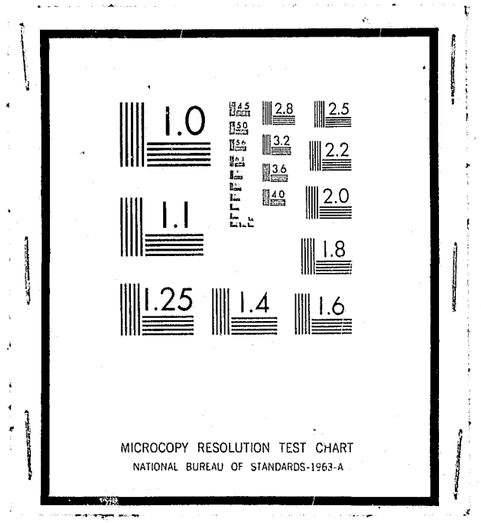


INDIVIDUAL TECHNICAL ASSISTANCE REPORT

In Response to a Request for Technical Assistance

by the

East Central Iowa Area Crime Commission

November 16, 1973

Prepared by:

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

(Per Contract J-LEAA-015-72)

I. PRELIMINARY INFORMATION

A. **Consultant Assigned:**

A. Robert Patzlaff
Communications Consultant

B. **Date Assignment Received:**

August 31, 1973

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

September 7, 1973

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

October 8—11, 1973

E. **Individuals Contacted:**

Jack Kellogg
Iowa Crime Commission

Robert Hilgenberg
Iowa Crime Commission

Doug Edmonds
Deputy Sheriff
Johnson County

David Epstein
Director, Public Safety
Iowa City

Paul White
Police Chief
Coralville, Iowa

John Dooley
Communications
Iowa University

Wayne Williams
Director, Civilian Defense

Jeff Petrie
Clerk and Ambulance Operator
Johnson County

Ray Seiler
Iowa Planning Board

Don Strand
Detective
Iowa City

Dwight Armstrong
Communications Officer
University of Iowa

Mr. Johnson
Manager, Northwestern Bell
Iowa City

Don Jacobson
911 Manager
Northwestern Bell

II. STATEMENT OF THE PROBLEM

A. Problem as per Request for Technical Assistance:

The law enforcement agencies of Johnson County, Iowa, desire to combine the communications function. Technical assistance in designing a consolidated communications system was requested.

B. Problems Actually Observed:

As stated.

III. FACTS BEARING ON THE PROBLEM

See attached Consultant's Report.

IV. DISCUSSION OF POSSIBLE COURSES OF ACTION

See attached Consultant's Report.

V. RECOMMENDED COURSE OF ACTION

See attached Consultant's Report.

CONSULTANT'S REPORT

Johnson County, Iowa, Radio Communication

System Review

I. NATURE OF THE PROBLEM

Johnson County, located in East Central Iowa, has an area of approximately 650 square miles and a population of just over 72,000 persons. The County has the unique situation, however, in that 75 percent of the population is concentrated in about 6 percent of the area of the County. This area is in the vicinity of Iowa City, the home of the University of Iowa campus. In close proximity to each other are the Iowa City Police Department, the Johnson County Sheriff's Police Department, the City of Coralville Police Department, and the University of Iowa Security Force.

Presently the Johnson County radio dispatcher dispatches sheriff's vehicles and the City of Coralville vehicles on a 24-hour basis. Iowa City has a separate radio frequency and dispatches its police vehicles during the daytime on their assigned channel, but after 11:00 p.m., due to the lower volume of traffic, the Iowa City Police Department transfers to the Sheriff's channel. Each, however, maintains a separate dispatch capability.

Preliminary studies by administrators in Johnson County and Iowa City have determined that $10,000 per annum can be saved by combining the two radio dispatch facilities and the jail facilities while providing more effective operations. A radio study was requested to determine the feasibility of combining radio communications equipment for single dispatch operation from the Johnson County Police Department with a view towards a possible future program which would construct a new combined city-county facility. This report, therefore, will discuss and recommend a combined dispatch facility and a new and improved communications system operating in the 150 MHz band.

At the present time, the County is operating on a radio frequency of 37.10 MHz. This is a common channel used throughout the State of Iowa and is very heavily loaded with radio traffic. The objectives the County is seeking are:

1. Increased portable communication range.
2. Two radio dispatch positions at a common location.
3. Countywide radio communication coverage.
4. Cooperative intercommunication capability between all units.

University of Iowa

While the University of Iowa operates their own security forces, the intent is that they remain autonomous in their operation since their enforcement procedures are somewhat different from the general methods used in the county and city police departments. There are times, however, when the University must call upon the City or County for assistance, and at the present time this is accomplished through wire line connections from the city and county police radio base stations into a communication console at the University. The University recently installed a new modern communication console, which gives them complete control of their facilities. Therefore, in this report there will be no changes recommended in the present arrangement used by the University but the report will be directed at the cooperative use of city and county equipment. The direct line connections now utilized between the University and the other police departments will continue since it has been a satisfactory arrangement.

II. FACTORS BEARING ON THE PROBLEM AND BACKGROUND INFORMATION

At the time of the field visit there was no decision on if or where a new combined facility may be built. This report, therefore, will only consider combining communication facilities for dispatching from the present Johnson County police building. The recommendations made will be such that should a new building be built the equipment could be moved to the new facility or used at an emergency dispatch locations.

Existing Equipment

Capability for operation on the following radio channels is now available at the departments indicated:

A. Sheriff's Department

1. High band point to point 155.370 MHz.
2. County Sheriff Frequency 37.10 MHz (transmit and receive).
3. State Highway 42.58 MHz (receive only).
4. County Fire 154.340 MHz[1] (transmit and receive - fire dispatching).

   154.280 MHz (fire mutual aid - transmit and receive).

B. Coralville, Iowa, Police Department

Coralville controls the 37.1 MHz transmitter at the Sheriff's Department by a remote control unit connected over a leased wire line. Coralville operates a station in the citizens band and also monitors 48.52 MHz, the State Patrol channel.

Iowa City Police Department

1. Point to point 155.370 MHz (transmit and receive.
2. City frequency 37.320 MHz.
3. County frequency 37.100MHz.

[1] The County controls approximately 60 alert monitor receivers located in schools throughout the County used for civilian defense, storm warning, or other emergency information.

D. The University of Iowa

Communication facilities at the University of Iowa are summarized in a letter dated September 5, 1973, and attached as an addendum to this report. (See Attachment A.)

Other factors having a bearing on this communication study are:

1. The State of Iowa is planning a coordinated statewide communication system and has assigned the following radio frequencies for use in the Johnson County area:

   - Base Transmit 155.685 MHz.
   - Mobile Transmit 155.770 MHz.

2. The County controls the operation of the ambulance services and is planning to install new high band (150 MHz) radios in the ambulances which will have the capability to transmit on the hospital emergency frequencies of 155.385 MHz and 155.340 MHz for mutual aid from other counties.

3. The State has established 155.475 MHz as the state law enforcement cooperative communication channel for mutual police assistance.

4. The following numbers of vehicles are operated by each Department:

Sheriff	6 county-owned vehicles
	4 private vehicles
Total	10
Coralville	3 city cars
	1 private car
Total	4
Iowa City	12 patrol vehicles
	2 motorcycles
	1 animal van
Total	15

III. ANALYSIS OF PROBLEMS AND POSSIBLE COURSES OF ACTION

Combined Dispatch Facilities (See Exhibit 1)

Remodeling of the area presently used by the Sheriff's dispatcher is necessary to convert it into a more effective communications center. The following recommendations are made:

The radio transmitting equipment now located in the equipment room should be moved to the storage room at the north end of the building. This room will provide more room for the radio equipment and facilitate servicing without disrupting the dispatchers' work. Several upright cabinets could be mounted side by side and accessibility to both the front and back of the cabinets would be available. While this will require antenna cables to be approximately 40 feet longer, the loss should not be more than 1/2 db, which should have little effect on the overall system operation. Removing the radio equipment from the present room will permit this room to be more suitably fitted for the teletype and other record information. This room could be lined with an acoustic sound absorbing material to reduce the noise level generated by the teletype machine.

Radio Dispatch Console

Because of the space limitations in the present area it is recommended that the County use a version of the standard multi-station modular communication control centers offered by several of the manufacturers and which may be mounted on a desk or table counter area. The present counter area could be suitable for such a control center. These control centers are basically standard equipment and can usually control up to eight or nine radio stations. The use of such a counter top control turret would also simplify any move to a new facility in the event the County builds a new building. The desk top units would involve less of an investment than at the present time, save space, and consolidate all controls into a single unit. It is recommended that two identical units be purchased and that they be located side by side.

Transitional System Considerations

The console turrets would be designed to immediately control the existing base stations but also be equipped with modules for the new high band radio equipment when installed, thereby providing for a smooth transition from low band to high band. At the present time, it is recommended that the city radio transmitter on frequency 37.32 remain at the civic center location. The reason for this is that between frequencies 37.10 MHz and 37.32 MHz there is only 220 KHz spacing. Thus, transmission on ony of the stations would cause desensitizing to the other if they were located at the same site. The civic center transmitter is approximately .4 of a mile from the county police transmitter. This

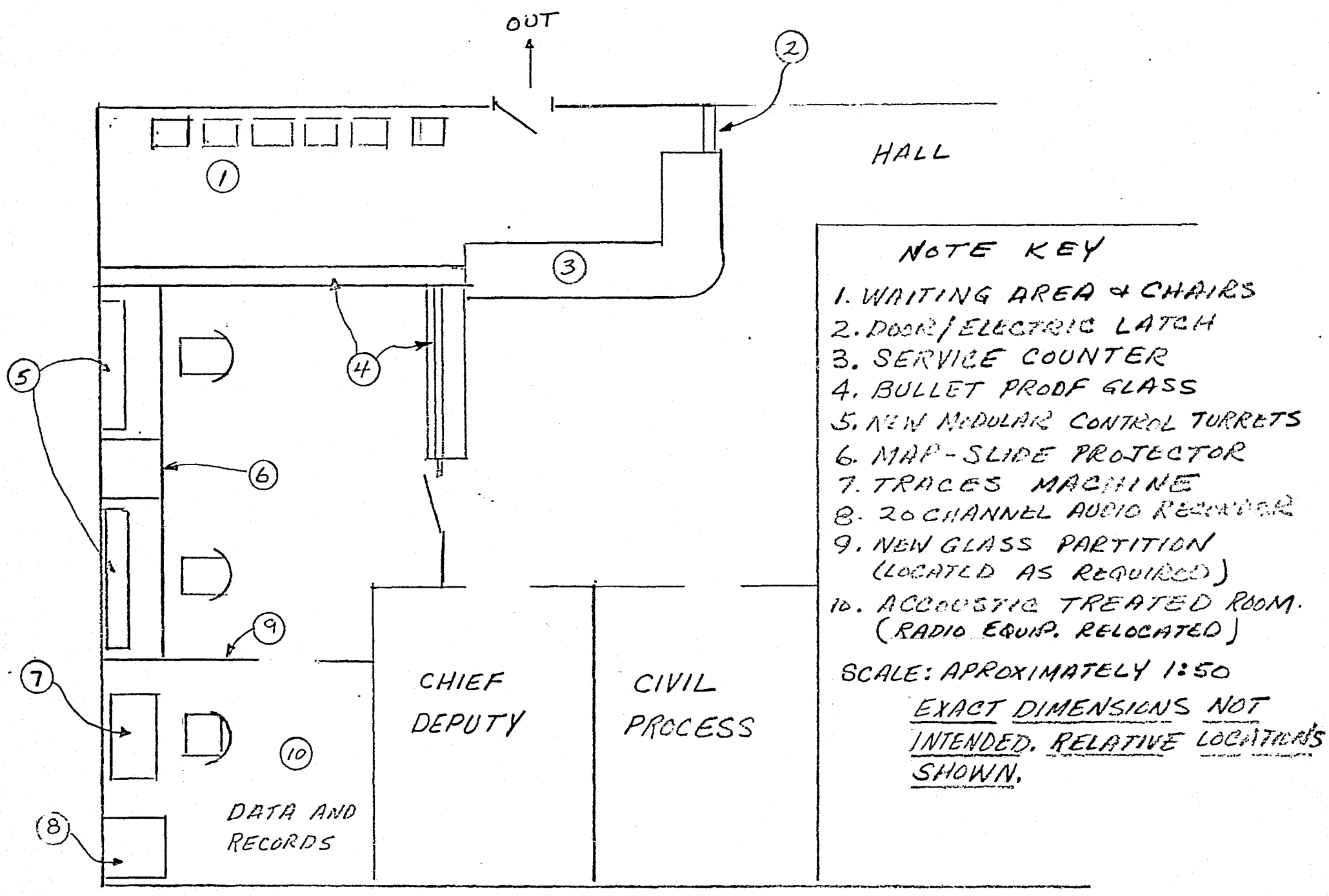


EXHIBIT 2 JOHNSON COUNTY, IOWA - COMBINED COUNTY AND CITY DISPATCH ROOM - COUNTY POLICE BUILDING.

