TRAINING EVALUATION OF THE HITMORE SYSTEM

EDWARD AYRAL and MAJOR J. CHANDLER

Imaging Systems Division
Government Systems
Fairchild Camera & Instrument Corp.

INTRODUCTION

Recent advances in the state-of-the-art in video cameras employing all solid-state charge coupled device (CCD) technology have prompted a re-evaluation of current training techniques and devices. This paper discusses the evaluation of this new technology in a training environment.

The Fairchild TOW Helicopter Installed Television Monitor & Recorder (HITMORE) was developed to provide a capability for real-time monitoring and assessment of gunner performance and immediate post-mission playback and analysis of gunner-aim point during live or simulated firings of the TOW Weapon System.

In this helicopter application, the gunner, located in the front seat of the AN-IS TOW COBRA, utilizes a stabilized Telescopic Sight Unit (TSU) with which he can detect and accurately track a target. As an aid to gunner training, and for effectiveness evaluation, provisions for a 16mm film gun camera form a part of the TSU. Training benefits of this film record are minimal because of the several day delay between exposure and screening of the film due to film processing requirements. Additionally, light level variations limit the usefulness of film cameras. Another training aid, the Gunner Accuracy Control Panel (GACP) displays azimuth and elevation gunner errors to the instructor-pilot (IP) in the second seat of the helicopter, but this system is usable only with specially conditioned targets.

HITMORE was developed to overcome these shortcomings by providing the instructor-pilot with a real-time image of gunner's field-of-view, including the TSU reticle, on a high brightness video monitor. In a training exercise, the IP can observe and verbally correct the way in which the gunner sights on the target and maintains position from initial acquisition to impact. Tracking errors and jitter in azimuth or elevation can be observed dynamically and corrected instantaneously.

For immediate detailed review of gunner performance upon return to base, the on-board video tape recorder (VTR) can be utilized. The video tape cassette, removed upon landing, can be replayed on a VTR and displayed on a video monitor for performance review, assessment and correction; this procedure can take place much more rapidly than in the case of 16mm film and therefore represents a significant training aid improvement for the IP and student. Relative advantages of the HITMORE are summarized in Table 1.

TABLE 1
VIDEO TRAINING BENEFITS

- No Target Conditioning Required
- Real-Time IP Observation/Verbal Queing
- Immediate VTR Playback on Landing
- 40 Simulated Firings on a Single Cassette
- Reusable Tape Cuts Cost Over Film
- Short Term Record to Demonstrate Improvements
- Modular Growth
- Operation Value
  - RECCE
  - Damage Assessment
  - Landing Air

HITMORE CAMERA SYSTEM DESIGN

The Fairchild HITMORE is made possible by the recent availability of small rugged low-light level TV cameras, high brightness monitors, and video tape recorders ruggedized for use in the helicopter environment. The smallest, most rugged and reliable TV cameras available employ a solid-state imaging device rather than a vidicon tube. Fairchild has developed solid-state charge coupled device (CCD) area imaging arrays and cameras which are ideally suited to this requirement. Operation at the low light levels available from the TSU beam splitter is possible because of the superior CCD sensitivity.

The CCD camera is mounted in a special bracket which maintains the same TSU interface as the previous film camera and receives information from an optical beamsplitter within the sight. The dynamic range and AGC characteristics of the CCD camera permit effective operation over a wide range of scene brightness without exposure control. This provides a state-of-the-art system with high reliability at a modest cost.

The HITMORE camera is depicted in Figure 1. The CCD camera output feeds both a video tape recorder and high brightness monitor. HITMORE Power is switched manually via a remote switching and control panel conveniently located for operation by the IP. Automatic tape recorder shut-off is provided with a manual override as a tape saving feature and assures that the recorder is not inadvertently left in a RECORD mode for extended periods. A warning light indicates end of tape.

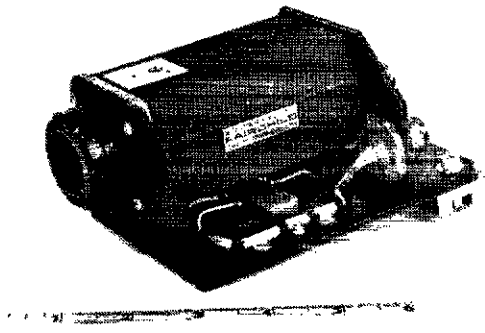

FIGURE 1. THE HITMORE CAMERA

The CCD television camera was designed to assure that mechanical and optical interface is maintained without modification to the TSU. Locating the small CCD format (7.2mm diagonal) in the 16mm film image place (12.6mm diagonal) reduces the displaced field-of-view to 57%. This provides improved target resolution and image magnification and enhances the instructor's ability to assess gunner accuracy at the projected time of target intercept.

VIDEO TAPE RECORDER AND MONITOR INSTALLATION

A High Brightness Video Monitor is mounted on the top of the gunners seatback for viewing by the instructor-pilot (Figure 2). The small size of the display serves to minimize obstruction of the IP's forward view in this location, and the increased visibility offered by use of the television camera more than compensates for the area blocked by the monitor. The video tape recorder also depicted in Figure 2 is located in the space immediately behind the pilot's seat.

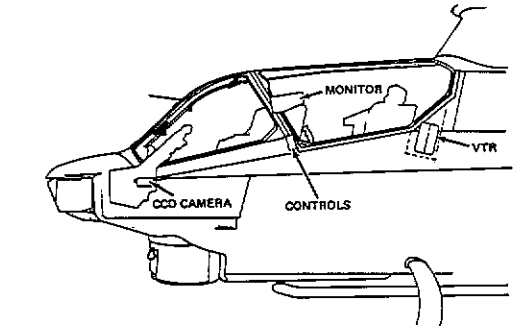

FIGURE 2. HITMORE IN AH-1S HELICOPTER

FIELD EVALUATION

In May 1978 three (3) HITMORE systems were installed at Fort Campbell, Kentucky and in July 1978, another three (3) systems were installed in Germany. Installations were accomplished at both sites just prior to extensive maneuvers and exercises with the TOW missile. Before the exercises commenced, a field questionnaire (Appendix 1) was distributed for completion by both procurement and user type personnel. Although this paper is being written prior to receipt and tabulation of all questionnaires, a number of salient evaluation factors have surfaced:

1) TRAINING EFFECTIVITY

Training effectivity was defined as the probability of a first round hit after training with HITMORE as compared to the probability of a first round hit with no training. It was estimated that this probability improved from approximately 75% to better than 95% with the use ofHITMORE.

2) TACTICAL VALUE

Instructor pilots and gunners determined that targets could be acquired several seconds faster when the HITMORE system was utilized.

3) AUTOMATIC LIGHT CONTROL (ALC)

A special camera with an auto iris was supplied prior to field evaluation in Germany to determine the ALC systems value. The basic system, without ALC, requires that neutral density filters be changed to accommodate varying light conditions. It was discovered, however, that the dynamic range of the camera was sufficient to provide acceptable images throughout all the lighting conditions encountered during training without ever changing the neutral density filter. Therefore, it would seem that ALC could add complexity with little system value.

4) NIGHT COMPATABILITY

During night exercises it was determined that the control box instrument lights were not compatible with use of the AN/PVS-5 night vision goggles. The dimmer provided could not reduce the light output sufficiently to prevent pilot blinding. The alternative suggested was use of a mechanical iris in front of each light. The optimum iris setting must be determined empirically. This solution, if satisfactory, will be incorporated in subsequent HITMORE systems.

CONCLUSIONS

- The HITMORE system has positive training value
- The tactical value of HITMORE should be further investigated
- Some minor design modifications are advisable