

Police
~~INDIVIDUAL~~ TECHNICAL ASSISTANCE REPORT

In Response to a Request for Technical Assistance

by the
a
New Orleans, Louisiana, Police Department

- *Police UHF*

*Communication System Design
assistance*

December 20, 1972

Prepared by:

Public Administration Service
1313 East 60th Street
Chicago, Illinois 60637

(Per Contract J-LEAA-015-72)

DEPARTMENT OF JUSTICE

INTERNAL ROUTING/ACTION SLIP

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FROM DD Hecul	BLDG.	ROOM
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I. PRELIMINARY INFORMATION

A. **Consultant Assigned:**

S. A. Yefsky
Computer and Engineering Sciences
524 Golf Mill
Niles, Illinois 60648

B. **Date Assignment Received:**

August 25, 1972

C. **Date of Contact with LEAA Regional Coordinator:**

Not applicable.

D. **Dates of On-Site Consultation:**

October 5 and November 14, 15, and 24, 1972

E. **Individuals Interviewed:**

(New Orleans, Louisiana, Police Department)

Major Lloyd Poissenot
Supervisor of Patrol Division

Major Joseph Murry
Supervisor of Technical Service Division

Lieutenant Richard Martin
Commander of Communications Center

Captain Robert Falcon
Electronics Section

Jules H. Killelea, Jr.
Detective Division

Claude Schlesinger
Data Systems Section

Forrest Craig

II. STATEMENT OF THE PROBLEM

The request was for an extension of work done under an earlier Request for Technical Assistance. See Individual Technical Assistance Report No. 8, prepared by Public Administration Service, and dated August 10, 1972. 34227?

III. FACTS BEARING ON THE PROBLEM

See II. above.

IV. DISCUSSION OF POSSIBLE COURSES OF ACTION

See attached consultant's reports.

V. RECOMMENDED COURSES OF ACTION

See attached consultant's reports.

PROCUREMENT OF PORTABLE RADIO SYSTEM
FOR HIGH RISE COMMERCIAL AND APARTMENT COMPLEXES

MOBILE-MOBILE REPEATERS

1.0 Invitation to Bid

Enclosed herein is the Invitation to Bid which details the general terms and conditions for bid to the City of New Orleans.

2.0 General Requirements

2.1 Intent Procurement.

The City of New Orleans is in the process of developing and implementing an advanced police communication system. Communications channels in the UHF band and VHF band will be utilized to provide advanced voice radio service to patrol officers and specialized units throughout New Orleans Parish. The system will feature extensive utilization of portable radios to provide constant communications with patrol officers.

The New Orleans Police Department recognizes the future needs for extending this coverage to high rise commercial and apartment complexes. Such coverage is not normally accommodated by radio systems. The Mobile-Mobile Repeater System has been designed to penetrate large concrete and steel high rise structures. Through this procurement the New Orleans Police Department will obtain Mobile-Mobile Repeaters which will permit such high penetration communications. The results of the Department's experience with these units will be used to guide the procurement of additional systems for utilization in areas requiring coverage from within major structures.

2.2 Inquiries.

Inquiries concerning this invitation should be submitted, in writing, to the issuing office. Responses to questions of general concern will be mailed to all vendors being solicited.

2.3 Briefing.

The vendors conference will be held on _____ 1972, at _____ P.M., in Room _____, at the New Orleans Police Department which is located at _____.

2.4 Closing Date.

Sealed bids must be received by the issuing office no later than _____ on _____ 1972. Bids will be opened at _____ on _____ 1972.

2.5 Terms.

A. Price.

All bids will be fixed price. Bids shall remain in force for a period of 120 days after the closing date. Upon delivery and completion of all work proposed, the issuing office will advise the supplier within 30 days as to the final acceptance of the equipment and services rendered. Payment will be made after such acceptance in accordance with contract price.

B. Delivery Schedule.

The delivery requested is 120 days or less. The bidder shall provide a delivery and installation schedule for all items proposed. All material and equipment shall be delivered with delivery charges prepaid.

2.6 Exceptions to Specifications.

Items in the specification which materially contribute to the intent of this procurement such as penetration of high rise structures and use of FCC type accepted equipment will not be compromised. However, bidders may propose equipment which they believe meets or exceeds these specifications but which may depart from the specific details. Suppliers shall state any such deviations and indicate how their alternate specifications will meet the requirements of this procurement.

