

## HIGH DEFINITION TV

The next technological generation of television (High-Definition Television - HDTV) is being pursued in Japan, USA and Europe. The European collaborative effort envisages the use of a pan-European technical standard whose viability is under question due to the merger of SkyTV and BSB, and other factors.

*This Briefing Note examines HDTV development worldwide and issues related to the future of this technology in Europe.*

### ADVANCES IN TELEVISION

The viewing public has been able to choose between an increasing number of TV systems in recent years. As well as BBC1, BBC2, ITV and Channel 4 broadcasts from terrestrial transmitters, satellite TV has become popular (over 1 million UK homes have receiving dishes). Cable television serves increasing numbers of subscribers, transmitting videos, satellite TV channels and even interactive services like home shopping. Local broadcast TV is also becoming practical. Finally, if none of these appeals, there is the video recorder.

While the choice of TV-based entertainment has grown, the TV picture has remained little changed. Since the 1960's, UK pictures have been composed of 625 lines and 25 picture 'frames' are broadcast every second. The screen format has remained constant with a width to height ratio of 4:3.

Advances in electronics offer a range of options to improve the quality of TV pictures. Current systems can be upgraded through various approaches to give 'Enhanced Definition' Television (EDTV). For example, wide-screen TVs for viewing national satellite TV have just been put on sale in France. In Japan, EDTVs called 'Clear Vision' are available which give better colour reproduction and sharper pictures equivalent to a doubling of resolution. A number of countries are also working towards even more advanced systems of 'High-Definition' Television where the number of lines per screen is over 1,000, providing a clearer picture with

1. 'EUREKA 95' involves 30 European collaborators, including electronics companies, such as Bosch, Philips, Thomson, Ferguson and Nokia, research institutes and broadcasters. Over the last three years, the DTI has contributed £5M of the total project costs of £300M.

### Box 1 COUNTRIES SERVED BY VARIOUS BROADCASTING SYSTEMS

|              |   |
|--------------|---|
| <b>NTSC</b>  | Used by 32 countries, including the US, Japan, Taiwan, South Korea, most of South America and islands in the Caribbean and the Pacific.   |
| <b>PAL</b>   | Used in 63 countries, including the UK, Germany, Spain, Scandinavia, Ireland, Iceland, Australia, New Zealand, China, nations in the Middle East, Africa, South America, Asia and Western Europe. |
| <b>SECAM</b> | Used in 42 countries, including France, the USSR and other nations in the Middle East, Africa, South America, Asia and Eastern Europe.  |

colours appearing truer to life. HDTV can also employ wide screens to give images a cinematic quality.

### WORLD BROADCASTING STANDARDS

TV has to be broadcast using equipment which operates according to specific technical standards. Although the TV industry is increasingly global (a single satellite can illuminate entire continents), different standards have evolved throughout the world and still apply. **Terrestrial** TV broadcasting uses three standards - PAL, SECAM and NTSC (Box 1). **Satellite** TV is broadcast in PAL, NTSC and another standard called MAC, for which the pioneering work was done in the UK by the Independent Broadcasting Authority (IBA).

With the development of a new system such as HDTV, it is in the interests of broadcasters, manufacturers and the public that a single standard be agreed, to avoid duplication of systems (as occurred with the VHS and Betamax formats of video recorders). Such international standards are developed through the International Telecommunication Union (ITU). Japan and the USA jointly proposed to the ITU in 1986 that a standard developed by the Japanese state broadcasters (NHK) should become the world standard for HDTV. The European delegates, however, disagreed on the grounds that the standard was incompatible with existing equipment. They decided instead to pursue the MAC standard which could be used for both HDTV and (with suitable decoders) on conventional TV sets. In this way there could be a gradual evolution of the domestic HDTV market without disadvantaging viewers who did not wish to use HDTV.

