

CONTRACT NO. ~~D-58-71~~

GRANT NO. 71-DF-687

SAN DIEGO COUNTY (CA) -

COMMUNICATIONS SYSTEM

NCJRS

FOR

JUL 9 1976

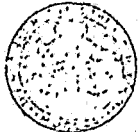
ACQUISITIONS

COORDINATED LAW ENFORCEMENT

35106
FINAL REPORT

COUNTY OF SAN DIEGO

PUBLIC WORKS AGENCY



GERALD B. WILSON
Director

Department of General Services

County Operations Center, 5555 Overland Avenue, San Diego, California 92123 Telephone 278-9200

November 21, 1972

Douglas M. Boyd, Chief
Administration and Finance Division
California Council on Criminal Justice
1927 - 13th Street
Sacramento, California 95814

Contract No. ~~D-58-71~~
Grant No. 71-DF-687

Dear Mr. Boyd:

The County of San Diego Communications System for Coordinated Law Enforcement, which was funded by the above mentioned grant, has been installed. A final technical report required by the grant conditions is attached.

During the past decade, the County of San Diego has been developing one of the finest communications system in the nation. Completion of the recently installed system has significantly increased the County's communications capability. I would like to express my appreciation to you for your assistance in making possible this successful installation.

Very truly yours,

G. B. WILSON, Director
Department of General Services

GBW:RRW:CH:ss

Attachment

cc: LEAA
Fiscal and Personnel
Criminal Justice Coordinator

TABLE OF CONTENTS

	Page
I. ABSTRACT	1
II. PURPOSE	2
III. SYSTEM PLANNING	3
IV. PROCUREMENT AND INSTALLATION OF EQUIPMENT	5
V. EQUIPMENT DESCRIPTION	6
VI. DESIGN DEVELOPMENTS	10
VII. PROBLEM AREA	11

I. ABSTRACT

During 1970 the County of San Diego developed a plan for a communication system to meet the communication needs of the law enforcement and other public safety agencies in Region XI. It was envisioned as expanding the capacity of the County Microwave System to make possible the linkage of all cities in Region XI. The expanded system would provide the capacity for hardcopy, data and voice transmissions between law enforcement and other public safety agencies of the County and participating cities. Future uses envisioned the implementation of a Dial 911 emergency telephone system.

The United States Department of Justice designated the County of San Diego as an agency eligible for discretionary grants. The County applied for and was awarded Discretionary Grant #71-DF-687. The award of the grant provided a means to implement the Communications System for Coordinated Law Enforcement.

Contractual arrangements were made for a commercial firm, under the supervision of County personnel, to engineer the system, furnish the hardware, then install and test the system. Agreements were made between the County and participating cities for the location of system equipment and the floor space, power and other support to be provided by the cities.

The Communications System for Coordinated Law Enforcement has been procured and installed. Some problems were encountered which caused a slippage in the original project completion date. The installed system, with the addition of channelizing equipment and user terminals, will have the capability to satisfy the communication needs of regional law enforcement and other public safety agencies for many years to come.

II. PURPOSE .

The purpose of this technical report is to present the general information required to assess the County of San Diego Communications System for Coordinated Law Enforcement.

This technical report describes the planning conducted for the system, the procurement and installation of the system, a description of the system equipment, changes made in system design and the major problem areas encountered.

III. SYSTEM PLANNING

The communication needs of the law enforcement agencies in Region XI were investigated during a study performed by a consulting firm. The study entitled "Feasibility for a Coordinated Law Enforcement Records and Communications System" was financed in part by a grant from the California Council on Criminal Justice. Some pertinent recommendations were made by the consultant which assisted the Region in developing the following objectives:

- A. A coordinated mutual aid dispatching system for all regional law enforcement agencies.
- B. Computer access to law enforcement records and information for all regional law enforcement agencies.
- C. A hot line intercommunication system to interconnect all regional law enforcement agencies.
- D. A Dial 911 emergency number telephone system to meet the needs of the public for rapid access to law enforcement and other public safety services.

