Hickling-Johnston

DEPARTMENT OF COMMUNICATIONS

TELECOMMUNICATIONS REGULATIONS BRANCH

*

WORK IMPROVEMENT STUDY

FINAL REPORT

*

JUNE, 1972

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B. G. Beatty
T. G. Hillis

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INTRODUCTION

"Consultation between industry and government, and among governments, is a growing necessity in all fields of public policy -- none more than communications, a key sector of Canada's future. It has become fashionable to focus on the increasing technological complexity in telecommunications, but the complexity in evidence is a human one of individuals and organizations with so many varied interests in Canadian telecommunications.[1]

To provide a necessary sensitivity to local, regional conditions in the management of the radio spectrum, a decision was taken to decentralize part of the decision-making function. But, the role and place of the regional bureaux *vis a vis* headquarters was not clearly defined. The appropriate division of duties, responsibilities and relationships, which provides for the need for regional autonomy in specific areas and meets the obvious requirements of integrated action in other areas, requires a clarification of management roles, and this precedes the detailed analysis of system and procedural improvements.

It is hoped that this report, by providing a framework for discussing the issues and opportunities surrounding a decentralized stance, will help to identify optimum workload designs needed to meet the Branch's differentiated environmental demands and formulae guidelines for determining its manpower requirements.

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1. Hon. Robert Stanbury, speech to the W.C.T.C., February 1, 1972.

ORGANIZATION DESIGN

The challenge in organization design is to release the skill and innovative abilities of individuals, so that knowledge can be directed to the primary goals of the enterprise. The decision-making structure must define relationships and authority in a way that provides focus on the effective discharge on the main programs and activities of the Branch, and the structure should be adaptable to changes in objectives and their priorities.

Organization forms which derive from a market viewpoint have gained wide acceptance. The Government, for example, is shifting from an internal orientation to a philosophy of management which focuses on the services provided. Planning, programming, budgeting systems are a departure from traditional thinking in that they force recognition of a government agency's "markets" and the means by which they are or could be serviced.

The result is a tendency toward developing an entrepreneurial atmosphere and the fostering of a marketing-oriented managerial process. This places the question of centralization or decentralization in a new perspective, as merely forms of adaptation to the new environment. Both can be operative at the same time within the same corporation; their relevancy depends entirely on whether the objectives of the corporation are being supported by the most appropriate structure form.

The demand is for uniquely-designed organizations which are structured to meet specific characteristics of the environment in which they must operate. This carries through to branches, divisions, regions and units. Each may need a different organization structure and system for decision-making tailored to its environment.

Differentiation and Integration

Research into the management of complex organizations has shown that where uncertainties are great and where there are inherently long time lags in the feedback of information on which to evaluate a decision, the organization must have a very high degree of *differentiation*.

Differentiation is a much more encompassing term than decentralization as it implies great differences among the components which make up the organization. These differences reflect the need for each organizational component to be highly adapted to that segment of environment which it serves. Each must have a different orientation especially suited to the work it does and may require different kinds of systems and methods appropriate to its particular task.

This is the antithesis of the one best way. In fact, it contradicts much of the traditional organization theory which has espoused a standardization and uniformity of approach across the organization.

But where a high degree of differentiation exists, there must also be a high degree of *integration*. Integration is the companion concept to differentiation. It encompasses the devices for tying together a highly diversified organization. Essentially, integration is conflict resolution: it represents the mechanisms for resolving conflicts among highly differentiated organization units. Clearly, the greater the differentiation, the more potential for conflict, and the more effective must integrative mechanisms be. A lack of proper integration results in: "decisions falling between the stools" and "groups which need to work together not communicating".

A Conceptual Structure

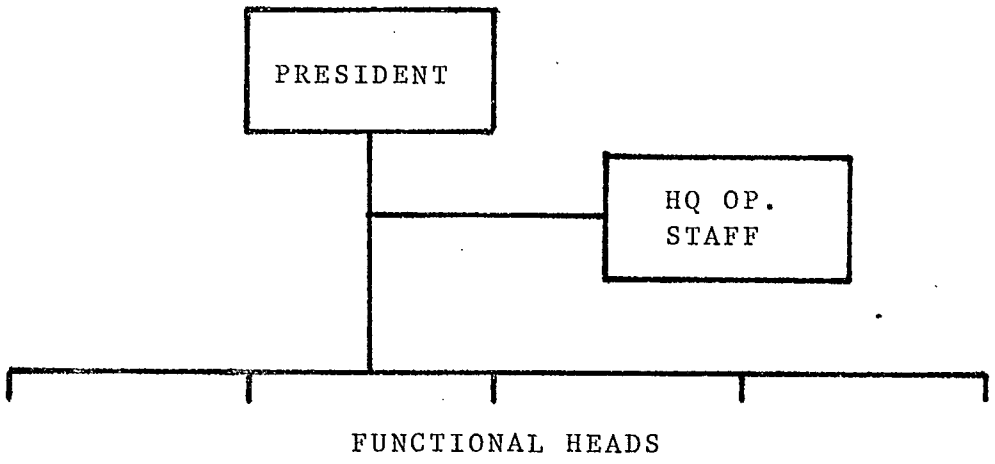
Two of the multitude of shapes that organizations can take are illustrated in Exhibit 1. Each attempts to match organization units with respective sectors of the environment and to coordinate different groups toward total organizational goals.

But, how is the Telecommunications Regulation Branch organized to manage the radio spectrum efficiently and effectively? At best, it would appear to be an amalgam. In part, the Branch has a product line orientation, such as in the evaluation of broadcasting and microwave applications. In part also, its structure is systems dictated; for example, people are organized around the radio licensing system. Additionally, the Branch is influenced by others in the Department who are functionally harnessed like the Finance and Personnel Branches. Finally, decentralization has

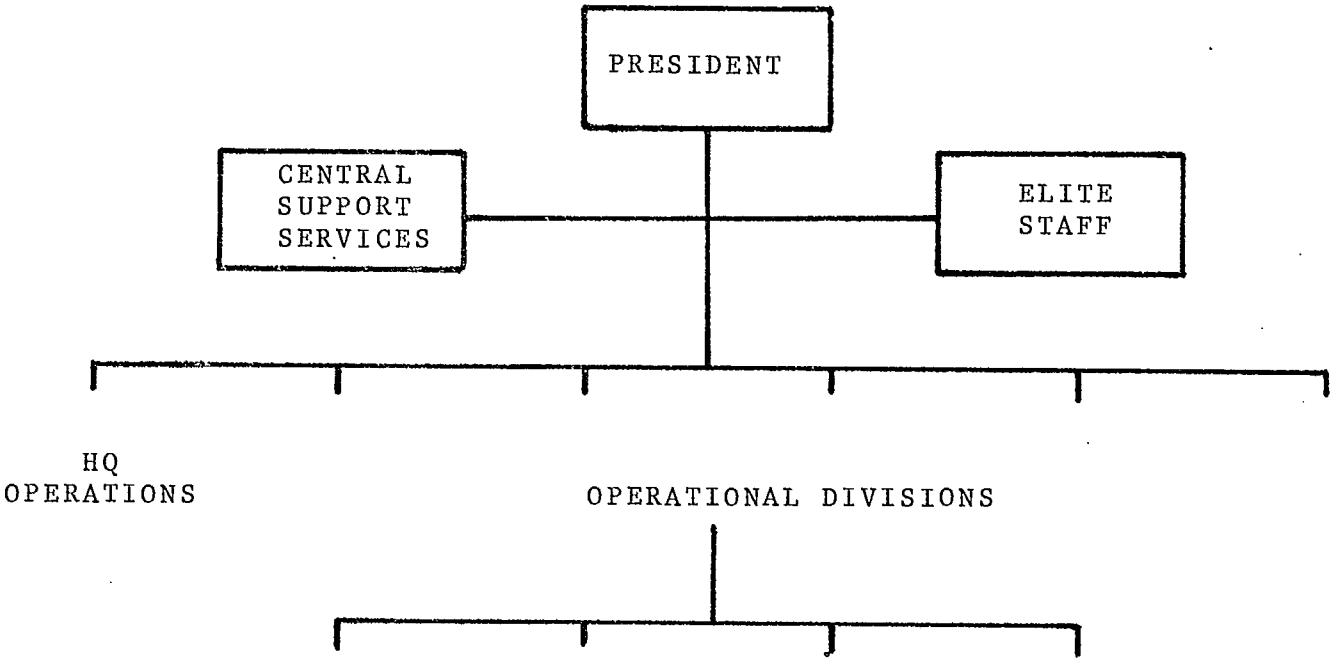
EXHIBIT 1

ORGANIZATION STRUCTURES CAN TAKE MANY FORMS ....

