SYSTEM PERFORMANCE SUBSYSTEM
SOFTWARE SUBSYSTEM DESCRIPTION
NO. 1 AND NO. 1A ELECTRONIC SWITCHING SYSTEMS

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1. GENERAL

INTRODUCTION

1.01 This section describes the functional operation of the system performance subsystem programs in a No. 1 or 1A Electronic Switching System (ESS) Central Office.

1.02 When this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 Part 7 lists the abbreviations and acronyms used in this section.

PURPOSE OF SYSTEM PERFORMANCE SUBSYSTEM

1.04 The purpose of the system performance subsystem is to provide the maintenance personnel with real-time indicators via the No. 1A System Status Panel (status lamps, light-emitting diode bar graph display, TTY printout) that reflects the system's performance of various call processing facilities and functions.

SCOPE OF SECTION

1.05 The information in this section includes:

(a) Brief Description of PIDENTS

(b) PIDENT Interface

(c) Subsystem Functional Description

(d) PIDENT Functional Description

2. BRIEF DESCRIPTION OF PIDENTS

2.01 The System Performance Subsystem is comprised of six PIDENTs grouped into the following functional operations:

(a) System Status and Activity Display

- System Performance Indicator (SYPI) Program

(b) Traffic Control and Service Measurement

- Dial Tone Speed Test (DTST) Program
- Line Load Control (LLOD) Program
- Receiver Attachment Delay Report (RADR) Program

(c) Service Observing

- Multiline Service Observing (SOBR) Program
- Direct Distance Dialing Observing (DDDO) Program

A. System Status and Activity Display

System Performance Indicator (SYPI)

2.02 The SYPI program collects test data, performs statistical tests, updates indicators on the system status panel (Fig. 1), and produces a TTY printout of the related data. The facilities and call processing functions monitored by SYPI include:

- Call Registers
- Hoppers

- Queues
- Service Circuits
- Line and Network
- Data Transfer
- Abrupt Traffic Change
- Originating Calls
- Incoming Calls
- Intraoffice Calls
- Tandem Calls
- Processor Occupancy
- Ineffective Attempts
- DP Dial Tone Speed Test Delays
- TT Dial Tone Speed Test Delays
- MF Receiver Attachment Delay Report Delays
- RP Receiver Attachment Delay Report Delays
- DP Receiver Attachment Delay Report Delays
- Tandem Calls First Failure to Match
- Incoming First Failure to Match
- Incoming Matching Loss
- Outgoing Overflow
- Intraoffice Overflow
- OMR Usage

B. Traffic Control and Service Measurement Programs

Dial Tone Speed Test (DTST)

2.03 The DTST program determines the grade of dial tone service given to originations. The results of the dial tone speed tests are used by the LLOD program as criterions for determining when to deny originating service to some nonessential lines.

Line Load Control (LLOD)

2.04 The LLOD program provides a means of assuring acceptable grades of originating service to lines considered essential in an emergency.

Receiver Attachment Delay Report (RADR)

2.05 The RADR program initiates test calls and determines the delay time taken for connection to a receiver. Test results are used by the network management program and as displayed indicators of system performance.

C. Service Observing Programs

Multiline Service Observing (SOBR)

2.06 The SOBR program administers the connection of the service observing circuit dedicated to a customer's line.

Direct Distance Dialing Observing (DDDO)

2.07 The DDDO program permits an operator to monitor direct distance dialing outgoing calls during the call process. The program controls various signal distributor points to cause the DDDO service circuit to control signals at the observing desks via lamp indicators.

3. SUBSYSTEM INTERFACE

A. System Performance Indicator (SYPI) Program

3.01 The SYPI program interfaces with the following PIDENTs (Fig. 2):

(a) Executive Control Main Program (ECMP)

(b) Traffic Counts Program (TCNT)

(c) Automatic Overload Control Program (AOVD)

(d) Seize and Release Routines and L-, J-, and T-Bit Administration Program (YAHA)

(e) Network Failure Maintenance Action Program (NMFL)

(f) Plant Measurement Program (PPMP)

(g) Network Failure Maintenance Action Lamp and Key Program (MCTW)

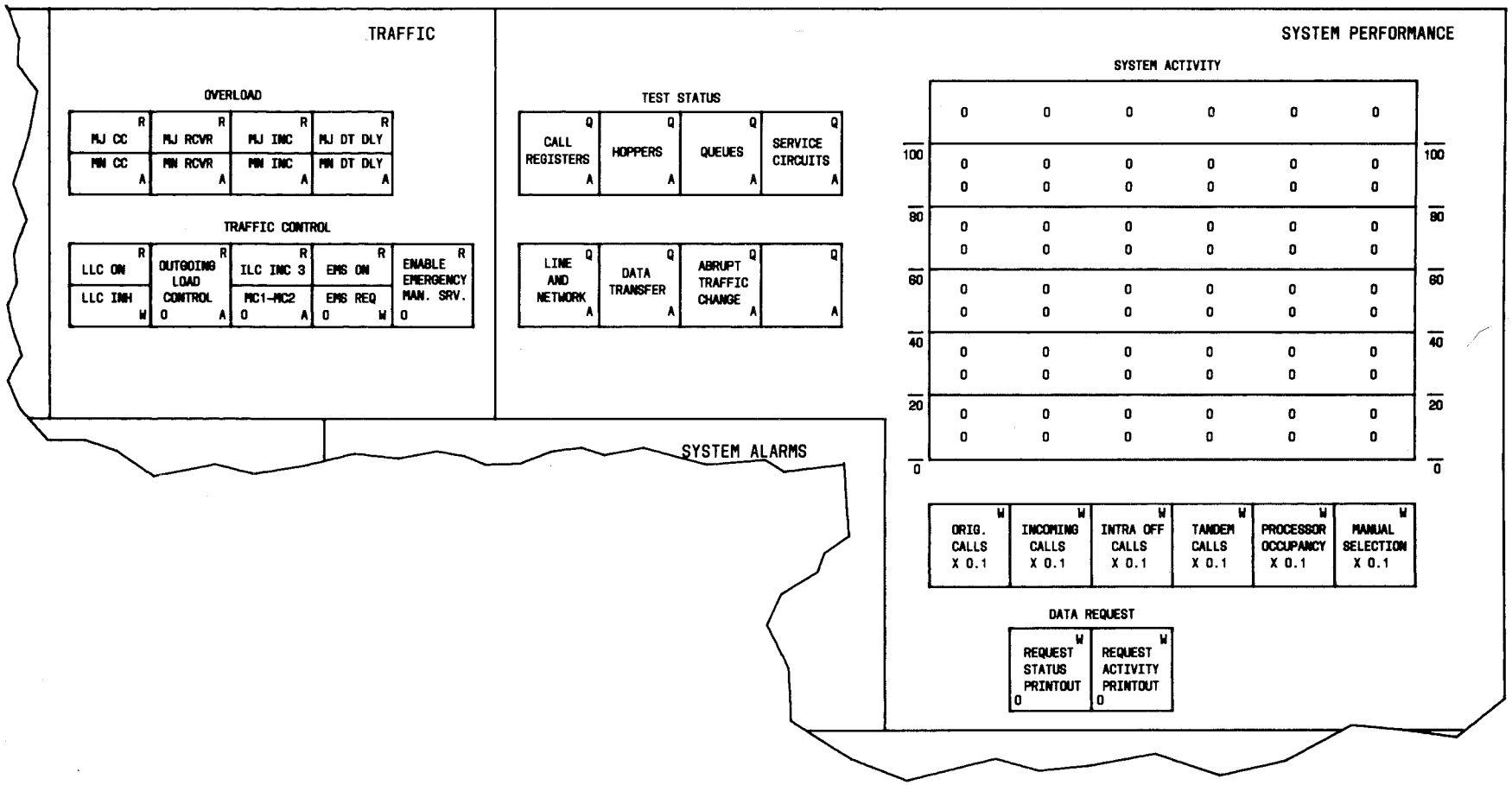

Fig. 1—System Status Panel Traffic and System Performance Indicators

(h) Memory Integrity and Recovery Program (MIRV)

(i) Parameter Data Assembler (PDA)

(j) TTY Input-Output (IOCP)

(k) Dialing Connection (DNCT)

(l) Receiver Attachment Delay Report (RADR)

Executive Control Main Program (ECMP)

3.02 The ECMP program interfaces with SYPI by executing an entry every 10 seconds at label SYPI_NTR.

Traffic Counts Program (TCNT)

3.03 The TCNT program accumulates traffic counts and once every hour zeroes the test control memory block SY2HR-FAIL. These counts are used by SYPI in the various statistical tests.

