Digital Television in Europe and Japan

JEFFREY A. HART

ABSTRACT *The decision of the FCC in the United States to select an all-digital HDTV system was a surprise to HDTV supporters in Europe and Japan. Both had adopted hybrid systems with both analog and digital features. Western Europe was quicker than Japan to move away from its previous arrangements. It dropped HD-MAC in June 1993 and moved on to create the Digital Video Broadcasting (DVB) group to support digital television. It also responded by increasing EU support for wide-screen standard definition television programming and manufacturing. In Japan, NHK and its allies strongly resisted the idea of abandoning MUSE Hi-Vision but some of the major consumer electronics manufacturers and the Ministry of Posts and Telecommunications (MPT) wanted to speed up the transition to an all-digital HDTV system. NHK was able to delay adoption of all-digital HDTV approach until mid-1997. In this article, I consider these two stories separately, and then try to explain the differences in the reactions of the two regions.*

Keywords: broadcasting, digital television, high-definition television, Japan, new media, Western Europe.

Introduction

The decision of the FCC in the United States to select an all-digital HDTV system was a surprise to HDTV supporters in Europe and Japan. Both had adopted hybrid systems with both analog and digital features. Both had decided to use direct broadcast satellites as the primary means of delivering HDTV signals. Both had counted on their ability to market HDTV programming and equipment in North America, as well as in their home region. Now they were confronted with criticisms at home about the obsolescence of analog technologies and the need to keep up with the United States in digital technologies. To these criticisms the already existing complaints were added, mainly from private broadcasters and pay-TV operators, about the high expense and low benefit for both consumers and broadcasters of making the transition to HDTV. As a result, both regions reconsidered their earlier decisions.

Western Europe was somewhat quicker than Japan to move away from its previous arrangements. It dropped HD-MAC in June 1993 and moved on to create the Digital Video Broadcasting (DVB) group to support digital television. It also responded by increasing EU support for wide-screen standard-definition television programming and manufacturing. In Japan, NHK and its allies strongly resisted the idea of abandoning MUSE Hi-Vision but some of the major consumer electronics manufacturers and the Ministry of Posts and Telecommunications (MPT) wanted to speed up the transition to an all-digital HDTV system. NHK was able to delay serious discussion of all-digital

0810-9028/98/020217-21

HDTV until the last year or so. In the spring of 1997, all the top managers of NHK were replaced with individuals more inclined to go digital. In this article, we will consider these two stories separately, and then try to explain the differences in the reactions of the two regions.

The Death of HD-MAC: the Birth of DVB

On 22 July 1993, the EU Council of Ministers adopted an Action Plan for the Introduction of Advanced Television Services in Europe.[1] The Action Plan endorsed the idea of pursuing widescreen analog equipment in the near term and digital HDTV in the longer term. The Council agreed to provide 228 million Ecus to subsidize the production of programs in wide-screen formats and the investment in broadcasting equipment for the transmission of wide-format analog images between mid-1993 and mid-1997. Whereas only 22 broadcasters in eight member states were transmitting wide-screen signals in 16:9 format in 1994, 39 broadcasters in 13 member states were doing so in 1995. As a direct result of increased wide-screen program availability, the sales of wide-screen receivers increased from about 10,000 in 1993, to 135,000 in 1994 and to 220,000 in 1995.[2]

While the wide-screen program continued, much of the debate over the future of television in Europe shifted to the question of how to take advantage of digital technologies. At the national level, private broadcasters continued to erode audience shares of the previously dominant public broadcasters and firms like BSkyB in Britain, Canal Plus in France, and Kirch and Bertelsmann in Germany were talking about moving into digital delivery of video signals.

In September 1993, a group of 120 organizations[3]—European broadcasters, satellite operators, manufacturers, and public agencies—signed a memorandum of understanding for the creation of a new organization called the Digital Video Broadcasting (DVB) Group.[4] The DVB Group focused on negotiating standards for digital video production, terrestrial, cable and satellite broadcasting and set-top boxes and encryption systems for pay-TV. They decided to tackle satellite and cable standards before working on terrestrial ones because the former were simpler and more immediate. One of the key goals of the Group was to avoid the proliferation of incompatible pay-TV decoders and set-top boxes.[5] The DVB itself was not empowered to set standards but instead passed along 'technical specifications' to ETSI (the European Telecommunications Standards Institute) and CENELEC (the European Committee for Electrotechnical Standardization), both of which are recognized standards organizations in Europe. ETSI and CENELEC can ask international standards bodies like the International Telegraphic Union (ITU) to incorporate European standards into their lists of global standards.