The County has developed this communications system to meet the needs of the regional law enforcement and other public safety agencies.

The Project included the procurement and installation of the Regional Microwave Communications System shown in Figure 1. This system consists of 12 microwave radio links interconnecting 10 cities as well as governmental and special district offices of Region XI. The system, with the addition of ancillary equipment, will have the capacity to carry a very large amount of communications between the regional law enforcement agencies.

Future system uses will include the implementation of a Dial 911 concept; the extension of the Regional Microwave System to the three cities in San Diego County not included in the initial plan; and the acquisition of equipment to divide the broad band microwave radio signals, provided by the present system, into some 600 channels suitable for transmissions such as hardcopy, voice, and data.

IV. PROCUREMENT AND INSTALLATION OF EQUIPMENT

The system described above was procured under Grant 71-DF-687. The equipment was received during April 1972. The contractor installed the equipment between April and August, 1972, and optimized and tested the links in August 1972. The amount of equipment purchased from grant and County matching funds consisted of:

<u>EQUIPMENT DESCRIPTION</u>	<u>GRANT FUNDS</u>	<u>MATCHING FUNDS</u>
12 GHz Terminals	20	4
4 ft. Antenna	2	10
6 ft. Antenna	0	6
8 ft. Antenna	0	1
8 ft. Antenna HP	3	0
10 ft. Antenna	0	2
1 12 x 16 ft. Passive Antenna	0	1
Vertical Antenna Mounts	0	24
Waveguide Kit	0	30
Waveguide	0	1375 ft.
Antenna Feed Guy Kit	0	13
3 Way Decoupler	0	7
Antenna Towers	0	15

V. EQUIPMENT DESCRIPTION

The MRS-1200 microwave relay equipment is solid-state, frequency-modulated and wideband remodulated microwave system. The system has the capability of providing up to 1200 frequency-division multiplex (FDM) channels. The basic equipment consists of one transmitter, one receiver, and one power supply.

The transmitter is a solid-state unit with an rf power source consisting of transistors and varactor multipliers, mechanical relays, and power tubes. A block diagram of the 12 GHz transmitter is shown in Figure 2. The baseband amplifier accepts the signal input and processes it to modulate the 2 GHz oscillator. The 2 GHz oscillator is the primary frequency-generating module in the transmitter. It operates at one-sixth of the assigned output frequency and is maintained on this frequency by an automatic frequency control. The isolator provides a one-way rf signal path and improved impedance matching. A five (5) watt, 2 GHz amplifier raises the 2 GHz oscillator output to a five (5) watt level. Two varactor multipliers increases the frequency from 2 to 12 GHz. The transmitter logic and alarm provides continuous monitoring of the transmitter rf power output level. The pilot demodulator provides a fault indication when the transmitter pilot signal goes below threshold level.

The receiver is a solid-state, single channel, super-heterodyne unit which processes frequency modulated microwave signals and delivers two outputs of a standard video, message, or data signal. A block diagram of the 12 GHz receiver is shown in Figure 3. The received signal is applied to the channel filter to remove unwanted signals. The isolator provides a one-way rf signal path and impedance matching. The local oscillator provides a stabilized rf signal at about 2 mw. The signal is 70 MHz above or below the received carrier. The mixer pre-amplifier accepts the received signal and mixes it with the local oscillator generated signal to produce a 70 MHz difference signal. The 70 MHz intermediate frequency (IF) signal is amplified about 25 db before being applied to the IF network. The 70 MHz signal is received in the IF network where it is filtered for proper bandwidth, corrected for parabolic group delay, and forwarded to the IF amplifier. The amplifier provides a maximum gain of 60 db for a low-level signal. An automatic gain control maintains the output signal at approximately the same level over a wide range of incoming signal levels. The amplifier forwards the signal to the second IF filter and phase equalizing network where the signal is again set for proper bandwidth and corrected for phase distortion and parabolic group delay. The signal is then routed to the IF limiter for removal of amplitude modulation signals from

