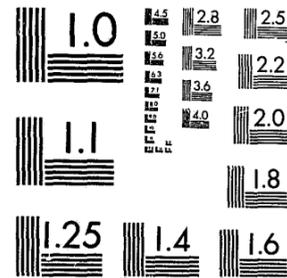


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National Institute of Justice
United States Department of Justice
Washington, D. C. 20531

10/19/82

FBI LAW ENFORCEMENT BULLETIN

MARCH 1982



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82155

Communications

FBI LAW ENFORCEMENT BULLETIN

MARCH 1982, VOLUME 51, NUMBER 3

NCJRS

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MAR 20 1982

ACQUISITIONS

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The Cover: Population growth in many areas has necessitated the development of more sophisticated communications systems.

Federal Bureau of Investigation
United States Department of Justice
Washington, D.C. 20535

William H. Webster, Director

The Attorney General has determined that the publication of this periodical is necessary in the transaction of the public business required by law of the Department of Justice. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through December 28, 1983.

Published by the Office of Congressional and Public Affairs,
Roger S. Young
Assistant Director

Editor—Thomas J. Deakin
Assistant Editor—Kathryn E. Sulewski
Art Director—Kevin J. Mulholland
Writer/Editor—Karen McCarron
Production Manager—Jeffrey L. Summers



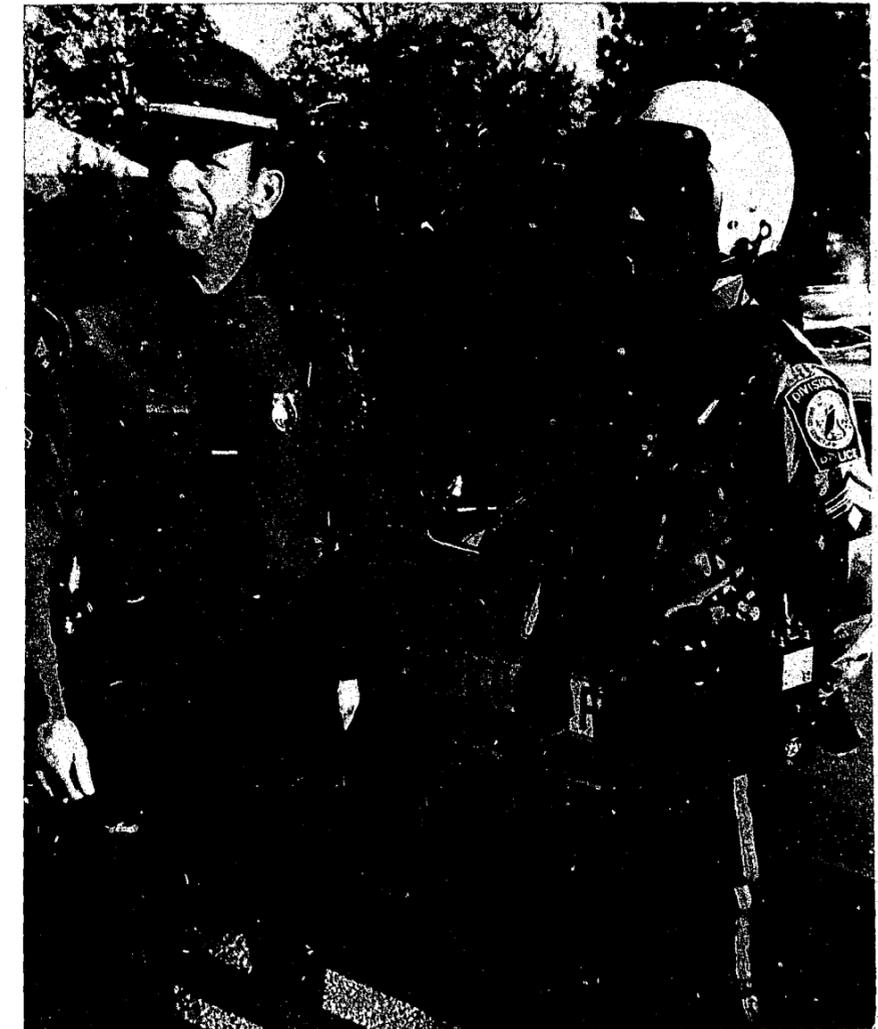
ISSN 0014-5688

USPS 383-310

Police Communications in an Urban County

The State of the Art

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History and Background

Henrico County, Va., is a modern, progressive community located on the north, east, and west boundaries of the City of Richmond, Va. Like many localities similarly situated on the outskirts of larger cities, it is both urban and rural in makeup and has experienced accelerated growth in the past 30 years, both in population and government services. Its 1950 population of 57,346 was served by a police complement of 21, who responded to 5,396 calls for service, and its 1980 population of 180,725 generated 82,355 calls for service by the present police complement of 486 members. The communications systems during those and the intervening years ranged from the 1950 cumbersome radio monitoring/telephone relay of calls for service through an adjacent jurisdiction to the 1980 VHF dual-channel simplex system, which had been modified and expanded over a 30-year period so that growing demands could be met.

