# WARC 1984 and the High Frequency Bands: To Interfere or Not to Interfere; That is the Question.

~~PLANNING THE HF BANDS~~

but what is the answer? Should at least be implied in your title.

Use of the word interfere is confusing - this interference seems not to be a matter of choice as it is depicted in your title.

Yesterday, while tuning in Radio Earth International on my SONY ICF-2001, to listen to Rudy Espinal's "This is the Caribbean", I encountered extreme difficulty enjoying the Merengues from the Dominican Republic he played. Vatican Radio was interfering with a broadcast to Europe. Since Radio Earth was intended for North America, it was naturally stronger, but still still the interference deterred my reception to make me frustrated for the rest of the evening.

Presently, there are about 1700 Shortwave transmitters in operation. With only about 2350kHz of frequency space allocated to international broadcast, there is room for 235 stations to broadcast interference free at any given time, since the necessary channel spacing is 10kHz. However, the distance betwee between channels may be reduced to 5kHz if the neighboring channels are used for broadcasts to substantially distant areas. /1/ Then, we have 470 channels available with tolerable but omnipresent interference. A serious problem is apparent when we realize that about 1000 transmitters are in operation at any given time of the day. /5/ When you cram 1000 broadcasts into 470 channels, congestion inevitably results. To attempt to find a res-olution to this problem, the International Telecommunications Union(ITU) held a conference dealing with this problem in early 1984.

Shouldn't these be chronological? See comment in Ref.

redundant

[Handwritten: page numbers?]

Between 10 January and 11 February 1984, the first session of the World Administrative Radio Conference on High Frequency Broadcasting was held in Geneva, Switzerland. The major purpose of the conference was to "draw up a report containing the technical criteria to be used for planning, and the planning methods and principles to enable the second session to plan these bands."/2/ The ultimate decision of this conference was to adopt a single-sideband(SSB) system for high frequency(HF) broadcasting. Such a system is the best solution to the problem [handwritten insertion: of overcrowding,] but we need a planning system for the transition period and post-transitional SSB period. After considering seven proposed planning methods, the WARC-HFBC chose the planning method submitted by Canada. ~~which was the best of the planning methods proposed.~~

[Handwritten: this is your thesis - or is it - state in one sentence not as an aside]

In the course of this paper, I shall try to explain and analyze the solutions [handwritten: SSB system + the Canadian planning method — be specific!] adopted by the Conference in terms understandable to the layman. This is important because the layman is the one who will ultimately be affected by these decisions, and yet he knows the least about them.

[Handwritten:
explain in terms understandable to the laymen = translate
analyze = separate into parts
→ don't you also intend to evaluate?
→ did you really do this? or did you simply reiterate the conclusions of the Conference and the WARC-HFBC evaluation? this is a real problem (perhaps remedied by better referencing.)]

## Adoption of a Single-Sideband System

major headings usually are centered + not underlined.

### Double-Sideband (DSB)

underlined for discrimination

The system of broadcasting currently in use in the high frequency(HF) broadcast bands is double-side band, the conventional amplitude modulation technique. There are three components of the DSB signal, the carrier and two sidebands. The carrier is a frequency generated at the transmitter which contains no information but is detectable in a shortwave radio. Each sideband contains the same information and they are mirror images of each other. This information is the n modulated onto the carrier, where it appears as variations in the amplitude of the carrier. This is referred to as the envelope. /1, 6/ Since the DSB signal has an envelope, the signal may be reproduced by envelope detection, a method in which the information contained in the envelope is converted back into sound waves, and emitted through the radio.

At maximum efficiency, the DSB signal is 100% modulated, meaning the amplitude of the carrier varies "between zero and twice its original value."/6/ To do so, the carrier uses 50% of the transmitter power, and each sideband uses 25%, under ideal conditions.

Since the sidebands are contained within 4.5kHz of the carrier frequency, "the total bandwidth of a DSB transmission shall not exceed 9kHz."/3/ The necessary space between channels using DSB, therefore, is 10kHz, for interfer--ence - free reception. However, according to section 3.1.2 of the WARC-HFBC final report, "To encourage spectrum conservation, it is also permissible to interleave DSB transmissions midway between two adjacent channels... provided the interleaved transmission is not to the same geographical area as either of the transmissions between which it is interleaved."/3/

Single-Sideband (SSB)

The system of broadcasting proposed by WARC-HFBC is single-side band. This system is based on the premise that if the carrier and one of the sidebands were removed or suppressed, there would be no adverse effect on the transmitted information. /6/ There are several varieties of SSB transmissions possible. The one adopted by the conference is a system with reduced carrier and suppressed lower sideband. The carrier is retained to some extent to "achieve automatic frequency control and/or gain control at the receiver."/7/

In SSB, the envelope differs from the programme signal because one sideband is missing. Because of this, envelope detection results in impaired reproduction quality in the receiver. /1/ If a single sideband system is used, the ideal receivers would use product detection. In product detection, the carrier is reinserted at the receiver, and then reproduced on the carrier frequency. Since only one sideband is used, and the carrier is suppressed, most of the power is concentrated in the sideband, with the remainder going to the carrier. Since there is only one sideband, the necessary bandwidth is only 4.5 kHz. Therefore, the necessary space between channels is 5kHz, for interference free reception. Here, contrary to DSB, no interleaving is permissible, so the number of possible stations is the same for SSB and DSB. However, the decrease in interference is significant with SSB.

One final characteristic of SSB makes it different. When the sideband is suppressed, some phase modulation occurs, in addition to amplitude modulation. This further separates SSB from DSB in characteristic.

Advantages of a SSB system

The WARC-HFBC decided to adopt the single sideband system because it has many advantages over the currently used DSB system. They cited the following reasons in the report to the second session of the conference:/3/

> "- a more efficient utilization of the frequency spectrum by a reduction of interference;"

With the SSB system, since interleaved channels are not permitted, the number of available stations will remain the same. However, no interference will occur between stations separated by 5kHz, since the suppressed sideband is no longer present to interfere. with the nearby channels.

> "- the capability of improving the quality of reception, in particular under poor propagation conditions(selective fading), with SSB receivers;"

In DSB transmissions, selective fading causes distortion which may affect the two sidebands and carrier either simultaneously or non-simultaneously, according to chance. In SSB, however, fading only affects the strength of the signal, instead of disturbing distortion of the signal as in DSB.

> "- the possibility of producing the same sideband power as a current DSB transmitter with less capital and operational costs."

In a DSB transmission, 50% of the power is distributed to the carrier, and 25% to each sideband. After the transition period, the power of the sideband in the SSB system will be twice the power of each sideband of the DSB system. If we let the power of the SSB system equal 2, then the DSB power would be 4(2 from the sidebands, and 2 from the carrier). So, the SSB system is dramatically more efficient than the DSB system currently in use.

Disadvantages of a SSB system

The introduction of a SSB system would not be without problems. Today's receivers and transmitters are not suited to use SSB. The receivers currently in use use envelope detection as a method of signal reproduction. As previously stated, this method is not entirely effective with SSB. To adequately reproduce SSB signals, product detection is necessary. If SSB is to be introduced, new receivers of the product detection type have to be cheaply mass-produced, and all envelope detection receivers ~~are~~ have to be discarded.

The transmitters, too, must be replaced. Theycannot economically be converted for use in SSB with a 12 decibal(dB) carrier reduction. /8/ So, if SSB is to be introduced, all new transmitters would need to be introduced. The purchase of these transmitters, however, would cause severe economic strain to stations, especially those in smaller countries with lower budgets. This is in direct opposition to a fundamental purpose of the conference, as designated by the ITU Administrative Council. This purpose is to "ensure the equal rights of <u>all</u> countries to their(the HF bands)free use." /2, 9/ If the cost of transmitters causes some countries to cease HF broadcasting, the SSB

✓ excellent - this is analysis and evaluation and I know who to credit for it. Much more of this is necessary in your paper.

solution has failed in the eyes of this writer.

Until the time when all stations use SSB, and SSB signals must compete with DSB, the SSB transmitters must use 60% more energy than existing DSB transmitters, if equal signal strength is to be realized. This is illustrated by the fact that the efficiency of SSB transmissions is only 38%, and the power of the SSB sideband is 4 times the power of the DSB sideband, if equal strength shall exist. Hence, increased costs, which in turn are more severe to small, low-budget stations. Some way must be found to overcome this economic problem, to remain fair to all nations. Otherwise, this solution should be found unacceptable to the ITU Administrative Council.

Further technical work should be done in these fields before SSB is implemented.

Transition Period

The WARC-HFBC decided that a period of 20 years would be required as a transition period from the DSB system currently in use to an all SSB system with a 12dB carrier reduction. Throughout the transition period, the SSB transmissions will be picked up with receivers designed for conventional DSB signals. To avoid substantial lessening of reception quality, the carrier reduction on transition period transmissions will be a maximum of 6dB; so they can be received on conventional receivers using envelope detection. However, to remain competitive, the SSB signal must have the same loudness level as the DSB signal, so they will need an additional 3dB of power, causing a 60% increase in energy consumption. A possible solution to reduce this problem would be to group the SSB transmisisions together, so they won't be in competition with the

the DSB transmissions. /4/ However, the WARC-HFBC decided that"SSB shall be introduced in the same bands as are used for DSB. It has also been recognized that no channels should be reserved exclusively for SSB."/3/ This conflict of opinion is an obstacle to this possible solution to excessive costs to low-budget stations. Since no explanation was given by the WARC-HFBC, I must again disagree with the actions of the conference. Here was a chance to lessen transition period costs, and the WARC-HFBC failed to utilize it. It seems that they forgot their purpose"to ensure the equal rights of all countries". /2/

Since the lifetime of a tranm sitter is about 20 years, by the end of the transition period, all transmitters will be using SSB. The International Radio Consultative Committee(CCIR) has proposed that SSB will be used exclusively after ten years with a 6dB carrier reduction. /4/ The exact time will be decided at WARC-HFBC-1986.