Unitary



Multi Division



introduced a geographic dimension in Telecom Regulation with the objective of improving the customer interface.

It is submitted that, as a first step to work improvement, a structural change is needed to differentiate the organization components and to align them more closely with their environment. At the same time, integration mechanisms should be identified to force consistency and balance among the differentiated units.

There would appear to be two major thrusts in Telecom Regulation: operational functions and central functions. These are illustrated in Exhibit 2. The five regions and their respective district offices have clear operational roles. Besides enforcement activities -- monitoring, inspecting, and interference investigating -- regions have responsibility for evaluating license applications, testing radio operators, and issuing certificates and letters of authority.

They have gone about their task with autonomy: each has its own organization format, its own subsystems for getting the operational job done and, most importantly, its own resource allocation process and priorizing criteria. Currently, the integrative mechanisms are emerging in the form of systematic objective-setting and operational planning, capital equipment forecasting, career planning and financial reporting. The timing is appropriate to formalize these processes and reinforce them with positional and group integrators with the aim of:

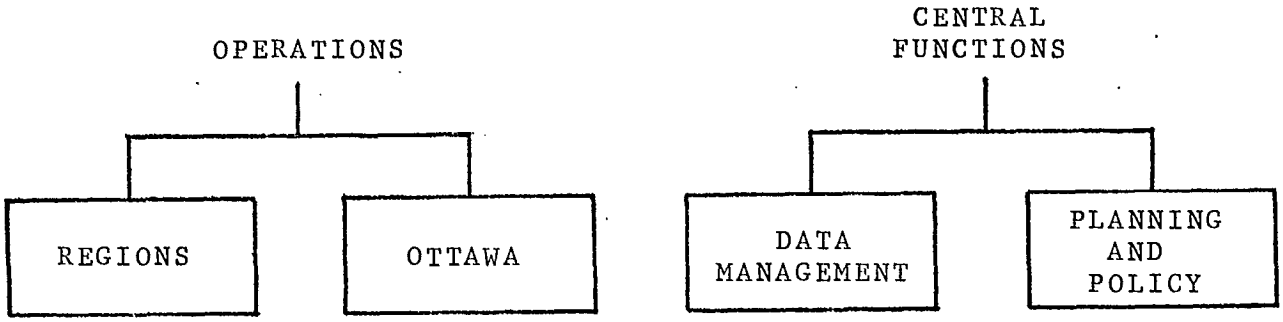
- providing support to the differentiated regions;
- managing a process of resource allocation among them;
- ensuring accountability within them.

The central function, on the other hand, manifests itself in an elite technical corps responsible for spectrum planning and policy development, and the setting of standards for equipment, radio systems, interference and facilities.

With decentralization, this group has been given a direct and important access to the customer through the regional apparatus; access to "market intelligence" that is complemented by their interface with international organizations and national associations. Because channels to both sources are critical to effective spectrum management at both central

EXHIBIT 2

A CONCEPTUAL STRUCTURE ....



- Application assessments
- Licenses
- Investigation
- Inspection
- Training
- Monitoring

- Specialized evaluations
- Interregional and international coordination

- Engineering data
- Information processing
- Computational support
- Program coordination

- Standards
- Spectrum planning
- Policy and regulations development

and regional levels, routine integrative devices are needed to ensure that the internal information flow is a two-way meaningful process.

Also classified as a central function, but separate and distinct from the planning and policy group, is the data bank resource. Viewed as a supportive management tool, this information centre should be capable of providing decision-making assistance to managers in all other groups in the Branch.

But, as elaborated later in this report, this central function has not been recognized as a separate, cohesive entity. Instead, a proliferation of information gathering and disseminating subsystems have permeated the Branch; many have limited computational applications and some are considered obsolete by the operating managers.

A central data group is, by definition, a support service with a strong user orientation. It must work with its "customers" to identify their decision-making needs and then design and operate efficient information systems for meeting these needs on an agreed-upon priority basis. In Telecom Regulation, the data bank is more than record keeping -- it provides vital input to the solution of engineering problems.

The other operational group, positioned in Ottawa, deals with specialized knowledge and a unique marketplace. Drawing on a scarce evaluation expertise and expensive computational facilities, this group assesses complex license applications, the results of which may have a national impact. Indeed, the scarcity of the resources utilized and the narrowness of their application dictates their confinement to Ottawa "region".

Another environmental fact of this latter group's existence is its client list. Agencies and departments of foreign administrations and the Government of Canada, and national corporations in the airline, broadcasting and telecommunications industries are representative of the Canada-wide consumer with whom it interfaces. Not only are these "customers" centrally-oriented (and that is *prima facie* evidence of the group's legitimacy) but, perhaps more importantly, the operational decisions taken by this group have broad government policy implications and so must be tightly coordinated with zero margin for error.

To illustrate the functioning of such a group and its operational role, a specific authorization system -- the procedure for issuance of a broadcast technical construction and operating certificate -- is described in detail. In addition, procedural change recommendations are made to give substance to the customer-orientation theme of decentralization.

BROADCAST CERTIFICATION SYSTEM

A detailed description of the current procedures for AM/FM/TV broadcast certification and CATV applications, including schematic diagrams of main management events, is presented in the appendix, wherein procedural change recommendations are *italicized*.

The ultimate objective of each system is the certification that prescribed high technical standards have been met or exceeded. The evaluation process involved demands a blend of sophisticated technical knowledge and experience and supportive management tools in the form of computer programs and broadcast maps. Coordination of effort must be tightly controlled within a "team" setting and a consistent, professional approach is mandatory. Significantly, the magnitude of the social and economic aspects of broadcast licenses dictates strict confidentiality in their appraisal.

Recently, certain decisions were taken on revisions to the certification system -- revisions in the flow of documentation which would result, hopefully, in more regional "involvement". Ostensibly, these changes in routine were made to provide higher visibility for DOC in the local broadcast community. We agree with the goal but not the means. In fact, the revisions agreed-on increase the possibility of customer confusion and undesirable public relations.

By way of illustration, the regional office is now signing and delivering a letter of acknowledgement to the applicant of receipt of the application and brief. But, from this point in the application process until it receives the letter of authority from headquarters for signing and forwarding to the applicant, the region is unaware of the status of the application. In the interim, headquarters will have corresponded directly with the applicant on the site clearance acceptability or rejection, the unacceptability of the application and brief (if applicable), and the content of the letter to CRTC advising the DOC intention to issue a technical construction and operating certificate. In similar fashion, the consultative, coordinating relationship with the applicant that the region is attempting to build is interrupted several times in the current certification process.

This dichotomy is symbolic of the fundamental issue on decentralization. What are the outstanding features of the sought-after relationship with the regional customer? What is meant by more effective customer service? Where is the cost-benefit threshold beyond which decentralization becomes counter-productive?

But, our conceptual organization structure, in which all operations are decentralized to the *six* regions, casts the question in a new perspective: what is the optimum division of duties between the regions, tailored to meet the differentiated environmental demands of each and compatible with the Branch's resource constraints? Said another way, where is the break point on the cost efficiency/customer effectiveness scale:

The principle is worth reiterating. Neither decentralization for its own sake nor the continuance of a centralized activity for reasons which ignore the total cost/effectiveness implications are sound bases for rearrangement decisions. A position on the scale must be chosen based on facts and logic.