According to one expert, the DVB:

> ... has speedily and painlessly produced specifications for digital satellite and cable TV transmission systems, which have sped rapidly through European standardization to achieve global acceptance as ITU Recommendations and seem set to achieve success in the global market. The terrestrial digital specification left the DVB earlier this year [1996] for formal standardization. Like all digital TV systems which used the globally agreed MPEG-2 compression system, the DVB systems work in either 4:3 or 16:9 formats.[6]

The DVB fastened upon MPEG-2 for video compression at a time when most computer firms were doing the same thing. It also adopted the idea of putting digital video information in packets with headers containing information about the type of content

contained in the packet using the model successfully pursued in international telecommunications standards negotiations. But the most important secret of DVB's success, according to one observer, 'lies in first defining broadcasters' user requirements and then matching technologies to those requirements, rather than the other way round, which has been more usual in Europe in the past'.[7] This is a round about way of saying that the DVB, unlike the Grand Alliance in the United States, steered clear of insisting on the inclusion of high-definition video formats in its proposed standards, on the presumption that it was too early to do so. According to one participant in the process:

> High-definition television (HDTV) has been considered but so far no European program service provider has been able to devise a satisfactory business plan to use it. Domestic HDTV receivers, and HDTV studio equipment are likely to be expensive. The viability of HDTV broadcasting, at least for Europe, in today's highly competitive broadcasting environment, seems years away. Nevertheless, if there is a demand for HDTV, the DVB systems will all have the capacity to transport the signals.[8]

This argument is quite similar to that made by the DTV Team in the United States. The DVB Project focused particularly on finding a standard interface for enhancements to digital set-top boxes that would permit pay-TV operators to use proprietary encryption systems without requiring consumers to buy a separate box for each system. This was a serious problem because not all pay-TV operators in Europe could agree on encryption methods and other aspects of set-top boxes. The DVB's proposed solution to this problem involved the use of plug-in cards, identical to those used in laptop computers (PCMCIA cards), which contained the proprietary encryption algorithms. A 'smart card' had to be inserted into the encryption card to show that the individual using the encryption card was a paid subscriber to the service.

The DVB cable standard called for the use of a QAM (quadrature amplitude modulation) transmission system, which was preferred by most cable operators in the United States over the VSB (vestigial sideband) system selected by the Grand Alliance and endorsed by the FCC. The DVB terrestrial system used channel-coded orthogonal frequency division multiplexing (COFDM) instead of VSB. The DVB selected COFDM because it wanted the terrestrial system to have as much commonality as possible with the cable and satellite systems, and because digital audio broadcasting in Europe had already been introduced successfully with COFDM technology.[9]

On 29 May 1997, the DVB Project announced that it would promote the formation of patent pool for all DVB standards with the exception of MPEG-2. Theo Peek, Chairman of the Steering Board of the DVB Project said:

> Now that much of the technical work of the DVB Project has been completed, we can turn to ensuring that the IPRs [intellectual property rights] associated with our standards are available efficiently and on terms which are fair, reasonable, and discriminatory.[10]

This was a notable difference between the DVB Group and the Grand Alliance: the latter failed to agree on a patent pooling arrangement.

After the DVB proposed and won acceptance in Europe for its recommended standards, European electronics manufacturers were criticized by US broadcasters for their failure to adequately support HDTV broadcasting within the DVB framework. Joseph Flaherty, Senior Vice President of CBS, in a speech at ITU Telecom '97 on 10 June 1997, said:

> Only the European consumer equipment industry is still ignoring HDTV in its

> digital receiver plans and this in my opinion is a grievous mistake. European broadcasters with the ability to broadcast HDTV through the DVB system, will be prevented from doing so by the inability of European digital receivers to decode the HDTV signal.[11]

In order to understand the achievements of the DVB group, one needs to view the efforts of the group from the perspective of the accelerating interest in digital television broadcasting in the individual member states of the European Union.