Receivers, the CCIR proposed, should no longer be made using envelope detection, but only with product detection, which involves the regeneration of the carrier in SSB transmissions. /4/ These new receivers will work equally well with conventional DSB transmissions, as well. Since the listeners will have to purchase new receivers by the end of the transition period, if they are to keep listening, a large financial burden is imposed. Due to this financial strain, the CCIR proposed only a 12dB carrier reduction at the end of the transition period to reduce receiver cost and simplify operation.

During the transition period, you will see a 3dB allowance for co-channel interference between SSB and DSB transmissions in receiving signals with envelope detection units. This is due to the DSB selectivity and lowered receivability of SSB signals in these receivers. This is a mere estimate, however, as the WARC-HFBC decided to wait until the second session in 1986 to make a decision about transition period minimum co-channel signal to interference ratioв. This is because "the criteria of compatibility between DSB and SSB are not yet known."/3/

predicted?

On the next two pages, you will find a summary of proposed effects of the introduction of SSB transmissions duirng and after the transition period, and a timetable to be followed in the transition period for receiver use, and transmitter use. /4/ cite the source in the body of the text

TABLE 13-I

Summary of the effects of the introduction of SSB transmissions with 6 dB carrier reduction during the transition period, and with 12 dB carrier reduction afterwards

| | **Transition system** | | **Final system** |
|---|---|---|---|
| **Transmitter carrier reduction** | **6 dB** | | **12 dB** |
| **Total transmitter power** | **with constant carrier: more power**<br>**with floating carrier: less power**<br>**(comparable to final system)** | | **less power** |
| **Transmitter capital cost** | **more than for conventional DSB** | | **less than DSB** |
| **Transmitter operating cost** | **more than for conventional DSB** | | **less than DSB** |
| **Transmitted bandwidth** | **DSB: ± 4.5 kHz**/SSB: + 4.5 kHz | | **SSB: + 4.5 kHz** |
| **Receiver selectivity characteristics** | **DSB:** EBU | **SSB: ceramic filter** | **SSB: ceramic filter** |
| **Receiver AF bandwidth** | **2 kHz** | **3.7 ... 4 kHz.** | **3.7 ... 4 kHz** |
| **Receiver RF bandwidth** | **4 kHz** | **3.7 ... 4 kHz** | **3.7 ... 4 kHz** |
| **Slope of IF filter** | **8 dB/kHz** | **35 dB/kHz** | **35 dB/kHz** |
| **Receiver costs** | **no change** | **initially more expensive** | **less expensive than during transition** |
| **Channel spacing** | **10 kHz** | | **5 kHz** |
| **Spectrum usage** | **no saving, slightly less efficient** | | **up to twice the number of emissions** |
| Relative adjacent-channel protection ratio | Worse by 2.5 dB | better | better approx. 25 dB |
| Quality | slightly worse | better | better |

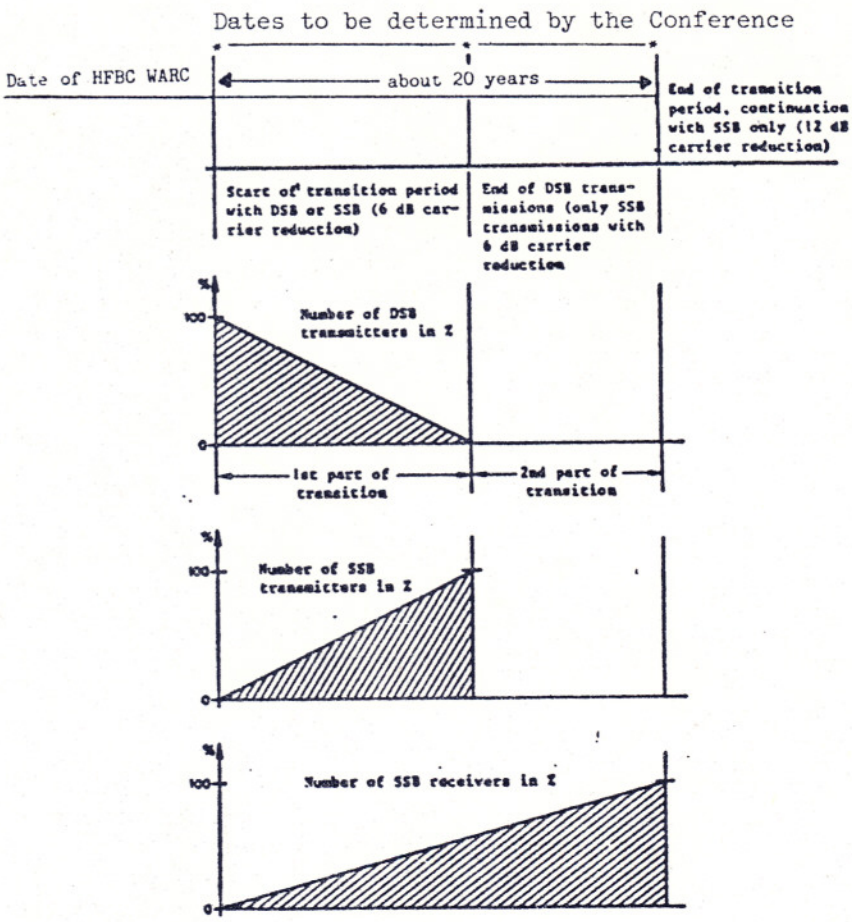



FIGURE 13-4

Possible time schedule for development and implementation of an SSB system in HF broadcasting

**The First Session of the HF Planning Conference takes a decision on the SSB system to be introduced and the procedure to be followed during the transition period.**

**A few years later: The decisions of the HF Planning Conference will be implemented and the transition period will start.**

About 20 years later: End of the transition period. In fact, DSB transmissions will have ceased some years earlier but, to implement the final stage of carrier reduction, these years preceding the definite end of the transition period will be necessary because of the very small proportion of DSB receivers still in use.

Overall evaluation of SSB

Ultimately, the decision to adopt the SSB system was the only realistic solution to the problem of overcrowded and congested shortwave broadcast bands. Even though there will be some monetary difficulties, especially in smaller nations and administrations, like Radio Earth, the eventual rewards reapable with the SSB system are overwhelming. The power reduction, and decreased interference will be worth the trouble involved./13/ This writer is looking forward to the end of the transition period, when he will be able to better receive Radio Earth and other small stations without worrying about the obnoxious interference that is at present omnipresent.

nice touch.

need transition to the H. section

Planning Method for HF Bands

Objectives of planning

There are three main objectives in planning the high frequency bands. First, we must guarantee free and equal rights to all administrations to use the high frequency bands. Secondly, we must provide listeners with a quality of service conforming to agreed technical standards. Finally, we must use the allocated bands in the most efficient manner. source?

Disadvantages of the current planning method

The currently followed planning method, Article 17, which has been in operation since 1960, no longer satisfies the majority of countries. Although this writer was unable to obtain a description of this procedure, a list of disadvantages was given in the October 1983 issue of the European Broadcast Union(EBU)Review-Technical:

good frame

> - No right to protection is given.
> - There is no guarantee that a notified frequency gives a satisfactory service.
> - Frequencies suffer from varying degrees of interference.
> - It can be difficult to find satisfactory new frequencies without extensive monitoring.
> - Because of the uncertainties of the success, the method can lead to the use of an excessive number of frequencies and higher powers than necessary in order to overcome interference.
> - Article 17 does not specify the technical data required for the assessment of incompatibilities.
> - The method of assessing incompatibilities, although it has developed during the time of its application, is not at all satisfactory. /9/

no marks w/ block quote

As you can see from this extremely long list of disadvantages, the planning method currently in use needs to be revised to accommodate the new problems of the 1980's.

Necessary Characteristics of a new system

All frequencies assigned under a new planning method are entitled to the same predetermined protection from interference, so all stations will be interfered with to the same extent. The new system also should be flexible to accommodate new or unforeseen requirements. Also, where possible, stations should be allowed to keep the frequencies thay are presently using, between scheduling periods, whenever this would not interfere with more beneficial results for the world broadcasting situatoin. Finally, the new system should take into consideration the manner in which a SSB system could be introduced without impairing DSB reception.

A new system for broadcasting should also retain the existing advantages of Article 17. A list of these was printed in the October 1983 issue of EBU Review-Technical:

> "- The method provides flexibility in the choice of the frequency, particularly when changes are necessary to reflect altered programme and/or service area requirements, including completely new requirements.
> - No frequencies need to be set aside for the long-term projexted requirements, and all frequencies are thus used for the short-term requirements only so that, in this case, good use of the spectrum is achieved.
> - Long-term forecasts for projected requirements are not necessary.
> - Coördinationamong interested administrations with a view to minimizing any incompatibilities is feasible.
> - Assessments of the compatibility can be based on monitoring rather than on prediction.
> - Necessary modifications, due to inaccuracies in the prediction method or due to failure to achieve interference-free reception can be implemented within a short time." /9/

It seems only logical that these should be retained, since one shouldn't mess with something that works. Still, from the lengthy list of disadvantages, something needs to be changed.

