



## CLASSROOM AND AAR FACILITIES



Classroom; Small, Large, and Non-Instrumented After Action Review (AAR); and CACTF AAR/ROC



## Purpose

All of the different standard Classroom and After Action Review (AAR) Facilities serve similar purposes on ranges. The primary purpose is to provide a location for the training unit to conduct pre-training briefs as well as post-training assessments and reviews of exercises. Each standard building includes the different size classrooms and the varying amounts of technology needed to support the different range types.

The Classroom Building is the simplest and is standard on most small arms ranges. The Small and Large AARs add space for the installation of communication and electronic equipment and office space for range operation personnel. These two are standard on ranges that have more sophisticated instrumentation and require a digital AAR; like the instrumented mounted maneuver ranges and Shoothouses. The Non-Instrumented AAR has the classroom space similar to the Large AAR without the instrumentation and is standard on the non-instrumented mounted maneuver ranges. The Combined Arms Collective Training Facility (CACTF) and Collective Training Facility (CTF) use a combined AAR/ROC (After Action Review/Range Operations Center) similar in size and complexity to the Large AAR, but configured specifically to support those ranges. Refer to the Range Building Target Matrix to determine which facilities are standard on each range type.

## Design Requirements

See the standard drawings in the RDG for details of construction not included in this document.

### General

The standard design must be site adapted to local conditions such as climate, typical construction materials and methods, and the installation design guide. Design the facility in accordance with the design codes and criteria of the specific location, geotechnical information, structural loads, mechanical design criteria, etc.

The facility typically requires access by able-bodied personnel only and does not require ADA compliance. However, the requirement must be coordinated with the installation.

### Siting

Range trainees and operators are the primary users of the facilities. Range operators require convenient access between the tower and the office end of the AAR. Trainees using the range need convenient access between staging areas, range baseline, bleacher enclosure, and the classroom space. Both should have convenient access between the AAR and the Latrine. Consider separating the AAR from range maintenance areas.

## Architectural

### General

Coordinate building material choices with the user and the installation design guide. The standard designs depict both Concrete Masonry Unit (CMU) and pre-engineered metal building versions as these are the most commonly used materials. Coordinate security requirements with the installation. Most installations require forced entry resistant windows and doors. Covered entries and ice guards may be required in northern climates. Provide interior finishes that are easily cleanable, durable and maintainable. Due to the location and training environment of the ranges, these facilities commonly

have sealed concrete or vinyl tile floors. Acoustical tile suspended ceilings are typical in finished areas to provide access for targetry system installation. Finished areas typically have impact resistant gypsum wallboard or other durable finished wall.

### **Classroom Building**

The standard size of the Classroom Building is 800 square feet (74.3 square meters) with space for 40 personnel plus instructors. The building is typically 20 feet wide and 40 feet long. It has a single double door at one end and a single door on the side. The minimum ceiling height is 9 foot. The building typically has windows except at the instructor end. Windows provide natural light and ventilation, however windows can cause unwanted glare on whiteboards and projection screens. The standard facility does not have any automation requirements; however, the design should include pull down screens, power outlets in the ceiling, and corresponding conduit with junction boxes to the front of the classroom to allow the use of projectors.

### **Small AAR**

The standard size of the Small AAR is 1,064 square feet (98.8 square meters); note that the covered area counts as only half value. The classroom area has space for 32 personnel plus instructors. A folding partition, with a minimum STC of 50, divides the space into two halves each with space for 16 personnel. The classrooms each include a non-automated pull down projector screen. The DTRs are located in the AAR development room along with space for a small office. A covered area outside the classroom provides space for individual gear storage during AAR exercises. The AAR includes some very specific conduit, cabling, and electrical requirements necessary to interface with the range instrumentation system, refer to the electrical section for additional details. The classroom should not have any windows; the office area can, if required by the installation. The Small AAR has slightly different instrumentation configuration requirements depending on the range type; the Electrical Section of this document refers the facility as the Small AAR or Shoothouse AAR in order to differentiate.

### **Large AAR**

The standard size of the Large AAR is 3,024 square feet (280.9 square meters); note that the covered area counts as only half value. The classroom area has space for 80 personnel plus instructors. A folding partition, with a minimum STC of 50, divides the space into two halves each with space for 40 personnel. The classrooms each include a non-automated pull down projector screen. The building has a separate communication room with raised flooring to house the DTRs. The building also has several offices, a storage area, separate mechanical room and a separate room to house common-user communications equipment. A covered area outside the classroom provides space for individual gear storage during AAR exercises. The AAR includes some very specific conduit, cabling, and electrical requirements necessary to interface with the range instrumentation system, refer to the electrical section for additional details. The classroom should not have any windows; the offices can, if required by the installation.

