipped with a turret mount or a standard C-mount. The turret mount is utilized for all applications where the WECODU is used as a transceiver. The turret mount accommodates two fixed focal length lenses for either face-to-face (16 mm) or graphics (22 or 26 mm) applications. For graphics, a flip-up reflecting visor is provided to permit table top viewing (see Figure 4).

Figure 5 shows a typical use of the WECODU transmitter equipped with a C-mount lens holder. Table I lists the stations where these

STATIONS	EQUIPMENT												
	VIDEO TRANSCIVER (WECODU)	VIDEO TRANSMITTER (WECODU)	VIDEO TRANSMITTER (Cohu - 4410 Series)	VIDEO MONITOR (Conrac SNA23/C)	VIDEO MONITOR (Ball Bros. TV8M)	HARD COPY UNIT (Tektronix 4632)	VIDEO TAPE RECORDER (JVC - CR 6000U)	VIDEO CONTROL UNIT (WE F-59812, 4 but.)	VIDEO CONTROL UNIT (WE F-59813, 12 but.)	AUDIO TRANSCIVER (WE Conf. Set 50A1)	AUDIO TRANSCIVER (WE 4A Speakerphone)	LOUDSPEAKER SET (WE 4A Speakerphone)	TELEPHONE SET
Public Defender (10th)	1							1		1			1
Public Defender (9th)	1					1		1		1			1
County Attorney	1					1		1		1			1
Adult Probation	1					1		1		1			1
County Jail (4th)	1							1				1	1
County Jail (3rd)	1							1		1			1
Jail Annex	1							1					1
Judge Rose (Sec.)	1					1		1					1
Judge Rose (Chhrs.)	1							1		1			2
Judge Strand (Chhrs.)	1							1		1			1
Judge Strand (Crtm.)	3	2	1	1		1	1	1	2	1			1
S. Phx. Justice Court	1	1		1	1	1	1	1	1	1		1	2
Phx. Pol. Crim. Inv.	1							1		1			1
Phx. Pol. Crime Lab	1	1							1	1			1
Phx. Pol. Substation	1	1				1			1		1		1
Phx. Pol. I-Bureau	1		1			1			1		1		1
Superior Court Clerk	1	1							1		1		1

