COMMUNICATIONS & ELECTRONICS DIV.			25X1
FACILITY NAME	STREET ADDRESS	CITY AND STATE	
CORP 853 10/65	**CLASSIFIED MATERIAL RECEIPT**	DATE PREPARED 11-23-66	RECEIPT NO.

I HAVE RECEIVED FROM— [redacted] 25X1

THE CLASSIFIED MATERIAL ADDRESSED TO— [redacted] 25X1

CLASSIFICATION OF MATERIAL	DESCRIPTION OF CLASSIFIED MATERIAL
Confidential	Three (3) carbon copies of letter dated 11-23-66 ref. RFP No. RD-4-67, Project No. 10167; [redacted] No. CX36. F700. 25X1 Recorded 85-DCL-P-257-2, -3, -4
Unclassified	Three (3) copies of [redacted] Cost & Price Analysis 25X1
Unclassified	Three (3) copies of TP 2121
Unclassified	Three (3) copies of Video Electronics Brochure

	JOB TITLE	DATE RECEI 25X1
		11/28/66

RECIPIENT'S FILE COPY

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Copy 2

November 23, 1966

[redacted] 25X1

SUBJECT: Request for Proposal No. RB-4-67, Project No. 10167; [redacted] File CX36.F700 25X1

ENCLOSURE:
(1) [redacted] Cost & Price Analysis (2 copies) 25X1
(2) [redacted] Technical Proposal No. 2121 (2 copies) 25X1
(3) Video Electronics Brochure (2 copies)
(4) Development Objectives (2 copies)
(5) Specification No. DB-1001 (2 copies)
(6) Installation Engineering Data (2 copies)
(7) Letter dated 10 October, 1966 - Project No. 10167

Gentlemen:

In response to the subject request, [redacted] 25X1 is pleased to submit its fixed-price proposal to supply a Magnetic Tape to Photo Reproducer. Enclosure (1), a [redacted] cost and price analysis, 25X1 In [redacted] DD-633 format presents our pricing for this program. Verbal 25X1 extension of the due date to 25 November, 1966 has been taken into consideration in this response.

[redacted] Technical Proposal number 2121 enclosure (2), 25X1 describes our approach to implementation. It should be noted that, after several telephone conversations between your technical representative and our [redacted] several conditions were included in our 25X1 Technical Proposal. These conditions are reiterated below:

[redacted] 25X1

1. Helical head VTR equipment is discussed. These devices are not priced, or included as part of the proposal; however, we will support your efforts to procure devices of this type for future integration into this system.

2. Per your request, we have included discussions of several subjects, including: electronic magnification, spot wobble, vertical aperture correction, contrast enhancement, etc. The pros and cons of these techniques are subjectively presented. Neither pricing, nor positive recommendations are contained for their inclusion. Enclosure (3) "Video Electronics" describes much of our background and provides experience in several of these areas.

3. The 819 line, 25 cycle frame rate, peculiar to a small geographic area, becoming obsolescent, and considered obsolete by the implementation time of these equipments is omitted from the proposed approach. This has been agreed to by your technical representative.

4. Planned delivery is 6 months from date of award.

5. Field services will be accomplished by [redacted] 25X1 Communications and Electronics Division field engineering personnel. The field service costs include not only the 12 months field services, but also a two month in-house training period. Because a recommended spare parts list is a contractual requirement, no spare parts are considered in the presently quoted field services.

In accordance with the requirements of your cover letter, two copies each of enclosures (4), (5) and (6) are returned along with the single copy of the cover letter, enclosure (7).

Both [redacted] 25X1
[redacted] 25X1 are available to coordinate additional information requirements, or to answer questions. We look forward to a positive response to your evaluation of this proposal.

Very truly yours,

[redacted] 25X1

Assistant Controller

18. OVERHEAD RATE AND GENERAL AND ADMINISTRATIVE RATE INFORMATION

A GOVERNMENT AUDIT PERFORMED ☐ YES ☐ NO ☐ PENDING	DATE OF AUDIT	ACCOUNTING PERIOD COVERED
B. NAME AND ADDRESS OF GOVERNMENT AGENCY MAKING AUDIT		C. DO YOUR CONTRACTS PROVIDE NEGOTIATED OVERHEAD RATES *(ASPR 3-704)? (If yes, name Agency negotiating rates)*

D. *(If no Government rates have been established furnish the following information)*

DEPARTMENT OR COST CENTER	RATE	BASE	TOTAL INDIRECT EXPENSE POOL	BASE FOR TOTAL

16. EXHIBIT A - SUBCONTRACT INFORMATION *(If more space needed, use blank sheets, identifying item number)*

NAME AND ADDRESS OF SUBCONTRACTOR(S)	SUBCONTRACTED WORK	SUBCONTRACT	
		TYPE	AMOUNT

17. EXHIBIT B - OTHER DIRECT COSTS *(Specify. If more space needed, use blank sheets, identifying item number)*

CERTIFICATE

The labor rates and overhead costs are current and other estimated costs have been determined by generally accepted accounting principles.. Bidder represents: (a) that he ☐ has, ☐ has not, employed or retained any company or person (other than a full-time bona fide employee working solely for the bidder) to solicit or secure his contract, and (b) that he ☐ has, ☐ has not, paid or agreed to pay to any company or person (other than a full-time bona fide employee working solely for the bidder) any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract, and agrees to furnish information relating to (a) and (b) above, as requested by Contracting Officer. *(For interpretation of the representation, including the term 'bona fide employee,' see (Code of Federal Regulations, Title 44, Part 150.)*

Number of contractor employees ☐ Over 500 ☐ Under 500

State incorporated in

DATE	SIGNATURE AND TITLE OF AUTHORIZED REPRESENTATIVE OF CONTRACTOR

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MAGNETIC TAPE TO PHOTO REPRODUCER

a technical proposal

[redacted]

25X1

Communications and Electronics Division, [redacted]

25X1

CX36.F700 TP 2121

MAGNETIC TAPE TO PHOTO REPRODUCER

Prepared for

DC Labs.

Washington, D.C.

by

[redacted]

25X1

November 22, 1966

Declassified in Part - Sanitized Copy Approved for Release 2012/11/15 : CIA-RDP79B00873A002900020088-6

1.0 Introduction

The Visual Equipment Laboratory of the [redacted] Communications and Electronics Division, 25X1
located in [redacted], is pleased to submit 25X1
this proposal to DC Labs. in response to RFP-RD-4-67 (Project-10167).

As described in our accompanying Video Capabilities Brochure this [redacted] laboratory has 25X1
an extensive background in the design and interfacing of special monochrome and color TV equipment. Included are high resolution TV systems operating at various line standards, and the responsibility for the world's largest high resolution closed circuit TV display system which is part of NASA's Mission Control Center at Houston, Texas. This system has been successfully used for control of all the Gemeni manned space flights, and will be used for control of the Apollo manned space flights. The system includes hundreds of TV cameras and monitors, digital to TV converters, two video switching units, large screen projection TV displays, six TV standards converters, and transverse head video tape recorders.

Although the [redacted] does not 25X1
manufacture a product line of TV studio and broadcast equipment, it is our opinion that our extensive experience in this field places us in the advantageous position of being able to select the best commercial components available for use in the Magnetic Tape to Photo Reproducer System.

2.0 Proposed System Description

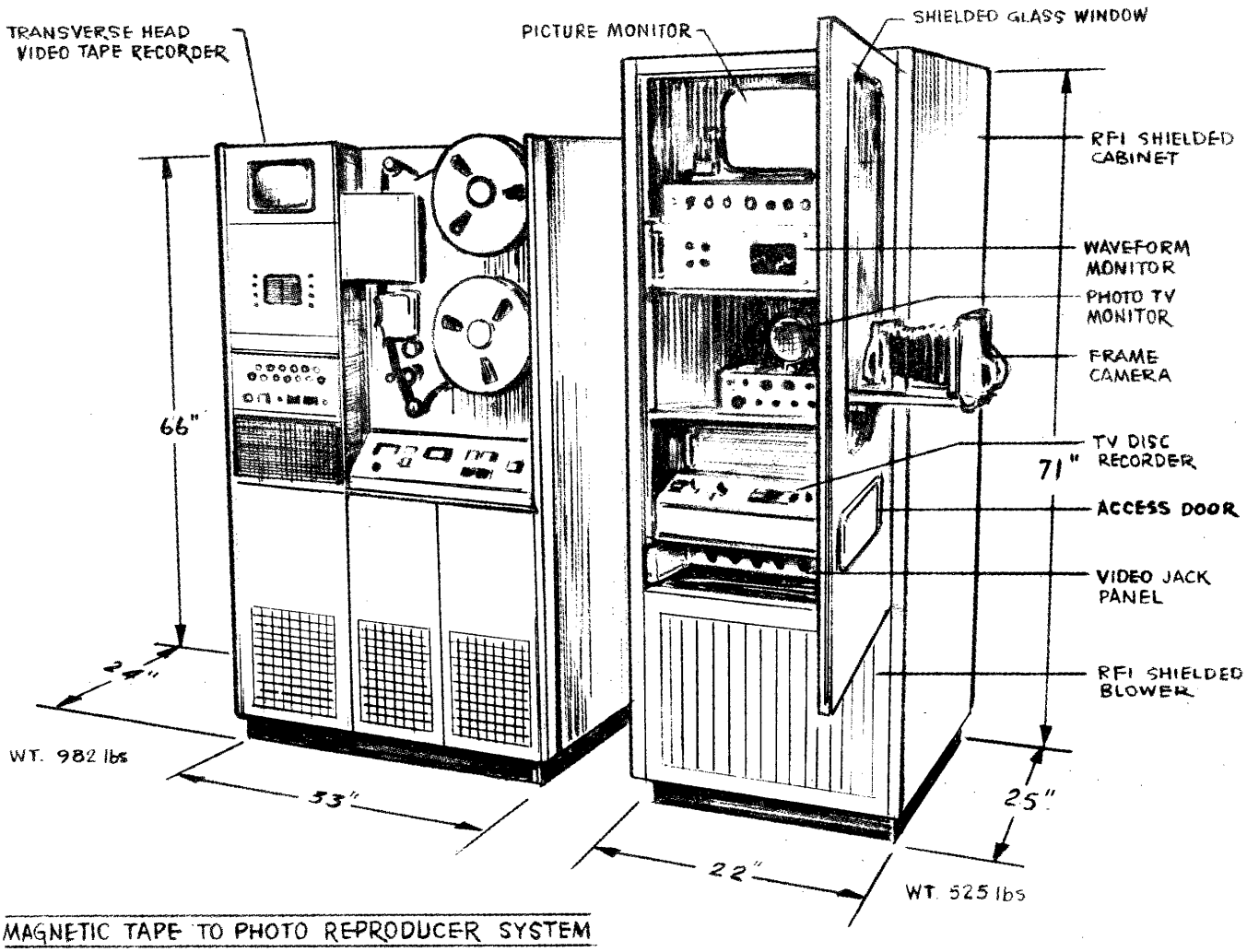
2.1 General

The prime function of the "Magnetic Tape to Photographic Reproducer" is to generate hard copy photographs of television picture signals recorded on magnetic tape. The system will be designed to operate with magnetic video tapes recorded at 405 or 625 lines, 50 fields or at 525 lines, 60 fields.