### **CACTF AAR/ROC**

The standard size of the CACTF AAR/ROC is 4,176 square feet (388.0 square meters); note that the covered area counts as only half value. The classroom area has space for 80 personnel plus instructors. A folding partition, with a minimum STC of 50, divides the space into two halves each with space for 40 personnel. The classrooms each include a non-automated pull down projector screen. The building has a separate communication room to house the DTRs. The building also has several offices, a storage area, separate mechanical room and a separate room to house common-user

communications equipment. A covered area outside the classroom provides space for individual gear storage during AAR/ROC exercises. The AAR/ROC includes some very specific conduit, cabling, and electrical requirements necessary to interface with the range instrumentation system, refer to the electrical section for additional details. The classroom should not have any windows; the offices can, if required by the installation. There is an area shown on the standard for a secure room if one is required.

### **Non-Instrumented AAR**

The standard size of the Non-Instrumented AAR is 1,776 square feet (165.0 square meters); note that the covered area counts as only half value. The classroom area has space for 80 personnel plus instructors. A folding partition divides the space into two halves each with space for 40 personnel. The building has two separate offices. A covered area outside the classroom provides space for individual gear storage during AAR exercises. The AAR does not have any automation requirements; however, the design should include pull down screens, power outlets in the ceiling, and corresponding conduit with junction boxes to the front of the classroom to allow the use of projectors.

## **Mechanical**

### **Non-Instrumented Facilities**

The HVAC system for the Non-Instrumented AAR and Classroom Buildings is for personnel comfort only since they do not normally have any instrumentation. Heating and ventilation are normally the only requirements, though comfort cooling is sometimes included. Design the system based on the requirements of the specific installation. Select the type and size of the system based on installation requirements, local weather design criteria, available energy sources, and building construction materials and design in accordance with UFC 3-410-01.

### **Instrumented Facilities**

The HVAC system for the Small and Large AARs and the CACTF AAR/ROC must provide sufficient heating, ventilation and cooling for both personnel comfort and equipment cooling. Select the type and size of the system based on installation requirements, local weather design criteria, available energy sources, and building construction materials and design in accordance with UFC 3-410-01. Include OPA provided targetry system equipment in heat release calculations; DTRs, workstations, etc. Coordinate with the MCX to obtain targetry and communication equipment size, location, and heat release information from targetry supplier. The AAR Development Room in the Small AAR and the Communications Room in the Large AAR and CACTF AAR/ROC require a dedicated HVAC unit. Size the HVAC system for these rooms to maintain an operational environment of 72°F +/- 2°F (22°C +/- 1°C) for the Data Termination Racks. Design the air distribution system in these rooms to provide adequate circulation throughout the space to avoid hotspots, which can cause premature targetry equipment failure. Design the HVAC system for the room housing common-user communications equipment in accordance with the Technical Criteria of the Installation Information Infrastructure Architecture (I3A) requirements.

## **Electrical**

### **Power Distribution**

Primary distribution service may be overhead or underground. Consider the type of tactical vehicles used in the Range Operations and Control Area, proximity of Control Tower to Ammunition Supply/Breakdown/Distribution points, and local utility requirements for determining the routing of primary power to the facility. Electrical service to the facilities may be 120/240Volt, single phase, 3-wire secondary; 480/277Volt, 3-phase, 4-wire; or 208/120 Volt, 3-phase, 4-wire secondary. Determine the actual voltage used based on the electrical load requirements in the building (i.e. HVAC electrical load requirements) and the voltage availability from the primary distribution system serving the range. Maintain supplied voltage within 5 percent at a frequency of 60 Hz, +/-0.5. Provide a Surge Protective Device (SPD) at the service entrance for protection of the distribution system within the facility. Extend rigid steel conduit a minimum of 1524mm (5 feet) beyond the outside of the building foundation for power circuits entering or leaving the building. Provide this facility with a panelboard supplied with main circuit breaker that serves separate circuits for the lighting, convenience outlets, range control equipment, and HVAC equipment. Use recessed panel boards, recessed outlets, and recessed junction boxes if installed in finished areas.

