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Spectrum Management

Consultation on Issues Related to Spectrum Auctioning

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Executive Summary

In June 1996 the Government's budget legislation amended the *Radiocommunication Act* to give the Minister of Industry explicit authority to use auctions as a method of spectrum assignment. The Minister may now choose to use auctions as a licensing mechanism in those instances where the various policy objectives of the Government can be met through the combination of competitive bidding and any of the other numerous instruments available, such as standards, conditions of licence, or auction rules. The only spectrum auction which has been announced to date is the second round of licensing for Local Multipoint Communications Systems (LMCS) spectrum and hence it is this process which may be the Department's first pilot auction; however, this does not preclude the possibility that another licensing opportunity could become the first pilot auction if the Minister finds it appropriate to do so.

In this document, a number of fundamental issues related to spectrum auctions are discussed. In some cases a number of options or proposals have been laid out. The Department seeks comments and advice on all issues discussed in this paper and looks forward to receiving the input of all interested parties.

Spectrum auctioning offers the possibility of realizing significant gains for Canadian businesses, consumers, and taxpayers alike. Through consultation processes such as this one, the Department is confident that spectrum auctions can be introduced in a manner that ensures Canadians derive the maximum possible benefit from their spectrum resource.

Finally, the Department would like to acknowledge the contribution to its auction development endeavours of Market Design Inc. and Charles River Associates, expert auction consultants who have provided valuable insight and advice.

1. Background

1.1 Spectrum Auctions - A Public Policy Perspective

Although it is only recently that auctions have gained prominence as a means of awarding access to spectrum - largely due to the high visibility of the auctions conducted by the FCC (Federal Communications Commission) in the United States - the advocacy of auctions as sound public policy can be traced at least as far back as the late 1950s¹.

In Canada, spectrum auctions appear to have been broached for the first time in 1970, as part of the sweeping series of Telecommission consultations and studies that were initiated by the then newly formed Department of Communications. Although spectrum scarcity was not as much of a problem at that time, one Telecommission study² explored in some depth various alternative approaches to dealing with its expected onset. This study postulated, for the first time in Canada, a conclusion that has only recently been incorporated in spectrum policy and regulation: that market mechanisms are a valid means of dealing with excess demand for spectrum.

By the late 1980s spectrum scarcity had become evident in certain bands in Canada's major urban centres. The Department of Communications undertook a series of internal studies to assess the ongoing efficiency and effectiveness of its spectrum management program. One such study focussed on the economic nature of the spectrum and, similar to the Telecommission study, observed that while competition alone could not be relied upon fully, due to "market failures", there existed potential "approaches such as auctions, user fees and shadow pricing" that were "promising means by which to incorporate economic factors into the administrative process."³ Noting that the spectrum management environment was undergoing significant changes and the growing importance of the radio frequency spectrum as an important social and economic resource, the study concluded that, "In view of the fact that deficiencies associated with current management practices are expected to intensify as demand for the resource increases, keeping the current system does not appear to be rational."⁴

¹ COASE, R.H. (1959), The Federal Communications Commission, *The Journal of Law and Economics*, vol. II, 10.

² ELLIOT, LIEFIELD, and SPENCE, *Spectrum Management: An Integrated Model of Management Alternatives and their Economic Implications*, Department of Communications Telecommission Study 2(c), 1970.

³ DEPARTMENT OF COMMUNICATIONS, Program Evaluation Division, (1989), *Radio Frequency Spectrum Management Program Evaluation, Economic Nature of the Spectrum: A Review of the Literature, Background Study*, p. 27.

⁴ *Ibid*, p. ii.

In 1990, the Department of Communications undertook a reassessment of spectrum policy in order to respond to the changes taking place. Consultations were initiated towards the formulation of a *Spectrum Policy Framework for the Twenty-First Century*.⁵ This consultation invited interested parties to provide their views and comments on a number of issues and principles “for the judicious utilization of spectrum resources”. In this consultation the views of the industry were again sought with respect to market-based approaches. While the responses indicated opposition to auction approaches because of a perceived need to “consider the best radio application in terms of public interest elements and technical merits in any licensing decision” the Department observed that “the most suitable strategy proposed was to enhance the present competitive licensing process and allow future flexibility to adopt other procedures as circumstances require.”⁶ The Department adopted the following policy guideline:⁷

Policy Guideline 11 - Market-Based Approaches

For competitive licensing, where the available spectrum is inadequate to satisfy all demands or where it is necessary to limit the number of new entrants, the Department will continue to refine its current approach - the administrative comparative process, which is used to select licensees from a number of qualified applicants.

If other market-based approaches are deemed to be in the public interest and applicable to specific services or frequency bands, they will be implemented only after full public consultation.

As part of the then recently formed Industry Canada, the continued refinement of the administrative comparative process was undertaken in 1994 in a public review of that process.⁸ Ten issues were targeted in the review in an attempt to discern to what extent the comparative process could be enhanced to account for the full range of social, cultural and economic considerations associated with the award of highly valued radio spectrum.⁹

⁵ DEPARTMENT OF COMMUNICATIONS, Canada Gazette, (September 8, 1990), Notice No. DGTP-03-90, *Towards a Spectrum Policy Framework for the Twenty-First Century*, p. 3232.

⁶ DEPARTMENT OF COMMUNICATIONS, (September 1992), *A Spectrum Policy Framework for Canada*, p. 18.

⁷ *Ibid*, p. 18.

⁸ INDUSTRY CANADA, Canada Gazette, (April 30, 1994), Notice No. SMRR-001-94, *Public Review of the Comparative Selection and Licensing Process*.

⁹ The ten issues were: Responsiveness, Openness, Encouragement of Innovation, Cost, Economic Allocation, Accommodation, Encouragement of System Implementation, Spectrum Assignment, Use and Spectrum Revenues.

While auctions were given no particular profile in the Gazette Notice that initiated the review, almost all of the twenty-two respondents provided comments on the advisability of spectrum auctions.¹⁰ In fact, spectrum auctions accounted for more commentary than the ten issues identified for review. Notwithstanding the negative views on auctioning of many of the industry respondents, the Department considered that a serious examination of spectrum auctioning was in order given its previous studies, the considerable accumulated literature on the public policy advantages of auctions, and their adoption by diverse administrations around the world.

In the course of the review the Department found that those favouring the comparative selection process differed in many important respects as to how it might be improved. This was particularly true with respect to the openness of the process. Suggested measures to achieve greater openness (such as tribunals, divulgence of submissions, opportunities for challenge, etc.) to a large extent were in conflict with the need for expeditious processing and the protection of confidential commercial arrangements and business plans. Measures to realize other improvements generally involved increased requirement for voluminous submissions and greater information processing and intervention by the Department at a time when Government fiscal restraint, increased reliance on market forces, and a need for minimal, flexible and timely regulation were stated Government objectives (and nowhere more so than in telecommunications).

In its review findings, the Department concluded that it would be in the public interest to establish a new alternative to the traditional comparative selection process that would feature competitive bidding where reliance on market forces was appropriate.¹¹

Having thus determined that having an ability to conduct spectrum auctions would be in the public interest, the Government announced in its 1996 Budget Plan its intention to take steps “to permit auctioning of the radio spectrum, where appropriate, in the future.”¹² Subsequently, the Government’s budget legislation amended the *Radiocommunication Act* to give the Minister of Industry explicit authority to use a system of competitive bidding to select the persons to whom radio authorizations would be issued.¹³

During the course of the review, and subsequent to it, the Department has had occasion to undertake several licensing processes in which mutual exclusivity in

¹⁰ This can be explained in part by the concurrent highly visible decision by the US Congress to direct the FCC to implement spectrum auctions in certain circumstances including Personal Communications Services (PCS) licensing in the 2 GHz range.

¹¹ INDUSTRY CANADA, (February 1996), *Review of the Comparative Selection and Radio Licensing Process: Findings*.

¹² MINISTER OF FINANCE, (March 1996), *The Budget Plan*, C. 5, p. 77.

¹³ MINISTER OF FINANCE (1996), Bill C-31 *Budget Implementation Act*, 1996.

demand was anticipated and/or manifested.¹⁴ Although these were opportunities in which auctions could have been implemented, the Department chose to continue to use traditional approaches largely because of its commitment to full public consultation prior to implementation of the first pilot auction.