FIGURE 1
VIDEO TELEPHONE STATIONS AND EQUIPMENT



FIGURE 2
COURTROOM INSTALLATION

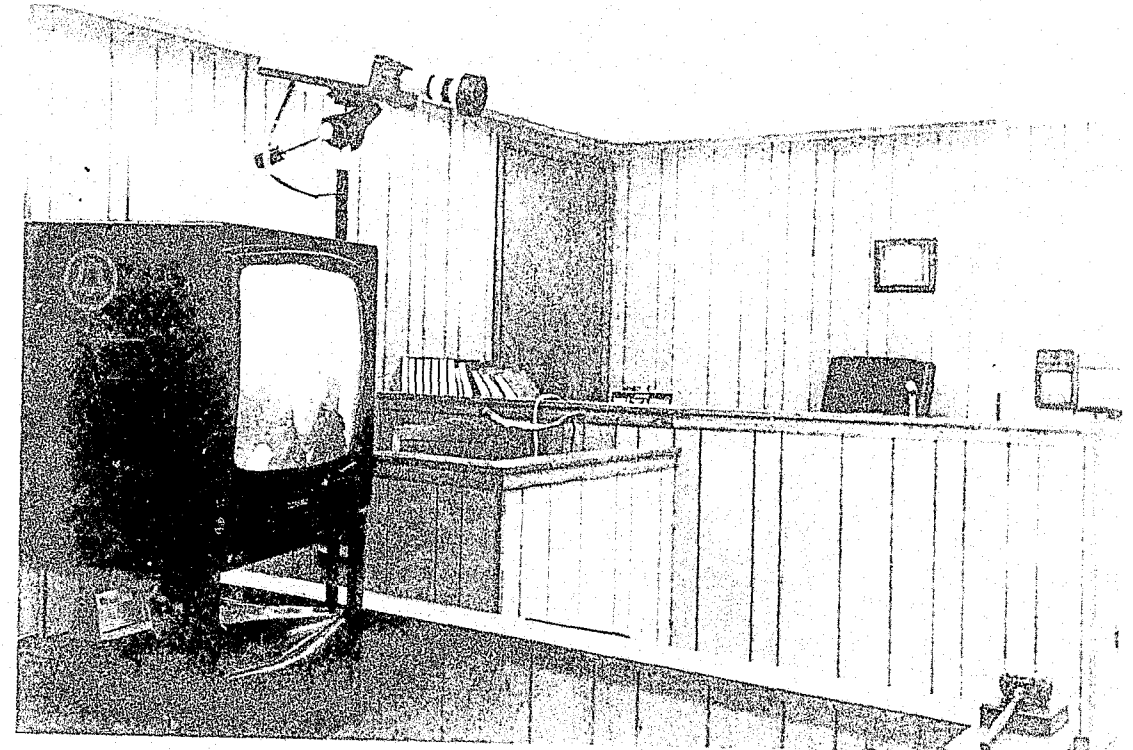


FIGURE 3
JUSTICE COURT INSTALLATION

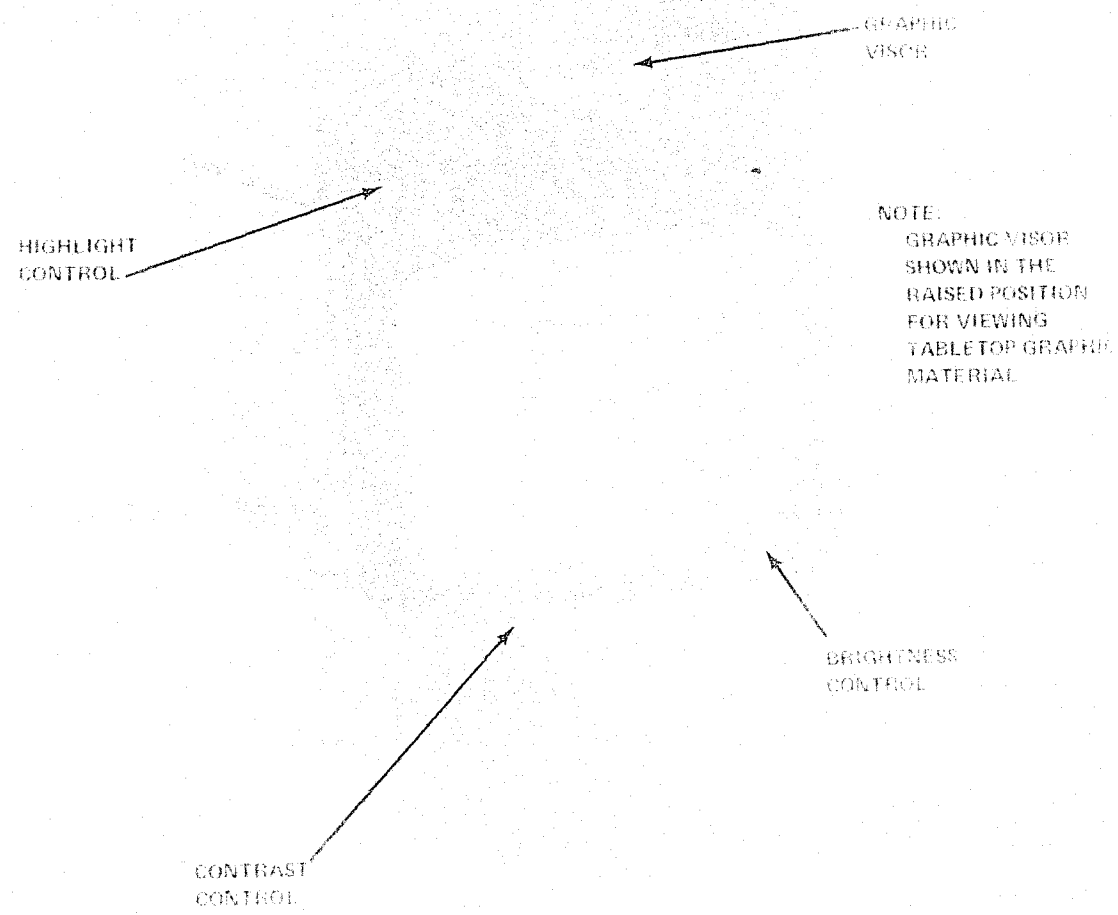


FIGURE 4
WEC0 DISPLAY UNIT

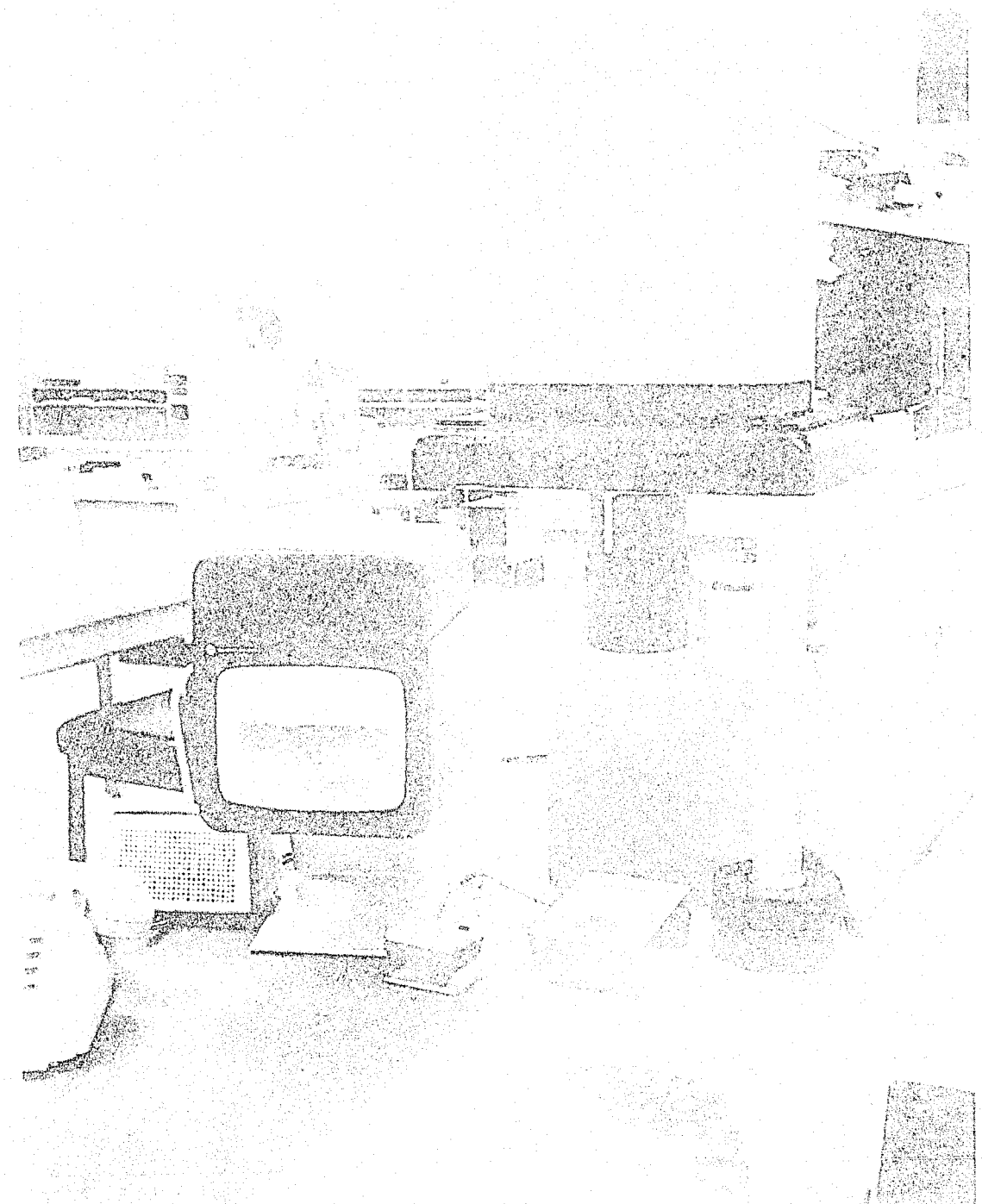


FIGURE 5
USE OF THE WEC0U TO ADJUST THE DISPLAY UNIT

TABLE I
C-MOUNTED LENSES USED WITH WECO AND COHU VIDEO TRANSMITTERS

STATION	MANUFACTURER AND TYPE OF LENS	MILLIMETERS	USE
A. <u>WECO TRANSMITTERS:</u>			
JUDGE STRAND COURTROOM	POLARIS-ZOOM	18 TO 90	SHOW ATTORNEYS AND DEFENDANT
JUDGE STRAND COURTROOM	COSMICAR-FIXED	25	SHOW JURY OR ATTORNEY STANDING BY JURY
SOUTH PHOENIX JUSTICE COURT	CANON-ZOOM	14 TO 108	SHOW JUDGE OR ATTORNEYS AND DEFENDANT
PHOENIX POLICE CRIME LAB	POLARIS-ZOOM	18 TO 90	SHOW EVIDENCE
PHOENIX POLICE SUBSTATION	POLARIS-ZOOM	18 TO 90	SHOW PHOTOS OR FINGERPRINTS
SUPERIOR COURT CLERK	POLARIS-ZOOM	18 TO 90	SHOW COURT RECORDS
B. <u>COHU TRANSMITTERS:</u>			
JUDGE STRAND COURTROOM	POLARIS-ZOOM	18 TO 90	SHOW EVIDENCE
PHOENIX POLICE I-BUREAU	POLARIS-ZOOM	18 TO 90	SHOW PHOTOS OR DOCUMENTS

transmitters are used separately with C-mounted lenses. The kinds of lenses and applications for these transmitters at each station are also identified.

As indicated in Table I, Cohu transmitters are used in Judge Strand's courtroom and the Phoenix Police Information Bureau - the two stations where there is the greatest need for production of high resolution and low distortion images of evidence or graphics materials.

Video Monitors - There are two video monitors used in the courtroom applications: a Conrac SNA23/C monitor and a Ball Brothers Research Corporation TU8M monitor.

The Conrac monitor is used in Judge Strand's courtroom to present large screen (23" diagonal) images to the jury and the court reporter. It is used to show the remote witness and, on occasion, to show what the remote witness sees, e.g., the defendant, or evidence presented in the courtroom. Another Conrac monitor is used for similar purposes at South Phoenix Justice Court for remote witness testimony in preliminary hearings. In this setting the monitor is viewed by the prosecuting and defense attorneys, the defendant and the court reporter (see Figure 6).

The Ball Brothers monitor (8" diagonal) is also used at the justice court to monitor what is recorded by the video tape recorder (JVC - CR 6000 U). In Judge Strand's courtroom, the bailiff's video transceiver is used for this purpose.

Figure 7 shows the Conrac and Ball Brothers monitors that are used at the justice court. Also shown with the equipment cart are the video transmitter equipped with a Canon zoom lens, the video tape recorder, and a loudspeaker (WE 4A Speakerphone) used for playback of audio recordings.