2.7 Alternative Proposals.

Bidders may propose alternative systems which they believe will meet the intent of this procurement. The Purchasing Agent reserves the right to accept or reject any such alternative proposals at his sole discretion.

2.8 Commercially Available Equipment.

Vendors shall bid equipment that is commercially available, currently in production and use in the Public Safety Services. Said equipment shall be type accepted by the Federal Communications Commission and conform to all applicable specifications of the FCC and EIA. It is recognized that suppliers may fabricate elements of the system which would not fall within the restrictions above.

2.9 Bid Preparation.

2.9.1 Bid Documents - Bidders will complete all bid documents. Bidders shall prepare a definitive and concise narrative describing their proposed system. This narrative shall include statements regarding compliance with each of the specifications under Paragraph 3.0.

2.9.2 Manufacturer's Data Sheets - Bidders shall include a specification sheet for each major component of equipment being proposed.

2.9.3 Model Number Designation - The Bidder shall define completely the model number of the equipment bid. This will allow the City of New Orleans to determine the full specification on the sheets enclosed by the Bidder.

2.10 Evaluation and Award.

Any award which may result from this procurement will be announced within 120 days after the closing date. Evaluation will be based primarily on the anticipated performance of the equipment

being offered under conditions which may be encountered by policemen when communicating from within high rise, commercial and apartment buildings. Performance under these conditions will be traded off against cost.

The Purchasing Agent reserves the right to accept one or more bids. Further, the Purchasing Agent may as a result of this procurement reject all bids or negotiate with an individual Bidder.

3.0 Specifications

The Bidders will deliver and install Mobile-Mobile Repeaters in accordance with the following specifications and furnish maintenance for one year.

3.1 Objectives.

The objective of this procurement is to obtain a Mobile-Mobile Repeater System which has the capability for communications from within high rise steel and concrete structures. This equipment will be utilized for patrol operations by the New Orleans Police Department. The experience gained by the Department in the utilization of this equipment will guide it in future procurements of equipment for this purpose.

3.2 Definition of Terms.

3.2.1 Portable Radio - The portable radio is that part of the Mobile-Mobile Repeater which is carried by the patrol officer and utilized for communications when he leaves his patrol car.

3.2.2 Vehicle Control and RF System - The vehicle control RF System receives communications from the portable unit. It simultaneously controls the mobile radio in the vehicle so that the mobile repeats the portable transmissions. It also contains devices which allow the duplex radio operation.

3.2.3 Mobile Radio - The mobile radio functions as a conventional receiver-transmitter when the patrol officer is inside the vehicle. The performance when the officer is inside the patrol car is indistinguishable from any patrol unit on the communications channel operating under similar conditions. When the patrol officer is out of the car, the mobile radio repeats messages received from the portable radio over a second channel.

3.3 System Description.

The Mobile-Mobile Repeater is a system developed for the purpose of solving the problem of communication from inside steel and concrete structures. The large losses and almost total absorption encountered in high rise structures make communications utilizing normal portable radios almost impractical. Satellite systems which provide adequate coverage from street locations in urban areas and from inside low rise frame structures generally fail to penetrate steel and concrete buildings. Even a severalfold increase in listening satellite stations fails to provide reliable coverage from inside such structures.

The Mobile-Mobile Repeater System utilizes the existing mobile communications channel. Messages received from a remote portable are repeated on the mobile channel. In essence, the Mobile-Mobile Repeater establishes a second communications path which is short range, on the average of several hundred feet, between the remote portable radio being carried by the patrol officer and his patrol car which is parked down the street. Experiments in a major city authenticated the reliability of this system utilizing 0.1 watt of power at UHF.

When the patrol officer is inside his vehicle, he will communicate using the mobile radio in the vehicle. When he leaves the patrol car, he will communicate utilizing the low-powered

portable. Transmissions from the portable are received by a separate receiver in the Vehicle Control and RF System. The transmitting frequency is unique to the portables. One mobile and one portable represent a unique pair. Each individual portable and its mating vehicle is equipped with tone codes so that only a given portable will cause only one mobile radio to repeat its transmissions. By having multiple tone codes, a number of vehicles all having mobile repeater capabilities can operate in a confined area without causing interference.