The French 819 line 50 cycle television system is becoming obsolete. It is expected by the time this program has been completed, there will be no television broadcasting on the 819 line standard. An increase in system bandwidth and the capability to operate at a fourth scanning standard would be required to also playback at the 819 line standard. A considerable increase in the complexity of the individual system components would be required. For these two reasons, impending obsolescence of the 819 line system, and the added component complexity, the 819 line capability will not be provided in the proposed system.

An artist's concept of the proposed system is shown on the following page. Physcially the system consists of two items; a transverse head video tape recorder and an RFI cabinet containing the remainder of the equipment. As can be seen in the illustration, the cabinet contains a solid state 17 inch television monitor, a waveform monitor, a five inch diameter CRT recording monitor, a video disc recorder, and a video patch panel. A photographic camera is mounted on the outside of the cabinet door to photograph the five inch monitor through a port. The 17 inch picture monitor and the waveform monitor are viewed through RFI glass (see Section 2.4).

In operation a transversely recorded video tape would be loaded onto the video tape recorder. The VTR may be set to operate at 405 lines 50 cps, 625 lines 50 cps, or 525 lines 60 cps by means of a selector switch.



MAGNETIC TAPE TO PHOTO REPRODUCER SYSTEM

TP 2121

The VTR standard selection is of course determined by the standard used in recording that particular video tape. The VTR contains built in television picture and waveform monitors. The video signal produced by the VTR from the video tape can be viewed on these monitors both in picture content and signal quality. The tape may be viewed in this manner to locate the portion of interest.

The VTR can operate in either the 50 cps or 60 cps field rate while being supplied with 120 volt 60 cps power. The only requirement to accomplish this is to provide a signal similar to TV vertical drive to the VTR. Therefore two precision oscillators will be supplied, one operating at 50 cps, the other at 60 cps to provide the reference signals.

The video signal produced in the transverse head VTR is routed via coaxial cable to the video patch panel in the equipment cabinet. Additional jacks will be provided on the patch panel for future addition of other video sources such as helical head type VTR's. A patch cord will be provided to select the desired input video signal source and loop it through the 17 inch television picture monitor and the waveform monitor terminating in the video disc recorder. The capability is thereby provided to preview signals from any of the video sources so that the portions which are of interest may be selected. The signal quality may also be monitored.

The video signal thus selected is fed to the video disc recorder which can record 20 second segments onto a magnetic disc. After the selected video information has been transferred from tape to disc, the head is reset to the start of the disc. The head was moved radically across the rotating disc to record the video information in the form of a long spiral. In the playback mode, the head is stationary while the disc rotates so that the video signal produced is that of one television frame. A push button, which can be remoted, will step the head along to successive frames on command. In this manner the video signal from any single frame can be read out when desired. In addition successive frames can be read out as stills by merely operating the push button.

It has been found that in a televised scene containing rapid motion, the information in the two fields of any TV frame may differ considerably. The result is that when such a single TV frame is viewed as a normal TV signal an objectionable sensation is encountered which is very similar to flicker at a 30 cps rate. When a signal of this type is displayed and photographed, the resultant hard copy will contain both TV fields. It will show the moving object in two positions plus possible motion smear due to the integration effects of the pick up device used to produce the TV signal for the original tape recording. To eliminate this effect, the video disc recorder will select one field from the frame over which the head has been positioned. The selected field is recorded twice, in sequence on a single circular track on the rear of the disc. The re-recording is performed in such a manner that playback of that track will produce a TV frame consisting of two identical interlaced TV fields. The motion problem is thereby greatly reduced.

The video signal produced by the disc recorder playback head reading out the single track is fed to a five inch television monitor for photo recording. The face of the photo recording monitor is viewed by a photographic camera through a glass plate in the cabinet door. The focal length of the camera lens will provide a 1:1 magnification of the 3x4 inch display on the photo recording monitor to the film.

By means of the equipment and techniques just described, it is believed that the goal of the "Magnetic Tape to Photographic Reproducer" can best be achieved.

2.2 System Components

2.2.1 Transverse Head VTR

The transverse head video tape recorder is a solid state unit manufactured by RCA and designated Model TR-4.

The TR-4 will be supplied with a switch to select the standards at which the machine is to operate. The available standards include 525 line 60 cps, and 405 or 625 line 50 cps. This switch changes all the necessary circuitry including the built in picture and waveform monitors.

The TR-4 can be adapted for color operation by the addition of a group of color modules beside those being supplied.

In addition to the basic tape recorder, the Automatic Timing Modules will be provided. These are transistorized modules which plug into existing connectors on the TR-4. The function of the ATC is to maintain correct picture geometry by automatically compensating for skewing, quadrature errors, and scalloping. Its action is fully automatic.

Another module which will be supplied is the Drop-Out Compensator. This module contains memory circuits that can reproduce a previous line of video information whenever the device senses a loss of R.F. Use of this accesory promotes greater stability and reduces video drop-outs due to tape imperfections.

In addition, the TR-4 provides the basic capability for later addition of highband, an accessory that provides a new FM standard for improved quality when using color and dubs made through the video system. The conversion reduces moire beats and improves signal to noise ratio for color recording.

TR-4 SPECIFICATIONS

General

Recording Medium.....Magnetic Tape 2"(5.08 cm)wide
Reel Size.....Up to 14"(35.56 cm)

Tape Speed: 60 Cycle
Normal Speed.....15" (38.2 cm)
Half Speed.....7.5"(19.1 cm)

Picture Sound Separation:
Normal Speed.....18.5 frames sound leading
Half Speed.....37 frames sound leading

Record/Playback Time:
Normal Speed.....64 min. on a 12.5" reel (4800 ft.)
Half Speed.....128 min. on a 12.5" reel (4800 ft.)

Rewind Time.....Approx. 3 min. for 4800 ft.

Stopping Time.....Less than .2 seconds from record to play

Recording Time Reference.....To incoming video signal or local sync

Playback Time Reference.....To power line or local sync
Starting Time for Stabilized Picture and Sound:
Tone Wheel Mode.....Less than 5 seconds from stop, less than 3 seconds from setup or standby
Switchlock Mode.....Less than 5 seconds from stop

Tape Interchangeability.....Tapes made on any machine may be played back on any other machine providing they are made in accordance with all applicable proposed SMPTE recommended practices and proposed ASA standards.

Tape Timer.....Accumulated time measured in minutes and seconds at 15 in/sec tape speed on a 60 cycle machine and 15.6 in/sec (39.7 cm) on a 50 cycle machine. Repeatable within 3 seconds per hour.

Horizontal Displacement of Vertically Aligned Picture Elements.....Not to exceed 20 nsec. at junction points

RF Limiting.....Sufficient to allow RF signal level into the demodulator to be 55 db below nominal before video signal is affected by a 10 percent reduction in level

Signal Levels

Input Signal Requirements:

VIDEO.....Input signal level may be between .5 volt p/p and 1.4 volts p/p composite signal. Signal may be looped through or terminated in 75 ohms.

AUDIO.....Line input level between -20dbm and +18dbm into a 10,000 ohms balanced bridging impedance.

SYNC.....Negative polarity 3 to 5 volts p/p loop through or terminated in 75 ohms

RF COPY.....0.8 to 1.2 volts, 75 ohm terminated.

Output Signal Availability:

VIDEO-MONOCHROME or COLOR (Processed):

Three Line Outputs.....Two composite-one composite or non-composite internally selected. Source impedance 75 ohms, load 75 ohms.

One additional composite line used internally for monitoring.

Video Level.....0.5 to 1 volt p/p

Sync Level.....0.2 to 0.4 volt p/p

Pedestal Level.....$\pm$ 20% of video level

AUDIO:
One line output: +18 dbm max. into 150/600 ohms balanced or unbalanced line
One phone jack output for high impedance phones
RF COPY.....1 volt p/p level, 75 ohms terminated.

Electrical

Power Requirements:
60 cycle ± 2 cycles.....115 volts a-c ± 10% single phase, 2.0 kw

Frequency Response:
Video Channel
Monochrome.....405/525 ± 1.5db 25 cycles to 4mc 625 ± 1.5db 25 cycles to 4.5 mc; -3 db max. at 5 mc
Audio Channel:
Normal Speed..... ± 2 db 50 to 15,000 cycles
Half Speed..... ± 2 db 60 to 10,000 cycles
Signal-to-Noise Ratio(Video at 15 ips)
405/525 Line Monochrome.....Better than 40 db(37 db at 7½ ips) on an interchangeable tape basis with 4 db pre-emphasis

625 Line Monochrome.....Better than 37 db (34 db at 7½ ips) on an interchangeable tape basis with 4db pre-emphasis

Audio.....Better than 50 db measured over-all between a recorded level corresponding to 3% total rms distortion at 1000 cycles per second and noise present when playing back an erased unmodulated tape moving at standard speed.

Transient Response.....Rise time less than 150 nsec. Overshoot less than 12% on 62 nsec. sine-squared window test pattern.

Wow and Flutter:
Total RMS wow and flutter 0.5 to 250 cps range:
Normal Speed, 0.2% rms; Half Speed, 0.25% rms

Ambient Temperature and Humidity....Between 35° and 100°F (0° and 45°C) at 20 to 90% relative humidity.

2.2.2 Disc Recorder

The video disc recorder selected is a model VDR-250 manufactured by the MVR Corporation. The VDR-250 is one of two models developed specifically for the television networks. In its commercial form the VDR-250 can provide the following features;

a) instant replay
b) stop action
c) slow motion (3:1, 5:1, and 7:1).

The operation of the VDR-250 is described in detail in Section 2.1.

The VDR-250 can operate in the 405 or 625 line 50 field mode and in the 525 line 60 field mode. To facilitate the scan rate change it is only necessary to plug in different servo and timing boards which can be done very quickly. All modes of operation are possible with 120 volt 60 cps power supplied to the unit.

2.2.3 Television Picture Monitor

The 17" television picture monitor will be a Hewlett-Packard Model KS-19833-mod A. The unit is all solid state and provides the finest in TV monitor performance. The unit will operate at 405 line or 625 line 50 fields or 525 line 60 fields as selected by a front panel switch. A fast acting keyed clamp will be incorporated into the monitor. This monitor was specifically designed for Bell Telephone Laboratories for use in monitoring network TV signals.