Currently, the broadcasting applications engineering section in Ottawa is divided into three highly specialized units -- one each for AM, FM, and TV, and CATV applications are processed by the special projects section. Employing a fail-safe document handling routine and with the help of computer programs especially constructed for solving broadcast engineering problems, such as those relating to radio radiation patterns, nighttime skywaves limitations and cochannel allocations, this compact team of experts is able to pursue a high standard of excellence in processing about 800 broadcast applications annually. The duplication of this capability in any of the other five regions is not justified.

In our opinion, the position of cost-benefit equilibrium will be reached when a number of key supplementary steps in the broadcast certification system are implemented. At that point, the Ottawa region will be charged with the responsibility not only for performing the complex evaluation of

the application and the delicate coordination of the evaluative procedures, but also for ensuring that all other affected regions are promptly notified of important developments in the certification process. It is anticipated that this can be accomplished without attracting additional staff costs.

These procedural changes will give content and meaning to the intent of decentralization. Credibility at the customer interface will be strengthened as the geographically-dispersed regions now will have full information and engineering involvement in appraising the structural adequacy and work certification, and in assisting the consultant in the proof of performance preparation. This early and continuing involvement with the broadcast applicant will provide a means for "preventive consultation" based on local knowledge, an important component of customer service at the local level.

Therefore, *we recommend that the procedural changes in the broadcast certification system italicized in the appendix of this report be implemented.*

It should be noted that the policies and procedures for evaluating CATV applications are in the formative stages. Since the June, 1971 revisions, no application has been examined against the redefined criteria. Organizationally, too, the method of handling these applications is transitional.

Also, CATV installations and modifications are different from other broadcast applications in one important respect: there is no transmitter involved. Consequently, the impact is more confined to a specific geographic community.

Finally, on a provincial level, community antenna configurations have high visibility and obvious political sensitivity. While it is true that the Government of Canada has jurisdictional authority over "communications receivers" and that provincial government aspirations have to do more with program content than technical qualifications, it may be that by providing superior technical skill readily accessable locally, any perceived need to duplicate federal CATV capability will be obviated.

For all of these reasons, *we recommend that further decentralization of the CATV application process be re-examined when the policies, tools and techniques of evaluation have been more clearly defined and can be assessed in the political context.*

RADIO LICENSING SYSTEMS

Preliminary findings on the integrated radio licensing systems in the Branch were submitted in colored schematic form in the Interim Report. The main events in the management process were defined as follows:

A. Application and fee received

The application is reviewed on receipt and the license fee received is agreed with the rate schedule.

B. Legal and policy check

First, the legality of the application is checked, in terms of citizenship eligibility and intended station use, against relevant provisions of the Radio Act and DOC Regulations. Then, using the Policy Manual and the Radio Act as guidelines, the application is reviewed for adherence to acceptable spectrum management practice, consideration being given to local practices and precedence.

C. Technical audit

The technical aspects of the application are checked for completeness of information and validity of the proposed radio system. Details of *equipment* to be used are agreed with the type-approved equipment list or the technically-acceptable equipment identity list; for unregistered equipment, specifications are submitted for evaluation. The transmitter and antenna *power* is related to the customer's communication need and, together with the proposed *bandwidth* and *emission* characteristics and equipment configuration, the impact of the total system is measured and assessed.

D. Frequency selection

The type of frequency required is decided on the basis of the customer communication need and the technical features of the proposed system. Specific frequencies are selected and checked, for duplication, against the list of assigned domestic frequencies. The selected frequency is tested for inter-modulation interference potential in the environment concerned and, in certain bands and geographic locations, it is also checked against the list of assigned international frequencies.

E. International coordination

In compliance with relevant coordination agreements, foreign agencies and administrations are consulted on the proposed frequency and a signed "coordination letter" is obtained to confirm their consent. This confirmation is retained on microfilm.

F. Socio-economic appraisal

Applied exclusively to microwave applications, the socio-economic review appraises the proposed system in terms of its social impact, its commercial viability and its efficient use of the radio spectrum.

G. Interim authority issued

After the frequency has been coordinated internationally (where necessary), its use is authorized on an interim basis pending issuance of the official license. For applications in certain bands, authority may be given *pro tem* to use another frequency, awaiting interim authority clearance.

H. Frequency registered

Domestic:

Details of the approved frequency are recorded on a "data input form" for biweekly key punch

processing. A "workbook" record is kept of all assignments made between monthly print-outs of the domestic list supplements. The entire list of assigned domestic frequencies is published semi-annually.

International:

Certain approved frequencies are also registered internationally with the International Frequency Registration Board by means of a "notification form". The intent is to protect Canadian spectrum interests by registering representative assigned frequencies which, in aggregate, provide national coverage.

I. License issued

From the manually-prepared requisition form, the license is typed, and then machine-signed and mailed to the applicant, with copies forwarded to the appropriate regional and field offices. Details on the requisition form are subsequently key punched into a data bank for use in issuing license fee due notices and license renewals.

"Frequency assigned" is not segregated as a main event activity because its definition -- communication to the applicant that he can commence using the frequency -- embodies obvious repetition with the issuance of the interim authority and, perhaps, the official license.

The remaining task is to relate these licensing systems to the conceptual organization mold and, using this as a framework for analysis, to appraise the cost efficiency/customer effectiveness equation for each system. The recommendations which follow deal with three distinct types of license application: line of sight, high frequency, and microwave. Where appropriate, the recommendations have been translated into detailed operating procedures by headquarters and regional superintendents, and these are included in the appendix.

LINE OF SIGHT APPLICATIONS

Most applications for radio licenses in the VHF and UHF bands are currently audited by the regions for legality, policy adherence, and technical acceptability. Frequencies are selected in the region, checked against assigned frequency listings and tested for environmental interference potential. Special cases outside policy guidelines are referred to headquarters for consultation and, when necessary, details of selected frequencies are coordinated through Ottawa with the appropriate international agencies and administrations. Interim authority to use a frequency is then granted by the region, pending issuance of the official license. Finally, the frequency is registered and the license is mailed by the Ottawa bureau.

With the exception of which office should issue the license document, there is general agreement within the Branch that this regionalization of authorization procedures is appropriate. The administrative and technical skills needed for these assessments are now in place and, while there is seasonal workload peaking in some areas, the system works well. But, procedural improvements are possible.

Responsibility for assessing applications in certain VHF bands, for example, has not been delegated to the regions:

108.0 - 136.0 Mhz., aeronautical
138.0 - 144.0 Mhz.,) point to point
148.0 - 150.8 Mhz.,)

The regions should be given this spectrum responsibility, together with relevant frequency listings needed for analysis, but with the proviso that headquarters coordination on applications for private aeronautical stations be mandatory in view of the radio range and safety factors involved.

Also, the turnaround time for coordinating frequencies internationally appears to be excessive (six weeks is not uncommon) and this should be reassessed on an individual country and agency basis.

Perhaps of more immediate importance, however, is the aged condition of the listings of frequencies which have already

been coordinated internationally. Although spectrum authorization, in particular, demands current, accurate assignment information, almost on a daily basis, these critical data are compiled and exchanged only every three months between Canada and the United States. In fact, even this arrangement has not been diligently pursued: the Federal Communications Commission frequency listing currently used for reference in evaluating applications is more than a year old. This deficiency is accommodated in headquarters by an informal card system, manually-posted from individual frequency confirmations, which provides a control mechanism for isolating unacceptable coordination requests from the regions. But, the recycling of applications which results has an obvious negative impact on both cost efficiency and customer effectiveness, and for this reason, steps must be taken to update the frequency assignment data and to ensure its maintenance and distribution on a more current basis.

Similarly, the method by which domestic frequency lists are updated may provide an opportunity for productivity improvement. At present, the comprehensive semi-annual printouts are supplemented by short lists of frequency additions and deletions, published monthly. If these "blue book" compilations could be replaced with computerized microfilm reprints, there may be significant savings in postage costs, storage space, and clerical workload; the clerical economies made possible by the replacing of ad hoc frequency recording sub-systems with a fast updating capability.