1.2 Disadvantages of Management by Regulation and Administrative Fiat

Spectrum management in Canada is generally regarded as having served the public interest and the industry well and is highly regarded internationally. Nonetheless, the Department has had to consider to what extent the criticisms of traditional spectrum management practice in general may equally apply to Canadian practice, and to what extent these practices should be modified. These criticisms are largely based on observations that maximum net social benefit is not being attained from the spectrum resource and that allocation and assignment techniques do not lead to the most efficient use of the spectrum. The most important concerns are listed below.¹⁵

1.2.1 Distorted Demand

When resources are made available at less than their associated opportunity costs - equal to the foregone benefits of putting resources to their best alternative use - it is generally observed that over-utilization results. While the effective supply of spectrum is increasing due to technological advances that extend the upper limit of usable spectrum and to greater technical efficiencies, it is outpaced by the increasing demands of those seeking to serve the ever-growing needs of the information or knowledge-based society. An inability to effectively address this demand stifles new services and the realization of efficiencies in economic activity dependent upon the enabling effect of information and communication technologies. This in turn hinders competitiveness, job creation and economic growth. Further, those having access to spectrum may lack the incentives to use it efficiently and substitutes for spectrum, (including technologies that would economize on spectrum use), may not be adequately considered.

¹⁴ These include: Narrowband PCS, PCS in the 2 GHz Range, LMCS, DBS and 23 & 38 GHz.

¹⁵ This discussion borrows heavily from reference 3.

1.2.2 Rigidities

The manner in which spectrum allocations, designations and assignments are made is such that as bands fill and/or demand shifts, the previous assignments made to incumbents make changes difficult. Pressures exerted by users, coupled with a general reluctance on the part of spectrum managers to impose unforeseen costs on their clients, act to retain the status quo. Although well-intentioned, rigidity is the result. Less efficient uses are not replaced and spectrum newcomers are assigned to areas of the spectrum that are more costly to exploit.

1.2.3 Opportunity Costs Not Considered

The opportunity cost of using any resource - like spectrum - in one activity is the value foregone by not using it in the best alternative activity. As a consequence of the absence of market-determined valuations of spectrum, the opportunity costs associated with its various uses remain largely suppressed and unknown and thus are not adequately considered in allocation and assignment decisions. In the absence of market signals, spectrum managers have no effective means of quantifying either benefits or costs and thus are unlikely to achieve optimum allocations and assignments. Where less than optimal decisions are made the opportunity costs of foregone benefits are undeniably but unwittingly borne by society.

1.2.4 Government Administration

Central planning and government management of spectrum is subject to all of the problems generally inherent in public administration which are obvious but not often mentioned. Management through administration and regulation consumes human and financial resources, the costs of which must be borne by spectrum users and/or the public. Government institutions tend to suffer from inefficiencies that result from imposed constraints and a lack of incentive to innovate or adapt behaviour. Administrative decisions are demanding of information and take time, both of which impose burdens on spectrum users who seek to be increasingly agile in order to be competitive and to capitalize on opportunities that may depart from the norm recognized and entrenched in standards, regulations and procedures.

1.2.5 Economic Rent Not Derived

If maximum net social benefit is not generated from the spectrum resource because opportunity costs are inadequately accounted for, then the problem is compounded by the failure to capture the economic value of the resource for the public. In relation to natural resources held in the public domain, society expects compensation from resource users in exchange for the privilege of using them. Oil, minerals, and timber are all examples of public property from

which society expects to share in the economic rent. In no case are these natural resources treated as a free good. Similarly with spectrum, it can be argued that the public is entitled to payment for usage rights granted by government.

1.3 Spectrum Auctions as an Instrument of Public Policy

From the foregoing discussion, one can recognize that the use of spectrum auctions in appropriate circumstances may constitute one significant means by which improvements can be realized.

By identifying those who most highly value spectrum, auctions present an effective means to achieve an efficient allocation of the resource and maximum net social benefit. The market value of spectrum is established through auctioning, thus avoiding the distortions that result from suppressing this value. Auction prices can hence serve as powerful market signals towards the need for improved allocations among services.

Auctions are also an open, objective, and administratively efficient method of selecting licensees and, with proper design, can be conducted quickly. There is no requirement to prepare burdensome and voluminous submissions in an auction. As well, the risks associated with the disclosure of information considered commercially sensitive are avoided. Auctions substitute real world investors and consumers for public servants in the determination of who has the better business plan, the most innovative ideas, the most highly beneficial services, the right technology and the best management team.

Auctions capture appropriate economic rents for the public for the use of its spectrum resources. Furthermore, the required payments established in an auction provide a built-in incentive to put spectrum to productive use in a timely manner and relieve the burden to police spectrum hoarding and speculation.

Finally, auctions are compatible with a wide range of policy instruments that may be required to achieve various social objectives.

1.4 When Would Auctions be Used?

At the time of the review of the Comparative Selection and Radio Licensing Process the Department noted the concern expressed by some parties that any revised selection process should not apply to certain users of the radio frequency spectrum. In adding auctions as a means by which licensees may be selected, the Department does not intend to broaden the scope of application beyond that employed in the past. The Department does not foresee any application of auctions in circumstances involving priority users. The Department continues to be of the view, expressed in the 1992 Spectrum Policy Framework, that:

"Radiocommunication systems vital to sovereignty and national security, national defence, public security, safety and emergency will be granted high priority and

support in the access and use of the radio spectrum. Also, essential government operations, and other agencies providing critical services to the general public, will have high priority in use of the spectrum."

Some interest has been expressed in the extent to which the Department might implement auctions for broadcast services. It should be noted that broadcast licences are issued by the Canadian Radio-television Telecommunications Commission (CRTC) under the *Broadcasting Act*. Where a licence issued under the *Broadcasting Act* entitles the licensee to operate a radio apparatus, the applicant must obtain a broadcast certificate (or assurance that such a certificate will be issued) from the Minister of Industry. Broadcast certificates are issued by the Minister on a non-exclusive basis and as such are not amenable to auction.

As has already been noted, the introduction of auctions does not in any way alter the Minister of Industry's responsibilities under the *Radiocommunication Act*, the *Telecommunications Act* or the *Department of Industry Act*. The exercise of the Minister's licensing authority under the *Radiocommunication Act* will continue to take into account Canada's social, cultural, and economic objectives in such a manner as to ensure that Canadians derive maximum benefit from their radio frequency spectrum resource. The *Radiocommunication Act* confers upon the Minister of Industry considerable authority to ensure that non-market policy objectives can be advanced through the use of such instruments as frequency allocations and bandplans; utilization and implementation policies; technical specifications, standards and approvals; terms and conditions of licence; and auction rules and procedures. Where these policy instruments adequately address the non-market policy considerations associated with the spectrum to be authorized, the Minister may choose to rely on the operation of market forces in an auction process for the selection of licensees.

1.5 The Implementation Challenge

The potential of spectrum auctions to achieve efficient outcomes, to be fair, and to contribute to improved spectrum management to the benefit of all Canadians is highly dependent on appropriate use and proper design. Early auction implementations by some administrations had unfortunate, if not embarrassing, results. These same administrations, however, have gone on to learn from their mistakes and to profit from the experiences and successes of others and today spectrum auctions and other economic techniques have been adopted by a large number of economically, demographically and politically diverse countries.

The Department continues to study the issues associated with auctions and to date has only announced one planned auction that will not occur until 1998.¹⁶ In the interim, the Department will share the results of its ongoing work and seek the views of

¹⁶ The Department has announced its intent to auction at least 1 GHz of spectrum in the 25.35 - 28.35 GHz range in a second round of licensing for LMCS.

interested parties through public consultation prior to implementation of its first pilot auction.

The Department firmly believes that the implementation of spectrum auctions will bring benefits to consumers and service providers alike and it encourages all interested parties to familiarize themselves with both the theory and practice of auctions so as to meaningfully participate in this and other consultations that will contribute to their success.

2. The Auction Process

2.1 Auctions in the Broader Licensing Context

The overall process leading up to and including an auction has two crucial requirements: (1) all policy matters and auction rules must be clearly and precisely specified prior to the auction so that bidders know exactly what they are bidding for; and, (2) public consultation prior to any auction is critical to ensure that optimal decisions are made with respect to these policy matters and auction rules. Bearing these points in mind, the Department is proposing a process proceeding as set out below.

2.2 Public Consultation Phase

The consultation process would commence with the publication of a consultation document on the particular spectrum in question and an associated Gazette Notice announcing the document's publication and availability. The consultation document will discuss, present options and/or proposals for, and seek comments on all policy issues such as: eligibility requirements; licence definition parameters; terms and conditions of licence; financial considerations such as pre-auction deposits, reserve prices, and bid payment schedules; auction formats, rules, and procedures; and any other measures that may be required to ensure that any of the Government's policy objectives that might not be adequately met by market forces alone are in fact properly addressed.