Elements of any planning process

There are 6 typical elements of any planning process. These are ~~reqx~~ requirement processing, propagation analysis, band and equipment selection, compatibility analysis, frequency selection, and adjustment of requirements. /10/

Requirement processing is necessary to give the computer the data needed to plan the bands. The broadcast requirements are submitted by the administrations with data concerning "required service areas, requested broadcast time blocks with associated transmitting sites, as well as the corresponding transmitter powers and types od antennas."/4/ The computer compiles these data into requirements files for later use.

Propagation analysys should be carried out for the ~~points~~ paths of the wanted and unwanted signals. Data on optimum frequency bands and path geometry to various test points in the required service area should be stored.

Band and equipment selection involves choosing the appropriate frequency band(s) for transmission of a given broadcast requirement. Further, antenna characteristics and ideal transmitter power are determined. After making these choices, the computer must check their reliability.

A compatibility analysis involves a determination of the number of channels required in each band for a specified signal-to interference ratio. Then, broadcast requirements are distributed among available channels in the most efficient way to insure uniform interference levels. If the overall signal-to-interference ratio for all requirements equals or exceeds the predetermined acceptible ratio for all requirements, a plan will be successful. Otherwise, the involved administrations must reconsider their requirements.

In the frequency selection stage, the computer must assign frequencies to each broadcast requirement submitted in a way to satisfy the maximum number of requirements with the fewest incompatibilities.

When incompatibilities arise, requirements must be adjusted. Several methods are possible. One solution is that they must try to distribute requirements more evenly over the frequency bands. Another is to try to distribute them more evenly over time, by moving some requirements to different times, or shortening some requirements. A third method is to change technical characteristics of some requirements to improve compatibility. The final method proposed by the CCIR is to reach a universal agreement on a lower protection ratio. Where none of these proposals work, administrative action must be taken. /4/

The flowchart on the next page illustrates visaully these essential aspects of planning. /4/ cite reference in text

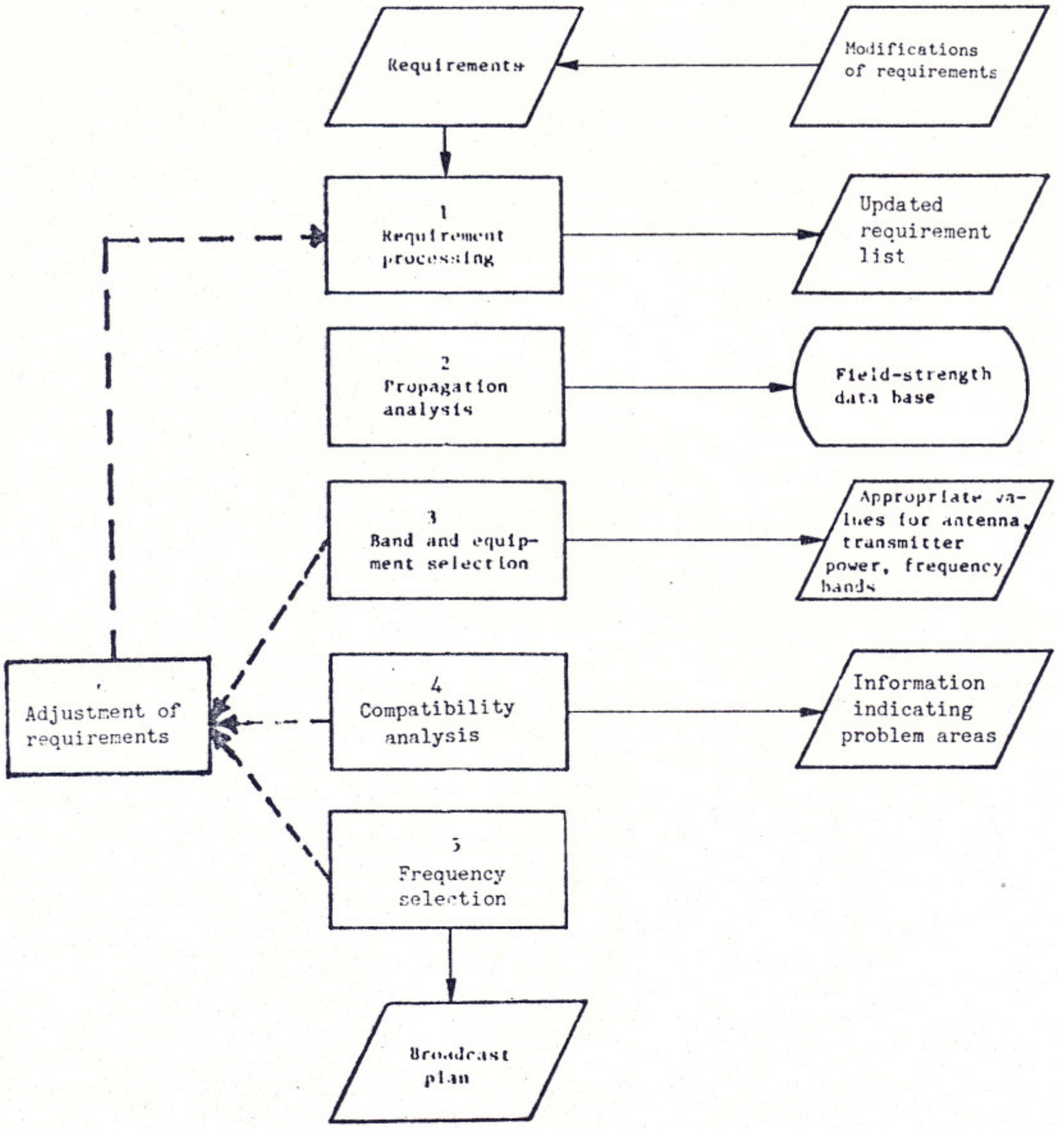



FIGURE 12-AI-1

Possible elements of any planning process

REFERENCES

CCIR Documents

[1982-86]: 10/10 (Japan)

Overall Comparison by CBC and EBU

The European Broadcast Union has prepared a chart of " relative advantages and disadvantages of the seven proposed planning methods."/9/ This chart appears on the following page. Since the chart itself is fairly self-explanatory, I shall describe what I mean by the system rating according to the CBC-EBU method. When the CBC sent me information for this paper, they enclosed a copy of the draft of an article in the EBU Review. On their copy of the chart, they rated each phase by the following method:

still, you must highlight what your readers should learn from it.

++ :well respected : 3points

\+ :quite well respected : 2points

0 :more or less respected : 1point

\- :poorly respected : 0points

Then, the sum of the evaluations for each method is the overall rating. The maximum possible is a 24, but the best proposed system received only a 17.

don't you agree with their decision?

In all, they agree with my decision for planning method no. 5, as did WARC-HFBC-1984, as you will see in the next few pages.

but there are problems which will be analyzed?

**Table 1**

**Example for evaluating the relative advantages and disadvantages of the seven proposed planning methods**

| Planning principles | Methods | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Efficient spectrum utilisation | – | – | – | + | o | + | + |
| Equal status of all requirements | o | o | – | ++ | ++ | + | ++ |
| Protection from harmful interference | +/– | – | – | + | o | +/– | +/– |
| Proportionally restricted protection | ++ | – | o | ++ | ++ | ++ | ++ |
| Improvement of service by coordination | o | o | o | o | o | + | o |
| Flexibility to accommodate changes | – | + | o | o | ++ | ++ | + |
| Continuity of frequency assignment | ++ | ++ | ++ | o | ++ | + | – |
| Provisions for introducing SSB | – | + | –/+ | + | + | + | + |

The seven proposed planning methods, which are described in the text, are as follows :

Method 1 : Establishment of a series of seasonal plans (a priori)
Method 2 : Evolutionary planning
Method 3 : Combination of fixed frequency plans and an evolutionary procedure
Method 4 : Fixed master list and seasonal planning process
Method 5 : Evolutionary master list and seasonal planning process
Method 6 : Seasonal processing in frequency-hour units numbered in priority order
Method 7 : Round-after-round processing

The symbols indicate the extent to which the planning principles may be respected. They have the following signification :

+ + : well respected
\+ : quite well respected, subject to certain restrictions
0 : more or less respected
— : poorly respected

omit

## 6. Conclusions

It may be seen from the preceding examination of the question that the Planning Conference faces a very difficult task for reasons which are both technical and political. It would of course be inappropriate to examine the latter here, even though it is certain that they will bear heavily on the decisions that are taken.

In the purely technical domain, it has been known for a long time that HF propagation conditions vary quite considerably as a function of the frequency, the time of day, the season and the sunspot number, whereas these have little influence in the other broadcasting bands. The results are that the received field-strength at any given point may vary a great deal and that it is often necessary to allocate several frequencies to each service area. As the number of requirements is very large, the amount of data to be processed is enormous and, as we have said at the beginning, it is essential to turn to powerful computers for assistance both during the Conference and afterwards, regardless of which planning method is finally adopted.

## BIBLIOGRAPHICAL REFERENCES


[1] *Technical bases for the planning of HF broadcasting.* EBU document SPB 203, February 1983.

[2] *EBU Guiding Principles for the HF broadcasting planning conference (1984/86).* EBU document SPB 204, September 1982.

[3] *Statistics of the occupancy of the HF bands for broadcasting.* EBU document Tech. 3242 (in preparation).