Automatic Overload Control Program (AOVD)

3.04 The AOVD program unloads hoppers and sets an overflow indicator in memory identified as SY2-HOPPERS. SYPI interrogates this indicator once every 10 seconds to determine if any hoppers have overflowed since the last test instant. SYPI processes this information for the HOPPERS status lamp test.

Seize and Release Routines and L-, J-, and T-Bit Administration Program (YAHA)

3.05 The YAHA program maintains peg and overflow counts for the disconnect and by-link dialing senior registers that are utilized by SYPI for the CALL REGISTER status lamp tests. This data is used in calculating the holding time and number of register seizures.

Network Failure Maintenance Action Program (NMFL)

3.06 The NMFL program detects the occurrence of an NN08 switch failure that is used by SYPI for the LINE AND NETWORK status lamp test. Whenever a switch failure is detected, transfer is made to SYPI at SYPISWFL. The SYPI routine periodically performs a test which determines if the detected switch is still on the faulty switch list monitored by NMFL.

Plant Measurement Program (PPMP)

3.07 The PPMP program interfaces with SYPI by maintaining a showering line failure counter PL2SHWL used in LINE AND NETWORK status lamp test calculations.

Network Failure Maintenance Action Lamp and Key Program (MCTW)

3.08 The MCTW program detects the manual operation of the REQUEST STATUS PRINTOUT, REQUEST ACTIVITY PRINTOUT, and MANUAL SELECTION keys. It transfers control to SYPI which, in turn, processes the request and initiates a printout of the data messages.

Memory Integrity and Recovery Program (MIRV)

3.09 The MIRV program zeroes the ENTRY_CNT item of word SY2CNTRS at the end of each phase, so that the SYPI program starts executing its tests in the correct order upon completion of the phase.

Parameter Data Assembler (PDA)

3.10 The PDA maintains the threshold values (engineered number of high day calls per minute) in memory block SY2PK-CLCAP. These values are used by SYPI in computing the ORIG. CALLS, INCOMING CALLS, INTRA OFF CALLS, and TANDEM CALLS bar graphs.

TTY Input-Output (IOCP)

3.11 The IOCP program provides interface media via TTY input and output messages for system initialization, bar graph printout, and a selection of items for display.

3.12 The input message INIT:SYSPRFM is used to initialize the system if shift in data has been detected.

3.13 The TTY output message REPT:SYSPRFM; a b is used for data related to tests on the call registers, service circuits, abrupt traffic changes, hoppers, queues, line and network, and data transfers.

3.14 The TTY output message REPT:SYSPFRM; BARGRPHS is used for retrieving data related to the bar graphs.

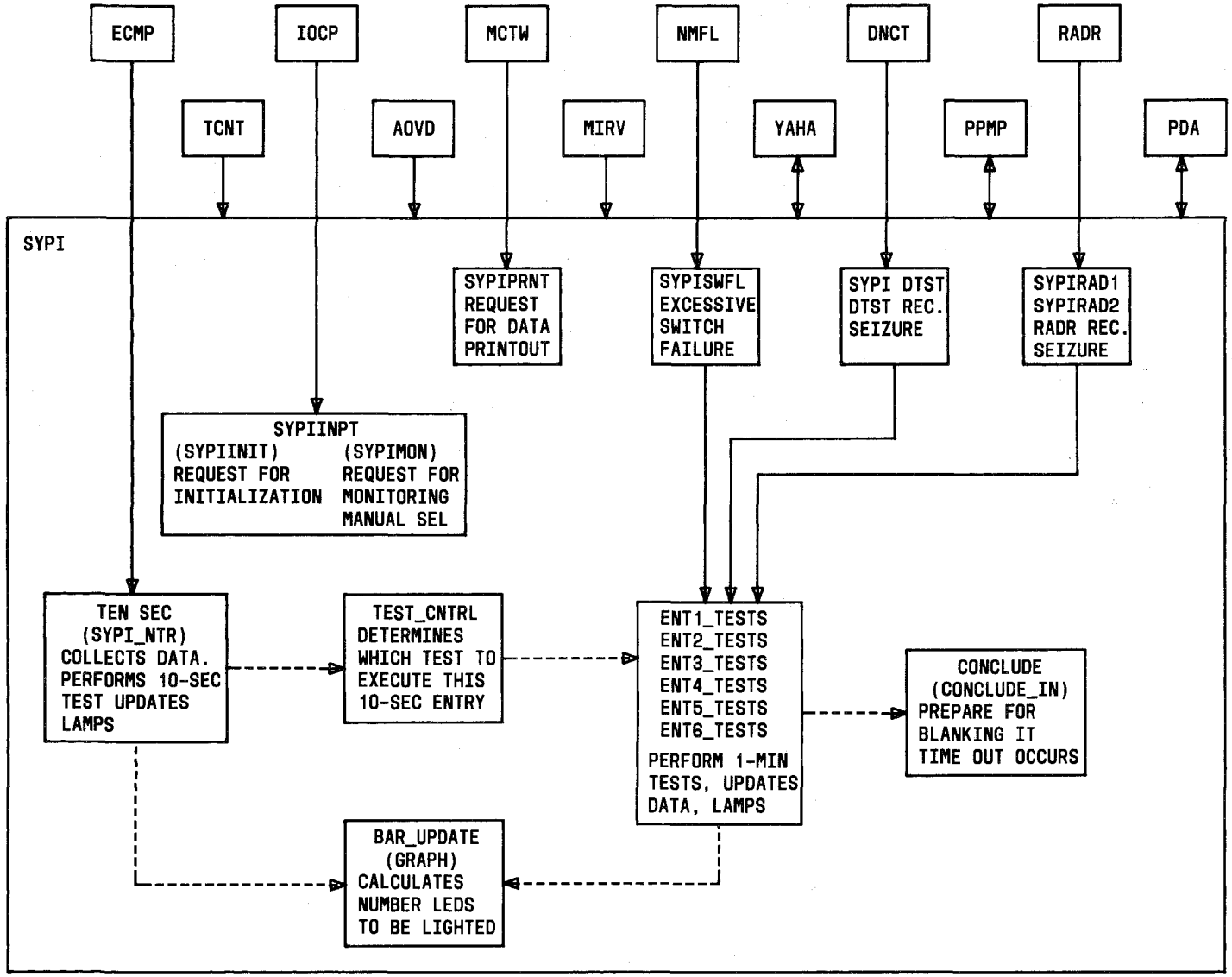

Fig. 2—System Performance Indicator (SYPI) Program Interface

3.15 The TTY input message MON:SYSPRFM;MAN a! is used when selecting an item for display on the MANUAL SELECTION bar graph.

Dialing Connection (DNCT)

3.16 DNCT program interfaces with SYPI if a receiver is to be seized for DTST. Entry is made at SYPIDTST.

Receiver Attachment Delay Report (RADR)

3.17 RADR program gives SYPI an entry at SYPIRAD1 when a trunk MF or DP receiver is seized for RADR. An entry is made at SYPIRAD2 when a trunk RP receiver is seized for RADR.

B. Dial Tone Speed Test (DTST) Program

3.18 Figure 3 shows the interface of DTST and the following PIDENTs:

(a) Executive Control Main Program (ECMP)

(b) Dialing Connection Program (DNCT)

(c) TTY Input-Output Program (IOCP)

3.19 ECMP interfaces with DTST by transferring control every four seconds for initiating the dial tone speed tests.

3.20 DTST interfaces with DNCT by passing control in order to obtain dial tone on the dial tone speed test calls.

3.21 The IOCP program provides interface for controlling the mode of operation and obtaining a printout of related data. Refer to Input/Output Message Manual (IM-6A001/OM-6A001) for use of the following messages.

- DT-ALLOW (Enable DTST)
- DT-INH (Turn-off DTST)
- TOC01 (Traffic and overload status when LLC feature is activated)
- TOC02 (Traffic and overload status when LLC feature is not activated)
- TC-TIME (Turn DTST on and off at specified times).