Organizationally in headquarters, job content and work flows associated with line of sight applications must be restructured to give emphasis to the changed Ottawa role. The resources spent on the duplicate assessment of the legality, policy adherence, and technical acceptability of these applications should be diverted to more meaningful tasks, perhaps in gathering input requirements for the proposed data bank.

At the same time, a compact team of specialists should be designated in the central authorization and assignment section to provide consultative service to the regions, to coordinate, register, and communicate frequency selections domestically and internationally, and to ensure a high level of regional spectrum management through application test-audits. For perspective, this team could be considered to be as much a part of the headquarters operational group as

the broadcasting applications engineering section discussed earlier in the report.

In summary, our recommendations for improved systems and procedures in processing VHF and UHF radio license applications are to:

1. *Delegate responsibility for managing the remaining VHF bands to the regions, together with the appropriate evaluative tools, and specify that certain aeronautical applications within these bands be sanctioned by headquarters.*

2. *Investigate the causes of time delays in the international frequency coordination routine and institute corrective measures.*

3. *Update international frequency assignment data and design safeguards to ensure its on-going maintenance and distribution on a current basis.*

4. *Evaluate the cost/efficiency potential of recording and distributing frequency assignment data on microfilm.*

5. *Restructure job content and work flows in the headquarters authorization and assignment sections so as to eliminate duplicative assessment tasks and to redefine the central operational role in terms of consultation, coordination and registration.*

HIGH FREQUENCY APPLICATIONS

Applications for licenses in the radio spectrum below 27.225 megahertz, bands commonly known as HF, MF, and LF, are appraised in the regions and at headquarters. While work systems tend to overlap on the relatively straightforward legal and policy checks, and some uncomplicated parts of the technical audit, the frequency selection continues to be the prerogative of the central staff, with the assistance of computational programs and other selection tools. Coordination and registration of frequencies -- tasks made more complex by the global propagation of the high frequency spectrum and its popularity with the military establishment -- comprise the other critical facets of the central role. The important regional contribution, on the other hand, is the assessment of spectrum need, validity of proposed coverage, and technical and maintenance capability of the applicant. Also, in the HF band, applications for additional stations on existing, internationally-approved frequencies are assessed at the local level, without recourse to headquarters.

The key to the workload division between regions and headquarters is the nature of the radio wave in this part of the spectrum: once liberated, it has no respect for regional or national boundaries. Clearly, frequency selection here is risky business. It commands experienced analytical judgement based on total information in a complex, rapidly-changing environment. It has a worldwide marketplace with a low tolerance for mistakes.

For these reasons, we appreciate the new-frequency/existing-frequency separation between central and regional authority in the HF, MF and LF bands. At the same time, there is a need for regions to develop expertise in various segments of this spectrum, particularly in the HF bands, if they are to provide a meaningful service to their local markets. Besides, proficiency in LF beacons will become increasingly important in Central Region as Canada's North continues to mature. And, because the development of these selection skills is unlikely without access to sophisticated technical aids, regional choice of frequencies should be encouraged, utilizing the HF program maintained by CRC and the LF program currently under development and the regional need for instantaneous transmittal of frequency assignment information should be stressed.

But, the credentials for frequency selection must be maintained, indeed reinforced, in the operational group at headquarters. The ability to interpret ionospheric and propagation data on a national scale against an international and military backdrop is vital to protecting Canada's leadership in high frequency spectrum management.

Accordingly, for license applications in the HF, MF and LF bands, we recommend that:

1. *Assessment of application legality, policy adherence and technical acceptability be done in the regions and not duplicated in headquarters.*

2. *Regions retain full responsibility with respect to applications for "add-on" stations to existing, internationally-approved frequencies.*

3. *Initial new-frequency selection be made in the regions, with the assistance of local monitoring reports, Ottawa-based computer programs and reliable assignment data.*

4. *All new-frequency selections be verified by the headquarters operational group, and inter-regional, national, and international coordination and registration of frequencies be done by the same group.*

5. *International frequency assignment data be updated and safeguards designed to ensure its on-going maintenance and distribution on a current basis, perhaps by microfilm methods.*

6. *All aspects of military applications continue to be handled by headquarters.*

MICROWAVE APPLICATIONS

About 250 microwave applications are processed by the Branch each year. Each application requires two submissions: a letter of intent and socio-economic brief and, following approval of the system in principle, an engineering brief. Approved applications have resulted in a recent growth rate in microwave frequency assignments of about 17% per year, to a current total of over 11,000 assignments.

And, this growth is likely to continue: "to meet the expected demand by 1980, the inter-regional transmission capacity of Canada's communications network will have to be doubled".[2] Indeed, microwave may be the fastest growing band of all in spite of the fact that Canada now has the most extensive microwave system per capita in the world, a total of 33,000 miles.

This numerical perspective provides an important background for examining the system used in processing microwave applications. For, while it is generally agreed that the Branch's past microwave management has averted any present-day serious congestion, the necessity to stay abreast of spectrum planning and system design techniques is apparent. But, it is in this area that the Branch is most vulnerable: microwave expertise in both headquarters and the regions is in conspicuous short supply.

The assessment of a microwave application is a multi-faceted exercise. The social-economic brief, for example, could theoretically require payoff calculations on not only commercial but also social investments. Even the more quantifiable of these two calculations -- the commercial viability of the microwave proposal -- can pose knotty questions: what costs are to be included in the investment amount and how is the rate of return to be measured?

The essence of the technical audit, on the other hand, is an analytical judgement on the probability of the proposed system causing spectrum interference. Standard Radio Systems

2. *Ibid.*

Plans provide a useful, but general, framework for this evaluation and engineering calculations deal with specific details. But the real foundation for the technical decision is someone's perception of what constitutes the "standard" for an acceptable interference level.

Because the written equivalent of such an interference standard does not exist, any rearrangement of microwave assessment procedures must be carefully planned to ensure a total transfer of this evaluative knowledge and subjective criteria. Microwave acumen cannot be gained solely from a text book nor can it be absorbed overnight. For instance, there is no standard equipment list for microwave installations; rather, the equipment assessment is more an appreciation of the total system and how it is to be used. It is obvious that the dual companions of regionalization in the microwave area are practitioner training and education, and policy and regulations development.

With regard to the latter, there is an urgent need for more SRSP's, specifications and guidelines. Frequency tables must be revised and notes on frequency planning updated. Only with laid down terms of reference can regional engineers expect to approach the high level of microwave management exhibited by headquarters to date. For that matter, these guideline requirements are valid regardless of who discharges the technical audit function in future.

At present, the important regional input to the evaluative process is primarily of a socio-political nature whereas the letter of intent and the engineering brief, after a preliminary review in the regions, is being examined in technical depth by the radio systems engineering approval section in headquarters.

To develop competence on the technical side, regions would require at least the following:

- acceptable national standards for gauging expected system performance, evaluating interference potential, and interpreting radio system plans;
- accurate, updated microwave overlay maps;
- some historical knowledge -- the "why" of the present configuration;
- details of civil and military radar systems;
- earth station data related to satellite systems.

While most of the required training would be on-the-job, working closely with headquarters, the development program should incorporate microwave courses offered by the telecommunications industry. Additionally, the microwave student should plan on spending considerable time with his microwave "customers" -- the telephone companies, for example -- who are acknowledged as being at the leading edge of microwave technology.

The decentralization of the microwave application assessment is a popular notion, but only in the regions. Headquarters is concerned about the consistency of evaluations and the looseness of the go/no-go decision criteria. As with all other frequencies suggested for decentralization, Ottawa fears the loss of "hands on" operational involvement in microwave systems and the concomitant skill obsolesence, particularly for spectrum planning and policy making. In actuality, regionalization should better equip the planners in that more "feelers" will be extended in the marketplace searching for environmental clues on future technology, occupancy, demands, etc. The real need here may be for planners to articulate their needs clearly and for integrative, information-exchange mechanisms to be established inside the organization.

Probably, a stronger case for centralized assessment could be made on the bases of the national implications and political sensitivity of transmission systems, the magnitude of the microwave investment, and the enormous commercial value of an approved application.