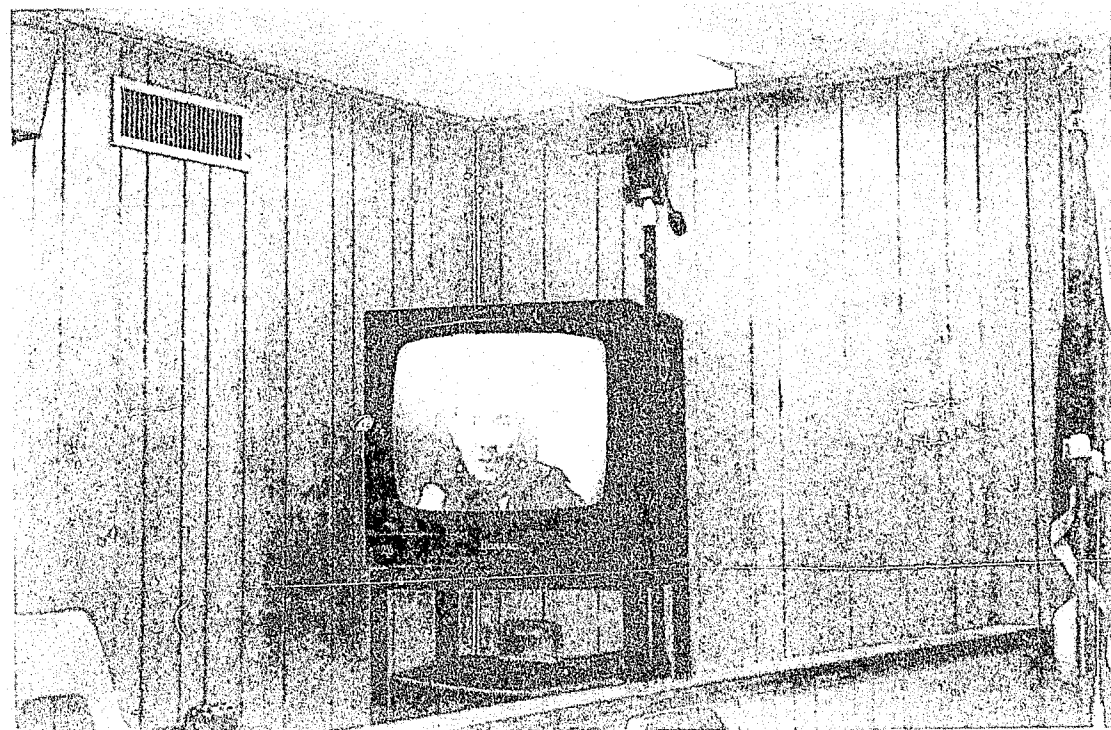


FIGURE 6
USE OF THE CONRAC MONITOR TO PRESENT WITNESS
TESTIMONY IN THE SYSTEM COURT

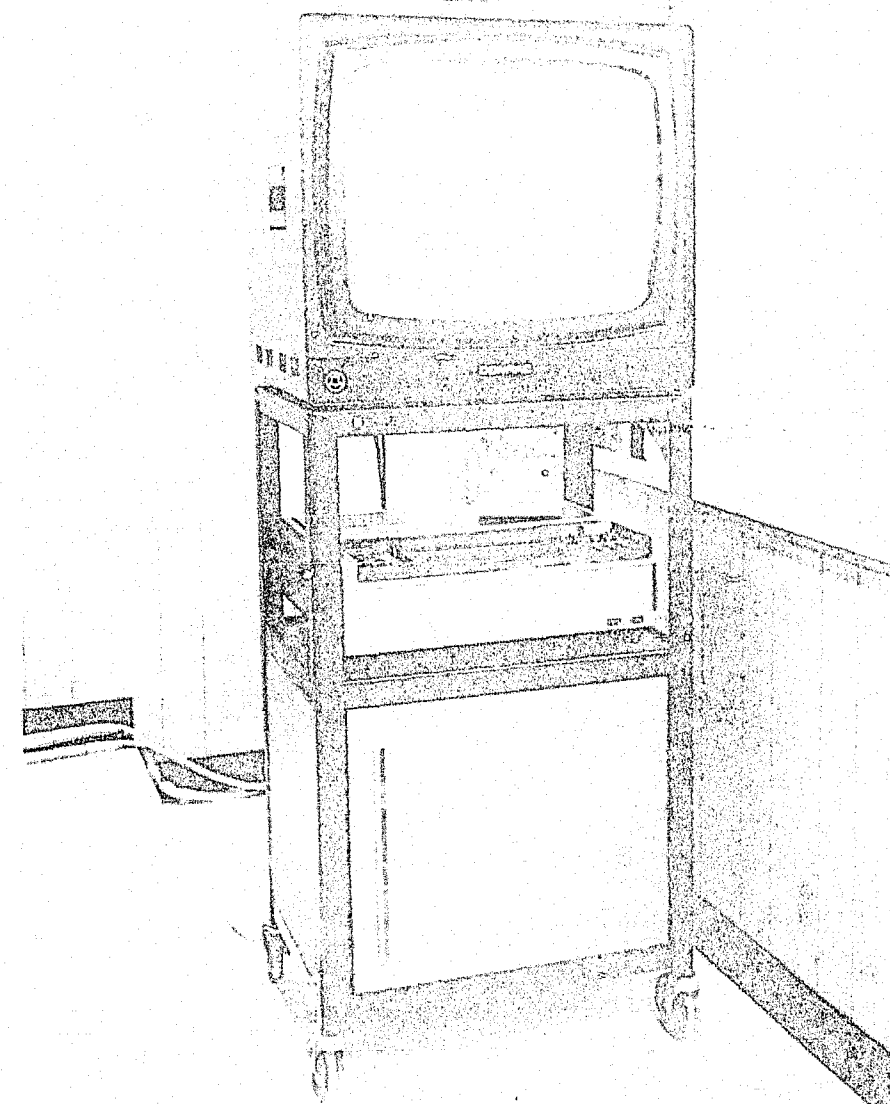


FIGURE 7
JUSTICE COURT EQUIPMENT CART

Hard Copy Unit - A specialized video receiver is provided at eight of the stations for making permanent records of displayed images (see Figure 8). The Tektronix 4632 Hard Copy Unit is powered from a 117 Vac, 60 Hz. single-phase outlet, and the unit is completely self-contained. It utilizes an internal paper supply and a dry development process. Copies are produced on specially treated 8 1/2 x 11-inch paper in black and white. Copying time per page is approximately 15 seconds. If the unit is not left "on" continuously, a ten minute warm-up period is required before the first copy can be produced.

Video Tape Recorder - Video tape recorders are used in both courtrooms to record the remote testimony of expert witnesses and police officers, and related court proceedings. A JVC - CR 6000 U video tape recorder (see Figure 7) is employed at both locations.

Video Control Units - Standard Western Electric Control Units are used to control video transmission and reception at each of the 17 stations in the network. The Control Unit is a small desk-top unit equipped with either four (WE F-59812) or twelve (WE F-59813) push buttons. A majority of the buttons are not operative at each station. For example, only one of the buttons is used at each of eleven of the stations equipped with a single video transceiver. The single button is used to control the "view Self" function. The station user may depress the "View Self" button to see what the remote party will see when a call is made, or to see what the remote party is seeing during a call. During a call, the transmitted video to the remote party is never interrupted when "View Self" is operated. A twelve button control unit is shown on the graphics stand in Figure 5.

Audio Transceivers - Two Western Electric audio transceivers are used in the Pheonix network: the WE 50A1 Conference Set and the WE 4A Speakerphone. Both transceivers provide for hands-free audio reception and transmission, and on-hook dialing.

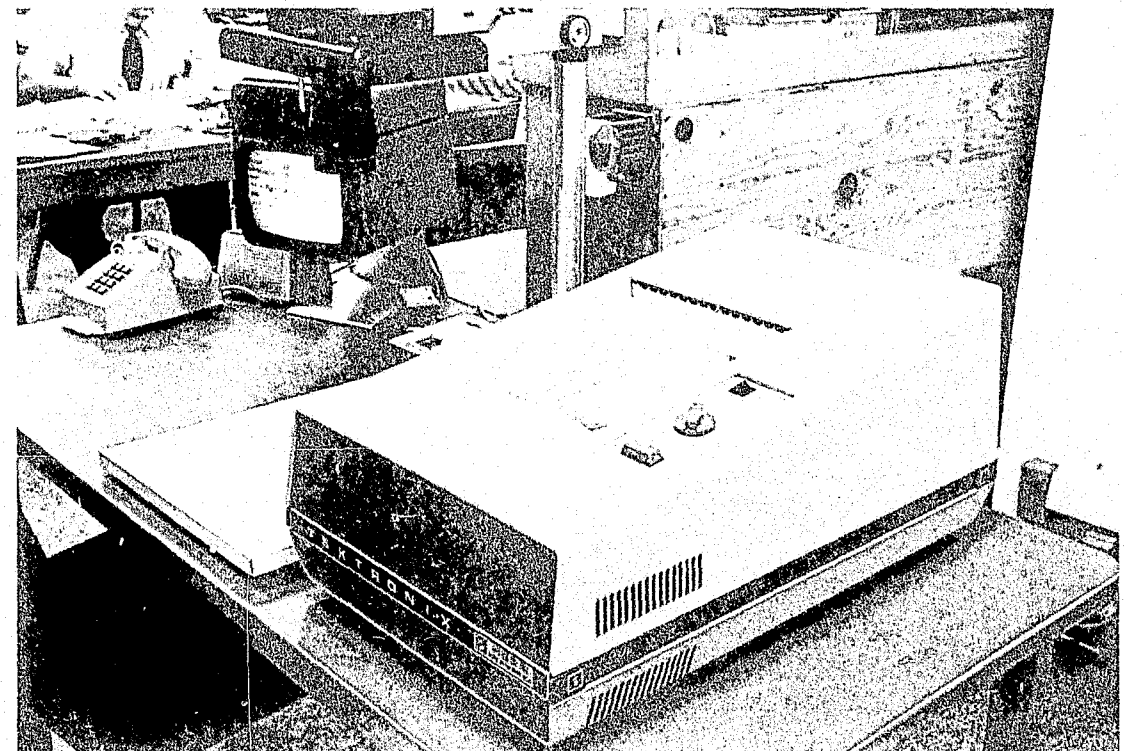


FIGURE 8
TEKTRONIX HARD COPY UNIT

The WE 4A Speakerphone is used at 10 of the stations in the network. It comprises a transmitter, a loudspeaker set and a separately mounted power unit.

The transmitter includes an on-off switch and a volume control to vary the output of the loudspeaker set for the incoming audio. The loudspeaker set and the transmitter are shown at the immediate left and right of the audio transceiver shown in Figure 5.

During periods of operation when there is no transmission of speech, gain is automatically removed from the transmitter circuit and is added to the loudspeaker circuit in order to avoid a "singing" condition while receiving. When speech is transmitted, the gain of the transmitter circuit increases to normal. Simultaneously, the gain of the loudspeaker circuit decreases to avoid "singing" as a result of increased transmitter gain. The amount of gain change depends on the setting of the volume control on the transmitter.

A circuit designated "switchguard" utilizes voltage in the loudspeaker circuit to reduce the possibility that surrounding room noise will cause unintended switching to transmission while receiving speech. A predetermined voice level is necessary to switch from the receiving to the transmitting condition.

In the presence of steady room noise, a special circuit automatically raises the threshold level to prevent operation of the switching control circuit by the noise. Talkers will still switch satisfactorily because they naturally increase their levels under noisy conditions.

A capability is provided for automatic switching from WE 4A Speakerphone to standard telephone handset operation. To switch from handset

to speakerphone operation, the transmitter "on" switch must be depressed until the handset is returned to its cradle in order to avoid a disconnection.

The WE 50A1 Conference Set is used at both courtrooms and at the two Phoenix Police stations primarily for remote testimony. In addition to the design features of the 4A Speakerphone discussed above, this unit accommodates a standard telephone handset and the use of multiple microphones. The unit is capable of reproducing both transmitted and received signals over an external public address system. Separate controls permit automatic switching to and from handset operation. In the courtrooms, the "ringer" is disconnected and a red neon lamp is added to indicate incoming calls.

Loudspeaker Set - Loudspeaker Sets (WE 4A Speakerphone) are provided at the county jail stations and at justice court. At the county jail the loudspeakers are used to permit defense attorneys to monitor the statements of a judge while defendants are conversing with the judge via a telephone handset, e.g., during an arraignment. At the justice court, a Loudspeaker Set is used during playback of audio recordings (see Figure 7).

Telephone Set - Standard dial or push button telephone handsets are used at all 17 stations in order to dial up a remote station or to conduct a private conversation with a remote party while simultaneously sending and receiving a video image.

FUNCTIONAL CAPABILITIES

The high quality and high degree of user acceptability of the equipment for live, 4.5 MHz bandwidth, face-to-face visual communications was well established prior to installation of the Phoenix network. The experience with the Phoenix network has affirmed these earlier results.

To illustrate, Figure 9 presents copies of photographs of typical images of a police officer and an adult probation officer as they would appear in Phoenix to another party seated 36 inches from the front of a remote video transceiver.

