Reflections upon a near-past
T-DAB conference

*"If there be nothing new, but that which is
Hath been before ..."*

William Shakespeare

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With the 2002 CEPT Maastricht Conference now behind us, this article provides an insight into some of the more important decisions made on the future spectrum availability for T-DAB services.

Background

Much of the background to the CEPT Maastricht Conference [1] (10 - 18 June 2002, Maastricht, Netherlands) was given in a previous article by two of the authors [1]. However, it seems worthwhile to review some aspects of the conference, for the sake of completeness, and to try to place the Maastricht Conference in the context of a process of more-or-less continual development – a process which continues and which will continue to continue for some considerable time. After all, it must be remembered that any given planning conference is only the start of a process. The 1961 Stockholm Conference (ST61) is a good example as the work started there and is still being developed. Only very recently, it was decided that the time has come for a replacement.

Actually, a reference to ST61 is relevant in another sense. The 1961 Stockholm Conference followed, and built upon, the 1952 Stockholm Conference. In a similar way, the 2002 Maastricht Conference followed, and built upon, the 1995 Wiesbaden Conference. Even the gaps between the two parts of these two conferences are similar, in spite of the well-known belief that the pace of life is constantly accelerating.

As is well known, the Wiesbaden Conference provided the basis for the deployment of T-DAB services in Europe in an equitable way. However, in 1995 it was only considered necessary, in the general case, to plan for two T-DAB services in any one area and, certainly, this is all that would have been possible at that time. Since then, it has become increasingly apparent that there is a need for an additional service "layer" – one which allows for rather smaller, or even much smaller, distinct coverage areas than those which were considered at Wiesbaden. The ability to have smaller distinct coverage areas allows for more localised programmes to be provided, while also allowing areas to be grouped together where such a need exists. This is a recognition of the

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1. The term 'Conference' is used for convenience and because it will be a familiar concept to most readers. The fact that, for legal reasons, a somewhat different terminology was employed to describe the meeting which took place in Maastricht is not relevant here.

increasing importance of local broadcasting, where the meaning of the term "local" varies considerably from one country to another, or even from one part of a given country to another. Cultural differences are perhaps increasingly important in a Europe which seems to be becoming ever larger and ever more uniform, and local radio services are one way of providing some of the necessary cultural diversity. Certainly, it is rather difficult to see how "pan-European" services could fill such a role.

While it can be seen that Maastricht follows in a pattern started at Wiesbaden, it cannot necessarily be assumed that it was "nothing new", in the sense implied by the opening quotation.

Of course, planning conferences do not just happen: they are the result of a large amount of preparation, both from a technical and from an administrative viewpoint. In particular, there are usually many preparatory meetings, at several different levels, and Maastricht was no exception to that general rule.

Preparatory meetings

Most of the technical preparations for Maastricht were made in the CEPT project team commonly known as FM 32 – with endorsement, when needed, from CEPT WG FM and the (then) ERC.

FM 32 started its work in 1997 and held a total of 13 meetings, including one extraordinary meeting, initially under the chairmanship of Manfred Mägele (Germany) and subsequently under the chairmanship of Chris van Diepenbeek (Netherlands). It was able to establish very rapidly that a total of about seven additional blocks in the 1.5 GHz band would be needed, if the coverage areas were of about the same size as those for the "second priority" requirements which were dealt with at Wiesbaden. These seven additional blocks would need to be taken from the spectrum then being held in reserve for S-DAB services which, at that stage, did not seem to be of much interest to anyone. It seemed that it should be possible to hold a planning conference very rapidly, say, in 1999. However, this optimistic belief did not take account of the sudden upsurge of interest from potential S-DAB proponents.

This interest needed to be taken into account in the work of FM 32 and resulted in extremely lengthy discussions which, among other things, went into very fine detail about the characteristics of the T-DAB system and, in particular, about whether it was still (only a few years after Wiesbaden!) an appropriate system choice. These discussions often seemed to involve the same points, as if repetition in some way made them true. (Here, the opening quotation seems to have been written especially to represent what was happening, although it is rather doubtful if even Shakespeare was that far-sighted.) On the other hand, and in retrospect, this can be seen to have been a very bad mistake, as the S-DAB proponents were not pressed to provide any significant technical details about their proposals. Of course, any questions which were asked were normally met with the response that further detail could not be given because of "commercial confidentiality". This aspect will be returned to later.