In our view, the development of microwave capability within the Branch totally must have high priority. This will involve careful planning of the learning process and timely, responsible execution of a regionalization strategy. As might be expected, the major constraint will be the present scarcity of microwave expertise.

Consequently, for microwave applications, we recommend that:

1. *Top priority be given to the development of microwave plans and guidelines needed for spectrum management.*

2. *A phased program be implemented to decentralize the technical evaluation functions; initially,*

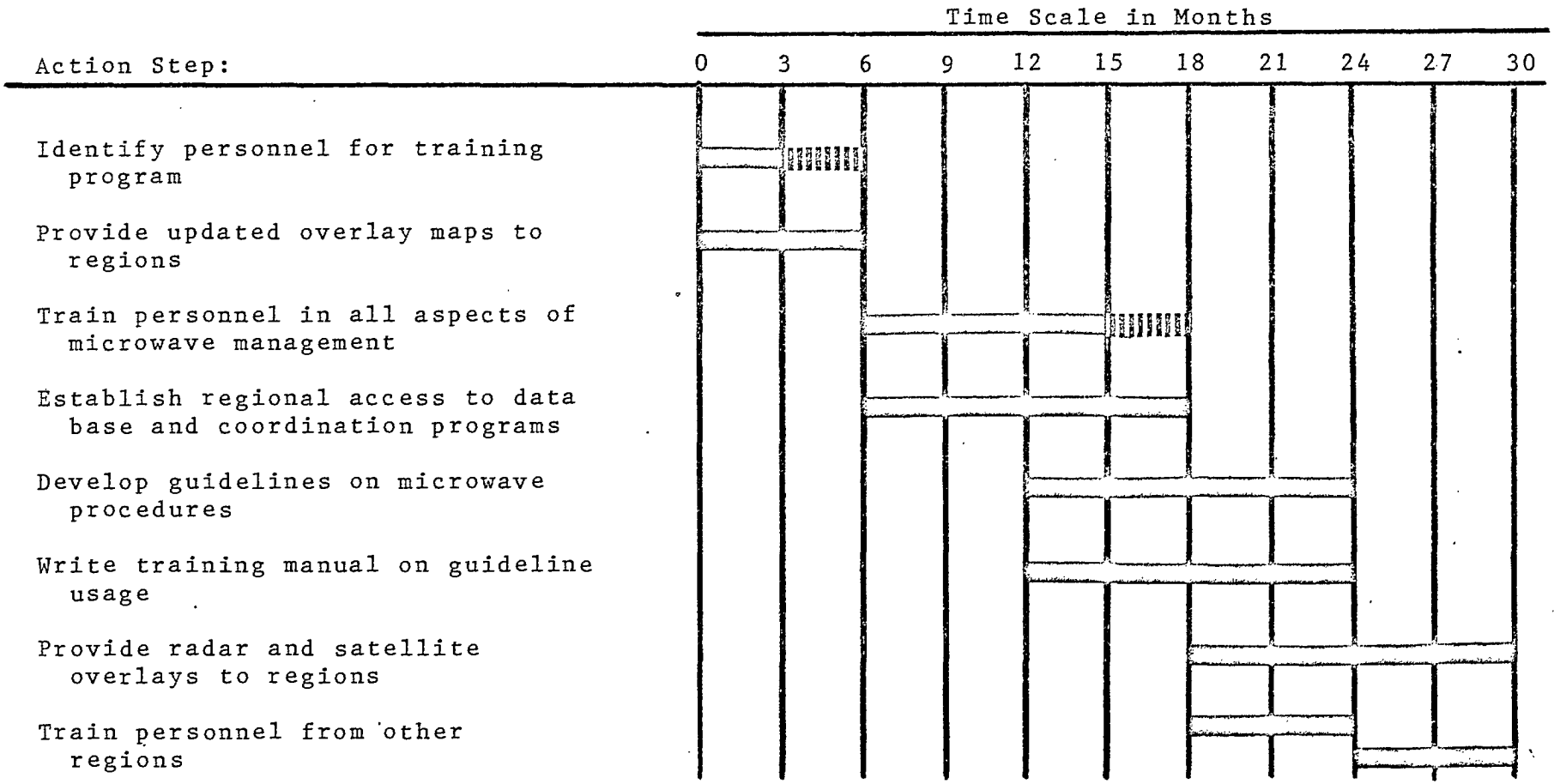
by selecting one region for an in-depth training and education program in microwave management and by shifting the managerial responsibility, together with the evaluative tools (overlay maps, system specifications, etc.), to that region.

3. *Headquarters operational staff build a supportive, advisory relationship with the region selected and establish appropriate monitoring mechanisms to ensure a continuation of excellence in evaluating letters of intent and engineering briefs, and to provide a means for coaching regional personnel and measuring their progress.*

These recommendations for microwave applications were discussed with headquarters and regional superintendents and agreement was reached on the action plan outlined on Exhibit 3. Central Region was selected as the first to be decentralized because it has fewer complex microwave situations, and it was felt that an uncomplicated implementation in this region would permit concentration on developing the technical support tools needed for all regions.

EXHIBIT 3

ACTION PLAN FOR DECENTRALIZING MICROWAVE MANAGEMENT



Total elapsed time -- 24 to 30 months

Legend:

Estimated elapsed time

Possible time saving

FIRST LICENSE ISSUANCE

When he says "we are planning, within months, the issuance of all initial radio licenses for all radio services in the regional offices",[3] the Minister's objective is to provide the applicant with a formal license faster than under the present system and remove the *pro tem* connotation of regional authority in this area.

On a non-automated basis, the additional clerical support staff required in the regions to discharge the license typing and document control duties probably would correspond with current stenographic man-years assigned to these tasks in headquarters. The precise volume of *incremental* work, however, is difficult to determine, because shifting first license issuance to the regions would eliminate the need for regional letters of interim authority and the ratio of interim authorizations to formal licenses is unknown. Another factor is a possible policy decision to institute bulk licensing, which would replace individual station licenses with bulk or system licensing and so generate significant savings in clerical workloading.

However, the new integrated licensing system currently being tested in the Branch has the capability of a one week turnaround time for computerized license issuance; that is, seven days after the approved application is received in headquarters, the official license could be mailed to the applicant. This quick processing would also cancel the need for most letters of interim authority and, at the same time, eliminate the typing task.

Therefore, *we recommend that, on request by the regions, license documentation be issued by the headquarters computer and mailed directly to the applicant.*

3. *Ibid.*

DATA MANAGEMENT

The management responsibility for computerized data, used for both record keeping and applied engineering, is scattered throughout the Branch. In fact, due to the predominance of highly individualized editions, it is difficult to accumulate a comprehensive overview of existing programs. This, in itself, could be regarded as a justification for establishing a central data bank function, a common resource pool which would be readily accessible by all potential users.

This central service notion is generally accepted; some would go further and provide the geographically-dispersed regions with on-line terminal access to the proposed bank. However, the usefulness of the current data on file as a tool for management decision-making is questionable.

In recent years, it appears that user data needs have not been properly reconciled with data systems design. The Department is attempting to rectify this gap in certain areas but these efforts are insufficient in scope, inadequately planned, and impulsively executed.

The new license revenue data system, for example, replaces the simplistic post card type fee notice with a multipart form. This form will be stuffed in an envelope addressed to the license holder together with a return envelope and a notice that either a) no receipt is issued for payment, or b) a receipt will be issued if two copies of the form are returned with the payment. In the new program, all notices will be mailed at the same time whereas, formerly, steps were taken to meter the release of notices according to the regional office's ability to process the returning payments. An early reaction to the new system in one region estimated a 30% increase in clerical workload.

While corrective measures for this particular system are under development, the message is clear: systems design must have a built-in user orientation in the first instance.

Other incompatible "bookkeeping" systems could be cited:

- the frequency assignment data bank and the radio license data bank have substantial overlap but

their system characteristics prohibit them being interrelated; instead each requires a separate input subsystem and manning complement;
- the benefits derived from using a computer to record accounts receivable payments or other "single entry" applications could be challenged;
- neither the frequency assignment data bank nor the radio license data bank can be used in the solution of engineering problems.