arrangement is operating satisfactorily at the present time, although an analysis by calculation indicates there is probably about 8 db desensitizing to one transmitter when the other is on the air. This is probably not noticeable because of the strong signals received from patrol cars in the immediate area of Iowa City, which would easily overcome this small amount of desensitizing. If both transmitters were located at the same location, however, it would be difficult to obtain sufficient isolation between them to prevent serious desensitizing and a reduction in range to county cars on 37.100 MHz. The effect would be that if the County were receiving a mobile unit with a relatively weak signal and the city transmitter came on the air, the mobile signal would suddenly be lost even though the city transmission would not be heard. This condition is avoided by retaining the tower at the City and using a leased line to control the city transmitter. This arrangement will also provide a stand-by 37.10 transmitter for the control center since the cCity equipments are designed for two frequency operation. The existing City point-to-point transmitter (155.370 MHz) should also be retained at that location and converted for use on 155.475, the police mutual aid channel.

Another desensitizing condition between frequencies which must be given consideration is that between the existing point-to-point frequency of 155.370 and the newly proposed hospital frequencies of 155.340 and 155.385. The 155.385 channel is only 15 KHz removed from the 155.370 point-to-point channel and serious desensitizing and possible modulation peak interference is expected between these two frequencies if located at the same site. The best arrangement would be to have the hospital transmitter located at the Veterans Administration Hospital location. However, even at this distance, some interaction between 155.370 and 155.385 is possible.

Controlling Ambulance Radio Channels

Locating the hospital radio equipment at the Veterans Administration Hospital would permit the installation of remote control units within the hospital as licensed as control points. However, another control point should be licensed at the police communications center and terminated on the control console. This position should also have the facility for phone patch operation. In this mode of operation the ambulance units would not be dependent on whether an operator at the hospital was alert to receive a call because all calls would be received by the police radio dispatcher on this console position. The police operator through use of a phone patch could direct the call to any location via telephone or alert the hospital that a car was en route and, if necessary, the hospital could activate the remote control unit.

Control Turret Capability

The control modules which should be provided in the desk top modular control unit are as follows:

1. Control transmitter and receiver - 37.10 MHz.

2. Control transmitter and receiver - 2 frequency 37.28 MHz. and 37.10 MHz - (transmitter at civic center).

3. Transmitter and receiver for point-to-point - 155.370 MHz (transmitter at County location).

4. State - mutual aid - 155.475 MHz transmit and receive - (transmitter at civic center).

5. Receive only 42.58 - State Patrol.

6. Fire transmitter and receiver - 2 frequency transmit and receive 155.280 and 154.370 MHz.

7. Hospital communication transmitter - 2 frequency transmit and receive 155.385 MHz and 155.340 MHz - (transmitter at V. A. Hospital.

8. Control of new high band base repeater station.

9. Optional - Remote receiver and stand-by repeater.

10. Monitor and voting control for 154.770 receivers.

A diagram illustrating the overall control configuration is submitted as Exhibit 2.

Conversion to High Band Communication System for the County

Iowa City is in an area of low ground elevation surrounded on all sides by higher terrain. This fact limits the effective height of the existing sheriff's tower, which is already at its maximum level due to aircraft restrictions imposed by the airport located approximately one mile southwest of the County Courthouse. The situation is particularly critical to the northeast direction where ground elevation rises sharply to approximately 100 feet above the Courthouse elevation. To the west and northwest, takeoff is more favorable since the Courthouse itself is on a hill with sharp falloff to the west.

Radio Range Considerations

Using U. S. Geological Survey Topographic Maps, ground elevation profiles were drawn in several directions from the Courthouse to show the actual terrain variations. These are submitted as Attachment B of this report. Based on this information, the range

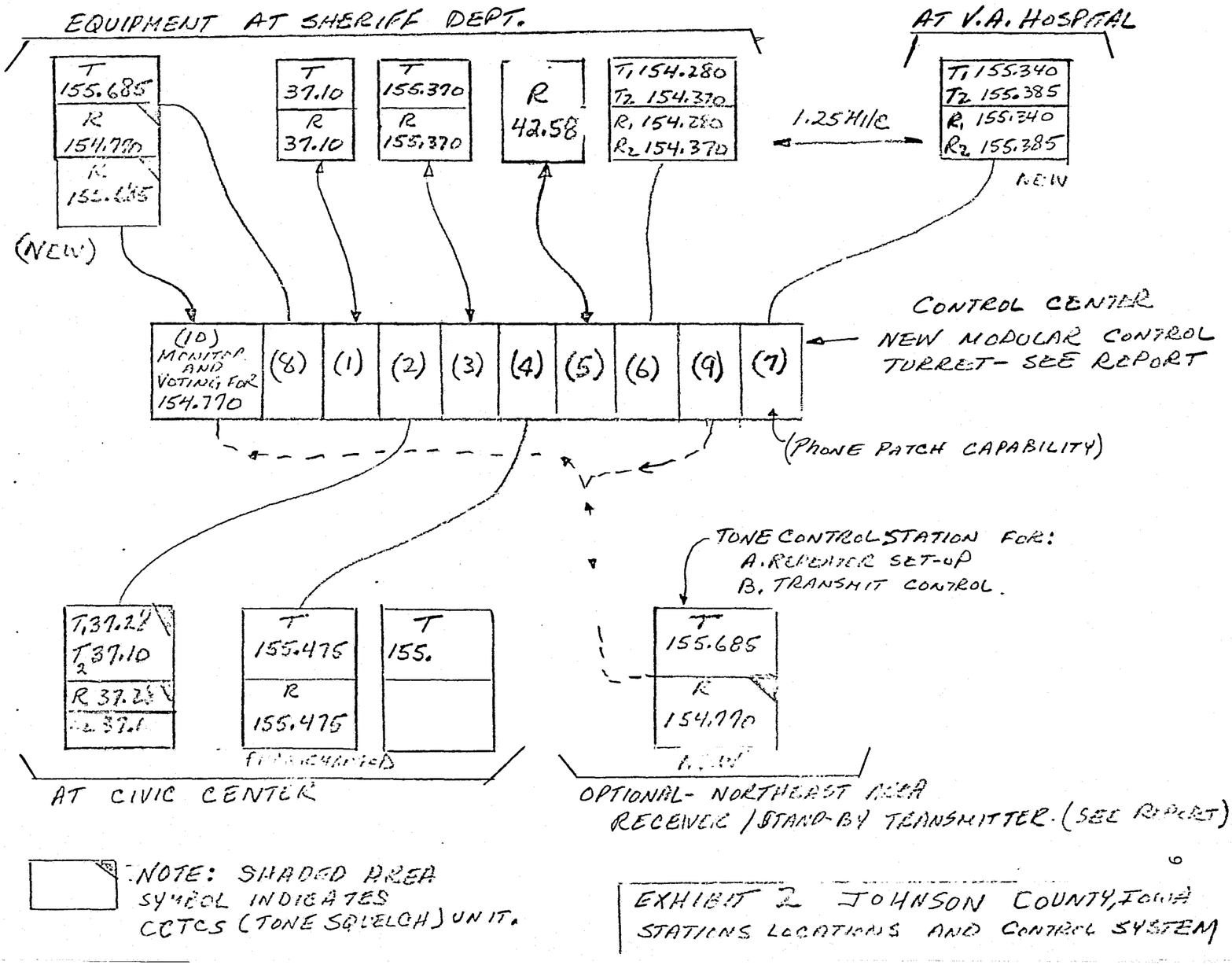


EXHIBIT 2 JOHNSON COUNTY, IOWA
STATIONS LOCATIONS AND CONTROL SYSTEM

predictions illustrated in Exhibit 3 were made. This exhibit shows the range expected for talk-back from a 5 watt portable and also the range for talk-out from a 250 watt base station with 5 db antenna. The larger circle (the 250 watt base range) would also approximate the talk-back range from a 100 watt mobile unit using a 3 db antenna. The range predicted shows some expected marginal coverage in the northeast portion of the County. In this area signals can be expected to drop to a marginal level depending upon the exact location of the vehicle at a given time. The question, then, is what is the best method for covering this northeast area and what value does the County place on coverage since there is relatively little population in this area?It should be recalled that 75 percent of the Johnson County population is near the metropolitan area of Iowa City.

The following two alternatives were considered for achieving coverage throughout the County:

1. Install four talk-back receivers--one in each quadrant of the County for providing solid talk-back coverage from 5 watt portable radios. Use 30 or 60 watt mobile radio power.

2. Equip the Sheriff's mobile units with the ability to repeat portable talk-back transmissions to the dispatch point and consider as an option one additional low power transmitter-receiver unit in the northeast quarter of the County located approximately six miles northeast of Iowa City. Use 100 watt mobiles for Sheriff.

A cost comparison of these two options reveals the following:

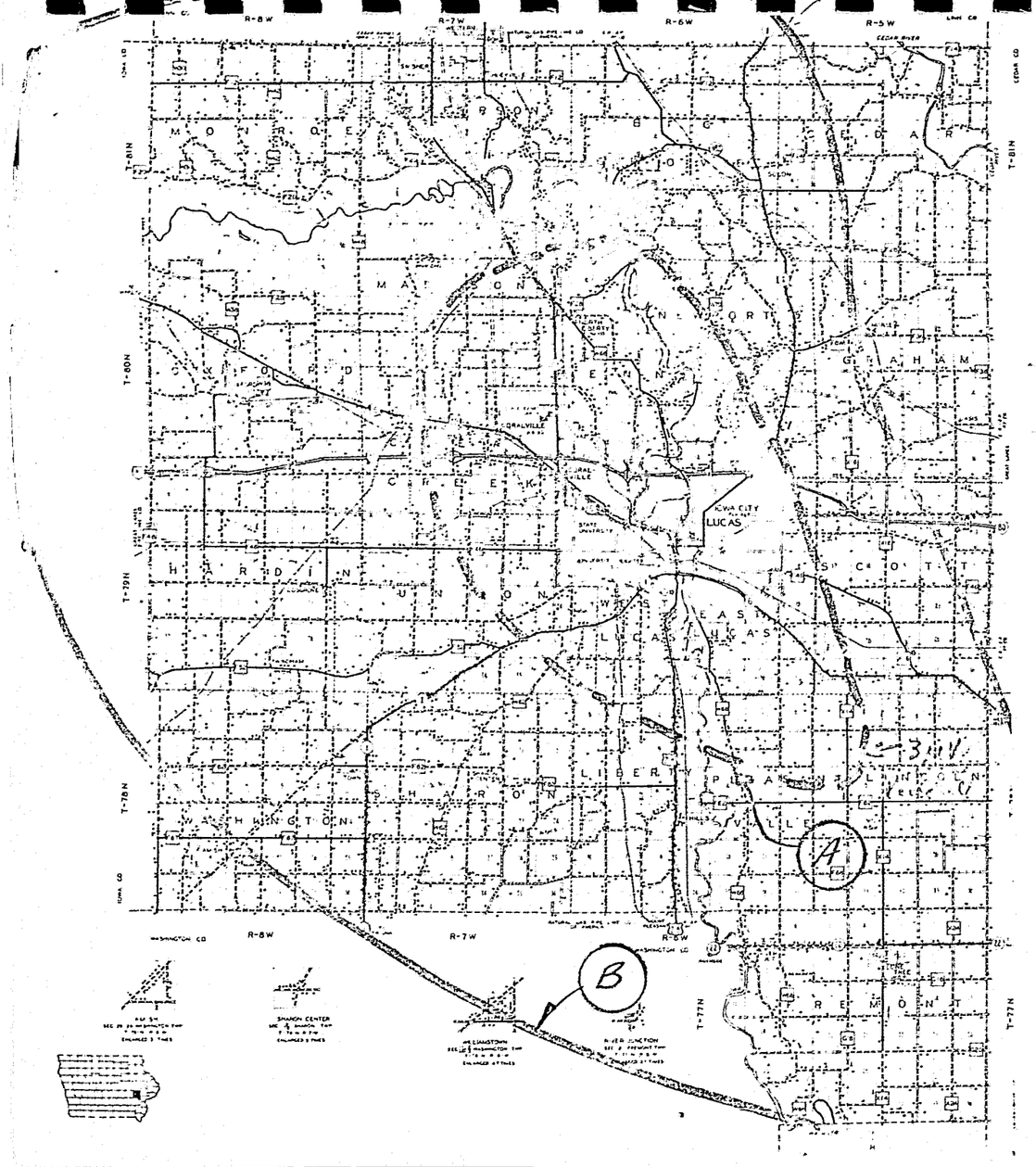
Option A

Multiple Receivers - three receiver sites with 100 foot tower estimated at $3,200 each:	$ 9,600
One receiver site with transmitting capability (northeast) estimated price:	4,600
Receiver voting equipment - estimated price:	1,500
Total	**$15,700**

Plus: Monthly lease line cost $200 per month.