2.2.4 Waveform Monitor

The waveform monitor selected is a Tektronix Model RM 529. This unit is designed specifically for television waveform monitoring. The following is a list of pertinent features.

Two Video Inputs (switchable)

Frequency response

FLAT - ± 1% to 5 mc; ± 3% to 8 mc.

IRE - 3.58 mc - 20db

HIGH PASS - 3.58 mc ± 400 KC

LOW PASS - 18 db down at 500 KC

Tilt - 1% on 60 cps window

DC Restorer

Gain Stability - ± 1%

Calibrated Sweeps

0.250 H/cm

0.125 H/cm

X5

X25

Uncalibrated Sweeps

2 line

2 field

Line Selector

2.2.5 Photographic Monitor

The photographic monitor will be a solid state unit identical to the monitor provided as part of the TR-4 VTR. [redacted] will perform the modification required to replace the present CRT with a flat faced, 5 inch, CRT with P11 phosphor. This monitor will also be provided with a front panel switch to select any one of three scanning modes. 25X1

2.2.6 Frame Camera

The photographic camera will be a Graflex. Graphir View II Camera, Model No. R25. It will be supplied with a Graflok back for 4"x5" cut film, a Polaroid Land 4"x5" film holder, and a high resolution lens operating at about unity magnification. [redacted] has used this same camera for other systems which involved making hard copy photographic records from CRT television displays. These are illustrated in our "Video Capabilities Brochure", on page 2, (High Resolution Electronic Viewing System), and page 11 (Electro Optical Scanner Recorder), which illustrate equipments designed for military agencies. 25X1

2.3 Adaptability to Various Helical Head Recorders

The interface of importance when considering the use of a helical head video tape recorder as a source of signal is the video disc recorder. The manufacturer of the video disc recorder has successfully dubbed onto disc from several of the higher quality helical head video tape recorders. In particular they mentioned the Sony Model 120 and the Ampex Model 660. However some of the lower quality VTR's are not capable of timing the video signal accurately enough for the tape to disc transfer.

Table #1 is a list of some of the commercially available helical head video tape recorders.

Mfg.	Model	Type Tape	Tape Speed	Reel Diam.	Record Time	Freq. Resp.	Size	Weight
Ampex	VR-303	¼"	-	-	50min.	-	W-23" D-17.5" H-12½"	95 lbs.
Ampex	VR-660	2"	8.7"/sec.	12½"	5hrs.	3 mc	W-30" D-17" H-14"	100 lbs.
Ampex	VR-7000	1"	9"/sec.	-	60min.	3.5mc	W-29" D-18" H-15"	80 lbs.
Dage/ Bell	DV-300	1"	5.9"/sec.	-	63min.	3 mc	W-25" D-12" H-15"	147 lbs.
Prec. Inst.	P1-4V	1"	8.5"/sec.	10.5"	85min.	3.5 mc	W-24" D-13" H-10"	80 lbs.
Sony	TCV 2020	½"	7.5"/sec.	7"	60min.		W-28" D-16" H-11"	70 lbs.
Wes-grove	800-VTR	¼"	7.5"/sec.	11.5"	28min.	2 mc	W-20" D-10" H-7"	28 lbs.
North Amer. Ph.	EL3400	1"	9"/sec.	9"	42min.	4.3mc	W-24" D-16" H-10"	100 lbs.

TABLE #1
VIDEO TAPE RECORDERS (HELICAL SCAN)

2.4 RFI Protection

As can be seen in the illustrated layout all of the equipment with the exception of the VTR is mounted in an RFI proof enclosure. This equipment can be operated with the cabinet door closed. The 17 inch television picture monitor and the waveform monitor are viewed through a special RFI shielding glass. This glass has a gold grid pattern sputtered on one side. The grid has about 100 lines to the lineal inch while retaining about 85% light transmission. The photo recording monitor will be photographed through the same glass. The grid pattern on the glass will not be seen in the photograph because it will be located at an out of focus plane.

3.0 Physical Characteristics

The illustration shows the components of the Magnetic Tape to Photographic Reproducer System. The physical characteristics of the system are listed in Table #2.

4.0 Additional Equipment Considerations

Many techniques to help produce improved video displays and therefore hard copy have been pioneered and developed by personnel of the [redacted] 25X1

4.1 Spot Wobble

Spot wobble is a technique designed to eliminate the distracting line structure from a television display. It is quite commonly used on large size 405 line TV sets in England. Simply increasing the size of the scanning spot is not adequate because it deteriorates horizontal resolution to the same degree that line structure is improved.

Component	Size Height	Width	Depth	Power	Model	Supplier
Transverse Head Video Tape Recorder	66"	33"	24"	115V a-c 2.0 KW	TR-4	RCA
Video Disc Recorder	10"	19"	20"	115V a-c 375 W	VDR-250	MVR
Waveform Monitor	5¼"	19"	20"	115V a-c 80 W	RM529	Tektronix
17" Picture Mon.	15 3/4"	19"	20½"	115V a-c	KS-19833 Mod. A	Hewlett - Packard
Photo Recording Mon.	10 1/8"	9"	17 3/16"	115V a-c 70W	3316127-3	RCA
Video Patch Panel	3½"	19"	8½"	None	M1-26219	RCA
50 cps Oscilloscope	4¼"	1 3/4"	1 3/4"	28V d-c 40 ma	JJ-50	Accutronics
60 cps Oscilloscope	4¼"	1 3/4"	1 3/4"	28V d-c 40 ma	JJ-60	Accutronics
Power Supply	5"	3¼"	3¼"	115V a-c 15W	RA30-.200	PMC

TABLE #2
PHYSICAL CHARACTERISTICS

The desired results may be obtained by increasing only the vertical dimension of the spot to just equal the line pitch. Horizontal resolution would be uneffected. However shaping the beam and maintaining its shape throughout the deflection field is rather difficult.

An effective technique for reducing the effects of line structure has been developed . This consists of moving the spot up and down at a very high rate around its normal line scanning path. The peak amplitude of this wobble covers the distance between TV lines. The wobble frequency is usually between 10 and 25 megacycles so it produces no visible effects.

Two techniques[1] have been employed to produce spot wobble. One method uses a small vertical deflection coil which is either part of the main yoke or mounted close to it. A small amplitude high frequency current is applied to this coil producing the spot wobble. An alternative method is to use a cathode ray tube with a longitudonally split focus cylinder. Both halves of the cylinder are returned to the same d-c focus potential but are driven 180^{o} apart by a high frequency wobble signal. An electrostatic spot wobble is effected.

[1] Francis T. Thompson, "Television Line Structure Suppression", Jour. SMPTE vol. 66, no. 10 Oct. 1957.

4.2 Vertical Aperture Equalizing

A television system consists of a series of cascaded components each of which introduces an aperture effect. The development of amplifiers, etc. has developed to the point where these components contribute very little to deterioration of the size of a resolvable element. This is not true of the television camera and monitor because these components require a scanning beam with a physical aperture size. The effects of the aperture size along the scanning line can be partially corrected by electronic horizontal aperture correction. This feature is incorporated in many TV cameras and monitors.

A technique has been developed to minimize the effects of the scanning aperture size in the vertical direction.[2] The technique is aimed primarily at improving the effective vertical dimension of the television camera scanning aperture.

Two methods have been used to implement this technique. The two methods arise from the fact that the television signals normally encountered are interlaced.

The principle of both systems is the same. The signal of corresponding elements on adjacent scan lines is sampled and the change is determined. This change signal is used to modify the actual displayed signal to enhance the change.

(2) W.G.Gibson and A.C.Schroeder, "A Vertical Aperture Equalizer for Television", Jour. SMPTE, Vol. 69, No. 6, June 1960.

The difference in the two vertical aperture correcting systems is that one system compares physically adjacent scan lines which are actually separated by 16.67 milliseconds in time. A wideband delay line providing 16.67 milliseconds delay is required. The vertical aperture compensation curve for this system provides maximum correction at 480 TV lines. The other correction system compares scan lines which are adjacent in time and therefore are separated by a scan line in the actual display. The vertical aperture compensation curve of this system provides maximum vertical aperture correction at 240 TV lines. The video delay required for this system is only 63.5 microseconds. Therefore this second technique is more readily implemented.

Both systems may be used to improve vertical detail contrast as limited by aperture effects in lenses, TV cameras, and CRT monitors.

4.3 Gamma or Black Stretch

Gamma correction is quite commonly employed in color television cameras. Its purpose is to transform the signals generated by the non-linear transfer characteristic of the camera tube into signals which correspond linearly to scene brightness. One part of this process involves black stretch.

The black stretch function is implemented quite simply by providing a stage whose amplification varies inversely with signal amplitude as measured from black level. The shape of this transfer curve as well as its break points are readily controllable.

4.4 Exponential or White Stretch

Exponential or white stretch is another form of gamma correction. It is implemented similarly. A circuit is provided whose gain varies with the input signal amplitude.

The shape of this curve as well as its break points are controllable. Both the black stretch and white stretch can be provided simultaneously.

4.5 Edge Enhancement and Outlining Techniques

[redacted] has pioneered in the fields of contrast and edge enhancement. Refer to pages 2, 3, 4, 5 and 13 of the accompanying Video Capability Brochure for examples of systems into which these features have been incorporated. 25X1

Basically edge enhancement consists of clipping a portion of the dynamic range of the video signal, and generating a derivative of the video signal. The derivative signal is then added to the original signal to enhance the rise time of signal transitions. Both the degree and amplitude of the second derivative signal can be controlled to produce the amount of edge enhancement desired.

Outlining uses the same basic procedure but with additional clipping. The positive pulses are amplified to full signal level and may be displayed by themselves as a white contour of brightness transitions of the original scene. Likewise, the outlining signal may be added to the original video to outline the objects in the display.

4.6 Electronic Magnification

Electronic magnification is produced by expanding the CRT deflection signals to stretch the displayed image. Since tube face area is limited the image will spread beyond the usable area if even a small amount of this form of magnification is used. Therefore, in addition to expansion of the sweeps a large range centering control must also be provided to recenter that portion of the display which is to be examined or photographed.

If a high resolution CRT is used to display the television picture, enlarging the image electronically will not provide any increase in resolution. Therefore magnification can perhaps more simply be provided by a lens change in the photographic camera. The camera can then be repositioned to view the area of interest.

5.0 Equipment, Services, and Reports to be Supplied

5.1 Equipment

A complete equipment list, and an artist's concept of the layout of the equipment to be supplied are shown in proceeding sections of this proposal. Since there are a number of types of helical-head video tape recorders available, many having different characteristics, it is our opinion that the procurement of units of this type should be carefully considered by DC Labs. and [redacted] prior to ordering. We will be pleased to 25X1
order these units for incorporation into the system, or to consult with DC Labs concerning the types of helical head video tape recorders to be ordered by DC Labs. As a result our submitted costs do not include the purchase of helical-head video tape recorders. However, the disc recorder selected has been interfaced satisfactorily with a number of commercial helical-head video tape recorders.