Engineering evaluation of radio systems requires a sophisticated, scientific data base. But, the data collection systems and the computational programs that have evolved to deal with technical applications of quantitative science are deficient. Information on spectrum occupancy, for example, is incomplete as is critical data on receiver and antenna characteristics. In large measure, the data bank gaps nullify its usefulness.

The establishment of a central data bank function will consolidate the current, usable programs under one juristiction. More importantly, data bank deficiencies can then be clearly identified, based on surveyed user needs. The priority deficiencies will provide a starting point for the construction of key "information building blocks" which can be used in a series of applications.

The central data bank will not necessarily be equipped with computer hardware. Instead, it will concern itself with systems development and design and rely, at least initially, on processing equipment maintained by others. Consequently, the skill requirement is for spectrum engineers, not computer technicians. In the early planning stages, for the first six months to a year, a compact team of experienced engineers will be required. Subsequently, those involved with current data banks in the Branch will be seconded.

Because the need is essential and apparent, *we recommend that a central data bank function be established in Telecommunications Regulation Branch, and a Director, responding to the ADM (O), be appointed.*

The Halladay study group on data management concluded that a departmental approach to information storage and retrieval may be appropriate. Of course, other branches of the Department must be kept informed of developments in Telecommunications Regulation, but a meaningful engineering data base for spectrum management decision-making is needed urgently and its development should not be delayed.

STAFFING IMPACT

Working with the Classification Auditor of the Personnel Branch, we have attempted to quantify, in broad terms, the manpower shifts which will occur with the implementation of certain recommendations in this report; primarily, the discontinuation of specific headquarters functions and the decentralization of others. In the main, our forecasted impact on manning profiles makes no allowance for changes in service levels; for example, the current backlog in application processing has been regarded as a constant for this analysis. Also, no attempt has been made to identify precise levels of classification on the premise that, with the assistance of the Personnel Branch, this will be done internally on a case-by-case basis.

Recommendation

For all line of sight applications and most high frequency applications, restructure job content and work flows in the headquarters authorization and assignment sections so as to eliminate duplicative assessment tasks and to redefine the central operational role in terms of consultation, coordination and registration. At the same time, computerize the issuance of the first license.

Manpower Available.

Location	Staff	Classification
HQ (RAL)	6-8	EL
HQ (RAF)	1-2	EL
HQ (RAL)	1-2	CR
HQ (RAL)	3	ST
HQ (RAL)	1	CR

Recommendation

For high frequency applications, regions retain full responsibility with respect to applications for "add-on" stations to existing, internationally-approved frequencies, and make initial new-frequency selection on other applications.

Manpower Needed

Location	Staff	Classification
RO (Pacific)	½	EL
RO (Ontario)	½	EL
RO (Quebec)	½	EL
RO (Atlantic)	½	EL

Recommendation

Develop microwave plans and guidelines needed for spectrum management and select one region for an in-depth training and education program.

Manpower Needed

Location	Staff	Classification
HQ (REA)	1	EL
HQ (REA)	1	CR
RO (Central)	1	EN
RO (Central)	½	EL

Recommendation

Establish a central data bank function in Telecommunications Regulation Branch, and appoint a Director responding to the ADM (O).

Manpower Needed

Location	Staff	Classification
HQ	1	EN

MANPOWER PLANNING AND CONTROL

Manpower: the key variable for operations management.

Factors affecting manpower requirements:

National level

(1) Level of service strategy.

(2) Installed capacity level.

(3) Workload controllability.

(4) Basis for staffing decisions.

(5) Standard work unit allowances.

Regional level as above, plus

(6) Regional workload factors.

(7) Volume forecasts.

(1) Level of Service Strategy

Mix of interdependent service variables.

Caseload versus surveillance.

Caseload policies and practices:

1. Interference investigations.
2. Prosecutions.
3. Special inspections and field examinations.

Surveillance policies and practices:

1. Monitoring.
2. Regular inspections.
3. Equipment standards level.

4. Quality of authorization process, technical audit and frequency process.

Strategic operational decision:

What mix of activities and quality levels produces the required results, i.e. meets the objectives of the Branch?

Deciding the Level of Service

Enforcement policies:

1. Complaint investigation.
2. Monitoring facilities and methods.
3. Inspections.

Engineering standards:

1. Equipment.
2. License application technical audit.
3. Frequency selection.

Service Stance:

1. Minimum level.
2. Standard level.
3. Improved level.

(2) Installed Capacity Level

Decisions:

1. Open or close an office or monitoring station.
2. Change installed capacity level of existing facilities.

Manpower implications:

Basic service capability complement is not automatically adjustable to lower workloads than the facility was planned to handle.

