The Closed Circuit Television (CCTV) Monitoring System for CLAS, Hall B and Associated Areas

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Introduction

The closed circuit television (CCTV) monitoring system is designed to provide information on the status of CEBAF's Large Acceptance Spectrometer (CLAS). Also, areas associated with CLAS are monitored by the CCTV system. These areas include: the experimental area (Hall B) where CLAS is located, the entrances to Hall B, the counting room, the access-cage and the gas-shed. Information provided by the monitoring system is vital for the efficient performance of the detector sub-systems and for the safe operation of CLAS.

The terms emergencies, disasters, failures and hazards are defined in section one. Also, the scope of the Jefferson Lab's Emergency Plan Safety Procedures and the responsibilities of the "on shift" crew members for minimizing the impact of a disaster on personnel and equipment are summarized in this section.

Presented in section two are: an overview of the CCTV monitoring system, descriptions of the various components used in the system, descriptions of each monitored area and specific hazards associated with that area. Also in section two, the location of these components, their functions and their identification labels are listed.

Section three concludes the paper by summarizing the scope, potential and operation of the CCTV monitoring system.

1.0 Emergencies, Disasters, Failures and Hazards.

According to *The Emergency and Disaster Plan for Computer Operations*, "An **emergency** is defined as any incident or event which results in a serious disruption of the work of a center and, if not controlled properly, could result in a disaster. A **disaster** is defined as any incident or event which results in a critical disruption of the work of a center." Equipment **failure** is defined as inoperable or malfunctioning equipment. The level of seriousness of a failure is determined by the amount damage that is caused by the malfunction, and the amount of time required to correct the malfunction. Potential sources of accidents are defined as **hazards.**

Problems that could be encountered in the monitored areas are:

Oxygen Deficiency Hazard: Because cryogenic helium and nitrogen are used, Hall B is considered to be a *"Level 0"* area (Jefferson Lab Safety Manual). Substantial leaks of these gases could lead to an emergency.

Water Hazard: The floor of the hall is below the ground water level. Also, the chilled water cooling system has the potential to cause severe water damage to the instrumentation. A leak in the chilled water cooling system could have a catastrophic outcome, particularly, if equipment is in the "power-on" state. The seriousness of the water damage depends on the amount of water that has entered a system and the amount of damage it has caused.

Fire Hazard: During operations, Hall B could contain hazardous and combustible materials such as flammable gas in detectors. Due to the nature of the equipment and the environment in the hall, fire poses the greatest hazard. Electronic equipment is susceptible to short circuits and overheating—conditions which could start a fire. Not only can equipment be damaged by smoke and fire, but the agents used to extinguish the fire could cause further damage.

Mechanical Equipment Failure: The term "Mechanical Equipment" refers to: cranes, air-pads which control the position of the forward and side-carriages, refrigeration equipment and gas handling systems. Failure of mechanical equipment could lead to a disaster.

Electrical/Electronic Equipment Failure: The term "Electrical/Electronic Equipment" refers to: all crate systems, all computer systems, all control systems, all measuring devices and all power systems. Failure of electrical/electronic equipment could lead to a disaster.

1.1 Scope of the Emergency Plan

According to the Jefferson Lab's Employee Safety Manual an emergency plan should include risk assessment, emergency recognition and an implementation of specific response actions to reduce the severity of the emergency.

Risk assessment: Risk assessment requires personnel to inform themselves about the hazards that are present. The previous list of emergencies and disasters covers only the emergencies that the CCTV monitoring system is capable of detecting. It is in this context that the CCTV monitoring system plays a quintessential role. For a complete list of hazards associated with Hall B operations, Jefferson Lab's Environmental, Health and Safety Office (EH&S) should be contacted.

Recognition of Emergencies or Disasters: The CCTV monitoring system provides advanced warning of an impending crisis by displaying visual clues. Visual clues such as smoke and gas plumes are obvious signs of a crisis. Subtle signatures such as small sparks or faulty gauge readings are harder to detect. For the CCTV monitoring system to be effective, personnel should be trained to identify the visual clues.

Response actions: If, while monitoring the CCTV system, an operator should detect an emergency, appropriate response should be taken. Appropriate response to an emergency requires clear and concise procedures for actions that need to be taken. The response action mentioned in this paper is limited. Shift operators should contact Jefferson Lab's Environmental Health and Safety (EH&S) Manual or a EH&S worker for additional information on crisis response.

2.0 Overview of System

The CCTV system consists of 33 cameras, two 24 -channel video switchers, one VCR and six black and white monitors. Patch panels located in the hall serve as the link between the cameras in the hall and the monitors in the counting room.

