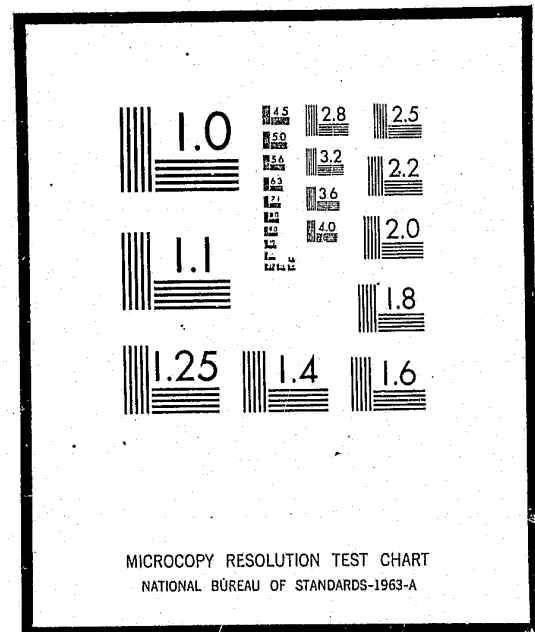


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**U.S. DEPARTMENT OF JUSTICE  
LAW ENFORCEMENT ASSISTANCE ADMINISTRATION  
NATIONAL CRIMINAL JUSTICE REFERENCE SERVICE  
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EQUIPMENT SYSTEMS IMPROVEMENT  
PROGRAM -- DEVELOPMENT

SYSTEM ANALYSIS -- RECORDING SYSTEM  
FOR ILLEGAL TELEPHONE CALLS

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Approved

---

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ABSTRACT

A system analysis of a proposed telephone monitoring system to record illegal telephone calls, with application to a future speaker identification system, is described. The current law enforcement procedure on handling complaints involving this type of call is investigated. A trade study of two approaches to where the recording might be accomplished is presented. The final recommendation at this time is that no special recording equipment be developed for telephone monitoring.

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## SUMMARY

A preliminary design study for a compact portable voice recording system shows that equipment costing approximately \$700 per unit could provide voice samples of persons making illegal telephone calls that would be acceptable as court evidence. Such equipment would be installed on the telephone of a person subjected to such calls. A system analysis that investigated the factors involved in recording at a customer's telephone, as the above equipment operates, or at the local telephone exchange, shows that central recording can be done more cheaply. The system analysis further concludes that no special equipment development should be undertaken for recording telephone calls at the present time.