Option B

Mobile Unit Repeat Capability - premium amount for repeat capability in 10 Sheriff's cars estimated at $500 additional per car:	$ 5,000



GENERAL HIGHWAY AND TRANSPORTATION MAP

JOHNSON COUNTY

IOWA

PREPARED BY THE
IOWA STATE HIGHWAY COMMISSION
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

DATA OBTAINED FROM
HIGHWAY PLANNING SURVEYS DEPARTMENT

1971

EXHIBIT 3

EXPECTED RANGE TO EXISTING RADIO TOWER AT COUNTY POLICE HQ. DISTORTED PATTERN IS RESULT OF HIGHER GROUND SURROUNDING IOWA CITY.

A. 5WATT PORTABLE

B. 100W. MOBILE WITH 3DB ANT. OR 250 W. BASE.

ASSUMES 5db ANT. AT TOP. - 150 MHz BAND

Additional transmit channel in 10 Sheriff's portables at $50 per unit:		500
Premium for ten 100 watt mobile units, $110 each:		1,100
Optional repeater station (northeast):		4,600
Receiver voting equipment:		1,500
	Total	$12,200

Plus: Leased line charges $30 a month.

It should be noted that in Option B, 100 watt mobile units would be recommended to provide the more reliable mobile talk-back coverage and thus this option would result in a higher cost mobile. If receiver sites were located throughout the County, 30 or 60 watt mobile units would be sufficient to provide talk-back coverage. The analysis favored the mobile repeat because of the few number of mobile units used by the Sheriff's Department. It will not be necessary to provide this capability in Coralville or Iowa City cars since they are within the primary coverage range expected from the tower location.

Northeast Station--Optional

The addition of the repeater station to the northeast is considered an optional one which could be added at a future time and controlled by a tone control module in the console to permit repeater set-up, or station control over one line. This additional repeater station could offer several advantages for system reliability. It is recommended that such a station have a 30 to 60 watt power capability, an A.C./D.C. power supply, and battery stand-by power. It should be located on high ground elevation in excess of 800 feet at some point in the vicinity of Newport, Iowa. This station could be used to cover the Iowa City area and a good portion of the County due to its high elevation and should there be a failure in the existing main transmitter it would provide a good stand-by on high ground. The station would normally serve only as pickup receiver for the northeast portion of the County. Signals it received would go to a voting network and be compared to that received at the County headquarters station. The northeast transmitter would normally not be activated for repeat operation. However, portable units operating in that vicinity could have extended unit-to-unit range within the service area of that station if the repeater were activated by the dispatcher. Control of the repeater would, of course, be under the control of the dispatcher. The dispatcher could also use this transmitter to talk out to mobile units when additional signal strength were needed for a particular spot in the northeast. It is recommended that the County give careful consideration to installation of this station for the reasons stated above. If the station is installed, it should be specified that it would automatically revert to repeat operation should there be failure in the control line. If installed, its primary function would be to provide extended talk-back reception, and its secondary function as a stand-by repeater for covering the area shown on Exhibit 4.

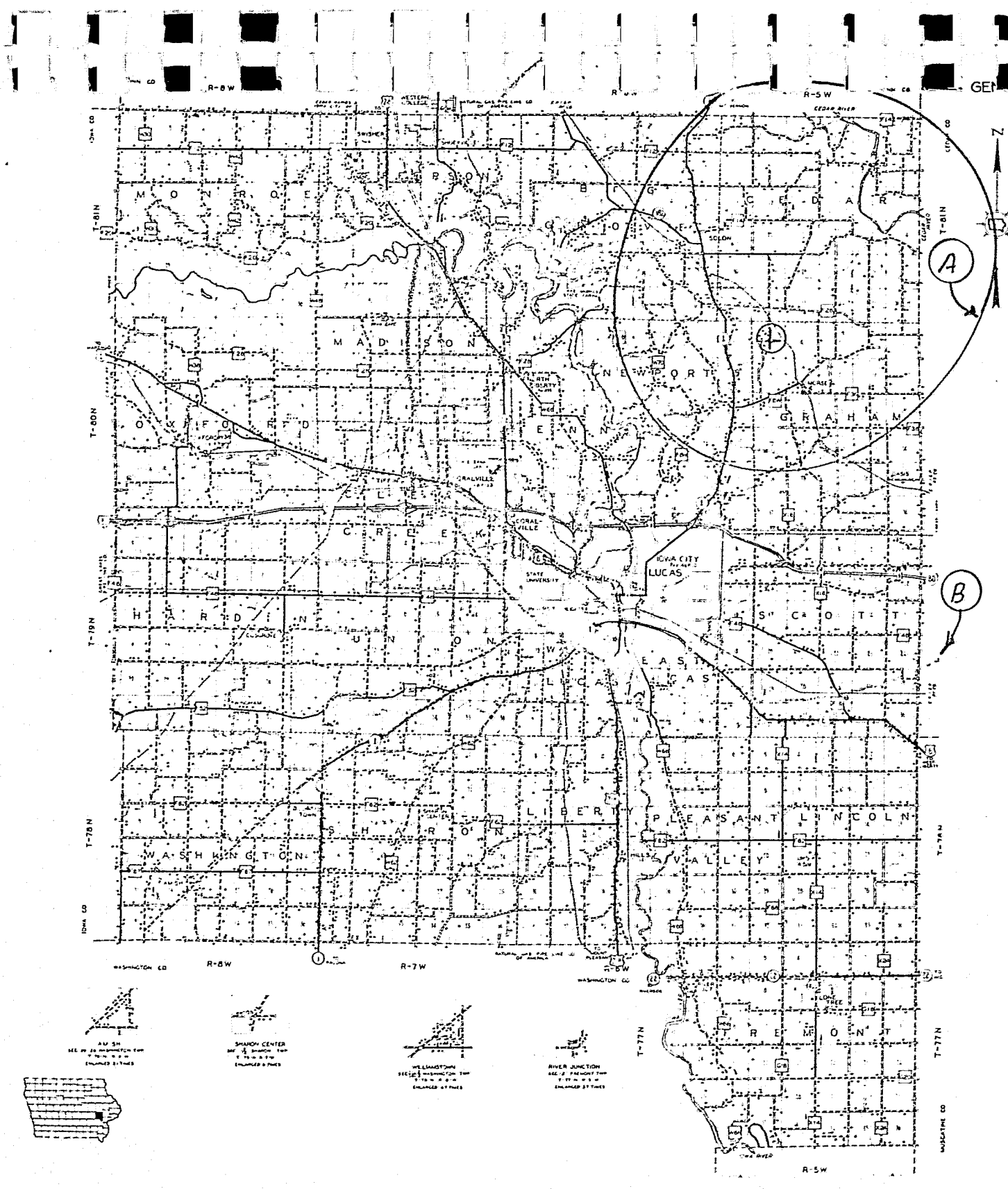


EXHIBIT 4

EXPECTED RANGE FROM 30 WATT STATION IN NORTHEAST IF IN GRAHAM TOWNSHIP SECTION 5.

A. 5 W. PORTABLE

B. BASE RANGE OR MOBILE TALK BACK

ASSUMES:

100' TOWER

5 DB OMNI. ANT.

150 Mhz Band.

Antenna Configuration–County Courthouse Location

Due to the close frequency space between 155.370 and the 155.685 talk-out frequency of the new system, caution must be exercised in mounting antennas. It is recommended that the antenna for the new system be mounted at the top of the tower, the fire antenna be mounted 60 feet below the top, and the point-to-point antenna (155.370) be mounted 90 feet below the top.

Intermodulation Analysis

Exhibit 5 shows the difference between all frequencies on the tower in the ultimate system and indicates no direct third order intermodulations products by simultaneous transmission of any two transmitters on the tower. It should be noted that the close frequency spacing between the two fire frequencies is not a factor since the corresponding receivers will be muted when any one of the fire frequencies is transmitting. The County is cautioned against these possible interference possibilities:

1. If there is a Channel 9 TV station in Iowa City, intermodulation between the 37.10 and all high band units is a possibility.

2. Any broadcast stations on frequencies that is of 600 kilocycles, 950 kilocycles, 1,000 kilocycles, 1,090 kilocycles, 1,350 kilocycles, or 1,405 kilocycles could produce intermodulation between the transmitters and receivers indicated for these frequencies differences. Such a broadcast transmitter would have to be very close to the tower to cause this type difficulty.

JOHNSON COUNTY, IOWA, - EXHIBIT 5
INTERMODULATION ANALYSIS
(FREQUENCY DIFFERENCES IN KHz, EXCEPT * ARE MHz)

	NEW REPEATER STATION		FIRE		POINT TO POINT
	T/R 155.685	R 154.770	T and R 154.370	T and R 154.28	T and R 155.370
T/R155.685		915	1315	1405	315
R 154.770	915		400	490	600
T/R154.370	1315	400		90(4)	1000
T/R154.280	1405	490	90(4)		1090
T/R155.370	315	600	1000	1090	
T/R 37.10	118.585*	117.670*	117.270*	117.180*	118.270*
37.10(sum)	192.785*	191.87*	191.47*	191.28*	192.47*

1. No third order products between above channels.

2. Channel 9 TV, in area could cause problems and necessitate special filters.

3. Near-by broadcast stations.

4. Receiver is muted when corresponding transmitter is active.

IV. RECOMMENDATIONS

Sheriff System Mobile Unit Frequencies

With the mobile talk-back repeat option, it will be necessary that the Sheriff's cars be equipped with an additional receiver frequency for this purpose. The frequency of 156.150 MHz is suggested as a possibility.