These discussions took a large amount of time and thus delayed the planning conference from 1999 (which was the first proposal) until 2002, which was the reality. However, overall, there does not seem to have been much practical impact on the system characteristics for T-DAB to be used in planning, nor on the tasks for the planning conference, nor on the amount of spectrum which was made available to accommodate the requirements. In fact the final decisions in this regard, taken by the ERC, were to proceed with the T-DAB planning conference with more-or-less the same T-DAB technical criteria as those which had been used at Wiesbaden. There were two changes. One was to use an updated receiver noise figure, as recommended by the receiver

Abbreviations

CEPT	European Conference of Postal and Telecommunications Administrations	**S-DAB**	Satellite - Digital Audio Broadcasting
		ST61	Stockholm Frequency Plan of 1961
DAB	Digital Audio Broadcasting (Eureka-147)	**T-DAB**	Terrestrial - Digital Audio Broadcasting
ERC	European Radiocommunications Committee of the CEPT	**ITU**	International Telecommunication Union
		WARC	(ITU) World Administrative Radio Conference
LAN	Local Area Network		

manufacturers, and the other was to allow for two new "reference networks", thus bringing the choice for any one requirement up to a total of three reference networks.

In fact, the delay can be seen to have provided a very large advantage for T-DAB! It allowed a better definition, based on more practical experience, of what types of services and how many requirements were really needed and, above all else, it allowed time for improvements in computer technology. In view of the very large number of T-DAB requirements which were actually dealt with at Maastricht (some 2000, compared with about 750 at Wiesbaden), it is extremely improbable that the computers available in 1999 would have been able to deal with the task in the time which was available at that conference. At the very least, they would not have been able to give as good a result as that which was achieved. In this respect, the T-DAB proponents owe considerable thanks to the S-DAB proponents, although the latter may not have quite the same reactions about the results of their efforts.

As was noted in the earlier article [1], FM 32 undertook a number of preparatory data collection exercises. Initially these served to identify difficulties with the data collection process and with the data themselves. Because of the lessons learned at Wiesbaden and because more time was available, the data-checking process was significantly more thorough than was possible at Wiesbaden and included checks on the reasonableness of the boundaries of the T-DAB requirement areas. In this latter process, the efforts of the S-DAB proponents must be acknowledged.

Towards the end of the work in FM 32, the data were used as the basis for a series of planning exercises and these exercises were undertaken with the conditions that:

❍ the nine Wiesbaden 1.5 GHz blocks (identified as blocks LA to LI) and the next seven blocks (identified as blocks LJ to LP) could be used for T-DAB;

❍ the blocks above LP would be available for S-DAB;

❍ Other Service requirements would be taken into account.

It was only at the end of the work in FM 32 that the protection criteria for S-DAB (against potential interference from T-DAB) were finally agreed and there was not really enough time available to examine them in the detail which would have been desirable. It can be argued that, as a result, the protection criteria were rather generous. As an example, one can quote the equivalent separation distances over water that are necessary for S-DAB (more than 300 km) and for T-DAB (0 km), both being calculated for the case where adjacent blocks are used. On the basis of the protection criteria agreed, it seems that any possible S-DAB service may be rather sensitive to interference effects.

Planning exercises

Planning exercises can fulfil many purposes, but their primary roles in this case were:

❍ to identify what could be done in terms of accommodating as many as possible of the input requirements;

❍ to identify any specific parts of the planning area which seemed to have particular problems;

❍ to identify and eliminate, as far as possible, any "bugs" in the planning software [2];

❍ to provide a means for exploring alternative approaches.

The actual process involved was to identify by means of analyses:

❍ the requirements that could not share any given block;

❍ the blocks which could not be used by any given requirement because of constraints created either by the Wiesbaden allotments, by S-DAB requirements or by Other Service requirements,

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2. In this context, it is important to remember the truism that *"debugging is the art of removing known errors while, at the same time, adding unknown ones"*!

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General view of Pater Vinktoren, a local landmark in Maastricht

... and then to use the results of the analyses to synthesize a plan which contained as many as possible of the T-DAB requirements.

Here, at least, there was a new approach – compared with Wiesbaden – in that a large number of planning exercises (more than 20) were carried out between the final meeting of FM 32 and the start of the Maastricht Conference. Most of these involved only a single country, or a small group of countries, and were intended to identify areas where significant planning difficulties could be expected. The intention was to allow the countries concerned sufficient time to carry out some private co-ordination to reduce the number of problems to be dealt with at the conference or, at least, to allow them to consider individually what might need to be done. In all of these cases, only those countries concerned saw the results of the exercises. However, the results of other planning exercises were widely distributed and led to a decision that any interaction between T-DAB and Other Services (with the exception of S-DAB) would be dealt with by means of administrative agreements and that there would thus be no attempt to "plan around" such Other Services. This was certainly "something new" and helped enormously in the smooth running of the conference itself.

