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Author: Richard E. Butler

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Direct broadcasting satellites as a factor in the development of international telecommunication policy

The ITU World Administrative Radio Conference for the planning of the broadcasting-satellite service *



by
Richard E. BUTLER
Deputy Secretary-General of the ITU

1. The mechanism of policy development in the International Telecommunication Union (ITU)

WHenever the need arises to take a major step forward in the commitments one is making with respect to future developments it is always a useful exercise to look back and try and understand a problem, at what may be described as the "grass roots level". This is particularly true of telecommunications, of broadcasting and especially of satellite broadcasting. The mould we shape today in the form of the technical standards and guidelines for operational practices will determine the magnitude, nature and life-time of the investments to be made by governments, the broadcasters and the public at large.

You all know that, seen as a system, broadcasting does not stop when the signals leave your transmitter antenna on their way to the public. On their way the waves mix with those of others and depending upon the relative strengths and frequency

difference of these waves so the listener benefits from a more or less satisfactory reception. This is the whole problem of the best use of the radio frequency spectrum and of harmful interference.

The use of the radio spectrum is, however, not the only part of the "rest" of the system. "Out there" there are thousands and millions of people like ourselves, including ourselves when we wear our other hat, that of the viewer or listener. This vast community of people, who in fact are not required to know anything about Radio Regulations (except that they should pay their licence fees if receiving licences are mandatory in their country) have, however, been asked indirectly to make technical and regulatory decisions. They have at some time (through the medium of a manufacturer building a receiver to tune in to a transmission whose characteristics corresponded to what the international Radio Regulations permitted), made a choice. This choice implies an act of trust, trust that the receiver will remain useful for at least as long as the buyer assumes the equipment to remain serviceable.

Since the early days of broadcasting we have known great stability with respect to those broadcasting bands for which long-range interference is possible. I believe that one can say with some confidence that it is highly probable that this stability will be maintained for at least a further fifteen or so years as current planning—particularly for Regions 1 and 3 following the recent Low and Medium Frequency Broadcasting Conference—is based on further use of the present bands. This stability is, however, not a foregone conclusion when we are entering a domain which depends on still rapidly evolving technology. Yet in order to be able to plan, to give a direction to research and development and last, but by no means least, to induce the political will to further the provision of new services while at the same time ensuring that the matter becomes sufficiently realistic to have popular backing, it is essential that certain very basic decisions be taken very early on.

* Outline of paper presented by Mr. Butler to the 12th General Assembly of the Asian Broadcasting Union (ABU), Adelaide, 20 November 1975.

Fundamental among these is most probably the question "In which part of the radio frequency spectrum should this new service operate?"

This is a particularly interesting question. Strictly technically speaking there may be several areas of the spectrum which are more or less suitable for a given application, i.e. where the propagation characteristics are suitable (path attenuation and signal stability) for providing a given service. Yet one has also got to be sure that reliable transmitting and receiving equipment can be manufactured at an acceptable cost at the time when one wishes to go into operation. One's difficulties do not stop here. Nowadays it is almost certain that somebody else, another application, another type of service, has already got its eyes on the same part of the spectrum—assuming that it has not already been in use for a long time.

Let us therefore look at the mechanism through which the international frequency allocations are decided. In the first place I should say that allocations are determined on strictly democratic lines at suitably empowered administrative radio conferences of the ITU and on the basis of the proposals put forward by individual or groups of Members of the Union. I wish to emphasize this point as it is not the Secretariat which makes these proposals. I think this is very important, because not only are the Members rightfully jealous of their sovereignty, but it also ensures that the Secretariat of the ITU plays a strictly neutral and independent role. Here one must keep in mind that allocations can in effect be worth hundreds of millions of dollars of business in the form of systems or hardware provision. It is therefore very important that the Secretariat be wholly outside such considerations.