As well, the deadline for receipt of comments and associated procedural details (where to send comments, for example) will be specified in the consultation document and/or the associated Gazette Notice.

It is also proposed that a second, perhaps shorter, consultation phase in which interested parties could respond to the first set of comments received might be beneficial.

2.3 Release of Policy and Rules and Call for Applications

After the deadline for receipt of public comments has passed, all comments received will be reviewed and the Minister will make decisions regarding all policy matters and

auction rules. At this point the Department will publish a document (and an associated Gazette Notice) describing these decisions and requesting interested parties to apply, by a specified deadline, to be qualified as eligible to participate in the auction.¹⁷

Beyond those eligibility requirements based in legislation or regulation, such as foreign ownership restrictions, the Department would generally seek both to minimize the number of requirements that any applicant must meet to be able to participate in the auction and to make those requirements clear and precise. For the most part these requirements would consist only of those necessary to ensure the integrity of the auction process. This should also serve to minimize the volume of material that applicants must submit.

Application materials to be submitted to the Department would generally consist of whatever documentation is required to show that the applicant conforms with the stated eligibility requirements (or alternatively, attestations of conformity might be considered sufficient for some or all items), an indication of the applicant's acceptance of the specified licence terms and conditions and auction rules - including measures designed to preclude collusion among bidders, and a bid deposit (preferably an irrevocable letter of credit, the amount of which would be related to the licences upon which the applicant wishes to be able to bid in the auction¹⁸).

2.4 Notifications of Interest

The Department has found in the past that the publication of a simple list of interested parties early in the licensing process has been helpful to some smaller industry players who, for financial reasons, might wish to investigate the formation of a lawful strategic alliance with others. To facilitate this, a date would be specified in the *Policy and Invitation for Applications* document by which parties could submit, if they so choose, a "Notification of Interest." This "Notification of Interest" would contain nothing more than basic identifiers such as the name, address, and phone number of the interested party. All Notifications of Interest received by the specified date would be made public shortly thereafter. No further actions regarding Notifications of Interest would be undertaken by the Department except in respect of the administration or enforcement of applicable law, including the *Competition Act*. The submission of a Notification of Interest would not be a requirement for participation in the auctions.

The Department stresses that the publication of the Notification of Interest does not imply that the Department condones prospective bidders' discussing their bids or bidding strategies with one another. The Department cautions potential bidders that certain types of activities are unlawful under the *Competition Act* and the Department strongly urges potential bidders to seek the advice of legal counsel before contacting

¹⁷ The Department may also use other communications means in addition to Gazette Notices to announce both the pre-auction consultation phase and the auction application phase.

¹⁸ See Section 7.2 of this document.

or entering into any agreements or arrangements with any other potential bidder. In particular, the Department refers potential bidders to sections 45 and 47 of the *Competition Act*. These criminal provisions, which carry severe penalties, prohibit certain types of agreements or arrangements with respect to price-fixing, market-sharing and bid-rigging. The Department may require, as a condition of participation in the auctions and of the awarding or retention of licences, that each bidder make full prior disclosure of any communications, agreements, arrangements or affiliations which they have entered into with any other potential bidder regarding the licence auctions.

2.5 Qualification of Bidders

After the deadline for receipt of applications has passed, the applications submitted will be reviewed and the Minister will make a determination as to whether or not applicants conform to the eligibility requirements to be a qualified bidder. A qualified bidder certificate will then be issued to all successful applicants along with notification of the auction schedule and a bidder's information package outlining in precise detail how the auction would run. Unsuccessful applicants will be notified and will have their deposits refunded.

As discussed in Section 8.4 below, the Department is developing a sophisticated yet highly user-friendly remote access electronic bidding system. Prior to an auction the Department may arrange opportunities, such as training seminars or mock auctions, for bidders to become familiar with the bidding system and software.

2.6 Auction Commencement

The auction would open as per the previously released auction schedule and would proceed to closure as per the previously specified auction rules. More detail on the actual auction process itself is contained in Section 8.5 of this document.

2.7 Auction Close

Once the auction has closed, high bidders will be officially notified and requested to submit any applicable down payments by a specified date as outlined in the original policy/auction rules document. Upon receipt of these down payments, authorizations will be issued. In those cases where the requested down payments are not submitted, the relevant bidder(s) will be deemed to have forfeited their licences and penalties will be imposed as appropriate.¹⁹ Unsuccessful bidders will have their deposits returned, net of any applicable penalties.

3. Licence Definition: Bandwidth and Geography

3.1 Use of Spectrum Licences

As discussed above in Section 2, licences must be clearly and precisely defined before they can be auctioned. As such, the appropriate authorization instrument in an auction context will be the spectrum licence, defined in sub-paragraph 5(1)(a)(i.1) of the *Radiocommunication Act* as an authorization “in respect of the utilization of specified radio frequencies within a defined geographic area”.

It is important to note that the block licensing approach inherent in the use of a spectrum licence (as opposed to apparatus-based radio licences) has recently been proposed and/or implemented for several new services²⁰ with strong support from industry. Respondents in public consultation processes associated with these services generally agreed that:

- ▶ spectrum blocks should be made available to users on a self-managed basis to permit the rapid deployment of communication facilities;
- ▶ the technical and operational constraints on the use of spectrum blocks should be minimal, allowing flexibility to the licensee to meet particular service demands in the most efficient and economic manner; and
- ▶ assignment of the blocks of spectrum should be over a given service area(s) and not subject to site-by-site authorization.

Given this block licensing approach in an auction context, the question then becomes one of how the total bandwidth and geographic area available for licensing should be divided. Depending on the types of services that may be envisaged for any particular spectrum allocation, the answer will vary. The public consultation phase that the

¹⁹ See Section 8.5.11 of this document.

²⁰ In particular, Local Multipoint Communications System (LMCS) and fixed wireless services in the 23 GHz and 38 GHz bands.

Department will hold prior to each auction will provide key input to the process of determining the bandwidth and geographic parameters of licences to be auctioned. Some general observations on factors pertinent to the determination of spectrum licence parameters are presented below, along with a proposal for a conceptual approach to service area definition.

3.2 Spectrum Licence Parameters

The objective in defining the geographic and bandwidth parameters of spectrum licences to be auctioned should be to structure these licences in a manner that will:

- ▶ allow licensees to most effectively and efficiently establish their market areas and provide their services;
- ▶ promote vigorous competition for the benefit of Canadian consumers; and
- ▶ ensure a fair and well-run auction.

The appropriate size of spectrum blocks will largely be a function of the (potentially diverse) types of services that bidders plan to provide and the technical characteristics of the equipment used to provide them.

As for the definition of service areas, one initial principle should be respected: full coverage. The principle of full coverage requires that the entire area available for licensing²¹ be covered by contiguous service areas. If undefined gaps exist between defined service areas, there can be difficulties later when trying to assign licences for areas within those undefined gaps.

Consider the case then, of an allocation of 100 MHz across all of Canada being made available for licensing. In terms of bandwidth, should the 100 MHz be assigned as one licence in each service area, or should it be divided into two 50 MHz blocks, or twenty 5 MHz blocks? In terms of geography, should there be national licences put up for auction? Should there instead be blocks made available on a regional or province-by-province basis, or maybe over a large number of localized service areas?

Smaller and more numerous service areas and/or spectrum blocks permit bidders more flexibility in determining the size of their total spectrum assignment and allow more small players to participate in an auction. However, the complexity of an auction increases when the partition is too fine and the number of licences being bid upon is very large.²² It may in fact be optimal to provide a mix of smaller and larger licences in the same auction. Following the example above, five regional or province-wide

²¹ For newly allocated (or reallocated) spectrum this would presumably be all of Canada.

²² The Department notes the generally successful auctions that have been run elsewhere with quite large numbers of licences (close to 1500 in one FCC auction).

licences of 10 MHz each and ten 5 MHz licences over a large number of localized areas could be auctioned simultaneously.

Another factor to consider is that service areas which coincide with some sort of widely recognized geographic definitions, such as political boundaries or census areas, are desirable in that they are easily understood and identified and also generally have “off the shelf” statistical and demographic data available which would likely be of significant value to prospective service providers.

3.3 A Conceptual Approach to Service Area Definition

The Department proposes that a set of service areas based on Statistics Canada’s 326 Census Divisions be created, with the expectation that these service areas would be used for most, if not all, future spectrum auctions. The Census Divisions provide contiguous coverage of the entire geography of Canada and are linked to extensive Statistics Canada databases.

