



Range Control Tower



Instrumented, Non-Instrumented, and Small Arms



RANGE AND TRAINING LAND PROGRAM – MANDATORY CENTER OF EXPERTISE

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Purpose

The Range Control Tower provides space for personnel conducting training exercises, e.g. computer operators, training evaluators and safety personnel. It is normally elevated and sited to allow personnel to control the safety and operation of all activities on the range. The Tower also provides space for the installation of the required electronics and communications equipment.

There are three basic range control towers. The Control Tower – Instrumented Ranges is standard on mounted maneuver ranges that use Digital Range Training System (DRTS) control system; including the BAX, DMPC, DMPTR, and DAGIR. The Control Tower – Non-Instrumented Ranges is standard on the non-digital mounted maneuver ranges; including the Scout/RECCE, MPTR, MPRC, and AGR. The Control Tower – Small Arms Ranges is standard on most other ranges. See Standard Support Building Matrix for specifics.

All three types have different sizes and configurations but use the unit of measure of each (EA) on programming documents, (DD1391).

Design Requirements

See the standard drawings at the end of this section and 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 applicable design codes and criteria for the specific location along with site-specific geotechnical information, structural loads, mechanical design criteria, etc.

The facility typically requires access for able-bodied personnel only and does not require ADA compliance.

Siting

For small arms ranges, locate the tower approximately 15 to 50 meters behind the baseline in an area that provides an unobstructed view of the entire baseline. This location must have an unobstructed view of the firing line and as much of the downrange area as is economically practical. The tower normally provides line of sight to all targets on qualification ranges but not on infantry maneuver ranges.

For mounted maneuver ranges, locate the tower at least 50 meters away from the firing positions in order to avoid damage from main gun blast pressures. Site selection is critical for the tower on these ranges. Range controllers must be able to see and control activities in and around the baseline to ensure safe operation of the range. The site should maximize views of downrange areas as much as economically possible. However, it is not necessary to be able to see all targets and course roads from the tower.

Architectural

The standard Control Tower – Small Arms Ranges has a 17-foot (5.18 meter) square control room; 289 sf (26.85 sm). The open observation level below the control room shown on the standard drawing is optional. The Optional CMU version of the Control Tower – Small Arms Ranges has two enclosed floors; each is 16 feet (4.88 meters) square. The Control Tower – Non-Instrumented Ranges has a 17-foot (5.18 meter) square control room, and adds an enclosed observation room below for the crew evaluators. The Control Tower – Instrumented Ranges is 24 feet wide and 20 feet deep (7.3 x 6.1 meters) with two enclosed levels.

Keep the height of the Control Tower to the minimum that provides visibility to the required areas. Taller towers increase the cost and reduce the operational efficiency of the range; it takes more time for range operators to climb the stairs. In addition, while a taller tower can increase visibility of down range areas, it often reduces the visibility of the firing line and other areas near the tower.

Coordinate building material choices with the user and the installation design guide. Structural steel with insulated metal panels is the most common construction material; the drawings include an optional Concrete Masonry Unit (CMU) version of the small arms tower. Coordinate security requirements with the installation. Most installations require forced entry resistant windows and doors, some installations require security fencing around tower. 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.

Depending on the location, consider deep roof overhangs, pull-down shades, and other measures to reduce the amount of solar glare. Some installations prefer tilted windows, but they can add cost and are not required. Tilted windows can also increase the glare from inside the tower at night. Use fixed windows on the side of the tower facing downrange due to the obstructions caused by mullions and screens in operable windows. Consider the requirement to clean the windows when determining window type. When outside access to the windows is not practical, consider other alternatives.

Depending on the installation, tower height, and use of aircraft in the area, towers may require aircraft warning lights. Consider maintenance and access to the lights when choosing lights. Options include mounting lights on folding poles attached to railing, lights accessible from the inside of the tower, or roof access hatches. The number of lights required will depend on the type and size of roof structure.

Provide a counter along the front wall (downrange side) of the tower, on both floors as appropriate.

Mechanical

The HVAC system for the control tower must provide sufficient cooling for 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. Size the mechanical system to maintain an operational environment of 72°F +/- 2°F (22°C +/- 1°C) for the Data Termination Rack (DTR). Select HVAC equipment that provides adequate air circulation throughout the space to avoid hotspots, which can contribute to premature targetry

equipment failure. 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. Design the HVAC system for personnel comfort in accordance with UFC 3-410-01. Provide a condensate drain, routed to grade, to prevent condensate from dripping on the observation level and stairs below.