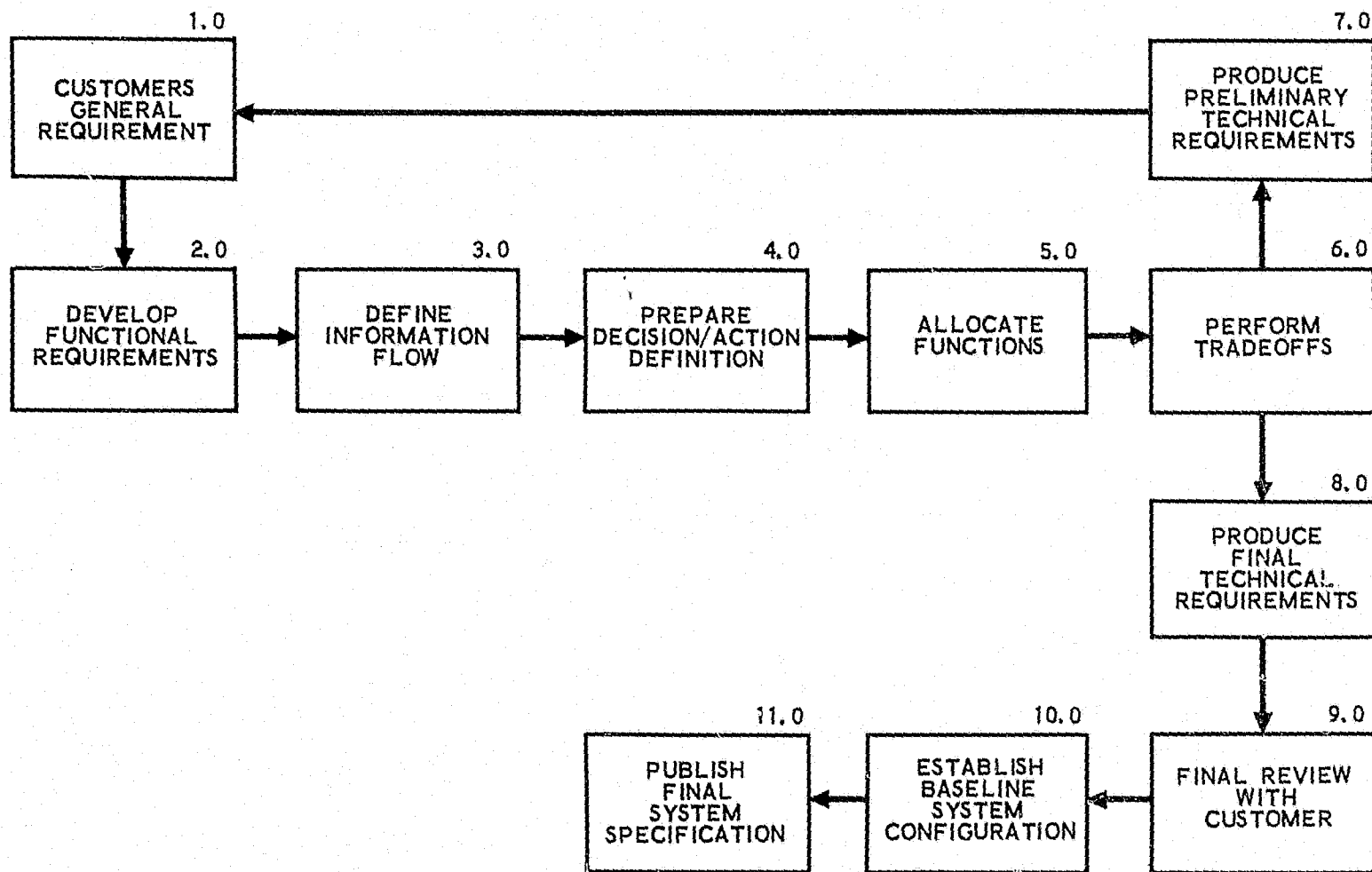
## CHAPTER I. INTRODUCTION

In an effort to briefly examine the system aspects of recording illegal telephone calls as an aid to law enforcement, this study examines the current illegal telephone call complaint procedures used by certain local police departments and a telephone company. Inputs to this study were limited to the Los Angeles area; however, it is the opinion of those contacted that local policies and procedures are in general agreement with those of similar agencies in other parts of the country.

Based on the understanding of current policies and procedures of the aforementioned agencies, functional requirements and information flow and decision action diagrams were developed as shown in Figure 1. Where applicable, functions were allocated to equipment items.

Two alternate locations for the recorders were considered. As a variation to the local recording concept described in Appendix A, a centralized recorder located at the telephone switching office was included.

The work performed in this study represents the tasks shown in blocks 2.0 through 6.0 of Figure 1.



-2-

Figure 1. Work Flow Summary

CHAPTER II. CURRENT COMPLAINT HANDLING  
PROCEDURES/POLICIES

Conversations were held with personnel from the Los Angeles Police Dept., Los Angeles County Sheriff's Dept., and a local telephone company to determine existing procedures for handling illegal telephone call complaints.

The procedures followed by the two law enforcement agencies are essentially the same and consist of the following actions:

- a. In response to a complaint by a victim that he has received an illegal phone call, a misdemeanor complaint report is taken (when the victim insists) under the classification of Section 653m of the California Penal Code (see Appendix B), and the victim is advised to report the incident to the telephone company. No further action is taken unless there is a high possibility of a felonious crime. Most of the complaints received relate to calls of an obscene nature or some threat of minor violence.
- b. If a felonious crime is involved, or appears likely, local investigative personnel can request that a monitoring of the victim's telephone (with his permission) be established by criminalistic laboratory technicians. The criminalistic laboratory maintains a number of commercially available tape recorders, both reel-to-reel and cassette type, equipped with magnetic coupled acoustical sensors which can be attached to the victim's phone. If

necessary, the technicians will make direct electrical connections to the voice circuit of the victim's telephone.

- c. Law enforcement personnel stated that under Section 251(2)(c) of Federal Public Law 90-351 and Section 633.5 of the California Penal Code they can legally intercept a wire communication where there is one party consent. Since they are acting under color of law, in accordance with both state and federal laws, they are of the opinion that Federal Communication Commission Regulations 11 F.C.C. 1033(1947), 12 F.C.C. 10005(1947), and 12 F.C.C. 10008(1948) -- regarding "beep tones" and "magnetic coupling devices" -- do not apply.
- d. Once the desired information is captured on tape, law enforcement personnel handle the tape as any other item of physical evidence. No special sealing of the recorder mechanism has been required by the courts. In most instances the tape recording is used to corroborate the victim's testimony as to what the suspect or defendant said. Inasmuch as these personnel currently have no court experience using the tape as input to a voice analysis system to produce conclusive evidence, they could draw no conclusions as to whether further handling and traceability restrictions might be imposed.

The procedure followed by the telephone company is not fully understood because of their policy that handling of this type of complaint is proprietary

information, and it is against their policy to disclose any procedural information. They did, however, volunteer the following information:

- a. Under no circumstances do they ever record any information on a service line.
- b. Upon request of a legal law enforcement agency they will institute a call trace procedure which provides a call source vs. time history.
- c. They are never aware of any monitoring activities associated with a civil authority investigation of crimes.

Further attempts to determine if the application of a recording device at a central switching center would be feasible from the company's viewpoint, and if a recording could simplify the call trace technique were unsuccessful.