C. Line Load Control (LLOD) Program

3.22 The LLOD program interfaces with the following two PIDENTs (Fig. 4):

(a) Executive Control Main Program (ECMP)

(b) TTY Input-Output Program (IOCP)

3.23 ECMP interfaces with LLOD every four seconds to check the mode of operation and status of the DTST tests.

3.24 The IOCP program provides for controlling mode of operation of LLOD via TTY input and output messages. Refer to Input/Output Message Manuals (IM-6A001 OM-6A001) for use of the following messages:

- LLC-ALLOW-ON (Manually enable LLC)
- LLC-ALLOW-AU (Automatically activate LLC)
- LLC-INH (Deactivate LLC)
- LLC-MASK-PRNT (Scan mask printout, LC02, used to determine number of line groups affected)
- TOC01 (Overload data and status reports printed as results of input message LLC-ALLOW-ON if system is OK)
- TOC02 (Traffic and overload data printed as result of input message LLC-ALLOW-AU if system is OK)
- LC01-AGR (Service requested)

D. Receiver Attachment Delay Report (RADR) Program

3.25 RADR interacts with the following PIDENTs (Fig. 5).

(a) Executive Control Main Program (ECMP)

(b) Network Management Program (NMGT)

(c) TTY Input-Output Program (IOCP)

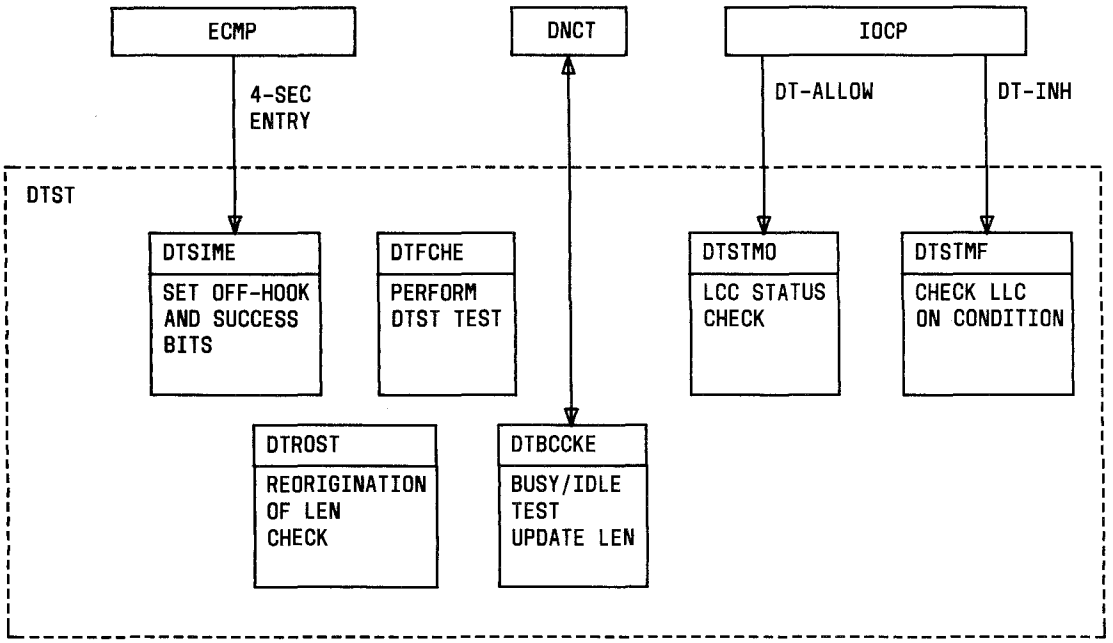

Fig. 3—Dial Tone Speed Test (DTST) Program Interface

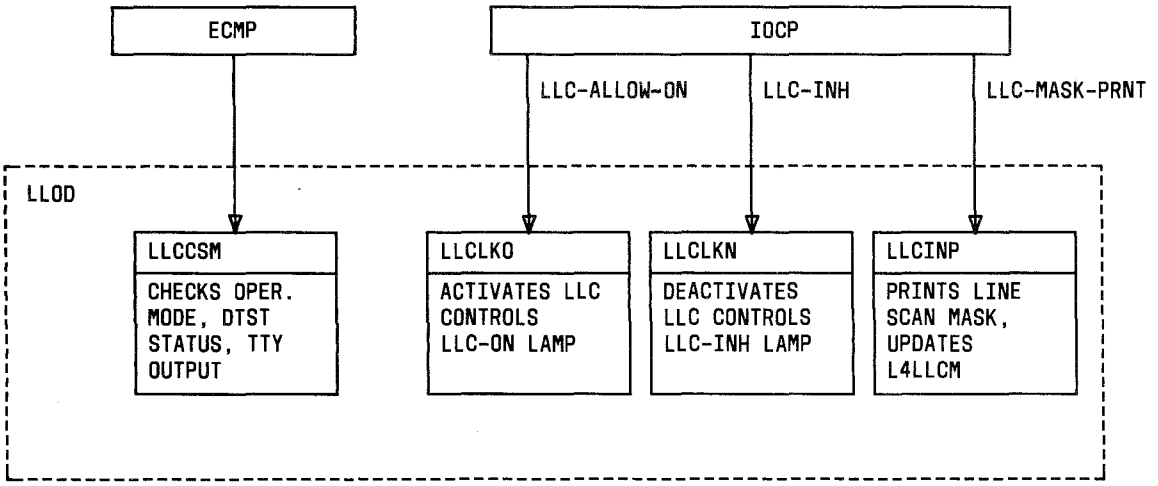

Fig. 4—Line Load Control (LLOD) Program Interface

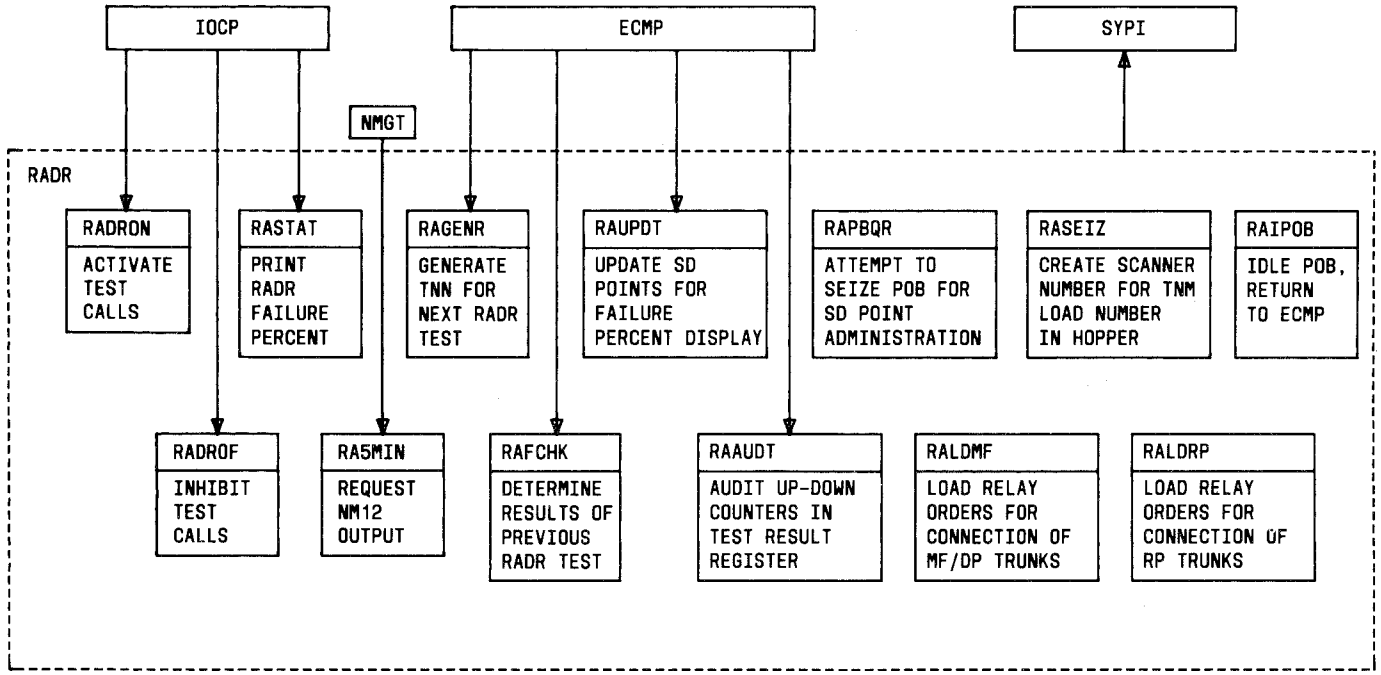

Fig. 5—Receiver Attachment Delay Report (RADR) Program Interface

3.26 The ECMP program schedules and administers the following items for RADR:

- Determines RADR test results every four seconds
- Generates TNN for test every 100 ms
- Simulates TNN seizure every four seconds
- Updates SD points for display every 30 seconds
- Audits up-down counters every hour