I have just said that the origin of international frequency allocations are the proposals put forward by the Member administrations. Now very obviously these proposals have to be based on some understanding of the particular technical and operational requirements of the projected service. It is here that organizations like yours, and at the ITU level the International Radio Consultative Committee (CCIR) can play their part when the very first ideas are put forward at

national levels, and long before the actual proposals to the administrative radio conference are drafted. The relative importance of different technical factors can then be discussed and appreciated, and may possibly already lead to a consensus on such matters as which part of the radio spectrum (as distinct from the exact limits of the band) is best suited for a given use. It is in the course of such exchanges that the number of possibilities initially envisaged by administrations gets less and that a few (hopefully only one) more concrete prospects are developed, which can then be considered by the administrations in their collective development of the international policy in the ITU administrative conferences, in terms of what they would mean with respect to existing allocations, coverage of national territory, service areas, etc.

I have dwelt at some length on how the ITU arrives at the international frequency allocations because I feel that it is fundamental to the understanding of the World Administrative Radio Conference for the planning of the broadcasting-satellite service in frequency bands 11.7-12.2 GHz (in Regions 2 and 3) and 11.7-12.5 GHz (in Region 1) (WARC-BS) to be held in January 1977.

The frequency allocation with which this conference will be dealing was agreed by the World Administrative Radio Conference for Space Telecommunications (WARC-ST) which was held in Geneva in 1971. This latter conference decided that the frequency allocation made in 1959 (by the ordinary Administrative Radio Conference, Geneva 1959) to:

- the fixed service,
- the mobile service (except aeronautical mobile), and
- the broadcasting service

between 11.7 and 12.7 GHz should be modified to accommodate also space services, notably direct broadcasting from satellites as well as the fixed satellite services (the latter in one region only). Before going on to describe the present regulatory provisions which resulted from this action, I should mention that the proposal to allocate this super high frequency to broadcasting was in itself a very far-sighted decision by the Member government representatives, when you

look back to the known technological parameters of 1959. In 1959, this was not an allocation for space broadcasting, but one for the provision of a large number of specialized television channels operating over rather short ranges. It aimed at meeting the needs of a multi-media society through radiocommunications. Alternative methods of meeting these needs have now been developed utilizing other technology (for example in the United Kingdom), such as the provision of coaxial cable ring mains in new towns. This is a development which the famous architect Frank Lloyd Wright had envisaged many years ago in his work the *Wired City*. Nevertheless, experiments with terrestrial broadcasting in this band have been made in Europe and it will be interesting to see whether the requirements for terrestrial broadcasting, for which an allocation remains, will be taken up on a regular basis, or whether an alternative means of such very short range broadcasting will be found.

Having outlined some of the history, it is appropriate now to turn, to the future and to consider the task which the 1977 Conference will be facing. The agenda of the conference is set out in detail in ITU Administrative Council Resolution No. 762. I shall read part of it to you and you will see the relative complexity of the subject matter and appreciate the need for administrations everywhere, but especially on a *regional basis*, to start doing their "homework" very thoroughly. This is particularly well illustrated by the first point on the agenda of the conference:

"to establish the sharing criteria for the bands 11.7-12.2 GHz (in Regions 2 and 3) and 11.7-12.5 GHz (in Region 1) between the broadcasting-satellite service and the other services to which these bands are allocated, namely:

- the fixed service;
- the mobile service (except the aeronautical mobile);
- the broadcasting service;
- the fixed-satellite service (space-to-earth) in Region 2;"

The question then is how does this fit in with the provisions of Article 5 of the Radio Regulations, the Frequency Allocation Table? Figure 1 reproduces the relevant part of the Frequency Allocation Table together with corresponding operative footnotes.



The first point you will observe by comparing the three footnotes concerned is the very fundamental difference of basic policy between Regions 1 and 3 (Africa, Europe, Asia and Oceania) on the one hand and Region 2 (the Americas) on the other hand. I wish to stress this aspect of policy, because the issues involved are not of a strictly technical or operational nature. They are related to resource management, concerning the radio spectrum usage, financial investments and emphasis given by Members in the policy considerations at the relevant ITU conferences.