The areas that are monitored from the counting room are:

1. Space frame, levels 0—3 (7)
2. Forward carriage, levels 2 and 3 (6)
3. Clamshell, side carriages north and south (4)
4. Target (3)
5. Tagger alcove and tagger dump (3)
6. Beam alcove and beam dump (2)
7. Hall (2)
8. Gas shed (2)
9. Access cage (1)
10. Special equipment and miscellaneous cameras (3)

The numbers in parentheses indicate the number of cameras in the area.

2.1 Components.

In the following subsections the features of the various components used in the CCTV monitoring system are described.

Cameras: Thirty-three Panasonic black and white tubeless cameras (Model # WV-BP310) are installed in Hall B and in the associated areas. Most of the cameras are fitted with Computar auto-iris, variable-focal-length (3.5mm to 8.0mm) lenses (Model # TG2Z3514FCS).

Another type of lens used for the cameras is the Panasonic aspherical, auto-focus, auto iris, wide angle lens (Model # WV-LA2.8). The horizontal and vertical field of view of this lens are 57.2° and 43.7°, respectively. Cameras which monitor the overall activity in Hall B use this lens.

Cameras are mounted on wall brackets which allow a 360° adjustment of pan and a 180° adjustment of tilt.

Monitors: Six black and white Panasonic monitors (nine inches diagonally) (Model # TR990C) are stacked two-by-two in the control console in the counting room. These monitors feature 75 Ω input impedance, switchable overscan capability, brightness control and intensity control.

Video Switcher: Two Burle, video-switchers are located in the counting room. Each video switcher has 24-camera inputs, 4-monitor outputs, an alarm input connector, an alarm output connector, an accessory output connector and is automatic, sequential and programmable. The video switchers serve to multiplex the thirty-three video signals to the six monitors.

There are two modes in which the switchers can be operated: normal mode and salvo-switching mode. In the normal mode, each monitor runs its sequence independently. In the salvo-switching mode, monitors switch scenes as a synchronized group. Such a procedure enables the operator to view all scenes in one general area before moving onto the next area. The quick-scan feature allows for a rapid scan through programmed sequences in both modes. For any given sequence, the dwell time for each camera can be set between 1 and 64 s. Camera titles are displayed on the picture. Cameras in vital areas should be monitored individually or with only a few other cameras in a sequence.

The alarm button on the front of the video switcher is capable of triggering an external device such as a VCR or video printer. When the alarm button is engaged, the alarm output contacts are closed for a fixed length of time. The length of time is programmable between 1 and 99s.

VCR: A Sharp VHS VCR can be configured to record continuously, in timed cycles or only when the alarm button is activated. The VCR captures and displays events on only one video monitor.

Patch Panels: Two patch-panels are located on level one of the space frame in rack L1-16. Both the patch panels are 19" long and 8.5" wide. Thirty barrel type F connectors are mounted on each panel. The cables from the cameras located in the hall are connected to the lower patch panel. The cables from the counting room are connected to the top patch panel. Jumpers link the two patch panels together.

Cable and Connectors: Coaxial cable (RG-6U), which has a characteristic impedance of 75 Ω, is used as the video cable. Labels identifying camera locations are attached to both ends of the coaxial cable. Connections are made by F connectors, BNC to F adapters and barrel connectors. The cameras, video switchers and monitors require BNC connectors. The VCR and the patch panels require F connectors.

Power: The cameras require 120V AC 60Hz power. Electrical outlets within five feet of each camera provide the required power.

2.2 Location of Components

The monitor, VCR and video switcher are located in counting room. These components are housed in the operator's console rack #2.

Tables in appendix 1 list the thirty-three cameras, their identifying labels, their location, their function, the potential hazards associated with the area (The coaxial cables are identified by the labels listed in Table 1.1.). In the event of an emergency the shift leader should be contacted.

The location of the cameras are shown in the drawings in appendix 2. The camera number identifies the camera in the drawings.

3.0 Conclusion

The CCTV system consists of thirty-three Panasonic cameras, patch panels, two Burle video switchers, a Sharp VCR and six black and white video monitors. The patch panels link the thirty cameras monitoring the hall with the video switchers located in the counting room. Six video monitors allow the operator to view equipment and activity in the hall, gas shed and access cage. A VCR is connected to one of the monitors to record important events. The current scope of the CCTV monitoring system can be enhanced to provide additional information to fire-station and Jefferson Lab's safety operators.

The CCTV monitoring system has the potential to provide advanced warning of an imminent emergency. To exploit the full potential of this system, information about the CCTV monitoring system, monitored equipment and areas, hazards associated with the area, recognition of emergencies, response actions and contacts have been provided in this document

For effective operation of the system every crew member on shift should be familiar with the CCTV monitoring system.

Appendix 1

Appendix 2