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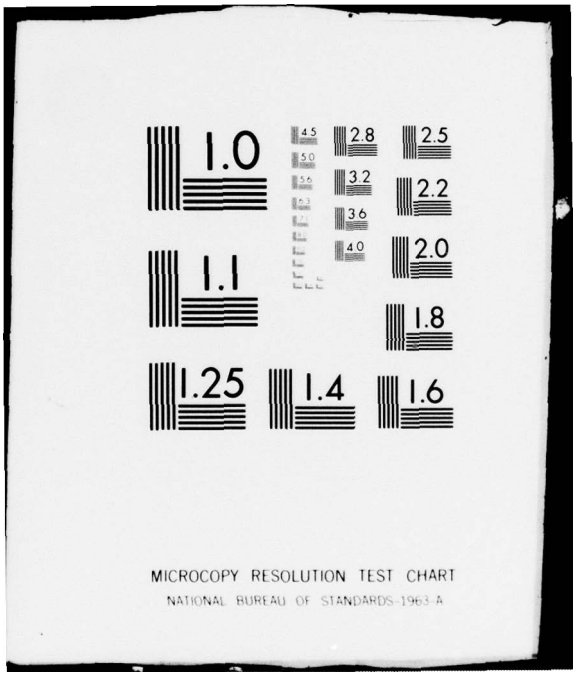
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Appendix B UTEK Report on Defense Communication System

Volume III File Analysis

64295

January 1978

(9) LEVEL III

FINAL REPORT

FOR THE EXPLORATORY SYSTEM CONTROL MODEL DEVELOPMENT

for

THE DEFENSE COMMUNICATIONS AGENCY
WASHINGTON, D.C. 20305

Burroughs Corporation
Federal and Special Systems Group
Paoli, Pa. 19301

Appendix B, UTEK Report on Defense Communication System,
Volume III File Analysis

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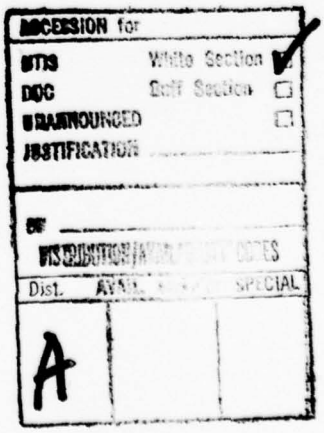

1. INTRODUCTION

UTEK Systems has completed the final analysis for the Exploratory Systems Development Model. This analysis is documented, in this the final report for ESMD. The report defines the functional and structural requirements for the data base necessary to support the levels of SYSCON.

Further definition is made detailing a concept of operations, types of file and how they relate to the present reporting structure, and file interaction. These definitions are made without abrogation of the present DCA reporting policies. They also recognize that the basic purpose of the DCS is to provide a level of performance to all customers.

2. OPERATIONAL REQUIREMENTS

Performance of the DCS is gauged by the service rendered to a customer of the DCS. As we stated in the Task 1 report, there are three levels of performance. These are;

Normal Operation - Customer is receiving his required service

Mode 1 - Service to the customer is degraded but not significantly

Mode 2 - Service to the customer is significantly degraded, causing call blocking or denial of service

There are some variations to these definitions, but if taken in sequence, the reduction in performance would be from normal to Mode 1 to Mode 2. Although direct transfer from normal to Mode 2 is possible due to catastrophic failure. Additionally Mode 1 circumstances during low volume conditions can become a Mode 2 event during high volume conditions. Therefore to sustain the highest level of performance possible, the objective must be to recognize Mode 1 status and define Mode 2 thresholds. It is then necessary to prevent entry into Mode 2 at all times, and as rapidly as possible return to normal operation.

2.1 Level V Requirements

To achieve the objective stated, it is parmount that the lowest level of the DCS, Level V, be made aware and be capable of monitoring those conditions that relate to

Mode 1 or Mode 2. As Level V consists of both transmission facilities and network facilities, the status information consisting of respectively quality of service and grade of service should be correlated and presented to both type facilities.