I would like to bring your attention to the difference in end-purpose of satellite broadcasting between Region 2 (the Americas, including the Caribbean) and the rest of the world. Footnote 405BC Spa2 specifically sets out that in Region 2 satellite broadcasting will be limited to domestic, I repeat, domestic systems. The administrations of Region 2 have furthermore provided, through footnote 405BB Spa2, and the fact that the allocation in that region is shared also with the fixed-satellite (space-to-earth) service, that in the plans to be drawn up countries can decide on which use they will make of the allocation.

So we have a situation where in one part of the world (Regions 1 and 3) plans will have to be drawn up so that the existing and future terrestrial services (fixed, mobile and broadcasting) will not cause harmful interference to the broadcasting-satellite service (even though it should be stressed that all the allocated services have equal rights and will have to be treated as such by the conferences) while in the other part of the world (Region 2) there exists an option to use the band either for the fixed-satellite service or the broadcasting-satellite service. The introduction of these services will furthermore, in Region 2, be the subject of:

- 1) plans for the space *radiocommunication* services (i.e. both the fixed and the broadcasting service (footnote 405BB Spa2); and
- 2) the introduction of the space services subject to agreement between the administrations concerned and those having services operating in accordance



World Administrative Radio Conference for Space Telecommunications (Geneva, 1971)—A meeting in progress

with the Allocation Table (footnote 405BC Spa2).

In addition to these basic differences between the regions, I should also mention that the allocation for satellite broadcasting extends up to 12.5 GHz in Region 1 (Africa, Western Asia and Europe) whereas in Regions 2 (the Americas) and 3 (most of Asia and Oceania) this allocation stops at 12.2 GHz.

I have given you this very brief outline of the regulatory framework in which the 1977 Conference will have to work to bring to your notice the complexity of the subject, even when one is only looking at the purpose of the agreement and associated plans. In so doing I have purposely avoided listing the problems which the conference will have to solve because without knowing what the Members of the Union will put forward as proposals this would be a purely hypothetical exercise and it would certainly not lead to a well-ordered list of such problems.

Nevertheless, you all appreciate the urgent necessity of drawing up within your respective countries and within the region, through your national administrations

and in co-ordination with the other radio services concerned, a catalogue of the interests for which you will have to seek provision and service protection from interference by other services.

These interests will not necessarily concern only satellite broadcasting, because even in Region 3, where you are looking forward to satellite broadcasting to overcome problems which are virtually impossible to solve quickly by terrestrial means, it is essential to have a nationally and preferably also some regionally co-ordinated policy on the use of *all* the services to which these bands are allocated.

Having dwelt on the broad policy aspects which the conference will have to handle, I would now like to come to a more technical matter.

One of the issues which countries will have to consider is the kind of satellite broadcasting they wish to provide in this band. The definition of the broadcasting-satellite service (Radio Regulation 84AP Spa2) refers to signals "intended for direct reception by the general public". The term "direct reception" is amplified in a footnote to "encompass both individual reception and community reception".

These two different kinds of reception are defined as follows:

“Individual reception (in the broadcasting-satellite service)

The reception of emissions from a space station in the broadcasting-satellite service by simple domestic installations and in particular those possessing small antennae.

“Community reception (in the broadcasting-satellite service)

The reception of emissions from a space station in the broadcasting-satellite service by receiving equipment, which in some cases may be complex and have antennae larger than those used for individual reception, and intended for use:

- by a group of the general public at one location; or
- through a distribution system covering a limited area.”

Between these two definitions a distinction is made with respect to the size of the receiving antenna—a small one for individual reception and a larger one for community reception. At the same time and perhaps less clearly stated but nevertheless still quite significant is the distinction made between the simple domestic installation and the “in some cases may be complex” receiving equipment to be used for community reception.

This distinction in the definition is indicative of the differences in radiated power expected for reception by the two types of application. Apart from the fact that it will have a pronounced effect on systems costs and therefore investments, the difference will also affect frequency sharing possibilities with other services.

What I have said so far is germane to a further aspect of the regulation of space radiocommunications, which is related to the use of highly directional transmitting antennae in order to make the best use of the radio frequency spectrum.