The suggested approach is similar to the “building block” methodology used by the FCC in the United States, wherein some licensing is done on the basis of Rand McNally’s 493 Basic Trading Areas (BTAs), some licensing is done on the basis of Rand McNally’s 51 Major Trading Areas (MTAs) - each of which is composed of a number of BTAs, some licensing is done on the basis of five regions - each of which is composed of a number of MTAs, and some licensing is done on a national basis - the nation being composed of the five regions.

The smallest service area that would be auctioned would likely be an individual Census Division²³ and the largest would of course be the entire country. Between these two limits, one or more tiers would be created. Census Divisions could be combined into a second tier of larger service areas and these larger areas in turn might be combined into even larger regional areas. For each auction, a decision would be made after public consultation as to which scale(s) of service areas would be appropriate; in some cases it may be optimal to offer a mix of licences over, say, “Tier 1” and “Tier 2” service areas.²⁴

One possible concern with such an approach is that some parties might wish to provide service to only one town or localized area that falls within one of the very large Census Divisions in, say, Northern Ontario. Not wishing to or not being able to provide service to an expansive service area, that party might be unable to effectively participate in an auction in which Census Divisions are the smallest lot up for bidding. The Department believes that there are a number of viable options for such parties to

²³ Alternatively, in areas of high population density such as Southern Ontario, it might be advisable to introduce an even finer degree of definition for the minimum sized area that would be individually auctioned, such as Census Subdivisions.

²⁴ See STATISTICS CANADA, *Census Divisions and Census Subdivisions maps set* (Cat. No. 92-319).

be able to acquire the right to serve the smaller areas they desire. First, as outlined below in Section 6 of this document, the Department proposes that auction winners would be able to come to various sorts of mutually beneficial commercial arrangements with parties who wish to serve small and remote communities that might not be part of the auction winner's planned service coverage. Second, there may be opportunities for a number of parties wishing to serve various individual communities within a Census Division to form a bidding consortium and enter the auction with the hope of winning a licence and then having each consortium member provide service to a portion of the Census Division. Finally, there may be instances where the amount of spectrum available and the number of interested parties is such that the supply of licences in some Census Divisions exceeds the demand; in such cases a party wishing to serve only one portion of a Census Division would be able to acquire a licence for the entire Census Division for only the modest reserve price that would be established prior to the auction and could then serve the particular portions of the Census Division as desired.

If the proposal to use Census Divisions (and/or perhaps Census Subdivisions in some parts of the country) as a building block for a number of tiers of service areas is adopted, the obvious next steps are to determine how many tiers between Census Divisions and national licences there should be and how Census Divisions should be aggregated to form the larger areas that will make up these tiers. The Department is currently doing exploratory work on this issue and looks forward to receiving comments and input via this consultation process.

It is worth reiterating that the first objective is to develop a set of standardized service areas in a number of differently sized tiers. Once developed, public consultation would be held prior to each auction as to which tier(s) should be used for the particular spectrum in question.

3.4 Geographic Border and Out-of-Band Emission Protection Conditions

A final issue that must be addressed with regard to spectrum licences is the specification of geographic border and band-edge conditions. Under the traditional approach of licensing radio apparatus, equipment standards or limits were prescribed in order to minimize the potential for interference to other spectrum users in adjacent spectrum bands and/or geographic areas. Under the new approach of spectrum licensing, spectrum users would be given increased flexibility in the way in which they implement their systems within their licensed spectrum blocks and service areas. There must, however, be a means of protecting other spectrum users from harmful interference. In a spectrum licensing context this means that some type of condition or limit must be set at the band-edge of a user's spectrum block and at the geographic border of a user's service area.

These limits would serve to give practical definition to a user's spectrum "right" and would form the basis upon which decisions would be made by the Department in the event of complaints of harmful interference. Where neighbouring spectrum users can

agree to mutually beneficial deviations from specified border and/or band-edge conditions without causing harmful interference to any third party, they would be free to do so.

As one example of how this issue can be addressed, the American FCC proposes to establish a maximum field strength limit at the boundary of service areas. These field strength limits would precisely define each licensee's rights at their service area boundaries, as well as provide licensees with greater freedom to manage their systems and spectrum, without unnecessary and burdensome coordination.

Similarly, the Australian Spectrum Management Agency (SMA) proposes an interference management framework for spectrum licensees that consists of conditions of licence relating to the operation of transmitters, and of the responsibilities for interference settlements. Some of the elements of the Australian framework include the core conditions that set emission limits outside the service area and outside the band and the determination of unacceptable levels of interference.

The Department notes the approaches of American²⁵ and Australian²⁶ spectrum managers and requests comments on these or any other approaches to answering the question of how baseline border and band-edge conditions should be defined in Canada.

4. Length of Licence Terms

4.1 Necessary Modifications in an Auction Framework

Under Industry Canada's traditional licensing approach, one-year station licences are issued, although for certain services such as cellular telephony or personal communications services (PCS), five-year terms have effectively been granted. Most authorizations, however, have had an implied, although non-guaranteed, longer tenure as it is only in relatively rare cases that licences are not renewed.

In exchange for the market-based payment that auctions will generate, licensees will expect that their licence terms be sufficiently long to ensure that they can make a sufficient return on their investment. This message was clearly articulated in the submissions received during the public consultation period following the Department's release of the document *Review of the Comparative Selection and Radio Licensing*

²⁵ See, for example, the emission limits contained in the rules governing PCS, found in the *US Code of Federal Regulations*, Volume 47, Part 20-39.

²⁶ WHITTAKER, M. J., *Establishing an Interference Management Framework for Spectrum Licensing in Australia*, IEEE Communications Magazine, 1997 (to be published). Also see, for example, *Spectrum For New Telecommunications Services: Invitation to Comment on Proposals to Re-allocate Parts of the 800 MHz Band and Parts of the 1.8 GHz Band*, (1996), Spectrum Management Agency, Government of Australia.

Process: Findings in February 1996. The Department agrees that the move to an auction framework will require changes with respect to licence terms.

4.2 Choice of Licence Term and Renewal Mechanism

There are two main considerations which must be balanced in determining the appropriate term of a licence. Longer terms provide the certainty licensees desire when making investment decisions, but make it more difficult to reallocate spectrum quickly to new uses as wireless technology evolves. Shorter terms, combined with uncertain licence renewal procedures, discourage the licensee from making the large fixed investments needed to exploit the technology to its best advantage, but make reallocation easier.

The optimal licence term depends on balancing these considerations, taking into account their relative importance. Mitigating measures and related policies must also be considered in assessing this balance. For example, the possibility that long licence terms might slow the introduction of new technologies can be mitigated by increasing the licensee's discretion in how to use its spectrum and by making licences transferable. (See discussion on flexible spectrum use and licence transferability in Section 6 of this document.) Similarly, the problem of dampened investment incentives caused by short licence terms with uncertain renewal fees can be mitigated by such simple measures as specifying renewal fees in advance on a basis that does not depend on the licensee's revenues or profits.

This issue has also been addressed by spectrum managers in a number of other countries. Australia has proposed amending legislation to extend the maximum term of a spectrum licence from ten years to fifteen years.²⁷ In New Zealand, legislation currently permits licence terms of up to twenty years, but it is expected that this limit may be increased to a quasi-perpetual term.²⁸ In the United Kingdom, the government has noted the need for greater security of tenure when licences are assigned and licence fees determined through market mechanisms, but has not yet specified any particular number of years as being appropriate.²⁹ The FCC in the United States has auctioned licences with ten year terms, but these licences also feature a "significant expectancy of renewal" which means that the licence retains a quasi-perpetual nature provided that the licensee does not breach any licence conditions or in some other way deal inappropriately with the FCC.

²⁷ SPECTRUM MANAGEMENT AGENCY (AUSTRALIA), (1996), *Spectrum for New Telecommunications Services: Invitation to Comment on Proposals to Re-allocate Parts of the 800 MHz Band and parts of the 1.8 GHz Band*.

²⁸ *Radio Spectrum Management: The New Zealand Approach*, speech by Wayne Wedderspoon, Manager, National Radio Spectrum Policy, Communications Division, Ministry of Commerce, Government of New Zealand, October 1995.

²⁹ RADIOCOMMUNICATIONS AGENCY (UK), (1996), *Spectrum Management: into the 21st Century* (White Paper).