### CHAPTER III. VALUE OF TAPE RECORDING TO LAW ENFORCEMENT

In attempting to analyze a system to record illegal calls, the immediate question arises as to what value the tape recording is to the law enforcement agency. A summary of the potential values is shown in Table 1.

Table 1. Functional Value of Recording

- Confirmation of Victim's Claim that Crime Occurred
- Possible Investigative Leads for Crimes where Police Action will be Taken
- Data Source for Voice Analysis Techniques
- Conclusive Evidence that Suspect was Perpetrator of Crime
- Marginal Value to Rehabilitation Therapist
- Improvement in Suspect/Crime Matching

Without the ability to locate a suspect to match the voice recording, the recording only provides a real-time record of a crime's occurrence. However, if a suspect can be isolated or a file search technique developed through voice analysis, conclusive evidence could be developed. Depending on the ability to perform a simple search of voice recording files, many complaints might be cleared by the procedure of isolation and voice matching to a single suspect.

Other functional applications are shown in Table 1 and include possible use of the recording by a rehabilitation therapist in treating a criminal.



How the voice/time recordings integrate into the general scheme of handling illegal calls is shown in Figure 2.

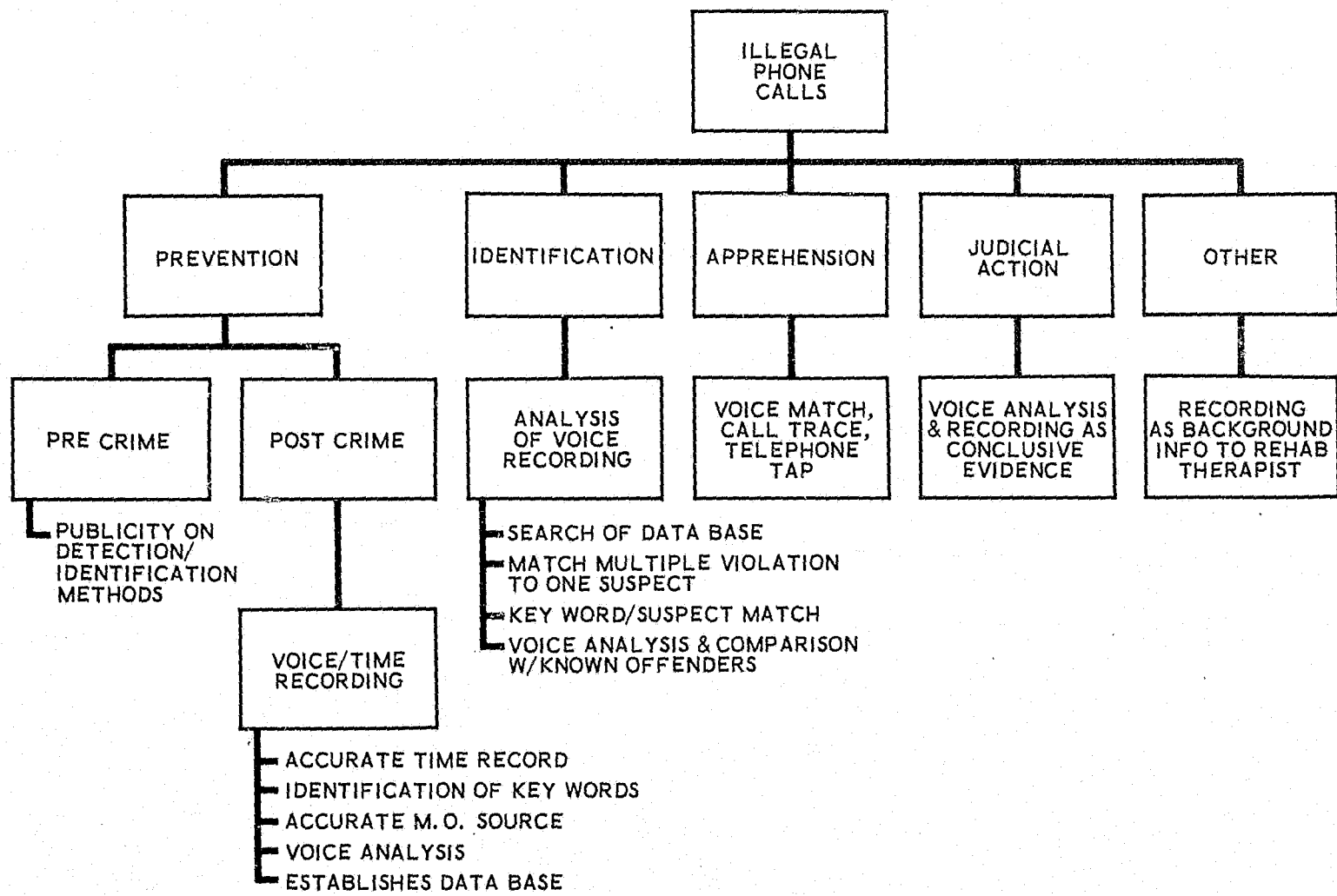


Figure 2. Recording Application Diagram

CHAPTER IV. FUNCTIONAL REQUIREMENTS OF THE  
RECORDING SYSTEM

The functional requirements of a system to record illegal calls are summarized in Table 2. The overriding requirement, as determined from the limited contacts with the potential using agencies, is that the system must make only minimum demands on their resources. They repeatedly stressed that currently they cannot follow up complaints of obscene or threatening calls because it is not cost effective.

