
APPENDIX L

COMMUNICATIONS DURING URBAN OPERATIONS

The complexities of the urban environment such as line-of-sight restrictions, inherent fortifications provided by structures, limited intelligence, densely constructed areas, and the presence of noncombatants can restrict military technology. Communications in an urban environment are extremely important. Prior planning is essential to ensure continuous communications. Units should anticipate possible communications failures during UO. Nonelectronic communication signals must be planned for and practiced as alternative methods. This appendix addresses communications planning, communications methods, alternative communications, problems and possible solutions encountered with planning communications during UO.

L-1. INTRODUCTION

Each urban area and operation is unique and prescribing specific doctrinal *solutions* for communications is virtually impossible. The information in this appendix provides a basis for approaching UO, which, combined with other appropriate Army doctrine, will assist units in achieving mission success during UO.

L-2. URBAN INFRASTRUCTURE: COMMUNICATIONS AND INFORMATION ELEMENT

This is the element of the urban infrastructure that is comprised of the facilities and means to transmit information from place to place. It includes telecommunications such as telephones (to include wireless), telegraphs, radios, televisions, and computers; newspapers, magazines, and other forms of written communications; as well as human interaction that conveys information. Perhaps more than any other element of the infrastructure, communications and information link all the other elements together in an interdependent “system of systems.”

a. **Computers.** In many urban areas, computers are an essential link between other elements of the urban infrastructure. They link not only functions and systems within the urban area, but also connect the urban area to other parts of the world. This latter aspect creates important implications for commanders. Operations involving this cybernetic function may produce undesirable effects on a greater scale than initially intended. For example, commanders may be able to close or obstruct an urban area’s banking system; however, this system may impact the international monetary exchange with unwanted or even unknown effects. Decisions to conduct this type of information operations may often be retained at the strategic level. Conversely, shaping the urban battlespace through the electronic isolation of selected decisive points may often be a key factor in permitting units to dominate their objectives.

b. **Alternate Communications Systems.** Urban communications and information systems can serve as an alternate or backup means of communications for both friendly and threat forces and can be easily secured with civilian, off-the-shelf technologies. Adversaries may make use of commercial systems intertwined with legitimate civilian users, making it undesirable to prevent use of these assets. Army forces can also use these

systems to influence public opinion, gain intelligence information, support deception efforts, or otherwise support information operations.

L-3. COMMAND AND CONTROL

The urban environment challenges C2 systems that support the commander. Perhaps one of the biggest challenges will be horizontal and vertical communications between and within units.

a. **FM Limitations.** The physical characteristics of manmade construction may significantly degrade FM communications. The frequency spectrum becomes more confined based on structures that would degrade all communications, especially line of sight (LOS) within the urban environment. This causes problems at brigade-level and below where commanders rely heavily on constant FM radio contact with subordinates. Tactical communications problems can result in many other issues including an inability to maintain a common operational picture (COP), give orders and guidance, request support, or coordinate and synchronize elements of the combined arms team. Communications problems within urban areas can contribute directly to mission failure.

b. **Measures to Mitigate Urban FM Limitations.** Units and staffs that properly prepare can mitigate the communications problems within urban areas. During offensive operations, use of retransmission and relay sites and equipment, careful positioning of commanders and command posts, careful placement of antennas, and proper communications procedures will permit adequate FM communications for mission accomplishment. In defensive, stability, or support operations, where positions do not change frequently without preparation, units should consider increasing their reliance on wire, commercial communications, and messengers. Even under combat conditions, some or all of the urban area's organic communications structure may be intact and available for use. C2 systems must use these alternatives to FM communications utilizing proper security procedures.

c. **Information Overload.** Urban areas have the potential of overloading C2 systems with information. Full spectrum urban operations can generate large volumes of information when crises threaten. The sheer volume of tasks that require attention in UO can overwhelm commanders and command posts. Training must prepare command posts to handle this volume of information and to filter the critical from the merely informative.

L-4. URBAN COMMUNICATIONS PLANNING

Communications planning for UO will assist in minimizing the effects of the urban environment. VHF radios are screened and communication ranges reduced in urban areas. Radios must be carefully located to maximize their effectiveness. Retransmission stations and remoting of antennas on taller structures maximize the communications range. Ground units attempting to communicate with aircraft or other ground units should use the upper end of the VHF band and high power switches on radios. Commanders must set limited objectives covering a small area and plan for the frequent relocation of retransmission stations. If time and METT-TC factors permit, maximum use should be made of the civilian telephone system.

