formation such as current situation maps, chart tabulations and operation maps of future actions, all of which can be presented effectively on TV.

In carrying out this project, the Television Division of the Army Pictorial Center supplied a Studio Location Section which consisted of 3 Du Mont image orthicon cameras, lighting equipment, audio facilities and a portable power plant. The layout of the distribution system is shown in Fig. 4. A total of 2300 ft of video and audio distribution circuits was involved. Two of the cameras were mounted on a 9 by 5-ft wooden platform at a height of 4 ft from the floor and 22 ft in front of the operations map. The third camera was placed on a balcony along the right wall of the room in which the briefings were given. It was 14 ft above the floor and 35 ft from the map. Four 1000-w scoops, two 2000-w spots, and four 1500-w scoops, hung from two suspended pipes above the operations map, furnished lighting (Fig. 5).

The lenses most frequently used on the center two cameras were 90mm and 135mm for cover shots and 8½-in. and 12-in. for close-ups on the briefing officers and on the maps and charts. The camera on the balcony used a 35mm lens for general shots into the operations room and for title cards which were mounted on an easel directly in front of it and used a 20-in. lens for close-ups.

The control van was parked adjacent to the operations room with cables and lines dropped from overhead. Seventeen monitors were installed during the exercises (Fig. 6). Speakers above the monitors provided one-way audio from the operations room. Questions and requests for repeats or additional maps or charts were transmitted to the operations room over the telephone system provided by the Exercise Signal Officer. An example of chart information is shown in Fig. 7.

Following is a typical briefing schedule:

0645 Map of area

0655 Charts showing CP locations, nuclear blast explosions, and areas of chemical contamination by map coordinate.

0700 Weather briefing officer. Nuclear fallout patterns shown, also chemically contaminated areas and weather forecast.

0706 G-2 briefing officer. Enemy tactical situation shown. This portion of the briefing included POW information, pictures of captured enemy equipment, psychological-warfare leaflets and a tape recording of an intercepted enemy broadcast.

0710 G-3 briefing officer. Changes in friendly troop locations shown, also details of action which had occurred during previous broadcast.

0715 G-3 Air briefing officer. Chart shown of air activity and statistics.

The success of this TV operation suggests the extension of its use to communications between and among various headquarters, beyond some use reported earlier.* This has not been feasible so far because of the difficulty of transporting complex equipment under field conditions, and also because of transmission security considerations. It may well be, however, that new equipment and techniques will make the use of closed-circuit TV an accepted development of military science.

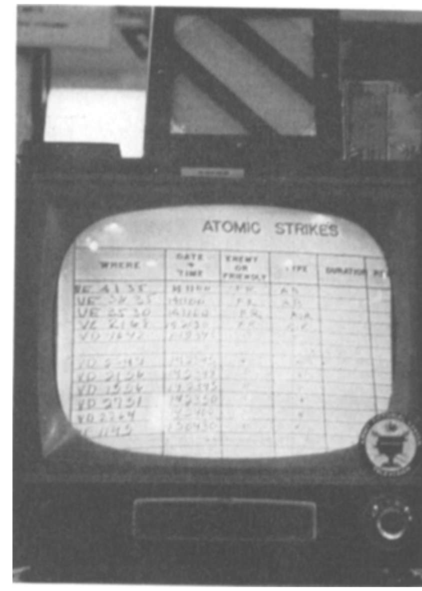

Fig. 7. Typical chart as seen by officers participating in conference.

* Norman Gray and James C. Jangarathis, "Television as a military intelligence and communication medium," *Jour. SMPTE*, *65*: 415–418, Aug. 1956.

Technical and Production Problems in Military Television Recordings

By NORMAN GRAY

Problems encountered in making kinescope recordings for use in Army recruiting programs and for other purposes are described. Procedures differ from those followed in industrial establishments.

Kinescope recordings are used for various military purposes in preference to motion-picture photography because of such advantages as lower costs, reduction of editorial time, rapid availability of the finished product, economical recording of high-quality audio with video, ability to produce special effects electronically, and the availability of military trainees who frequently have worked in small TV stations and who make up in enthusiasm, initiative and imagination what they may lack in experience.

The main disadvantage of kinescopes is that their quality is inferior to that of motion pictures. Certain equipments and methods suitable for industrial purposes do not meet military requirements. This situation, however, may be regarded as temporary because of continuing developments.

Presented on April 30, 1957, at the Society's Convention at Washington, D.C., by Lt. Col. Norman Gray, Chief, Television Branch, Army Pictorial Service Division, Office of the Chief Signal Officer, The Pentagon, Washington 25, D.C.
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Methods Used in Military Recordings

Within the military, efforts have been made to bring the quality of kinescope recordings up to the highest standards. A chain, as we know, is only as strong as its weakest link. In producing kinescope recordings, there are many links in the chain where the quality of the final product can deteriorate.

In the first step, reflected light is collected by a lens and converted to an electrical signal at the camera. The cameraman must maintain sharp focus, or else the first deterioration will take place. The output of all cameras must be properly matched for balance and smooth switching. This matching is the responsibility of the video operator who must also correct for contrast, brightness levels, etc.