In addition to face-to-face capability, the police applications in Phoenix called for a capability to send, receive and copy images of documents, photographs and fingerprints. However, the capability of the equipment for reproducing graphics, and, particularly, the usability of such reproductions for police purposes had not been established prior to the installation of the Phoenix network. For this reason, a portion of the evaluation effort was devoted to performance of controlled tests to explore the extent to which the display and hard copy reproductions of images are usable for police purposes.

Ten police officers examined 14 photographs of display presentations and 14 hard copies of mug shots, fingerprints and documents. Using a five point scale, officers were asked to respond to the question: "Is this reproduction usable for purposes of suspect identification, criminal investigation and case preparation?". Scale designations and values were as follows: strongly agree - 5, agree - 4, not certain - 3, disagree - 2, strongly disagree - 1. Results are summarized in Table II.

The average scores, which range from 2.7 to 3.4, indicate that the officers in general were uncertain about the usability of the graphics reproduction at best. Also, recognizing that these results were achieved, even with magnified images, it appears that magnification is essential to achieve even marginal acceptability for graphics reproductions.

Sixteen out of 28 of the test items (57%) were rated higher than "3" on the scale. Agreement as to usability was stronger, on the average, for photographs and fingerprints than for documents. Eleven



a. Police officer



b. Adult probation officer

FIGURE 9
TYPICAL LIVE DISPLAY OF OFFICERS

TABLE II
AVERAGE SCORES BY TYPE OF ITEM AND MODE OF PRESERVATION

TYPE OF TEST ITEM		MODE OF PRESENTATION		\bar{X}
		DISPLAY	HARD COPY	
PHOTOGRAPHS	X	3.4	3.4	3.4
FINGERPRINTS		3.4	3.0	3.2
DOCUMENTS		2.7	3.6	3.2
	\bar{X}	3.2	3.3	3.3

out of 18 mug shots (61%) and three out of four fingerprints (75%) were rated higher than "3", while only two of six documents (33%) were so rated. Highest ratings were obtained for the magnified, light-skinned, black and white and color mug shots (4.25 average).

In the creation of the test items, multiple hard copies were generated with the best picked. The display corresponding to that copy was photographed. Therefore, the results obtained are biased upward for the hard copy test items, and downward for the display test items. Nevertheless, the superior resolution of the display over the hard copy is indicated clearly by the higher average score obtained for displays of fingerprints (3.4 compared with 3.0).

With regard to police officer variations, six detectives and analysts scored the items more usable on the average (3.4) than did four patrol officers (3.2).

A detailed description of the controlled tests and the results are presented in the next section.

SECTION II

CONTROLLED TESTS OF IMAGE REPRODUCIBILITY AND USABILITY

PURPOSE

As indicated in Section I, controlled tests were performed in order to evaluate the capability of the Phoenix network to reproduce displays and hard copies of originals of mug shots, fingerprints and documents that are usable for police purposes. The purpose of this section is to describe the test method and test results in greater detail.

TEST METHOD

A preliminary study was made of the reproduction potential and characteristics of the terminal equipment, and of the nature of the graphics materials processed by the Phoenix Police Department in order to identify an appropriate and representative range of test conditions. As a result of this study, fourteen test conditions were identified, and one original graphic was obtained covering each condition. Each original was reproduced as a photograph of a video transceiver display and as a Tektronix hard copy, for a total of 28 test items.

Subject to a rule that no hard copy of a test condition would precede or follow a display of the same condition, a table of random numbers was used to determine the order of presentation. Test items were inserted in plastic sleeves and were mounted in a notebook in the order determined.

The test conditions and the order of presentation are listed in Table III. For mug shots, there were eight combinations (i.e., three two-state conditions - black/white or color, magnified or not magnified and light or dark skin. Because of its utility as a means of identification, a magnified, standard Arizona driver's license photograph also was included. Because of the size of the original (7/8" x 1 1/4"),

TABLE III
LIST OF 28 TEST ITEMS BY IMAGE TEST CONDITION

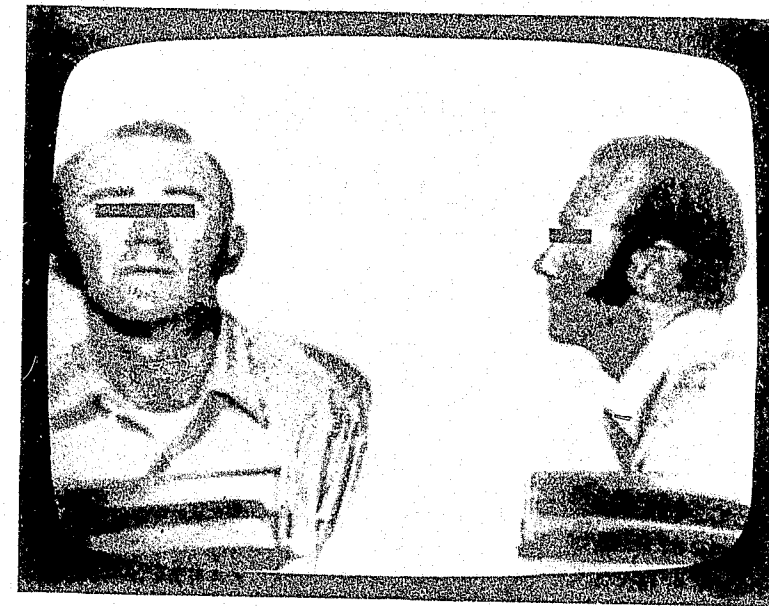
TEST CONDITION	ORDER OF PRESENTATION
A. DISPLAYED IMAGES	
1. B&W PHOTO, MAGNIFIED, LIGHT SKIN	19
2. B&W PHOTO, NOT MAGNIFIED, LIGHT SKIN	24
3. B&W PHOTO, MAGNIFIED, DARK SKIN	10
4. B&W PHOTO, NOT MAGNIFIED, DARK SKIN	17
5. COLOR PHOTO, MAGNIFIED, LIGHT SKIN	20
6. COLOR PHOTO, NOT MAGNIFIED, LIGHT SKIN	22
7. COLOR PHOTO, MAGNIFIED, DARK SKIN	11
8. COLOR PHOTO, NOT MAGNIFIED, DARK SKIN	15
9. ARIZONA DRIVER'S LICENSE PHOTO, MAGNIFIED	25
10. SINGLE FLAT FINGERPRINT, MAGNIFIED	8
11. TWO ROLLED PRINTS, MAGNIFIED	6
12. 8 1/2" WIDTH DOCUMENT, ELITE TYPEFACE, MAGNIFIED	16
13. 8 1/2" WIDTH DOCUMENT, PICA TYPEFACE, MAGNIFIED	21
14. 8 1/2" WIDTH DOCUMENT, HANDWRITTEN, MAGNIFIED	7
B. HARD COPY OF DISPLAYED IMAGES (CONDITION 15 THROUGH 28 SAME AS CONDITION 1 THROUGH 14 ABOVE)	1, 5, 13, 26, 23, 18, 2, 4, 9, 3, 14, 12, 28, 27

only a magnified condition was tested. A magnified, single "flat" print of a right index finger was selected for test because the Phoenix police sometimes use such a print to verify a suspect's identity. For classification searches to identify an unknown suspect, ten "rolled" fingerprints are required. However, the resolution capacity of the equipment for a single presentation is limited to two magnified, rolled prints. Therefore, only this condition was tested. For typewritten documents, the resolution capacity of the video receiver is limited to a 7 1/2" x 5 5/8" visual field. Therefore, half-pages of sample 8 1/2" x 11" departmental reports were reproduced for test under three conditions: typewritten (elite typeface), typewritten (pica typeface) and handwritten. Copies of photographs of the 28 test items, ordered by test condition, are given as Figures 10 through 25.

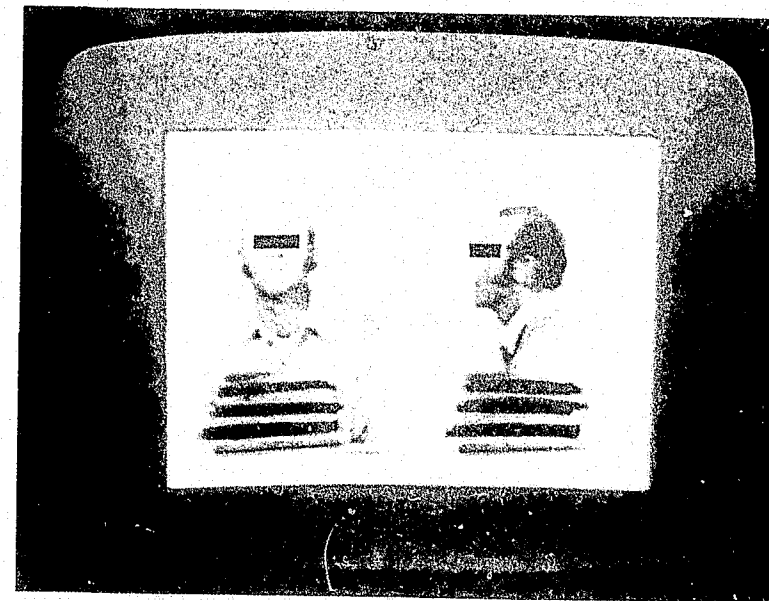
Ten experienced police officers that were considered by police department representatives to be qualified to respond to the test items were selected to participate in the test. The sample included five detectives, a research and development analyst (police officer), and four patrolmen. Using a five point scale, officers were asked to respond to the question: "Is this reproduction usable for purposes of suspect identification, criminal investigation and case preparation?". Scale designations and values were as follows: strongly agree - 5, agree - 4, not certain - 3, disagree - 2, strongly disagree - 1.