In order to provide needed space, the system was moved in 1965 to a communications center in the Emergency Operations Center, located in the eastern portion of the county. The new 600-square foot location accommodated one police and one fire console, three six-position telephone sets, and four communications officers per shift.

By the spring of 1975, the existing emergency communications systems were overburdened. To remedy the situation, an additional VHF police channel was placed in service, providing one frequency for each end of the county, thus reducing channel congestion. More telephones were added, along with a central switchboard to service them, and additional personnel were authorized. Those measures were recognized as stopgap in nature, and in 1977, the telephone communications network again required upgrading. As a consequence, the entire communications system became the subject of an intensive study—one which led to the present day configuration.

The Study

The major objective of the study was to develop a radio network which would eliminate two principal weaknesses: 1) Channel crowding caused by increased emergency service response to county growth; and 2) reception impairments in several parts of the county, created by its topography, its size of approximately 245 square miles, and the placement of the only transmitter in the eastern section of the county—a condition that was eased by the placement of an additional transmitter site in the western part of the county in 1977.

The three primary areas of the study were designed to define a radio system which would meet the county's emergency communications needs, provide budgetary cost data for financial planning, and decide what rationale would be used for the selection of the recommended system.

To predict adequately immediate and future requirements, the following data elements were collected and analyzed:

- 1) Number of calls for service placed on the communications system,
- 2) Average number of transmissions per call for service,
- 3) Average message length,
- 4) Anticipated county growth,
- 5) Anticipated growth of the division of police and other emergency services on the system.

The final recommendations of the study were to:

- 1) Construct a new communications center to be located in the planned public safety building. This would provide for both future expansion and flexibility. The past had shown that communications demands would increase, causing larger space needs. Since future budgetary limitations were likely to restrict expansion, space and flexibility needs should be met early.
- 2) Provide for an additional transmitter site comparable to the existing one in the east for the western portion of the county. In addition, satellite receivers were to be constructed to enable field unit transmissions to be received from any location within the county.
- 3) Provide five UHF duplex frequencies for dispatch purposes, plus one channel each for future mutual aid use with other jurisdictions and a simplex frequency for local, tactical use. In calculating channel requirements, a standard of 5 seconds maximum wait to gain access to any frequency during the peak

traffic hours of any week was used.

- 4) Convert to an all-portable operation to provide for constant communication with all field personnel. The key factors considered in this decision were primarily officer safety, which is achieved by constant availability of radio communications, and reduction of vehicle downtime associated with the mobile radio system.
- 5) Continue to act as a joint service to both fire and police operations—to be a public safety communications center.

The only significant problem not solved was the restriction on the tower height in the eastern portion of the county, created by its proximity to the metropolitan airport. Relocation was not economically feasible and reception is still not at a desirable level in a few isolated locations at the outermost boundaries.

Certain decisions had major impacts on the functioning of the radio system. One decision was to divide the county into two geographical radio dispatch areas—one in the east and one in the west. Each of these would be subdivided into two dispatch sectors synonymous with indicated patrol sectors. In turn, the patrol sectors were composed of individual patrol areas or "beats," in which one officer was normally responsible for handling calls. Either of the frequencies assigned to the dispatch sectors is sufficient to cover the entire geographical area.

This allowed for flexibility in assigning communications personnel in accordance with anticipated workloads and calls for service. During all shifts, the countywide frequency primarily serves the police administration, investigators, sheriff's department, and the three volunteer rescue squads and is operational along with two patrol frequencies—one each for the eastern and western geographical radio dispatch areas during the day and mid-night shifts. From 9:30 p.m. to 1:30 a.m., all five frequencies, including the two additional patrol frequencies, are operational. The increased capability during these latter hours provides improved access time for the greater number of patrol units available during the overlap period when two uniform platoons are on patrol. This overlap occurs during the peak calls-for-service time period and is created by the scheduling of four, 10-hour days for both communications and patrol personnel.

A second decision impacting on the functioning of the radio system was that requests for proposals by companies desiring to provide the radio system be performance-related. The proposal specified a 97-percent radio coverage requirement. The number and location of satellite receivers were not specified, and although the use of governmentally owned sites was encouraged, this was left to the discretion of the successful vendor. This proved extremely beneficial when, in the first several weeks of use of the new system, it was found that additional satellite receivers were necessary because of poor reception from four areas in different parts of the county. These receivers were provided by the vendor without additional cost to the county.