The point I wish to make now stems from Radio Regulation 428A Spa2 which states:

“In devising the characteristics of a space station in the broadcasting-satellite service, all technical means available shall be used to reduce, to the maximum extent practicable, the radiation over the territory of other countries unless an agreement has been previously reached with such countries.”

I should add that such an obligatory principle was introduced for the first time into ITU policy statutes in 1971. This provision, when coupled with other provisions which put much emphasis on planning of particular bands before

services commence to operate, further exposes the limitations of the first come, first served principle in frequency allocations and the 1971 Conference can thus be regarded as a hall-mark in major policy development, in the widest sense, in the area of frequency co-ordination. It is evident that if this new provision is to be applied to a degree comparable with the state of the art (as it is likely to be when regular space services will be introduced in the 12 GHz band) then a high degree of station keeping and pointing accuracy of antennae is going to be required.

The Radio Regulations already contain provisions dealing with pointing accuracy, but it is possible that the 1977 Conference may wish to apply, for the satellite stations in the plans, conditions specifically tailored to the sharing patterns covered by the forthcoming agreement.

Last but by no means least among the basic policy issues connected with the forthcoming conference is the fact that it will be addressing itself more specifically to cases of the use of the geostationary orbit (i.e. orbital spacing) than the earlier conferences. Previous conferences, and

notably the World Administrative Radio Conference for Space Telecommunications (Geneva, 1971), had considered the principles underlying the occupancy of the geostationary orbit. The 1971 Conference approved Resolution No. Spa2-1 “Relating to the use by all countries, with equal rights, of frequency bands for space radiocommunication services” which recognizes quite clearly the indissociable link between the geostationary orbit and the radio frequency spectrum as far as the efficient use of the spectrum is concerned.

The International Telecommunication Convention (Malaga-Torremolinos, 1973) also now contains a provision, number 131, enjoining the Members of the Union to use radio frequencies and the geostationary satellite orbit “efficiently and economically so that countries or groups of countries may have equitable access to both in conformity with the provisions of the Radio Regulations according to their needs and the technical facilities at their disposal”.

The introduction of specific and general provisions into the statutes means that much more preparatory policy thought is

Figure 1
Extracts from Radio Regulations

Region 1	Region 2	Region 3
11.7-12.5 GHz FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE	11.7-12.2 GHz FIXED FIXED-SATELLITE (space-to-earth) MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE	11.7-12.2 GHz FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE
405BA	405BB 405BC	405BA

405BA Spa2 In the band 11.7-12.2 GHz in Region 3 and in the band 11.7-12.5 GHz in Region 1, existing and future fixed, mobile and broadcasting services shall not cause harmful interference to broadcasting-satellite stations operating in accordance with the decision of the appropriate broadcasting frequency assignment planning conference (see Resolution No. Spa2-2) and this requirement shall be taken into account in the decisions of that conference.

405BB Spa2 Terrestrial radiocommunication services in the band 11.7-12.2GHz in Region 2 shall be introduced only after the elaboration and approval of plans for the space radiocommunication services, so as to ensure compatibility between the uses that each country decides for this band.

405BC Spa2 The use of the band 11.7-12.2 GHz in Region 2 by the broadcasting-satellite and fixed-satellite services is limited to domestic systems and is subject to previous agreement between the administrations concerned and those having services, operating in accordance with the Table, which may be affected (see Article 9A and Resolution No. Spa2-3).

428A Spa2 In devising the characteristics of a space station in the broadcasting-satellite service, all technical means available shall be used to reduce, to the maximum extent practicable, the radiation over the territory of other countries unless an agreement has been previously reached with such countries.

needed in the establishment of your national inputs to the conference—not overlooking the basic obligation to permit efficient, and effective application of new technology for the common good.

While I am speaking about the radio frequency spectrum and the geostationary orbit, it is necessary to draw your attention to the important functions of the International Frequency Registration Board (IFRB).

Before referring to the actual functions of the Board I should say that the Board is made up of five full-time members elected by the Members of the Union. Each of the members of the Board comes from one of the five regions of the world (Africa, the Americas, Asia and Oceania, Eastern Europe and Northern Asia, and Western Europe).