Digital Television in Europe

In the member states of the European Union, a few influential private broadcasters were converting to digital standard-definition television (SDTV) systems in order to protect their investments in programming and infrastructure for pay-TV and cable TV systems in Europe. They needed to use encrypted signals to make sure that only paid subscribers could receive the signals; and digitization of the signals was a natural adjunct to encryption. Digitization would make multiplexing possible, which was desirable because of the obvious appeal of greater programming choice for consumers. The first to digitize its satellite broadcasts in Europe was Canal Plus in France, but it was followed in short order by the Kirch Group in Germany.

The British government, frustrated with the slow growth of cable TV services in Britain, and concerned about the lack of competition to BSkyB's direct broadcast satellite TV services (Rupert Murdoch's News Corporation owned 40% of the equity of BSkyB) coming from either terrestrial broadcasters like the BBC or British cable operators, adopted the policy of promoting a rapid transition to digital terrestrial broadcasting.

The impetus behind all of this was the pressure from European consumers for more choice in television programming. The reason for that pressure was the slowness with which the public broadcasters, who still dominate television broadcasting throughout Europe, recognized the consumers' desire for greater variety in programming and therefore failed to see the attraction that the new private pay-TV satellite services would hold for them.

Digital Broadcasting in Britain

As early as 1993, Rupert Murdoch's News International was funding research on the development of a digital system for satellite services in Britain. The BBC began its own program of research into digital signal delivery

On 9 August 1995, the British government published a White Paper announcing plans to create 18 new digital terrestrial TV channels.[12] An industry-wide forum called the Digital TV Group was formed to discuss this proposal just after the publication of the White Paper. Members of the Group included the BBC, British Telecom, and the ITV companies (Carlton, Pearson, and Granada). A new broadcasting bill was introduced to Parliament by the Major government on 15 December 1995. The Broadcasting Act of 1996 empowered the ITC to establish digital terrestrial television in Britain. On 21 May 1996, the Independent Television Commission (ITC) began public consultations on digital terrestrial TV.

Rupert Murdoch responded to this government initiative by announcing his plans to deploy 120 channels of digital television via direct broadcast satellite. Granada Television, one of the members of the ITV group, formed a joint venture with BSkyB in December 1995 called GSkyB. All of the programming that Granada provided to British

audiences via terrestrial analog broadcasting would now be available to satellite subscribers. Granada had recognized the growing market appeal of BSkyB's pay-TV services, which had over 5 million British subscribers at the time. In December 1995, the Office of Fair Trading initiated a review of BSkyB's 'dominant position'. This review was later dropped, much to the displeasure of public broadcasters like the BBC, but it reflected a growing concern over the seemingly unstoppable momentum of Murdoch and BSkyB.

In May 1996, the BBC launched a new program called 'Extending Choice in the Digital Age'.[13] The basic idea was to digitize the signals of the two BBC terrestrial channels (BBC1 and BBC2) and 24-hour news services in widescreen format and offer them to subscribers on digital satellite, cable, and terrestrial systems. This was the BBC's first move in an attempt to match the boldness of Murdoch's strategy.

On 31 October 1996, the Independent Television Commission invited applicants to apply for licenses to run 24 new terrestrial digital television channels. Six 'multiplexes' or packages of new channels would be available. The first three were reserved for the BBC, the ITV group, Channel 4, Channel 5, and the new Welsh channel S4C with the proviso that these broadcasters would use some of the spectrum to simulcast their existing services digitally. The other three multiplexes would be open to newcomers. Applications were due on or before 31 January 1997.

Two rival groups bid for the licenses: British Digital Broadcasting (BDB) and the Digital Television Network (DTN). BDB was initially made up of BSkyB with Carlton Communications PLC and Granada Group PLC (the latter two were both members of the ITV group). The three partners committed $490 million to the venture. BSkyB had almost 6 million subscribers to its analog satellite services at the time and wanted to add subscribers via terrestrial broadcasting. DTN's members included US-owned CableTel, Britain's third largest cable company and owner of NTL (National Transcommunications Limited), a TV transmission company that had formed after the decommissioning of the Independent Broadcast Authority, and United News and Media, owner of the Express newspapers and two ITV companies. The DTN group was financially smaller and weaker than the BDB group, and to compensate for this it promised to add telephony and interactive services to its digital terrestrial services. It also promised that its set-top decoders would be compatible with decoders for other services (terrestrial, satellite, or cable) so that consumers would need only one box if they decided to subscribe to multiple services. The DTN argued in its application that 'the BDB bid will effectively prevent DTT [digital terrestrial television] from developing as a major platform for pay-TV in competition with BSkyB's services ...'[14]