The overall frequency arrangement in the Sheriff's patrol cars is recommended as follows (See Exhibit 6):

1. Iowa Police mutual aid transmit and receive 155.475 MHz.

2. Car to base and repeat through base transmit 154.770 and receive 155.685.

3. Sheriff car to car direct transmit and receive 155.685 MHz.

4. Spare channel for possible city frequency - (Refer to "Iowa City Police System" in a subsequent section).

Portable radio units used by the Sheriff would be on the following frequencies:

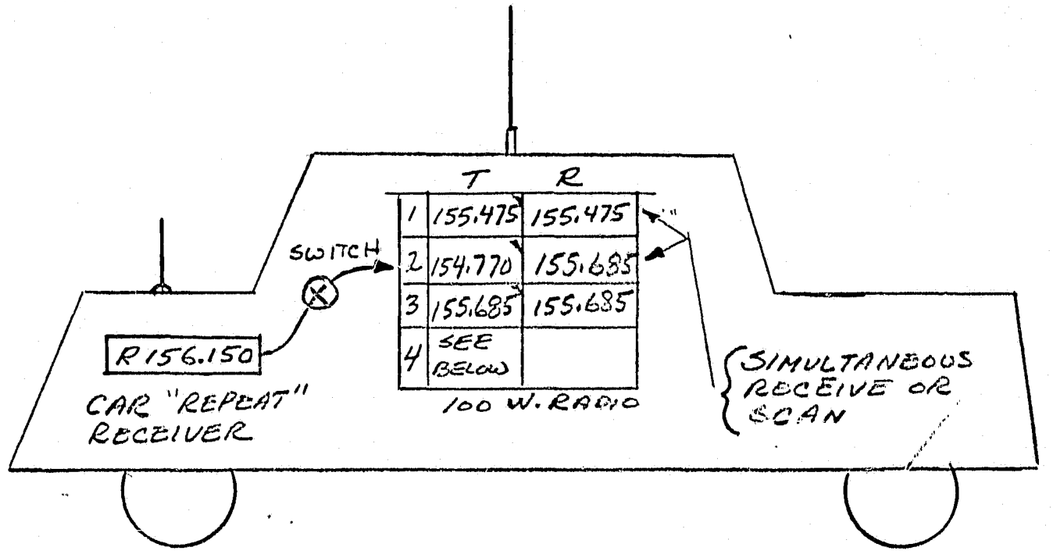
- Channel Number 1. Iowa Mutual Aid--155.475.

- Channel Number 2. Portable to base direct--transmit 154.770, receive 155.685.

- Channel Number 3. Portable to car or portable to portable direct-transmit and receive 155.685.

- Channel Number 4. Portable repeat through vehicle transmit 156.150, receive 155.685.

It is recognized that when the vehicle is in the repeat mode that the receive frequency of 156.150 will be removed only 1.38 MHz from the associated mobile transmit frequency. This could result in some desensitizing; however, it is anticipated that signals from the portables will be strong enough to overcome the desensitizing when operating within 1,000 feet of the vehicle. This is considered to be adequate range for a portable to be from the vehicle.



CHANNEL	SHERIFF POLICE CARS - USE FOR:	TRANSMIT	RECEIVE
1	STATE MUTUAL AID	155.475	155.475
2	CAR TO BASE/RPTR	154.770	155.475
3	DIRECT CAR TO CAR	155.685	155.685
4	SPARE-OR NEW IOWA CITY FREQ.	*156.210	*156.210

* Possible FREQ. - REQUIRES F.C.C CHECK

EXHIBIT 6

JOHNSON COUNTY, IOWA

NEW SYSTEM - FREQUENCY PLAN
FOR SHERIFF DEPT. MOBILE UNITS

One of the features now enjoyed in the Iowa system is the ability to receive the Iowa Highway Patrol. When conversion is made to high band, it is recommended that the mutual aid frequency 155.475 be used for this purpose. It is therefore recommended that the mobiles be provided with simultaneous receive capability on frequencies 155.475 and 155.685 so that they will be in a position to receive both an emergency call from the State and all County transmissions simultaneously.

Ambulance Communication System

The County is already well along with plans for putting high-band radios in the ambulance vehicles. The patch arrangement at the console was already discussed in earlier portions of the report.

Of major concern to the ambulance operators was the ability to communicate to the hospital or the dispatcher direct from the patient's side or from inside the building. Exhibit 7 shows a recommended frequency plan for the ambulance mobile radio units.

Portable radio units could be used by the operators on the same high-band frequencies as the mobile operates, but there may be times when it will be difficult to reach the base from inside a building with the high band portable (See Exhibit 11, Plan A).

An optional plan is for the County to petition the FCC to permit them to use two frequencies from the listings for Ambulance Operator Rescue Operations for repeating to and from the base through the vehicle. This will be similar to the mode proposed for the Sheriff's cars, except repeat will be two-way. There is no rule provision for this in *The Special Emergency Services* at this time, but the County can probably show a "need" and perhaps obtain approval. For most reliable penetration into the buildings, the portables should be in the 450 MHz band. Two suggested mobile frequencies are 458.100 and 458.350 MHz. Ambulance hand-held radio units would then be two-frequency 450 MHz portable radios as follows:

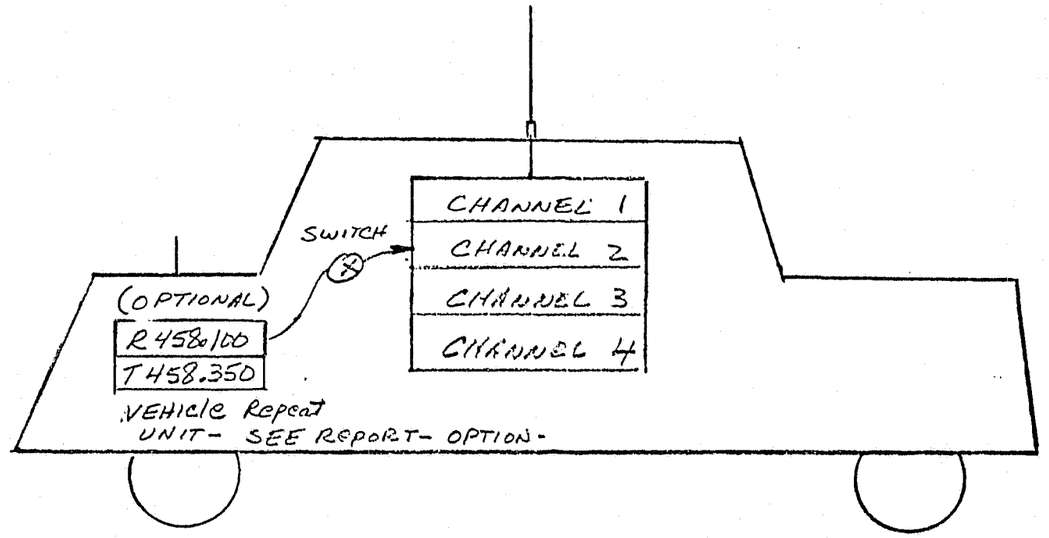
1. T 458.100, R 458.350——Operator repeat through vehicle on the Region 11 channel.

2. T and R 458.350——Direct operator communication at the scene.

The County should check the availability of a mobile repeat capability with the major equipment manufacturers and if it can be offered, petition the FCC for operating in this way.

Iowa City Police System

Two options are offered for consideration in the Iowa City system (See Exhibit 8):



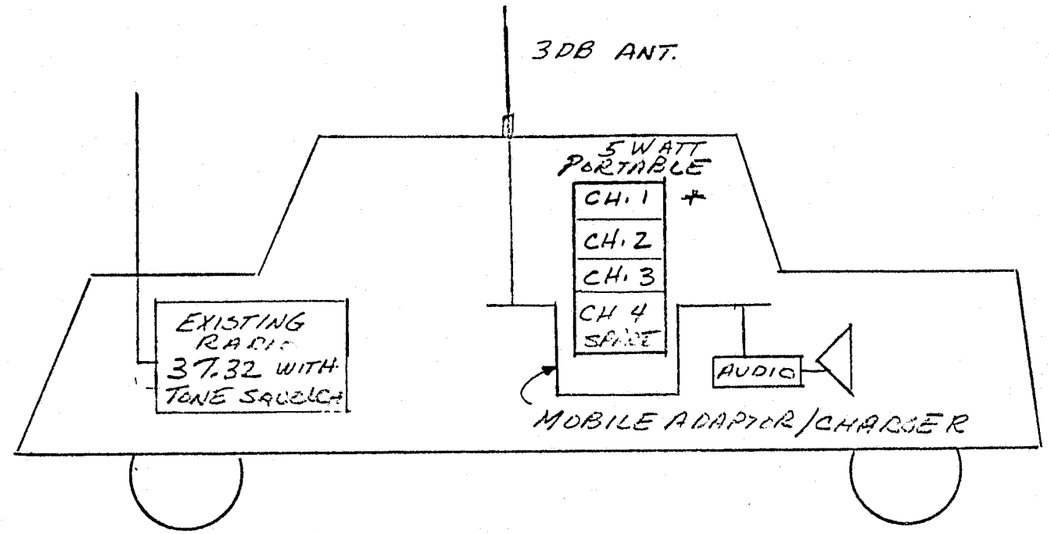
CHANNEL	AMBULENCE VEHICLE CHANNEL USE	TRANSMIT	RECEIVE
1	AMBULENCE-MUTUAL AID	155.340	155.340
2	SHERIFF BASE/RPTR	154.770	155.685
3	DIRECT TO COUNTY POLICE CARS	155.685	155.685
4	AMB. REGION II	155.385	155.385

EXHIBIT 7

JOHNSON COUNTY, IOWA

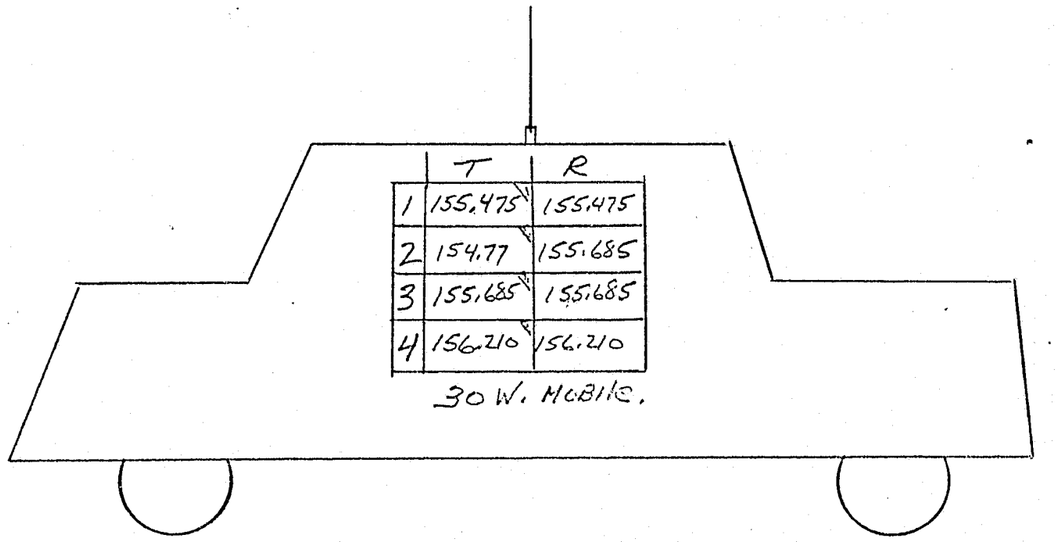
NEW SYSTEM - FREQUENCY PLAN

FOR COUNTY AMBULENCE MOBILE UNITS



PLAN A

* SAME 3 CHANNELS AS SHERIFF CARS



PLAN B OFFICER HAS PORTABLE ON SAME 4 FREQ.

EXHIBIT 8

JOHNSON COUNTY, IOWA - NEW SYSTEM
FREQUENCY PLAN FOR IOWA CITY MOBILE UNITS

Plan A.

Retain the present 37.32 MHz for vehicle use and install racks for converting high band portable units to mobile application.

Plan B.

Obtain a separate frequency in the high band for Iowa City operation, e.g., 156.210 MHz.

With respect to the first option, the present low band units are already on hand and from the economics involved, could still be used to dispatch Iowa City patrol cars. These radios should be converted to tone coded squelch to avoid the nuisance and skip interference now being received from throughout the County. With a portable unit in the high band the City cars would have the capability to receive simultaneously their individual city transmissions on low band and the county transmissions on high band. It should be remembered from the propagation study that solid talk-back direct from portables in Iowa City to the central dispatch is anticipated. When an officer would leave the vehicle, he would take his high band portable unit with him. The frequency plan in the city portables would be the same as the first three channels used in the County Sheriff's vehicles; that is, Channel 1 (Mutual Aid 155.475), Channel 2 (Sheriff Dispatch or repeat through base transmit 154.770—receive 155.685), and Channel 3 (direct car to car to Sheriff's cars—transmit and receive 155.685) The fourth channel in the portable radios could be devoted to surveillance purposes or to detectives and only certain radios would be equipped with this fourth channel. The detectives in Iowa City already have a frequency for this purpose within this frequency range. Thus detective portables would have the ability to communicate on their surveillance channel and switch to the County or mutual aid channels for requesting assistance from other units.

