53118

STATE CRIMINAL JUSTICE TELECOMMUNICATIONS (STACOM)

FUNCTIONAL REQUIREMENTS STATE OF OHIO

5030-43 Rev. A

October 1, 1977

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1.0 INTRODUCTION

1.1 PURPOSE

This document presents the Functional Requirements for the Ohio State Criminal Justice Telecommunications (STACOM) Network as developed by the JPL/ OHIO STACOM Project study.*

The Functional Requirements document is the top level network specification and serves as a base for all lower level design specifications for the total network, including functional and design specifications of network elements. All subsequent documentation must be consistent with this specification.

1.2 SCOPE

This document provides a basic description of the Ohio STACOM network, definition of network elements, and defines the required functions of the total network as well as the network elements. The description is intended to provide a succinct overview of network functions and requirements. Further details related to how the functional requirements shall be implemented shall be contained in later requests for proposals.

The use of the term STACOM Network refers to a single network or a group of networks that meet the functional requirements outlined herein.

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* This document presents the results of one phase of research carried out at the Jet Propulsion Laboratory, California Institute of Technology, for the State of Ohio by agreement with the National Aeronautics and Space Administration (Contract NAS7-100).

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2.0 GLOSSARY OF TERMS/ABBREVIATIONS

Term/Abbreviation	Definition
ASCII	American Standard Code for Information Interchange. An eight level code for data transfer adopted by the American Standards Association to achieve compatibility between data devices.
Availability	The average fraction of time that a system or part of a system can be expected to be operational. It is the ratio of the average or mean time between failures, (MTBF), and the sum of the MTBF and mean time to repair, (MTTR), i.e. $$A = \frac{MTBF}{MTBF + MTTR}$$
Baud	Unit of signaling speed. In this document baud is the same as bits per second.
BPS	Bits per second.
CCH	Computerized Criminal History.
Contention	A condition of line control when more than one terminal may request to transmit on the same line at the same time.
KBPS	Thousands of bits per second.
Long Term Store and Forward	The interruption of data flow from the originating station to the designated receiver by storing the information for long periods of time prior to forwarding to the receiver at a later time.
Multidrop	In a multidrop network, all stations are connected on a common transmission link. One station is designated as master and controls all network activity. Each station

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	can listen to messages broadcast by the master but only one station can transmit at a time under the master's control.
NCIC	National Crime Information Center. A law enforcement data base and communications network operated by the FBI used to provide data of interstate/national interest. Communications are from states to the NCIC and vice-versa.
NLETS	National Law Enforcement Telecommunications System. A communications network which provides message routing from state to state for a variety of message types and state to national or national to state for administrative messages only.
OBSCIS	Offender Based State Correctional Information System.
OBTS	Offender Based Transaction System.
O-D	Origin-destination.
RCIC	Regional Crime Information Center, Cincinnati, Ohio.
RSC	Regional Switching Centers. The message switching computer centers which are the major internal nodes of the STACOM network.
SJIS	State Judicial Information System.
STACOM Network	One or more network configurations that meet the functional requirements of this document.
System Termination	Points at which users interface with STACOM Network services. System terminations consist of one of three types: • individual terminals • groups of terminals in cities • interface points to regional criminal justice systems
WE	Weather Status message

3.0 STACOM NETWORK DESCRIPTION

3.1 NETWORK PURPOSE

The purpose of the STACOM Network is to provide efficient telecommunications capable of transporting information between Ohio state criminal justice agencies on a statewide scale and to and from specific interstate criminal justice agencies. Criminal justice agencies are agencies whose primary functions encompass law enforcement, prosecution, defense, adjudication, corrections and pardon and parole. The network shall be designed to handle communication requirements among these agencies projected through the year 1985.

3.2 STACOM USERS

Users of the STACOM Network shall consist of any authorized agency within the Ohio Criminal Justice System. Users shall consist of the present users of the Ohio Law Enforcement Automated Data System, (LEADS), and other criminal justice agencies to the extent that their needs and contributions are compatible with the overall network goals of the Ohio STACOM Network Management.

3.3 BASIC NETWORK CONFIGURATION

The basic configuration of the STACOM Network is an array of network system terminations connected through Regional Switching Center, (RSC), facility(s) to a single data base located in Columbus, Ohio. There may be one or more networks comprising the STACOM Network to be determined during network analysis and design phases of the STACOM Project.

Each system termination on the STACOM Network shall be defined as one of three types:

a. individual terminals
b. groups of terminals in cities
c. interfaces to regional criminal justice systems

Any of the system terminations shall be able to communicate with any other system termination. Each system termination shall not be routed through more than one RSC in gaining access to the Columbus data base, not including the Columbus switching facility, during normal network operation.