“... Henrico County has moved from the ‘dark ages’ to a ‘state of the art’ in the area of communications.”



System Elements

One-watt portable radios were purchased to ensure adequate battery life during a member's tour of duty. Even though the shifts are now 10 hours long, battery life is not a problem. In addition, sufficient batteries were acquired to permit each shift to have color-coded, fully charged replacements available when reporting for duty. Investigators, undercover personnel, and a limited number of staff officers are provided with vehicular-mounted chargers from which the radio

is taken when exiting the vehicle.

For the uniformed officer, additional accessories include a speaker/microphone/antenna combination which is attached to the officer's epaulet by means of a velcro fastening. Each officer is issued a leather carrying case for the radio, which attaches to the gun belt.

In keeping with the concern for officer safety, radios are equipped with a unique identifier. Whenever a unit transmits, a data burst identifies that unit on the console serving the radio's

A telephone-responsive console features a 911 control panel, radio controls, and a playback recorder which permits review of calls received during the last 30 minutes.

frequency. Should an officer require immediate assistance and be unable to transmit by voice, he may pull a ring located on the radio, signifying a "may-day." This, in turn, causes the radio number on the console to flash and an audible signal alerts the console operator to the situation.

There are now 20 satellite receiver sites located throughout the county. Each site is equipped with a minimum of three complete receivers and a battery that will sustain the receivers for 24 hours in the event of a power failure.

Most satellite receiver sites consist of a 100-foot, self-supporting tower and antenna. The equipment is housed in an all-weather cabinet enclosed by an 8-foot chain link fence. When it was practical, existing structures were used—antennas were mounted on forest fire lookout towers or elevated water tanks. In some instances, it was possible to mount the equipment inside available buildings.

All transmissions to the eastern portion of the county emanate from the communications center to the transmitter located at the emergency operating center, via dedicated land lines. Conversely, field unit transmissions are routed to the communications center via the voted receiver in the east, to the emergency operating center, and then by land line.

Each radio channel has a minimum of two base/repeater stations that are used alternately every 12 hours to reduce maintenance potential which increases when the equipment is not frequently used.

The decision to locate the western transmitter off the government center where the public safety building is located was based on two considerations—aesthetics and economics. The availability of a tower near the government center played a major role in this decision. Although the transmitter receivers are routinely serviced by dedicated land lines, low-powered transmitters located in the public safety building can serve as control stations when required.

Communications Center and Personnel

The new communications center, located in the public safety building, is approximately 5,500 square feet, with approximately 1,400 square feet being devoted to current and future console operations. The remaining space houses peripheral radio equipment including console-controlling microprocessing equipment, telephone and computer equipment, a lounge for communications officers, a public viewing area, and fire suppression equipment. Offices are provided for the communications staff, support personnel, and the necessary printing and recording equipment. The former communications center, located in the emergency operating center, has been converted to permit limited operations in the event that the new center has to be evacuated for any reason.

There are two major functions of the communications center's 15 radio consoles. The first function—that of receiving calls for service—is handled by eight consoles. This type of console is telephone responsive, but has radio

controls to enable the operator receiving the call to immediately dispatch the appropriate number of field units. More personnel are required to provide this type of service; however, this approach has helped to eliminate dispatch delay, a frequent problem under the old system. This, in turn, has eliminated some of the citizen dissatisfaction in the area of complaint reception. The second function is performed on six consoles that respond to field personnel. One is used to dispatch fire equipment, and five other service the functional police areas and are manned according to the need, based on the time of day. These positions are equipped with considerably more radio capability than the telephone positions. In addition to the five dispatch frequencies, these consoles may monitor broadcasts from adjoining police and fire jurisdictions, transmit and receive on the statewide interdepartmental radio system (SIRS) and on the VHF high-band channel used for covert surveillance, and transmit to the radio pagers issued to key personnel.

Both the telephone and service consoles are linked to a second element of the communications center—the county's communications computer. The software which operates the computer is centered around the computer aided dispatch (CAD), which serves five target areas:

- 1) Unit management maintains control of the various field units' status with respect to availability or nonavailability. Any unit's activities can be traced through the system for an entire tour.
- 2) Call management maintains control of calls-for-service status, including all pending or inprogress calls.

"The present communications system now provides efficient response to citizen needs, greater officer safety, and management information. . . ."

- 3) Unit services provide specific information to the officer, such as vehicle inquiries, whether a vehicle has been stopped recently, etc.
- 4) Dispatcher service determines the three closest units able to respond to a given call, indicates certain types of questions to be asked of the complainant based on the type of call for service, and makes the dispatcher aware of certain messages connected with an address.
- 5) Locational assistance identifies the call as to location and provides cross streets and map page information. It also indicates whether the address is considered hazardous, whether a police officer resides there, or whether previous calls have been received there. The address look-up function of CAD is based on determining in which of 623 geographic areas of the county (small reporting areas) the call is located. These geographic areas use the Census Bureau's Dual Independent Map Encoding (DIME) file, which assigns street segments to census blocks.