5.2 Services

As requested in paragraph 7.3 of the RFP our cost breakdown,includes a separate price quotation for a trained [redacted] technician to be assigned to 25X1
DC Labs. for one year. His function will be to keep the equipment constantly tuned to optimum performance, perform minor modifications as necessary, make repairs as required, and to train DC Labs maintenance personnel to eventually assume his duties.

5.3 Reports

As requested in paragraph 7.5 of the RFP, monthly progress reports, including currently up-dated schedules for delivery and installation in accordance with DC Labs. Specification DB-1001 will be provided.

5.4 Delivery

It is anticipated that delivery and installation at DC Labs can be accomplished five months after award of contract.

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VIDEO ELECTRONICS

Communications and Electronics Division

25X1

capabilities

VIDEO ELECTRONICS CAPABILITIES

August 1965

[redacted]

25X1

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COMMUNICATIONS AND ELECTRONICS DIVISION

FOREWORD

The Communications and Electronics Division of [redacted] has an extensive background in research, design, development and manufacture of all types of commercial and military electronic equipment. This experience encompasses such fields as television and video techniques for industry, military, and medical research, data processing, communications, data displays, radar, navigation, guidance, underwater technology, advanced systems and many others. [redacted] has acquired wide experience in equipment integration analysis, and evaluation, as well as in implementation and maintenance of equipment and in training of personnel. 25X1 25X1

This brochure describes [redacted] major accomplishments in those fields which are particularly applicable to video apparatus and television systems. Also included is a brief description of [redacted] general corporate background and facilities. 25X1 25X1

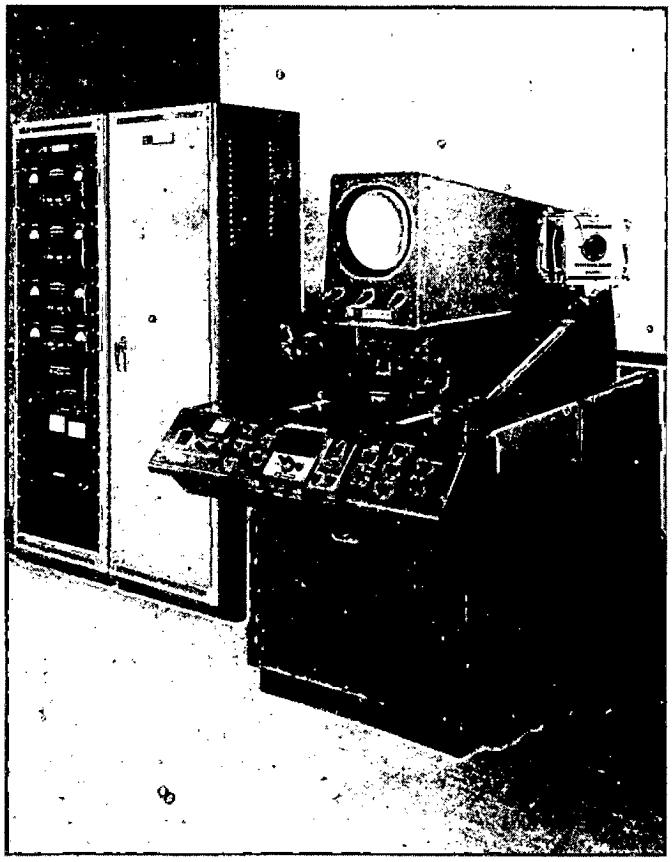
I. BACKGROUND AND EXPERIENCE

During the early 1930's [redacted] designed and built one of the world's first experimental television broadcasting facilities, and conducted pioneering research and development in televisionreceiving equipment and displays. Later, during the early 1950's [redacted] owned and operated TV Station WPTZ which served the Philadelphia area. 25X1 25X1

The [redacted] has always played a prominent part in the field of video electronics. Under contracts to military agencies, [redacted] has designed and built a number of airborne television systems, special video equipment for use in photographic interpretation, and has done considerable pioneering work in color television. 25X1 25X1

The Manned Spaceflight Control Center at Houston, which was used to control the Gemini-4 flight, and will be used for control of all future Gemini and Apollo manned spaceflights, was completely designed and built by [redacted] The Control Center contains the largest high-resolution closed-circuit television system in the world devoted almost exclusively to the generation, distribution, and display of computer derived alphanumeric data. 25X1

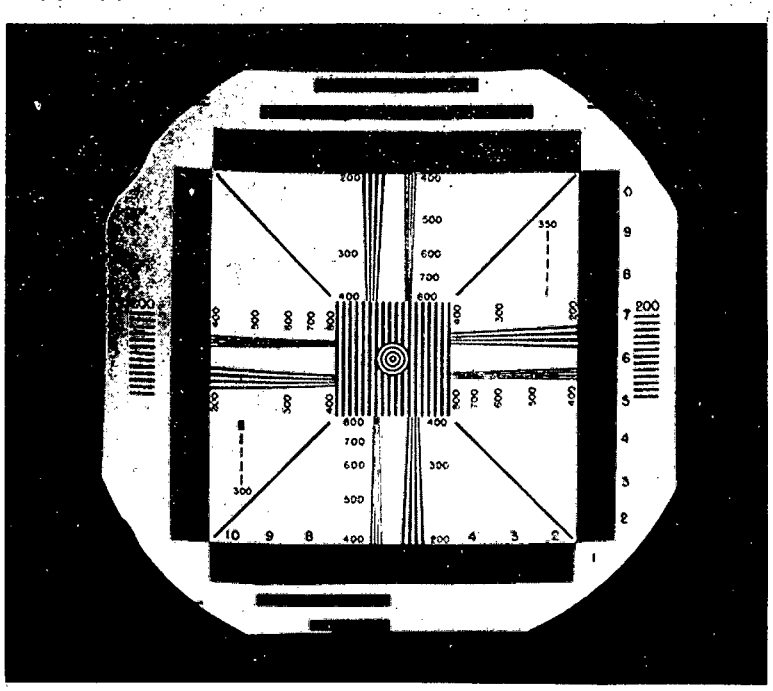
It is difficult to state within the limit of this document all the efforts, projects, details, and contractual systems that have evolved in the field of television and special video apparatus. Hundreds of man-years of video experience back up [redacted] results. We are listing in this brochure only some of [redacted] major efforts in the television field. 25X1 25X1



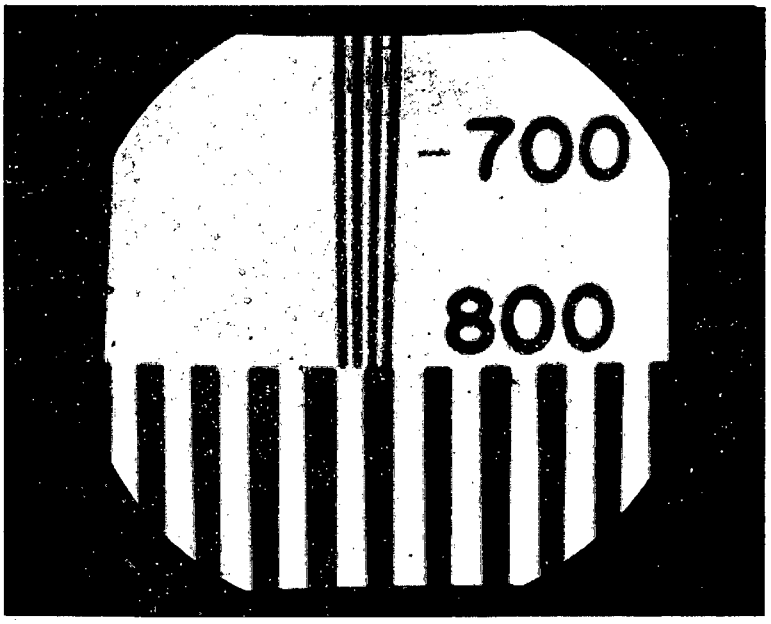
High Resolution Electronic Viewing Systems, Model II

HIGH RESOLUTION ELECTRONIC VIEWING SYSTEM, MODEL II [redacted] was designed and built for the U.S. Naval Photographic Interpretation Center, Suitland, Md., under contract to the Bureau of Naval Weapons. The unit was delivered in March, 1963. Video processing to provide selective area contrast enhancement, outlining of equal density contours, and crispening is included. Two modes of scanning are provided, the first at 1029 TV lines, interlaced 2:1 with a field rate of 60 cps, and the second at 2025 TV lines, interlaced 2:1 with a field rate of 15 cps. Three different lenses are provided so that a 2.25 inch x 2.25 inch, 0.5 inch x 0.5 inch, or 0.25 inch x 0.25 inch area of the film can be scanned. This provides magnifications of 4 times, 16 times, and 32 times. With the highest magnification the system can resolve about 80 photographic line pairs per millimeter. The bandwidth of the video amplifiers is in excess of 20 megacycles.

25X1



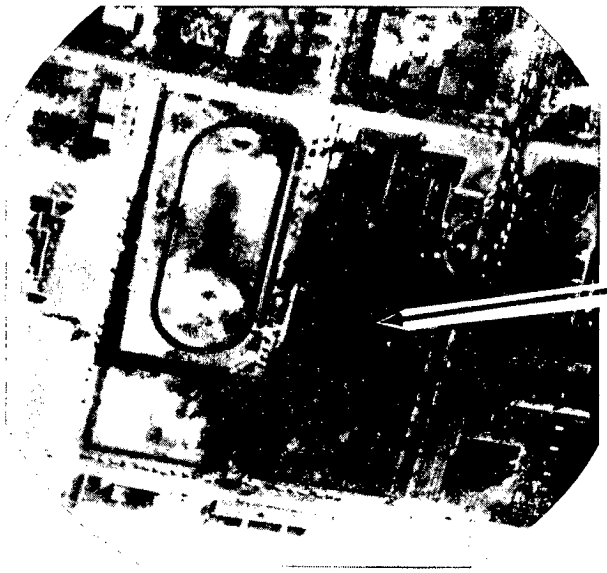
EIA TV Resolution Chart (2.25" x 2.25") inserted in film aperture. Photograph illustrates horizontal and vertical system resolution of greater than 800 TV lines with good interlace performance.