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. Provide 120/240V, single-phase, 3-wire secondary power with a Surge Protective Device (SPD) on the incoming service to the facility. 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.

General Power Requirements

Provide general purpose 120V, 20A duplex convenience receptacles; mounted 18" (450mm) above the finished floor. Provide receptacles for the DTR; refer to the DTR Section in the Range Design Guide for additional details. Provide three duplex receptacles on separate, dedicated 20amp circuits under the counter for the targetry system provided workstations. For two-story instrumented range towers, provide these dedicated receptacles under the counter on each floor. Provide 120/240V power for the HVAC unit(s) as required.

Lightning Protection and Grounding

Grounding and lightning protection systems are required for safety. The Range Control Tower ground system consists 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. Locate the ground rods near each tower leg. The DTR and power panel ground points will be connected 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. Bond any additional DTRs or power panels together with a minimum No. 6 AWG, insulated, stranded, copper cable, or a larger wire size as required by the National Electrical Code.

RTLP standards require lightning protection for the control tower 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. Run the down conductors for air terminals mounted on the building structure on the tower's structural steel. The structural members will electrically interconnect the tower roof and floor. For all cable connections and connections to the ground rods and structural steel, use exothermic welds or high compression connections as allowed by UFC 3-520-01



Lighting

Design illumination levels in accordance with the IES. Provide red lenses or red lamps in addition to standard lighting on ranges where training will occur at night. See Night Operations Lighting Paragraph for more information. Provide Emergency and Exit lighting in accordance with NFPA 101 and NFPA 70. Provide 3-way switching for exterior lighting, with one switch located inside the Control Room and one switch located at ground level next to the bottom of the stairwell.

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.

Down Range Target Control

For most ranges, all down range data cables run directly into the Control Tower and terminate in the DTR. For ranges that include an After Action Review (AAR) facility, the downrange cables terminate in the DTR in the AAR. Route 24 strands of fiber from the AAR to the Control Tower; terminated in the DTR at each end. Refer to the Down Range Power & Data Distribution, DTR, and each individual range in the Range Design Guide for additional details.

Wireways

The targetry system requires a data connection between the DTR and the computer(s). The connection is different depending on the type of range and corresponding tower type; see below. Power and/or common user cabling require separate conduit.

Control Tower - Small Arms

For small arms control towers, provide six (6) data outlets installed under the worktable in front of the control room. The data outlets use RJ45 type connectors. Locate the outlets under the worktable such that two outlets are located on the left side of the worktable, two outlets are located in the center of the worktable, and two outlets are located on the right side of the worktable. Connect the outlets back to the DTR with individual CAT6 cables. Route the cables in conduit. Terminate the cables in the DTR in an RJ45 connector patch panel.

Control Tower - Instrumented Ranges/Control Tower - Non-Instrumented Ranges

Provide 4" X 4" enclosed wireways approximately 20" above the finished floor around the perimeter of both the Control and Evaluation rooms. The wireways connect the DTRs and all workstation locations. Connect the wireways on each floor to each other and to the DTR with 4" X 4" enclosed vertical sections. Provide three 4" grommets evenly spaced in the worktable of each room to permit access to wireway system.

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. Provide recessed telephone outlets to the control tower if service is available at the range.

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 requires its own separate enclosures and/or cabinets; each 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.

Public Address Systems

Some small arms ranges require a Public Address (PA) system from the tower to the firing line; refer to the specific range types for more information. Coordinate with the installation to provide a PA system compatible with others on the installation. Be aware that some types of funding cannot purchase some types of PA components. Components classified as personal property, typically those components that are not permanently installed (some microphones and amplifiers for example), cannot be purchased with MILCON funds.

Antenna Mounting

Separate antenna towers are no longer included on Instrumented Ranges. For Instrumented Ranges only, the standard includes a 4" rigid conduit with weatherhead at the corners of the tower. Reinforce the fascia to allow antenna mounting.

Special Considerations

Fire protection is not normally required for this facility, although installation requirements may differ. Consult the installation Fire Marshal for local requirements. Typically, a local audible fire alarm is required. Fire extinguishers and cabinets are required per NFPA. Consider Sustainable Design features when designing the facility.

Some installations require fencing around the tower with locable gates. Consider graveling the entire area inside the fence to reduce grass maintenance requirements.