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Each system termination shall be connected to an RSC which serves the region in which the system termination is located. System terminations shall be connected to RSC's in minimum cost configurations that meet the functional requirements outlined herein. Direct connections between system terminations and RSC's and multidropped configurations shall be considered.

4.0 FUNCTIONAL REQUIREMENTS

4.1 MESSAGE CHARACTERISTICS

4.1.1 Digital Message Types

The STACOM network shall handle the following five basic types of messages.

- Data File Interrogations/Updates
  These messages shall be inquiries, entries, modifiers, cancels, clears and responses to and from a data file at the state or national level. The text is generally in fixed format.
- Administrative Messages
  These are messages between network users which do not involve data file access. The text is in a less restrictive format.
- Network Status
  These messages shall provide information at terminals initiating messages in the event that destination terminals or intermediate switchers or lines are unable to function.
- Error Messages
  These messages shall contain information regarding the nature of errors detected in transmitted messages. Messages in which errors are detected are not automatically retransmitted on the network, but may be re-sent at the users discretion.
- Fingerprints
  Digitized and/or analog representations of fingerprints shall be included on the STACOM Network.

4.1.2 Message Content

Criminal justice messages shall contain the following information in known locations:

Internal LEADS messages shall contain

- Message Origin
- Message Type

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Regional LEADS messages, (RCIC, NCIC), shall contain

- Message Type
- Message Sequence Number
- Message Origin

The State Data Base Computer in Columbus shall determine for each message

- Message Destinations
- Message Number
- NCIC Identifiers of Sending Department
- Sending Authority

4.1.3 Message Lengths

Digital messages transmitted over the STACOM Network shall not exceed 500 characters in length. Actual messages exceeding 500 characters shall be blocked in message segments which shall not exceed 500 characters each. Multi-segment messages shall have a single overall message number and distinct message segment numbers. Each segment shall be transmitted as a separate message. The destination terminal(s) must reassemble the overall message upon reception.

4.2 NETWORK MESSAGE HANDLING

4.2.1 Message Routing

The STACOM Network shall provide communications routing for all messages between any two of its system terminations.

The following specific routing capabilities shall be provided:

- Data base inquiry/update messages shall be routed from the originating terminal to the Columbus data base through no more than one intermediate Regional Switching Center, not including the Columbus switcher, under normal network operation. Interface routing to NLETS and the NCIC shall be maintained as in the present Ohio LEADS system.
- Administrative messages shall be routed from the originating terminal to the destination terminal through no more than two RSCs under normal network operation. Administrative messages shall

also have a capability for ALL POINTS routing as currently employed by the Ohio LEADS system.

- Digitized fingerprint data shall be routed from the originating terminal to the Ohio Bureau of Criminal Investigation, London, Ohio through no more than two RSCs under normal network operation.

Message routing shall be accomplished by the regional switcher(s) utilizing the destination information in the message. Single messages destined for the same region in which they originate shall be switched to the appropriate system termination by the regional switcher servicing that region.

When more than one system termination is specified as the destination point, the message shall first be routed through the Columbus switcher where STACOM Network Management may exercise the option to grant message approval. The Columbus switcher shall then generate the required number of messages and transmit them to designated system terminations in its own region, and shall transmit a single message to other regional switchers which serve system terminations that are also designated, where the appropriate messages shall be generated and transmitted.

4.2.2 Message Prioritization

Prioritization of messages shall be incorporated in the STACOM Network to the extent required to meet the message response time goals outlined in paragraph 4.2.3.

Messages shall be handled on a non-preemptive priority basis. In this scheme, messages or message segments in process of being transmitted shall not be interrupted, but allowed to complete before higher priority messages are honored.

Under the above conditions, the STACOM Network shall be capable of recognizing and handling message types in accordance with the following prioritization:

Priority 1: Items that may be directly related to officer safety, such as inquiries into Auto Alert, Vehicle Registration, Operators License and Wants/Warrants files, and ALL POINTS Administrative messages of a tactical nature.

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Priority 2: Administrative messages not related to officer safety or tactical needs, and CCH/OBTS, WE, SJIS, and OBSCIS messages.

Priority 3: Fingerprint data or other criminal justice data consisting of large numbers of message segments.

The assignment of message types by the STACOM Network to a given priority level shall be under computer software control so that such assignments may be altered by STACOM Network management as needs arise.

4.2.3 Response Time Goals

Response time for the STACOM Network is defined as the time duration between the initiation of a request for service of an inquiry message by the network at a system termination and the time at which a response is completed at the inquiring system termination.

The response times shown below are maximum times for mean response times and for response times of messages 90% of the time. These response times represent maximum allowable goal values on the STACOM Network.