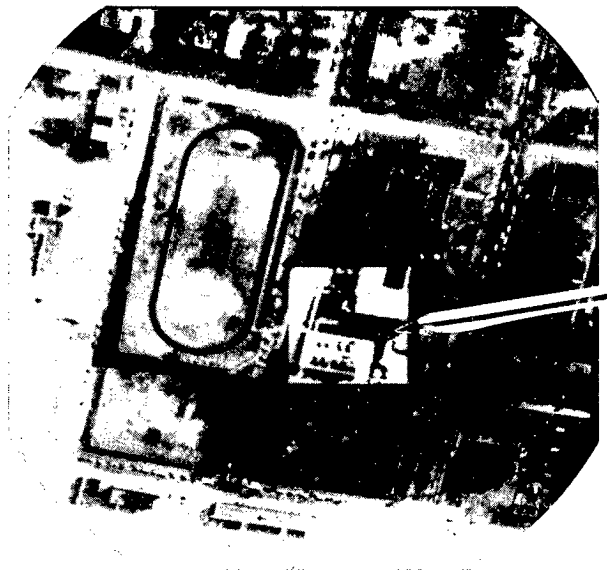


Resolution attainable when an area of 0.25" x 0.25" of film used in above is scanned. Magnification of 32 times.

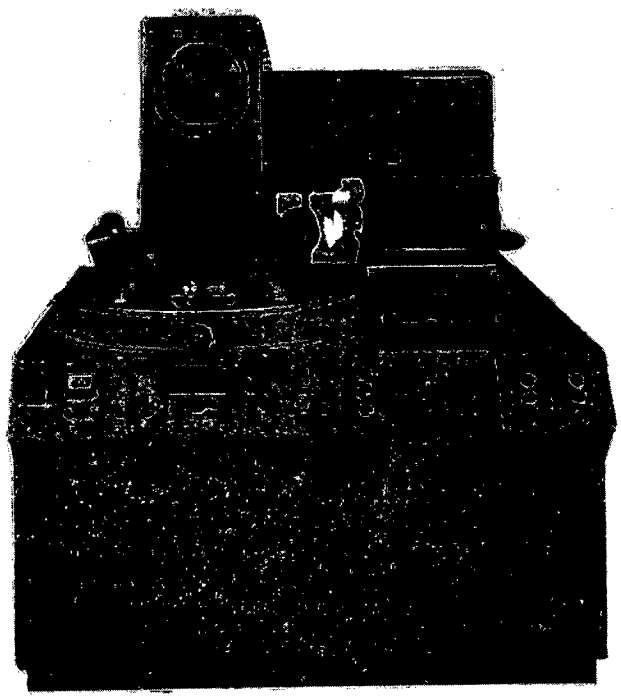
Performance of [redacted] High Resolution Electronic Viewing System, Model II (Sheet 1 of 3) 25X1

(Photographs taken from display monitor having image size of 8.25 inches x 8.75 inches)





Selective Area Electronic Contrast Enhancement of Low Key Portion of Aerial Photograph. (Photographed from display monitor of [redacted] 1029-line, 20-Mc, "High Resolution Electronic Viewing System.") 25X1

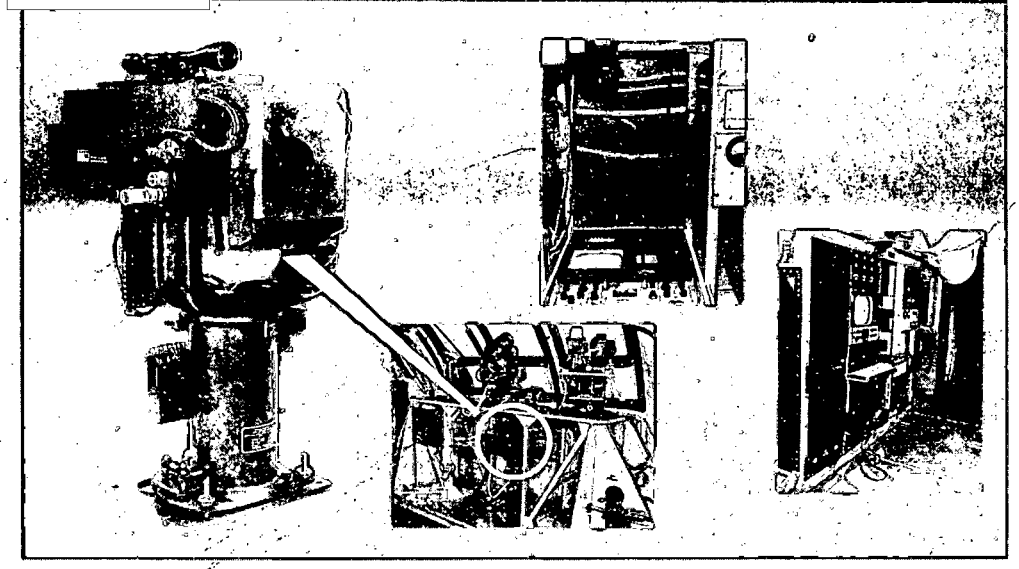


Sensor Image Enhancement Display

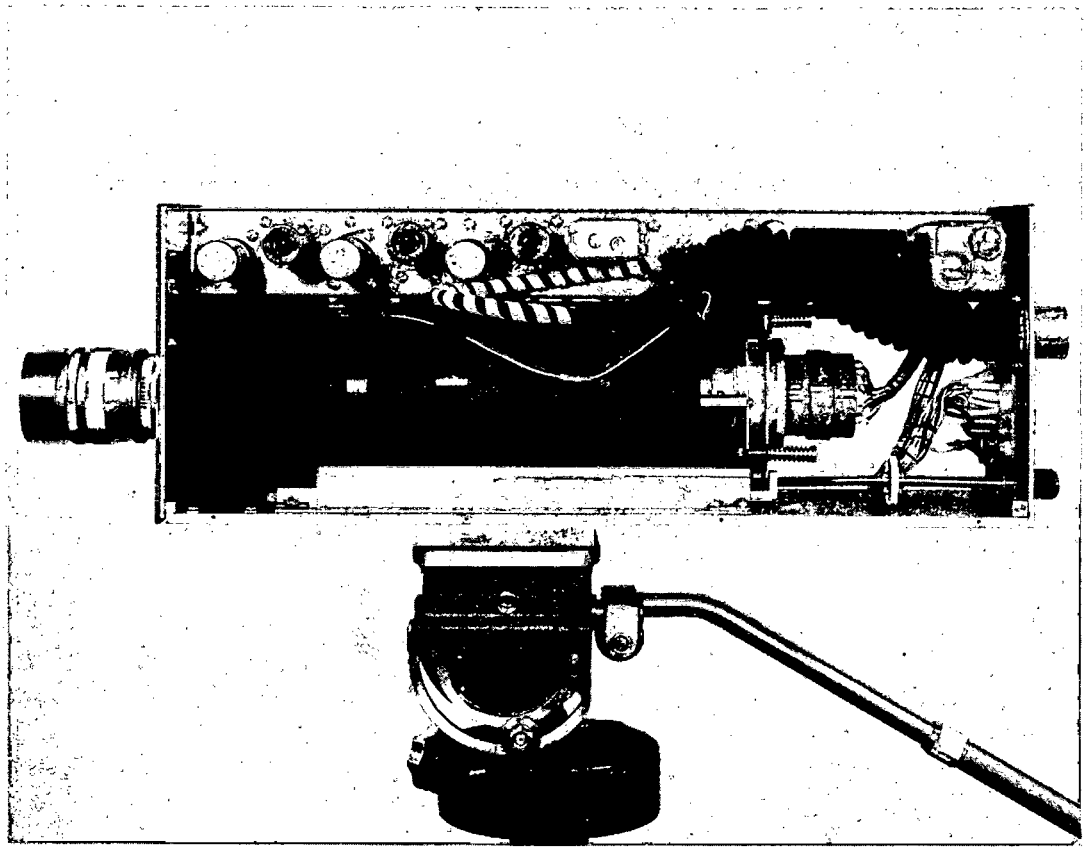
SENSOR IMAGE ENHANCEMENT DISPLAY was designed and built for U. S. Army Signal R&D Lab., Fort Monmouth, N. J. [redacted] 25X1
[redacted] This system increases the amount of information obtainable 25X1
from aerial photographs by enhancing contrast, enhancing the outline, and crispening for visual interpretation of positive or negative films. Changes in aerial photographs taken at different times can be observed when they are superimposed and their signals are subtracted electronically. The unit operates on the flying-spot scanner principle. It has provisions for selection of the area and size to be enhanced. This is a dual unit; that is, it has two complete pickup systems, each with a 10-inch and 135-mm lens, to scan 2.25 - by 2.25-inch and 0.5 - by 0.5-inch areas of film and magnify them 4x and 16x, respectively. It can operate at either 1029 lines, interlaced two-to-one with a 60-cycle field rate, or 2025 lines, interlaced two-to-one, with a 15-cycle field rate. In the latter case, the enhanced image is photographed from the display because of the low flicker rate. All timing pulses are supplied by two self-contained sync generators. All amplifiers are designed for over 22 Mc bandwidth to provide equal horizontal and vertical resolution. Over 800 lines resolution are obtained at the 60-cps field rate and over 1000 line resolution at 15 cps.

25X1

AIRBORNE TV SYSTEM PROJECT "TRAP"



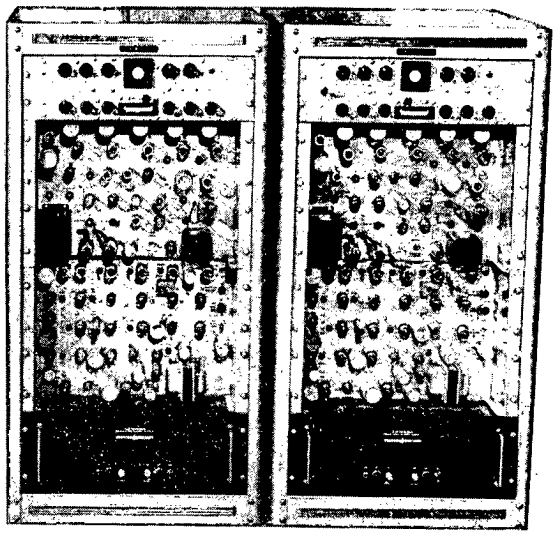
AIRBORNE TV SYSTEM PROJECT "TRAP" was designed and built in 1961 by [redacted] for the U. S. Air Force [redacted] 25X1
[redacted] for the study of re-entry vehicles. This airborne image 25X1
orthicon TV system was delivered to the U. S. Air Force and is now installed in a KC-135 jet aircraft. The photographs show the television equipment installed in the aircraft. The image orthicon camera and gimbal system is mounted as shown in the photograph. The optical sensors are servo controlled for synchronous tracking. The image orthicon camera contains a variable density liquid iris which automatically maintains the peak highlight brightness on the image orthicon photocathode at 10^{-3} foot-candles. Special electronic circuitry for controlling the iris transmittance is located in the TV equipment racks. Also contained in the equipment racks are the sync generator, camera deflection circuits, grating unit, shading unit, video processing amplifier, master control, and power supplies. A 10-frame per second, 35-mm kinerecorder is used to record the location and brightness of the targets.