Instructions administered to each officer are provided in Figure 26. During the administration of the test, any negative comments made concerning the items were recorded. In addition, after all scale responses were recorded, the responses were reviewed, and officers were asked to comment on their reservations about the usability of any items scored as "3" or less. These comments also were recorded.

(Text continues on page 40)



a. Magnified

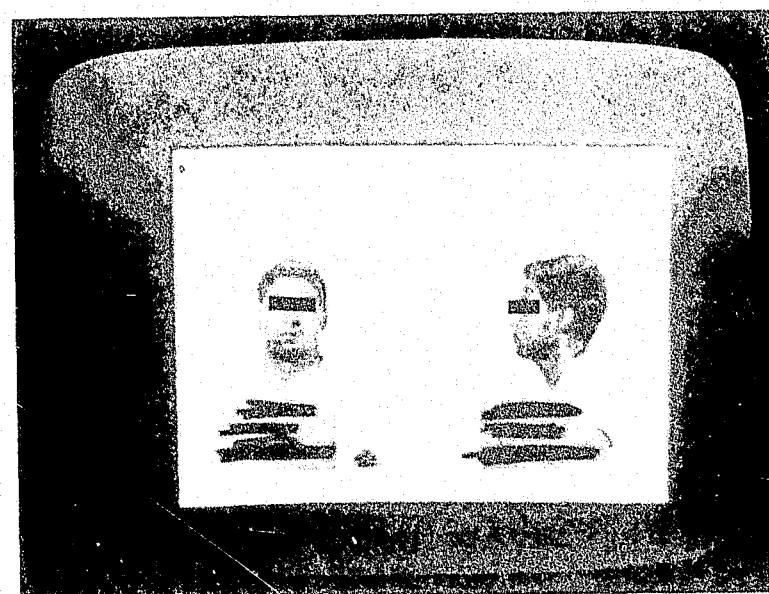


b. Not magnified

FIGURE 10
DISPLAY OF BLACK/WHITE PHOTO, LIGHT SKIN



a. Magnified

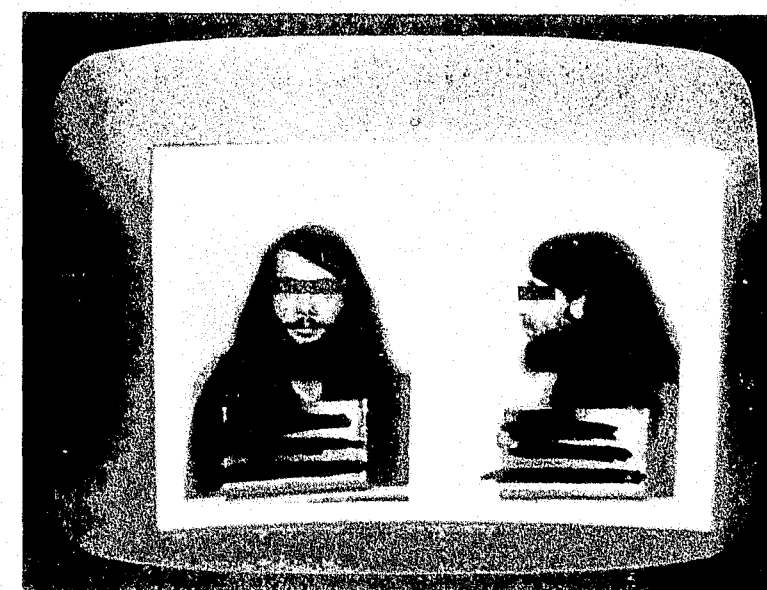


b. Not magnified

FIGURE 11
DISPLAY OF BLACK/WHITE PHOTO, DARK SKIN



a. Magnified

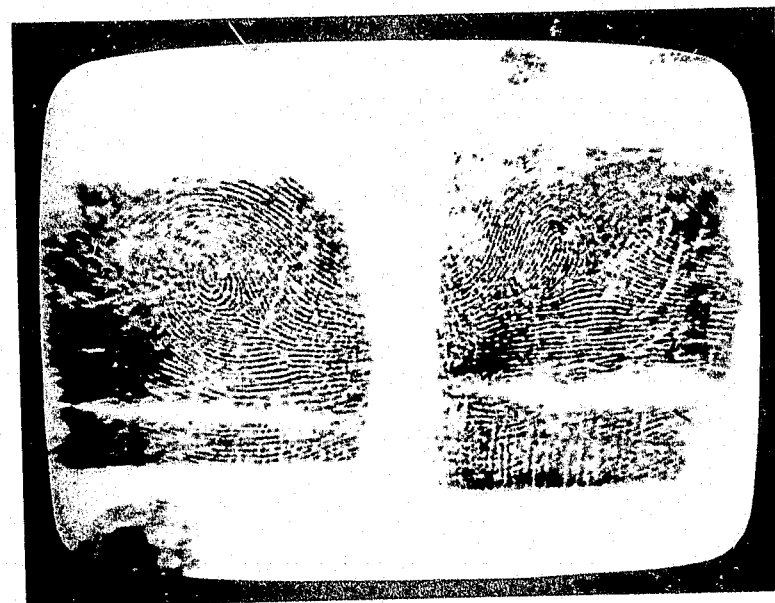


b. Not magnified

FIGURE 12
DISPLAY OF COLOR PHOTO, LIGHT SKIN

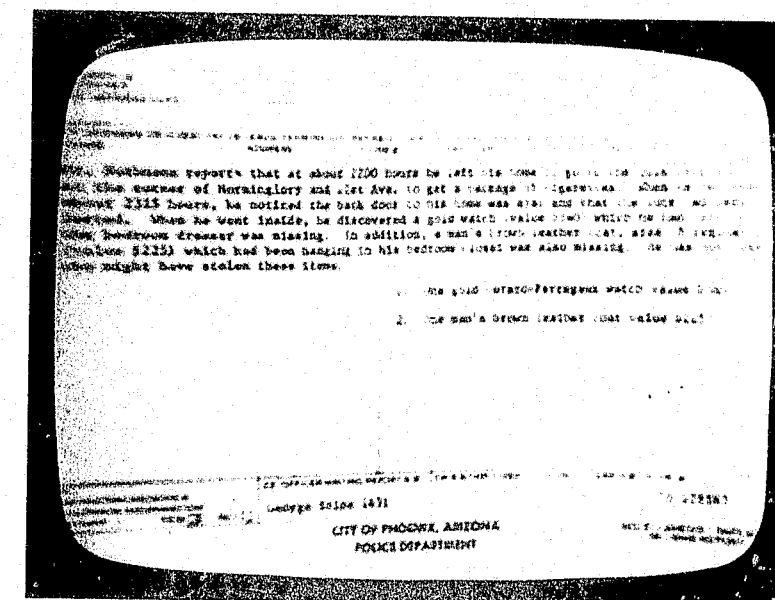


a. Single flat print

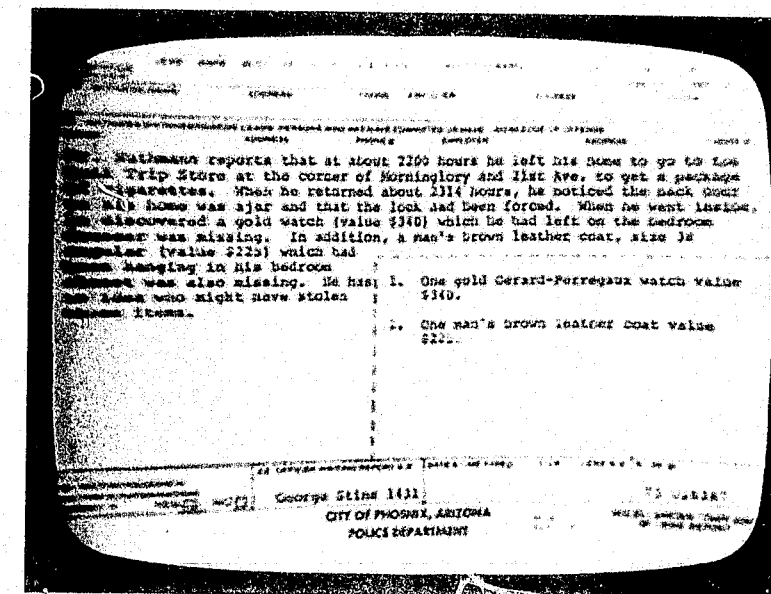


b. Two rolled prints

FIGURE 15
DISPLAY OF FINGERPRINT, MAGNIFIED



a. Elite type face



b. Pica type face

FIGURE 16
DISPLAY OF 8 1/2" WIDTH TYPED DOCUMENT, MAGNIFIED

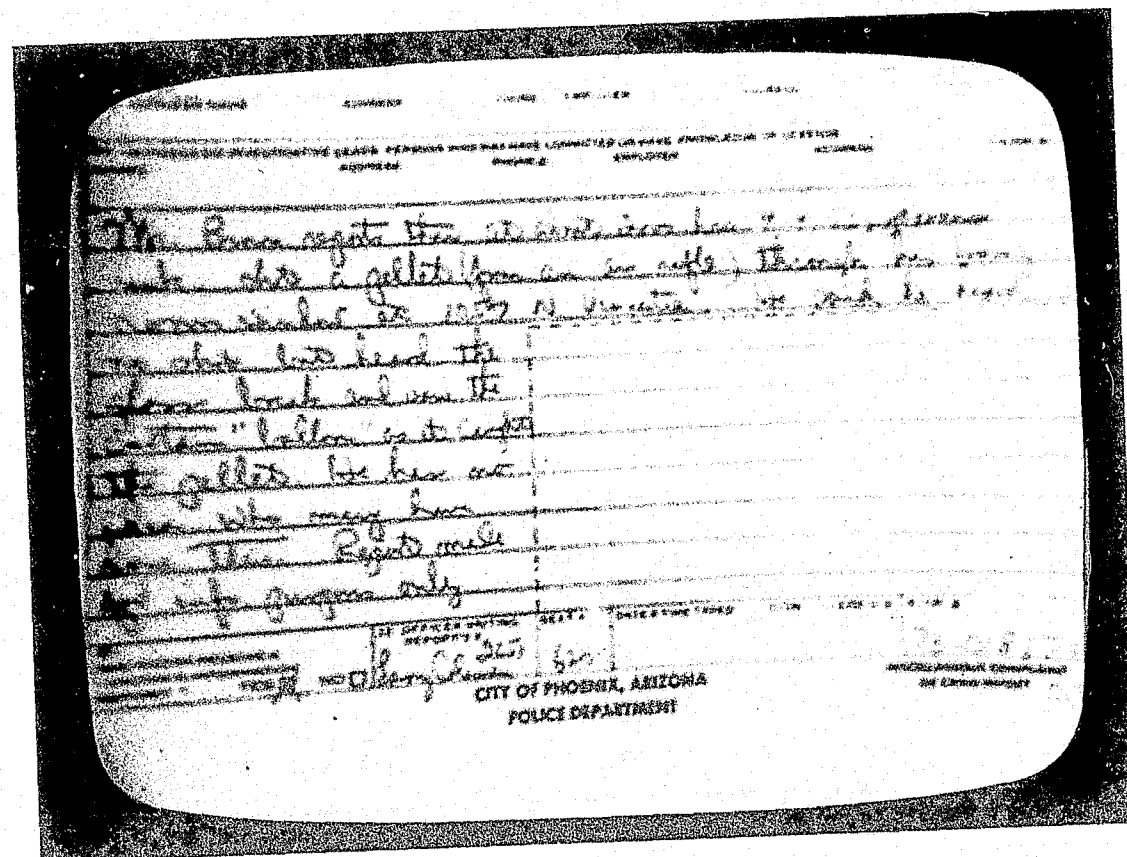
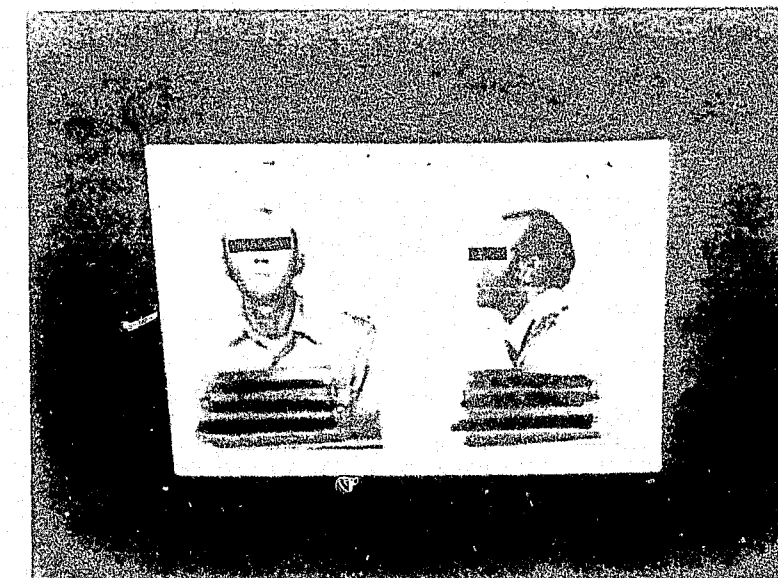


