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DEPARTMENT OF COMMUNICATIONS

REVIEW AND CRITIQUE OF SMS WORK
MEASUREMENT METHODS AND OF DOC
PRE-PILOT EVALUATION RESULTS

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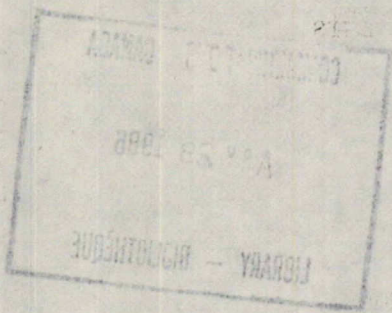
1. REVIEW AND CRITIQUE OF SMS WORK
MEASUREMENT METHODS AND OF DOC
PRE-PILOT EVALUATION RESULTS

July 24, 1979

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Submitted by: P. Le May

Copies to: Mr. S.N. Ahmed



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I. INTRODUCTION

This report number 2 follows the document prepared previously by our Mr. François Chassé and dated June 6, 1979 and is part of a series of reports which will be produced as various parts of our mandate are completed.

The purpose of this report is to validate the measurement methodology and results obtained for staff utilization as described by the System Implementation Group and their document "A Report on SMS Pre-Pilot Evaluation" dated June, 1979. In particular, we have undertaken the following activities:

- Review and assess work measurement techniques used on the application processing functions and procedures under the existing manual system.
- Review the approach and methodology used to determine the cost of processing applications for land mobile licenses across Canada using current manual methods for accounting fees collected and selecting compatible frequencies, as well as the results obtained from the Montreal and Halifax District Offices.
- Review and assessment of work measurement techniques employed as a basis for determining resource requirements under national implementation of SMS.

The scope of the project, the description of the methodology or work measurement and cost methods, the review and critique of work measurement methods applied to Pilot and the validity of the results obtained are discussed in the following sections.

II. SCOPE OF THE PROJECT

As stated in our first report, the Department of Communications (DOC) has an objective to improve spectrum management and is presently focusing on land mobile communications as they represent 85% of non-GRS licenses. The main objective of SMS is to allow for more efficient use of the frequency spectrum initially within this frequency range. In order to accomplish this, the Engineering Programs Branch of the Telecommunications Regulatory Service undertook the development and implementation of an integrated spectrum management system in order to:

- permit more efficient use of the frequency spectrum
- constrain growth of personnel and administrative costs through the automation of certain support and license processing operations.

Prior to proceeding with national implementation, a number of pilot projects were planned to assess the feasibility of SMS, test the adequacy of the sub-systems, and confirm costs of assigning land mobile licenses across Canada using the current manual methods for accounting for fees collected and selecting compatible frequencies.

This report addresses the approach established by the DOC to make the work measurements in order to confirm the possibility of reaching its second objective, which is the reduction in growth of administrative costs, as stated above.

The next section presents the methodology which has been used by SMS to obtain pre-pilot measurements in the Montreal and Halifax District Offices.

III. DESCRIPTION OF METHODOLOGY FOR WORK MEASUREMENTS AND COSTING METHODS

The objective pursued with the proposed methodology was to establish the average time and cost per application. In order to achieve this,

a certain number of steps were followed. They consisted of identification of tasks to be measured, establishment of measurement techniques, the recording of measurements themselves, the costing of processing land mobile applications and the extrapolation for national expansion. Each of these steps is further described in the following paragraphs.

This section contains a brief description of each of these steps in the methodology established by DOC and followed by their personnel during the course of the pre-pilot measurement.

A. IDENTIFICATION OF TASKS TO BE MEASURED

Based on a number of fact-finding visits to the Montreal District Office, a responsible Headquarters Engineering design staff prepared a comprehensive flow chart of the land mobile licensing activity. Then a list of task definitions was prepared and each task description was written to have a logical and clearly defined end. Also, each task or group of tasks was matched with its proposed counterpart in Pilot III. Each task was coded, its respective unit of measurement identified. The task descriptions were presented and approved by the Montreal District Office personnel.

B. ESTABLISHMENT OF MEASUREMENT TECHNIQUES

DOC conducted a review of the current information systems but it was found that the current IRLS and STMIS do not provide sufficiently detailed measures for the purpose of the evaluation except for the extrapolation of cost of a national SMS system with IRLS.

The measurement techniques chosen for the evaluation were the ones previously used on similar studies conducted at the National Parole Board. The techniques found to be most appropriate for these measurements was the Task Listing method with all tasks and outputs clearly identified and coded for easy reporting. This technique

requires the employees to report their own times and outputs on a pre-designed form. On the other hand, the stop-watch technique using an observer was rejected because it was felt as somewhat disruptive of the work environment and that stronger user rejection could result from such a technique.

C. THE RECORDING OF MEASUREMENTS

Before measurements were taken, meetings were held with the district managers and selected personnel involved in those measurements, and the necessity of the measurements as well as the importance and accuracy of the times reported, were explained.