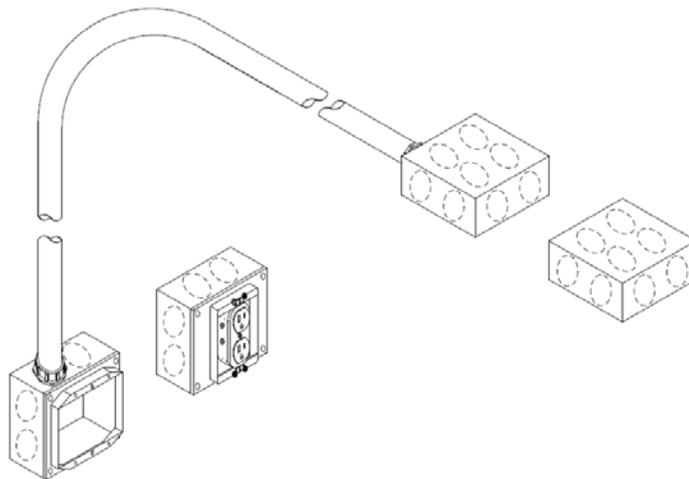
### General Power Requirements

Provide general purpose 120V, 20A duplex convenience receptacles; mounted 18" (450mm) above the finished floor. Provide receptacles for the Data Termination Rack; refer to the Data Termination Rack Section in the Range Design Guide for additional details. Provide power for the HVAC unit(s) and AAR instrumentation equipment.

### Instrumentation

#### Non-Instrumented Facilities

There are no devices or instrumentation equipment provided in the Classroom Building or the Non-Instrumented AAR through Army standard instrumentation contracts. Some installations require power and a data pathway for an overhead projector(s) in the Classroom Building and both sides of the Non-Instrumented AAR to add flexibility. If included, provide dedicated 120V duplex receptacles flush in the ceiling for the projector and at the front of the classroom for a computer. Provide 4" X 4" junction boxes with blank faceplates adjacent to both the ceiling and wall outlets interconnected with 1/4" conduit with nylon pull strings. The overhead project will be provided by the installation range control.



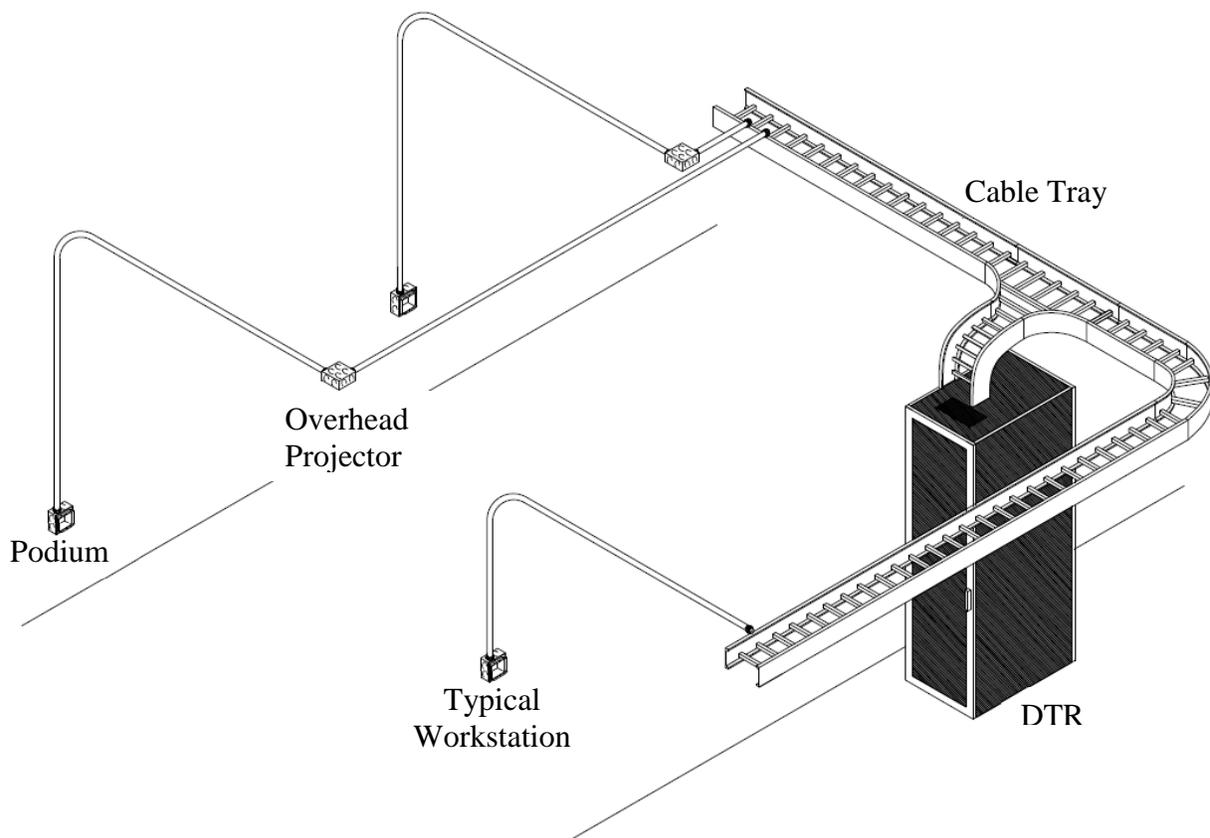
## **Figure-1. Overhead Projector Conduit and Outlets**