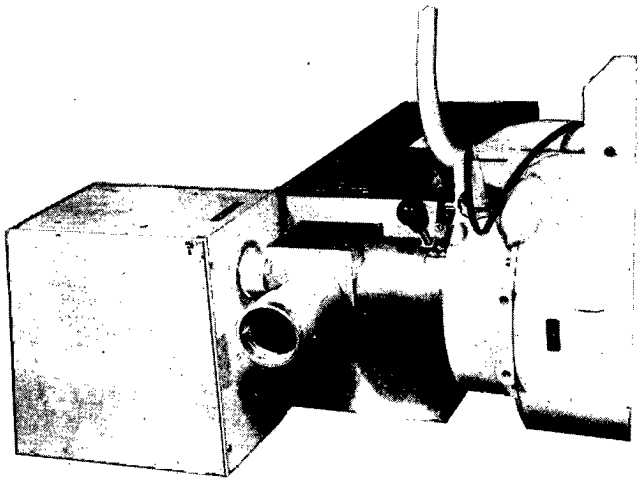
Compact Image Orthicon Television Camera

COMPACT IMAGE ORTHICON TELEVISION SYSTEM is a complete self-contained television system. The camera head is compact, only 20 by 6.5 by 7-5/8 inches and weighs less than 30 pounds; therefore, it may be used in applications which require the sensitivity of the image orthicon pick-up tube without the bulk, such as viewing image intensifiers for X-ray use, or observation in locations where space is a limiting factor. This compactness was accomplished by designing the system so that the deflection circuits and some of the video processing amplifiers, which are generally located in the camera head, are mounted in a remote equipment rack. The system operates at 525 lines, interlaced two-to-one, with a field rate of 60 cps. The video bandwidth is flat to 10 megacycles. Depending on the purpose, a variety of tubes may be used; for example, with the type 5820 image orthicon tube, the camera serves in well-lighted areas, but with a type Z5294 or the ruggedized Z5358, it serves in low-light-level applications (illumination of 10-5 foot-candles).

Stereo TV Display



TV Equipment Racks

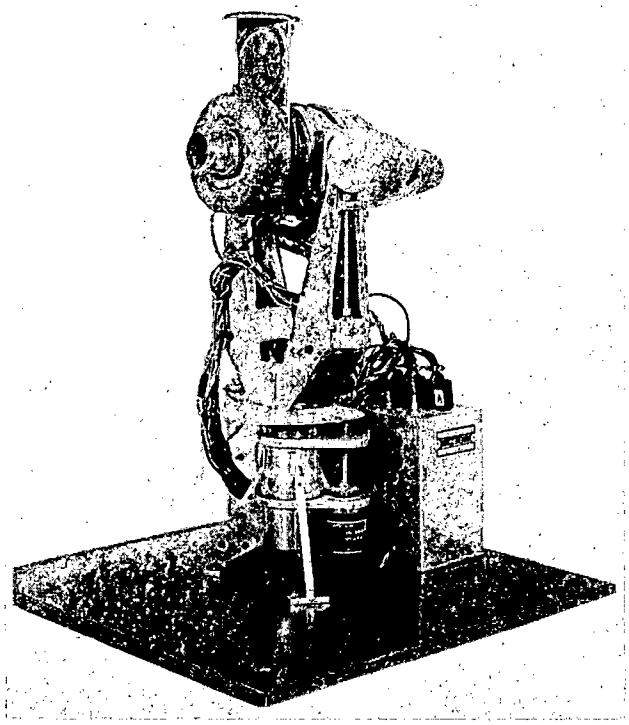


Optical Multiplex of Two Image Orthicons
from X-Ray Image Intensifier

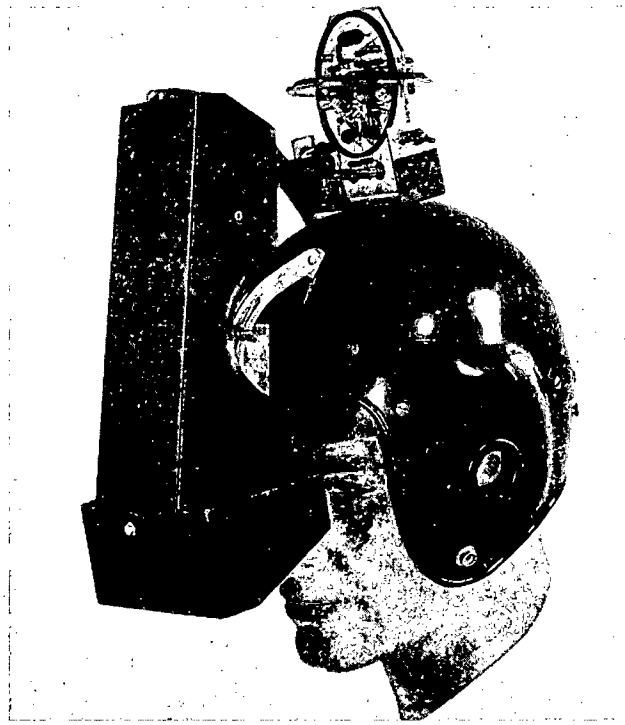
Experimental Image Orthicon Stereo Television System

IMAGE ORTHICON STEREO TELEVISION SYSTEM is a complete, self-contained stereo television pickup system. The system was designed and built by [redacted] for Temple Hospital for use in the field of medical fluoroscopy. The dual-image orthicon camera chains are used with a two-target X-ray tube, a single image intensifier tube, and an optical multiplex system to provide the two views necessary for use with a stereoscopic television display. The image orthicon cameras use low-light-level camera tubes. This equipment is now being evaluated for use in the medical fields of heart catheterization, bone pinning, and location of foreign bodies in the trachea.

25X1



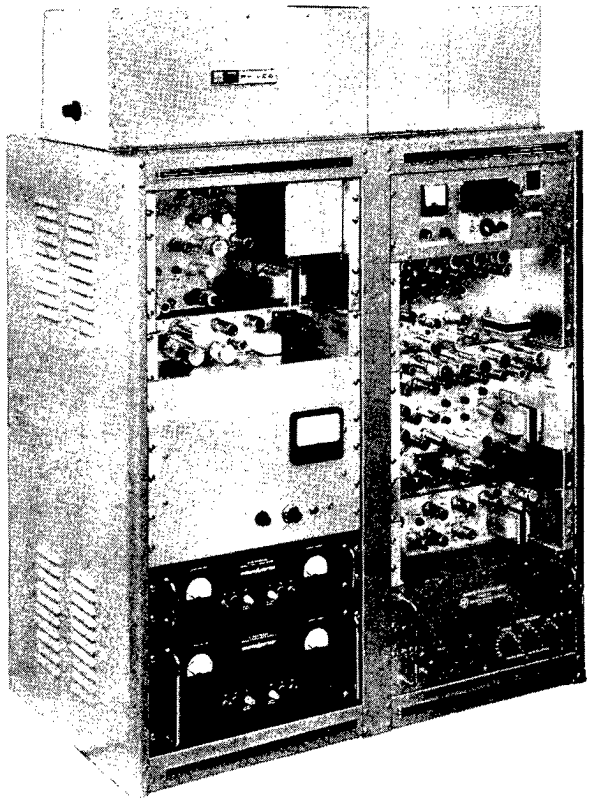
Servo Controlled TV Camera



Headsight Viewer and Head Position Sensor

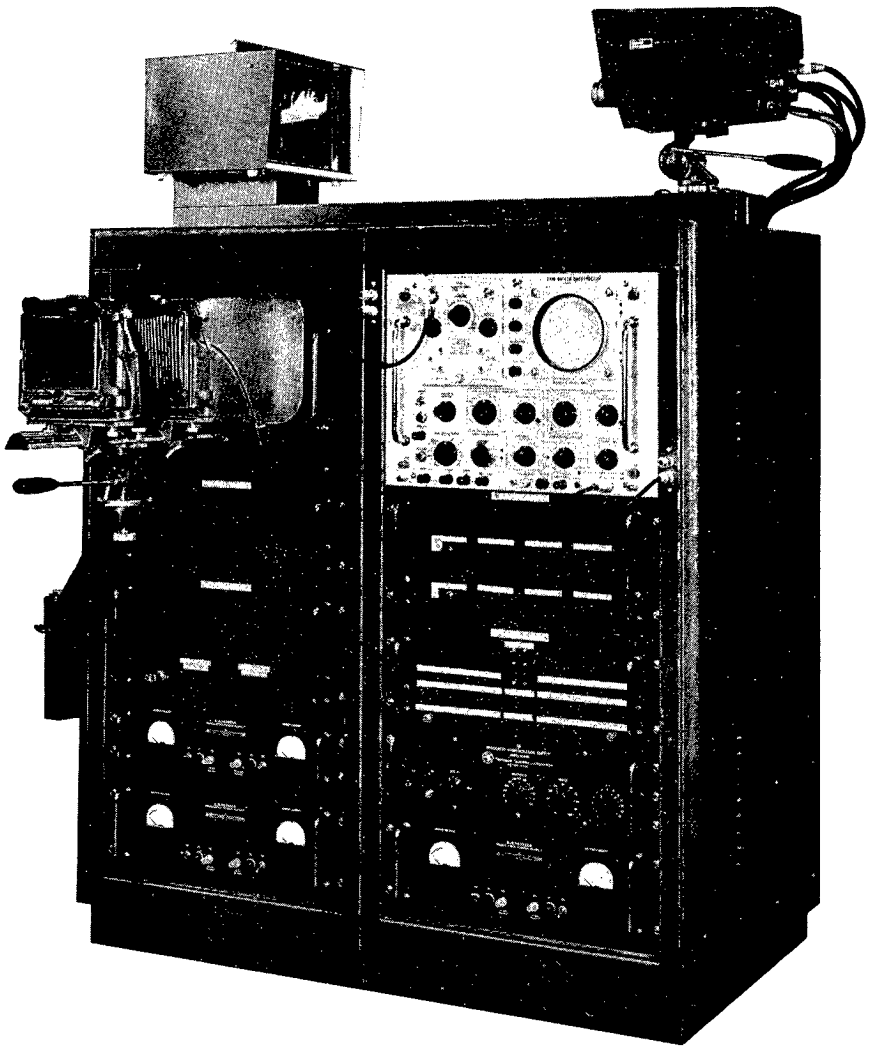
Miniature TV Headsight

MINIATURE TV HEADSIGHT senses the attitude and orientation of an operator's head and servos a remotely located television camera to duplicate this action. A high-resolution miniature cathode ray tube mounted in a harness on the operator's head projects the virtual image through a system of lenses to give the operator the illusion of being at the remote camera location.