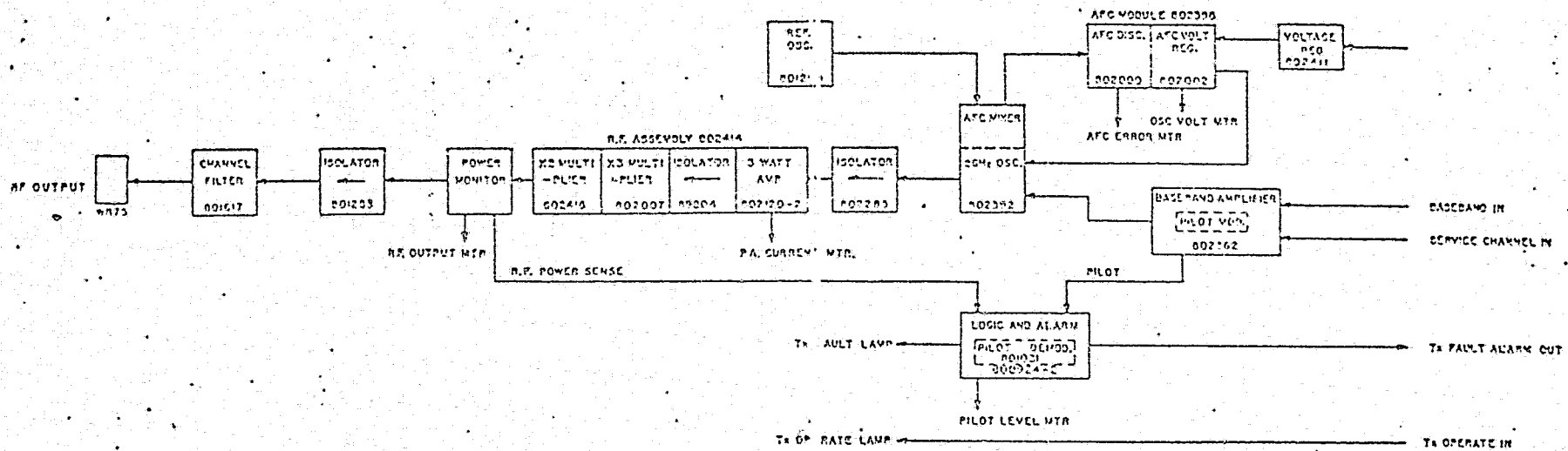


FIGURE 2
 12 GHz Transmitter
 Block Diagram

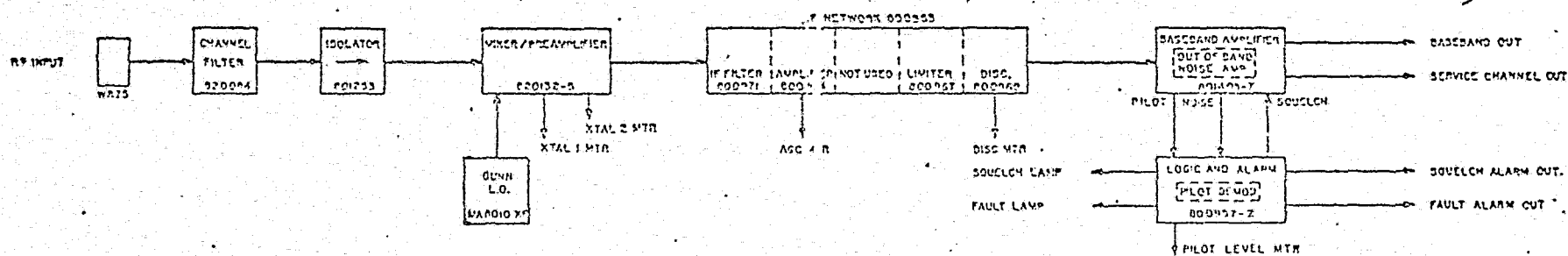


FIGURE 3

12 GHz Receiver
Block Diagram

the 70 MHz intermediate frequency and then forwards the signal to the IF discriminator. The discriminator demodulates the 70 MHz frequency-modulated signal to produce an amplitude-modulated baseband signal. This signal is forwarded to the receiver baseband amplifier where the baseband signal is amplified to reproduce the transmitter input signal. The receiver logic and alarm provides continuous monitoring of the receiver baseband for out-of-band noise level. The pilot demodulator provides a fault indication of pilot signal loss.