### **Instrumented Facilities**

For Instrumented Facilities, (the Small AAR, Shoothouse AAR, Instrumented AAR, and CACTF AAR), OPA installs instrumentation equipment under separate contracts after the construction of the AAR facilities is complete. The OPA contractor installs data cables to rack mounted equipment, overhead projectors, AAR editing workstations, ROC workstations, and automated podiums. In order to support the instrumentation system, the construction contract includes a complete data cable, pathway system with access between all components installed by the follow-on contracts. The specific AAR facility type under this section defines the general requirements for each of these components. The pathway system, developed during the design process, is unique to each specific range project and building. The design documents must fully define the requirements of the pathway system to include the complete bonding of all cable trays, conduits, and outlet boxes to ground.

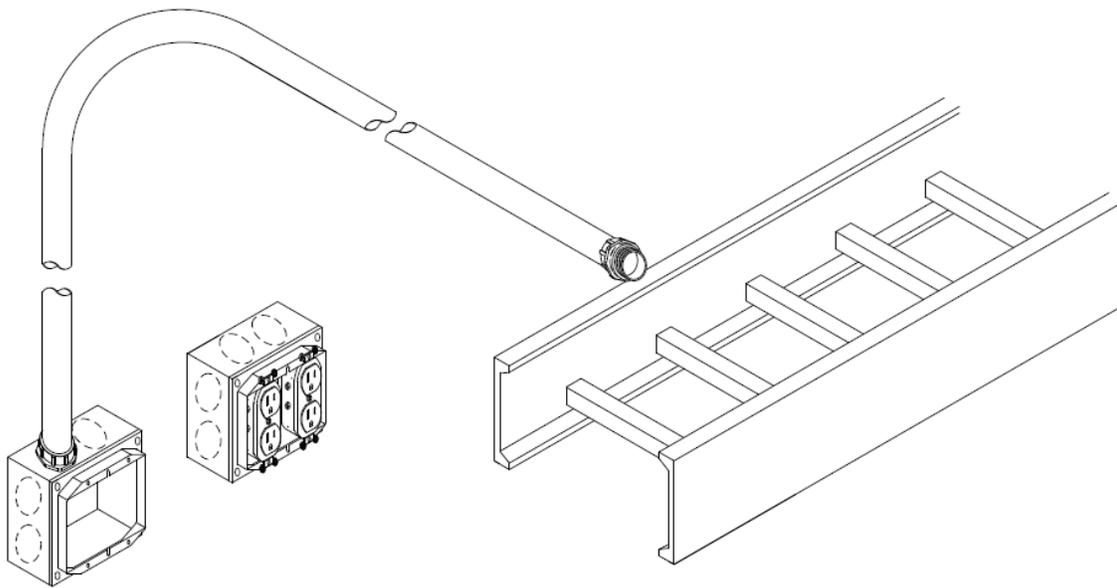
### ***Data Cable Pathway Requirements***

The pathway consists of a cable tray, (ladder type, wire way), over the DTR and extending to the general location of each point of connection. Conduits routed from junction boxes to the cable tray complete the system. Use 4" X 4" junction boxes with a blank faceplate. Mount boxes flush in the wall. Use 1 1/4" conduit. Figure-2 depicts a generic example showing, in general terms, the design requirements of the complete pathway system. Figure 2 does not show all specific requirements such as conduit bushings, bonding jumpers, hangers, and outlet box faceplates flush with wall and ceiling surfaces. Figures 3 and 4 show specific requirements for the Projector/Podium and Workstations.