3.27 Every five minutes, NMGT interfaces with RADR to process the threshold values used by the RADR test.

3.28 IOCP interfaces to allow for controlling the mode of operation and obtaining status of the RADR feature. Refer to Input/Output Message Manual (IM-6A001 OM-6A001) for use of the following messages:

- RAD-ALLOW (Activate test calls)
- RAD-INH (Inhibit test calls)
- RAD-STATUS (Print RADR failure percent message)

E. Multiline Service Observing (SOBR) Program

3.29 Figure 6 depicts the following PIDENTs that interface with SOBR.

(a) Dialing Connection (DNCT)

(b) Scan Point Change Director (CXYH)

(c) TTY Input-Output Program (IOCP)

3.30 The DNCT program transfers control to SOBR to seize a service observing register for the service observing call.

3.31 The IOCP program provides interface for operation of the SOBR feature. Refer to the input and output manuals for the following messages:

- Recent Change Order (Assigns customer's line for SOBR)
- A3-S001 (Indicates service observing circuit failure)
- SO-RESTORE-a (Indicates service observing circuit release)

F. Direct Distance Dialing Observing (DDDO) Program

3.32 The DDDO program interfaces with the following programs (Fig. 7).

(a) Executive Control Main Program (ECMP)

(b) Automatic Message Accounting Data Accumulation Program (AMAC)

3.33 When a seizure signal is sent to the observing desk, ECMP controls a 50-ms scan which detects an answer.

3.34 The DDDO receives control from AMAC to determine if the call is to be service observed.

4. SUBSYSTEM FUNCTIONAL DESCRIPTION

4.01 The system performance subsystem provides the maintenance personnel both manual and automatic means of evaluating the call processing facilities and functions via TTY printouts, test status lamps, and LED bar graph indicators.

4.02 The SYPI program collects data on facilities and processing functions, performs statistical tests, and updates the system performance section of the No. 1A system status panel. The display is intended to indicate early system activity and the presence of abnormalities in the call processing or system software resources to allow corrective measures to be implemented before system deterioration occurs. Call processing facilities monitored and displayed on the system status panel via TEST STATUS lamps are:

- Call Registers
- Hoppers
- Queues
- Service Circuits
- Line and Network
- Data Transfer

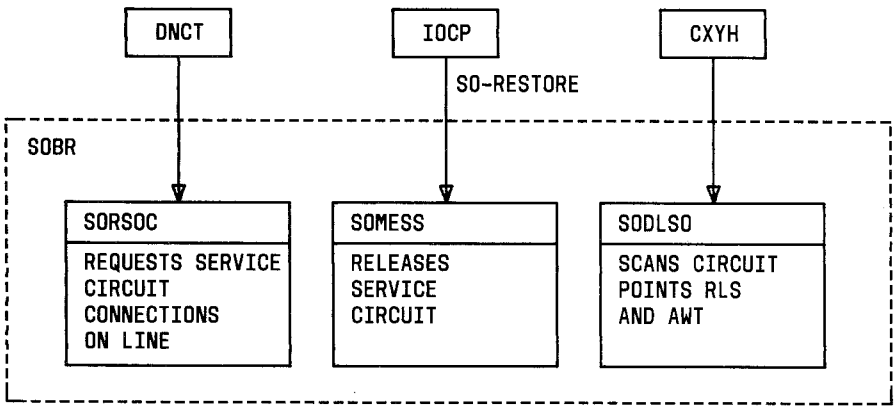

Fig. 6—Multiline Service Observing (SOBR) Program Interface

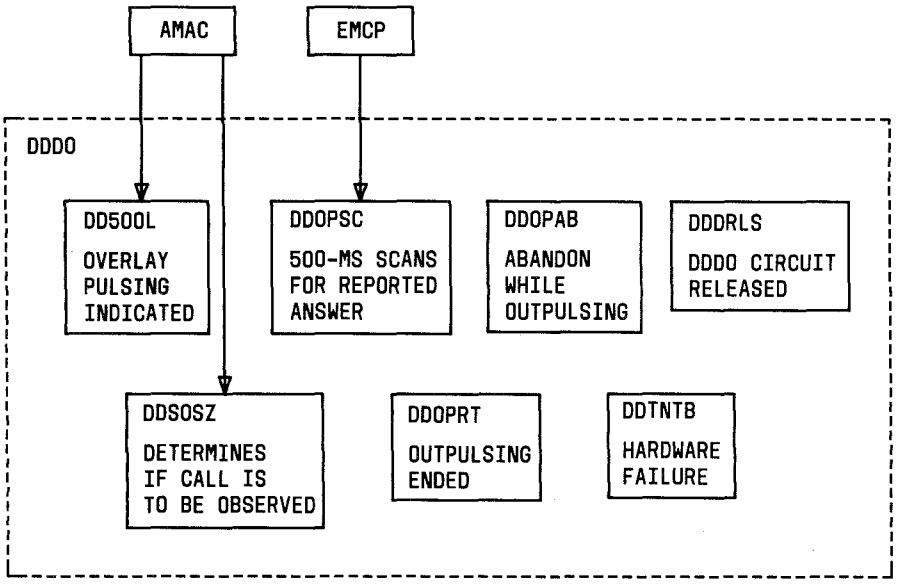

Fig. 7—Direct Distance Dialing Service Observing (DDDO) Program Interface

- Abrupt Traffic Change

System call processing functions displayed by bar graphs are:

- Originating Calls
- Incoming Calls
- Intraoffice Calls
- Tandem Calls
- Processor Occupancy
- Manual Selection—Ineffective Attempts, DP DTST Delays, TT DTST Delays, MF RADR Delays, RP RADR Delays, DP RADR Delays, Tandem Calls First Failure to Match, Incoming First Failure to Match, Incoming Matching Loss, Outgoing Overflow, Intraoffice Overflow, OMR Usage

4.03 Data associated with the TEST STATUS lamps is available to the maintenance personnel via the maintenance TTY. Whenever a printout is requested via the REQUEST STATUS PRINTOUT keys, the associated lamp will light for approximately one second to indicate that the request has been acknowledged.

4.04 Whenever a TEST STATUS lamp is lighted amber for a long period of time, the maintenance personnel may periodically query the system performance program by operating the DATA REQUEST keys. The output data should be examined to ensure that other legitimate problems have also not simultaneously occurred in the system. Each test result in the output message is prefixed by a word indicating the pass or fail status of that test. This enables the maintenance personnel to quickly detect the occurrence of new problems by determining the test which has failed since the previous printout request.

4.05 Data associated with the SYSTEM ACTIVITY bar graphs is obtainable via the TTY by operating the REQUEST ACTIVITY PRINTOUT key. The lamp will light for approximately one second to acknowledge the printout request. The MANUAL SELECTION key must be operated to obtain data displayed by the bar graph furthest to the right. The test for bar graphs is assumed to have failed when the red light emitting diode (LED) is lighted. A persistently lighted amber TEST STATUS lamp or a persistently red lighted LED at the top of the bar graph generally indicates that either something is wrong or that a permanent shift has occurred in the data. In both cases, the maintenance personnel should analyze printed test results and traffic information when either implementing corrective measures or reinitializing the data.

4.06 The maintenance personnel can also request the reinitialization of any system performance test. If the maintenance personnel feels that a permanent legitimate shift has occurred in the data, then the test can be reinitialized.

4.07 DTST, LLOD, and RADR initiate test calls on which periodic tests are performed to be used in determining system performance. DTST provides a measurement of dial tone service furnished to the customer. RADR administers test calls for measuring the amount of delay incoming calls experience in getting a receiver connection. The LLOD provides means of assuring acceptable grades of originating service to lines considered essential during emergency conditions. If the LLOD has been placed in the automatic operation mode, it is enabled depending upon the results of the dial tone speed tests.

4.08 SOBR and DDDO provide manual means of observing various stages of the call processing function. SOBR allows an operator, located at the centralized service observing desk, to monitor various types of calls. DDDO provides observation of DDD outgoing calls from the centralized office.

5. FUNCTIONAL DESCRIPTION OF PIDENTS

A. System Performance Indicator (SYPI) Program

5.01 SYPI is entered from ECMP at global SYPI_NTR every ten seconds to collect, update data, and perform tests on call functions and facilities. Data, collected at each 10-second entry, is processed for the bar graph PROCESSOR OCCUPANCY, and TEST STATUS lamps for HOPPERS, DATA TRANSFER, SERVICE CIRCUITS, and ABRUPT TRAFFIC CHANGE.