Since the decision to pursue different systems in 1986, Europe has therefore embarked on its own collaborative satellite-borne MAC-based, HDTV development programme under the EUREKA initiative<sup>1</sup>. Following agreement between the EC and the European Broadcasting Union (EBU) in 1986, the European Commis-

| TV TRANSMISSION STANDARDS            |                  |                   |                        |
|--------------------------------------|------------------|-------------------|------------------------|
| SYSTEM                               | LINES per SCREEN | FRAMES per SECOND | SCREEN WIDTH TO HEIGHT |
| <i>Conventional TV</i>               |                  |                   |                        |
| NTSC                                 | 525              | 30                | 4:3                    |
| PAL, SECAM                           | 625              | 25                | 4:3                    |
| <i>Enhanced-Definition TV (EDTV)</i> |                  |                   |                        |
| PALplus                              | 625              | 25                | 16:9                   |
| MAC                                  | 625              | 25                | 16:9                   |
| <i>High-Definition TV (HDTV)</i>     |                  |                   |                        |
| HD-MAC                               | 1250             | 25                | 16:9                   |
| NHK-HDTV                             | 1125             | 30                | 16:9                   |

sion (EC) issued directive 86/529, that all high-power satellite TV in Europe should adopt the MAC format. Initially the greater information-carrying capability of MAC would be used to provide an enhanced (EDTV) quality broadcast with greater picture width and quality. Full HDTV using a high-definition version of MAC (HD-MAC) would follow later in the decade. Prototype HDTV sets receiving pictures of very high quality in HD-MAC have already been demonstrated.

In parallel with technical development of the MAC standard, efforts are also being made to develop an enhanced terrestrial TV system based on PAL through an Anglo-German project which aims to have a wide screen 'PALplus' TV system available by 1997. Existing PAL receivers will still be able to display PALplus programmes but without the enhanced quality picture.

In Japan, HDTV is being developed using their own standard. A system called 'Hi Vision' was used to broadcast the Seoul Olympic Games to public viewing locations in Japan, and a three-channel domestic HDTV service should be available this year. Converters are under development to allow the HDTV signals to be received on standard TVs on the (Japanese and US) NTSC system.

Meanwhile in the USA, more than 20 proposals for EDTV have been put forward. Recently, announcements of practical digital television have also been made and the US Federal Communications Commission is set to choose between six competing systems in 1992 (four of them digital) to set the technical standard for its future HDTV services.

The differences between the three main industrial groups are thus widening. Europe's HD-MAC and Japan's NHK-derived high-definition systems will not be compatible with each other (see Box 2 for the differences in standards) and the US is placing increasing emphasis on a digital approach. Indeed, the rapid advances in digital TV are leading many to see this as more attractive eventually than either of the other approaches to HDTV. If this optimism proves to be justified, digital TV could ultimately make systems such as MAC (and PAL) or the Japanese HDTV systems outdated in the

way that compact disc players are increasingly displacing record players.

## CURRENT STATUS OF MAC IN EUROPE

Following the 1986 decision that new high-power satellite transmissions in Europe should use MAC, progress has been slower than forecast. In the UK, delays in manufacturing the supporting electronics meant that the new SkyTV operation opted to use the Astra (PAL-based) satellite. (Astra is low-powered and thus not subject to the EC Directive). British Satellite Broadcasting (BSB) chose to use the high-power Marco Polo (MAC-based) satellite, but delays occurred. Now, BSB has merged with SkyTV and the combined TV service is broadcast in PAL from Astra, and in MAC from Marco Polo. How long this simultaneous broadcasting (simulcasting) of BSkyB in both PAL and MAC will continue, is open to question. For instance, there are difficulties in resolving the different copyright clearances inherited from BSB and SkyTV (BSB was conceived as a national TV service while SkyTV is international). The Independent Television Commission is also seeking new operators to take up the erstwhile BSB broadcasting licences and BSkyB may seek purchasers for its Marco Polo satellites. UK viewers who have invested in dishes of whatever kind thus face significant uncertainty.

In Germany, the most economical way of replacing the former East German television service was to use a satellite. In December 1989, it was decided to broadcast all TV channels via satellite using PAL, in spite of the European long-term commitment to MAC. Six months later, however, this decision was reversed and it was agreed to return to the use of MAC, apparently as a result of talks conducted at the highest intergovernmental level. Presently, German TV companies (both commercial and public-broadcast) are increasing their use of PAL satellite channels on Astra and their own satellites, and simulcasting in both PAL and MAC.