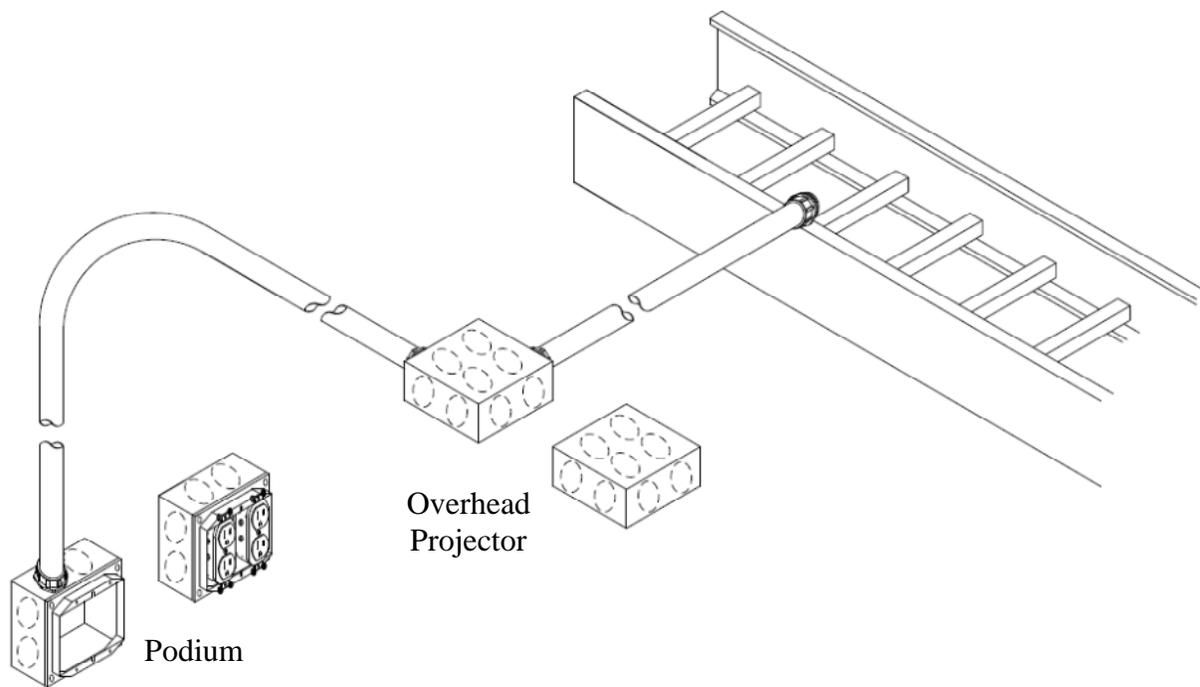
### **Figure-2. General Data Cable Pathway Example**

Provide a quad outlet fed by a dedicated 20-amp circuit for each Workstation and AAR Editing Station. Provide a 4'x4', flush mounted, junction box with a blank faceplate at each location. Route a 1 1/4" conduit with a nylon pull string from the junction box back to the Cable Tray. See Figure-3 below.



### **Figure-3. Workstation / AAR Editing Station Facility Requirements**

Provide a 120V duplex receptacle flush in the ceiling for each projector and a quad outlet at the front of each classroom for the podium. Provide a 4" X 4" junction box with a blank faceplate, flush mounted, in the ceiling and the front wall next to each power outlet. Locate the projector power outlet and data junction box about 10'-12' back from the front wall in each partitioned area, centered in front of the projector screen. Locate the podium power outlet and data junction box 18" above finished floor in the front of each classroom. Route a 1 1/4" conduit between the podium and projector junction boxes. Route an additional 1 1/4" conduit from the projector junction box to the cable tray. Provide a nylon pull strings in each empty conduit. The conduits shall not have more than two 90-degree bends between junction boxes. Do not surface mount conduits or junction boxes; flush mount boxes and run conduits inside the walls. See Figure-4.



**Figure-4. Overhead Projector and Automated Podium Facility Requirements**

### ***Small AAR***

For ranges provided with a Small AAR (except the shoothouse), the downrange data cables route to the Range Control Tower. (Some older ranges use a Range Operations Center (ROC) instead of a Control Tower.) A 24-strand, direct buried, single mode fiber optic cable is routed from the Tower to the Small AAR. This fiber optic cable terminates inside a DTR in both the Tower and the AAR. The DTR is located in the AAR Development Room inside the AAR. Refer to the DTR Section of the RDG for detailed information and requirements that must be included in each of the facilities.