5.02 Program control is passed from program unit TENSEC to subroutine TEST_CNTRL which controls a counter used for determining which activity test routine is to be executed during

the current 10-second entry. The subroutines that perform statistical tests on the facilities are:

- ENT1_TESTS
- ENT2_TESTS
- ENT3_TESTS
- ENT4_TESTS
- ENT5_TESTS
- ENT6_TESTS

5.03 Data, collected on the 10-second entry of each minute (subroutine ENT1_TESTS) is used for tests performed on bar graphs ORIG. CALLS, INCOMING CALLS, INTRA OFF CALLS, and TANDEM CALLS.

5.04 Processing facilities, displayed via TEST STATUS lamps, are processed by subroutines ENT2_TESTS, ENT3_TESTS, ENT4_TESTS, and ENT5_TESTS. The MANUAL SELECTION bar graph is updated and controlled by subroutine ENT6_TESTS.

5.05 Program control is then passed from the above test subroutines to subroutine CONCLUDE_IN which zeroes the level and column bits of the bar graph record so that if time out occurs, the display is blanked. This routine then returns control to ECMP.

5.06 The number of LEDs to be lighted for the bar graph is calculated by subroutine GRAPH. This routine determines the status of the low scale and threshold lamps and updates the associated indicator accordingly. Threshold values, used in the calculations, are obtained from memory block SY2PK-CLCAP.

5.07 When initialization is requested, an entry is made to subroutine SYPIINIT.

5.08 Whenever a request for monitoring the MANUAL SELECTION bar graph data is received, entry is made to subroutine SYPIMON.

SYSTEM ACTIVITY BAR GRAPH UPDATE ROUTINE

5.09 In general, the number of LEDs lighted green indicate the value of the item being displayed as a percent of the threshold (100 percent) value. If the value of the item falls below 10 percent of the threshold value, the column identification lamp at the bottom of the bar graph is lighted white to indicate a change in scale. The change implies that the percent reading for that bar graph must be multiplied by 0.1 to obtain the true reading. For these low values, each LED represents increments of 1 percent. If, on the other hand, the item being displayed exceeds the threshold value, the LED at the top of the bar graph is lighted red in addition to the ten green lighted LEDs.

5.10 Bar graphs, ORIG. CALLS, INCOMING CALLS, INTRA OFF CALLS, and TANDEM CALLS are updated only once each minute. The PROCESSOR OCCUPANCY bar graph is updated once every 10 seconds.

5.11 The PROCESSOR OCCUPANCY bar graph value is calculated by ECMP once every 10 seconds. This value is the percent of real-time spent by the processor on nonrelinquishable and call processing functions. The bar graph reflects the time spent on accomplishing the basic objective of the system, which is to process calls. SYPI utilizes the integer portion of the ECMP value.

5.12 The MANUAL SELECTION bar graph is normally not lighted. SYPI examines word SY2MNL-REQ to determine if any of the bits are set indicating that an item is to be displayed. If so, a corresponding code is executed causing display of one of the following items.

- Percent of Ineffective Attempts
- Percent DP DTST Delays
- Percent TT DTST Delays
- Percent MF RADR Delays
- Percent RP RADR Delays
- Percent DP RADR Delays
- Percent Tandem Calls First Failure to Match
- Percent Incoming First Failure to Match
- Percent Incoming Matching Loss

- Percent Outgoing Overflow
- Percent Intraoffice Overflow
- Percent OMR Usage
- Blank bar graph

Ineffective Attempts Test

5.13 The percent of ineffective attempts is defined as the percent of regular and common overflow to the normally processed originating and incoming calls.

DTST Delay Tests

5.14 Bar graph displays of percent of DP DTST delays and TT DTST delays indicate tests that were experiencing delays of more than 3 seconds to obtain dial tone.

RADR Delay Tests

5.15 The percent RADR delays (MF, RP, DP) display the ratio of the number of tests which experienced delays of more than 3 seconds when attempting to obtain a receiver connection to the number of initiated tests.

Matching Loss Tests

5.16 The matching loss failures, displayed by the bar graph, are reflected by the percent tandem calls first failure to match, percent incoming first failure to match, and percent incoming matching loss. The bar graph reflects a percentage value and the ratio of failure calls to total calls.

Overall Tests

5.17 The completion status of intraoffice and outgoing calls, as indicated via bar graph, is based on overflow conditions. Percent outgoing overflow is the ratio of overflow to actual outgoing calls. Percent intraoffice overflow is the ratio of overflow to actual intraoffice calls.

OMR Test

5.18 The percent output message registers (OMR) is the number of seizures less the number of releases divided by the total OMRs times 100.

TEST STATUS Lamps Update Routine

5.19 The system status panel displays TEST STATUS lamps to provide indications of both normal and abnormal processing conditions for the following facilities:

- Call Registers
- Hoppers
- Queues
- Service Circuits
- Line and Network
- Data Transfer
- Abrupt Traffic Change

Call Registers Test

5.20 Table A lists the call registers monitored by SYPI. The SYPI program applies a statistical test which utilizes the holding time as a parameter. The average holding time is defined as the ratio of the sum of the active elements to the number of seizures. A moving average and a moving variance are computed based on the average holding time. If the sample is very small, no statistical analysis is performed. A safety factor of 4 is normally applied if the sample is sufficiently large. If the value falls beyond the safety value, the test is considered a failure and the lamp is lighted amber. Also, whenever there are requests for the facility but no seizure is made, the lamp will be lighted amber.

TABLE B

HOPPERS MONITORED BY SYPI

HOPPER	TTY I/O MESSAGE ABBREVIATION
Abandon-Interdigital Time-out	AIT
Centrex Key	CNTXKY
Dial Pulse Outpulsing	DPOP
Hit Scan Result	HITSCN
Line Ferrod Disconnect	LDISC
Miscellaneous Scan (TSJR)	MISSCN
Multifrequency	MF
Release Dial Tone	RLSDT
Revertive Digit Reception	RPR
Revertive Digit Transmission	RPX
Ring Trip	RNGTRP
Step-By-Step Reorder AIT	SXS
TOUCH-TONE®	TT
Trunk Dial Pulse Reception	TRKDPR
Trunk Seizure and Answer	TSA

Queues Test

5.22 The status of queues, as determined by SYPI, is based on the number of POBs encountering queuing versus the total traffic at the instant. The TEST STATUS—QUEUE lamp is lighted amber if the test fails three times consecutively, and lighted green if the test passes three times consecutively. A chance failure or success of the test does not change the color of the lamp. The test is executed once every minute.

Service Circuit Test

5.23 SYPI monitors only the standard service circuits as listed in Table C for determining the status of service circuits. The SYPI program applies the same statistical test as for the call registers (5.20). The TEST STATUS—SERVICE CIRCUIT lamp is lighted amber if the average value falls beyond the given tolerance interval, or if there are requests but no seizures.

TABLE C

SERVICE CIRCUITS MONITORED BY SYPI

CIRCUIT	TTY I/O MESSAGE ABBREVIATION
Ringing Circuits (Phase 1, 2, 3)	RNG1, RNG2, RNG 3
Audible Circuits (Phase 1, 2, 3)	AUD1, AUD2, AUD3
Interoffice Transmitters Multifrequency Dial Pulse Revertive Panel Call Indicator	 MFX DPX RPX PCIX
Interoffice Receivers Multifrequency Dial Pulse Revertive Panel Call Indicator	 TRKMFR TRKDPR TRKRPR TRKPCI
Customer Digit Receivers Dial Pulse and TT overflow Dial Pulse TOUCH-TONE	 CDPTTR CDPR CTTR
Tandem Tie Lines TT-DP Trunk Receivers TT-DP Customer XMTR-RCVR TT-DP Trunk XMTR-RCVR	 TRKTTR TRTLC TRTLT
Coin Circuits Coin Control Circuit Initial Announcement for DT First Overtime Deposit Prompt Announcement	 CCCK CSIANN RICODP
Recorded Announcement/Tone Circuits 60-IPM Busy Tone 120-IPM Regular Overflow Tone Vacant Code Announcement Receiver Off-hook Announcement Call Forwarding Denial Announcement Reciver Off-hook Tone Partial Dial-Intercept Call Waiting or Busy Verify Tone	 BT OVFLT VACC OFFH CFWDNL ROFFHT PDINCT WAIT

Line and Network Test

5.24 The lines and networks are checked for excessive failures by SYPI using two independent statistical tests. For the purposes of determining system performance, the classification of failures (Table D) is based on whether the failure is due probably to a fault in the lines or in the network. The failure counts are maintained in plant measurements program (PPMP) and pegged by the network failure maintenance action program (NMFL).