Maastricht itself

For the purpose of this article, no real distinction will be made between the work undertaken in the first six days (which was, strictly speaking, an extraordinary meeting of CEPT WG FM) and the final two days (which was a multilateral meeting of CEPT administrations), except to note that the first part, which was chaired by Reiner Liebler (Germany), dealt primarily with the production of the Plan and that the second part, which was chaired by Chris van Diepenbeek (Netherlands), dealt primarily with the production of the Agreement. This may be the place to note that the ability of chairmen to remain both focused and outwardly calm, in spite of the provocations created by the delegates(!), is an important part of any conference.

In fact, a rather different quotation (also from William Shakespeare) may be more appropriate with regard to the work at the Conference:

> *"Weary with toil, I haste me to my bed, ...*
> *But then begins a journey in my head ...*
> *And keep my drooping eyelids open wide, ..."*

As is the case with many conferences, the hours for working were too many, the hours nominally available for sleeping were too few and there were always things to be thought about which reduced the actual sleeping time too much. One result is that, for the authors at least, the memories of what really happened during the Maastricht Conference cannot be claimed to be entirely clear. It is hoped that any reader who was present will forgive the lack of detail and even the errors in what follows.

It is, however, certain:

❍ that considerable use was made of electronic working, including document distribution by both fixed and wireless LAN, on which more than 75 GB of data were transported;

❍ that there was an uncountable number of hours spent in co-ordination efforts between the 150 delegates;

❍ that there were nearly 2700 agreements reached between administrations, of which 445 have been retained in the final agreement;

❍ that 12 planning exercises were carried out, including an analysis of the Final Plan;

❍ that more than 500 pages of output documentation were produced, the Final Acts being signed by 33 administrations;

❍ that there were some errors, some friction and a great deal of co-operation;

❍ that allotments were made to 1916 new requirement areas and only seven requirements remained unsatisfied at the end of the conference.

Some items from this list are worth looking at in more detail – as they can provide guidance and even improvements for the conduct of future conferences.

Electronic working

This item is not entirely new – even at Wiesbaden a large amount of data capture and transfer was done electronically. However, Maastricht went much further and, in particular, used direct electronic transfer as the method for processing the agreements which were reached between administrations (and those reached within a single administration). In addition, the results of calculations were distributed only via the LAN arrangements which were set up. Of course, there was still some use made of data transfer on diskette, and even some paper-based transfer, but the large majority of transfers were made electronically.

Administrative agreements

In many respects, the existence of agreements between administrations was the key to the success of the Maastricht Conference. There were several elements to such agreements.

One such element was an agreement within a single administration that a number of its contiguous requirements could share a single frequency block, if necessary. In effect, this created a new larger requirement from two or more individual requirements and was particularly useful where there were simply too many requirements in a given area. In practice, such problems arose in areas where there were several countries with a common and relatively small sea area between them, and where there were many T-DAB requirements in the coastal area. Such areas present problems because of the characteristics of over-sea propagation for the small time percentages which are particularly difficult from the point of view of interference avoidance.

There was another solution to the type of problem noted in the previous paragraph and that was to change the "type" of the reference network in order to use one with a lower interference potential – even if it might not be the best fit to the service needs of the T-DAB requirement. In effect, this is a process of making the planning easier and accepting that the implementation is likely to be made more difficult. In some cases, this even involved a rather more far-reaching solution which was to split a large requirement area into two or more smaller ones. While this may seem to be in contradiction to the "solution" described above, it really only means that the requirement areas should be neither too large nor too small, nor should they be too different in size in adjacent countries.

Another element was an agreement between two administrations that two T-DAB requirements (one from each administration!) could share a single frequency block, if necessary. This provides a mechanism for the acceptance of relatively small amounts of interference or the acknowledgement that there are specific reasons – for example, the particular topography involved – why it is believed that interference will not occur in practice.

A further element is related to Other Services and deserves special mention here.

Other Services agreements

A very important decision taken within the CEPT was that the protection of Other Service requirements from interference by T-DAB, or the reverse, would be achieved by means of agreements governing the date of entry into force of the relevant T-DAB requirement. This apparently simple decision had very far-reaching effects. It meant that it was not necessary to constrain the frequency-block choice for any given T-DAB requirement – because of the current existence of some Other Service implementation which would later be discontinued – then have to go through a potentially lengthy process of negotiation about start dates and subsequently have to reconsider the block availability for the same T-DAB requirement. At Wiesbaden, a similar outcome was achieved but by means of a process which involved separate agreements for each T-DAB requirement, possibly for each of the frequency blocks which it might potentially use.

Planning exercises

As noted above, there were 12 planning exercises carried out at Maastricht. In fact, these were concentrated into the first four days and nights of the meeting and many of them were for specific areas where there were particular planning problems, always involving over-sea propagation! As a guide for the future, it could be argued that more attention should have been given to the previously identified problem areas and that administrations should have made more attempts to solve the problems before the start of the Maastricht Conference. However, it is human nature that things which look difficult are usually left to the last minute – or just after! This is a common feature of many conferences and also applies to writing articles, this one being no exception!