The duplex operation of New Orleans Police Department's base stations will allow the maintenance of net discipline. The receive frequency of the portable unit will be the same frequency of the district channel in which the Mobile-Mobile Repeater vehicle is assigned. When the officer leaves his vehicle, he will continue to receive base station transmissions directly over his portable radio. When the channel is clear, he will transmit over the frequency assigned for Mobile-Mobile Repeater use. This repeat frequency will be received by all mobile repeaters operating on that frequency. Only the mobile repeater paired to that portable will be actuated and will repeat the transmission from the portable.

3.4 Codes.

The portable unit and Vehicle Control and RF Unit shall utilize a coding system to prevent multiple repeating by several vehicles. The portable shall have the capability of one of twenty-six sub-audible tone codes. This will provide at least twenty-six codes. The New Orleans Police Department will specify subsequent to the award which tone it desires on each system being ordered.

Vendors are encouraged to propose additional or alternative coding schemes which would provide greater coding capability.

3.5 Frequency Assignments.

The New Orleans Police Department has twelve channel assignments from 460.025 MHz to 460.500 MHz for base stations and 465.025 MHz to 465.500 for mobiles. The mobile radios will be configured with crystals in all twelve channels. One frequency will be selected

for the transmitting frequency of the portable (receive frequency of Vehicle Control Units receiver). This frequency will be 460.500 MH_z. The received frequency of the portable will be 460.225 MH_z or 460.025 MH_z. The New Orleans Police Department will specify the frequencies subsequent to the award.

3.6 Portable Specifications.

The portable radio will be a single channel radio. It will contain tone codes and frequency assignments in accordance with the above specifications. Where a manufacturer has a low-powered portable, the manufacturer is encouraged to propose this unit. It is envisioned that the portable would be under 20 cubic inches and weigh less than one pound (1 lb.). The power output would be a minimum of 0.1 watt. The manufacturer shall provide rechargeable batteries with a minimum capability of 8 hours at a 5%, 5%, 90% (transmit, receive, stand-by) duty cycle.

Manufacturers may propose alternative portables utilizing larger equipment such as the GE - PE, or the Motorola HT 220.

The Bidder shall provide a complete delineation of all the specifications shown in 3.9 for the portable bid.

A carrying case, belt clip, vehicular charger, and a desk charger will be supplied with each portable.

3.7 Vehicle Control and RF System.

Vehicle Control and RF System shall contain a receiver and decoder to monitor transmissions from the portable. It will contain a control system for causing the mobile radio to repeat transmissions from the portable. It will contain duplexers (antenna, filters, cavities, etc.,) or other devices which will enable the receiver unit to operate simultaneously with the mobile transmitting.

When operating in the relay mode with the mobile radio transmitting 70 watts, the sensitivity of the Vehicle Control and RF System's receiver shall not degrade to less than 0.7 micro volts @ 50 OHMS for 12 db Sinad. A 1.0 KH_z signal initiated at the portable at a rated deviation of 2/3rds with less the 10% distortion and causing 1000 micro volts at the Vehicle Control and RF System's

receiver shall cause the mobile radio to deviate at 2/3rds of rated deviation plus-minus 20% over its rated temperature range with less than 16% distortion.

3.8 Mobile Radio.

The Mobile Radio shall interface with the Vehicle Control and RF System in 3.7. When so interfaced, the Mobile Radio shall be basically equivalent in operation and performance (except for the additional Mobile-Mobile Repeater capability) to a twelve channel UHF mobile in the 450-470 MHz₂ region with a nominal 70 watt output power such as the following:

Motorola Motrac	T64MST.....
G.E. Professional	YT75TPU88.....
RCA Super Carfone	CLF6.....

The mobile radio head shall have provision for manual switching by the patrol officer from normal vehicular operation to repeater operation. Bidder will provide specifications in Paragraph 3.9.

The mobile shall have crystals in each channel. Frequencies will be specified subsequent to award.

The mobile repeat channel will be specified subsequent to award.