Although the members of the IFRB are elected by all the Members of the Union from regional lists, it is very important to know that the ITU Convention specifies that the members of the Board "shall serve, not as representing their respective countries, or a region, but as custodians of an international public trust".

Having briefly outlined the constitutional aspects of the IFRB I would like to say a few words about its duties. The Board's first duty (in the order in which they are given in the International Telecommunication Convention) is, in summary, the orderly recording of frequency assignments with a view to ensuring formal international recognition thereof. A second duty is the orderly recording of the same purpose of the positions assigned by countries to geostationary satellites.

The Board has further responsibilities aimed at assisting the effective utilization of the radio spectrum and the co-ordination of spectrum use (you will find them set out in the Convention and the associated Radio Regulations). However, it is especially the duty relating to geostationary satellites to which I wish to draw your attention. This is because it demonstrates that there exists today, in international law having treaty force between nations and with respect to the use of outer space for telecommunication purposes, the mechanism necessary for ensuring formal international recognition of specific uses of the geostationary orbit.

2. The timing of the WARC-BS (12 GHz)—Why in 1977?

To understand the present world-wide interest in planning the provision of satellite broadcasting in the 12 GHz band it is necessary to have a clear appreciation of the current status of two of the lower frequency bands in which satellite broadcasting is permitted. (There are a number of higher frequency bands reserved for satellite broadcasting, but existing technology does not yet permit their utilization.) I am referring, of course, to the bands 620-790 and 2500-2690 MHz.

The 620-790 MHz frequency band is already extensively used in many countries for terrestrial broadcasting and other terrestrial services. For this reason the Radio Regulations place severe restrictions on the use of this band for satellite broadcasting.

The 2500-2690 MHz frequency band offers greater, but still limited, possibilities for the development of broadcasting-satellite systems. Once again this is a band which is extensively used for fixed and mobile terrestrial services in that part of Region 1 comprising Western Europe and in the North American portion of Region 2. The band is therefore unlikely to be developed for satellite broadcasting in these areas, except on a very limited scale. However, there are many countries where this band is not widely used and where large areas could be served by a relatively small number of television channels—although of course these can be re-used. Technical limitations, as required by the Radio Regulations, also restrict the use of this band to community reception. The South American countries of Region 2 have been studying the possibility of developing this band for educational television broadcasting by satellite and, in the future, the band may be developed for this purpose to serve countries in Africa and Asia and the Pacific. It should be noted that India has given preliminary notice (in accordance with the Radio Regulations) of its plans to use this band for satellite broadcasting.

In those parts of the world, notably the European Broadcasting Area of Region 1, where severe restrictions exist on the

development of these two lower frequency bands, the 12 GHz band is considered to be the band in which the broadcasting-satellite service could be developed. Account has to be taken of the ever increasing pressure for extension of services, particularly the fixed and mobile services, which will share the allocations in this band. Indeed, this factor provided the basis for certain European countries to seek a regional conference (Region 1) to enable the use of this band for such services, but the Union's Plenipotentiary Conference, taking the broader considerations into account, reached a policy agreement for a world conference for planning purposes.

Thus it is significant that the first item on the agenda of the 1977 Conference is "to establish the sharing criteria for the bands 11.7-12.2 GHz (in Regions 2 and 3) and 11.7-12.5 GHz (in Region 1) between the broadcasting-satellite service and the other services to which these bands are allocated".

Clearly the future development of the broadcasting-satellite service depends upon many technological, social, economic and political factors which are still being evolved:

- political issues are under discussion in the United Nations and developments in the Committee on the Peaceful Uses of Outer Space and the General Assembly will undoubtedly affect the work of the 1977 Conference;
- social and economic factors are under study in many parts of the world with some considerable emphasis being placed at present on the development of broadcasting-satellite services for educational television. Whether the high cost of such systems in these bands is justified by the social benefits to be obtained is a question currently being evaluated in practical experiments in the United States and India;
- future costs will be affected by technological developments and interesting development orientated experiments are under way in the 12 GHz band in Japan, Europe and elsewhere.