Noting the views expressed in public consultations and the decisions taken by other administrations, and given the significant up-front fixed investments required by most wireless services, licence terms in the range of ten to twenty years would appear to be appropriate. Comments and supporting rationale are sought on this proposed range and on the specific term (ten years? fifteen years? twenty years?) that would be appropriate.

Furthermore, to ensure that licensees have a continuing interest in maintaining and improving their technical infrastructure, it may be advisable that licensees who have not breached any of the terms or conditions of their licences would have their licences renewed for successive terms unless a fundamental change in spectrum allocation is required. Under such a scenario, incumbent licensees would be notified of their renewal status no later than, say, three years before the end of their current licence term.

Alternatively, licences could be re-auctioned prior (e.g. three years) to the end of each licence term. While this would create more uncertainty for incumbent licensees than the renewal approach described above, re-auctioning would still provide incumbents - who would presumably have a significant advantage in the “re-auction” due to their established infrastructure and client base - with advance knowledge of whether or not they would be receiving a successive licence term. One downside to this approach is the potential “hold-up” problem it creates: an initial licensee could be targeted by an investor who hopes to win the spectrum licence and then acquire the incumbent licensee’s equipment at a “fire-sale” price. Another downside to this approach is the potential it provides for parties to bid solely with the purpose of breaking up an incumbent’s licence aggregation. For example, an economically efficient assignment of spectrum might see one licensee acquire a block of spectrum in each market area in, say, Atlantic Canada. A competitor may seek to damage this licensee by bidding very highly in a “re-auction” for just one key licence, say Halifax, and thus significantly disrupting the business operations of the incumbent licensee.

Comment is sought on the issue of licence renewal versus re-auctioning.

5. Service Roll-Out Requirements

To prevent a licensee from warehousing spectrum for the purpose of pre-empting the entry of other service providers, many spectrum authorities in other countries impose service roll-out requirements as a condition of licence. Service roll-out requirements generally stipulate that a licensee provide service to a certain percentage of the population in its licence area within a specified time frame. Roll-out requirements may not be necessary if the market for the services authorized by a licence is relatively competitive. In this situation, it is in the economic interest of the licensee to provide service earnestly or to transfer the licence to another party. Therefore, roll-out requirements might be unnecessary and may only impose burdensome constraints on licensees and an additional administrative workload on the Department.

Industry Canada solicits comment as to under what circumstances, if any, it should impose roll-out requirements as a condition of licence. Furthermore, in those cases where service roll-out requirements may be deemed necessary, Industry Canada solicits comments on the type of conditions roll-out requirements should entail.

6. Flexibility of Use, Transferability, and Divisibility

6.1 Flexible Spectrum Use

As noted in Section 1, a key benefit to using auctions is that they allow market forces to determine who will gain access to spectrum as well as the uses to which spectrum will be put. To ensure that licensees can quickly and efficiently adapt their service offerings to changing consumer demands, the Department would propose to provide licensees with the maximum possible flexibility in determining the services they will provide.

It should be noted again, however, that certain licence conditions may be required to ensure effective competition or to further social policy objectives. All licence conditions will be clearly specified prior to the auction and after public consultation has taken place.

6.2 Transferability

One policy measure designed to facilitate the adaptation of spectrum use to changing market-place conditions is to make licences transferable. Even if an auction works perfectly in generating an efficient initial assignment of licences, circumstances can change over time so that firms and consumers would benefit from provisions that allow licences to migrate to other users with new and more innovative service offerings or more efficient technologies. By allowing licences to be bought and sold after an auction, a firm with a more valuable new use of the spectrum can negotiate a transfer with the incumbent licensee that is beneficial not only to both parties, but also to consumers.

A number of other administrations, such as Australia, New Zealand, the United Kingdom, and the United States, have either proposed or implemented policies designed to facilitate the workings of a secondary market in spectrum licences.

The Department believes there is merit to making licences transferable with a minimum of regulatory oversight and administrative work and notes a significant level of support for the general concept of licence transferability expressed during previous public consultations. The Department is of the opinion, though, that an absolutely unfettered secondary market in spectrum licences might not be consistent with sound spectrum management.

The Department suggests that the following elements would be necessary in a transferable spectrum licence regime:

- ▶ All eligibility criteria, licence conditions, and payment obligations that apply to a licence would continue to apply should the licence be transferred.
- ▶ Should an auction winner transfer its licence to another party, say, nine years into a fifteen year licence term, the second party would only receive a licence term of six years, but would be eligible for the same licence renewal provisions as the original licensee.
- ▶ All proposed licence transfers must comply with any spectrum caps or other measures intended to preclude anti-competitive behaviour that may be in place.³⁰
- ▶ Written notification would be required of all proposed licence transfers. The Department could also request attestations or other documentation to ensure that the points above have been satisfactorily addressed.
- ▶ The Department would maintain a publicly accessible database listing all spectrum licences and the respective licensee and would update the database upon approval of a licence transfer.

6.3 Divisibility

The Department proposes that licensees be permitted to transfer their licences not only in whole, but also in part; that is to say, licences should be divisible in both the bandwidth and geographic dimensions. This policy will serve many functions. First, it will encourage competition by removing potential entry barriers to certain competitors such as small businesses that may not have been successful in a past auction; second, it will encourage more efficient spectrum use by permitting the deployment of a broader mix of service offerings; and third, it will speed service to unserved or underserved areas.

³⁰ It should be noted that any licence transfer would also be subject to the provisions of the *Competition Act*.

In addition to the necessary elements for a transferable licence regime listed in the preceding section, there are several other issues that must be addressed with respect to licence divisibility.

6.3.1 Limits to Divisibility

When spectrum licences are divisible, should a minimum allowable geographic area or a minimum spectrum block size be defined? The specification of some limit below which a licence cannot be sub-divided can be beneficial in terms of interference management and administration and record keeping. On the other hand, the flexibility of spectrum users is constrained when limits are imposed. The Department does not have a suggested or preferred approach at this time, but notes some options that have been put forth by the governments of Australia³¹ and the United States³² below.

6.3.2 Divisibility in the Bandwidth Dimension

In Australia, a minimum spectrum block size is specified for each of several different spectrum bands. Licensees are not permitted to disaggregate and transfer their spectrum in sizes smaller than these specified limits. In the 500 MHz band, for example, spectrum blocks cannot be smaller than 12.5 kHz.

In the United States it has been proposed that licensees be permitted to divide their spectrum blocks into any number of smaller spectrum blocks of any size. However, the same out-of-band emission protection conditions specified for the original licence would apply to the block sub-divisions unless an alternate arrangement is reached among affected parties.

6.3.3 Divisibility in the Geographic Dimension

In the Australian model, the minimum level to which a licence can be sub-divided and transferred is the Spectrum Trading Unit (STU). The entire geography of Australia is covered by a grid pattern of STUs, defined in terms of so many degrees, minutes, or seconds of latitude and longitude.

In the United States, it has been proposed that licensees could sub-divide their licences into any geographic partition they desire, but would have to provide detailed definitions, in terms of latitude and longitude, of the partitioned areas to the FCC.

³¹ SPECTRUM MANAGEMENT AGENCY (AUSTRALIA), (1996), *Radiocommunications (Trading Rules for Spectrum Licences) Determination 1996*.

³² FEDERAL COMMUNICATIONS COMMISSION (USA), (1996), *Report and Order and Further Notice of Proposed Rulemaking: In the Matter of Geographic Partitioning and Spectrum Disaggregation by Commercial Mobile Radio Service Licensees*.

6.3.4 Divisibility and Licence Payments

As discussed in Section 7.1 below, the Department proposes that auction winners would not be required to submit their winning bids in the form of lump-sum payments; rather, the bid payment would be spread out over the term of the licence. The concept of licence divisibility raises the issue of how the future licence payments should be divided between the transacting parties. In keeping with the principle of minimum regulatory requirements, it might at first seem best if this matter be left entirely to the parties negotiating a division agreement. However, this creates a problem of opportunism where two parties can carve out a small portion of a licence region, and ascribe the vast proportion of the payment to the party serving this region. If this party later defaults, the other party will basically have the right to the original licence area for a nominal payment. To avoid this possibility, there have to be some guidelines and conditions governing the distribution of the annual payment between parties negotiating the division of a licence.

Industry Canada welcomes comments on the problem of apportioning the annual licence payment between parties when a licence is either geographically partitioned or its bandwidth is divided. In order to foster discussion, Industry Canada mentions the following proposals which are being considered by other spectrum management administrations.