Table 2. Functional Requirements

- Comply with Legal Requirements
- Use Law Enforcement Resources Efficiently
- Provide a Deterrent to Potential Violators
- Build Confidence of Victim that Action Is Taken
- Be Compatible with Future Voice Identification Systems
- Preserve Value as Physical Evidence
- Enhance Call Tracing Techniques

CHAPTER V. SYSTEMS ANALYSIS

To provide a systems operational analysis of the recording scheme, a top level functional flow diagram was developed (Figure 3) setting forth the major functional areas that should be spelled out in the birth-to-death life cycle of a system such as this. For purposes of this study, the only interest was to develop the information associated with the block on operation of the system so that the technical requirements could be established to enable the development of specification parameters.

A flow diagram detailing the logical flow of information from the time the illegal call is received to the time that all evidential items derived from the tape recording are submitted to judicial review is shown in Figure 4.

Decision/action logic diagrams were developed (Figure 5) to identify the decisions or actions, or both, that would be required in the application and operation of the recording system. The logic (block 2.10) again demonstrates that if no suspect can be easily located by either a phone trace or voice analysis comparison technique, the recording of the call generates only a data base item against which a future suspect may be tested. It has been assumed (block 2.11) that a controlled sample of the suspect's voice would be required for voice analysis comparison; therefore, a legally authorized intercept of the suspect's voice is required which does not have one party consent. It is understood that this may not be possible in all states, California for one, since under the Federal Omnibus Crime and Safe Streets Bill enabling legislation may be required by the state legal body to provide for telephone wire taps (no consent by caller or receiver) by local enforcement agencies.