An example of a condition warranting this information follows. A transmission facility serving an AUTOVON Network facility has slightly degraded circuits, not sufficiently to render a restoral action. These circuits are serving as AUTOVON trunks. The degraded circuits are causing AUTOVON subscribers to disconnect and or repeatedly dial. Traffic data obtained during that period of time, via ACAS for instance, would indicate an all trunk busy (ATB) condition. Although the ATB status is correctly indicated, its cause could be considered normal if its occurance was at the beginning of a busy period. As the degradation of service is not significant, a Mode 1 circumstance exists. Furthermore, if the degradation of the transmission media presists or worsens, or if the AUTOVON busy period is entered, entry into Mode 2 would result.

The example given typifies how reporting indicators can be misinterpreted. Insufficient data was analyzed to reach a positive conclusion. Continual monitoring of correlating data must be accomplished to assure Mode 2 is averted and return to normal operation can be accomplished as soon as possible.

Correlation of the following data for the example provided would have yeilded a more positive conclusion;

a. Transmission media measurements such as would be available from ATEC, reflecting the slightly degraded condition

b. Circuit information reflecting these circuits are AUTOVON trunks

c. Traffic data reflecting the All Trunk Busy Condition

d. Comparision with historical data to verify busy period

e. Verifying and comparing other different directional trunk traffic data to assure the switch is not being isolated and determine if heavy traffic load due to secondary route usage is degrading service

f. AUTOVON equipment status for the trunks in question, thus verifying or eliminating equipment failure

Each data element above provides a more positive "yes"-"no" relationship isolating the fault.

The data presented should be formatted as simply as possible with elements keyed to specific status and restoral actions. The objective is to achieve maximum efficiency in restoring service while minimizing analysis by personnel of reporting indicators. Level V must be protected from being inundated with data but it must receive the appropriate amount to achieve the desired results. Consequently the

system must provide data relating to entry into Mode 1 with immediate flagging of Mode 2 threshold.

2.2 Level IV Requirements

Level IV supports subordinate stations in assuring resources are available to sustain normal operation. Level IV is the first point operational analysis of status information can be accomplished. Practical considerations dictate that Level IV contain the resources for the operational data base with Level V regulated to I/O devices to this data base. Level IV would therefore witness Mode 1 and Mode 2 thresholds and assist Level V trouble shooting. This level is the first operational level with the visibility for correlated grade of service and quality of service information. Therefore Level IV is responsible for supporting a short term operational data base and providing inputs to long term data base and files. It also handles the administrative workload associated with status reporting. The latter is in consonance with the requirement for Level IV consolidating and reducing subordinate level status information for upward reporting. For downward data movement Level IV becomes the level for rationalizing DCA policies, procedures and management direction to the respective MIL-DEP methodology for accomplishing these directives.

2.3 Level III Requirements

Level III is the pinnacle point of operational control for the SYSCON structure. However its manning and role can

be more refined with regards to support to subordinate levels.

With the proper status and service data available at Level IV and V, Level II can accomplish its management role during normal operations and Mode 1 status. The role of Level III is to assist and support Levels IV and V during special situations or Mode 2 status.

Level III might be manned under the following circumstances;

a. Tactical exercises and tactical situations

b. Special situations such as foreign travel by U.S. dignitaries requiring special communications support

c. A coordinated consensus between Levels II and IV, nominally occurring when additional operational assistance is required. Exemplary of these type events are; Mode 1 status becoming critical, entry into Mode 2 due to catastrophic failure, or a heavy workload during Mode 1 status above the capability of Levels IV & V. It should be noted that Mode 2 status may not always require Level III participation, since conditions may allow easy restoral by subordinate levels. Conversely situations may arise requiring Level III without consideration of status mode.

d. Natural disasters to geographical areas whereby additional resources must be committed to support

the area of catastrophy due to the influx of support personnel and equipment. Natural disasters causing catastrophic failure of portions of the DCS would require the same role support.

e. Deployment of a TRI-TAC element which would result in Level III management of the DCS/TRI-TAC interface.

All of these events are situations where an additional workload is presented to Levels IV and V necessitating additional support. For the situations expressed above, Level III support would consist of;

- Coordination of tactical requirements versus DCS resources. Assisting in the coordination with the DCS for implementing these requirements. Providing all data base file support coincident with these actions
- Coordination of special circuit requirements, activations or pre-emptions. Providing all data base file support coincident with these actions.
- Assisting subordinate levels in consolidating reports and coordinating new circuits. Essentially relieving as much of the administrative burdens from subordinate levels, allowing these levels to concentrate on restoral and corrective actions
- Coordinating additional resources, manpower or equipment, necessary to abate natural disaster.