3.9 Specifications Defined in Accordance with EIA.

General:

- Size
- Weight
- Controls
- Duty Cycle
- Temperature Range
- Channels

Receiver:

- Sensitivity (12 db Sinad)
- Sensitivity (20 db Noise Quieting)
- Selectivity
- Modulation Acceptance
- Spurious Response
- Intermodulation
- Frequency Stability
- Audio Response
- Audio Power and Distortion

Transmitter:

Power output
Spurious Emission
Frequency Stability
Harmonic Emission
FM Noise
Modulation
Audio Response
Audio Distortion

3.10 Warranty.

The Bidder shall warrant that all equipment shall conform to its published specifications and be free from defects in material, workmanship and title.

The minimum warranty period should be as follows:

Oscillator crystals for the life of the equipment.

Crystal filter assemblies containing no active elements, for the life of the equipment.

Frequency control modules containing quartz crystals and active elements, three years.

Silicon transistors, two years.

Tubes, ninety days.

Non-rechargeable batteries, fuses and pilot lamps, operable on arrival.

All other items, one year.

<u>Item No.</u>	<u>Description</u>	<u>Unit Price</u> <u>(Quantity 2 to 10)</u>
1.	Furnish and Install: Mobile-Mobile Repeaters consisting of a Portable, Vehicle Control and RF System and Mobile Radio	
2.	Maintenance For One Year.	

TO: NEW ORLEANS POLICE DEPARTMENT
FROM: S. A. YEFSKY
DATE: NOVEMBER 20, 1972
SUBJECT: RECOMMENDATIONS: MICROWAVE TELECOMMUNICATIONS

SYNOPSIS

A recommendation is made to proceed with the procurement specifications for a microwave system. The microwave system will enable the new UHF radio system to deliver higher performance and more reliable communications. These benefits will be delivered at an estimated cost savings of \$20,000.00 per year after a pay out. The pay out will be in 10 years or in 4 years with anti-crime fund assistance.

TO: NEW ORLEANS POLICE DEPARTMENT

FROM: S. A. YEFSKY

DATE: NOVEMBER 20, 1972

SUBJECT: RECOMMENDATIONS: MICROWAVE TELECOMMUNICATIONS

During the evaluation of the proposals for the New Orleans Police Department UHF Radio System, a problem with telephone lines was identified. Telephone lines will be utilized to link five (5) satellite receiving sites to headquarters. In the limit, the quality or intelligibility of the radio communications will be no better than the quality of the telephone lines linking the satellites to headquarters. It is well known to Department's operating personnel that the actual telephone service provided varies and frequently is of a poorer grade than specified. Further, the telephone service is highly vulnerable to storm damage.

Based upon the Department's evaluation of local telephone service, a study of microwave telecommunications was indicated. A feasibility study was undertaken to determine the basic engineering requirements for a microwave system and to estimate the cost for hardware. A system was designed in which each remote site transmits directly to headquarters. In a final design, one or more paths might require either a repeater site or be looped to another satellite because of an intervening structure. The system requirements were discussed with Motorola's Point-to-Point Microwave Division. They agreed with the feasibility of the engineering requirements and made an estimate of \$173,000.00 for a basic system. With automatic switchover redundant RF the cost would be \$194,000.00. I would estimate that the cost for a basic system would be around \$200,000.00. The Department has costed telephone line at \$26,336.00 per year for the full system. This rate can be expected to increase regularly. Given an annual maintenance cost for the microwave system at \$5,000.00, then the microwave system would pay out in 10 years. If a 60% - 40% cost sharing grant is obtained from the

State of Louisiana, then only that portion or \$80,000.00 would be borne by the City of New Orleans. Consequently, the system microwave would pay out in 4 years. After the pay out, the microwave system will save the Department \$20,000.00 per year.

There is, therefore, two significant reasons for serious consideration to a microwave telecommunications system. First, the over-riding consideration in the police communications is coverage reliability. A microwave system will provide more reliable and higher performance communications than telephone lines. Secondly, the practical financial consideration. A microwave system will cost less over the long term. Based on these two factors, cost and performance, it is recommended that the New Orleans Police Department proceed with the writing of a procurement specification for a microwave telecommunications system.