With respect to the second possible system for the City mentioned; that is, the use of a separate 150 MHz channel, the City could convert its existing 155.370 transmitter to a new frequency and use it for dispatch purposes. One possible frequency which is located far enough to avoid desensitizing is 156.210. The City would have to apply for this channel from the FCC. If this option is chosen, city mobile units would be four-channel. They would use the same three channels listed for County Sheriff mobiles and their fourth channel would be devoted to the city frequency. Iowa City hand-held patrol portable units would also have the fourth channel devoted to the city frequency. Detective units could devote the county car to car channel in their portables to another surveillance frequency. If the City chooses to go to complete high band operation, mobiles need not be higher than 30 watts in power. The City may desire to operate exclusively with the portable unit serving as a mobile when installed in the car. This operation is not recommended because the officer is then completely dependent upon that one radio; should he lose it in an encounter while out of the vehicle or should it become damaged, he has lost all communication. It is therefore recommended that a back-up mobile unit be provided in either case; that is, either the existing low band or a new high band mobile radio unit.

Tone Coded Squelch

All equipment in the County system should operate in the tone coded squelch mode to prevent outside interference from co-channel users. It is stressed that the same code should be used on all police equipments to allow transfer from one radio frequency to another. In mobile units, it is recommended that the tone code be used in the mobile transmitter only and that the receivers be operated as carrier squelch. The reason for this is to permit the mutual aid frequency 155.475 to receive out-of-county calls. Tone coded squelch on the mobile transmitters will provide the protection at the base locations against interference from other stations. The base stations are the most likely to receive interference from external sources (Refer to Exhibit 2 for tone coded equipment recommendations). Tone *filters* should be in all receivers.

City of Coralville

It is recommended that the Coralville mobile and hand-held portable units operate on the same frequency plan as the Sheriff's vehicles with the exception that their mobile units may be of 30 watt power because of the short range. Also these units do not require the portable repeat capability through the mobile unit. It is recommended that Coralville have a 30 watt base station to permit direct dispatch of its vehicles when required and this station be on the following frequencies:

- Channel 1—transmit 155.685, receive 154.770.
- Channel 2—transmit 155.685, receive 155,685.
- Channel 3—repeater control transmit 154.770, receive 155.685.

Coralville can then dispatch its mobile units directly. It will be noted that they will not cause interference to the Sheriff's dispatcher because of the duplex frequency arrangement. An antenna height of approximately 25 feet should be adequate from Coralville. Coralville should also operate a carrier squelch receiver on 155.475 to monitor the mutual aid channel. The station unit should scan the two received frequencies so that both car to car transmissions and car to base transmissions can be monitored at Coralville.

This arrangement for Coralville will eliminate the leased line charged between Coralville and the Iowa dispatcher and provide an additional back-up station for communication. If Iowa City elects to use a separate high band frequency, a fourth channel could be installed in the Coralville base station for direct communication with Iowa City units.

Consideration for 911

Exhibit 9 indicates the Northwestern Bell Telephone Company territory. Within this service, 911 common telephone number usage could be arranged by negotiation with Northwestern Bell. To extend beyond this range could get into additional telephone companies where cooperative arrangements must be worked out between companies. It would therefore seem somewhat cumbersome to have complete 911 for the entire County. An important consideration involving the communication control center if the County goes to a 911 dispatch facility is that all emergency facilities; that is, fire, police, ambulance be able to be dispatched from a common location. Any other arrangement where calls are received at a central point and then distributed to the proper dispatch point is time consuming. The proposed Sheriff's Department control center would be rather confined in space and if fire calls were to be dispatched from this same area, one would expect a considerable increase in noise level in the dispatch room. It is recommended that the County and City meet with the representatives of the telephone company to discuss more thoroughly the 911 plan and in particular how Fire Department communications would be tied in if a common number is used. The present cramped quarters that would exist at the Sheriff dispatch location does not seem conducive to dispatching of fire from this same location. Perhaps the 911 could be better considered when a more permanent answer on a new facility is determined by the County.

Central Recording Equipment

If the County and City institute the combined dispatch capability, a multi-channel tape recorder for logging all transmissions and receptions on radio and all incoming telephone call communication is recommended.

Map Display

With central dispatching for the County, a projected-type map system may be helpful to the dispatchers to provide direction to mobile units. Cost of this equipment is approximately $6,000, but by savings achieved through use of the modular-type console recommended and the savings in space which these consoles provide, it may be possible to include the Map Projector System which would be a useful tool to the radio dispatcher's day-to-day operation.

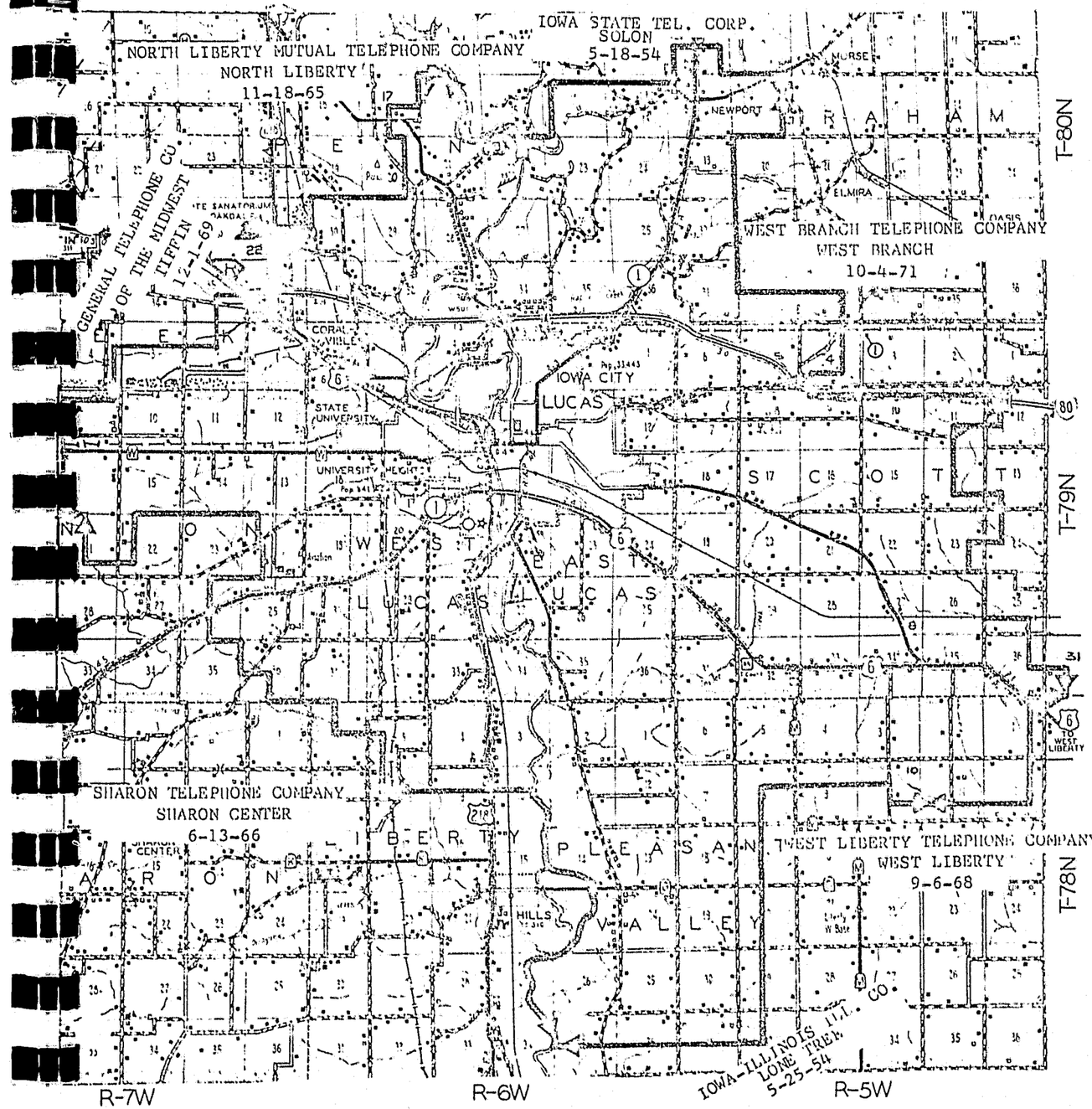
EXHIBIT 9

IOWA CITY

LEGEND

BOUNDARY LINE

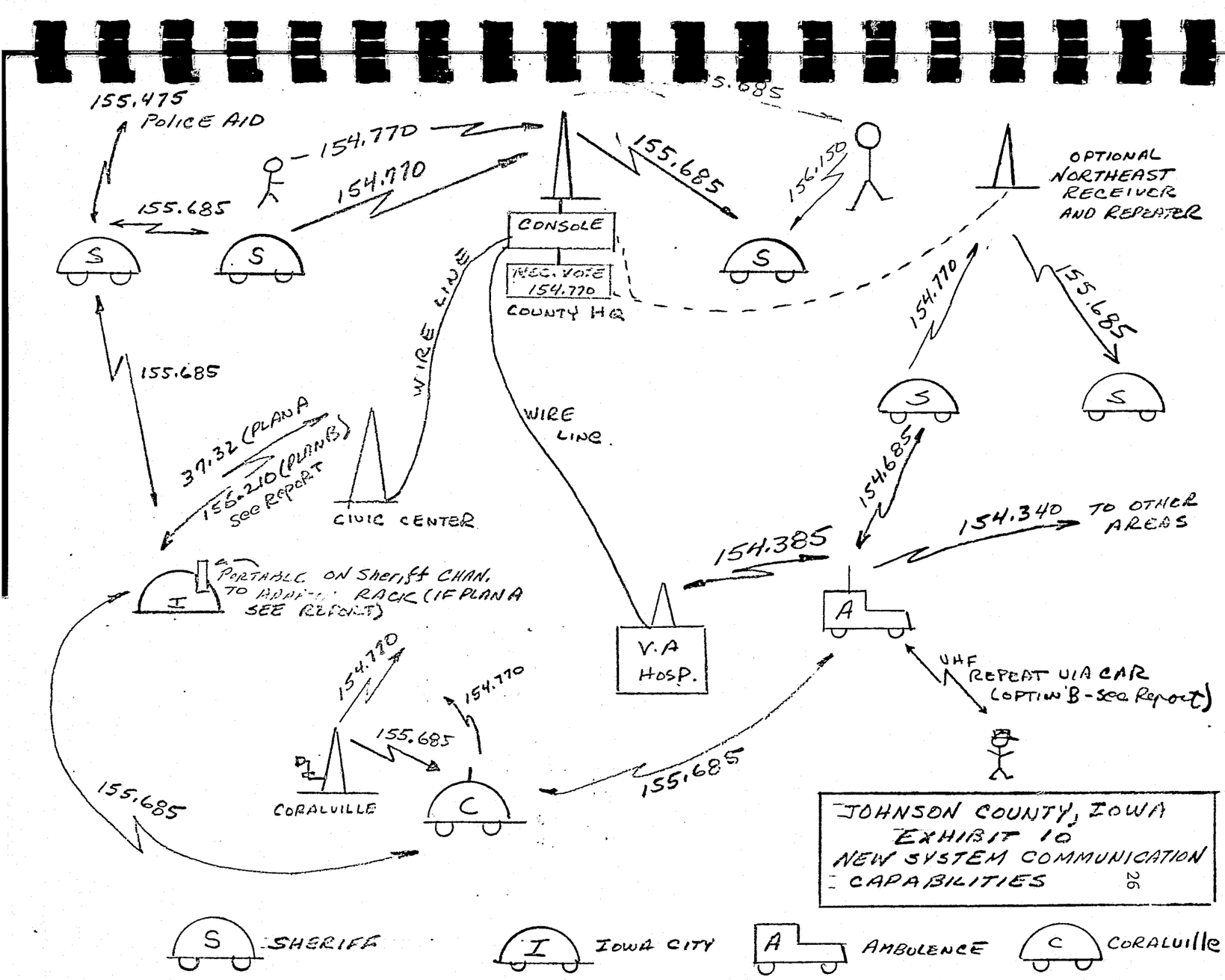
REVISED 11-23-71



SUMMARY

The recommendations outlined above for a combined communications capability are summarized in Exhibits 10 and 11. These summaries should assist the County and City in analyzing the recommended communications system.