EXHIBIT 4

LEVEL OF SERVICE STRATEGY: A MIX OF INTERDEPENDENT SERVICE VARIABLES

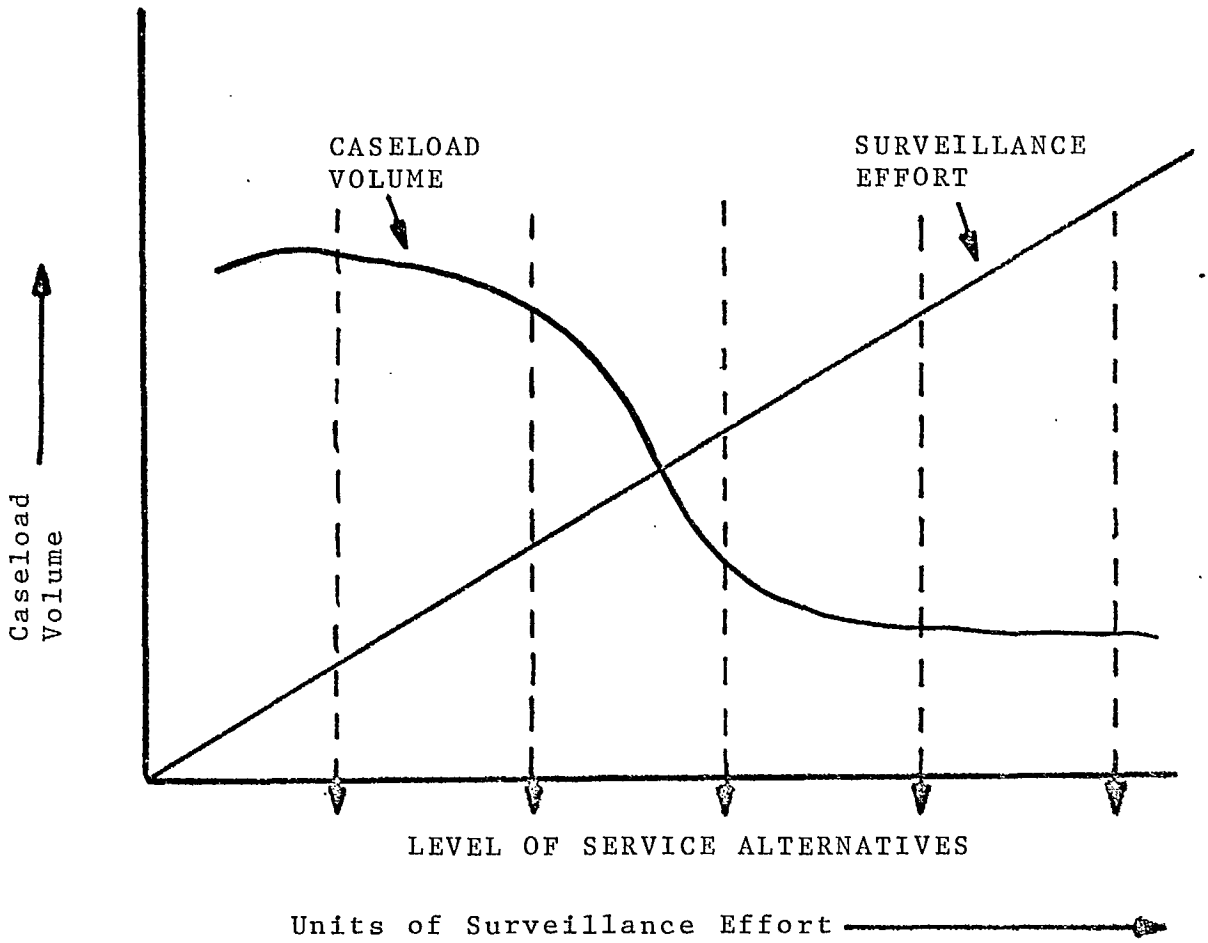
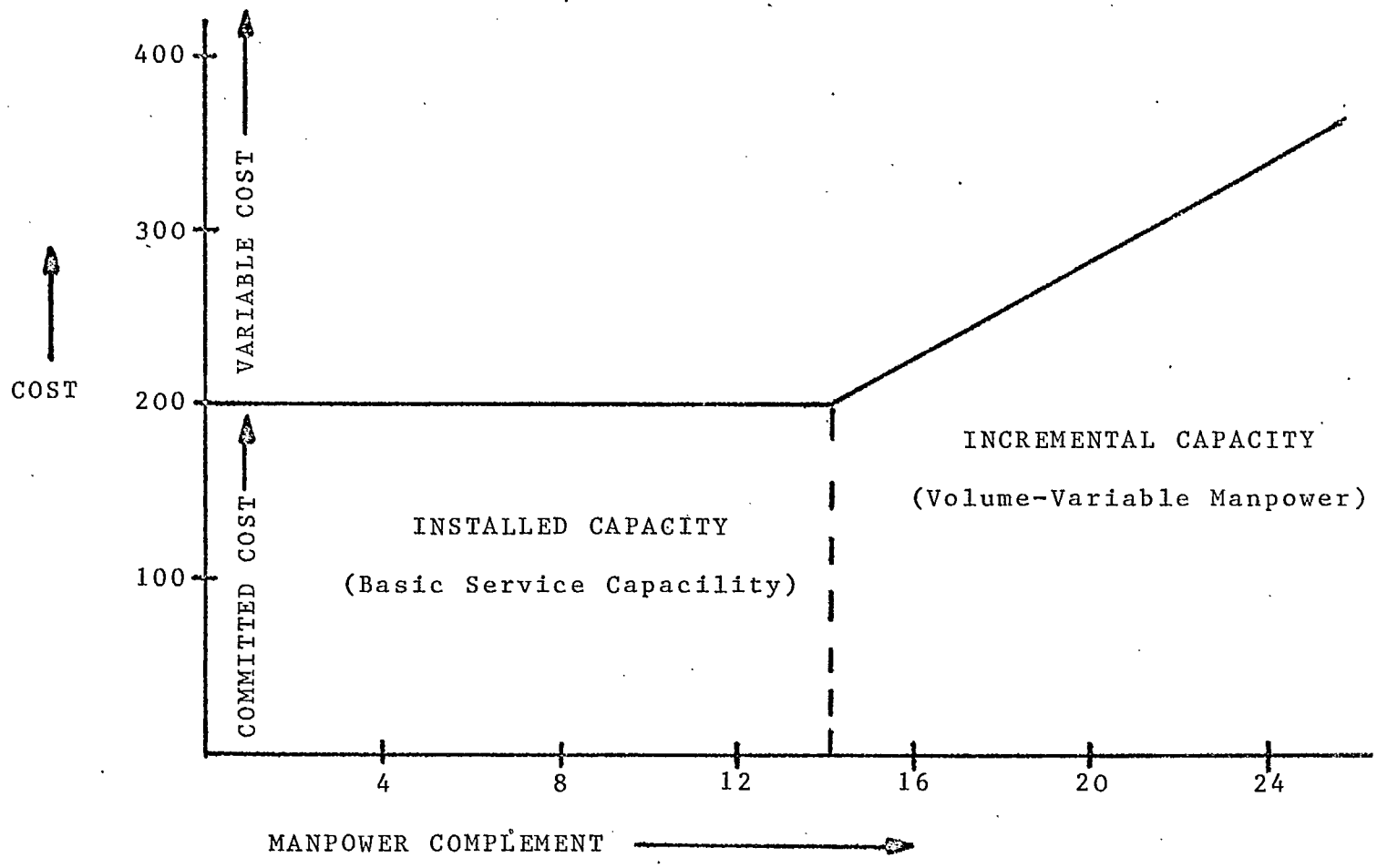
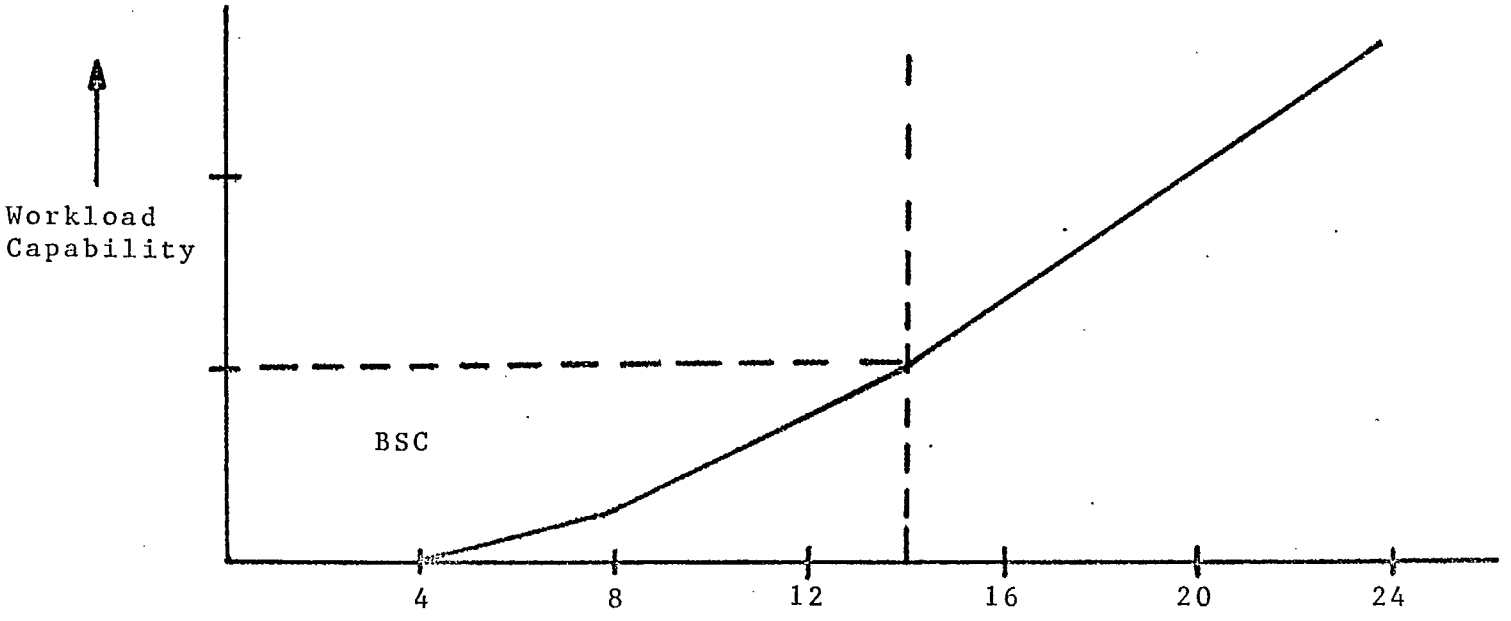


EXHIBIT 5

INSTALLED CAPACITY, COMMITTED COST
AND SERVICE WORKLOAD CAPABILITY





(3) Workload Controllability

Authorization process:

Uncontrollable
- policies: ministry, CRTC, FCC, international
- license applications
- technical audit requirements;

Controllable
- license reissue process
- process flow.

Enforcement process:

Uncontrollable
- caseload, interference investigation
- mandatory inspections;

Controllable
- surviellance practices
  - programmed inspections
  - monitoring methods
- quality of authorization process
- appropriateness of standards
- investigation policy.