FIGURE 17
DISPLAY OF 8 1/2" WIDTH HANDWRITTEN DOCUMENT, MAGNIFIED

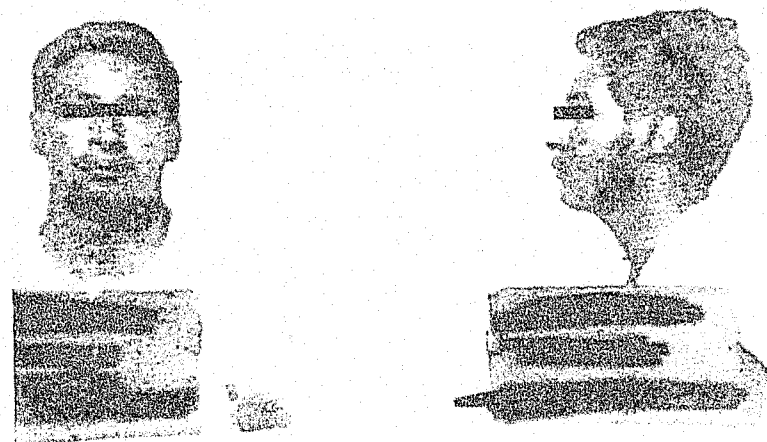


a. Magnified

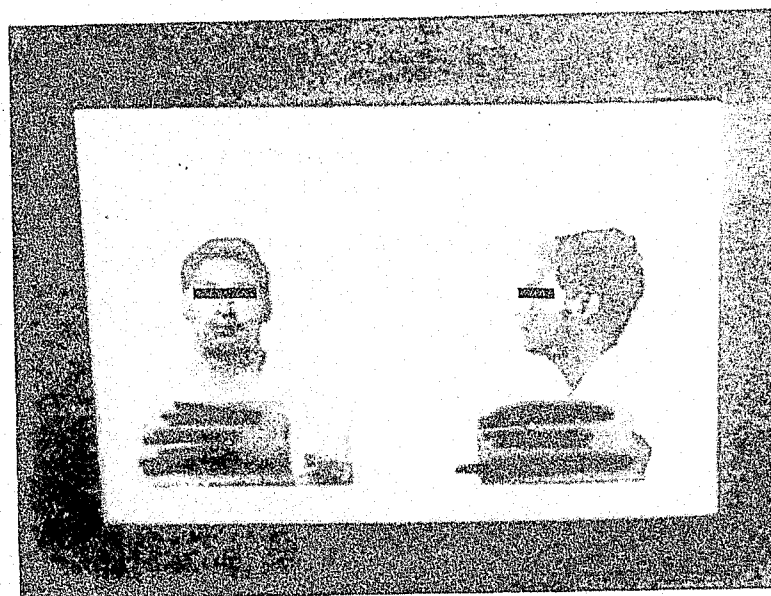


b. Not magnified

FIGURE 18
HARD COPY OF BLACK/WHITE PHOTO, LIGHT SKIN

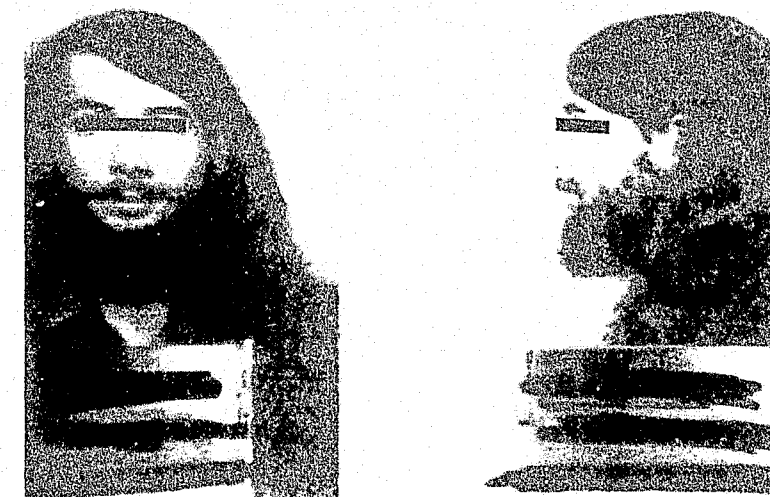


a. Magnified

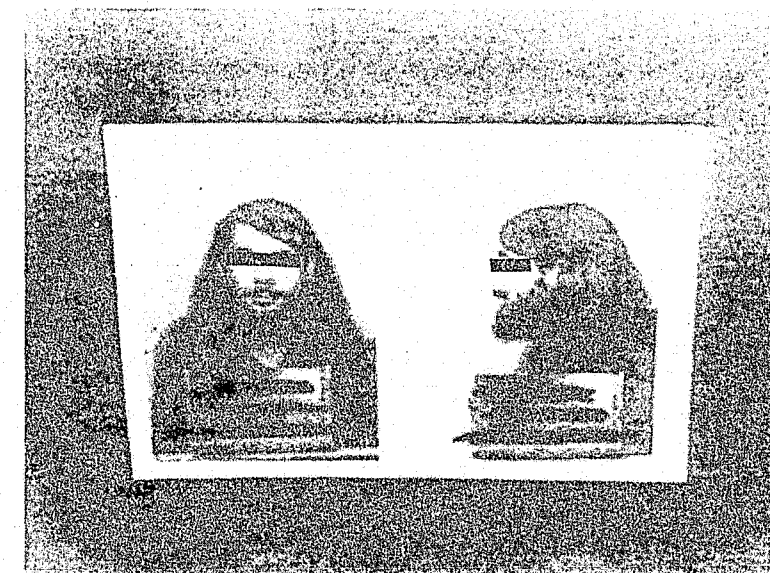


b. Not magnified

FIGURE 19
HARD COPY OF BLACK/WHITE PHOTO, DARK SKIN

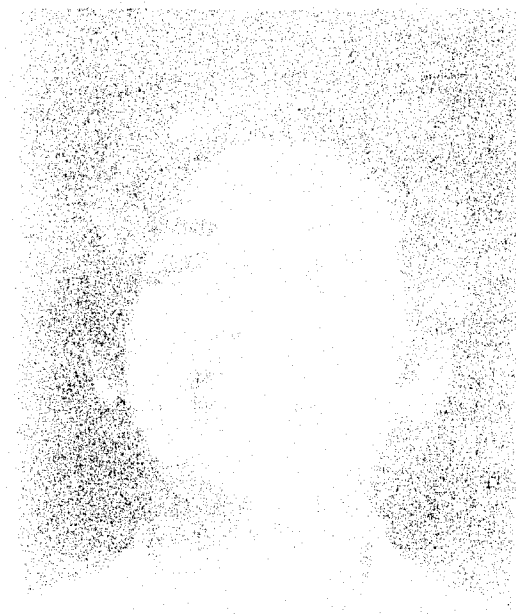
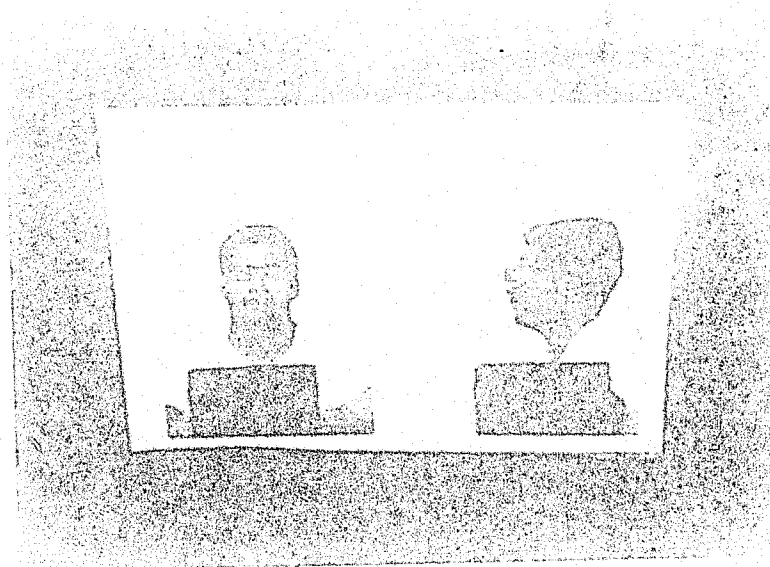
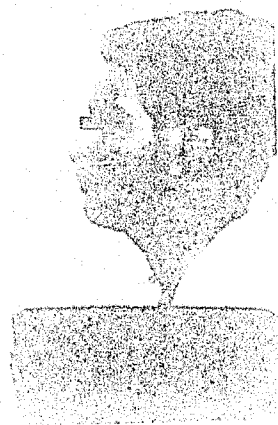
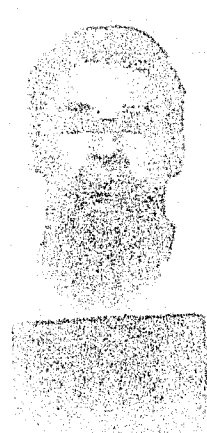