Attachment C, a listing of public safety frequencies obtained for the asking in an electronic equipment retail store in Iowa City, illustrates the ease with which the general public may learn police licensed radio frequencies. Surveillance frequencies used per FCC Rule 89.309C2, however, would not be public information. The City may want to continue use of scramblers for special messages to foil eaves-dropping on the police channel.



JOHNSON COUNTY, IOWA
EXHIBIT 10
NEW SYSTEM COMMUNICATION
CAPABILITIES

EXHIBIT 11

SUMMARY OF PORTABLE RADIO CHANNELS

Channel No.	Sheriff	Ambulance (Note 2)		Iowa City (Note 3)		
		Plan A Direct	Plan B Mobile Repeater	Plan A (Note 4)	Plan B	City Detectives
1	Police Mutual Aid T&R 155.475	Amb. Mutual Aid T&R 155.340	Relay thru car T 458.100 R 458.350	Police Mutual Aid T&R 155.475	Same as for Plan A	Surveillence (Note 5)
2	Port. to Base or Base Relay T 154.770 R 155.685	To Sheriff Base Relay T 154.770 R 155.685	Portable to Port. T&R 458.350	Port. to Sher. Base Relay T 154.770 R 155.685	Same as for Plan A	To Sheriff Relay Station For Extended Range - T 154.770 R 155.685
3	Port. to Port. or Car Direct T&R 155.685	To Sheriff Car-Direct T&R 155.685		Port. to Port. or Sheriff Car T&R 155.685	Same as for Plan A	Surveillence (Note 5)
4	Talk Back With Relay Through Car T 156.150 R 155.685	Ambulance Region 11 T&R 155.385		Spare	City Freq. Possibility 156.210	City Freq. (if used) 156.210 or Surveillence (Note 5)

NOTE:

1. All frequencies require FCC approval.
2. See report for special license requirements.
3. See report regarding plan descriptions.
4. Coralville portables use this frequency plan too.
5. Power output must be 2 watts. Frequencies may be any available for Police Service per FCC Rule 89.309 CZ.

ATTACHMENT A

THE UNIVERSITY OF IOWA

IOWA CITY, IOWA 52242

Transportation and Security

September 5, 1973

M E M O

TO: David Epstein, Iowa City Director of Public Safety
✓Gary Hughes, Johnson County Sheriff
Paul White, Coralville Police Chief
Duane Nollsch, University of Iowa Physical Plant Director

FROM: Dwight Armstrong, Communications Officer

SUBJECT: Radio communication with Transportation and Security Department

We are asking you or your representative to review this memo and to attend a meeting at the Transportation and Security Department, 131 South Capitol Street, on September 13, 1973, at 3:00 p.m. We will have a demonstration of our new radio console and discuss the contents of this memo.

The University Transportation and Security Department will soon be able to monitor the following radio frequencies and stations:

37.10	Iowa City, Johnson County, Coralville, etc.
37.26	Transportation and Security (Security)
37.32	Iowa City F2
45.32	Transportation and Security (Parking)
453.375	Physical Plant (U of I) (BASE TRANSMITTER)
458.375	(MOBILE TRANSMITTER)

These additional frequencies will be monitored after September 30, 1973:

42.58	Iowa Highway Patrol ✓
42.68	Iowa Highway Patrol ✓
42.74	Iowa Highway Patrol ✓
154.340	Iowa City Fire Department ✓

The Transportation and Security Communications Room will have transmit capabilities as follows:

37.10 & 37.32	(not simultaneously)* by remote control of Iowa City's transmitter
37.26	Transportation and Security (Security)
45.36	Transportation and Security (Parking)
453.375	Physical Plant (U of I)

The following auxiliary radio functions can also be performed through the Transportation and Security communications center:

Simultaneous transmission on any multiple combination of the following frequencies:

37.10 or 37.32 (not both)*
37.26
45.36
453.375

Cross Channel Rebroadcast patching of any multiple combination of the following frequencies:

37.10 or 37.32 (not both)*
37.26
45.36
453.375

This will enable any radio unit on any one of the "patched" frequencies to transmit to and receive transmissions from all radio units on any of the "patch" frequencies.

Telephone patch one phone line with any one of the following frequencies:

37.10 or 37.32 (not both)*
37.26
45.36
453.375

This will enable any phone call to or from Transportation and Security to be "patched" for direct communication between all radio units on the "patch" and the phone party.

Base to Base intercom between Transportation and Security and Iowa City Police Department, and between Transportation and Security and University of Iowa Physical Plant bases (those with intercom capability).

In order to provide the widest possible use of our radio auxiliary functions and facilitate interdepartmental radio communications, the following procedures are suggested here for your review and comment.

Effective immediately, the designated radio "call name" of the Transportation and Security radio base will be University Control.

Cross Channel Rebroadcast Patching

1. Notify University Control operator that a cross channel patch is desired between ... (give units and/or frequencies to be patched).

2. University Control operator will

   a. execute patch
   b. broadcast notification of patch

3. Proceed with your broadcast. Use the term "clear" to signify that cross channel traffic has been completed.

4. University Control operator will wait momentarily for any return traffic and then dissolve the patch and "sign off" the patched transmitters individually (this will signify to the respective stations that the patch is dissolved).

Telephone Patching

1. Contact University Control by either phone (319-353-4583) or radio.

2. Request a radio-phone patch.

   a. give officer(s) and/or departments you desire patched or give name and number (if known) of person to be called.

   b. give reason for patch.

3. University Control operator will obtain contact with party(ies) and execute patch, and broadcast notification of patch.

4. You may proceed.

5. At the end of your traffic, the University Control operator will dissolve the patch and "sign off" the station.

Remember that when using the radio-phone patch that the entire conversation is transmitted over the air to all units on the patched frequencies. The use of the phone patch should be limited and as brief as possible.

All of the preceeding functions are licensed and governed by FCC regulations.

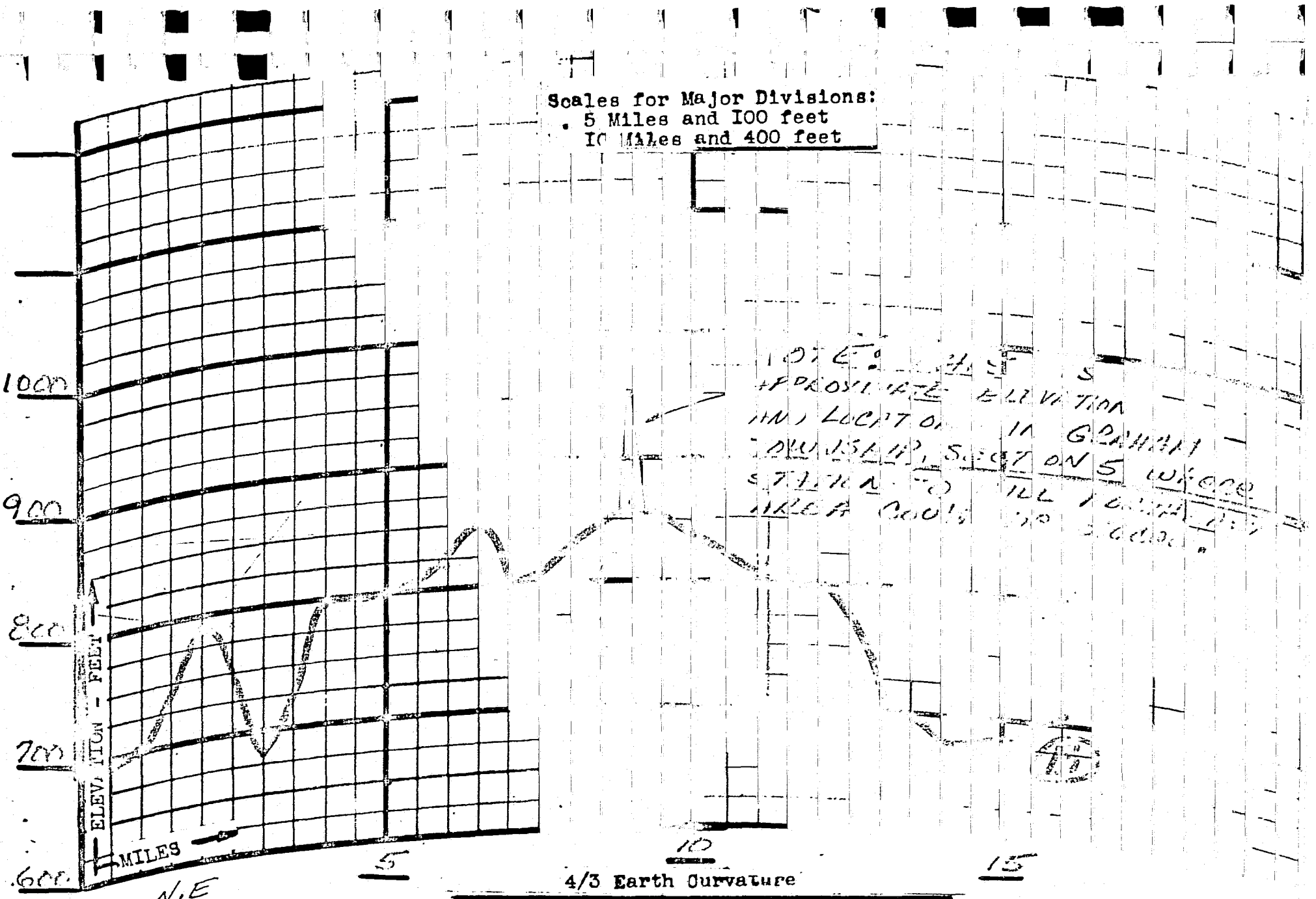
*When transmitting and/or using auxiliary radio functions of frequencies 37.10 or 37.32, University Control will be remotely keying the Iowa City transmitter. Therefore, it will be necessary for the University Control operator to request and receive permission from the Iowa City operator to use the Iowa City transmitter. The Iowa City operator will have override capability.. Because of the use of the Iowa City transmitter which is not capable of simultaneous transmission on 37.10 and 37.32, University Control functions cannot be used on these two frequencies simultaneously.