STACOM RESPONSE TIME GOALS
MAXIMUMS

MESSAGE PRIORITY	MEAN RESPONSE TIME	90% OF RESPONSES TO INQUIRIES RECEIVED IN LESS THAN
1	9 sec	20 sec
2	1 min	2.3 min
3	2 hrs	4.5 hrs

4.2.4 Line Protocol

4.2.4.1 Half Duplex

The standard interface to system terminations shall be half duplex.

4.2.4.2 Full Duplex

Full duplex line discipline may only be used interregionally.

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4.2.5 Message Coding

All STACOM Network messages shall be coded using the American Standard Code for Information Interchange (ASCII), USAS X3.4-1968. Message coding for interaction with the NCIC, RCIC, and NLETS systems shall conform to existing practices of the Ohio LEADS Network.

4.2.6 Error Detection

The STACOM Network regional switchers shall provide for bit error detection of erroneous messages. Error messages shall be transmitted to system terminations in accordance with present practices of the Ohio LEADS Network. The computer shall detect format errors and transmission errors on incoming messages and notify the sending terminal appropriately. The computer shall also detect off-line or inoperative terminals.

Messages shall not be automatically retransmitted upon error detection. Messages may be retransmitted at the discretion of the user.

4.2.7 Network Status Messages

The STACOM Network shall provide for notification to system terminations of any conditions which prevent operation in the normal specified manner. System terminations shall receive such status messages upon attempting to use the network when the network is in a degraded mode. System terminations so notified shall receive a further status message indicating normal network operation has been restored when malfunctions have been corrected.

4.3 SYSTEM TERMINATIONS

STACOM Network system terminations having interface capability of 1200 BPS or greater shall interface with the network using half duplex protocol. Terminals shall have the capability for off-line construction of input messages and for hard copy production of received messages.

All terminals shall be pollable and provide for parity error detection.

The number of system terminations per multidropped line shall not exceed 25.

4.4 REGIONAL SWITCHING CENTERS

The STACOM/Ohio Network shall be comprised of one dual processor Regional Switching Center (RSC) with a redundant data base located in Columbus and up to three additional RSC's without data bases. The following describes the capabilities of each type of RSC.

4.4.1 Switchers Without Data Bases

4.4.1.1 Communication Line Interfaces

An input communication line interface shall convert incoming serial bit streams into assembled characters and furnish electrical interface for the modem and logic required for conditioning.

An output communication line interface shall convert characters into a bit stream. It shall also provide logic necessary to condition the modem for transmission and furnish the necessary electrical interface.

RSCs shall be designed to handle either full or half duplex line protocols on any line interface.

4.4.1.2 Message Assembly/Disassembly

A message assembly unit shall assemble messages by deblocking the character stream.

A message disassembly unit shall segregate messages into logical blocks for output. It shall also disassemble the blocks into a character stream for presentation to the communication line interface.

4.4.1.3 Error Control

The error control function shall provide error detection capability and initiate error messages in accordance with requirements outlined in Section 4.2.6. The error detection function is highly dispersed. Character parity is most efficiently checked during assembly of characters in the interface. Block parities are checked upon assembly of blocks. Additionally, all internal data transfers shall require a parity check.

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4.4.1.4 Message Control and Routing

The message control and routing function shall provide logic which examines the assembled message, determines its priority, destination, and forms the appropriate pointers and places them in the proper queue, (the pointers are queued, not the messages).

Message routing shall be performed by RSCs in accordance with procedures outlined in Section 4.2.1.

In addition, this function shall maintain network status information for the purposes of determining availability of alternate communication paths in degraded modes of operation.

4.4.1.5 Queue Control

This function shall provide buffer and queue storage used to assemble input messages, buffer them for output and to form space to queue the message pointers.

Regional switchers shall maintain necessary queues for each system termination they service and for interregional traffic. These queues shall hold messages that cannot be sent immediately due to line usage conflicts. However, the regional switchers shall not maintain a long term store and forward capability. In the event that queue space is full, the regional switcher shall not accept any more messages and shall notify the other switcher not to accept messages destined for the switcher in question.

This capability shall be provided through use of upper and lower queue threshold specifiable by the regional switcher operator. All system terminations sending messages to the regional switcher which would demand queue space in excess of the upper threshold shall be sent negative acknowledgement responses. Once the upper threshold has been exceeded, the regional switcher shall enter the input control mode (i.e., the regional switcher shall output only). Any request for regional switcher service while it is in the input control mode shall result in a wait acknowledgement being sent to that system termination. The regional switcher shall stay in the input control mode until the lower threshold is attained.

Queue control procedures at the regional switchers shall be comprised of the following basic functions:

- Provide three independent queues for each system termination by priority as required.
- Dynamic queue management where a common core pool is made available for queueing on an as-need basis.
- Queue overflow management as discussed above.
- Provide queue statistics for input to statistics gathering function, as discussed in Section 4.4.1.7.