British Telecom began negotiations with Matsushita and BDB at the end of February 1997 to furnish subsidized set-top decoders for BDB's digital terrestrial services if it received a licence from the Independent Television Commission (ITC). On 7 May 1997, BSkyB announced the formation of British Interactive Broadcasting (BIB), a joint venture of British Telecom, Matsushita, and Midlank Bank which would be responsible for the design, manufacturing and financing of the subsidized set-top boxes for digital terrestrial television. BIB intended to offer home banking and shopping services over the BDB multiplex, if BDB won its bid for a licence.[15] On the same date, BSkyB announced that it had awarded a contract to Grundig and Hyundai to provide digital DVB/MPEG-2 and SCTE compliant set-top decoders, and other types of transmission and reception equipment. Hyundai's TV/COM subsidiary, based in the United States, would handle Hyundai's part of the contract.[16]

When the Labour Party won the elections in early May, it was thought that DTN's chances for winning its bid for a digital terrestrial TV license were improved because

Lord Clive Hollick, chief executive to United News and Media, was a Labour Peer and a prospective adviser to the new government of Tony Blair. On 9 May 1997, Hollick announced that he would purchase a large stake in DTN if it won its bid for a license. However, this was not sufficient to reduce the ITC's worries about the financial soundness of the DTN group, especially relative to the BDB group. The ITC did not like the participation of BSkyB in the BDB, however, and insisted in early June 1997 that BSkyB withdraw from the partnership. The group was duly restructured and the ITC announced its decision on 24 June to award a license to the restructured BDB. BSkyB was directly compensated from withdrawing from the group (£75 million) and was permitted to supply programs to BDB, a right potentially worth £1 billion over 5 years if the services were successful.[17]

The BDB deal was not quite complete, however, because on 27 August 1997, the Commission of the European Union announced that it would open a probe focusing particularly on the cooperative arrangements between British Telecom and BSkyB in the BDB bid. EU Competition Commissioner Karel van Miert said on 4 June 1997:

> There is a problem as far as the pay-TV business is concerned because there could be an enhancement of an already dominant position.[18]

The Commission was also concerned that BIB would hold a monopoly of digital interactive services in Britain. It decided to put pressure on the BDB and the BIB (jointly with British regulators) to make their digital program guides and set-top boxes open to other competitors in the future. Still, unless the Commission or some other EU body decided to intervene, the parameters for the introduction of digital terrestrial television services in Britain were set.

Digital Broadcasting in Germany

On 22 December, 1995, the German government unveiled a proposal for legislation to foster the growth of multimedia industries by the building of an information superhighway—the so-called 'Infobahn'. The main purpose of the legislation was to do away with the red tape that was limiting the growth of information industries in Germany. The intention was to open up telecommunications markets completely by 1 January 1998 by privatizing Deutsche Telekom and permitting private companies to bid for licenses to operate competitive telecommunications services businesses in Germany.[19]

In broadcasting as in telecommunications, the German market was dominated by public firms. The two largest television broadcasters in Germany were ARD and ZDF, the national public broadcasters. ARD and ZDF controlled terrestrial broadcasting in Germany indirectly through their links with the regional public broadcasters who owned the enormous broadcasting towers that could be found in most major urban areas in, while Deutsche Telekom controlled directly or indirectly most cable television operations in the country. Because of this, the main vehicle for the delivery of private broadcasts was via direct broadcast satellites. Attempts by the public broadcasters to control satellite transmission of TV signals failed when SES-Astra (a company based in Luxembourg) succeeded in delivering analog TV beginning in 1988 to German audiences via lower-powered communications satellites.

By the mid-1990s, the eroding audience shares of the public broadcasters, increasing costs of production, and stable license fee revenues made ARD and ZDF particularly anxious to find new ways of competing in the broadcasting marketplace. They played a significant role in the formation of the European Launching Group for Digital Video

Broadcasting and its successor, the DVB Group. Yet it was the private broadcasters who were most aggressive in pushing Germany toward digital television broadcasting.