The power supply is a solid-state unit which provides the necessary operating voltage to operate one transmitter, one receiver and associated auxiliary equipment. The power supply operates from a floated " - 48 volt" battery. This primary input voltage may vary considerably from its nominal floated value. Six output voltages are provided of which five are regulated. The regulated voltages are +12V, -12V, -24V, +24V and +28V. The unregulated voltage is -48V. The power supply output performance characteristics are:

<u>OUTPUT VOLTAGE</u>	<u>MAXIMUM OUTPUT CURRENT</u>	<u>MAXIMUM RIPPLE VOLTAGE</u>
-48 volts dc	1.0 amps	
-24 volts dc	1.9 amps	3 mv peak-to-peak
-12 volts dc	0.25 amps	5 mv peak-to-peak
+12 volts dc	0.25 amps	5 mv peak-to-peak
+24 volts dc	0.1 amps	5 mv peak-to-peak
+28 volts dc	1.8 amps	10 mv peak-to-peak

VI. DESIGN DEVELOPMENTS

The radio equipment originally proposed by the contractor and accepted by the County was the MRS-400 12 GHz. Subsequently, the contractor recommended that the original equipment be replaced with the newer MRS-1200. The County accepted the recommendations. The decision to use the new equipment was considered to be the best interest of the law enforcement agencies and the County because the newer equipment will provide better system performance; is capable of handling additional future growth of the system; and it is more economical to support.

VII. PROBLEM AREAS.

A. Change in Scope

The regional law enforcement usage of the microwave system was determined to be much more extensive than was originally envisioned. It was, therefore, considered prudent to delay the purchase of multiplex (channelizing equipment) and terminal user equipment until a more detailed study could be made of the requirements of the small cities served by the system. The system has the capacity to handle the communication requirements of the small cities, however the multiplex equipment as originally planned was not adequate. If the multiplex equipment had been installed as planned, large portions would have soon become obsolete. The major changes caused by the revision was a reduction in the total project costs.

B. Delivery and Licensing Delays

The change in equipment from the MRS-400 to the newer MRS-1200, described in Design Developments, was made realizing the possibility of late delivery of equipment. The change did result in late delivery of equipment and also resulted in a delay in obtaining the F.C.C. license, as the license application had to be resubmitted to cover the new equipment. The delivery and licensing delays caused a slippage in project completion from August 31, 1971 to June 30, 1972.

C. Installation Delays

Prior to installing the equipment, County personnel visited the city managers, police chiefs and fire chiefs of all of the cities involved to formalize the exact locations of antenna towers and floor space available for installation of radio equipment. Subsequently, one of the cities desired a change in location which required obtaining and installing a passive antenna that was not included in the original equipment list.

A problem developed at the installation on the County Courthouse in that analysis showed the roof load would be unsafe as it was originally planned. The design of the tower for the Courthouse roof was modified and manufacture of the new special tower was accomplished. The installation delay caused a slippage in project completion from June 30, 1972 to August 31, 1972.

L. , Feliz
July 8, 1974

JUNE ACTIVITIES REPORT

1. Meetings attended
Problems and needs: 1975 Plan
Northern California APCO

2. Technical Assistance consulting
Region D: Countywide Systems: Yuba, Sutter,
Placer, Nevada and Sierra
Region E: Sonoma Countywide System Plan
Region N: Tulare Sheriff's Office
Statewide 911 Planning

3. CRACLE
Phase I
Data Processing
Phase I Report
Communications Planning Guidebook
Radio Frequency listing
Phase II
Staffing
Database update and maintenance

END

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