Hence, although the actual timing of the introduction of operational broadcasting-satellite services is still in doubt, it is

necessary that the road ahead be cleared of technological obstacles to their development. It is for organizations such as the ITU to clarify what can be achieved by scientific and technical developments in terms, for example, of antenna directivity and interference-free operation within well-defined boundaries and with a minimum of radiation "spill over" across frontier boundaries. The development of well-defined parameters in these areas will, of course, assist in achieving policy agreement, essential for the further development of broadcasting-satellite services.

There are therefore compelling reasons for the convening of the conference which is scheduled to start in January 1977 even if the immediate interest in the application of a broadcasting service plan is not imminent. The interests of particular regions in the development of broadcasting-satellite systems will vary and much more experimental work will be undertaken. Perhaps, in some cases, regional interests will be content to have world-wide planning standards and sharing criteria developed at this time with detailed regional planning to proceed later. This procedure would be consistent with the step-by-step approach foreseen by the 1971 Conference.

While it is not my intention to talk in detail about telecommunications hardware which will form an integral part of future broadcasting-satellite systems, we should not lose sight of the impact the conference is likely to have on the development of such equipment. Decisions of the conference will influence the type of broadcasting systems to be adopted. The conference will affect the definition of technical characteristics and standards for such items as community and individual reception equipment operating within this band.

As always, the ITU objectives in the development of broadcasting-satellite systems will be the agreement of world-wide standards and the regulation of the systems. These standards will be of immense importance to the manufacturers of telecommunications equipment, to governments and to the public. It is desirable that early agreement be reached on equipment and system standardization to enable detailed design to proceed and to permit an assessment of potential investment levels in system construction and operation.

3. Preparations for the conference

The success of the 1977 Broadcasting-Satellite Conference can only be assured if adequate preparations are undertaken by all concerned.

Within the ITU, the preparation of the detailed technical criteria required by the conference, for planning purposes, proceeds through the CCIR.

The importance of the preparatory work of the CCIR is well appreciated by all Members of the Union and it is anticipated that the necessary technical information will be submitted directly to the WARC-BS 12 GHz following the next series of CCIR Study Group meetings which will be held in May 1976. The importance attached to these preparations was underlined during the 30th session of the Administrative Council when the Council adopted a special resolution which invites "the CCIR to continue to take action for timely provision of all available technical information relevant to planning the use of the 12 GHz band by the broadcasting-satellite service, and concerning the technical criteria for sharing among various services in this band, so that the WARC-BS 12 GHz may have adequate technical bases for its work."

I would now briefly like to draw your attention to the urgency concerning your preparations for the conference.

The conference is scheduled to meet on 10 January 1977 for a period of five weeks.

While it is desirable that all Members of the Union participate actively in the work of the CCIR it is appreciated that this is not always possible. In the developing countries the technical staff of the administration is frequently hard pressed to keep pace with the work involved in the maintenance, operation and development of the national systems. There is little time to spare in preparing contributions to international study programmes or in participating in meetings, even if they have the financial resources.

A major aim of the technical assistance activities of the Union is to provide information and technical expertise to the administrations of developing countries on telecommunications, including broadcasting-satellite systems. Notable examples of this type of activity are to be found

in the UNDP*/ITU projects undertaken in India and the feasibility studies in a number of countries of Latin America.

The SITE—satellite instructional television experiment—in India is expected to produce extremely valuable data as to the usefulness and the economic aspects of television broadcasting systems using both terrestrial transmitters and a satellite. As such the experiment has considerable international significance particularly for developing countries which may like to use space technology for educational television and telecommunications to support and accelerate national development.

Through various projects, the ITU has contributed to the dissemination of information and expertise concerning broadcasting-satellite systems.

Focusing specifically on the 1977 Conference, further efforts will be undertaken to highlight the issues which will be before the WARC-BS 12 GHz during seminars which are being planned for 1976. These will be workshop type planning seminars which should serve as group training exercises in the understanding of various planning parameters which belong to the process of evolving regional plans for broadcasting-satellite systems and appropriate sharing arrangements with other services.