[4] Gröschel, G. : *Technical parameters of a future single-sideband transmission system for HF broadcasting.* EBU Review, No. 201, October 1983, pp. 234-248.

[5] *Report by Interim Working Parties 6/12 and 10/5 to Study Groups 6 and 10.* CCIR document 6/1 or 10/3, 28th February 1983.

[6] *Proposals of Japan to the First Session of the World Administrative Radio Conference for the Planning of the HF bands allocated to the HF broadcasting service (Geneva 1984).* Document submitted to the Conference by Japan.

## Proposed planning methods

Seven methods were proposed to the WARC-HFBC for the planning of the high frequency bands. These methods are summarized best by the chart on the next page taken from the CCIR report. /4/

This chart effectively and concisely describes the proposed methods. After considerable evaluation and thought, I have decided that solution number 5, proposed by the Canadian Inter-departmental Committee for High Frequency Broadcasting(HFBC)WARC Preparations, /10/ is the most beneficial plan proposed. I shall now analyze the other plans to explain why.

### Planning method No. 1:Establishment of a set of frequency plans:

In this method, proposed by the EBU, frequencies will be chosen by the computer for a period of 11 years at one time. Because of this advance planning, administrations must submit projected requirements. Since it would obviously be difficult to forecast the needs of 11 years in the future, several assigned frequencies may never be used, causing blocked frequencies, which greatly reduces the efficiency of spectrum utilization. The modification procedure allows new requirements to be added later, but in this case, it is possible that no acceptable solution may be found.

If this method were strictly observed, the signal-to-interference(S/I)ratio should be maintainable. However, in lieu of the inevitability of blocked frequencies, the S/I ratio will not be uniform over the whole band. Finally, as sunspot numbers cannot be forecast in the long term with reliability, this method does not provide for a significant accuracy in prediction of propagation. Hence, the overall rating of this system(See "Overall Comparison by CBC and EBU"), according to the CBC and EBU, is 8.

## TABLE 12-AII-I

Basic steps for each of seven possible planning methods

| Method | Requirements | Assignment process | Establishment of seasonal plans | Modification procedure |
|---|---|---|---|---|
| 1 | Programme requirements and technical constraints, if any, to be submitted at the time of the Conference for n years (2-3 < n < solar cycle) | - Frequency-selection process at Conference<br>- Analysis process<br>- Coordination at Conference<br>- Adjustments in case of overloading | Conference produces set of plans for selected seasons and sunspot numbers for n years | Procedures for the modification of technical characteristics and the addition of new requirements to be determined at the Conference |
| 2 | Frequency or programme requirements to be submitted on seasonal basis to IFRB | - Seasonal Frequency-selection by administration, or IFRB upon request<br>- Compatibility analysis<br>- IFRB recommendations for improvements<br>- Bi-lateral or multi-lateral coordination between administrations to resolve interference problems<br>- Arbitration for difficult interference problems | Conference produces planning procedure | Administrations retain possibility to make modifications of their choice according to agreed coordination procedure |
| 3 | Combination of Method 1 and Method 2 | Combination of Method 1 and Method 2 | Conference produces set of plans for designated portions of the bands for selected seasons as well as a planning procedure | Combination of Method 1 and Method 2 |
| 4 | Operational broadcast requirements as well as projected requirements for n years submitted to the Conference | - Frequency-selection process to be tested and agreed to at the Conference<br>- Applied by IFRB to established list of requirements<br>- Frequency-selection process to be used after the Conference to produce seasonal plans | Conference produces list of requirements, plan development process, modification procedure to list of established requirements | Modification to established list of requirements may occur at any time according to a procedure to be adopted by the Conference |
| 5 | Operational and projected broadcast requirements are submitted at any time, to be included in a Master List | - Frequency-selection process using optimization techniques to be tested and agreed to at Conference<br>- Process applied by IFRB, every season, using operational requirements for that season, to produce a Tentative Schedule | Conference produces a coordination procedure, which will provide for the elimination of incompatibilities to obtain the seasonal schedule or plan | Modification of the Master List is achieved by simple notification to the IFRB at any time |
| 6 | Programme or frequency requirements quantized in time and frequency and given the processing order by Administrations are submitted on seasonal basis to the IFRB. | Frequency-selection is carried out in the processing order on the basis of equal treatment of all Administrations, adapting to the busy time and the congested frequency band. | Conference produces frequency planning procedure including process for adjustment of requirements | Submission of modifications at any time according to the procedure adopted at the Conference |
| 7 | Operational and projected broadcast requirements for n years would be submitted to the Conference | - Band and equipment selection for each requirement to be established during Conference<br>- Compatibility analysis to accomplished round-after-round during the Conference<br>- Adjustment of requirements to be performed during Conference<br>- Round-after-round planning process to be agreed to at Conference and to be used during and after Conference | - Set of seasonal plans for n years to be established at Conference<br>- Seasonal plans including projected requirements as they become operational in the relevant seasons are generated by a Panel of Experts established at the Conference, with the assistance of the IFRB. | Procedures to be established at the Conference for modification of technical characteristics and the inclusion of new requirements |

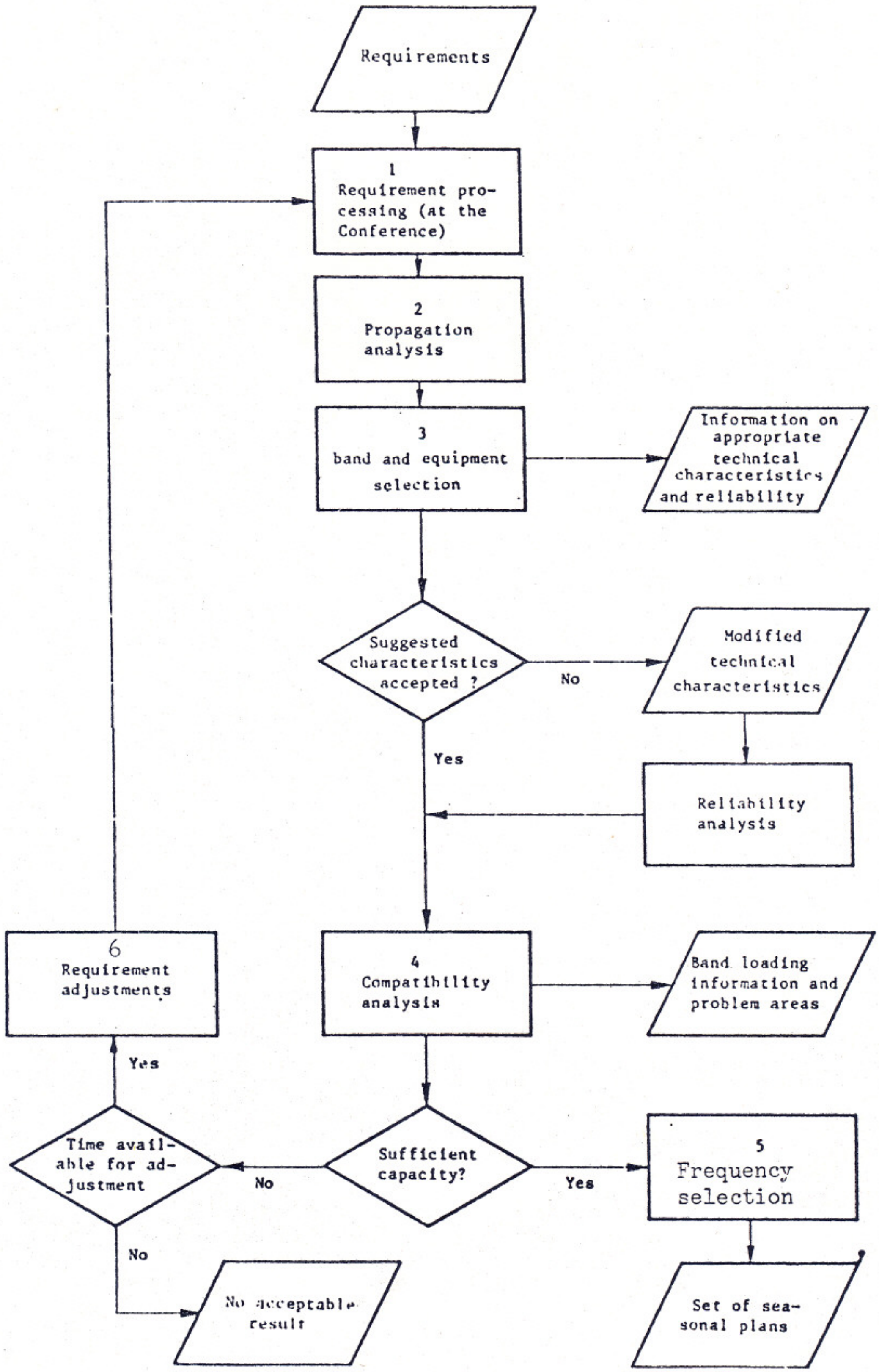



FIGURE 12-AII-1

Method 1 (to be followed during the Conference)

Planning Method No. 2: An Evolutionary Procedure

In this planning method, a set of frequency plans would be made for a season, and at the end of that season, the plans would be modified to accommodate the problems encountered during the planning season that just finished.

In this method, the individual administrations hav e some choice in the frequency they will be using, but because of the extensive coördination needed, this would be difficult to accomplish. Further, in this system, the protection ratios would be difficult to maintain, because of this multilateral frequency allocating. On the scale of ratings I mentioned before, the EBU-CBC rating of this method is 9.