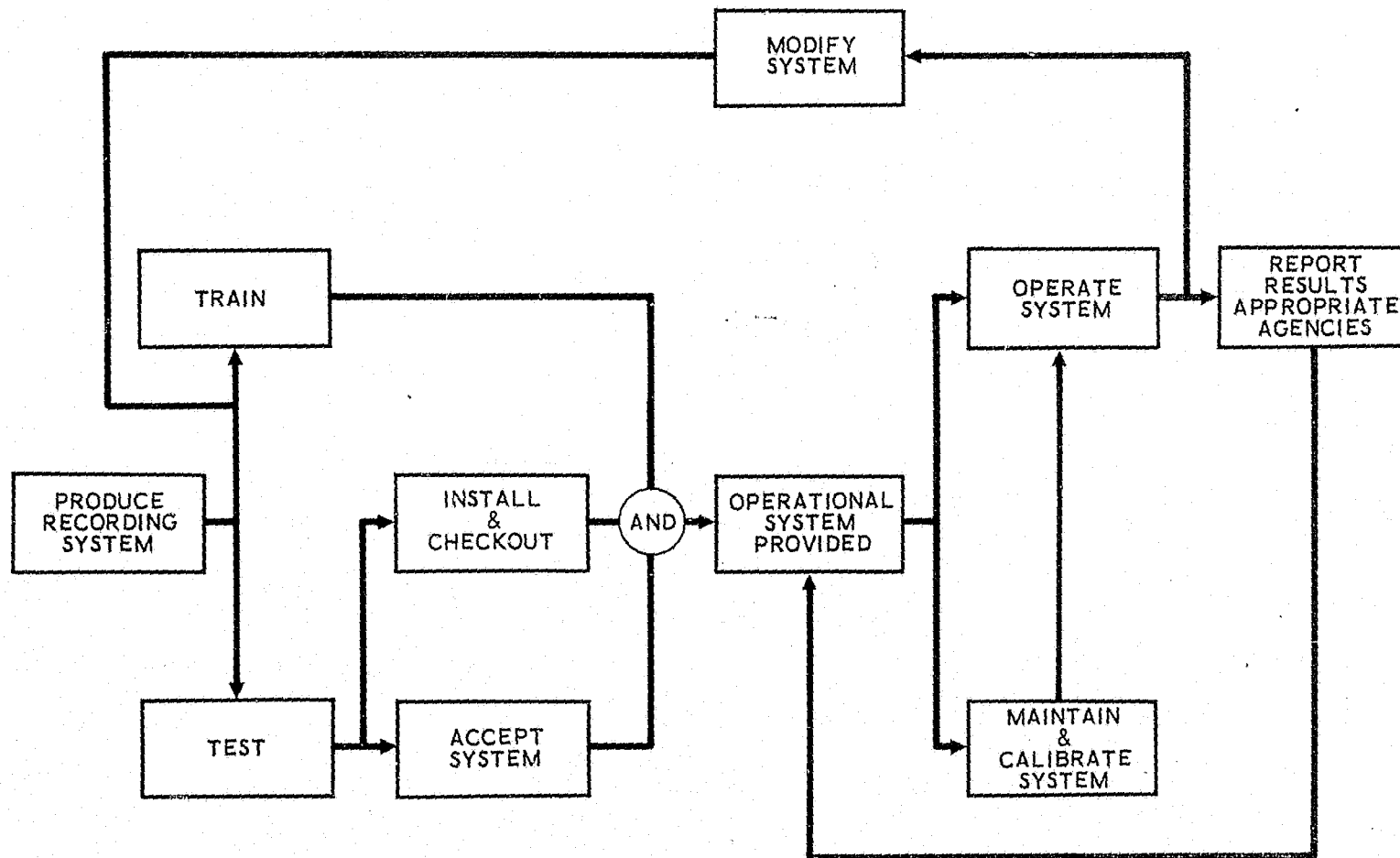


Figure 3. Top Level Functional Flow Diagram

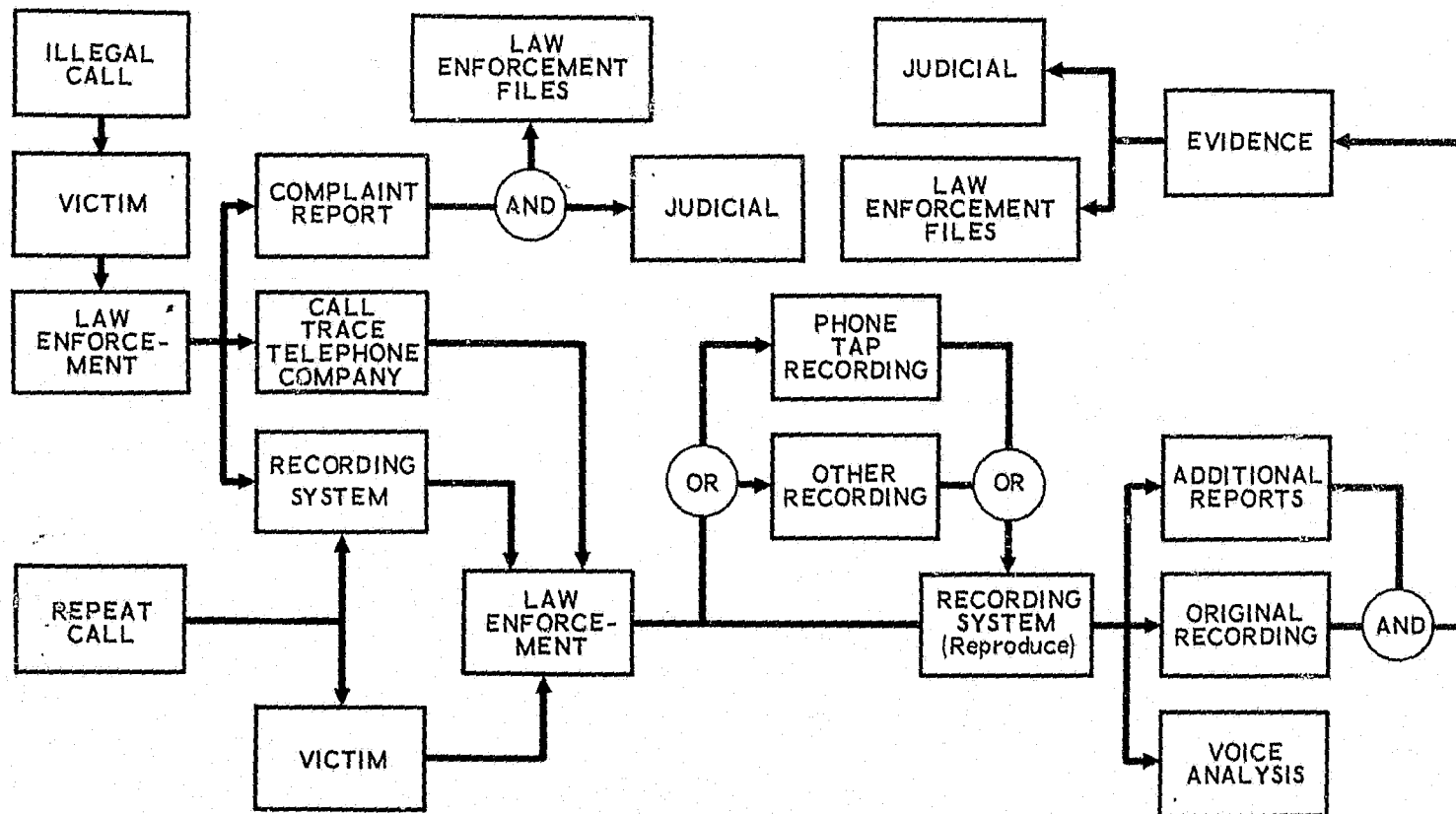


Figure 4. Information Flow Diagram

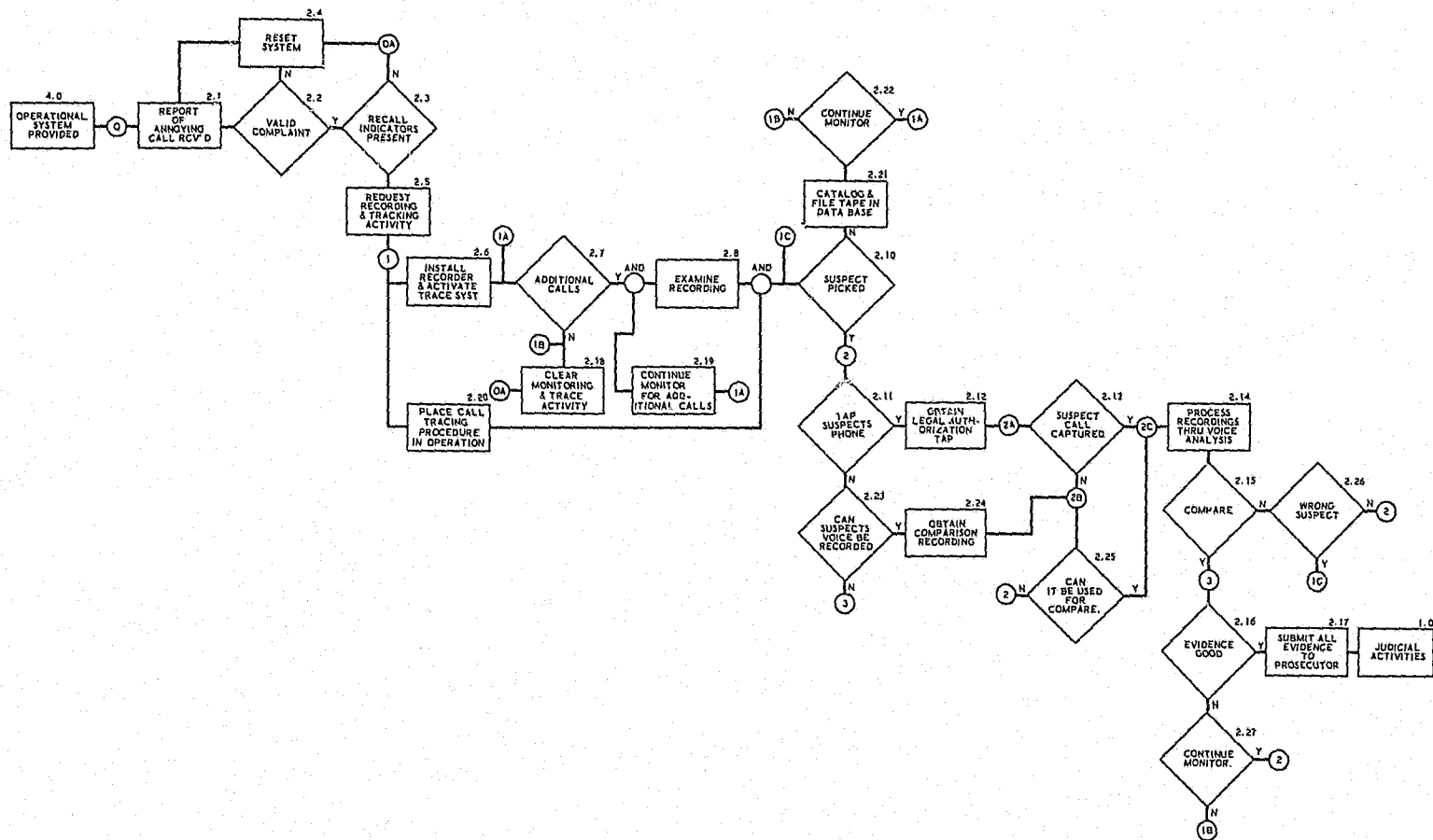


Figure 5. Decision Action Diagram

The final product of the system analysis is the allocation of the functions on the decision/action diagram to actual equipment classification, software, and/or agencies. This allocation is shown in Table 3.

Table 3. Function/Requirements Allocation

Fig. 5	Functional Requirements	Police Agency						Telephone Company						Judicial					
		R	T	RP	AN	TR	TP	R	T	RP	AN	TR	TP	R	T	RP	TR	TP	
2.1	Report of Call	A						A											
2.2	Crank Complaint Decision						A												
2.3	Recall Indication						A												
2.5	Request Recording/Trace	M						A								M			
2.6	Install Recorder and Activate Trace		*M						*M							M			
2.7	Additional Call																		
2.8	Examine Tape Recording			M/E															
2.10	Suspect Picked						M												
2.11	Tap Phone Decision						M												
2.12	Authorization								*M					M/E				M	
2.13	Call Captured	A																	
2.14	Process Tape			M	A														
2.15	Compare						M												
2.16	Sufficient Evidence						M/E											M	
2.17	Submit Evidence													M/E		M		M	
2.18	Clear Monitor Activity	A						A											
2.19	Continue Monitor						M												
2.20	Trace Call													M/E					
2.21	Catalog and Place in Data Base						M/I												
2.22	Continue Monitor						M												
2.23	Can Reference Recording Be Made						M											M	
2.24	Obtain Recording		*M/E						*M/E										
2.25	Recording Used for Analysis			M	A/E														
2.26	Valid Suspect						M												
2.27	Continue Monitor						M												