Each of these seminars will emphasize the preparatory work which will be necessary if administrations are to collaborate meaningfully in the 1977 Conference. In Asia we are working in close collaboration with the ABU—exploring together the possibility of obtaining bilateral finance which would permit this type of meeting in the form of a seminar to take place sometime in September/October 1976.

The conference is not far away. As the Members should have an opportunity to examine and study the proposals of other administrations it is essential to consider mid-1976 as the time by which your proposals should reach the Secretary-General of the ITU in order that they may be translated, reproduced and distributed to others as quickly as possible.

Naturally, much of the success of the conference will also depend upon the

* United Nations Development Programme.

elaboration of an effective method of handling the complicated inter-relationships which exist between the regulatory provisions applicable in the different ITU regions. There will probably have to be a form of step-by-step procedure so as to ensure that each phase of the work provides the necessary foundation for the next phase. Similarly it will be necessary, given the comparatively short duration of the conference, to have various phases of the work going on at the same time.

This problem of work organization is very important in view of the novelty of the task before the Union. It is therefore highly desirable that Members give this matter urgent consideration.

Let me here re-emphasize the necessity for the careful and timely preparation of Members' proposals to the conference. The preparation of such proposals is a demanding task, requiring close consul-

tations at the national level to define domestic interests and equally important consultations at the regional and global levels in a collaborative effort to develop policy measures which could be acceptable to the international community.

Inevitably different positions and objectives will be defined in the proposals which Members will place before the WARC-BS 12 GHz reflecting the different priorities and interest of individual countries and regions. The existence of numerous satellite systems (in other bands) providing not only for intercontinental and domestic telecommunications but also for many other earth and space survey applications will have to be taken into account. The task of the conference will be to reconcile and harmonize the proposals of the Members in the interests of the development of a logical and acceptable global policy for the most effective utilization of resources.

4. Cost perspectives

Finally, I would like to turn to an entirely different aspect of satellite broadcasting namely, system costs, because I feel that such costs will weigh heavily in the decisions which will have to be taken at the national levels in the coming years.

In an annex some cost estimates have been indicated. I have confined myself to hardware costs. At this stage some of these estimates are speculative. Nevertheless, they give some further indication of the importance of, and the reasons for, my earlier remarks on the need for regional collaboration. These costs do not cover transmitted programme (software) costs. They will vary with the relay quality requirements which may also be different depending upon the particular service need.

(Original language: English)

ANNEX

Cost estimates—Broadcasting-satellite systems (FM, 4 channels, coverage 1500 × 1500 km)

	Community reception (US dollars)	Individual reception (US dollars)
1. Investment		
1.1 Satellite and launching	50 million	80 million
1.2 Transmitting earth station	1.5 million	1.5 million
1.3 Station for tracking, telemetering, control	1.5 million	1.5 million
1.4 Space segment (3 satellites and 3 launchers and stations 1.2 and 1.3) total:	153 million	243 million
1.5 Receiving antenna and converter	1500 each (100 000 production including power source)	100 each (1 000 000 production) 200 each (100 000 production)
1.6 Receiver (standard 22", black-and-white)	300 each	250 each
2. Running costs (1 year) for the space segment		
2.1 Depreciation over 7 years (3 satellites)	21.43 million	34.29 million
2.2 Cost of capital (8% per annum; average over 7 years)	6.00 million	9.60 million
2.3 Depreciation over 14 years (stations 1.2 and 1.3)	0.14 million	0.14 million
2.4 Cost of capital (8% per annum; average over 14 years for stations 1.2 and 1.3)	0.08 million	0.08 million
2.5 Operation and maintenance of stations 1.2 and 1.3	0.40 million	0.40 million
2.6 General and administrative charges (5% of above)	1.40 million	2.23 million
Annual charge total	29.45 million	46.74 million

Notes: For para 1.3—If this service is not provided by another authority.

For para 1.4—In a satellite broadcasting system, 3 satellites are required (one in operation, one spare in orbit, one spare on the earth).