Planning Method No. 3: A combination of fixed frequency plans for part of the bands and an evolutionary procedure for the remainder of the bands

This planning method is a combination of planning methods 1 and 2. Since most countries would be satisfied with the set of fixed seasonal plans, they set aside a portion of the bands for their use. However, the 25% of the countries that use 60% of the bands need the evolutionary procedure, since their frequency requirements are much greater. Again, here, there is no guarantee of protection from interference, and there would be needed a great deal of international coördination if this is to be pulled off successfully. The other problems with this method are basically the same as in the first two methods, and the flowcharts are, too. The EBU-CBC method rated this method as an 8.

in order to justify your inclusion of the flow-charts, you must introduce them, interpret them and indicate what the reader should notice

why are they included? are they necessary?

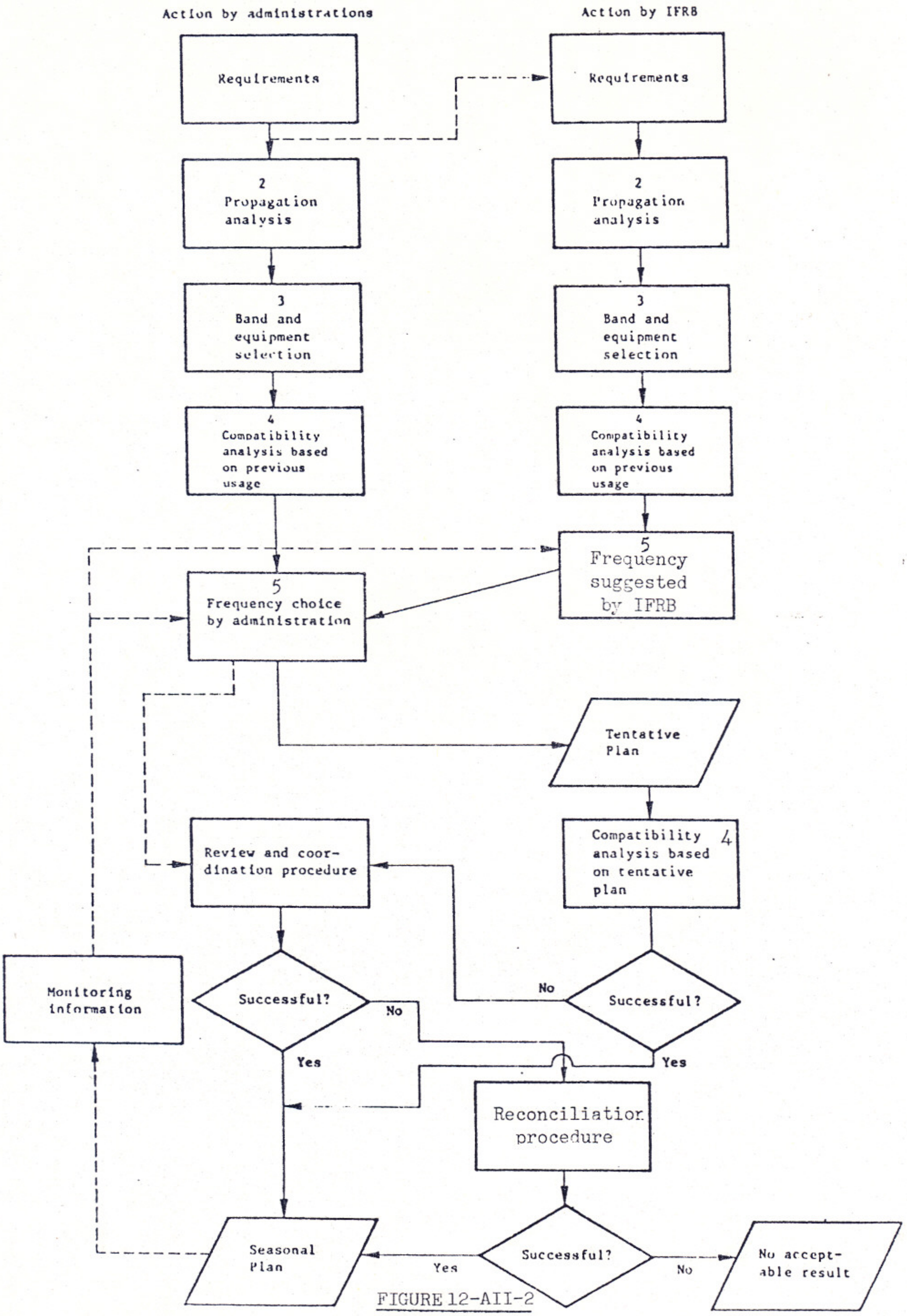



FIGURE 12-AII-2
Method 2

Planning Method No. 4: Establishment of a list of broadcasting requirements (fixed master list) and agreement on a planning process to be used subsequently in the preparation of seasonal plans

In this method, powerful computer facilities must "identify problem areas and...select frequencies for the assignment in seasonal plans."/9/ The method would necessitate projecting plans for the whole solar year (11 years). Then, the International Frequency Registration Board (IFRB) would draw up seasonal plans season by season after WARC-HFBC-1986. At WARC-HFBC-1984, it would be necessary to resolve two major tasks:

- a fixed master list of actual and projected programme requirements would need to be drawn up;
- this list would have to be adjusted during the Conference so that in the worst case encountered during the life-time of the planning process, all requirements could be reasonably satisfied."/11/

With this system, as I said, powerful computer facilities are essential. Aside from this, the other major problem is in amending the schedule after the conference. This would be problematic because changes would be restricted by other stations currently using the bands. If a station wanted to broadcast in a band that was already congested, problems would occur in maintaining the required minimum signal-to-interference ratio. Hence, the end result would be unacceptable. The ultimate success of this method depends on the size of the list submitted to the conference so that all proposed requirements would be satisfiable. The overall EBU-CBC rating of this method is 15.