R = Report  
T = Taping Equipment  
RP = Reproducer  
\* = Function of Central or Local Recording  
AN = Analysis Equipment  
TR = Tracing Equipment  
TP = Trained Personnel  
A = Automatic  
M = By Request  
I = Information Only  
E = Evidence

CHAPTER VI. TRADEOFF STUDY

A summarization of the advantages and disadvantages of central location recording and local recording is set forth in Tables 4 and 5. From a technical viewpoint there is little difference between the two approaches, since recordings adequate for voice analysis should be capable of being made at either location. If the current practice of local law enforcement agencies to use commercially available equipment presents no undue operation and maintenance difficulties and if no current problems with the evidential value of the recordings is recognized, then special hardware development does not appear necessary for recording at either location.

The real tradeoff appears to be: which approach offers the lower cost to implement and operate? Since the labor costs of applying the equipment and handling the recordings will so greatly outweigh the recorder costs, the lower cost system will be that one in which the recorders can be assigned, connected, disconnected, and reassigned with minimum labor expenditure. This should be the central telephone company switching center where the recorders never leave the building and trained personnel are on duty 24 hours a day.

An estimate of the costs involved in the two approaches is presented in Table 6; although the values may be subjective, they are believed to be sufficiently valid for purposes of comparison.

Table 4. Central Location Recording

Advantages	Disadvantages
<p>Multi-Channel Recorder Can Be Used</p> <p>More than One Line Monitor/Recorder</p> <p>Recorder Easily Reassigned</p> <p>Technical Personnel on Location</p> <p>No Transporting of Equipment</p> <p>Installation Costs Minimized</p> <p>Minimum Impact of Law Enforcement Resources</p> <p>Less Ruggedization of Equipment</p> <p>May Enhance Tracking Procedure</p>	<p>All Calls Recorded</p> <p>Victim Does Not See Action</p> <p>May Require Secure Recording Technique</p> <p>More Difficult to Coordinate</p> <p>Requires Telephone Company Cooperation/Regulation</p> <p>Additional Agency in Evidence Chain</p>



Table 5. Local Recording

Advantages	Disadvantages
<p>Operated by Victim</p> <p>Victim Sees Action</p> <p>Only Three Parties Involved</p> <p>Only Illegal Calls Are Recorded</p> <p>Protection from Disclosure of Contents</p> <p>Simpler</p>	<p>High Installation Cost</p> <p>Equipment Must Be Low Cost</p> <p>Equipment Must be Rugged</p> <p>Equipment Must Be Simple to Operate</p> <p>One Activity per Recorder</p> <p>Little Value in Tracing Call</p>

Table 6. Cost Factors (Manhours)

	Central*	Local
Original Report	4	4
Notify Telephone Company (Trace/Record)	0.5	0.5
Telephone Company Installation	2	0
Local Installation	0	4-6 MH
Acquire Recording/Trace Information (Per Day of Recording)	1	0.5-2
Review of Additional Calls (Per Call)	0.5	0.5
Supplement Report of Additional Calls (Per Call)	4	4
Comparative Recording	8-40	8-40
Analysis	Unknown	Unknown
Final Report	8	8
Totals	28 to 60 Manhours Per Complaint  \$300 to \$500 Per Recorder	29.5 to 65 Manhours Per Complaint  \$700 to \$1000 Per Recorder
*Not presently being accomplished. Telephone company will only provide a time history of calls.		

## CHAPTER VII. RECOMMENDATION

Based on the preceding study elements, it is recommended that no special hardware be developed to record illegal phone calls since currently available equipment is adequate to fulfill immediate and near future requirements.

As has been previously brought out, the capturing of a suspect and his subsequent prosecution for illegal phone calls appears to be given an extremely low priority by the law enforcement community. Providing law enforcement personnel with better recording equipment will not change this priority. Furthermore, there is no reason to believe that providing the telephone company the ability to record illegal calls will change this priority. Therefore, it would appear that the concept of illegal call recording prior to selection of a suspect would involve far too large an expenditure of resources to be a viable approach.

## APPENDIX A

### PRELIMINARY DESIGN OF A LOCAL TELEPHONE RECORDER

Purpose: To provide a portable recording system which will automatically record incoming illegal telephone calls for later speaker identification via machine or other processes. It would be installed at the request of persons receiving illegal telephone calls on their premises.