In the case where a spectrum licence is geographically partitioned, the annual payment can be apportioned to each party based upon the ratio of the population of the partitioned area to the population of the entire original licensed area. In accordance with this policy, a default on an obligation will only affect that portion of the service area held by the defaulting party. This means that if the partitioner is unable or unwilling to make its annual payment, its spectrum rights are suspended but the partitionee's licence is not affected.

In the case where a spectrum block is divided in the bandwidth dimension, the parties entering into the commercial agreement can pay annual payments based upon the ratio of the amount of spectrum disaggregated to the amount of spectrum licensed. For example, if a 30 MHz spectrum block is disaggregated into two 15 MHz spectrum blocks, each party receiving one 15 MHz block would pay one-half of the annual payment.

6.3.5 Service Roll-Out Requirements

In the event that a licence is geographically partitioned or disaggregated, Industry Canada wishes to ensure that any service roll-out requirements that may be specified in the terms and conditions of licence will continue to be met. In addition to this objective, Industry Canada also wishes to give the licensee maximum flexibility in organizing a commercial agreement with another party.

In keeping with these twin objectives, Industry Canada puts forward the following suggestions. Comments are invited on these specific ideas and any suggestions of other possibilities are welcomed.

When a spectrum block is divided geographically, one of two possible options can be followed. In the first option, the party acquiring spectrum through the division of an existing licence (divisee) will be required to satisfy the same service roll-out requirements as the initial licensee (divisor) in its licence area. The second option is applicable in the case that an initial licensee who, at the time of partitioning, has met its service roll-out requirements and certifies that it will continue to do so to the end of the licence term. In this instance, minimal or no service roll-out requirements will be imposed on the divisee.

When a spectrum block is divided along the bandwidth dimension, the initial licensee may elect to retain responsibility for meeting the service roll-out requirement or it may negotiate a transfer of this obligation to the divisee. Alternatively, both parties in the commercial arrangement may agree to share the responsibilities. In the instance where both parties share a responsibility in meeting the service roll-out requirements and one or both parties fail to meet their obligations, both parties' licences are subject to forfeiture.

In the case where a commercial arrangement between two parties involves both geographic partitioning and a division of bandwidth, Industry Canada proposes that the rules regarding geographic partitioning predominate.

7. Financial Aspects of Auctions

7.1 Bid Payment

An issue which was frequently raised in previous public consultations was the potentially difficult financial burden that lump-sum bid payments could place on some winning bidders just at the time they are beginning to invest in infrastructure. To overcome this, it was suggested that winning bidders be permitted to pay the amount of their winning bid in instalments over a long term horizon.

A potentially serious drawback with an instalment payment system is that a smaller up-front payment encourages speculators to enter the bidding process. For example, a firm may not have a viable business plan which requires the use of a spectrum licence at the moment an auction is called; however, it may anticipate that the licence will be worth a substantial amount to other firms in the not too distant future. In this case, a firm may enter the auction in the hope of securing a licence inexpensively and then capitalizing on reselling it at a later date. The risk to a speculator may not be that large if the licence value turns out to be less than anticipated, since the speculator can simply stop making the annual payments and forfeit the licence. The participation of speculators may prevent an efficient assignment of licences since they may win licences

which would otherwise go to firms who want to use the licences immediately to start a wireless service.

Setting a payment schedule for the winning bidders to follow thus involves a tradeoff. On one hand a large up-front payment may place a financial burden on some firms genuinely interested in the spectrum while a payment which is too small may encourage participation by speculators. In an attempt to balance this tradeoff, the Department proposes that winning bidders pay 25 per cent of the amount of their bids within 30 days of the auction closing date. The remaining 75 per cent would be paid in future instalments.

A number of options are available as to how the payment schedule for the remaining 75 per cent could be structured. Bidders will factor any payment schedule into their bidding strategies: the proviso being, of course, that the schedule be made absolutely clear prior to the auction. Given this discounting process that bidders will undertake, the choice of payment schedule should be essentially revenue-neutral for the government in present value terms. These options include the following:

- ▶ A terminal payment date, say the end of year five or year ten, could be specified. The remaining 75 per cent of the bid amount would be payable in equal annual instalments (i.e. 15 per cent of the original bid amount per year if five years were chosen or 7.5 per cent of the original bid amount per year if ten years were chosen). After this terminal payment date had been reached, no further payments would be required in either the initial or subsequent licence terms. The terminal payment date could correspond to the end of the initial licence term, but would not necessarily have to. This option has the advantage of relieving both the licensee and the government of the administrative burden of collecting payments after the terminal payment date.
- ▶ Instead of specifying a terminal date for bid payment, the remaining 75 per cent could be made payable in equal annual instalments over the initial term of the licence (i.e. 5 per cent per year for a fifteen year licence), with that same annual amount (e.g. the 5 per cent) being required in each year of a successive licence term if the licence is renewed.
- ▶ Should the policy be to re-auction licences after each term, the payment for the subsequent term would of course be established in the “re-auction”.

Most, if not all, of the other administrations around the world who have implemented spectrum auctioning have chosen either to require auction payments in an up-front lump-sum amount, or have specified terminal dates for auction payments where

up-front lump-sum payments have not been required. Australia appears to be the only administration which has chosen to re-auction licences after each licence term.³³

It is important to note again that licence payments fairly established in an auction process would not be altered in any way after the auction, nor would licensees be subject to any other form of licence fees for the spectrum in question.

7.2 Pre-Auction Deposits

Based on the academic literature on auctioning and the experiences of other administrations, the Department feels that the integrity of an auction is enhanced by requiring all bidders to submit a pre-auction deposit. The deposit should be large enough to dissuade frivolous bidders from trying to enter the auction process while not so large that sincere bidders are unable to participate; additionally, the deposit should be large enough so that it covers all of a bidder's likely bid withdrawal and forfeiture penalties (for a description and explanation of bid withdrawal and forfeiture penalties, see Sections 8.5.5 and 8.5.11 below). Since the size of these penalties will depend on both the number and value of the licences that a bidder wishes to bid on, a bidder will be asked beforehand to indicate the number of licences it is interested in. A bidder's deposit will generally be based on the population or number of households located within the geographic areas of the licences it is interested in acquiring.

8. Auction Design and Rules

8.1 Auction Design Principles

Auction design is an extremely important matter. A badly designed auction may result in inefficient assignments, delayed deployment of services, and lost resource rents for the Canadian public. When initiating an auction, the rules of the auction must be clearly specified beforehand, and to the greatest extent possible, account for all possibilities which may arise during the course of the bidding. Usually, in the context of the radio spectrum, several licences in many different contiguous areas need to be assigned at the same time. In this instance, the auction design must address two key issues: the winner's curse and licence interdependencies.

8.1.1 The Winner's Curse

The winner's curse refers to the observation that the winning bidder is often the firm that has the most over-optimistic estimate of a licence's value. Winning the bidding, in this sense, conveys the bad news to the winner that everyone else estimated the licence's value to be less. In a sealed-tender auction, bidders

³³ Note that the Australian government has given itself additional flexibility by stating that licences could be renewed instead of re-auctioned where it is in the public interest to do so - see, for example, Volume 1 of the SMA's Applicant Information Package for their 500 MHz auction.

who anticipate the winner's curse bid cautiously. An ascending multiple round auction which is open and in which bidders can gather information about their rivals' value estimates from the bids they make, helps to reduce bidder uncertainty and encourage more confident bidding.

For a multiple round auction to reduce the probability that a bidder overestimates a licence's value, bidders must have time to process information during the auction, so the pace of bidding must not be too fast. A measured pace allows bidders to evaluate bidding information and review strategy. Such pacing can be achieved by using a multiple round auction format, with the results of the previous round announced before the next one begins.

8.1.2 Licence Interdependencies

Spectrum licences are interdependent, that is, firms typically value them as part of a collection. For example, a firm whose business plan calls for establishing a regional or nationwide presence may have to purchase several licences to implement the plan. The licences may then complement each other geographically: the value of a collection of licences to the firm may exceed the sum of the values the firm would pay for the licences individually. Different licences may also substitute for each other: various frequency bands over a given geographic area might be very similar from the bidders' points of view. The auction form must be flexible enough that bidders are able to construct their preferred licence aggregations. The simultaneous multiple round auction form was devised to achieve this flexibility. This auction format has been used successfully by a number of administrations.

8.2 The Simultaneous Multiple Round Auction

In the simultaneous multiple round auction, multiple licences are open for bidding at the same time, and remain open as long as there are acceptable bids placed on any of the licences. Bidding occurs in a sequence of rounds, with the results of each round announced to the bidders before the start of the next round. Unless the number of licences and bidders is small, the auction is best run by computer, with on-line bidding.