High Resolution Flying-Spot Video Signal Generator

HIGH RESOLUTION FLYING-SPOT VIDEO SIGNAL GENERATOR is an electronic instrument designed to evaluate and test the performance of special-purpose cathode-ray tubes. It was built by the Video Products Group for the Cathode-Ray Tube Laboratory, Lansdale Division, [redacted] 25X1
[redacted] 25X1
It is capable of generating a high resolution, high quality video signal with up to 18-db boost of aperture correction. It also has a built-in grating generator for scanning linearity checks.



Electro-Optical Scanner-Recorder

ELECTRO-OPTICAL SCANNER-RECORDER. The Electro-Optical Scanner Recorder was designed and built by the [redacted] 25X1
Systems Section in 1963 for the USAF Aeronautical Systems Division, Wright-Patterson AFB, Ohio under [redacted] The 25X1
system is being used to investigate the performance of analog-to-digital television encoding equipment. It uses a 1-1/2 inch high resolution vidicon camera tube. The unit may be switched to operate at four different scan rates, namely 525, 625, 875, and 1029 TV lines. The video bandwidth is in excess of 25 Mc. A built-in camera is provided to record single television frame information.

MILITARY AIRBORNE TELEVISION SYSTEMS. In the field of military television, the [redacted] has designed, built and field tested a complete UHF television system, under Bureau of Ships Con- [redacted] In this equipment the image orthicon camera and transmitter, which operates in the 780-mc to 900-mc frequency range, are located in a helicopter while the receiving equipment is located aboard ship or ground bases. This equipment has been field tested at Quantico, during naval maneuvers in the Caribbean, and in the Philadelphia-Trenton area. 25X1 25X1

In addtion, by arrangement between the [redacted] this equipment has been used on a number of network television broadcasts with excellent results. Under line-of-sight conditions the equipment has a range of approximately 100 miles. 25X1 25X1

The [redacted] has also completed an airborne UHF television system for the U.S. Air Force under [redacted] The equipment successfully withstood extensive flight testing at Wright Air Development Division, Dayton, Ohio (WADD). The primary purpose of this system is to provide high resolution television reconnaissance, (utilizing an image orthicon camera tube) from a high-speed aircraft which transmits the information to the ground or to an airborne receiver or repeater. The receiving system includes high resolution monitors and recording indicators. The delivered equipment includes a photo-recording system which photographs the image on two separate cathode-ray tubes at a frame rate of 10 cps, rapidly processes the two film strips, and presents the image on adjacent viewing screens within one minute elapsed time. The range of the equipment, air-to-ground, is about 100 miles. The operating frequency is 780 mc to 900 mc. The equipment utilizes automatic exposure control by use of pulsed photocathode techniques which, in addition, serve to minimize smear. This production prototype equipment is designed to full military airborne specifications. 25X1 25X1 25X1

The "Trap" airborne TV system, designed and built by the [redacted] in 1961, is illustrated on page 6 of this brochure. 25X1

STUDY FOR AERIAL RECONNAISSANCE TELEVISION SYSTEMS. The [redacted] have completed a "Study for Aerial Reconnaissance Television Systems" under U. S. Air Force [redacted] This study program resulted in a three-volume report covering the relative merits of spot-scan, and frame-scan for both high altitude (70,000 feet) operation at speeds of Mach 1.5, and low altitude (1,000 feet) operation at speeds of Mach 0.9. In addition, the reports contain the results of a theoretical study and laboratory investigation of a Rotating Prism Deviator (Television Camera Optical Image Immobilizer). 25X1 25X1

COLOR TELEVISION. The [redacted] has a long and distinguished history in color television research and development. Active work in color television transmission systems encompasses more than 18 years of effort. During this time the company did pioneering work on the present NTSC system of color television transmission, and designed novel receiver and display techniques. The company established a special laboratory charged with the sole responsibility of suggesting and testing color television standards. This laboratory worked in close cooperation with the NTSC and at various times served as host to this organization and the FCC in conducting industry-wide color television field tests. 25X1

Many patents have been issued to [redacted] scientists and engineers in the fields of both monochrome and color television. To illustrate the depth of the research and development in color television, a few of the articles which have appeared in leading technical journals, authored by [redacted] personnel, are listed below: 25X1 25X1

(1) [redacted] et al: "A New Beam-Indexing Color TV Display System," Proc. of the IRE, Sept. 1956 25X1

(2) [redacted] "Television Techniques for Contrast Enhancement and Color Translation of Roentgenograms," The American Journal of Roentgenology Radium Therapy and Nuclear Medicine, Feb. 1958 25X1

(3) [redacted] "Generation of NTSC Color Signals," Proc. of IRE, March 1953 25X1

(4) [redacted] "Alignment of a Monochrome TV Transmitter for Broadcasting NTSC Color Signals," Proc. of IRE, Jan. 1954 25X1

(5) [redacted] "Measurement and Control of the Color Characteristics of a Flying-Spot Color Signal Generator," Proc. of IRE, June 1953 25X1

(6) [redacted] "Color Film Scanner Circuits," Convention Record of IRE, 1954 25X1

(7) [redacted] "Continuous Film Scanner for Monochrome or Color," Electronics, Aug. 1954 25X1

(8) [redacted] "Television Engineering Handbook," McGraw Hill, 1957. 25X1
(Many chapters authored by [redacted]) 25X1

(9) [redacted] "Colorimetry in Color Television," Proc. of IRE, Jan. 1954 25X1

(10) [redacted] "Color Television Standards," McGraw Hill, 1955 25X1

COMMERCIAL COLOR TELEVISION BROADCAST EQUIPMENT. A color film scanner utilizing flying-spot scanning was developed in the laboratories of the [redacted] This equipment was further developed in the Engineering Laboratories of the Communications and Electronics Division, and a number of the units built by [redacted] have been used in commercial television broadcasting stations and independent laboratories to originate color television signals from both 16-mm and 35-mm color motion picture film. In the course of this work much valuable experience was gained in the use of flying-spot scanner techniques, and color video-signal processing. 25X1 25X1

TELEVISION SUBSYSTEM DESIGN FOR FIRST GENERATION NATIONAL MILITARY COMMAND CENTER (NMCC). During the latter half of 1962 C&E Division television engineering personnel evaluated the display and visual inter-communication requirements for the Joint Chiefs of Staff. A closed-circuit television system was planned and specified in detail which monitors critical status functions, facilities, studio-originated briefings, and incorporates generation of pictorial presentation from a variety of film information retrieval devices. The system provided for video distribution, switching, and monitoring. Televsion camera and rear screen TV projectors were specified for the Joint Chiefs of Staff Conference Room.

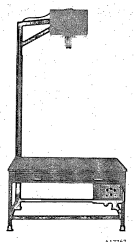
Television engineering personnel of the C&E Division in Philadelphia are presently providing support for the [redacted] 25X1

in Arlington, Virginia, under a contract awarded by the Defense Communications Agency, for further study of NMCS Visual Communications Support.

NASA MANNED SPACECRAFT CONTROL CENTER (MSCC) - The [redacted] had prime responsibility for the complete design and implementation of the MSCC in Houston, Texas. This center is being used for control of all Gemini and Apollo manned spaceflights. Television engineers of the [redacted] in Philadelphia were assigned key positions in the [redacted] operation to design and implement the MSCC television system. The TV system which is used for display and control is the largest high-resolution closed-circuit television system in the world devoted almost exclusively to the generation, distribution, and display of computer derived alphanumeric data. 25X1 25X1 25X1

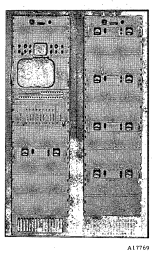
As illustrated in the [redacted] advertisement, which is reproduced on a following page of this brochure, the TV system in the MSCC provides a direct link between the NASA spaceflight controllers and the telemetered data from the spacecraft. The telemetered data is stored in computers, converted to a TV signal, and distributed to the controllers by means of a computer controlled video switching matrix. The TV system operates with 945 lines, interlaced two to one, and uses a 20 megacycle video bandwidth. Included in the MSCC TV system are 70 digital to TV converters, six TV standards converters, five Eidiphor projectors, 23 opaque Televisors, hundreds of monitors and cameras, and two video switching matrixes each having a capacity of about 80 inputs and 120 outputs. 25X1

A number of the TV components required for this system were designed and built by the [redacted] in Philadelphia during 1964. Some of these are illustrated on the next page. 25X1



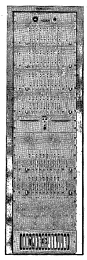
A17767

Opaque Televisor – Television camera system with zoom lens for televising maps and opaque copy.



A17769

Television Interface Equipment – All television input and output circuits to and from Cape Kennedy and to Commercial Networks (CBS, NBC, ABC) will be controlled and monitored by this equipment.



A17770

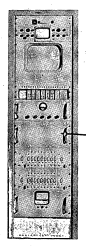
Television Synchronizing Generator and Distribution System – This equipment generates and distributes pulse timing signals to all TV cameras and TV monitors in MSCC. Television system uses 945 interlaced TV lines and video bandwidth of 30 megacycles to provide a resolution about six times greater than commercial home TV receivers.

A17777

Time Display TV Converter, _____ – Television camera mounted above Alpha-Numeric Display Panel to generate and distribute TV signals pertaining to mission status. Data displayed includes the following:

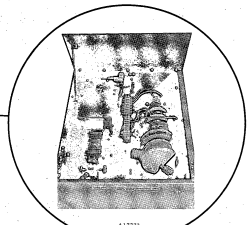
(1) GMT in Days – Hours – Minutes – Seconds
(2) Countdown Status
(3) Recovery Area Time
(4) Mission Elapsed Time
(5) Mission Status

(Front panels removed to show TV cameras and display panel).



A17774

Television Test Generator (945 lines) _____
Signals generated by this unit are fed throughout the MSCC to align, test, and determine if individual television components are providing optimum performance.

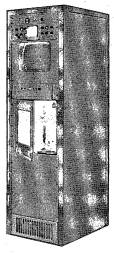


A17773

Optical Drawer (Television Test Generator)_____
Flying-Spot scanner television picture generator used to originate high quality picture test signal.

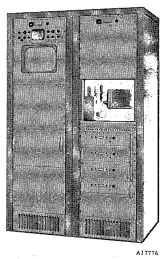
A17768

Video Engineers Console and Equipment – Used to monitor 64 digital-to-television converters.



A17775

Television Standards Converter – This equipment is used to convert the commercial 525-line TV signals generated at remote locations such as Cape Kennedy to 945-line TV signals for display on the MSCC TV monitors. Three of these units were built by the C and E Division for use in the MSCC. Three similar units to convert 945-line TV signals to 525-line signals were also provided. These will be used to feed signals generated within the MSCC to the commercial TV Networks.