4.4.1.6 Line Control

The line control function shall provide the capability of controlling and ordering the flow of data between the various message switchers. It also determines which line discipline is to be used. Full-duplex, half-duplex, polled or contention line discipline capabilities shall be possible.

4.4.1.7 Network Statistics

The STACOM Network shall be capable of collecting statistical data fundamental to the continued efficient use of traffic level prediction and network design tools developed by the STACOM Project.

The STACOM Network shall be capable of collecting the following statistical data:

- Number of messages by message type received from each system termination at State Data Bases.
- Number of messages by message type sent to each system termination from State Data Bases.
- Average message lengths by message type received at State Data Bases.
- Average message lengths by message type sent from State Data Bases.

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The STACOM Network shall provide for periodic sampling of the following statistics:

- Origin-Destination message volumes by system termination.
- Percent of "HITS" and "NO-HITS" on each data base type.
- Average waiting times of input messages at switching and data base computers for CPU service.
- Average waiting times of output messages at switching and data base computers for output lines after CPU service.
- Average CPU service time per message at switching and data base computers.
- Total number of messages received each hour at the State Data Base.
- Total response time for data base interrogations/updates of selected system terminations.

4.4.1.8 Operator Interface

The regional switcher shall provide means of interfacing with the operator. This interface shall be used to control and monitor the regional switcher and its network. The following functions are to be provided:

- The regional switcher shall provide a set of commands for the purpose of communicating with the operator.
- The regional switcher shall provide means of outputting data to the operator at a rate of at least 30 characters per second.
- The regional switcher shall provide means of accepting operator control input.
- The regional switcher shall provide high speed data output capability. This data output capability shall not be less than 300 lines per minute. A line shall have 132 characters.

4.4.2 Switchers With Data Base

RSC's with data base capability employ the additional function of providing file search and update capability. This function involves receiving messages from the switchers message control and routing function (see 4.4.1.4), and placing their pointers in queue by priority for access to data base files. Upon completion of data base access, messages are returned to the message control and routing function in preparation for output.

RSC's with data bases shall maintain redundant data base files, each of which is updated in parallel at the time of file update.

4.5 NETWORK AVAILABILITY GOAL

The availability goal for the STACOM Network shall be 0.979 for the worst case Origin-Destination, (O-D), pair of system terminations on the network. The worst case O-D pair is defined as that link from system termination to system termination that employs the largest number of system components in its path, or the one that is most vulnerable to failure.

Availability of 0.979 implies an average outage of less than or equal to 30.2 minutes per day for the worst case path.

4.6 TRAFFIC VOLUMES

The STACON Network shall be designed to handle traffic projections through the year 1985. These projections shall include traffic estimates plus design margins for peak vs. average loading. The total network throughput projected from 1977 to 1985 is as follows:

YEAR	TOTAL STACOM NETWORK THROUGHPUT (Average Msg/Day) in 1000's		
	LEADS	BMV	NEW DATA TYPES
1977	147	9	14
1981	214	85	142
1985	284	98	170

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4.7 CONSTRAINTS AND BOUNDARIES

4.7.1 Data Handling Constraints

- All data transmission shall be digital with the exception of fingerprint data which may be transmitted analog, or digitally, or both.
- No unscrambling or decryption shall be performed within the STACOM Network. (Some modems perform scrambling in the normal course of their operation but this scrambling is transparent to the user.)
- Traffic loading by network users in excess of the traffic safety margins for which their system terminations are designed could result in degraded message response time.

4.7.2 Data Rate Constraints

The minimum service goal for the STACOM/Ohio Network shall be 1200 Baud half-duplex lines. All available line capacity services above this rate shall be eligible for consideration in a cost/performance effective manner.

4.7.3 Security and Privacy Constraints

The STACOM Network shall be configured to allow management control by an authorized criminal justice agency or group of such agencies. Only STACOM Network operating personnel who have been authorized by STACOM Network management shall have physical access to the network equipment. These personnel shall have been thoroughly screened. It shall be the responsibility of the STACOM Network management to institute and maintain security measures and procedures consistent with good practice.

It shall be the responsibility of the STACOM Network Management to insure that unauthorized personnel are not allowed access to system terminations and that authorized personnel do not employ the network facilities for any purposes other than those for which the STACOM Network is specifically intended.

STACOM Network design shall assist in the realization of adequate security to the extent that engineering considerations can contribute. The STACOM Network shall consider in its design methods to prevent any alteration of the content of messages once they have been routed over the network. All of the equipment comprising the STACOM Network, except for the communication lines, shall provide adequate physical security to protect them against any unauthorized personnel gaining access to the STACOM Network. The computers and other network accessing equipment comprising the STACOM Network shall be located in controlled facilities. Redundant elements should be configured such that a single act of sabotage will not disable both redundant elements.

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END