There can be multiple AAR editing workstations provided inside the AAR; the type of range, among other factors, dictates the number of workstations. Coordinate the total number of editing stations with the MCX, the instrumentation procurement agency (PEO-STRI or TACOM), and TCM-Range during the design process. Provide separate power outlets and data pathways for each workstation. See Figure 3.

Provide power and data connection for two podiums and projectors, one for each side of the dividable classroom. See Figure 4.

### ***Small AAR - Live Fire Shoothouse***

The Small AAR facility when used on the Live Fire Shoothouse also serves as the ROC; some projects refer to the building as a ROC-AAR. Trainers run exercises and edit camera footage from the AAR. Refer to the Downrange Power and Data Distribution – Shoothouse section of the RDG for additional information on the power and data requirements for the Live Fire Shoothouse.

Route a 12-strand fiber optic data cable from the Live Fire Shoothouse to the AAR, terminated inside the AAR development room in a wall mounted, enclosed patch panel. The instrumentation package

provides the DTR in the Live Fire Shoothouse AAR not the construction contract. Locate the fiber optic cable patch panel as close as possible to the DTR location and provide a pathway between the two to accommodate the 12 fiber optic cable patch cords.

There can be multiple AAR editing workstations provided inside the AAR; the throughput, among other factors, dictates the number of workstations included with the Live Fire Shoothouse instrumentation package. Coordinate the total number of editing stations with the MCX, the instrumentation procurement agency (PEO-STRI or TACOM), and TCM-Range during the design process.

Provide power and data connection for two podiums and projectors, one for each side of the dividable classroom even though the instrumentation package normally only provides a single podium and projector. See Figure 4.