The objective in manning Level III, in all these circumstances, is to add additional operational support resources to the SYSCON structure rather than management control. During these periods of crisis or special activities added management monitoring through to Level II and Level I can only deter from required activity. With proper data mobility and real-time reporting, data would be available on a real-time basis at Level II for immediate management visibility, thus reducing the requirement for this visibility at the lower level.

2.4 Level I & II Requirements

Level I and II requirements again basically stem from the requirement to be aware of normal operations, Mode 1 or Mode 2 status, conveying this information to the appropriate higher activity and providing a downward flow of information relating to performance. Data of sufficient detail to establish long term planning activities are also required.

3. DATA BASE FUNCTIONAL REQUIREMENTS

The term data base as used herein refers to the totality of all files within the SYSCON structure. It has no relationship to its physical location or as to its use. The basic concept employed is that the data base is a compilation of files, resident at many locations with many users. To support the SYSCON structure, as discussed in the Task 1 report, this data base must support certain functional requirements for the DCS to provide satisfactory performance

to customers of the DCS. These functional requirements are iterated as follows;

a. It is of critical importance to alleviate entry into Mode 2 and when this occurs to return to normal operation as soon as possible. Accordingly, the data base must provide support to managerial and operational levels of SYSCON to assist in monitoring Mode 1 or Mode 2 conditions. The data base must also assist in the decision making process to alleviate entry into Mode 2 from Mode 1, and return to normal operation from Mode 2.

b. For the SYSCON structure to operate efficiently, the data base must provide useful operational data to the lowest operational level, Level V. Accordingly, data inputs and outputs at all levels consistent with operational requirement is necessary. These data consist mainly of status data, restoral activity and directives affecting restoral.

c. Provide real-time data correlating grade of service and quality of service to Level V transmission media and network facilities.

d. Provide lateral as well as a downward flow of data between levels of the structure. The data content would primarily be status performance data.

e. Provide sufficient data at Level II to sustain management visibility of Levels IV and V operations during Mode 1 and Mode 2 status.

f. Data link flexibility to provide the user of status information at any level, the means of obtaining sufficient information regarding the level of performance of the DCS at any time. With this data appropriate decisions can be made to activate Level III. Continual intelligent data outputs will support Level III operational control

g. Provide immediate access to Level III upon its a activation without disrupting the data network or data base operation. Provide immediate status imformation upon Level III activation, in order that immediate assistance may be rendered.

h. To support the long term management role of the SYSCON structure, the data base must provide statistical information (management reports) on the level of performance of the DCS. The statistical data is thus analyzed to establish short term solutions, such as new restoral plans, or longer term planning such as programming new assets.

i. The data base must serve as a record keeping media of all the assets (equipment & facilities) that is the DCS.

4. NETWORK STRUCTURE

Consolidating the operational requirements and data base functional requirements, network requirements that evolve consist of;

a. A multi-node network with access by all levels of SYSCON

b. A data base geographically distributed yet with data links interconnects allowing access to any portion of the data base by any user.

c. Of sufficient volume to support the peakload of operational requirements yet sustain back ground managerial tasks.

d. Capable of accepting automatic status data from ATEC, AUTOVON, AUTODIN, etc as well as manual inputs such as status reports and quality assurance data.

Certain trade offs and considerations require further investigation with regard to the activation of Level III. As the netwrok is multi-node, the activation and deactivation can be easily implemented by implementing or deleting the terminal from the Level III network node. Of significance however are two elements: What must the volume capacity of the network be to allow Level III terminal participation but yet not inhibit Level II, IV and V operation. The network must be able to dynamically expand to accomodate Level III data inputs/outputs yet not be statically large to be uneconomical to implement. Since Level III terminal is not a continual active participant in the network, establishing a resident data base of any magnitude would not seem to be practical. Yet once activated, Level III must become aware of the situation and support through

some resident data base function of the DCS. Therefore the volume of the apportioned data base to Level III must also be derived. To provide practical solutions these two elements should be modeled. The model should be exercised to simulate special situations requiring Level III activation although status is normal and under adverse conditions such as Mode 2. The practical capacity of the network and data base could be determined. It should again be emphasized that network node is envisioned for Level III which manages information transfers between MIL-DEPS and DCA. The terminal is satellited from this node and activated only when circumstances require.