cc: Robert Keating, Iowa City Fire Chief
Jim Ward, Johnson County Ambulance Director
Iowa Highway Patrol Communications Officer, Post 11

mf

ATTACHMENT B

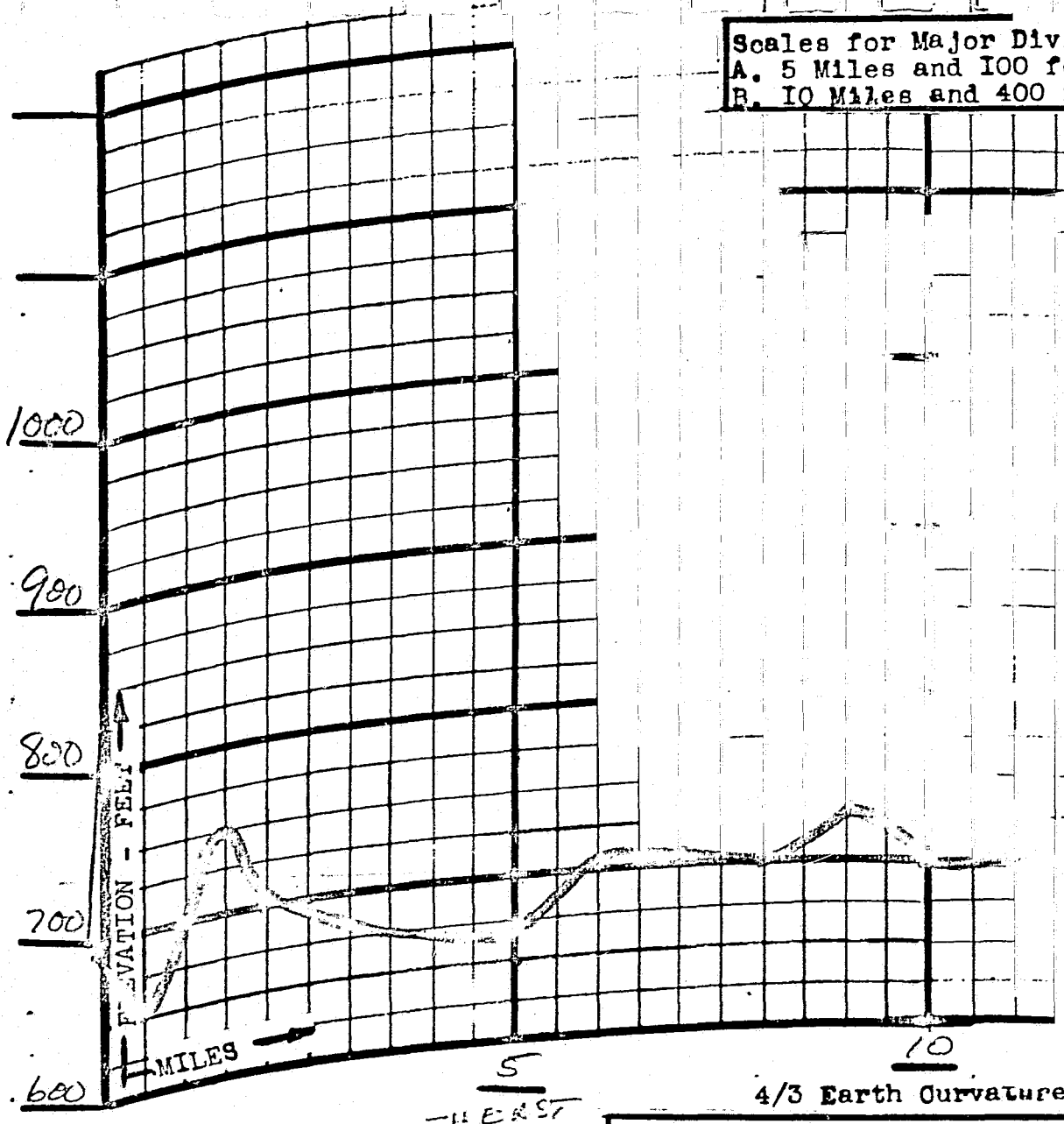
Scales for Major Divisions:
. 5 Miles and 100 feet
10 Miles and 400 feet



4/3 Earth Curvature

Site A: COURTHOUSE TOWER	Project: JOHNSON COUNTY, ILLINOIS
LAT. N: 41 D 39 M 21 S	Path Bearing (A to B): 30 Degrees
LONG. W: 91 D 32 M 06 S	Drawn By: GLP Date: 10/15/73
	Page 1 of 6 ATTACHMENT B
Site B: FIVE COUNTY CORNER	
LAT. N: ___ D ___ M ___ S	
LONG. W: ___ D ___ M ___ S	

Scales for Major Divisions:
A. 5 Miles and 100 feet
B. 10 Miles and 400 feet



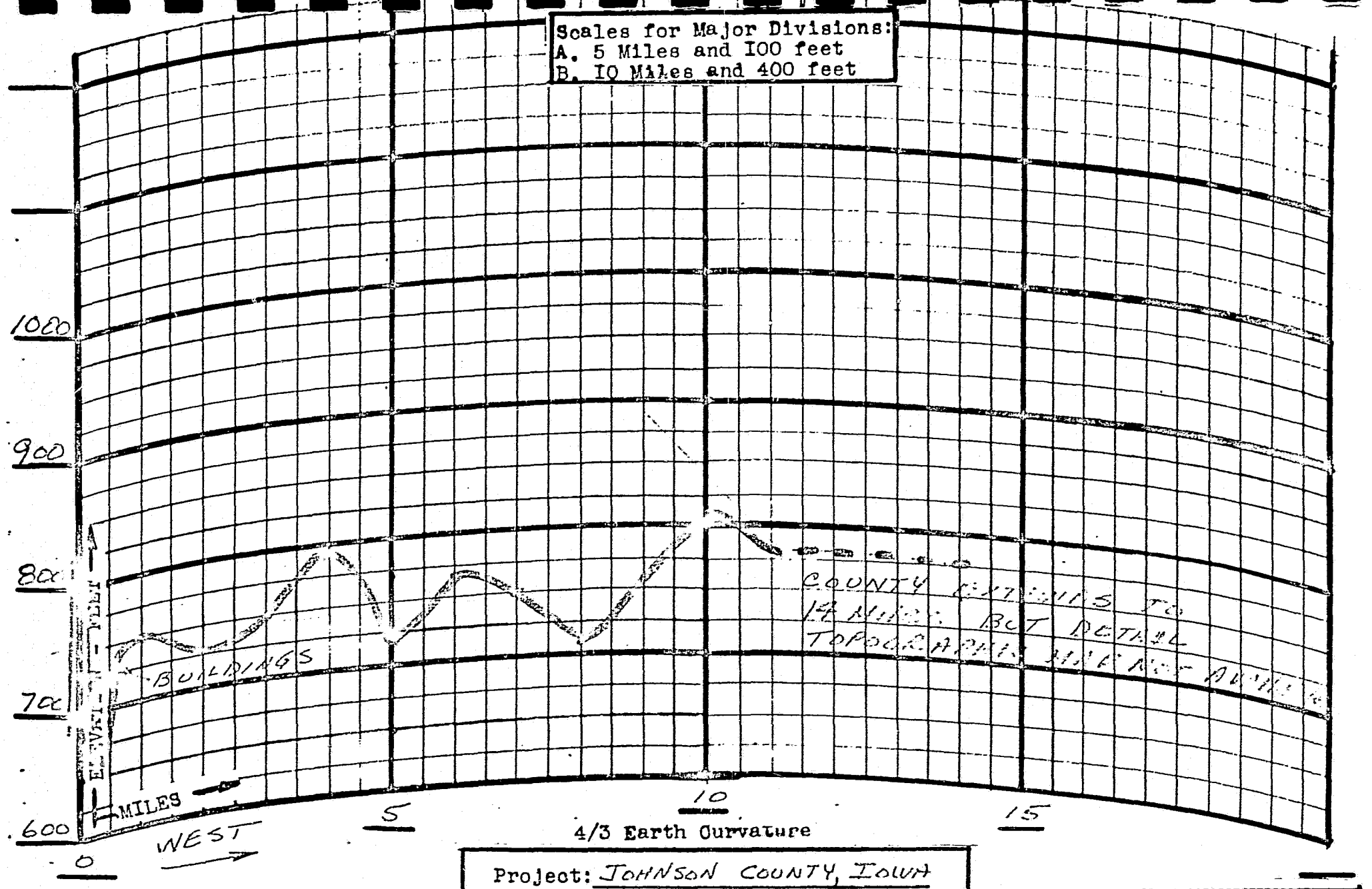
4/3 Earth Curvature

Site A: COURTHOUSE TOWER
LAT. N: 41 D 39 M 21 S
LONG. W: 91 D 32 M 06 S

Project: JOHNSON COUNTY, IOWA
Path Bearing (A to B): 130° Degrees
Drawn By: app Date: 10/15/73
Page 2 of 6 ATTACHMENT B

Site B: _____
LAT. N: ___ D ___ M ___ S
LONG. W: ___ D ___ M ___ S

Scales for Major Divisions:
A. 5 Miles and 100 feet
B. 10 Miles and 400 feet



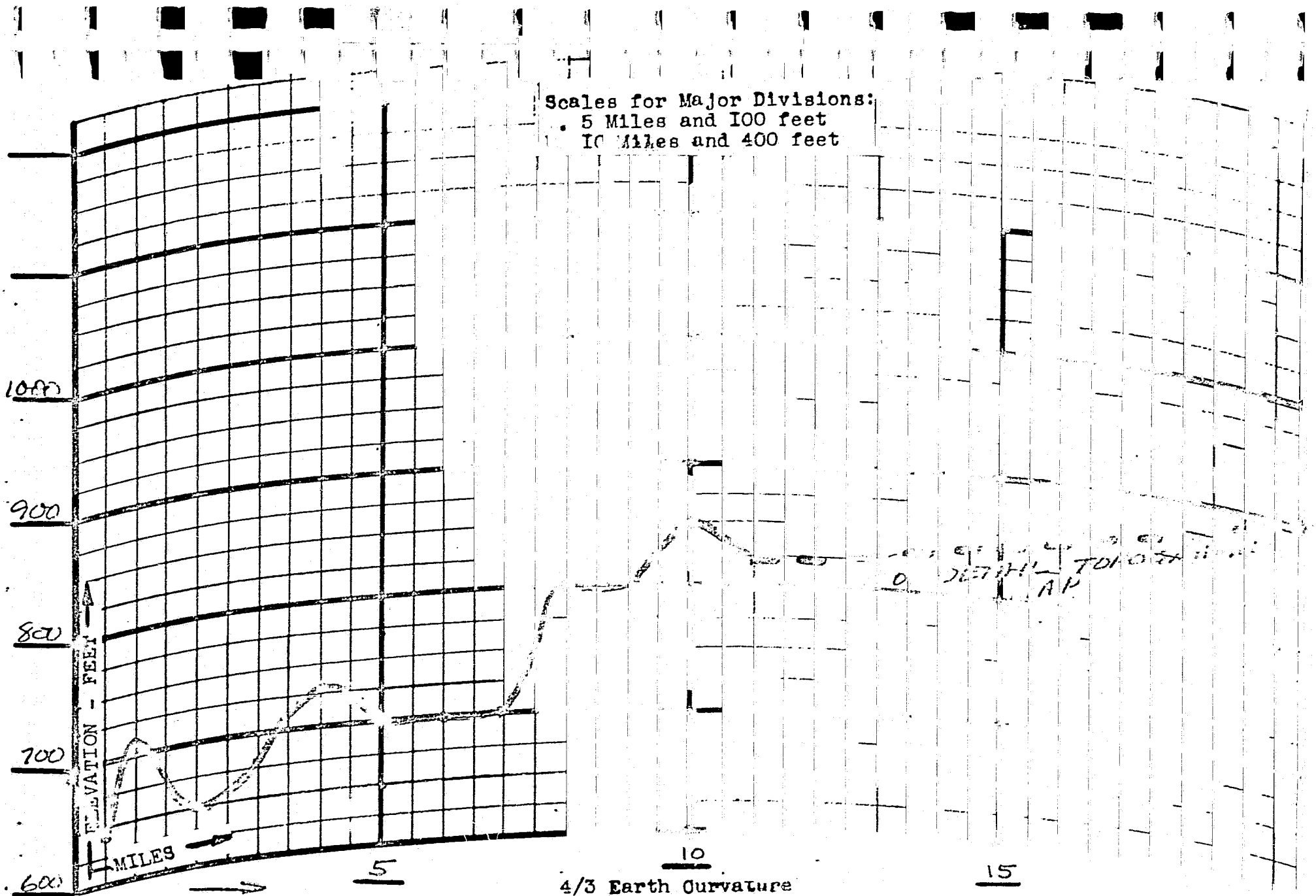
4/3 Earth Curvature

Site A: COURTHOUSE TOWER
LAT. N: 41 D 39 M 21 S
LONG. W: 91 D 32 M 04 S

Project: JOHNSON COUNTY, IOWA
Path Bearing (A to B): 270 Degrees
Drawn By: ARP Date: 10/15/73
Page 3 of 6 ATTACHMENT B