TABLE D

LINE AND NETWORK FACILITIES MONITORED BY SYPI

FAILURE	CATEGORY	WEIGHTED FACTOR
SUPF — Supervisory Scan	Network	1
FCGF — False Cross and Ground	Network	2
RVFY — Restore and Verify	Network	2
RC — Ringing Current	Line	1
SHWL — Showering Line	Line	1
LLR — Low Line Resistance	Line	1
PX — Power Cross	Line	8

5.25 The check periodically computes the ratio of the weighted sum of the faults constituting the particular failure type to the total traffic per network observed during the interval. If this ratio exceeds a predefined threshold, then the TEST STATUS—LINE AND NETWORK lamp is lighted amber.

5.26 The statistical tests for line and network are done once every minute. Based upon this criteria, the TEST STATUS—LINE AND NETWORK lamp is lighted amber whenever an excessive number of failures in comparison to the traffic occurs in the system. The lamp is lighted green only if the statistical checks are successful for a certain number of consecutive tests and if the test on the NN08 switch passes.

5.27 The occurrence of a NN08 switch failure implies that probably a switch or a trunk connected to a switch is faulty and this faulty element is being repeatedly used. Upon a NN08 switch failure, NMFL transfers to SYPI. SYPI causes the lamp to be lighted amber. The switch number is checked once every 5 minutes against a current list of faulty switch numbers that is maintained by NMFL. If no match occurs, the lamp is once again lighted green.

Data Transfer Test

5.28 The TEST STATUS—DATA TRANSFER lamp reflects results of the test on the disk and TTY equipment. The tests are executed once every 10 seconds by SYPI.

5.29 Two types of test are applied to the disk facility:

- Functional
- Statistical

5.30 Subroutine FNCTDRWC performs a functional test on the disk operating functions. A failure is recorded if either the disk request failed, or the data was incorrect, or a read/write timeout occurred. Whenever a failure occurs, SYPI requests the disk audit no more than once every 5 minutes.

5.31 The desk statistical checks are processed by subroutine FNCTDSKC. A failure condition

is when there are either excessive invalid requests or too few successes. A queue is full most of the time when there is excessive queuing. Whenever a failure is noted, SYPI requests the disk audit routine (no more than once every 5 minutes).

5.32 The TTY operation is verified by subroutine FNCTTTYC. A statistical test is performed to verify the availability of the output message registers (OMR). A failure is recorded if there is either an excessive number of OMR seizure failures or a lack of idle OMRs. In either case, SYPI requests the appropriate TTY audit (no more than once every 5 minutes).

5.33 The TEST STATUS—DATA TRANSFER lamp is lighted amber if any of the preceding tests fail. The lamp is lighted green only if all tests pass continuously a fixed number of times.

Abrupt Traffic Change Test

5.34 Every 10 seconds SYPI applies a statistical test on certain traffic as listed in Table E. The test is similar to that as applied to call registers and service circuits differing in precision maintained in calculations. If the value falls beyond the given tolerance interval, the TEST STATUS—ABRUPT TRAFFIC CHANGE lamp is lighted amber.

TABLE E

TRAFFIC MONITORED BY SYPI	
TRAFFIC TYPE	TTY I/O MESSAGE ABBREVIATION
Originating	ORIG
Incoming	INC
Intraoffice	IAO
Tandem	TDM

The main differences between this test and that used for call registers and service circuits are:

- Different smoothing constants
- Moving average and moving variance calculations are based on traffic rather than on holding time.
- Lamp not lighted because of no seizures.

B. Dial Tone Speed Test (DTST) Program

5.35 The purpose of the DTST program is to provide measurement of dial tone service. It applies a test to measure the interval of time separating customer goes off-hook and receipt of dial tone. If dial tone is furnished within 3 seconds, a success is recorded. If the 3-second test was a failure and at the end of a 11-second period dial tone has not been furnished, the test is scored as an extended failure.

5.36 DTST consists of six globals:

- DTSIME—Entry point from main program
- DTBCKE—Entry for dial tone busy line check
- DTFCHE—Entry for dial tone failure check
- DTROST—Entry point for checking reorigination of LEN
- DTSTMO—Entry point for TTY input message "DT-ALLOW"
- DTSTMF—Entry point for TTY input message "DT-INH"

5.37 Every 4 seconds, the main program transfers control to DTSIME subroutine. This routine zeroes the success bit and sets the receiver off-hook bit in the DTST register (D4STRO). The SUSC-LI program checks for the receiver off-hook bit, and if found, sets a flag which signifies that this LEN is associated with a DTST. When the dialing connection program processes the line service request hopper, transfer is made to the DTBCKE subroutine if the receive off-hook bit is set.

5.38 The dial tone busy check (DTBCKE) subroutine performs a busy/idle test on the acceptable LEN. If the LEN is idle, the routine determines if LLC is in effect on the line, by interrogating the LLC bit in the DTST register. If LLC is in effect, the LEN is marked to be given DTST, the success bit is set to 1, and control is passed to

DNCT which attempts to give dial tone to the generated call.

5.39 The dial tone failure check (DTFCHE) subroutine performs checks at the end of 3 seconds and 11 seconds to determine if dial tone has been applied to the line. If the success bit (see 5.37) is a 1 when the 3-second test is made, and if both the LEN was not affected by LLC and dial tone furnished within 3 seconds, the test is recorded as successful.

5.40 The DTROST subroutine checks the line equipment number (LEN) to determine if it is the most recent for the dial tone speed test. If so, a transfer is made to the routine SROH which sets the receiver off-hook bit and causes a reorigination of the DTST.

5.41 When DTST is activated by the TTY input message DT-ALLOW, a transfer is made to DTSTMO which zeroes the DTST inhibit flag in the traffic and overload status A6FLG1 and checks for an LLC on-condition. If LLC is on, the LLC ON lamp is lighted red, a major alarm is sounded, the TTY bell is rung, and a TOC01 output message is printed. If the LLC is off, a TOC02 is printed out on the TTY.

5.42 When DTST is initiated by the TTY input message DT-INH, entry is made at DTSTMF. This routine checks for on-condition of LLC. If the LLC is on, the LLC ON lamp is extinguished, the LCC INH lamp lighted, major alarm sounded, traffic TTY bell rung, and TOC01 message printed. The LLC feature is inhibited, plus printing of dial tone delay information in the traffic output message. But if LLC is off when the inhibit message was entered, a TOC02 message is printed by the IOCP program.

C. Line Load Control (LLOD) Program

5.43 The LLOD program provides a means of assuring acceptable grades of originating service to lines considered essential in an emergency by temporarily denying originating service to nonessential lines. It is applied during system overload conditions, such as real-time, software, and hardware overload.

5.44 The mode of operation of line load control (LLC) may be either automatic, manually activated, or manually deactivated. If the LLC has been placed in the automatic mode by TTY input message LLC-ALLOW-AU, the program recognizes the request and automatically enables it when three successive extended 11-second DTSTs have failed. When activated, the program calculates the number of line groups to which service will be denied, and as the overload condition subsides, it gradually restores service.

Every 4 seconds, the ECMP enters the LLOD at LLCCSM. It initially determines if a complete line scan has taken place. If not, control is returned to the main program. If line scan has been completed, the program then checks to see if DTST has been inhibited. If so, control is also returned to the main program. Otherwise, if the LLC has been activated by the TTY input message LLC-ALLOW-AU, the program sets the LAU flag bit to 1 and requests printing of a TOC02 output message. Whenever the system recognizes the need for LLC, overloads that cause three successive extended 11-second DTST failures, the LLC "on" flag is set to 1 and appropriate alarms, bells, lamps, and TOC01 output message are generated.

5.45 The LLOD program consists of four subroutines (GLOBALS):

- LLCCSM—Entry point from main program every 4 seconds
- LLCINP—Entry point resulting from TTY input message "LLC-MASK-PRINT"
- LLCLKO—Entry point resulting from TTY input message "LLC-ALLOW"
- LLCLKN—Entry point resulting from TTY input message "LLC-INH."

5.46 The program monitors the 3-second DTST test failure indicator D4STR2 and the percentage of network overload every 4 seconds. Service is denied or restored to nonessential groups depending on the results of these measurements. If there are three successive DTST failures, or if a 3-minute check of the amount of matching loss in the trunk link network (TLN) for incoming calls reveals that more than 10 percent have blocked, the program will remove dial tone service from one-half of the nonessential line current able to receive service. Three more successive DTST failures or another 3-minute period with greater than 10 percent incoming matching loss in the

TLN will result in another 50 percent decrease in the number of nonessential lines being served. All nonessential lines are denied dial tone service after four 50 percent decreases. Whenever LLC is denying service or whenever a 3-second DTST failure occurs, the MN DT DLY lamp lights (amber). When all groups are restored to service, the LLC "on" flag is set back to 0 and the LLC ON lamp is extinguished.