5. DATA BASE STRUCTURE

5.1 Four basic elements must be supported by the data base in order for the SYSCON structure to function as described in the Task I report and further defined herein. These four elements do not differ significantly from the policies, procedures and activities presently existing in the DCS. They are presented to lend perspective and follow on definition to the type of files and their content for the data base. These elements are;

a. Knowledge of the nominally fixed base line structure of the DCS.

b. Knowledge of the real-time status performance of the DCS.

c. A record of the events and occurrances.

5.2 The four types of files that can be further defined from these four elements become;

a. A Fixed Data File

b. A Status Reporting File

c. A Statistical Data File

d. A Management File

5.3 The Fixed Data File

This file contains the essentially static data reflecting the physical structure of the DCS. It would contain the Circuit/Link/Trunk File and the Facility Link File. Typically this file would be updated as permanent changes are made to the DCS. Correlation of this file with the status reporting file would provide the operational visibility required at Levels IV & V to monitor Mode 1 or Mode 2 status. Typical correlation would consist of;

a. Comparison of specific circuit status obtained from the transmission media facility with circuits identified as serving network facilities. As the amount of circuits that are degraded increase and simultaneously these circuits all serve the same network node, the thresholds to Mode 1 can be defined. Link and trunk failures can also be similiarly analyzed. This activity would be on a real-time basis.

b. Comparison of traffic data obtained from network facilities to spare circuit availability from the CLT file and equipment availability from the

Facility/Link File would allow interim circuit activation for short term overload conditions. This activity would also be on a real-time basis.

c. Development of new or update of existing restoral plans. This could be accomplished by, retaining the history of previously correlated information, reviewing the success of the resulting restoral or interim activation, and updating or establishing new plans. This activity would be non-real-time and would be in consonance with the uses of the Management and Statistical data files.

d. Further non-real-time comparison of facility equipment to status information identifying equipment outages would yield long term planning information for programming new assets.

e. Review of existing circuit and equipment availability against new customer requirements provides immediate results towards satisfying the customer's needs in the immediate future or establishing long term programming.

5.4 The Status Reporting File

This file contains the status reporting of both transmission media facilities and network facilities required of DCAC 310-55-1. The majority of all activities in this file is real-time. This file is updated frequently in consonance with the frequency of status reports. It would provide the correlation of grade of service and quality of

service as reported by the respective facilities. Thresholds defining Mode 1 and Mode 2 entry would be provided from this correlation. Other thresholds established for hazardous conditions as defined in DCAC 310-55-1, would also be flagged by this file. Specific correlations available are;

a. Circuit measurements versus established levels thus defining degraded or failed conditions.

b. Correlation of link to trunk to circuit outages in conjunction with the Fixed Data File.

c. Direct comparison of circuit, link and trunk degradation serving network facilities, as defined by the Fixed Data File, versus traffic data from the same network facilities. This would provide a Mode 1 threshold indicator.

d. Direct comparison of a circuit, link and trunk outage serving network facilities, as defined by the Fixed Data File. This would provide a Mode 2 threshold indicator.

e. Providing refined status data to the Management data file for development of higher level reports.

f. Providing record traffic data refined as required, to the statistical data file for further analysis.

g. Providing refined equipment status data to the statistical data file for further analysis.