L-5. COMMUNICATIONS METHODS

During Operation Just Cause, the two most significant elements of the Army communications network were the airborne command and control center (ABCCC) and satellite communications (SATCOM) radios utilized by the ground and air elements. In addition, multi-channel unit radios provided essential command and control links. Several units augmented their administrative communications with commercial “walkie-talkies” (brick radios). Brick radios were used for perimeter security and communications within logistical areas.

a. **Retransmitters.** Currently, radio retransmitters are used to communicate with elements on perpendicular and other streets. If the urban terrain has tall buildings with iron support beams, or if the buildings have metal roofs, position UHF transmitters some 2 to 5 times the height of the intervening building away from that building.

b. **Directional Antennas.** A directional antenna can use stone or brick walls as retransmitters to bounce signals down a street. When trying to bounce radio signals off adjacent buildings, avoid aiming antennas at windows. The reflective properties of glass are different from brick or stone. Communications using a directional antenna with a clear LOS to the other station is best. When a tall object such as a church is located between the stations, the stations should aim their directional antennas at a common point. Avoid positioning radios near power and telephone lines. If a radio is located inside a building, position the antenna on an upper-story or window facing the receiving station or on the rooftop. A directional antenna has better range than a whip antenna. Use a 10- to 15-meter-long cable to connect the radio to the antenna, but avoid longer cables as they weaken the transmission signal.

L-6. ALTERNATIVES TO FM RADIO

Units should consider alternatives to FM radio communications.

a. **Wire.** Wire is a more secure and effective means of communications in urban areas. Wire should be laid overhead on existing poles, underground, or through buildings to prevent vehicles from cutting it.

b. **Messengers and Visual Signals.** Messengers and visual signals can also be used in urban areas. Messengers must plan routes that avoid the enemy. Routes and time schedules should be varied to avoid establishing a pattern. Visual signals must be planned so they can be seen from the buildings.

c. **Sound.** Sound signals are normally not effective in urban areas due to the amount of surrounding noise.

d. **Satellite Communications.** SATCOM would alleviate many communications problems, keeping in mind the space needed for proper take off angles for the satellite orientation. A retransmission or radio relay site is another alternative communications method.

e. **Existing Systems.** If existing civil or military communications facilities can be captured intact, they can also be used by units. An operable civilian phone system, for instance, can provide a reliable means of communication. Telephones should not be considered secure. Other civilian media can also be used to broadcast messages to the public.

(1) Evacuation notices, evacuation routes, and other emergency notices designed to warn or advise the civilian population must be coordinated at the battalion and brigade

levels through the S1 or civil affairs officer. Such notices should be issued by the local civil government through printed or electronic news media.

(2) Use of news media channels in the immediate area of combat operations for other than emergency communications must also be coordinated through the S1 or civil affairs officer.

f. **Civilian Telephone Network.** Units can use the civilian telephone networks when METT-TC factors permit. Apartment buildings, stores, and factories are wired into the civilian telephone system. Every building has a telephone distribution box, which controls many (up to 200) individual telephone lines. Setting up wire communications using these points is relatively simple. Computers hooked to the Internet through existing telephone lines can relay a commander's order to his subordinates and can include audio, video, and graphics.

g. **Cellular Telephones.** Cellular telephones work well in urban areas, but are disabled easily by taking out the repeater stations or destroying the central cellular telephone system. In addition, the signal from an omnidirectional antenna can be used to locate and target the site with indirect fire. Cellular telephones as alternative communications method should be considered as a less desirable alternative.

h. **Message Pagers.** Message pagers can be used by leaders. They provide flexibility for short message communications. Disadvantages to using the pager are the beeping sound and the visual light indicator. Leaders should ensure that the pager is in the vibrate mode and, if necessary, that the visual light indicator is covered.

L-7. POTENTIAL PROBLEMS AND SOLUTIONS

The problems encountered in an urban environment may be different from other tactical environments. Units must contend with buildings, electrical structures, and noise.

a. **Potential Problems.** Large cities have power lines, electric trains, trolley lines, and industrial power lines, which can interfere with communications. Potential problems that might be encountered when communicating in an urban environment include:

(1) Dead spots in communications caused by structures that block or absorb signals.

(2) Fading of communications caused by the reflection of the signal off urban terrain. The signal and one or more of its reflected versions meet at the antenna causing constructive or destructive interference. The severity of fading increases with frequency. For most VHF radios, fading is usually less than 10 decibels. Higher frequency radios may experience fades as severe as 20 to 30 decibels.

(3) Manmade electrical noise concentrated at low frequencies. This will cause communications to decline rapidly as frequency increases, but still will be 15 to 20 decibels higher than open terrain.

(4) Mechanical noise problems caused by heavy concentration of manmade noise associated with heavy industry or manufacturing. The more audible the noise level, the higher the volume must be adjusted on communications equipment.

b. **Solutions.** Urban communications problems vary depending on the area. The following solutions are provided for most of the problems units are likely to encounter.

(1) Increasing the power or antenna gain may increase the communications capability. Trade-off is decreased battery life and increased susceptibility to EW.

(2) HF is susceptible to noise but best in reducing dead spots and multi-path effects. UHF/SHF (above 500 megahertz) is very susceptible to dead spots and multipath but best

in reducing noise interference. VHF to low UHF range offsets various problems associated with operating in an urban environment.

(3) Diversity can eliminate multipath effects by using multiple receive antennas or multiple frequency transmissions. Frequency hopping or direct sequence spread spectrum can also provide diversity.

(4) Retransmission stations shorten distances and can overcome noise problems. Retransmission stations used on higher urban terrain/structures unmanned aerial vehicles, or air platforms reduce dead spots.

(5) Commercial systems developed for robotic use in manufacturing may have military application. These systems use spread spectrum modulation (direct sequence or frequency hopping) to overcome fading and interference.