Establishment of the master list of requirements during the Conference

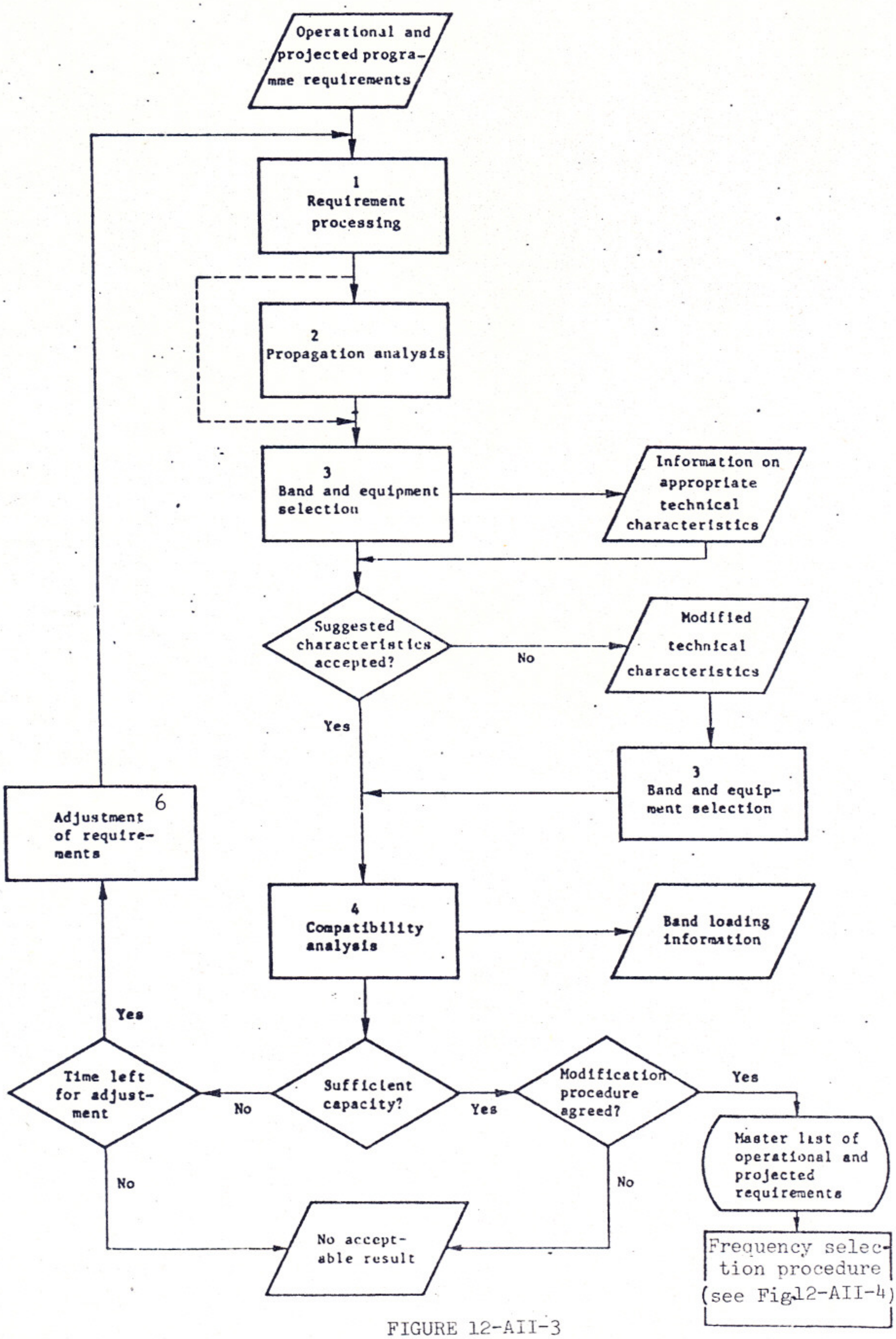



FIGURE 12-AII-3

Method 4

Establishment of seasonal frequency-assignment plans after the Conference

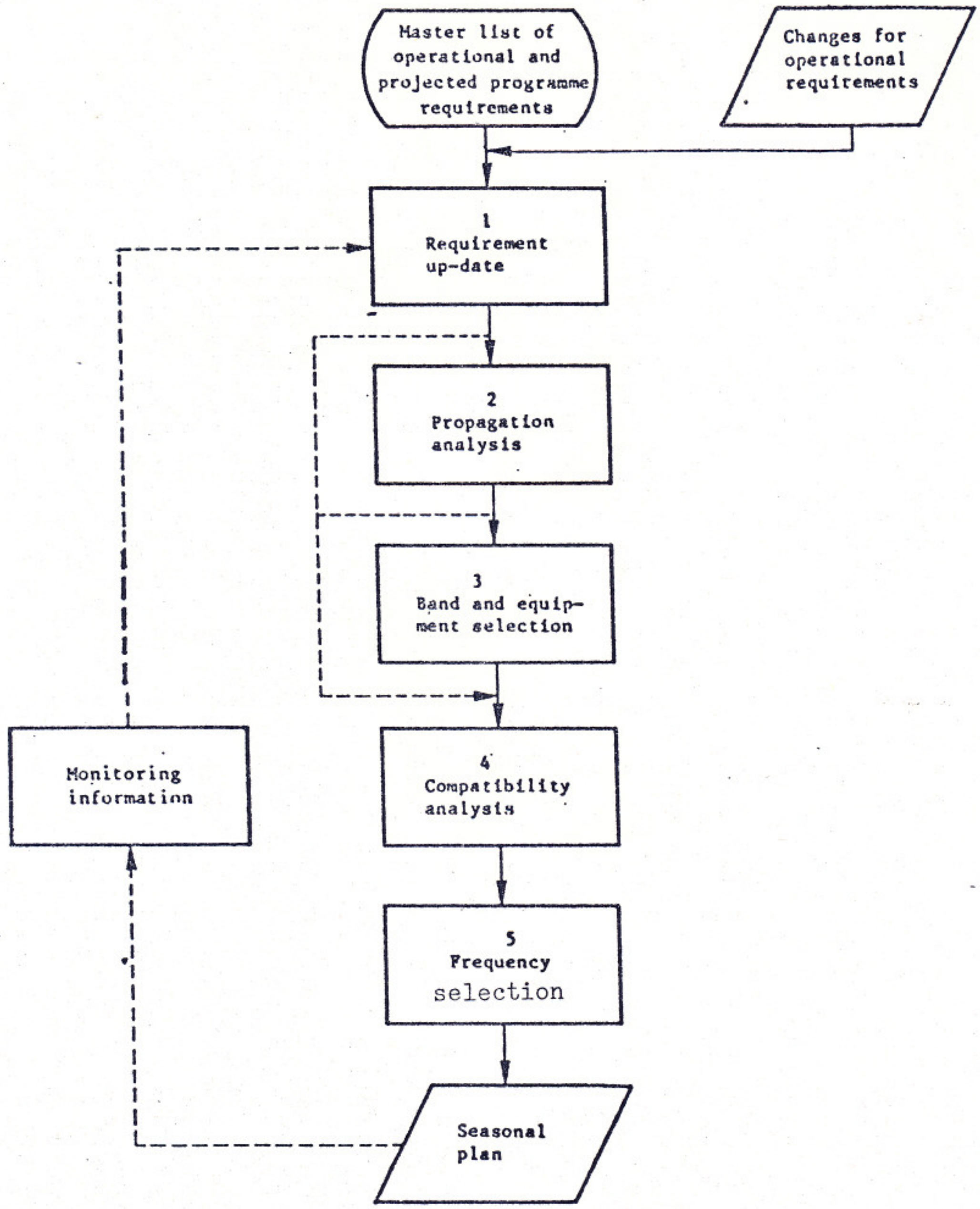



FIGURE 12-AII-4

Method 4

Modification of the master list after the Conference

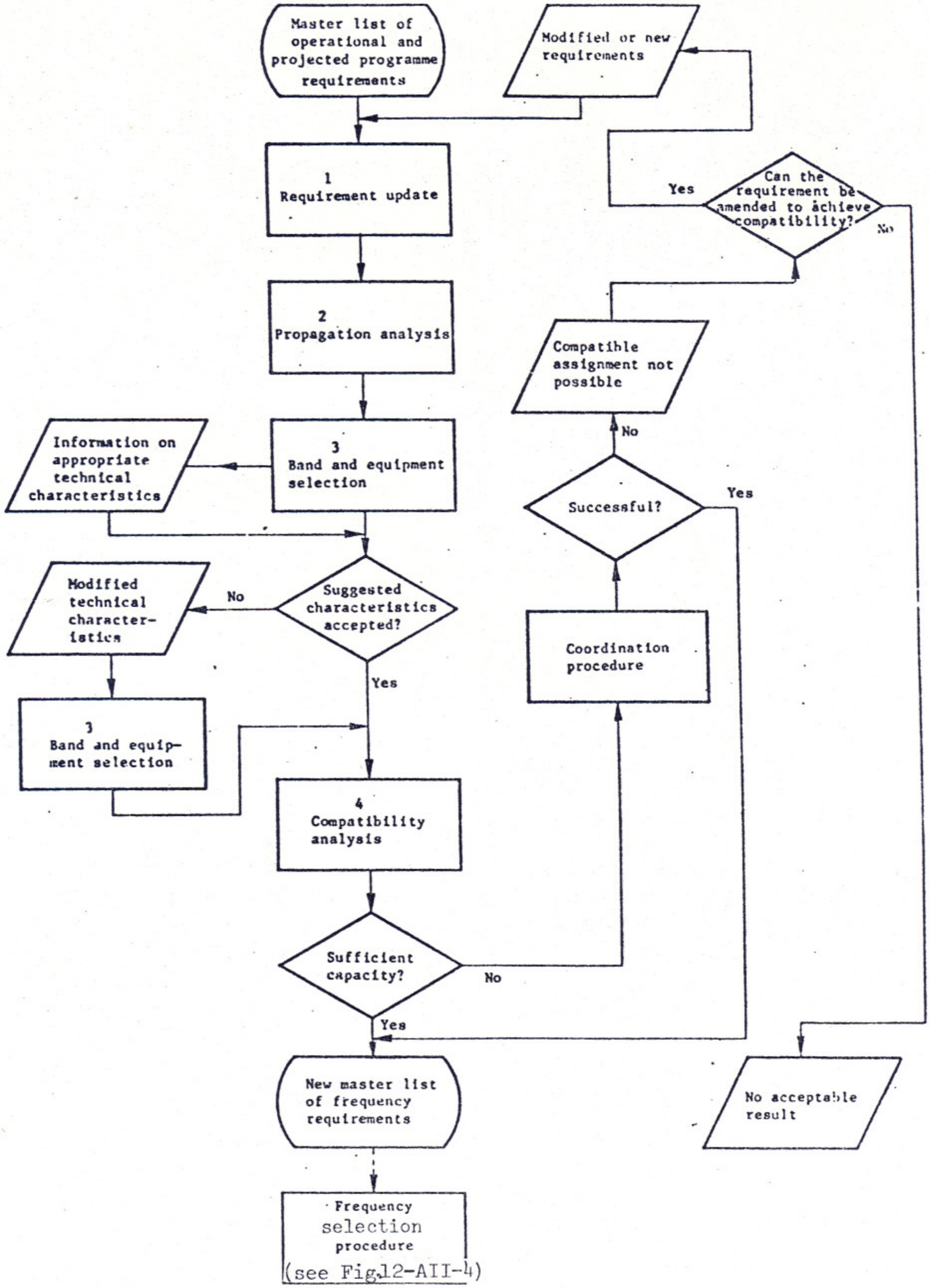



FIGURE 12-AII-5

Method 4

Planning Method No. 6: A frequency-assignment process based on numbered requirements in frequency-hour units on a seasonal basis