5.47 If LLC has been activated by the input message, LLC-ALLOW-ON entry is at subroutine LLCLKO. The program sets the LAU bit to "0". The LLC ON lamp is lighted (red), a major alarm is sounded, and a TOC01 message is requested. The subsequent program routine is that as discussed in 5.49.

5.48 While LLC is denying service, TC15 TTY output message will be printed each quarter hour.

5.49 If the LLC is deactivated by the TTY input message LLC-INH, entry is made at LLCLKN. The LON and LAU data are zeroed in word A6FLG1 and a TTY TOC02 output message is printed. If the LLC ON lamp was lighted, it will be extinguished and the LLC INH will be lighted (white), and dial pulse counters are incremented. However, if the LEN was affected by LLC and even though the test call was a success, it is treated as a failure. The DTST counter is incremented and control is transferred to the DTBCKE subroutine if the 3-second test was a failure.

5.50 At the 11-second test entry, a check is made of the third most recent LEN to determine if the line was affected by LLC. If so, an extended test failure is scored. Otherwise, the success bit for the 3-second test is checked. If, at the end of 11 seconds, the success bit indicates that dial tone has not been received, the test is scored as an extended test failure. The push-down list is then updated by placing the LEN into the list and removing the LEN just tested.

5.51 On the first transfer to the DTFCHE routine, no LEN is found in the push-down list and the extended 11-second DTST is not enabled. At the 3-second interval determined by the enable bit, a transfer is made to the update subroutine (5.52), which generates the first LEN to-be-tested (LEN) plus the next one that is intended to-be-tested (LENI). A flag is then set which is used to cause transfer to subroutine DTSIME. The 11-second DTST is completed at the fourth entry to DTFCHE. The main program continues to transfer to DTSIME and DTFCHE subprograms every 4 seconds.

5.52 If the busy/idle test finds the LEN busy, entry is made at BC11 where the LEN is updated with the LENI. The new LEN is first checked rangewise. That is, the LLN of the LEN must be less than or equal to the highest LLN and the LSF must be less than or equal to the highest LSF. The LEN is then checked for translation requirements. The LEN must be an assigned line, which is not a manual, master control, or denied service line. If the LEN is found to be acceptable for DTST, another busy/idle test is performed. However, if the LEN is found to be unacceptable, the routine will make a maximum of 30 update attempts before the test is disabled.

5.53 The LLOD subroutine LLCINP updates the word L4LLCM as system overload varies. This data is used by the supervisory scan program as a scan mask with each bit representing a line group. A printout LC02 of the LLC mask is obtained with the TTY input message LLC-MASK-PRNT.

5.54 The program utilizes the parameter L4ESSL. Each position bit in the word corresponds to the essential lines in office. This 16-bit mask word is updated by LLOD as the traffic overload varies.

5.55 The network overload condition exists if 10 percent or more of incoming calls to an office experiences network blockage on the talking path during the previous 3-minute period. Control overload exists when three consecutive relevant DTST failures are recorded. DTST considered as nonrevelant are the first three following restoration of a group.

D. Receiver Attachment Delay Report (RADR) Program

5.56 The RADR program generates, maintains, and administers incoming test calls designed to measure the amount of delay incoming calls are experiencing in getting a connection to a receiver. Activation and deactivation is via TTY input messages.

5.57 Every 4 seconds, the RADR feature is activated. A test call is generated on a randomly selected incoming trunk. Attempts to

establish a connection between the incoming test call and a receiver in 3 seconds are termed delays. Outputs of the program include:

- Peg counts of number of tests performed
- Number of failures by receiver type
- Current failure percentages by receiver type on demand or in 5-minute exception output messages
- Current failure percentage readout updated every 30 seconds transmitted for display.

5.58 The RADR program operates in multiple levels and for printout requests on interject. It consists of the following globals:

- RADRON—Activates Test Calls
- RASTAT—Prints RADR failure percentage
- RAFCHK—Determines results of previous RADR test
- RAGENR—Generates a TNN for next RADR test
- RASEIZ—Creates scanner number for TNN and loads number in hopper
- RAAUDT—Audits up-down counters
- RAUPDT—Updates SD points for failure percentage
- RA5MIN—Requests print of NM17 output message
- RALDMF—Loads relay orders for MF/DP trunk connection
- RALDRP—Loads relay orders for RP trunk connection to receiver
- RAPBQR—Attempts to seize POB for SD point administration
- RAIPOB—Idles POB and returns to ECMP
- RADROF—Inhibits test calls

5.59 Entry is made at RADRON in response to a TTY activation request, RAD-ALLOW. This subroutine verifies that parameters are set up properly to allow calls, then tacks either an OK or NG onto the input request. If RADR calls are activated, an OK is tacked onto the input message and a TOC02 output message will be printed. But, if activation is not made, an NG notation is tacked onto the TOC02 message. The subroutine then passes control back to ECMP.

5.60 Any entry is made at RADROF in response to the TTY input message RAD-INH. The purpose of this routine is to configure all call store memory associated with RADR test calls in such a manner to prohibit call processing. The routine:

- Sets an inhibit bit
- Causes a TOC02 output message to be printed immediately and on subsequent quarter hours until reactivated by an automatic or manual request
- Zeroes out registers containing failure percentage up-down counters and results of the previous 50 RADR tests
- Zeroes the CS words that pertain to the current test information.

5.61 The RAFCHK is entered every 4 seconds from ECMP to determine test results of the previous test call if one occurred. A check is first made to see if RADR has been inhibited. If so, control is returned to ECMP; otherwise, another check is made to determine if a test was performed during the last 4-second interval. If so, traffic counts associated with the test call are administered. After processing the test results, including the setting of the TOC02 flag if the threshold value was exceeded, control is returned to generate a TNN for the next RADR test.

5.62 Entry is made to RAGENR every 100 ms from ECMP to generate a suitable TNN. If a satisfactory TNN is not found or until the 4-second entry to simulate the seizure occurs, a total of 120 TNNs are considered before a test call is skipped. The routine checks the TNN for the following:

- Within office range

- Assigned
- 1-way or 2-way
- Not operator, by-link, or make-busy
- MF, TDP, or RP impulsing
- Defined by office parameters
- Idle when selected

5.63 The chosen TNN is converted to a scanner number by RASEIZ and placed in the hopper word for processing by the supervisory scan trunk scanning routine, SUSC-MS. The scanning routine then places the record directly into the trunk seizure and answer hopper as if it had gotten a real report on this trunk. RASEIZ then returns control to ECMP.

5.64 If queuing for a POB is required, entry is made from the trunk and service circuit maintenance control (TNKC) program to RAPBQR. The purpose of RAPBQR is to make an attempt to seize a POB for SD point administration. The SDs are administered according to receiver types specified in the office.

5.65 When the POB has been activated, either successfully or otherwise, it is made idle by RAIPOB and control is returned to the main program.

5.66 When seizure of the POB is seen on the trunk, RALDMF will load the necessary relay orders to do a pseudo connection of an MF or DP trunk to its associated receiver. This loading function is performed by RALDRP if a RP trunk is used. If there is an incoming call that requests usage of the trunk, connection is made to the receiver, thus allowing normal processing of the call rather than forcing the seizure back through the trunk service and answer hopper. If the test was a success (less than 3 seconds since hopper was loaded), the success bit in R3RDTO is set and both receiver and trunk restored.

5.67 Every 30 seconds an entry is made to RAUPDT from ECMP to update the SD points on the network management indicator circuit for RADR failure percentage display.

5.68 Hourly, an audit of the up-down failure counters and result registers is performed by RAAUDT. Only those registers of valid receiver types are audited. The purpose of this audit routine guarantees that the up-down counter containing the number of test failures in the last 50 tests are correct.

5.69 Every 5 minutes, entry is made to RA5MIN from the network management program NMGT to determine if any threshold values have been exceeded in the last 5-minute interval. If so, a request is made for printing an NM17 output message. The exception indicators are zeroed and control is returned to the main program.