Policies and standards:

Uncontrollable
- equipment sample testing
- international agreements
- minimum research and standards determination;

Controllable
- pure research
- sophistication of standards
- expanded equipment testing.

Definitions:

Uncontrollable
- externally generated volume-variable workload;

Controllable
- internally programmed activity-level-variable workload.

(4) Basis for Staffing Decisions

Installed field capability:

- monitoring stations;
- number and size of regional and district offices;
- basic service capability of each.

Volume-variable incremental staff for:

- authorization process;
- enforcement process;
- equipment checking.

Installed headquarters staffing:

- engineering standards capability wanted;
- data centre;
- management.

(5) Standard Work Unit Allowances (National Application)

1. For Controllable, Internally-Generated, Activity-Level-Variable Workload

   Basis: standard practices derived from policy decisions.

   Examples:
   - inspections -- non-compulsory;
   - enforcement practices beyond minimum or standard levels;
   - monitoring.

   Workload factors:
   - based on programmed level of activity.

2. For Uncontrollable, Externally-Generated, Volume-Variable Workload

   a. Volume predictable:
      - compulsory inspections (volume predictable on local inventory of license-holders and inspection program);
      - examinations;
      - certain field examinations;
      - regular license applications.

EXHIBIT 6

STAFFING ANALYSIS: PACIFIC REGION

COMMITTED CONFIGURATION
(Not Sensitive to Volume)

Regional Management		2		
Administration		5		
			7	
Technical Capability				
Engineering		1		
Authorization		1		
Enforcement		1		
Support		2		
			5	
District Offices				
Manager	1			
Technician	1			
Support	1			
	3 x 5 Offices		15	
Monitoring Stations			5	
TOTAL BASIC SERVICE CAPABILITY				32

WORKLOAD VARIABLE CONFIGURATION
(Directly Related to Volume)

	Technicians	Support	Total	
Authorization	7	4	11	
Enforcement	5	-	5	
Engineering	1	-	1	
District Offices	4	-	4	
	17	4		21
				53

b. Volume unpredictable:
   . interference complaints;
   . prosecutions;
   . special field examinations;
   . license applications of special nature.

Workload factors for:
   . based on standard level of work;
   . based on average time allowance, if possible, otherwise actual time is the allowed time.

(6) Regional Workload Factors

National workload allowances to be adjusted by following regional productivity factors. (The factors are subject to regular discussion and endorsement):

1. Regional enforcement differences.

2. Regional equipment assistance, which increase productivity.

3. Territorial coverage and travel area.

4. Flexibility of staff -- pooled skills.

5. Seasonal workload pattern.

The seasonal workload pattern points up the load balancing flexibility of each region. This determines what programmable activity can be done, and when.

(7) Volume of Activity Forecasts

Regional factors:

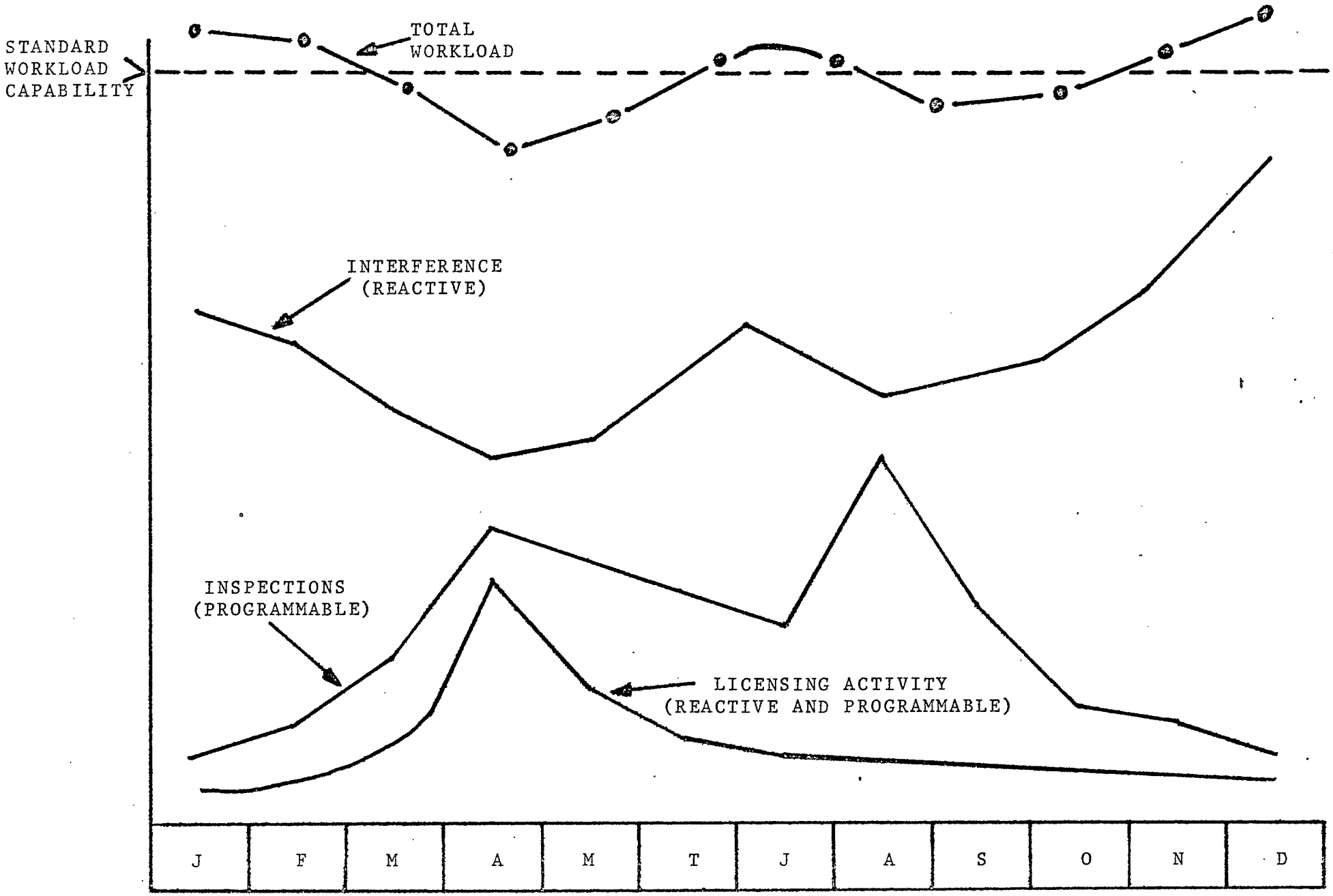
1. Inventory of license holders.

2. Mix of bands - broadcast
   - line of sight
   - microwave
   - high frequency.

3. Mix of services - navigational
   - aeronautical
   etc.

EXHIBIT 7

SEASONAL WORKLOAD PATTERN



Hickling-Johnston

4. Territory density and occupancy congestion.

Volume expectations can be determined for each service type to assist planning for manpower.

Manpower Formulae

Planning factors:

1. M = BSC + VVW

   Manpower equals Basic Service Capability
   plus Volume-Variable Workload.

2. BSC = Installed Capacity Manpower.

3. VVW = Volume Expectations
   times (x)
   Standard Work Units
   factored by (x)
   Local Productivity Factors

   The workload units resulting is then reduced by the workload capability of the BSC

   The resultant workload units is divided by standard per employee type to arrive at manpower requirements.

Evaluation factors:

The local work units can be monitored monthly to evaluate productivity and effectiveness of manpower scheduling.

Summary and Recommendation

There are three interacting elements for manpower decisions:

1. Caseload versus surveillance strategy.

2. Installed capacity levels.

3. Regional workload factors.

Manpower decisions -- key variable for operations management. A structured approach leads to:

1. Statements of objectives.

2. A basis for organization.

3. A foundation for managing.

4. A planning process.

5. A basis for unit costs.

Recommendation: *A pilot project on manpower planning and unit costing be initiated in headquarters and one region to develop:*

- *manning profiles;*
- *activity level factors;*
- *Branch strategy clarification;*
- *standard workload units;*
- *regional workload factors;*
- *manpower plans;*
- *operations plans.*