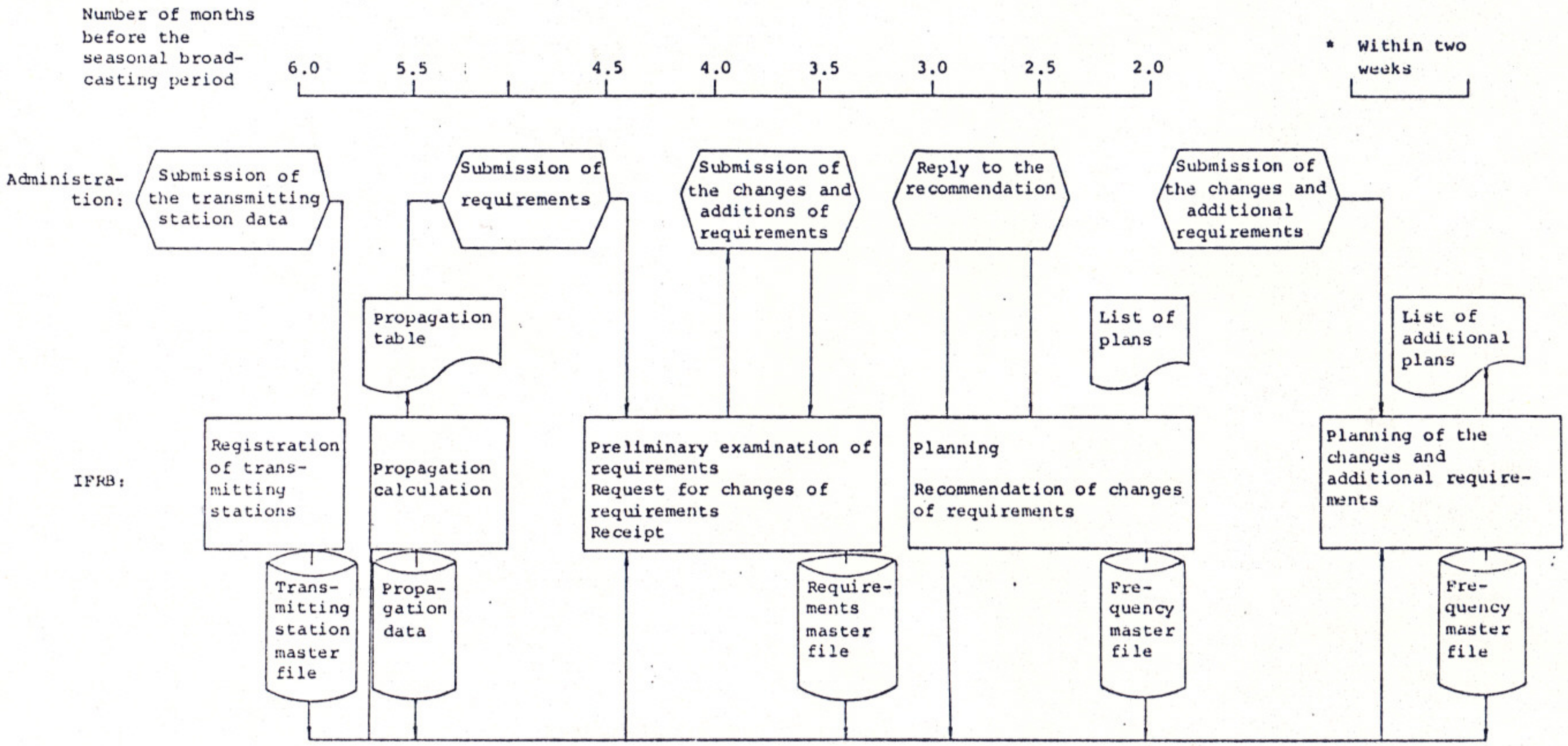
This method proposed by the Japanese delegation to the conference/12/ is perhaps the most complicated and highly computerized of the proposed solutions. Given that the band space available for use is finite, this solution tries to satisfy requirements in order of priority. The process begins six months before the planning occurs, and follows the order of steps illustrated in the flowchart.

what order? there are no numbers - will your reader understand this

This system forces administrations to list their requirements and technical objectives for the planning board in such a way that no service reliability checks are necessary at the IFRB. Aside from this, the only real weakness of the system is in the protection ratios. After the planning has been done, several administrations must suffer from excessive interference. They will be notified two and a half months before the new season if they will be so affected, but the decreased signal-to-interference ratio is still irreparable. Hence, the major difficulty with this system is obvious. This system was rated 16 by the EBU-CBC method.

Planning Method No. 7: Round-after-round processing

The Chinese proposition involves allocating at least one frequency per programme with acceptable signal-to-interference ratios. Then, where possible, other additional frequencies will be allocated. Problems might occur when stations with a high broadcast reliability to maintain aren't allocated sufficient frequencies. Then, they might add frequencies on their own, causing interference to others. The EBU-CBC rating for this method was 13.




* The changes and additional requirements should be submitted by [ two ] weeks before the expiry of the seasonal broadcasting period concerned.

FIGURE 12-AII-7

Outline of the planning in every seasonal broadcasting period

Insufficient title for the figure. - what method #?

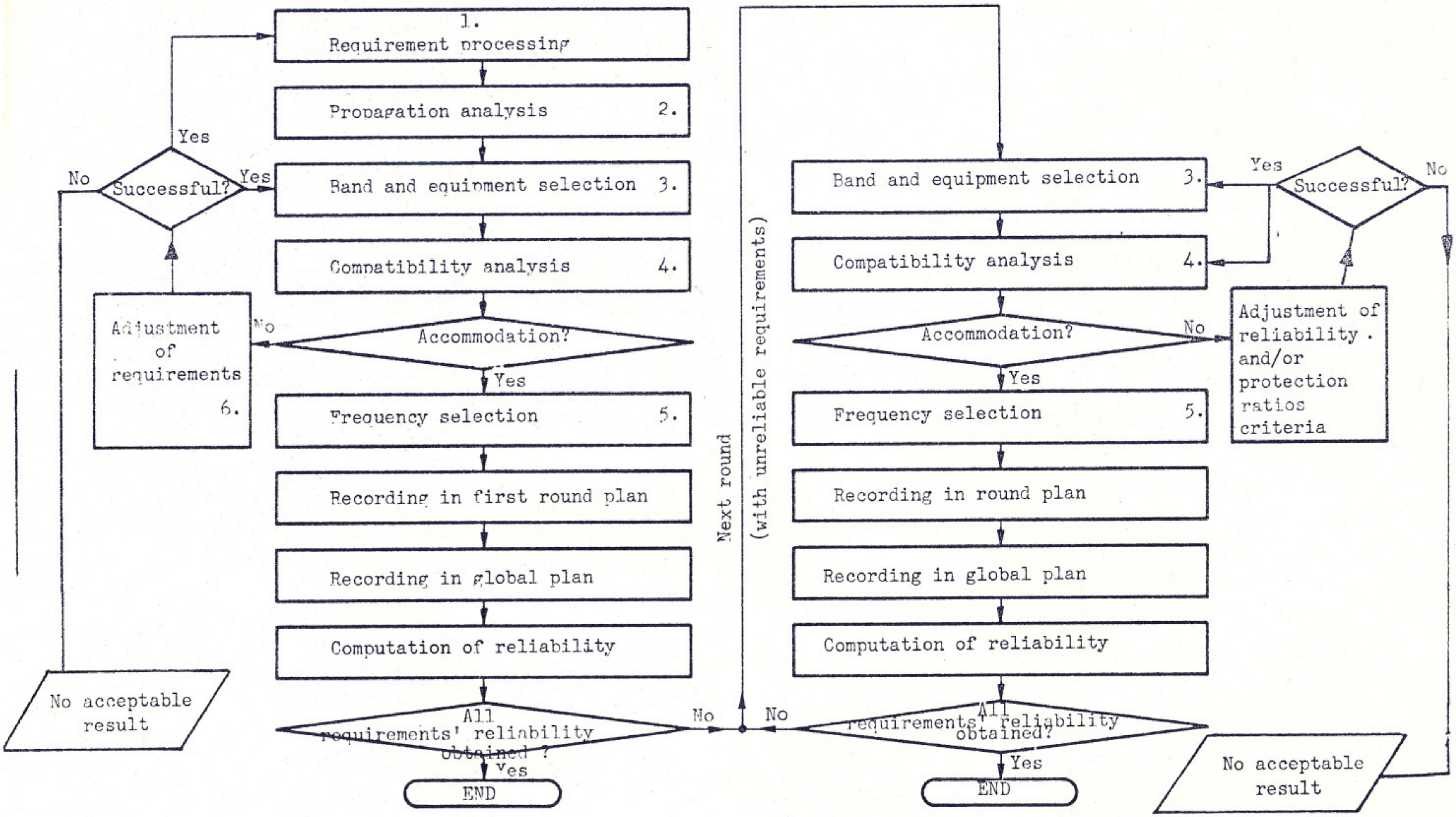



FIGURE 12-AII-11

Method 7

Planning Method No. 5: Coordinated seasonal planning method based on broadcast requirements

This Canadian proposal to the conference is similar to planning method no. 4, with four notable differences. One is that the master list of requirements would not be restricted through a complicated modification process, but rather a more evolutionary list, changing from season to season. A problem occurs here, for the chance of finding a satisfactory result is considerably reduced, and the conference can not test the worst-case conditions due to the evolutionary process involved. The second difference is that this method would only produce tentative schedules, not seasonal plans, with a list of problems and recommended solutions for the involved administrations to consider. The third difference is that the frequency selection is continuous, since each new schedule is based on the previous season's schedule. The fourth difference is the seasonal schedule would be formed by the IFRB after the tentative schedule problems are resolved. Then, "the definitive schedule would be produced before the season concerned has started."/9/

This solution is the best solution to the problem proposed. It treats all administrations fairly as equals, and allows for modifications and adjustments without any constraints on them. It is also certain that no frequencies would be blocked for projected requirements. This solution was rated 17 by the EBU-CBC system, which is the highest rating they gave to any of the systems. Incidentally, a very significant point is that the WARC-HFBC adopted a system very similar to this system with slight modification for use inthe planning of the HF bands.