Site B: _____
LAT. N: ___ D ___ M ___ S
LONG. W: ___ D ___ M ___ S

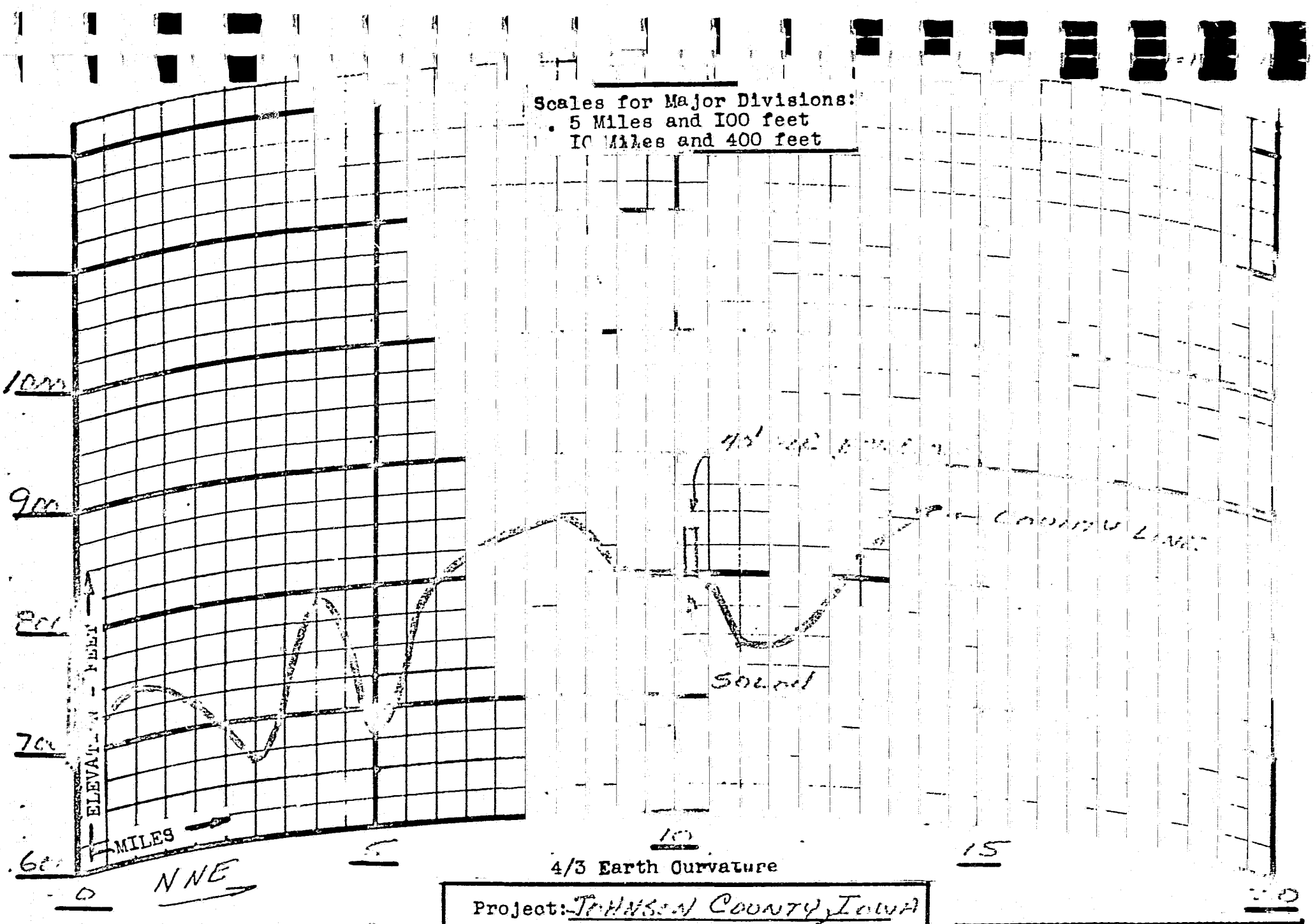
Scales for Major Divisions:
• 5 Miles and 100 feet
10 Miles and 400 feet



4/3 Earth Curvature

Site A: COURTHOUSE	Project: JOHNSON COUNTY, IOWA	Site B:
LAT. N: 41 D 39 M 21 S	Path Bearing (A to B): 300 Degrees	LAT. N: D M S
LONG. W: 91 D 32 M 04 S	Drawn By: ARP Date: 10/15/73	LONG. W: D M S
	Page 4 of 4 ATTACHMENT B	

Scales for Major Divisions:
5 Miles and 100 feet
10 Miles and 400 feet

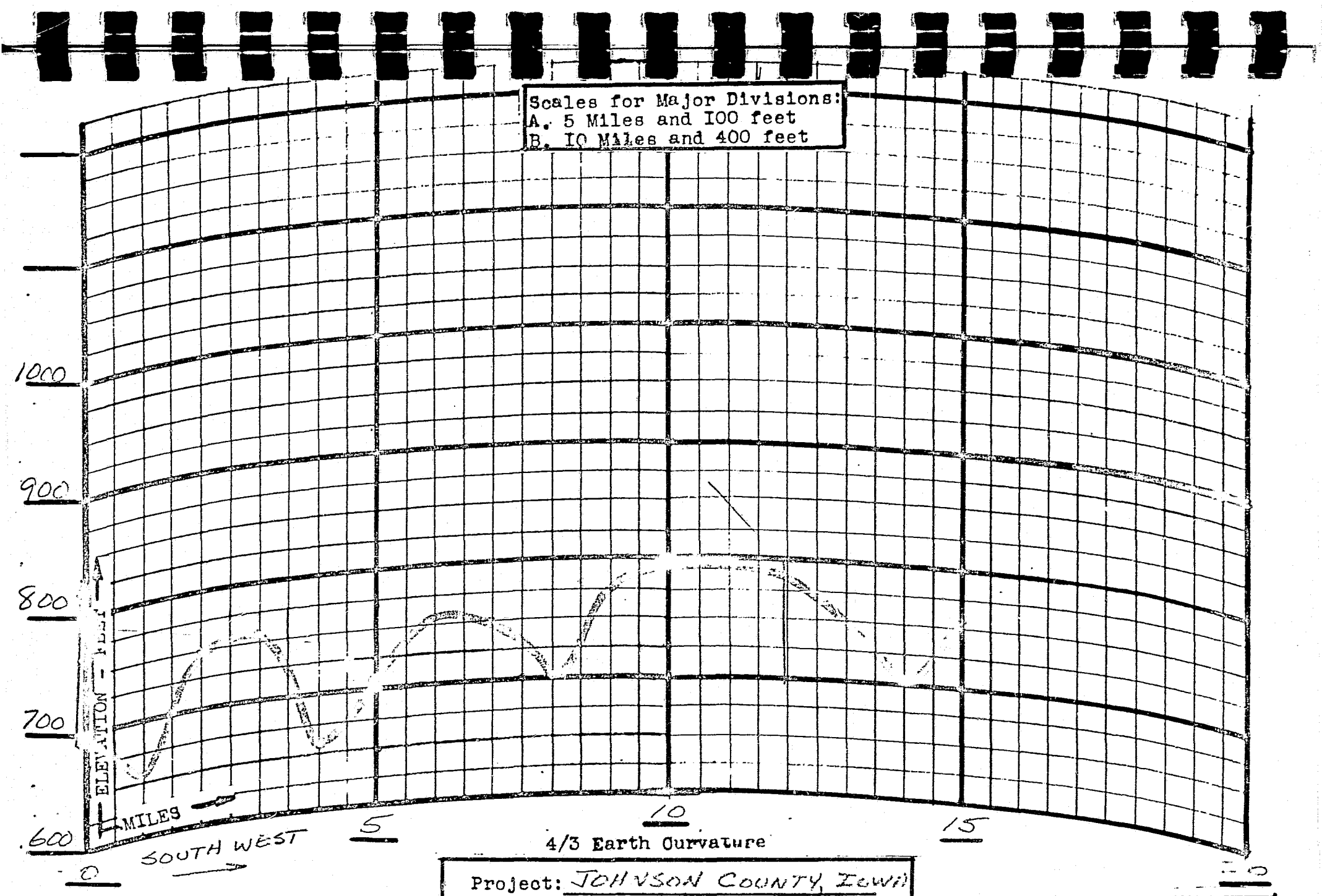


4/3 Earth Curvature

Site A: Courthouse Tower
LAT. N: 41 D 39 M 21 S
LONG. W: 91 D 32 M [illegible] S

Project: Jefferson County, Iowa
Path Bearing (A to B): 13° Degrees
Drawn By: A.P.P. Date: 10/15/73
Page 5 of [illegible] ATTACHMENT B

Site B: _____
LAT. N: ___ D ___ M ___ S
LONG. W: ___ D ___ M ___ S



Site A: COURTHOUSE TOWER

LAT. N: 41 D 39 M 21 S

LONG. W: 91 D 32 M 06 S

Project: JOHNSON COUNTY, IOWA

Path Bearing (A to B): 225 Degrees

Drawn By: ARP Date: 10/15/73

Page 6 of 6 ATTACHMENT B

Site B: _____

LAT. N: ___ D ___ M ___ S

LONG. W: ___ D ___ M ___ S

ATTACHMENT C

500 KHz International Distress Frequency (Morse Code only)
2182 KHz International Distress Frequency (voice only)
37.10 MHz Iowa City, Coralville Police mutual aid
37.20 MHz Johnson County Sheriff - ambulance
37.22 MHz Security Hospital - Oakdale
37.28 MHz University of Iowa Police-Security
37.32 MHz Iowa City Police subfrequency
42.58 MHz Iowa Highway Patrol (this district)
42.68 MHz Iowa Highway Patrol
42.74 MHz Iowa Highway Patrol
45.075 MHz Civil Air Patrol Rescue
48.18 MHz Iowa-Illinois Gas and Electric Company
118.10 MHz Waterloo Airport tower
118.30 MHz Des Moines-Kansas City, Missouri,Airport tower
118.70 MHz Cedar Rapids Airport tower
118.70–119.90 MHz Cedar Rapids approach pattern control
121.50 MHz Emergency Aircraft Distress Calls (world wide)
121.90 MHz Cedar Rapids, Des Moines, Kansas City, Missouri, Sioux City, Waterloo (ground control)
122.20–122.60 MHz Cedar Rapids flight control
122.80 MHz Iowa City Airport (UNICOM)
132.80 MHz Relay station for Chicago O'Hare Airport flight control located near Washington, Iowa
152.21–152.24 MHz Answer Iowa Inc., radio paging service (Iowa City)
152.27 MHz Yellow Cab Company base station (transmit only)
157.53 MHz Yellow Cab Company base station (receive only)
157.53 MHz Yellow Cab Cars (transmit only)
152.27 MHz Yellow Cab Cars (receive only
154.34 MHz Iowa City Fire Department (also Coralville)
154.28 MHz Iowa City Fire Department (alternate)
155.37 MHz Iowa Highway Patrol (point-to-point)
155.55 MHz Iowa City Public Works Department
156.30 MHz Intership Safety Channel (inland navigation only)
156.80 MHz Intership and ship-to-shore (inland navigation only)
158.13 MHz Iowa Southern Utilities Company
158.22 MHz Iowa Southern Utilities Company
161.61 MHz Rock Island Railroad
162.40–162.45–162.55 MHz 24-hour weather forecast (where available)
152.21 MHz Iowa City operator - radio telephone service
152.18 MHz Iowa City operator - radio telephone service
158.27 MHz Radio telephone mobile units (Iowa City area)
158.64 MHz Radio telephone mobile units (Iowa City area)
158.70 MHz Answer Iowa Inc., radio paging service (Cedar Rapids)
152.09 MHz Cedar Rapids operator - radio telephone service
152.12 MHz Cedar Rapids operator - radio telephone service
158.55 MHz Radio telephone mobile units (Cedar Rapids area)
158.58 MHz Radio telephone mobile units (Cedar Rapids area)
159.195 MHz Iowa State Highway Maintenance Department
159.105 MHz Johnson County Road Maintenance Department (base transmit)
156.225 MHz Johnson County Road Maintenance Department (base receive)
156.225 MHz Johnson County Road Maintenance Department (mobile units transmit)
159.105 MHz Johnson County Road Maintenance Department (mobile units receive)

END