Documentation and errors

These two elements are placed together because they have some common features. At conferences, there is always a large amount of documentation and there are always some data and computation errors. The real questions which need to be asked are whether the documentation can be produced in advance and whether the errors can be foreseen and, in particular, if precautions against them can be taken. In both cases, the answer seems to be a partial "yes". No matter how much documentation is prepared in advance, there are always surprises when it is found that not everyone interprets even simple phrases in the same way (what happens with complicated phrases is best left to the imagination). It does not seem to be possible to avoid all such differences of interpretation, no matter how much effort is deployed in advance and it looks as though we all have to live with the fact that a conference will spend a large amount of time making relatively small changes to the output documentation (and also usually failing to make some changes which the participants later wish had been made!).

Similarly, it does not seem to be possible to foresee and deal with all potential data and computation errors. Again, human nature plays a large part. It is always the case that some potential errors may be foreseen and then dismissed on the grounds that "surely nobody would do that". No matter how improbable, it seems to be the case that somebody will indeed do just that! However, this does not really help – the list of potential errors is so large that if precautions were to be taken against all of them, it can be guaranteed that no useful results could be provided at all.

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A pleasant way of passing some spare time when in Maastricht — regrettably the Conference delegates had no spare time!

Errors, like last minute changes to documentation, are just something which we have to live with and deal with as they occur.

Final Acts

The Final Acts of the Maastricht Conference contain all of the 1.5 GHz allotments agreed at Maastricht and all of those agreed at Wiesbaden. The Final Acts from the Wiesbaden Conference were revised to take account of this transfer of the 1.5 GHz allotments and now only contain the allotments in the VHF band. The task of preparing much of the administrative documentation for the Final Acts was undertaken in advance by the extraordinary meeting of FM 32 which goes some way to explaining how it was possible to deal with it in little more than two days at Maastricht.

Overall impression

As the Maastricht Conference was able to agree allotments to 1916 new requirements, and to agree the methods to ensure that their implementation does not create unsolvable interference nor unacceptable delays, it is

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Mr Hunt joined the EBU in 1985 and took early retirement at the end of 1999. Since then, he has continued to work for the EBU as a consultant, concentrating on the interactions between the EBU and organizations dealing with frequency management. He continues to decline to be photographed whenever he can avoid it.

Terry O'Leary received a doctorate in Physics at the University of California. In 1975, he joined the *Institut für Rundfunktechnik* (IRT Munich) where he conducted research on a range of topics including propagation, antennas, and terrestrial network and satellite planning.

In 1979, Dr O'Leary joined the EBU Technical Department where he became involved in many projects within the framework of EBU Working Party R. From 1984 to 1990, the IFRB benefited from his specialist knowledge of HF and television network planning. He returned to the EBU in 1990 and was involved in T-DAB planning, WARC'77 BSS replanning and other projects.

Terry O'Leary took part in the Maastricht conference in June 2002 and is looking forward to the replanning of the ST61 plan.

Darko Ratkaj graduated in 1991 from the faculty of Electrical Engineering at the University of Zagreb, Croatia. He then undertook postgraduate studies in radiocommunications at the University and obtained an MBA in project engineering from the Zagreb Business School. After graduation, he worked for two years as a research associate in the field of electronic measurements within the faculty of Electrical Engineering, University of Zagreb.

In 1993, Mr Ratkaj joined the Croatian Ministry of Maritime Affairs, Transport and Communications, as a technical advisor for frequency management, where he was responsible for planning and international co-ordination of terrestrial fixed and mobile services as well as for the development and implementation of an IT system for frequency management.

In 1999, Darko Ratkaj joined the European Radiocommunications Office as a frequency management expert. His main responsibilities in the ERO are T-DAB Plan management and support to the CEPT/ECC in the area of frequency management and spectrum engineering. He is particularly involved in the CEPT activities concerning the introduction of T-DAB and DVB-T, and in the preparations for the forthcoming ITU RRC-04 conference to revise the Stockholm Agreement of 1961. He took part in the Maastricht conference in June 2002.

clear that it was a great success. Such success depends very largely upon the willingness of administrations to accept compromises which are intended to improve the overall situation – even at the expense of some inconvenience – and upon the willingness of delegates to work long hours and to remain both calm and concentrated. At Maastricht, as at most conferences, success comes from the people involved.

Most delegates seemed to leave the Maastricht Conference in a happy frame of mind. Indeed, some were heard to say, *"What about a conference for the fourth priority requirements?"*. However, there is a great deal of work to be done before that, in terms of implementing the allotments already agreed.

Bibliography

[1] K. Hunt and T. O'Leary: **Reflections upon a near-future T-DAB conference – or making "war on this bloody tyrant time"**
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