5.70 At the request of TTY input message RAD-STATUS, an NM17 output message containing the current contents of the up-down counters in the RADR result registers R3RGMF, R3RGDP, and R3RGRP are printed by global RASTAT. If RADR tests are inhibited or if parameters specify no tests can be run, an NG will be tacked onto the input request. If the TTY output hopper is full, an NG will be tacked onto the request. Otherwise, an OK is tacked onto the request and printed with the NM17 message.

E. Multiline Service Observing (SOBR) Program

5.71 The SOBR program provides means by which an operator, at the centralized service observing desk, can monitor various types of calls during the processing procedures. It connects a service observed line to the service observing circuit whenever the observed line originates a call. The SOBR program is activated by a recent change TTY input message that places a service observing indicator in the LEN translation, while at the same time, the service observed line is manually connected with patch cords at the main frame to one of the four available service circuits within the office. The program also releases the line from the circuit at the appropriate signal.

5.72 The SOBR program is entered at SORSOC from the dialing connection program for lines (DNCT). Upon entry, the program checks the register activity bit in a 2-word service observing register (4 per system) associated with the service observed LEN. If the service observing register is busy, call control is returned to DNCT. If not, transfer is made to the scan point change director program which interrogates two scan points, RLS

and AWT, to determine if the service observing circuit is available. If either the release (RLS) or awaiting call (AWT) scan point is busy, no connection will be made. However, if the RLS scan point is active, the T2 bit will be set to accept so that the CHGD program will recognize and cause an entry at SODLSO which will release the circuit. If both the service observing register and circuit are idle and awaiting a call, the control pulse distributor (SPD) will receive instructions to connect the particular loop to the service observing circuit. Transfer is then made to ECMP at TIMENR which controls a 100-ms time delay before allowing a check of the connection. A successful connection of the circuit causes the AWT scan point to change states. If it has changed states, transfer is made to the main program. If not, transfer is made to IOCP which causes the TTY to print a message indicating that the connection has failed. After printing out the failure message, the program transfers to the release routines.

5.73 The portion of SOBR that causes release of the service observing circuit may be entered at either SOMESS or SODLSO, depending upon the disconnect requirement. If the TTY input message SO-RESTORE-a is typed, the program is entered at SOMESS. A transfer is then made to TYMI which causes an "OK" output message. However, if the supervisory scan of RLS scan point caused the releasing of the circuit, an entry is made at SODLSO. Otherwise, entry is made at DISC which resets all 10 CPD points. Then, after obtaining a 100-ms time delay, a transfer is made to the scan program which determines if the circuit had released. If not, transfer is made to TYMI which causes circuit release failure message to be printed on TTY. Otherwise, control is returned to the main program.

F. Direct Distance Dialing Service (DDDO) Program

5.74 The DDDO program provides observation of DDD outgoing traffic from centralized service observing office. When this type of call enters the system, a seizure signal is sent to the supervisor desk during a request for observance. If the operator accepts a call, a transmission path is established. The called number is outpulsed by an MF transmitter to the observing desk. The program controls the dedicated DDDO observing circuit to send to the operator a signal which indicates various steps in the program of the call by lighting or extinguishing supervisory lamps. The program recognizes the release of the circuit by the operator and the circuit is restored to the idle state.

5.75 DDDO has seven global entries.

- DDSOOL—Entry point if overlap pulsing (interoffice) was indicated.
- DDSOSZ—Entry point from AMA program after ORDL has determined the line to be observed.
- DDTNTB—Entry point if hardware failure occurs.
- DDDRLS—Entry point when DDDO circuit is released by observer.
- DDOPSC—Entry point from ECMP for 500 ms when a seizure signal is sent.
- DDOPRT—Entry point at end of outpulsing.
- DDOPAB—Entry point if abandon occurs while outpulsing.

5.76 When an outgoing call is determined by the digit analysis program (ORDL) to be interoffice, control is passed to the AMA program. If an AMA register is required and seized, transfer is made at either DDSOOL or DDSOSZ. This subroutine performs a series of tests to determine if the call should be service observed. The major class of the call is checked to see if it is a coin call. Only noncoin calls are accepted for DDD service observing. A check is made to see if the operator's desk is ready to accept the call. If not, control is returned to the client program; otherwise, a seizure signal is sent in an attempt to seize an idle position at the desk. The release (RLS) feared is scanned. The operator is allowed 800 ms, after the seizure signal is sent, to accept the call for observation. If the call is not accepted within this period of time, the call will not be observed.

5.77 At the time the seizure signal is sent to the observing desk, entry is made at DDOPSC. A 500-ms scan program, controlled by ECMP, checks for a reported answer. If received, control is returned to ECMP; otherwise, the dialed digits stored in the originating register are transferred to the DDDO register, and outputted to the desk

by transferring to an entry in the MF digit transmission program.

5.78 Entry is made at DDOPRT after the called number has been outpulsed to the desk and it is determined that the line trunk path is connected. A DDDO register is initialized and transfer is then made to global CICXAM of the CICS program which sends a seizure signal to the desk to extinguish the S lamp at the desk. Transfer is made to CIN11H which then makes an attempt to establish a transmission path via the no-test vertical on the trunk junctor switching frame.

5.79 If because of a busy or blocked condition this path cannot be established, transfer is made to CICS which causes the TRK lamp to flash. If the calling party is connected to a tone trunk, transfer is made to the tone connection program. DDDO upon receiving a tone report makes a request for the DDDO register to become the master at OFBRG. DDDO seizes the POB prior to start of the tone report when this request is honored. The path memory of the line-to-tone trunk connectors is in the path memory annex (PMA) or the DDDO register. This connection will allow the observer at the desk to hear the tone that the calling party hears. If the call does not make connection to the distant office, the forward supervision (FSV) lamp will flash. Control is then passed to ECMP.

5.80 When the called party answers, DDDO subroutine ANSW1 causes a signal to extinguish the FSV lamp indicating the called line is off-hook. If after answer a special service such as add-on or conference is requested, the DDDO program does not establish connection to observe the new connection. A signal is sent to flash the TRK lamp at the desk requesting observer to terminate the observation. If an answer report occurred while the DDDO register is on a queue for a POB, the answer report will enter via the POB queue return slot in the PT table.

5.81 Entry is made at DDDRLS when the RLS key is operated. If the DDDO register is in the outpulsing state, control is given to ECMP. If the tone path is connected, it is released; also released are the DDDO register and circuit. If not, the observing bridge connection is taken down, the DDDO register and circut is released, and the disconnect is reported. DDDO performs a down-check test on the circuit by scanning the in-service ferrod to see if it returned to the idle state properly.

6. GLOSSARY

Average Holding Time	Number of active elements for a given facility divided by the number of seizures times the number of seconds. The number of seizures is the difference between the number of peg counts and the number of overflows that occurred during the time interval.
Occupancy	Sum of (a) percent of time spent on call processing, and (b) percent of time spent on noncall processing that is not relinquishable to call processing.
Standard Deviation	Square root of the moving variance
Threshold Value	Engineered High Day Calls for a given traffic type in calls per updating interval

7. ABBREVIATIONS AND ACRONYMS

ATP	All Tests Passed
AOVD	Automatic Overload Control Program
DDDO	Direct Distance Dialing Observing Program
DTST	Dial Tone Speed Test Program
ECMP	Executive Control Main Program
ESS	Electronic Switching System
ICOP	TTY Input-Output Program
LLC	Line Load Control
LLOD	Line Load Control Program
MCTW	Lamp and Key Program
MIRV	Memory Integrity and Recovery Program

NMFL	Network Failure Maintenance Action Program
OMR	Output Message Register
PDA	Parameter Data Assembler
PPMP	Plant Management Program
RADR	Receiver Attachment Delay Report Program
SOBR	Multiline Service Observing Program
STF	Some Test Failed
SYPI	System Performance Indicator Program
TCNT	Traffic Counts Program
YAHA	Seize and Release Routine, L-, J-, and T-Bit Administration Program

8. REFERENCES

A. Section 231-045-000 Introduction to No. 1A ESS Software

B. Section 231-045-100 Operational Subsystem

C. Section 231-045-105 Call Processing—POTS Subsystem

D. Section 231-045-106 Call Processing—Centrex Subsystem

E. Section 231-045-135 Charging Subsystem

F. Section 231-045-155 Queue and General Purpose Subsystem

G. Section 231-045-165 Measurement Subsystem

H. Section 231-045-170 Network Management Subsystem

I. Section 231-045-205 System Verification and Recovery Subsystem

J. Section 231-045-250 MCC Man-Machine Interfacing

K. Section 231-045-265 Teletypewriter Programs Subsystem

L. Section 231-045-270 Network Fabric Maintenance Subsystem