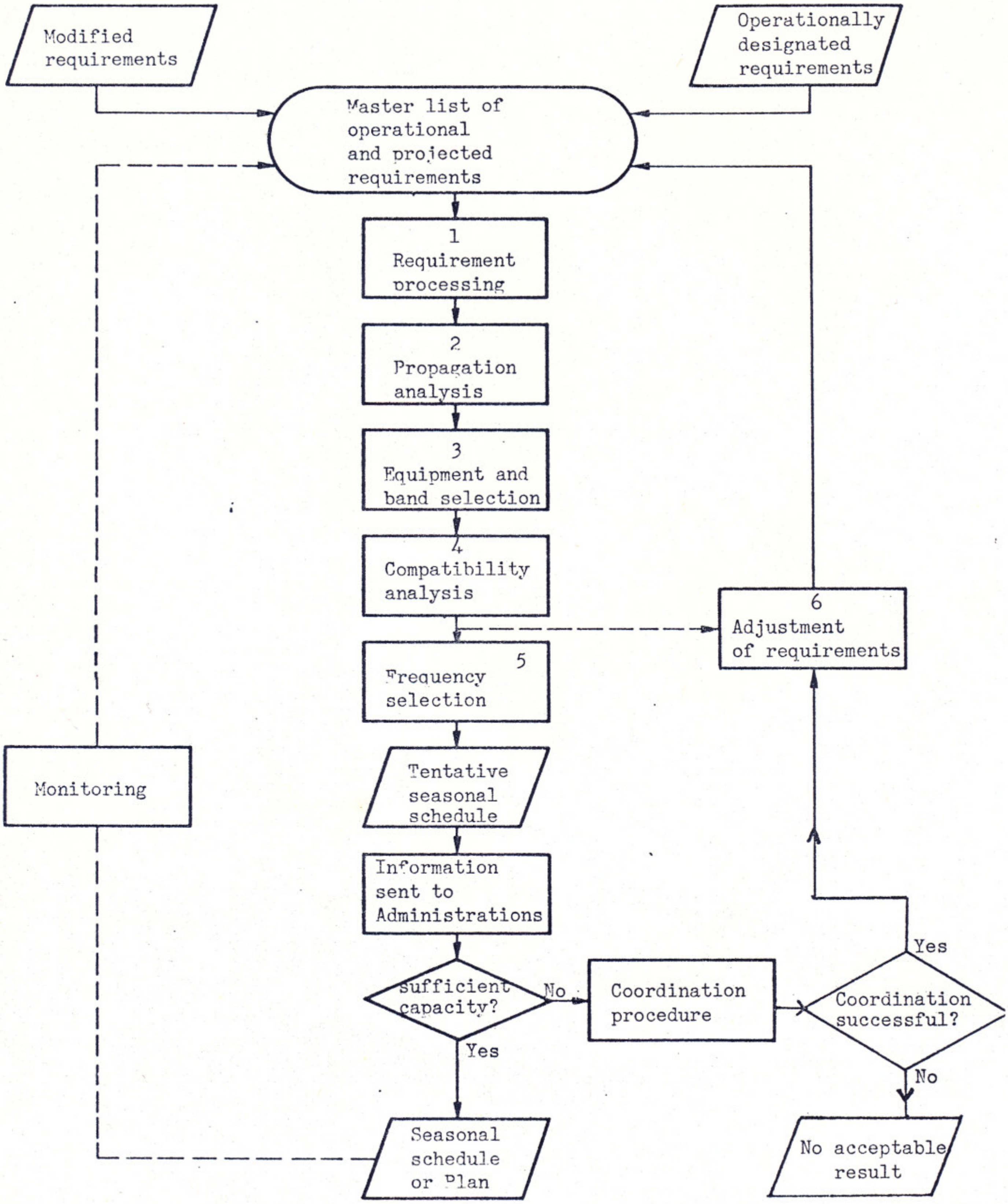



FIGURE 12-AII-6

Method 5

Overall Evaluation of planning procedure

In essence, the planning method most suited for use in the HF bands was adopted by WARC-HFBC-1984, that being the Canadian plan no. 5. Throughout the next several years, we will be able to see how effective the adopted system is in reality, and thus evaluate the validity of this decision. In any event, it is at least a step forward from Article 17, which is currently in use. The effort has been made, and now, it is up to the IFRB to institute the plan. However, it is ultimately in the hands of the various administrations to coöperate among themselves to realize the goals of the solution. Without international coöperation in this issue, failure is inevitable. Still, this writer hopes to see this [reference] implemented successfully in the upcoming years.

~~you need a conclusion for your whole paper - what have you shown~~ or proved?

(sorry - missed the ff. page!)

Results of WARC-HFBC and their Benefits

The WARC-HFBC-1984 decided to establish the SSB system and the Canadian planning method to relieve congestion in the HF bands. When both of these are implemented, I feel confident that I will spend no more sleepless nights sulking over the impairment of reception of stations I enjoy, like Radio Earth and, of course, Radio Netherlands. After the implementation, our world will be a better place to DX in.

doesn't this confirms that your paper merely explains without analyzing except in terms already identified by WARC-HFBC?

clever, but do you mean to imply that DX will indeed be trouble-free after implementation?

## REFERENCES

what determined the order of these references?


/1/ Eden, H.: Technical Aspects of the Introduction of SSB Operation in HF Broadcasting.
IFRB Document SEM HFBC No. 110/83-E, October 1983.

/2/ Closure of the First Session of the World Administrative Radio Conference for the Planning of the HF Bands Allocated to the Broadcasting Service.
ITU Press Release 84-1, 11 February 1984.

/3/ Report to the Second Session of the Conference.
WARC-HFBC-1984 Report, 11 February 1984.

/4/ Technical Bases for the First Session of the World Administrative Radio Conference for the Planning of HF Bands Allocated to the Broadcasting Service.
CCIR Document, Geneva, 1983

/5/ Vastenhoud, J.: WARC 1984 - International Conferences in 1984 and 1986 Will Determine the Future of Shortwave Broadcasting.
World Radio TV Handbook, Vol. 38, 1984, pp. 44-46

/6/ van Amstel, W.: SSB: Facts, Fiction, and Fairy Tales.
World Radio TV Handbook, Vol. 36, 1982, pp. 576-579.

/7/ IFRB Handbook on Recommended Techniques for Better Utilization and Reduction of Congestion of the High Frequency Radio Spectrum.
IFRB Document, Geneva, 1 August 1973, pp. III-39—IV-20.

/8/ Gröschel, G.: Technical Parameters of a Future Single Sideband Transmission System for HF Broadcasting.
EBU Review-Technical, No. 201, October 1983.

/9/ Edwards, J.K. and Kopitz, D.: Technical Preparations for the First Session of the HF Conference in 1984.
EBU Review-Technical, No. 201, October 1983.

/10/ Jackson, G.: Préparatifs de Radio-Canada à la Conférence de la Planification de la Radiodiffusion sur Ondes Courtes.
Revue Technique de Radio-Canada, Vol. 23, Montréal, May 1983, pp. 15-20.

/11/ Edwards, J.K. and Kopitz, D.: Technical Preparations for the First Session of the HF Conference in 1984.
Draft of article in EBU Review-Technical No. 201, October 1983.

/12/ Proposals of Japan to the First Session of the World Administrative Radio Conference for the Planning of the HF Bands allocated to the HF broadcasting service (Geneva, 1984)
Document submitted to the Conference by Japan.

/13/ Einseitenbandbetrieb.
Deutsche Welle pamphlet, January 1982.

/14/ Der Kurzwellenempfang.
Deutsche Welle publication, 1982.

/15/ All Around Dx'ers Course.
Radio Nederland Wereldomroep publication.

Name Joseph Terwilliger

14.6

EN112B Research Paper Specification Sheet

| Points | Specifications | | Comments |
|---|---|---|---|
| (7.0) | ARGUMENT - | 5 | |
| 1.0 | thesis: clear & arguable | .2 | What is your thesis? Is it arguable? I don't see it. |
| .5 | terms are defined when necessary | .3 | hard to determine how much of your paper is really in terms the lay person would understand - see indiv. comments |
| 1.0 | organization: logical & interesting | 1 | excellent organization |
| 1.5 | evidence: relevant | | the criteria by which you evaluated the proposed planning methods should be explicit |
| .5 | reliable sources | | |
| .5 | range of sources | 2.5 | data are absolutely current and diverse. good leg work here! |
| 1.0 | refutation: opposition considered | 1 | your purpose is unclear here - on the one hand you are translating + advocating the WARC position, on the other, you are critical - difficult shift for the reader. |
| 1.0 | countered convincingly | | |
| (4.5) | STYLE - | 3.2 | |
| .5 | accomodation: audience is clear consistently addressed | .3 | style is consistent but confused purpose makes it unclear who you are addressing |
| .5 | tone: respectable, but not deadly | .5 | very professional, but personal touch at beg. + end are equally appealing |
| .4 | title: catches attention represents content | .2 | clever, but misleading |
| .6 | opening paragraph: purpose & pizazz | .3 | very slow getting to the point catchy but a bit vague |
| .5 | conclusion: recapitulates content suggests further thinking | .4 | good |
| .5 | transitions are smooth | .4 | usually |
| 1.0 | quotations: balanced with paraphrase & original ideas, well chosen | .6 | original ideas are hard to identify - quotes well chosen but charts are borrowed too frequently. |
| .2 | long quotes are framed | .2 | |
| .3 | subheadings are parallel & logical | .3 | small problem - see comment |
| (3.5) | FORM - (Indicate style manual used.) | 2.6 | I need a prototype. |
| 1.0 | citations | .5 | may be done correctly, but not enough - big problem! |
| 2.0 | reference list, end notes if used | 1.8 | what order? |
| .5 | subheadings & manuscript form | .3 | no page #'s, some subheadings don't differentiate levels of specificity |
| (5.0) | QUALITY overall quality of ideas & expression | 3.8 | your massive effort to analyze a new + changing phenomena was worthy but problematic |