TO: NEW ORLEANS POLICE DEPARTMENT
FROM: S. A. YEFSKY
DATE: NOVEMBER 16, 1972
SUBJECT: LONG RANGE TELECOMMUNICATION PLAN

SYNOPSIS

A recommendation is made to proceed with a study program to develop a long range plan. A long range plan is crucial to the effective development of the UHF radio system and future computer oriented command and control systems. The benefits realized through this planning will be high performance, cost effective systems which can pay out in a short number of years.

TO: NEW ORLEANS POLICE DEPARTMENT
FROM: S. A. YEFKY
DATE: NOVEMBER 16, 1972
SUBJECT: LONG RANGE TELECOMMUNICATION PLAN

The New Orleans Police Department stands at the threshold of development of a whole new generation of telecommunication systems. The 1970's will see a whole new spectrum of support services for the basic police operation which will be achieved through the coupling of the UHF voice radio system with computer oriented command, control and information systems.

Crucial to the effective development of these systems is a long range plan. High performance, cost effective systems will not evolve from haphazard piece meal programs.

The New Orleans Police Department has already embarked on the initial phase of the development program for the UHF radio system. This phase was initially intended to alleviate the communication requirements of four special units. However, through planning, the program has been structured to include a formal program to investigate alternative communications systems for patrol operations. During early 1973, five (5) satellite stations will provide coverage throughout the City. The special units will receive their much needed compliment of mobile radios and portable radios. The patrol communications program will consist of the 6th District and perhaps the 1st District in a full scale model demonstration of at least three (3) communication systems. The data and information obtained will be vitally needed for the planning of patrol communications.

However, recent efforts by the Department to go forward with other phases of the voice radio program have been thwarted by the lack of a formal long range telecommunications plan. The Department is attempting to specify the Communications Center that will be required to operate the UHF system for patrol operations commencing

in approximately 1973. As this effort progressed, it became apparent that the Communication Center could not be specified until the matter of channel allocation was settled. The needs for specification of channel allocation, in turn, created the need for structuring districts into radio zones; which, in turn, created the need for review and analysis of the communication's procedures, and so on. A telecommunications plan would delineate the needs and objectives of the New Orleans Police Department for the next ten years or more. From this plan systems may be designed and specifications written.

During planning sessions at the Department, several channel allocation plans were discussed. Also, the concept of a two-man patrol channel was introduced. The primary dispatcher would handle the voice traffic and the second man, the dispatcher assistant, would handle the inquiries for computer information. These plans ranged from four patrol channels to six patrol channels, with both either the one-man or the two-man per channel. The cost implications of this broad range of channel and manpower allocations are presented in Tables I and II.

Table I presents cumulative operating cost for both the one-man and the two-man channels. These costs are derived for three (3) salary levels: \$10,000.00, \$12,000.00 and \$15,000.00 per annum. It can be expected that over the next ten years, salaries will tend toward these levels. A 24 hour operation requires five (5) men. Thus, a one-man channel at \$10,000.00 per year with 25% fringe costs the Department \$62,500.00 compared to \$125,000.00 per year for a two-man channel. It can also be seen from Table I that in the course of ten years, a one-man channel can minimally cost the Department \$625,000.00 while the cost for a two-man channel could cost \$1,875,000.00.

Table II was prepared to provide cost comparisons between four channels and six channels in both the one-man and the two-man configuration. The costs so derived for a salary of \$10,000.00 per annum. It is seen that the Department's annual cost for operating a four channel one-man system is \$250,000.00. The six channel two-man system

is \$750,000.00 per annum. Over a ten year period, the one-man four channel system will cost 2.5 million dollars as compared to \$7,500,000.00 for a six channel two-man system, a difference of \$5,000,000.00.

The Department's justification two-dispatcher channel is the volume inquiry information for license and between persons checks. Similarly, the justification for the additional channels was also associated with information.