The main reason for using a simultaneous multiple round auction is that spectrum licences are interdependent. For many of the licences there is a close substitute: a similar licence that covers the same region and the same amount of spectrum. Licences can also be complementary: a licence may be more valuable if the holder also has the licence for a contiguous region.

Efficiency in a spectrum auction - which means assigning the licences to the firms that value them the most - often is manifested by some bidders winning multiple licences, because licences can be complementary. Typically, the seller has less information than the buyers about how the licences should be aggregated. This is partly because the technology may be new, but also because different bidders may have different,

mutually inconsistent preferred aggregations (for various reasons, such as their other lines of business and their local expertise). The simultaneous multiple round auction was designed to let market processes establish the shape of the licence aggregations.

Both features of the auction form - the *simultaneous* bids and the *multiple round* (ascending) bids - aid efficiency. The multiple round bids let bidders see how highly their rivals value each licence and which aggregations they are seeking. By the time equilibrium is approached, each bidding firm knows whether it is likely to be able to construct its preferred aggregation, and roughly how much it is going to cost. With all licences open for bidding simultaneously, a bidder has flexibility to seek whatever licence aggregation it wishes, as well as to switch to a backup aggregation if its first-choice aggregation becomes too expensive.

As well as aiding licence aggregation, the simultaneous multiple round auction diminishes the possibility that the winning bidder overestimates the value of a licence because it allows bidders to observe and respond to each others' bids. Also, simultaneous multiple round bidding makes it likely that substitute licences will fetch similar prices, because, in practice, bidders will switch across the substitutes if their bid prices differ significantly, bidding up any lower-priced licences.

8.3 Alternative Auction Formats

The standard alternative auction forms include a single round sealed-bid and sequential sales of either the sealed-bid or multiple round bid varieties. Single round sealed-bid and sequential auctions are easy to administer, and work reasonably well for selling certain kinds of items. They do not work well, however, for collections of interdependent spectrum licences.

The single round sealed-bid auction neither encourages efficient aggregation nor ensures that similar items will fetch similar prices. In a single round sealed-bid auction, bidders must bid blind, unable to know how high they must bid to win a particular licence. Only by good luck does a bidding firm win all the licences it needs for its business plan; bad luck can mean either that a firm wins more licences than it needs or that it wins a collection that it cannot use with any plausible business plan. Simultaneous single round auctions of spectrum licences were used by some other administrations with disappointing results.

Another alternative is to conduct a sequential auction - an auction in which the licences are sold one at a time, in sequence. However, this alternative is problematic as well, for three reasons. First, identical items can sell for quite different prices; in practice, items sold later in the sequence most often fetch less than items sold earlier. Second, such auctions encourage strategic bidding that disrupts efficient licence assignments. For example, a firm might engage in predatory bidding, hoping to force its budget-constrained rivals to pay higher prices for the initial licences in the sequence in order to handicap them in later bidding, thereby allowing the firm to acquire the later licences for a lower price. Such strategies may prevent bidders from acquiring

efficient collections of licences. Third, the sequential form still requires guessing that hinders licence aggregation. When the first licences are being sold, a firm must bid without knowing whether it will win the complementary licences offered later. Later, a firm may wish to rebid on a licence already sold if it discovers it needs that licence to complete its set; but in a sequence of auctions it cannot go back.

Sequential auctions and simultaneous sealed-bid auctions pose severe problems for bidders for spectrum licences. Both present the bidders with a large amount of risk and the prospect of regret. In a sequential auction, the bidder must guess about future prices when deciding how high to bid for the early licences in the sequence. Later in the sequence the bidders are likely to discover that they bid either too high or too low for the early licences. In a single round sealed bid auction the bidders must choose their bids for each licence without knowing which other licences they are going to win, and without having any information about the strength of their competitors' interest in the licences. Bidders are more confident when bidding in a simultaneous multiple round price auction.

8.4 Proposed Approach

Industry Canada concludes that each of the traditional auction forms - simultaneous sealed bids, with the price being either the highest or second bid, or sequential bids - has major defects as a way of selling spectrum licences. The simultaneous multiple round auction is not subject to these defects. The simultaneous multiple round auction was novel when the FCC first used it to sell nationwide paging licences in the United States in July 1994. By now it has a track record. At least eight large-scale spectrum auctions have been run in the United States and additional simultaneous multiple round auctions have been run in New Zealand (broadcasting licences in 1995 and 1996) and Mexico (paging licences in 1996). These auctions are widely judged to have been successful in efficiently assigning spectrum.

The Department therefore proposes to use simultaneous multiple round auctions, in most if not all cases, when assigning spectrum licences for which there is mutually exclusive demand. User-friendly bid tracking and auction management software is being developed to implement this type of auction format. This software makes remote access electronic bidding feasible and secure, which will allow bidders the convenience of submitting bids from a wide array of locations. Remote access electronic bidding will mean bidders will not have to incur travel and accommodation costs in order to be in one physical location for the duration of the auction. These cost savings to the bidders can be substantial when an auction takes weeks to close - a situation which can occur if there are many properties to be sold.

8.5 Auction Rules

The rules for the simultaneous multiple round auction call for a related set of licences to be offered for sale at the same time. Bidding is organized into a series of rounds. At the beginning of each round, bidders are provided with information that includes, at

a minimum, the standing high bids on each licence and information about the bidder's own eligibility for bidding. New bids for a licence are required to exceed the standing high bid by at least the minimum bid increment. In each round bidders are offered an opportunity to withdraw bids, subject to a penalty. A minimum pace of bidding in the auction is established by the "activity rule," which penalizes bidders who are inactive by reducing their eligibility. The rounds continue until there are no new bids on any licence.

The Department's proposals regarding some of the details of the auction are described below.

8.5.1 Eligibility

Before the auction begins bidders are asked to indicate how many licences they may want to bid on during the course of the auction. This total number, or in some cases, a measure of the bandwidth and population³⁴ covered by the licences that a bidder wants to bid on, defines a bidder's eligibility. The purpose of this information is to assist in the development of activity rules (discussed in more detail below) which are used to hasten the speed of the auction.

8.5.2 Reserve Prices and Minimum Opening Bids

In accordance with the principle that all spectrum users should make a contribution toward the costs of spectrum management, reserve prices will be established for licences up for auction. As for the level of the reserve price, there are two competing influences. High reserve prices have the disadvantage that there may be no bidder willing to bid at that level, even though there is a bidder who would value winning the licence; that is, high reserve prices can lead to an inefficient outcome. On the other hand, low reserve prices can contribute to long, drawn-out auctions if bidding starts out at levels far below eventual selling prices.

As economic efficiency is Industry Canada's primary auction objective, reserve prices will be set at quite modest levels. However, minimum opening bids set above the reserve price are seen as a useful way to speed up the auction, avoiding the waste of time and resources when prices are perhaps unrealistically low.

³⁴ The FCC, for example, has generally used the "MHz*pop" (the product of the bandwidth and population covered by a licence) as the unit of account by which eligibility is expressed. A suggested alternative is to assign each licence a number of "points", based roughly on the MHz*pop figure, but rounded so as to make licences with similar MHz*pop figures exactly equal in terms of points. This will provide bidders with greater flexibility in switching bidding strategies during an auction, especially in the later rounds.

Opening bids would be established at some level above the reserve price to provide an auction “jump-start”. In each subsequent round, if a licence has not yet received any bids, the minimum bid on the licence will be reduced by a fraction of the initial minimum until the reserve price is reached. In that way, if a licence has received no bids for the first few rounds, the minimum bid would drop to the level of the reserve price. The Department anticipates that there could well be instances where spectrum licences for remote or less populated parts of the country are awarded for the modest reserve price.

With this proposed procedure, a bidder faced with a minimum bid exceeding its value or its estimate of the likely price could exercise a waiver (see discussion on activity rule waivers in Section 8.5.9 below) and wait for the minimum bid to fall. If the bidders are allowed five waivers during the auction, as has been the rule in recent US auctions, then the loss of a waiver is likely to be a sufficient penalty to encourage bidders to enter the bidding early when the minimum bid is still high, thereby helping to bring the auction to a timely close.