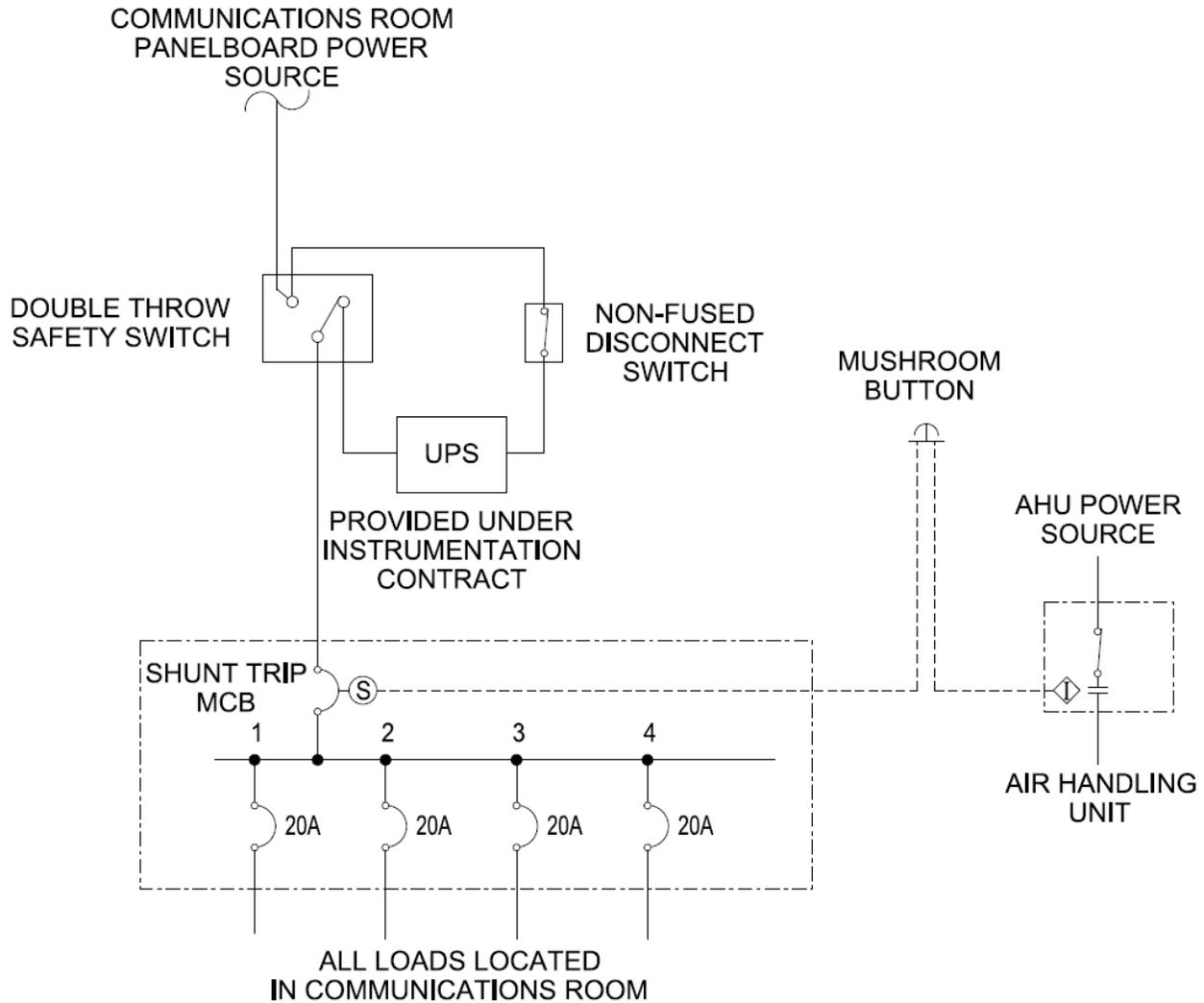
### *Instrumented Range AAR*

The Instrumented AAR is the main communications hub for entire range complex. The function of this facility is unique to digital ranges. All downrange data cables route into the AAR Communication Room. The Communication Room houses many of the servers and instrumentation equipment required to operate the range. A 24-strand single mode fiber optic cable connects the Instrumented AAR to the Tower. Terminate this cable in a DTR in each facility. A 6-strand single mode fiber optic cable connects the Instrumented AAR to the Vehicle Instrumentation Dock. Terminate this cable in a DTR in the Instrumented AAR facility and in a Master Target Data Panel in the storage room on the Vehicle Instrumentation Dock.

The Communications Room in the AAR houses the range data equipment racks for the targetry and instrumentation package. The construction contract provides the DTR(s) for terminating instrumentation data cables coming from downrange and going to other ROCA facilities. The instrumentation contract provides additional racks, and instrumentation equipment. The construction contract provides power and grounding provisions for all DTR(s). Coordinate the number and location of DTR(s) provided under the instrumentation contract during the design process. The standard Instrumented Ranges AAR Communication Room can accommodate up to 14 racks.

Provide two duplex receptacles each on a dedicated 20-amp circuit for each DTR. Install the receptacles in floor boxes with covers, flush with the raised floor. Wire the floor boxes to junction boxes under the raised floor using flexible conduit so that the floor tiles are removable. Locate the floor boxes under each DTR such that they will be accessible after DTR installation.

Provide a dedicated panelboard in the Communication Room that only serves DTR(s) located within the Communication Room. Provide this panelboard with a shunt trip main breaker wired to a mushroom style button located at the doorway. Upon activation, this button shunts the main breaker in the panel board and shuts off the air-handling unit serving the Communication Room. The instrumentation contract will provide an UPS to serve the Communication Room panel board. Provide a double throw safety switch and separate disconnect switch to allow power to serve the panelboard when the UPS is not present. This transfer scheme will simplify the installation of the UPS after the completion of the construction contract. See the sample one-line diagram showing the UPS transfer switch, mushroom button, shunt trip breaker, and panel board serving the Communications Room below.



The Instrumentation contract provides a number of Workstations and AAR editing stations located in various offices within the AAR providing a multitude of functions in the range instrumentation system. Coordinate the total number and type of workstations with the MCX, the instrumentation procurement agency (PEO-STRI or TACOM), and TCM-Range during the design process. See Figure 3.

Provide power and data connection for two podiums and projectors, one for each side of the dividable classroom. See Figure 4.

### ***CACTF AAR/ROC***

The CACTF AAR/ROC is the main communications hub for entire range complex and serves as the ROC. All of the data cables coming from the training buildings route into the Communication Room in the AAR. The Communication Room houses all of the servers and instrumentation equipment required to operate the range.

The Communications Room in the AAR houses the range data equipment racks for the targetry and instrumentation package. The construction contract provides the DTR(s) for terminating instrumentation data cables coming from downrange. The instrumentation contract provides additional racks, and instrumentation equipment. The construction contract provides power and grounding provisions for all DTR(s). Coordinate the number and location of DTR(s) provided under the instrumentation contract during the design process. The standard Instrumented Ranges AAR Communication Room can accommodate up to 4 racks.

Provide power to the DTRs by serving two 60A disconnect switches with dedicated 1-phase, 3-wire circuits. Provide these circuits with neutral and equipment grounding conductors. Install the disconnect switches on the walls closest to the DTRs. Provide an empty 1" conduit, with nylon pull string, from each disconnect switch to a junction box located in the ceiling above the DTR. These circuits are for rack mounted UPSs installed under the instrumentation contract. The instrumentation contractor will field wire the UPSs back to the disconnect switches.