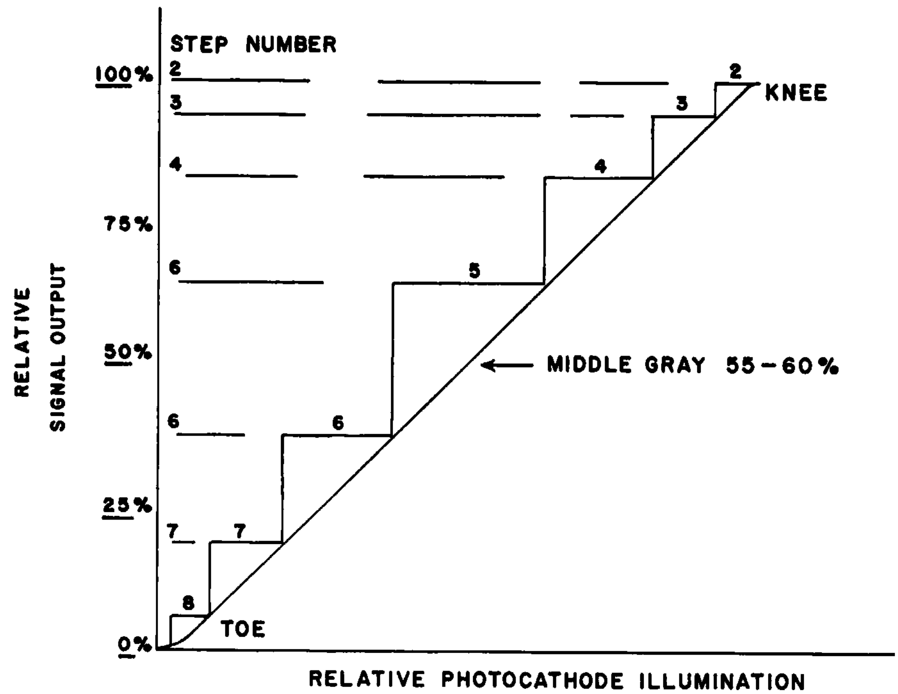

Fig. 1. Response characteristics curve.

Before the video signal travels through the switcher, it often goes through a special effects amplifier, another source of potential trouble. Finally, the video image appears on the face of the kinescope in the kine recorder where a special camera records the image on film. Equipments and techniques are continually being modified to improve the finished product.

Some of the procedures followed in making a military recording may differ from those followed in industrial productions. In military practice, new image orthicons are tested for blemishes and if a tube falls below standard it is replaced. If found satisfactory, the tube is given a breaking-in period of about 50 hours which brings the tube to its best output in resolution and noise-free video.

Video amplifiers are completely swept so that no details will be lost in the four corners of this final film. Camera viewfinders and control-room monitors are masked to compensate for the cropping of a frame in printing and reducing from 35mm to 16mm.

In matching cameras, image orthicons are operated using the maximum amount of the linear portion of their characteristics curve (see Fig. 1). Steps 1 and 2 of the gray scale are compressed. This is done because less detail appears in the white portion of the gray scale and maximum blooming appears in this area. Steps 3 through 8 are then aligned on the linear portion of the curve to produce maximum information.

A four-channel waveform monitor is used to match the video levels from the three cameras. At a glance, the video operator can see if levels are matched. In recording, a zero pedestal (black) is used instead of the 10% pedestal normally used by the networks.

Film Processing

Until recently, TV recordings for military use were made on 35mm variable-density sound negative stock. This film is normally developed to a gamma of 0.70 or 0.80 in a Kodak D-76 type developer. Because the kinescope (10NP11) does not produce much light, the recording camera lens aperture was at a constant maximum of *f*/2.3. Also, the video voltage of the kinescope was driven to a near maximum to achieve sufficient light on the face of the tube for proper exposure of the sound recording stock. This resulted, to some extent, in a loss of resolution and depth of field.

In an effort to compensate for the underexposure problem, the film was processed in a Kodak D-19 type developer to a gamma of about 1.20. This somewhat improved the gray scale but distorted the characteristic curve of the sound recording stock. At present, kinescope recordings are made using a panchromatic negative of the Plus X or Superior 2 type, both of which have been found to be satisfactory.

A well-exposed negative is obtained when developed in a Kodak D-76 type developer gamma of 0.65 to 0.67. This procedure makes it possible to retain the desirable characteristic curve of the emulsion with no objectionable increase in grain as compared to a print made from a sound recording negative.

Greater film sensitivity permits the use of less light, allowing stopping down to about *f*/4 which results in increased depth of field and permits operating the kinescope with a lower bias and video voltage requirement and enables reducing the size of the scanning aperture, giving considerable improvement in resolution of the scanned image. Blooming effect is reduced with lower video voltages and the kinescope has a longer life.

Present Developments and Prospects

We are experimenting with a 24-frame/sec scanning rate to replace the normal rate of 30. With a 24-cycle system, the television frame rate is matched to that of standard film cameras, eliminating any existing shutter bar. Reduced scanning rate can lead to further improvements in resolution and depth of field.

To alleviate the problems of frame cropping during printing and reduction of the 35mm negative to 16mm film for release printing, we are building an electronic mask, using delay multivibrators, which will enable the director to achieve proper framing.

Conclusion

Considerable progress has been made in improving the quality of kinescope recording for military use but much remains to be done. The development of high-quality video-tape recording will be an important step forward. Problems are being met and overcome by the modification of present equipment and the exploration of all possible avenues to produce films by TV recording.