a. Magnified



b. Not magnified

FIGURE 20
HARD COPY OF COLOR PHOTO, LIGHT SKIN



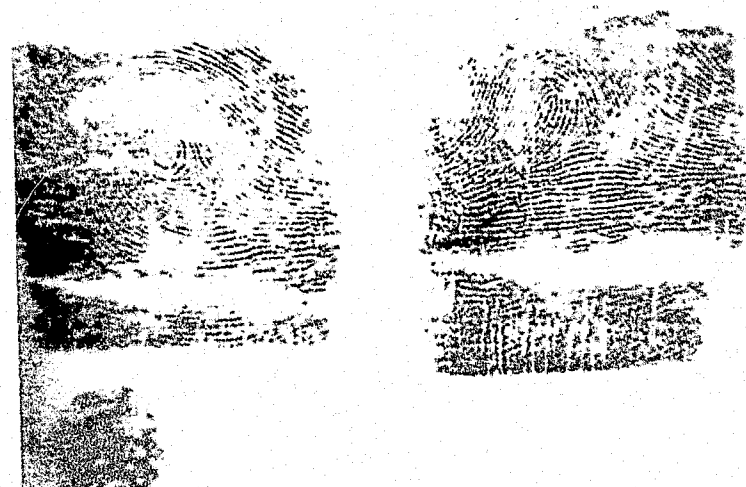
10-11-1968

THE ARIZONA
STATE PRISON

HARD COPY OF ARIZONA PRISON RECORDS, MAGNIFIED

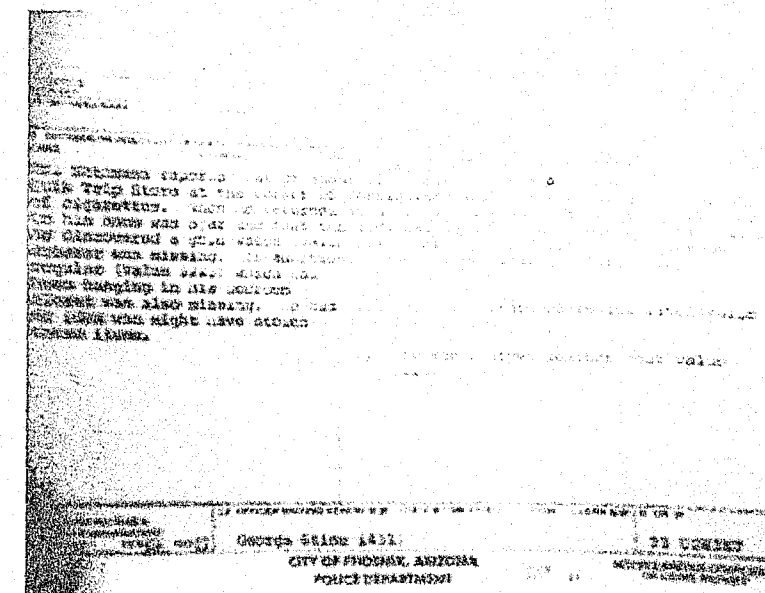


a. Single flat print

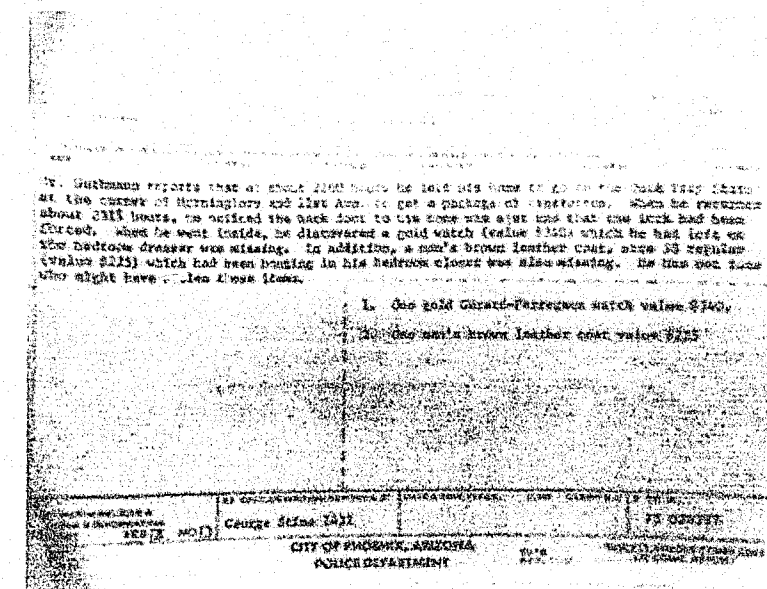


b. Two rolled prints

FIGURE 23
HARD COPY OF FINGERPRINT, MAGNIFIED



a. Elite type face



b. Pica type face

FIGURE 24
HARD COPY OF 8 1/2" WIDTH TYPED DOCUMENT, MAGNIFIED

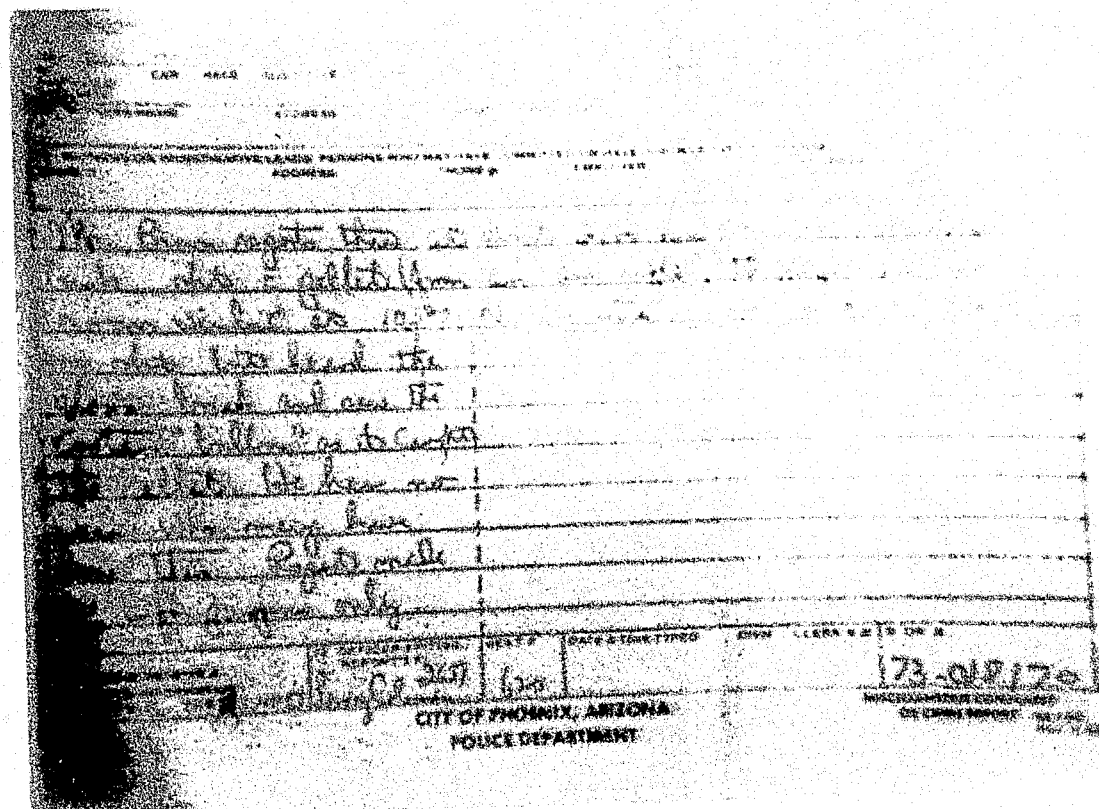


FIGURE 25
HARD COPY OF 8 1/2" WIDTH HANDWRITTEN DOCUMENT, MAGNIFIED

INSTRUCTIONS TO PARTICIPATING OFFICERS

THIS IS AN EXPERIMENT TO HELP DETERMINE THE USABILITY FOR POLICE PURPOSES OF DISPLAYS AND COPIES OF MUG SHOTS, FINGERPRINTS AND DOCUMENTS GENERATED BY THE VISUAL COMMUNICATIONS EQUIPMENT NOW BEING EVALUATED BY THE PHOENIX POLICE DEPARTMENT.

YOU WILL BE SHOWN 14 PHOTOGRAPHS OF PICTUREPHONE DISPLAYS AND 14 HARD COPIES OF PICTUREPHONE DISPLAYS. FOR EACH ITEM, PLEASE ASK YOURSELF:

"IS THIS REPRODUCTION USABLE FOR PURPOSES OF SUSPECT IDENTIFICATION, CRIMINAL INVESTIGATION AND CASE PREPARATION?"

PLEASE RESPOND WITH ONE OF THE FOLLOWING STATEMENTS:

I STRONGLY AGREE	} ... THAT IT IS USABLE FOR POLICE PURPOSES
I AGREE	
I AM NOT CERTAIN	
I DISAGREE	
I STRONGLY DISAGREE	

FIGURE 26
INSTRUCTIONS FOR TEST PARTICIPANTS

TEST RESULTS

The responses of individual officers with average scores for each officer and each test item are listed in Table IV in the order of item presentation. Average item scores and comments of individual officers regarding each item are summarized in Table V in order of test condition. Average item scores for photographs, fingerprints and documents and for display and hard copy items are given in Table VI.

On the average, the findings indicate that the equipment is marginally satisfactory for reproduction of graphics typically used by the Phoenix Police Department. As indicated in Tables IV and V, only sixteen of the 28 test items (57 percent) had average scores higher than 3.0, although eight of the ten officers scored the items higher than 3.0, on the average (see Table IV). Given the resolution capability of the equipment under test, the results indicate that magnification is essential to create usable images of fingerprints and documents, and is important in creating usable images of photographs.

Agreement as to usability was stronger, on the average, for photographs and fingerprints than for documents (see Table VI). Eleven out of 18 mug shots (61 percent) and three out of four fingerprints (75 percent) were rated higher than "3", while only two of six documents (33 percent) were so rated. It is noted that the average score for magnified photographs was 3.6 ($36.1 \div 10$), while the average score for unmagnified photographs was 3.1 ($24.5 \div 8$). Highest ratings were obtained for the magnified, light-skinned, black and white and color mug shots (4.25 average).

As indicated in Table V, five or more of the ten officers commented negatively concerning fifteen of the items. Most of the negative commentary centered on the lack of clarity or blurry nature of the