In a formal telecommunications plan, the cost benefit potentials for a number system solution would be assessed. For example, the cost benefits of computer oriented vehicle systems would be evaluated. At least three companies Motorola, Kustom and IBM have announced vehicle inquiry systems. These systems would allow a patrol officer in a vehicle to query computer files without the use of a voice channel or voice communications to a dispatcher. The amount of actual channel time for such inquiries is in the order of miliseconds. There is a channel time savings compared to voice in the order of 1,000's. Insofar as planning at this point, such systems are a definite possibility from both technical feasible and cost viewpoints. There seems to be direct cost effective trade-offs at this time. For example, it would cost approximately \$448,000.00 to equip 140 patrol cars and \$60,000.00 for a special purpose computer in the Kustom system. In the Motorola system, the special purpose computer would cost \$150,000.00 and equipping 140 cars would cost \$350,000.00. In both cases, the initial capitalization for inquiry alone would be in the order of \$500,000.00. Note that this is a ball park figure. In addition, maintenance is estimated for the system at \$30,000.00 per year. In Table I it is seen that if the system replaces only a single one-man channel, then the pay out is in the order of eight years or four years with State aid. If the difference is between four one-man channels and six two-man channels, then the pay out is one year. The central point being made here is that the overall set of requirements must be assembled. These must then be assessed against all of the current and future systems solutions possible

through technology.

A formal telecommunications plan is the product of a study. The study would have as Phase One, a review of the present departmental structure, its procedures, operating policies and hardware systems. Key individuals would provide information on the Department's future goals and requirements. Once the Department systems future requirements are defined, Phase Two would analyze operating systems and procedures to determine future effectiveness in meeting the Departments needs. As a result of this examination certain procedures will be retained, others will be modified, and yet others will be discarded. New procedures or planning programs to develop new procedures would be recommended. Requirements for telecommunications will be assembled as a result of this analysis. Phase III of the study will be to design various alternative systems and assess to their performance and cost effectiveness. During this Phase, key individuals from the Department will play an important role in the evaluation of alternative plans. Phase IV will be the selection of a final plan. Specifications would be written for those systems which will be procured in the near term.

CUMULATIVE OPERATING COSTS OF COMMUNICATIONS CENTER CHANNELS

ONE MAN - TWO MEN

Dispatcher Salary	\$ 10,000	\$ 12,000	\$ 15,000
Fringe @ 25%	<u>2,500</u>	<u>3,000</u>	<u>3,750</u>
Total Labor	\$ 12,500	\$ 15,000	\$ 18,750
24 Hour Total Labor	\$ 62,500	\$ 75,000	\$ 93,750

Cumulative Years	One Man		Two Men		One Man		Two Men	
	One Man	Two Man	One Man	Two Man	One Man	Two Man	One Man	Two Man
1	\$ 62,500	\$ 125,000	\$ 75,000	\$ 150,000	\$ 93,750	\$ 187,500	\$ 187,500	\$ 375,000
2	125,000	250,000	150,000	300,000	187,500	375,000	187,500	375,000
3	187,500	375,000	225,000	500,000	281,250	562,500	281,250	562,500
4	250,000	500,000	300,000	600,000	375,000	750,000	375,000	750,000
5	312,500	625,000	375,000	750,000	468,750	937,500	468,750	937,500
6	375,000	750,000	450,000	900,000	562,500	1,125,000	562,500	1,125,000
7	437,500	875,000	525,000	1,050,000	656,250	1,312,500	656,250	1,312,500
8	500,000	1,000,000	600,000	1,200,000	750,000	1,500,000	750,000	1,500,000
9	562,500	1,125,000	675,000	1,350,000	843,750	1,687,500	843,750	1,687,500
10	625,000	1,250,000	750,000	1,500,000	937,500	1,875,000	937,500	1,875,000

CUMULATIVE TOTAL OPERATING COSTS FOR PATROL CHANNELS

<u>Years</u>	<u>Four Channel</u>		<u>Six Channel</u>	
	<u>*One Man</u>	<u>*Two Man</u>	<u>*One Man</u>	<u>*Two Man</u>
1	\$ 250,000	\$ 500,000	\$ 375,000	\$ 750,000
2	500,000	1,000,000	750,000	1,500,000
3	750,000	1,500,000	1,125,000	2,250,000
4	1,000,000	2,000,000	1,500,000	3,000,000
5	1,250,000	2,500,000	1,875,000	3,750,000
6	1,500,000	3,000,000	2,250,000	4,500,000
7	1,750,000	3,500,000	2,625,000	5,250,000
8	2,000,000	4,000,000	3,000,000	6,000,000
9	2,250,000	4,500,000	3,375,000	6,750,000
10	2,500,000	5,000,000	3,750,000	7,500,000

* Annual Salary of \$10,000.00.

END

7 ables/men