A trial measurement period then took place and instructions were provided as time sheets were being filled in by the personnel. With the objective to obtain a statistically valid sample size with little or no bias from cyclic operations, measurements were performed in four distinct periods, during a two-month interval. Times were reported on a task basis, as opposed to an application basis, in order to augment the sample size for each task.

Later, the Task Listing Method was used on a per application basis while a number of applications as selected by the Montreal District Office personnel was submitted to the measurements.

Weights for each task had to be determined since all tasks do not necessarily need to be performed for every application. Using ~~actual SIMS historical data~~, selected applications weights were calculated for the applicable authorization tasks. To confirm the analysis of those weight factors, since the available sample size was small, the authorization personnel was submitted to a Delphi test in order to elicit and refine their opinion regarding the weight factors. The results of those two approaches were combined to obtain the final weight factors used in the analysis of the results.

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The Montreal District Office was selected for the measurements since the Pilot was to take place in that District Office. However, since the congestion level in Montreal is one of the highest in the country and also since they already have access to some computer assistance, it was decided to select one other District Office to complement the measurements results. Halifax was selected on the grounds that it is also a large urban center, without computer assistance, and that the congestion level is such that approximately 80% of land mobile assignments in Canada are made in areas with levels of congestion equal or higher than in Halifax.

D. COSTING OF LAND MOBILE LICENSING

The ultimate objective of the pre-pilot evaluation as stated by DOC was to establish the average cost to process an application for a land mobile license and several aspects were considered in determining the final cost.

Since the time measures for each task included only the productive time or the actual time to perform the task, a productivity factor was used to take into account items such as: time spent for a personal need, coffee break, personal telephone calls, etc. It was estimated that because of the items there was only six productive hours in a normal 7½ hours/day for a productivity factor of 80%. Therefore, an overhead factor of 25% was applied to direct task time in order to take into account the average level of productivity.

Three other elements of overhead are also under consideration such as:

- Fringe salary benefits not included in a salary such as pension, annual leave, etc.

- Cost of office space, furniture and telecommunication.
- Management overhead including the following:
 - i DOC headquarters overhead for all employees.
 - ii DGTR headquarters overhead for employees and regional and district offices.
 - iii Regional office overhead for employees and district offices.
 - iv District management overhead for district offices employees.

Based on the Department's Human Resources Inventory Survey, the average salaries for working level clerical (CR) and technical (EL) were determined. They were to be used accordingly in the calculation of the direct cost per application.

E. EXTRAPOLATION FOR NATIONAL EXPANSION

To extrapolate the results for a national system, the cost of the current versus automated system will have to be established for the three types of processes as identified in the SMS evaluation criteria and methodology documents. Those processes are renewals, new assignments and amendments.

Renewals give rise to only financial and administrative transactions and the current and proposed automated systems could be readily compared in that area. Two approaches are still being considered for new assignments and amendments. First, the applicable weight factors for each task for new assignments and technical amendments would be used to derive an overall weighted average for both types of processes. The other approach would identify those tasks which are likely to be performed for typical applications of various complexity, that is low or high. The weight factor for low and

high complexity systems would then be used to extrapolate. The complexity levels will be defined by the density of base stations in a given area. So far, no decision has been made regarding which approach to use for extrapolation purposes.

The applicability of Montreal and Halifax results for national extrapolation has not been dealt with in DOC's evaluation report and are to be determined in the cost roll-up report. The preliminary conclusion was that, for 80% of base land stations licensing, time required to perform the various tasks should on the average lie around the Montreal and the Halifax results. Furthermore, DOC expected this average to be closer to the Montreal results since the high congestion offices present a larger proportion of the total assignments made across Canada. Furthermore, based on actual transaction data from IRLS input into the network analysis model, it is estimated that 50% of all EMC studies will be performed in eight District Offices which are considered medium to high congestion areas.

IV. REVIEW AND CRITIQUE OF WORK MEASUREMENT METHODS APPLIED TO PILOT

We have reviewed the work measurement techniques used by DOC and we consider that it provides a reliable measure of the amount of work required to process land mobile applications. More specifically, the task listing methods permits the establishment of realistic time estimates since it covers the range of tasks normally performed when processing applications. Furthermore, a sound analysis was done by the DOC headquarters personnel to prepare the task list and validate the task description with District Office personnel prior to the implementation of the measurement program.

The averages used in the sample task times taken during the measurement period should be reliable to the extent that the chosen period was representative of the typical mix of applications processed in the

Montreal and Halifax Offices. We have examined the mix of applications processed during the measurement period and it appears representative of the average workload normally found in the District Offices.

The recording of measurements themselves in the District Offices was made with minimum disruption of the working environment. Verification of certain times could have been made using stop-watches, but due to the disruption on the working relationship, the results would not have increased greatly the level of confidence in the measurements.