The Instrumentation contract provides a number of Workstations and AAR editing stations located in various offices within the AAR providing a multitude of functions in the range instrumentation system. Coordinate the total number and type of workstations with the MCX, the instrumentation procurement agency (PEO-STRI or TACOM), and TCM-Range during the design process. See Figure 3.

Provide power and data connection for two podiums and projectors, one for each side of the dividable classroom. See Figure 4.

The instrumentation package may include other systems that require additional building and building infrastructure like secure rooms and provisions for secure data systems. This should be determined during the planning and programming phase of the project with the specific details coordinated during the design process.

## **Lightning Protection and Grounding**

### **Non-Instrumented Facilities**

Grounding and lightning protection systems are required for safety on the Classroom Building and the Non-Instrumented AAR. Building electrical system grounding will consist of one or more ground rods connected to the service panel in accordance with NFPA 70. Provide lightning protection system if required by NFPA 780 Risk Assessment. Follow local installation requirements for lightning protection systems where they are more stringent than the requirements defined in the Range Design Guide. The lightning protection system may be provided as a mast-style system or air terminals located on the building structure. Cable connections and connections to the ground rods and structural steel require exothermic welds.

### **Instrumented Facilities**

Grounding and lightning protection systems are required for safety on the Small and Large AARs and the CACTF AAR/ROC. The After Action Review Building ground system will consist of a buried, No. 4/0 American Wire Gauge (AWG), stranded, copper conductor and ground rods all interconnected to yield a resistance of 25 ohms or less. Connect the DTR and powerpanel ground points to a Single Ground Point (SGP) with a minimum No. 6 AWG, insulated, stranded, copper cable, or a larger wire size as required by the National Electrical Code. Connect the SGP to the ground system with at least a No. 4/0 AWG, bare, copper cable. Any additional Data Termination

Racks or power panels should be bonded together with a minimum No. 6 AWG, insulated, stranded, copper cable, or a larger wire size as required by the National Electrical Code.

RTLTP standards require lightning protection for the Instrumented AAR Buildings regardless of NFPA 780 Risk Assessment. The lightning protection system may be provided as a mast-style system or air terminals located on the building structure. Use exothermic welds for cable connections and connections to the ground rods and structural steel.

## Lighting

Design illumination levels in accordance with IES at a level of 50 foot-candles with dimmer control. Use fluorescent lamps where appropriate. Provide exterior lighting with separate switching located near points of egress. Provide emergency lighting to ensure adequate illumination to egress the building in the event of a power outage and the emergency electrical system in compliance with NFPA70 and NFPA 101.

## Night Operations Lighting

To prevent interference with specialized equipment used during night operations, provide separate fixtures with red lenses or red lamps in addition to standard lighting on ranges used for night training where the lights will be visible from training and/or staging areas. Include the following areas as a minimum

- exterior lighting visible from the training area
- rooms where ROCA building has windows that are facing the training area and cannot be covered
- rooms where the building has a doors that opens to the training area

Provide separate switching for the standard and red lighting. Clearly label switches and provide covers over white lights, or similar protective measures, to deter turning on white lights while red lights are in use. Locate switches near points of egress. Provide a means to turn off all exterior white lights including an over-ride for lights controlled by a photocell.



## Common User Cable Systems

All ranges are required to have two forms of communications for safety during training exercises. These forms of communications do not have to be wired telephone service to the range. The

requirement for telephone and/or common user data is a local requirement specific to each range site. It is extremely important to identify telephone and common user data requirements during the planning phase of every range project, or funding will not be available for telephones and common user data.

Do not connect downrange instrumentation and control systems to common user data networks or telephone systems; downrange instrumentation and control systems are not certified or approved for external connection. Telephone and common user cable systems and equipment must be contained completely separated from down range control systems and equipment. Each system must have its own separate enclosures and/or cabinets, and each must be specifically labeled to indicate the systems it serves. Design and construct common user telephone and data systems in accordance with Technical Criteria for the Installation Information Infrastructure Architecture (I3A) and local Network Enterprise Center (NEC) requirements.

### **Special Considerations**

Fire protection is not normally required for this facility, though installation requirements may control. Consult the installation Fire Marshal for local requirements. Typically, a local audible fire alarm is required. Fire extinguishers and cabinets are required per NFPA.