France is a strong supporter of MAC, but has experienced technical problems (unrelated to MAC) with its own satellites. The Netherlands are understood to be re-examining their initial intention to simulcast in PAL and MAC.

| COST COMPARISONS FOR SATELLITE TV                    |                              |                                    |
|--|------------------------------|------------------------------------|
|  | ASTRA<br>Low-Power<br>in PAL | MARCO POLO<br>High-Power<br>in MAC |
| Price per channel to operator                        | £4.68 M                      | £15 M                              |
| Cost of TV set to consumer                           | £250 upwards                 | £300-350 upwards                   |
| Cost per channel to consumer (if all channels taken) | £31                          | £80                                |

Finally, in the new Europe, Eastern states are already turning to Western satellite TV. Although from a technical viewpoint, TV pictures in MAC are better than those in PAL, MAC receivers are more complex and slightly more expensive than PAL TV sets. There are thus concerns that adherence to the MAC standard could limit the growth of truly pan-European TV in the emerging democracies of Eastern Europe.

## CURRENT ISSUES

### *Is MAC the right standard for Europe?*

The EC directive stipulating the use of MAC for high-power transmissions comes up for renewal in December 1991. One option is to extend the directive to all satellite TV, requiring the current low-power PAL transmissions to be made in MAC. Supporters of this option include European manufacturers of electronic components and TV receivers. They point out that they have invested over \$2 billion in MAC technology in recent years in the expectation that MAC would be made the single European standard. They argue that failure to enforce MAC will delay and reduce the market for MAC-based technology. This could have potentially severe consequences, not only for the European TV and video manufacturers but also for the whole of the European electronics industry, since a substantial proportion of a TV set's value lies in the electronics contained within it.

On the other hand, the possible extension of the MAC standard to all satellite transmission is of considerable concern to satellite TV broadcasters. Most satellite TV customers<sup>2</sup> use PAL receivers which would have to be fitted with converters to receive MAC transmissions. This is technically possible but would cost around £150 per set. There is concern that disruption during the transition period from PAL to MAC would affect viewing and reduce advertising and subscription revenues. Furthermore, the high-powered satellites offer fewer channels than Astra<sup>3</sup> - due, in part, to their being designed to be as reliable as terrestrial TV services and thus containing electronic back-up systems. This makes the higher quality MAC-based transmission more expensive than PAL (Box 3). Satellite TV companies believe that for many viewers, the choice and cost of programmes are more important than ultimate viewing quality. On the other hand, equipment manufacturers point to the rapid take-up of high-quality MAC receivers in Scandinavia - 3 million in two years.

Cable TV companies also raise cost issues against the compulsory use of MAC. At present, a single cable can transmit 40-60 TV channels simultaneously in PAL. The

use of the MAC format would reduce this marginally. But transmission in MAC would require suitable converting electronics, which would result in increased costs for both distributor and customer. The take-up of cable TV in the UK has been slower than forecast and cable operators consider that minimising costs is important to the development of their business.

Satellite and cable TV companies thus advocate that the *status quo* should be maintained, at least for a year or so. Low-power satellite TV stations should be allowed to continue to broadcast in PAL. If emerging competitive satellite companies wish to use MAC, with its higher quality sound and pictures, then that should be for the market to decide. The contrary view sees the viewer as potentially vulnerable if multiple standards persist in future TV transmissions. (One consequence of the formation of BSkyB, transmitting in PAL, is that the 100,000 viewers who have invested in MAC equipment to receive BSB may, in future, find themselves unable to receive satellite TV broadcasts). A compromise would be for satellite broadcasters to be required to simulcast in both MAC and PAL, although a cost penalty would inevitably accrue. (This would be analogous to the situation when the BBC and ITV started broadcasting 625-line TV but continued for many years to broadcast in the older 405-line system as well).

There are conflicting views within the EC with regard to the future form of the satellite TV directive. These range from extending the directive to cover all transmissions, to relaxing all restrictions. A third option under consideration is to provide a transition period before enforcing MAC, during which broadcasters would be allowed to use PAL or MAC technology. A transition period of 5 years has recently been mentioned. This would go some way to protecting existing viewers and satellite broadcasters, and could also allow electronics companies to work with the satellite and cable TV industry to manage a transition from PAL to MAC.

The UK Government's view is that it is not for politicians to pick winners in technology by setting standards which preclude other options. The Broadcasting Minister has also said that the opinions which matter most are those of the broadcasters who have to pay for the introduction of any new technology, and the viewing public.