However, it must be recognized that the work pace of personnel is somewhat increased whenever time measurements are taken of their various tasks, particularly at the beginning of the measurement period with a diminishing effect towards the end. This tends to introduce a conservative bias in the time measurements and consequently in the cost estimate of the manual system.

V. VALIDITY OF THE RESULTS OBTAINED

A. ESTABLISHMENT OF THE AVERAGE LICENSING COST IN THE DOLLARIZATION OF TIME ESTIMATES

Overhead costs such as office and furniture cost and as well as management overhead are of largely fixed nature; their inclusion in the overhead costs of licensing should be reconsidered. On the other hand, the productivity factor should not be considered as an overhead but rather as a re-adjustment of time estimates in order to take into account the average office workdays. This factor should be applied to time estimates before and separately from the dollarization.

The calculations made in the report are in 1979 dollars. In completing the economic justification it will be necessary to make modifications to take into account cost changes that are likely to

occur between the results of the evaluation and the time period at which the implementation will take place. The cost escalation factor to be used should reflect the probable rate of inflation based on past historical trends. A sensitivity analysis should also be made based on a minimum and a maximum future rate of inflation between which the most likely rate of cost escalation will lie.

In summary, we recommend that overhead costs include only employee fringe benefits as these are the most likely to be influenced by the national implementation of SMS.

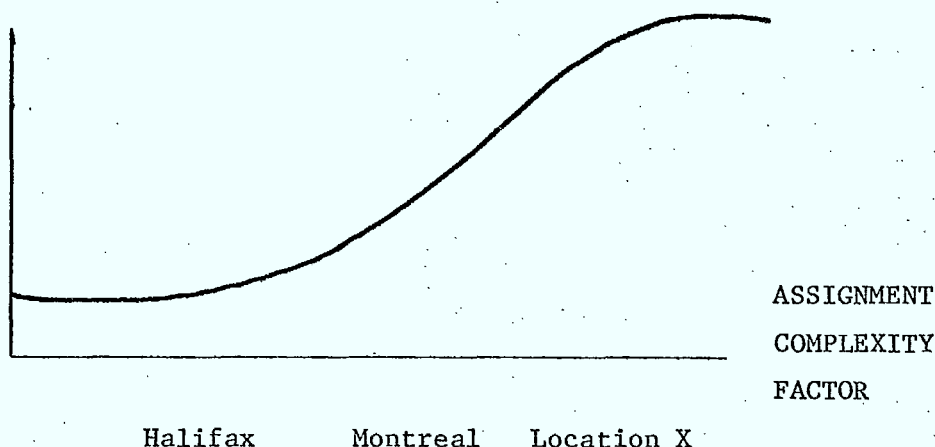
B. EXTRAPOLATION OF RESULTS TO THE NATIONAL LEVEL

The approach to be used for extension of the results to a national system has not been decided upon and some alternate methods are still being considered by DOC. Nevertheless, we have drawn certain conclusions since this extrapolation is of prime importance. One of the prime justifications of the proposed automated system is based upon the overall cost improvement to be expected from its implementation at the national level.

The time estimates obtained for completing the licensing process are representative of the amount of work required to issue licenses in the respective District Offices where they were taken. However, extrapolation of Montreal district results to the national level can not be made directly. The evaluation of the average complexity of applications between the various District Offices will have to be taken into account in extrapolating the results, particularly in relation with the EMC related tasks since the time spent on the EMC analysis is a direct function of the complexity level of the application.

A complexity factor could be established based on the density of base stations in a given area and a correlation identified between the level of complexity of applications in a given district and the average time required to process the application. The relationship curve could be as following:

AVERAGE TIME PER APPLICATION



On the other hand, we suggest that some measurements of individuals tasks be made at least on a sample basis in a third location having a high degree of complex assignments particularly for the EMC analysis related tasks. This would permit the confirmation of the results of the Montreal District office and provide additional data to establish a relationship between average time and level of complexity. Based on the results of these three locations, the method of extrapolation at the national level could be made with greater degree of precision.

VI. CONCLUSION

In summary, our review of SMS work measurement methods has revealed that the approach used as well as the preparation made and the time period chosen for measurement of individual task durations were sound.

The pre-pilot evaluation results obtained were valid since they are representative of the typical mix of assignments usually encountered in the respective district offices where measurements took place as well as the average work load and work pace of personnel.

On the other hand, the use of overheads costs other than fringe benefits in dollarization of the results should not be taken into account, since they tend to be largely of a fixed nature specially on a short term basis. We therefore suggest that this issue be resolved by DOC prior to submission for approval of national implementation of SMS.

The dollarization should also reflect the level of costs to be expected during the implementation period taking into account a realistic inflation rate to be expected until the automated system is fully operational.

Finally, the extension of results to the national level will have to reflect the varying level of complexity of assignments between the different DO's in order that the economic justification of the automated system be representative of a realistic cost improvement to be experienced once implementation is completed.

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