A17776

Recovery Room TV Control System, _____
Equipment provides the facility to select any one of a thousand reference slides within three seconds and convert it to a TV signal for display on a large screen TV projector in the Recovery Room. Camera control equipment and monitoring facilities for the TV camera used in the Recovery Room are also included.

(Front panel removed to show reference slide file and TV camera)

25X1

Ford Motor Company is:

a lifeline to two men in space

The exact position of Gemini 4 in its flight. The heartbeats of its pilots. The status of all its systems. Thousands of vital facts poured into NASA's Mission Control Center near Houston. Facts recorded, interpreted and instantly displayed to NASA's flight controllers by the world's largest and most sophisticated space-control system. This lifeline to space enabled flight controllers to know the conditions in space and to make vital mission command decisions.

Prime contractor for the Mission Control Center was Philco—a subsidiary of Ford Motor Company.

Philco designed this Center. Engineered and built most of the complex electronic equipment, including the world's largest closed-circuit television system. Assisted NASA flight controllers who operated the Center throughout the history-making flight.

We at Ford are proud of NASA's success and that of America's two men in space. And of the part that Philco—and Ford—played in the Gemini 4 mission.

As advertised in:
Newspapers—June 15, 1965
Life—June 25, 1965
U. S. News & World Report—June 28, 1965

Ford

II. ORGANIZATION

[redacted] has created the Communications and Electronics Division (CED) so as to keep pace with the rapidly advancing scientific technology and the continuing upgrading of military, defense and industrial systems. This new division has combined the abilities of two former operating divisions into one flexible division to provide the optimum integration of system management experience with the most complete engineering and production facilities available. 25X1

By effecting this total integration, [redacted] can more readily offer the timely technological skill and experience that is required in today's challenging and ever-changing electronic age throughout the universe. 25X1

[redacted] is specifically primed to all national and international requirements. Responsibilities are well defined and authority is centralized. Flexibility, speed, efficiency and maximum utilization of specialized talents are built into the organization through the use of Project Managers who are responsible for the total results of each specific major program. The Project Manager integrates personnel and facilities into an efficient system entirely devoted to the success of the program, thus assuring a singleness of direction for all the talents required. 25X1

III. EXTENSIVE SUPPORT AND BACKUP FACILITIES

To support the Communications and Electronics Division in specialized programs from design through final mass production, extensive facilities, laboratories and departments have been established. These include a Human Factors Department, a Quality Assurance Department, a Reliability and Maintainability Department, a Purchasing Department, modern Environmental Testing Laboratories, Spare Parts and Accessories section, complete manufacturing facilities, and others.

IV. HUMAN FACTORS ENGINEERING

Human factors specialists enter into each program during its early phases to set up basic criteria and contribute to overall system requirements. The experience of this group covers military and industrial human factors engineering and includes the man-machine design interface for automated systems, the design of operator systems, and the conducting of man-machine simulation studies.

V. QUALITY ASSURANCE

The Quality Assurance Department of the [redacted] 25X1
[redacted] has the primary responsibility of ensuring compliance 25X1
with all applicable procurement documents, specifications, and [redacted] stand- 25X1
ards within the scope of the work statements. To ensure accomplishment of this mission, the Director of Quality Assurance reports directly to the General Manager of the Division and can, therefore, effectively interpret and enforce the quality policies and directives of management.

The Quality Assurance Department maintains an effective and timely quality program, planned and developed in conjunction with all other departmental functions. This program demonstrates recognition of the quality aspects of each contract and an organized approach to achieve them. The program ensures that quality requirements are determined and satisfied throughout all phases of contract performance. It also ensures that quality is a part of original designs, and any changes in component, subsystem or system cannot compromise quality or reliability. The program provides for early detection of actual or potential deficiencies or incompatibilities, marginal quality, or trends and conditions that could result in unsatisfactory quality. It also provides prompt corrective action on all deficiencies. Objective evidences of quality conformance, including inspection and test data, are available to customer representatives.

The Quality Assurance system at the [redacted] has been 25X1
developed to meet the requirements of MIL-Q-9858. The Divisional Quality Assurance Manual describes in detail the organization, duties and responsibilities of the Quality Assurance Department.

Principal areas of responsibility of the Quality Assurance Department include but are not limited to:

a. Verification that procurement documents and specifications reflect the required functional, environmental and reliability design objectives.

b. Qualification of vendors through surveys and prior vendor rating information to select only the most capable sources of parts and materials.

c. Inspection of all supplies to assure compliance with applicable purchase order and subcontract requirements.

d. First unit inspections on critical parts, components, subsystems, and systems to establish confidence in the process capability and also to assure early detection and correction of inadequacies.

e. In-process surveillance of all products and processes to assure compliance with acceptable standards of workmanship in accordance with applicable specifications.

f. Review of engineering test and evaluation plans. The plans shall be capable of demonstrating compliance with all requirements of the contract and its associated specifications.

g. Visual and mechanical inspections to assure conformance to [redacted] workmanship standards. 25X1

h. Performance or audit of all acceptance tests and inspections for deliverable equipment. This includes all tests in the test and evaluation plan as approved by the customer.

i. Immediate reporting of failures, acquiring failure analysis and initiating corrective action.

j. Audit of associated controls such as: Calibration, standards, material identification, change control and material handling.

k. Shipping inspection surveillance to ensure packing, marking, identification and inclusion of pertinent data is as required.

The Quality Assurance Department issues a Quality Plan for each contract. The plan is tailored to meet the individual requirements of the contract and covers in detail:

a. Organizational structure of the Quality Assurance Department showing the elements which will perform functions applicable to the contract.

b. Quality Assurance operations and functions to be performed. For the production phase of the contract this will include:

(1) Detailed incoming inspection procedures.

(2) Complete documentation of applicable workmanship standards.

(3) Test and inspection flow process charts.

(4) Detailed test procedures.

(5) Special operating procedures.

(6) Production quality audit procedures.

During all phases of the program, design, breadboard, prototype and production, close liaison will be maintained between Quality Assurance and the Reliability and Maintainability Department to implement those disciplines required to produce the desired levels of reliability and maintainability.

VI. ENGINEERING RELIABILITY AND MAINTAINABILITY

[redacted] Engineering Reliability, Maintainability and Standards Department provides a comprehensive facility for reliability and maintainability (R&M) consultation, surveillance and direct R&M support for design, development and fabrication programs. The Department establishes reliability and maintainability policies; educates, advises, and assists design personnel and management; establishes design standards; and monitors reliability and maintainability programs with audits to management. The staff is comprised of reliability, maintainability and standards engineering personnel. The facility includes handbooks, documented techniques and procedural data, extensive failure rate compilations including data from proprietary equipment in service and design guidelines. Personnel are active in professional activities of interest to industry and the Military such as the IEEE Professional-Technical Group on Reliability and the EIA M-5 Committee on Maintainability. 25X1

To implement the reliability program for a particular project, a competent and experienced reliability group is assigned to the project. While this group works very closely with the project group, it remains part of the parent organization with direct access to all the resources of the department. As a result, the approach taken to any specialized requirements or problems does not depend solely on the capabilities or experience of the engineers directly assigned. Instead, the optimum application of available knowledge and skill is assured.

The Manager of the Engineering Reliability and Maintainability Department reports to higher management (The Director of Engineering). Thus, the reliability-maintainability group can operate objectively in accomplishing the R&M programs.

The reliability programs conducted by [redacted] have provided tasks and activities considered necessary for achievement of program objectives. All reliability programs are initiated and implemented based upon reliability program plans. These are detailed time phased plans with monitoring points. Reliability training is conducted employing education through formal lectures, informal indoctrination, "education by example", educational text material, contractual documentation and specifications, training films, etc. These activities are conducted commersurate with program requirements and goals employing techniques appropriate to the project and personnel involved. Reliability progress reports and problems status reports are prepared and distributed in accordance to project needs and customer requirements. 25X1

VII. PURCHASING DEPARTMENT

The Purchasing Department contracts for all materials and services necessary to implement division projects. It is responsible for buying at the right price, in the right quantity, and to arrange for delivery in accordance with schedules.

To achieve its goals, the Purchasing Department works closely with other C&E Departments and [redacted] in the exchange of material information to develop maximum efficiency. 25X1

A constant search for additional sources of supply is maintained along with an evaluation program of each supplier's management, financial, and technical capabilities. Competitive bids are obtained on materials and services to support cost proposals for prospective contracts.

VIII. ENVIRONMENTAL TESTING

The Division's extensive Environmental Testing Laboratories are among the finest testing facilities in the country. Here, experienced engineers simulate any number of natural or induced conditions to check out design and system endurance to environmental extremes.

Test equipment occupies about 30,000 square feet of floor space and can simulate temperature, altitude, humidity, salt spray, immersion and rain or any environmental extreme. Equipment is also available for such induced environments as vibration, shock, acceleration, hydrostatic pressure, transportation, inclined plane, vacuum steam pressure, and radio interference. Multiple test facilities are available for simultaneous testing.

IX. SPARE PARTS AND ACCESSORIES

The Division fully recognizes the importance of providing proper equipment support, after delivery to the customer, to assure optimum use of [redacted] equipment in the field throughout its useful life. As a world-wide service, the Communications and Electronics Division maintains a special department experienced in supplying renewal parts, test equipment, technical services, and accessories where and when they are needed. 25X1

X. COMPLETE MANUFACTURING FACILITIES

Over 2000 skilled technicians and manufacturing specialists provide the many diverse skills required to machine, fabricate and assemble the vast number of components and subsystems which make up today's complex industrial and Military systems.

Within a total floor space of 700,000 square feet, every production area is carefully planned for maximum efficiency and includes the finest, most modern machine tools, sheet metal, welding, plating, printed panel and assembly facilities.

New, more modern and more efficient production methods and techniques are being constantly sought by the Communications and Electronics Division's management team. Other modern facilities are in their final planning stage. As a part of this program to increase production and to assure the continuance of [redacted] high standards of quality, many new devices and techniques have been introduced. These include: numerical and program controlled machines, advanced assembly techniques, high-density electronic packaging techniques and advanced testing techniques. 25X1

XI. BIOGRAPHIES OF PERSONNEL

The biographies of some of the individuals who will contribute to Television Systems Projects are contained in this section.

As may be expected, the capability of any technical organization depends largely on the quality of its engineering personnel. The selection of the listed management and engineering personnel has been based on their possession of a thorough knowledge of and experience in fields directly related to specific areas of the proposed program. Accordingly, these biographies have only highlighted their backgrounds on education, training, experience and accomplishments to the know-how and grasp necessary for purposeful contribution to the proposed projects.

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