### ***The Future of Digital TV Broadcasting***

The rapid advances made in computer technology are well known. Lately, it has become possible to apply the digital technology used in computers to many other purposes. Digital telephone exchanges and compact discs are obvious examples, but digital audio tape recorders are used professionally and digital radios by the military. Digital TV is a natural extension and

2. There are 2 million satellite dish owners, and a further 26 million can view satellite TV through cable connections throughout the EC.

3. Astra 1 broadcasts 16 channels in PAL (8 are in English); Marco Polo 1 broadcasts 5 MAC channels.

would be compatible with computers, digital telephony, and thus the business-related TV market. Indeed, some digital technology is already used in current television - e.g. in stereo sound broadcasting and in the supporting electronics for MAC.

The potential advantages of digital TV include:

- Modern electronics can be used to manipulate the transmitted signals to remove intrusive artefacts such as 'picture flicker'.
- Digital TV signals can be electronically 'compressed', allowing a satellite transmitter or cable to carry more channels simultaneously.
- Less transmitter power is needed for digital TV; it is thus potentially less costly than current technology.
- Digital TV can be broadcast by terrestrial transmitters (as well as by satellites and cables) possibly by employing channels which are currently unusable because of interference.

Significant strides have been made in the USA and Europe towards perfecting digital TV. Although technical problems still exist, confidence is high in the USA that wholly digital EDTV will be in an advanced prototype form in 1993. In Europe, there is a Spanish/Italian EUREKA programme (EU 256) on digital HDTV which has made good progress (digital HDTV relays of the 'Italia 90' World Cup were demonstrated in Italy). This project is however, aimed at professional use rather than the domestic market. The UK also has a strong research position in digital TV. As part of the EC's Research on Advanced Communications in Europe (RACE) programme, National Transcommunications (formerly part of the IBA), the BBC and UK industry have developed techniques that some believe are ahead of EU 256. The situation in Japan is less clear and they may opt to remain with their NHK (non-digital) HDTV system.

While all agree that a form of digital TV will emerge eventually, there is less consensus on when it will reach the high street. Some point to the rapid progress in the USA and elsewhere and predict that digital HDTV could be on the air as early as 1995. Others believe digital HDTV will only be available after the year 2005.

Timing is crucial, in view of the advantages of digital TV listed above. Many believe that early development of digital HDTV will seriously undercut the demand for non-digital systems (including MAC). Many therefore believe that the key question for Europe is whether there is a worthwhile window of opportunity from the point at which HD-MAC will be available (mass production is predicted to start from 1995) to the arrival of digital HDTV.

In view of the optimism in some quarters at the rapid progress of digital HDTV, some experts are concerned

that the imposition of the MAC standard may place Europe at a disadvantage compared with the rest of the world, committing it to a technology which could become rapidly outdated. On the other hand, if fully digital TV does not become available for 10-15 years, failure to have developed an effective European industry based on MAC could lead to emerging consumer demand for HDTV being met by non-European sources.

### ***The Consumer Market for HDTV***

The discussion in this note has concerned the transmission of HDTV, but the receiving TV is of equal importance. The better quality of HDTV pictures is only noticeable on TV screens wider than 33 inches, and currently such large screens are heavy and expensive. The price of a Japanese model has been estimated at £5,000, while £2-3,000 has been forecast for a European HDTV; a 33-inch TV weighs 250kg. Alternatively, high-quality projection TV systems can be used - those currently made in Europe cost £2-3,000. The Japanese and others are developing small projection systems which attach to the ceiling and use a wall as the 'screen'. There are also research efforts on large flat-panel displays. Some observers believe that by the time that HDTV transmission systems are in place, advances in technology will be such that HDTV sets will be only 20-40% more expensive than a conventional TV set.

Many consider that HDTV will not have mass market appeal until an unobtrusive and low-cost screen or other viewing means becomes available, and therefore that HDTV is unlikely to become commonplace before the end of the decade. They argue that this delay should be used by equipment manufacturers and others to refine digital technology. In this way, digital HDTV could move seamlessly into European homes as a direct replacement for PAL.

Others point out that business, professional and limited domestic markets for HDTV will certainly exist before this and that MAC HDTVs will be ready to access this market in 1995. They see an EC directive requiring the use of MAC in Europe as essential to developing a wide customer base for MAC equipment which would allow European manufacturers to compete effectively in the HDTV market with Japan and the Far East.

### **FURTHER READING**

Additional details and background information are available from POST, 2 Little Smith St., London SW1P 3DL, tel: (071)-222-2688.

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