5.5 Statistical Data File

This file contains the historical data for all events and occurrences within the DCS. The file would contain traffic data, transmission media degradation and outage data and quality assurance data. Long term planning would be supported by this file. Data obtained from the status data file, correlated with the fixed data file, and analyzed as discussed below, would support derivation of new restoral plans, implementation of new circuits, replacement of old equipment, and programming of increased assets. Analysis would comply with the following;

a. Use of call data from the AUTOVON & AUTOSEAVOCOM system to calulate trunk usage. Additional trunk requirements and equipment necessary to increase capacity would be noted. Additionally, engineering of new activations could be verified. Requirements to reduce circuit requirements and verifications of some after implementation could also be surfaced with this file.

b. Use of message data from AUTODIN centers would be used to calculate trunk throughput, holdtimes, and message delivery among other statistics. Refinement of these calculations would reveal requirements for equipments and circuits, much the same as AUTOVON.

c. Use of quality assurance data versus time to determine long term degradation of the DCS transmission

media. Data derived could be used to justify equipment replacement, warrent changes in maintenance procedures to include the addition of different test equipment as necessary to yield higher performance. Analysis directed towards personnel training, type and quality could also be made.

d. Use of status data reflecting equipment degradation and failure would be used to determine requirements for new maintenance procedures, test equipment utilization or replacement requirements.

e. Develop an operational historical portion of the file that would;

(1) Surface the effectiveness of Mode 1 and Mode 2 restorals. Review of this information versus existing restoral plans for update if necessary.

(2) Correlate the cause and effect of degradations and failures. Review of this data to correct threshold points for Mode 1 and Mode 2.

5.6 Management File

This file has two elements of operation. One supports the operational requirements for developing the day to day status reports such as COMSPOTS and COMSTATS. The other element supports the management staff elements of DCA in accomplishing much of the analysis of data derived from the statistical data file. This file is in direct support to Levels I & II. Operational management review of

statistical data specifically related to Mode 1 and Mode 2 status and restoral, might provide downward direction regarding new thresholds or restoral plans. Staff element entry to other data files would be supported by this file. Computations and analysis beyond those described for the statistical data file would be accomplished by this file.

6. INFORMATION MOBILITY

All major data base files, discussed in paragraph 5, should be resident at Levels I & II. Practical considerations dictate that these files be retained at the same structure levels as they are today. These files require extensive hardware and software resources as well as maintenance of these resources. The latter refers to system analysts, programmers and repair personnel. Levels I & II presently contain the hardware and software resources plus they are manned to accomodate these files. However, the information content of these files must be available to the lower levels of the structure on a real-time basis. Coincident with this requirement is the implementation of short term case files and software routines at subordinate levels in order that the status information can be processed on real-time basis and necessary corrective action taken.

6.1 Information Access

Information access of the data files is required at the lowest operational level. As Level IV contains the

resources to use this information, predominate access for operational purposes is required by this level. I/O interface would be maintained by Level V. Downward and upward informational access by Level V would be accomplished via the resources at Level IV. To provide a real-time activity at Level IV, software routines and a short term case file would be required. The software routines would accomplish the grade of service/quality of service correlation, plus defining Mode 1 and Mode 2 thresholds. The short term case file would be used to store retrieved information required to develop conclusive outputs as well as compile the results of software operations. The short term case file would also be used to store status information for further refinement and delivery upward in the structure. Level III information access is required during those periods where its participation has been dictated by established events. In this case, informational data to Level III would consist of an immediate assessment of the status of the DCS. Continued operational activity would also require short term case files and software routines in performing its basic function. Short term case files would also be used by Level III to provide the administrative support required for Level IV and V during Mode 2 activities. The major processing effort is retained at Levels I & II. Informational access would also be provided to staff elements responsible for review and analysis of statistical data.

6.2 Security Requirements

Software routines developed to monitor and flag Mode 1 and Mode 2 status must be protected from reprogramming by subordinate levels. As these routines not only define the performance of the DCS, they also reflect the efficiency of personnel at these levels. Tampering with these routines could significantly alter the effective reporting of true status data to higher levels.

Communication security requirements would be advisable The majority of all data type order wires are presently secure. Although the status data is not classified, it does convey critical information regarding the structure and status of the DCS. Accordingly, it should be protected from unauthorized entities.

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UTEK Systems, Inc. completed Task 1 of the study for the Exploratory Systems Development Model. This study is based on the present day policies and procedures promulgated and published by DCA. The study has been accomplished in the perspective of the 1980 Defense Communication Systems (DCS).

It assumes that the reporting policies for the future would remain the same, however, the mechanisms for reporting and the information content of these

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20. Abstract (Cont'd)

reports may well vary. It also assumes that the basic purpose of the DCS is to provide a level of performance to all customers.

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