TABLE IV
INDIVIDUAL RESPONSES AND AVERAGE SCORES

ORDER OF PRESENTATION/OFFICER		1	2	3	4	5	6	7	8	9	10	X
1	CONDITION: 15	4	4	4	3	2	4	3	4	4	4	3.6
2	21	4	4	4	4	2	4	4	4	3	2	3.5
3	24	3	3	4	3	4	4	2	3	3	2	3.1
4	22	4	4	2	4	4	2	2	4	3	1	3.0
5	16	4	4	2	2	4	2	2	3	4	2	2.9
6	11	4	4	4	3	4	4	2	4	2	2	3.3
7	14	4	3	4	2	2	4	2	4	3	2	3.0
8	10	4	4	4	3	4	4	2	3	4	2	3.4
9	23	3	4	4	4	4	4	5	3	3	4	3.8
10	3	4	3	4	4	2	2	4	3	3	2	3.1
11	7	5	4	5	5	4	2	5	4	4	4	4.2
12	26	5	4	5	5	4	4	4	5	4	5	4.5
13	17	3	4	2	3	2	2	4	3	3	4	3.0
14	25	3	4	4	3	2	4	2	3	2	2	2.9
15	8	2	4	3	2	4	4	4	4	3	2	3.2
16	12	2	2	3	2	2	2	2	4	1	2	2.2
17	4	2	2	2	2	2	2	2	4	2	2	2.2
18	20	4	4	4	3	4	4	4	4	4	4	3.9
19	1	5	4	5	2	4	4	4	4	4	5	4.1
20	5	4	4	5	5	4	4	5	4	4	5	4.4
21	13	3	3	5	1	2	3	2	4	4	2	2.9
22	6	4	4	4	4	4	4	4	4	3	4	3.9
23	19	4	4	5	4	4	2	4	4	4	4	3.9
24	2	3	3	3	2	2	2	2	4	3	2	2.6
25	9	2	3	4	3	2	2	2	2	3	2	2.5
26	18	3	3	2	4	4	2	2	3	4	1	2.8
27	28	3	4	4	1	2	3	2	4	4	2	2.9
28	27	4	4	4	4	2	4	2	4	4	2	3.4
X		3.5	3.6	3.8	3.1	3.1	3.1	3.0	3.7	3.3	2.8	3.3

TABLE V
AVERAGE ITEM SCORES AND OFFICER COMMENTS

TEST CONDITION	AVERAGE SCORE	NATURE OF OFFICER COMMENT	NUMBER COMMENTING
1	4.1	DISTORTED	1
2	2.6	NOT CLEAR, BLURRED, NOT ENOUGH DETAIL	9
3	3.1	NOT CLEAR, TOO DARK	6
4	2.2	NOT CLEAR, BLURRED, NOT ENOUGH DETAIL	9
5	4.4	NONE	0
6	3.9	NOT CLEAR, BLURRED, TOO DARK	1
7	4.2	BLURRED, TOO DARK	4
8	3.2	NOT CLEAR, NOT ENOUGH DETAIL	5
9	2.5	NOT CLEAR, BLURRED, TOO LIGHT	8
10	3.4	NOT AN I.D. TECHNICIAN (2), PRINT NOT READABLE (2)	4
11	3.3	NOT AN I.D. TECHNICIAN (1), PRINT NOT READABLE (3)	4
12	2.2	WORDS OFF SCREEN, BLURRED LEFT SIDE	10
13	2.9	BLURRED LEFT SIDE	8
14	3.0	NOT READABLE, BLURRED LEFT SIDE	6
15	3.6	NOT CLEAR, BLURRED	3
16	2.9	TOO DARK, DISTORTED	7
17	3.0	NOT CLEAR, BLURRED, TOO DARK	7
18	2.8	NOT CLEAR, BLURRED, TOO LIGHT	6
19	3.9	TOO DARK LEFT SIDE	1
20	3.9	BLURRED	1
21	3.5	BLURRED	1
22	3.0	NOT CLEAR, TOO DARK	5
23	3.8	BLURRED	2
24	3.1	NOT AN I.D. TECHNICIAN (4), BLURRED (3)	7
25	2.9	NOT AN I.D. TECHNICIAN (3), BLURRED LEFT SIDE (4)	7
26	4.5	NONE	0
27	3.4	BLURRED LEFT SIDE, TOO DARK	3
28	2.9	BLURRED LEFT SIDE, TOO DARK, PRINT NOT READABLE	6

TABLE VI
AVERAGE SCORES BY TYPE OF ITEM AND MODE OF PRESENTATION

TYPE OF TEST ITEM	MODE OF PRESENTATION		
	DISPLAY	HARD COPY	\bar{X}
PHOTOGRAPHS	3.4	3.4	3.4
FINGERPRINTS	3.4	3.0	3.2
DOCUMENTS	2.7	3.6	3.2
\bar{X}	3.2	3.3	3.3

NOTE: SAME AS TABLE II

item, and on the lightness or darkness of the image. Typically, the left side of the image was considered to be blurred, distorted and/or too dark (for examples, see Figures 16, 17, 23(b), 25.

It is noted that the scores were biased upward for hard copies and downward for displays because of the method used to create test items. In creating the items, multiple hard copies were generated, and the best of each set selected for use. The display corresponding to that copy simply was photographed with no attempt made to improve its quality. Nevertheless, the superior resolution of the display over the hard copy is indicated clearly by the higher average score obtained for displays of fingerprints (3.4 compared with 3.0). (See Table VI, and compare Figure 15 with Figure 23.)

END