8.5.3 Duration of the Rounds

In a simultaneous multiple round auction the bidding progresses in a series of rounds. A round is an interval of time where bidders have the opportunity to assess the standing high bids on each licence and submit bids of their own. The length or duration of a round must be sufficient to allow bidders time to process the requisite information, plan strategies and submit bids. Typically, the duration of a bidding round will not be constant throughout the auction. Early on, when the bidders are still becoming familiar with the auction method and software, bidding rounds should be quite long. It is common to have only one or two rounds in the first day of bidding. As the auction proceeds and bidders become more comfortable with the bidding process, the rounds can be shortened to reduce the overall time of the auction.

8.5.4 Activity Rules

In a simultaneous multiple round auction, bidders may bid cautiously, waiting to see how the others bid while not revealing their own intentions. If all participants bid in this manner, the auction could take inordinately long to close. The activity rules are designed to prevent the bidders from holding back, so the auction proceeds at a reasonable pace. Before the auction, each bidder must specify how many licences he wishes to bid on (see the discussion on eligibility above). A bidder is defined to be active on a particular licence if either he has the standing high bid from the previous round or he submits an acceptable bid (one which is at least one bid increment above the current standing high bid) in this round. There are multiple stages - three has been common, each containing an unspecified number of bidding rounds. In the first stage bidders must be active on licences that add up to a certain percentage of their desired totals (for example, one-third); in the second stage the percentage is increased (perhaps to two-thirds); and in the final stage bidders must be active on one-hundred per cent of their desired totals. If a bidder falls short of the required activity level, the number of licences it is eligible to bid on shrinks proportionately. An auction begins and continues in stage one until bidding activity declines to an unacceptable level (say new bids come in on only five percent of licences). At this point, the auction can move to stage two - and similarly to stage three later in the auction.

8.5.5 Bid Withdrawals

In the event that a bidder makes a bid which he later wants to change, that bidder should be given the opportunity to withdraw it. To encourage meaningful bids, however, a bid withdrawal penalty needs to be imposed. It is natural to have this penalty correspond to the potential loss in revenue caused by the withdrawn bid. If the licence for which the bid has been withdrawn ends up selling for more than the withdrawn bid, no penalty should be charged to the bidder. If the licence ultimately sells for less than the withdrawn bid, the penalty usually has been the difference between the withdrawn bid and the eventual final selling price. The total withdrawal penalties owed by each bidder would be due as a lump-sum amount shortly after the close of the auction.

As a measure to reduce the overall time of the auction, while not compromising the auction's efficiency, the Department proposes to allow bidders to place and/or withdraw bids at the same time during a round, as opposed to having two distinct phases - one for bid submission and one for bid withdrawal - during each round.

8.5.6 Minimum Bid Increments

Minimum bid increments, like activity rules, are a necessary ingredient to help hasten the auction's progress. For a bid to be acceptable it must be larger than the current standing high bid by the minimum bid increment. Increments can be set in percentage terms (say, five percent) or in absolute dollar amounts. Bid increments can and should be changed during the course of an auction. For example, at the beginning of an auction when bidding activity is likely to be high, bid increments can be relatively large. As the pace of the bidding falls below a certain threshold, bid increments can then be reduced. The rules for changing bid increments should be laid out with a fairly high degree of precision prior to the auction; however, to ensure the auction closes in a reasonable amount of time, there should be flexibility to "override" the rules regarding bid increments. Of course, all bidders would be given prior notice well in advance of any proposed changes to the size of the bid increments.

8.5.7 Non-Discretionary Bidding

In somewhat of a departure from simultaneous multiple round auctions that have been run elsewhere, the Department proposes the use of non-discretionary bidding. What this means is that rather than bidders being offered the opportunity to enter any amount that exceeds the standing high bid by at least the required minimum bid increment, bidders would instead have the choice of giving either a "Yes" or "No" response as to whether they wish to bid an amount equal to exactly the standing high bid plus the required minimum bid increment. Such non-discretionary bidding has a number of advantages:

- ▶ It drastically simplifies submission of bids, eliminating the errors that sometimes occur when a bidder must fill dozens (or even hundreds) of boxes with potentially quite large numbers.
- ▶ It allows rounds to be more brief and more frequent, both because the mechanics of entering and checking bids are simpler and because the prices, which never jump in the revised design, are more predictable. This also reduces the need for frequent executive oversight during the bidding, saving costs for the bidders.
- ▶ It completely eliminates opportunities for bidders to send messages through their bid amounts, and also eliminates certain other kinds of strategic bidding.

The Department believes the use of non-discretionary bidding will be of benefit to all parties involved in a spectrum auction.

8.5.8 Tie Bids

In the case where two identical bids are submitted for the same licence, a tie-breaking rule must be used. A natural rule in this instance is to declare the first bid submitted in the round as the high bid in that round. Tie bids would obviously be a much more common occurrence with non-discretionary bidding than with discretionary bidding.

8.5.9 Waivers

Waivers are designed to prevent a bidder from losing eligibility when it does not satisfy the activity requirements in a given bidding stage. The purpose of waivers is to protect bidders against possible mistakes they might make during the course of an auction or to allow a bidder to maintain eligibility in the case of technical or communication problems. Typically, each bidder is given five waivers.

8.5.10 Close of the Auction

A simultaneous multiple round auction closes when a round goes by without any acceptable bids having been submitted on any licences. In exceptional circumstances, and after all participants have been notified in advance, any round can be declared as the final round.

8.5.11 Forfeiture Penalties

After the conclusion of the auction, any bidder who has submitted the high bid on a licence but fails to comply with the specified payment schedule forfeits his right to the licence. Furthermore, the bidder is required to pay a penalty in the amount of the difference between the forfeited bid and the eventual selling price of the licence, provided this is positive. An additional amount may be charged to account for the administrative expenses incurred to reassign the licence. The total forfeiture penalties owed by each bidder would be due as a lump-sum amount shortly after the amount of such penalties has been determined.

9. Incumbent Treatment in an Auction Environment

Given the trend towards using auctions as a mechanism to assign new spectrum licences, there is the question of how incumbent licensees, who may have received their licences through a non-market based mechanism, should be treated under the new regime. The Department wishes to maintain a spirit of fairness among industry players and recognizes that new licensees will pay market value for the spectrum while many spectrum incumbents, who might be direct competitors to auction winners, pay licence fees which do not necessarily reflect market value. The difference between the two systems could mean that

new spectrum users would pay amounts significantly greater than those paid by incumbents. The Department seeks comments on how a “level playing field” can be ensured with respect to this fee issue.

Of course any attempt to bring licence fees closer in line with market-based prices as reflected in auction payments, would have to take account of the differences in the terms and conditions of the licences involved. For example, many incumbents are now required to spend a certain percentage of their gross revenues on research and development. If the incumbent finds conditions such as this restrictive, then the conditions serve to reduce the value of the licence. Furthermore, new licensees may have more rights in terms of how they choose to use the spectrum compared to incumbent licensees. New licensees may also have more flexibility in terms of transferring spectrum to other parties. The added freedom which may be granted to new licensees will certainly raise the value of their spectrum licences relative to older licences which have more restrictions. Any method of readjusting fees charged to incumbents so that they more closely reflect market prices, will have to discount winning bids to the extent that they reflect an increase in property rights and not the value for the spectrum itself. Conversely, incumbents may see advantages in both accepting the “full” increase in their fees and receiving a concomitant increase in the rights bestowed by their licences.

Input is sought on the subject of adjustments to the fees and/or licence terms and conditions of incumbent licensees and on appropriate methodologies for making these adjustments.

10. Instructions for Filing Comments

Comments may be submitted in writing and/or in electronic format (comments submitted in electronic format should be in either WordPerfect or Microsoft Word - please specify the software, the version number, and the operating system used in a covering note). Address your submission to:

CONSULTATION ON AUCTION RELATED ISSUES
Radiocommunications & Broadcasting Regulatory Branch
Industry Canada
300 Slater Street
Room 1489D - Jean Edmonds Tower North
Ottawa, Ontario
K1A 0C8

We can also receive comments electronically via the Internet at:
auctions@ic.gc.ca

Comments sent via e-mail should be prefaced by the statement “Attached are comments in response to the consultation on auction related issues” in the body of the e-mail message.

To ensure your comments are considered, your submission must be received within 90 days after the publication of the notice in the Canada Gazette.

Submissions received in response to this document will be made available for public viewing for a period of one year following the closing date for filing submissions. These submissions may be seen in the libraries of the Department at 365 Laurier Street, 2nd Floor, Ottawa, or the Department's spectrum management offices in Moncton, Montreal, Toronto, Winnipeg, and Vancouver.

This document is available electronically via the Internet at the following address:

<http://strategis.ic.gc.ca/spectrum>