Because of the availability of in-house expertise, the CAD system was developed by county personnel, as opposed to outside consultants. The willingness of the county's data processing staff to aid in this development and their capability to modify programs quickly as the need might arise have proven to be both productive and cost-saving.

The CAD system uses two cathode ray tubes (CRT) on each console. One tube provides the available/unavailable status of field units and calls pending or in progress. The status screen provides a flashing cursor beside any unit number that has been out of service in excess of a predetermined time for the nature of the call. Every status screen is automatically updated each time any unit's status is revised.

The other CRT is used for logging complaints and various types of inquiries. Through the computer, inquiries

may be made to the Virginia Division of Motor Vehicles, Virginia Criminal Information Network (VCIN), National Law Enforcement Telecommunications System (NLETS), and National Crime Information Center (NCIC). The 15th console is the command position. It is always manned by the platoon sergeant or a senior communications officer. This position can perform any function possible on other consoles. The supervisor may provide a telephone to radio connection. Since it is possible to provide cross-channel communications between any two fre-



The field service console has greater radio capability and a high-speed projector for sectional maps.

quencies controlled by the center, a division member may communicate with a State trooper by the "marrying" of UHF to the low-band SIRS network.

The command console can take over any or all positions. The supervisor can remotely monitor activity at any console, monitor any one of the telephones or radio frequencies taped on a 40-channel recorder, or determine which satellites are being "hit" by a field unit's transmission and which satellite is voted. This is the position which may disable repeaters when re-broadcast is not desirable or remotely activate or deactivate transmitters or receivers at locations across the county. The staff of the center consists of a captain, a lieutenant, 5 sergeants, 3 police officers, 5 senior communications officers, 51 communications officers, and a secretary. Each platoon consists of a sergeant, a senior communications officer, and 10 communications officers. The three police officers comprise the telephone reporting unit (TRU). They are assigned to the day and evening shifts and were responsible for handling 8 percent of the approximately 82,300 calls for service received in fiscal year 1980.

Planning and Implementation Considerations

Given the cost of the radio system—\$1,450,000—and the vast benefits of the system to the citizens of Henrico County as well as to the division, considerable personnel efforts were expended.

Planning for the CAD involved a cross section of law enforcement and communications personnel. The 623 small reporting areas were designed by this group, and a subcommittee of the group, composed of patrol personnel, designed the response table matrix to determine the best unit in a priority

sequence to respond to each small reporting area. The division's advisory committee, composed of both civilian and sworn personnel of all ranks, recommended the appropriate time out for each type of assignment. Output requirements for data to be captured were specified by both the command staff and users.

When dealing with computers, contingency plans must be made for downtime. In this system, two computers are available. In the event both fail, procedures exist for a reversion to the manual card system. Status is then tracked on a modified bingo flash board which was designed and constructed by five engineers from the telephone company and a sergeant, all of whom volunteered their time and talent. This device is controlled by relays activated through the telephone touch pads. Any of the 15 console operators may activate or deactivate status lights visible to the entire center when the computer is out of service.

Another contingency feature is a direct-line teletype not connected through the computer. This allows inquiries of a priority nature in the event the primary system fails.

Major personnel efforts were expended in updating the census' DIME file. Time constraints and the need to update the file from its 1976 level of street segments forced the division, and specifically the police planning section, to do its own updating. An accurate and up-to-date DIME file was critical to the success of the locational assistance aspect of the CAD system. Not only was the DIME file updated, but additional files were built to provide names of businesses, apartment com-

plexes, shopping centers, banks, etc., when addresses were not commonly provided, as well as to provide for the development of a street alias file. These files have provided an address match of more than 90 percent of all calls for service received since the system was placed in operation in May 1981.

Training time was significant for both field and communications personnel. Every effort was made to acquaint all division personnel with major aspects of the system, and communications officers underwent intensive training. Information relating to changes or improvements in the system are provided on a monthly basis through the division newsletter.

Conclusion

In the past 3 decades, Henrico County has moved from the "dark ages" to a "state of the art" in the area of communications.

Through the years, many dedicated public safety people have contributed their efforts to this successful project. In addition, the support of the board of supervisors and the county administration was considerable, indicating their faith in the Department of Public Safety and the needs of the county. The present communications system now provides efficient response to citizen needs, greater officer safety, and management information, which will allow for improved use of resources and a means to maintain an effective communications system. **FBI**

END