General: A recording device is configured which will record with sufficient fidelity to enable speaker identification to be made by the various methods currently in use or being proposed. Automatic activation, portability, mechanical integrity, and cost effectiveness can be factored with an acceptable degree of confidence, but all of the electrical criteria are not specifically defined. The dynamic range, frequency response, and distortion parameters can be defined because the telephone circuit itself is the limiting factor. However, three parameters unique to the recording process -- flutter and wow, timing accuracy, and amplitude fluctuations -- are not bounded with any degree of precision by the identification processes employed to date. Furthermore, these requirements are dependent upon the type of identification process involved. Therefore, a preliminary guideline is presented on a "best guess" basis.

Tape-speed variations result in a one-to-one variation of the reproduced frequency spectrum. These variations consist of a long-term change in tape speed and a dynamic short-term shift commonly referred to as flutter and wow. The long-term variation results from a drift in the capstan motor speed

controller, tape stretch, or changes in frictional drag components in the spooling mechanism. The flutter and wow variations are caused by the dynamic tape tensioning characteristics of the spooling mechanism and eccentricities of rotating components. In normal audio recordings, these variations are specified separately as timing accuracy (in percent) and flutter and wow (in percent). The normally used standards are the NAB (commercial) and IHFM (consumer).

High-quality expensive tape recorders are available with timing accuracies on the order of  $\pm 1\%$  from machine to machine, and flutter-and-wow capabilities of  $\pm 0.1\%$  record to playback. Although less expensive machines have advertised specifications that look as good, the standards to which they are measured are usually not specified nor does a typical production unit meet the advertised claims.

Investigative Results: It is proposed that a recorder with an absolute timing accuracy of no more than  $\pm 2\%$ , flutter and wow of  $\pm 0.3\%$ , amplitude variations of  $\pm 3$  dB RMS, and a bandwidth of 100 to 5000 KHz with less than 3% total harmonic distortion is sufficient for speech identification purposes. These specifications can be met by any number of reel-to-reel machines ranging in cost from \$300 to \$1000, operating on 115 VAC. A German-made unit, which is battery operated, has been used by Stanford Research Institute and is evidently satisfactory for machine processing. The portability of such units leaves something to be desired. The cassette-type recorders are very attractive with respect to price, size, portability, ease of operation, and power considerations; however, most units available cannot meet the aforementioned

specifications. One two-channel unit, presently being introduced to the market by General Radio, is a somewhat large and heavy cassette-type data recorder with advertised specifications that appear to be sufficient. General Radio is noted for the quality of its product and the recorder should perform as specified; however, a preamplifier may be necessary to drive it from a telephone pickup device.

Proposed System: A recording system is outlined which will permit easy installation at the intercept site, essentially automatic operation, useful reproduction of the intercept, and offer options of automatic data-time coding and legalistic security. The basic requirement is for a two-channel recorder which must be electrically controllable. The peripheries included are an induction pickup unobtrusively attached to the telephone earpiece, an automatic "start" function activated by the motion of the telephone handset, and a "stop" function to avoid wasting tape on calls of no interest, activated either automatically by replacement of the handset or manually via a switch button. A flag will indicate the nearing of tape exhaustion and a security housing will ensure the mechanical integrity of the unit and satisfy the legal aspects of evidence integrity. There will also be a date-time code generator option. The intercept system will be battery operated with the batteries floating on a line charger.

APPENDIX B

APPLICABLE STATE AND FEDERAL LAWS

Section 653m of California Penal Code: Offense committed by use of telephone.

(a) Every person who with intent to annoy telephones another and addresses to or about such other person any obscene language or addresses to such other person any threat to inflict injury to the person or property of the person addressed or any member of his family is guilty of a misdemeanor. (b) Every person who makes a telephone call with intent to annoy another and without disclosing his true identity to the person answering the telephone is, whether or not conversation ensues from making the telephone call, guilty of a misdemeanor. (c) Any offense committed by use of a telephone as herein set out may be deemed to have been committed at either the place at which the telephone call or calls were made or at the place where the telephone call or calls were received. -- Added, Stats. 1963, Chap. 801.

Section 633.5 of California Penal Code: Recording for purpose of obtaining evidence in certain crimes. Nothing in Section 631 or 632 shall be construed as prohibiting one party to a confidential communication from recording such communication for the purpose of obtaining evidence reasonably believed to relate to the commission by another party to such communication of the crime of extortion, kidnapping, bribery, any felony involving violence against the person, or a violation of Section 653m, and nothing in Section 631 or 632 shall be construed as rendering inadmissible in a prosecution for extortion, kidnapping, bribery, any felony involving violence against the person, or a

violation of Section 653m, or any crime in connection therewith, any evidence so obtained. -- Added, Stats. 1967, Chap. 1509.

Section 251(2)(c) of Federal Public Law 90-351: It shall not be unlawful under this chapter for a person acting under color of law to intercept a wire or oral communication, where such person is a party to the communication or one of the parties to the communication has given prior consent to such interception.

**END**