The main players in the private broadcasting side in Germany were: (1) the Kirch Group, (2) Bertelsmann, and (3) the Compagnie Luxembourgeoise de Telediffusion (CLT). The Kirch Group was run by the reclusive Leo Kirch, a Bavarian media mogul who made his fortune by licensing and distributing films and TV programs from Hollywood producers. Kirch controlled two commercial TV channels in Germany: Sat. 1 and DSF (a sports channel), both of which were delivered to German households primarily through satellite and cable systems. The Kirch Group owned 25% of a pay-TV service called Premiere (the other owners were Bertelsmann with 37.5% and Canal Plus with 37.5%). Kirch also owned 35% of the Axel Springer publishing group.[20]

Bertelsmann AG was a multinational company headquartered in Gütersloh with annual revenues of $14.7 billion in 1996, that had started out as a book and magazine publisher and later became a diversified media company. Bertelsmann had four main divisions: BMG Entertainment, Books, Gruner + Jahr (newspaper and magazine publishing), and the Industry Group. BMG Entertainment was in charge of a wide variety of businesses, including several recording studios, a record club, video tape distribution services, and a television channel called RTL, which it operated in partnership with CLT. BMG Entertainment also owned a stake (along with Kirch) in two pay-TV operations: Premiere and Vox. In July 1996, Bertelsmann merged its Ufa film and television interests with the Luxembourg-based television company, CLT.

In the early 1980s, the Compagnie Luxembourgeoise de Télédiffusion (CLT) in Luxembourg proposed to deliver both French and German-language televisions programs via satellite to France and Germany. The service was to be called RTL (Radiodiffusion-Télévision Luxembourgoise). One of the early investors in CLT was the Banque Bruxelles Lambert. Later, the Bertelsmann and WAZ (Westfälische Algemeine Zeitung) publishing groups in Germany would become major stakeholders in RTL. In 1983, a group of private investors, including Clay Whitehead, who had headed the Office of Telecommunications Policy in the Nixon administration, proposed the launching of an intermediate-power broadcast satellite to deliver programming to European listeners, primarily via cable systems. This was the GLD-Coronet (GDL stands for Grand Duchy of Luxembourg) project. Whitehead lined up financial support form the invest banking firm, Salomon Brothers, and programming support from Home Box Office (HBO).

The French government strongly preferred the RTL project to Coronet. In the meantime, CLT and the government of Luxembourg began to argue over CLT's claim to a contractual monopoly for broadcasting in Luxembourg (in order to block the Coronet project). The European PTTs (postal, telegraphic, and telecommunications agencies) came to the defense of CLT. The issue began to be framed in terms of resisting an American cultural invasion, and key politicians like François Mitterrand and Helmut Kohl weighed in on the side of CLT. After the 1984 elections in Luxembourg, the new Prime Minister, Jacques Santer, and his government decided to form a new satellite company, the Société Européenne des Satellites (SES), to replace Coronet. SES took over all of Coronet's assets, bought out Clay Whitehead's financial interest, and took over Coronet's contract for an RCA satellite.[21]

In 1987, the Bundespost launched its first high-power direct broadcast satellite, the SAT-1. The satellite failed soon after launching. Its solar panels did not unfold. SAT-2 was launched in 1989, but it also experienced a series of technical difficulties. In contrast, the Astra 1A satellite was launched successfully in December 1988 by the SES using an Arianespace rocket. Rupert Murdoch had announced in June 1988 that he intended to

use the Astra satellite as the means for delivering his new Sky Channel programming (see the section on the UK above). Whereas SAT-1 and SAT-2 were BSS (Broadcast Satellite Services) satellites, the Astra 1A was an FSS (Fixed Satellite Services) satellite which required less power for its transmission but somewhat larger satellite dishes on the receiver end. In addition, SAT-1 and SAT-2 signals had to be transmitted in the MAC (multiplexed analog components) format, while the Astra satellite could deliver signals in the PAL (phase alternation by line) format—which was already the standard for television signals in Germany. This meant that consumers did not have to buy a converter or a new receiver to display Astra signals on their television. Both sets of satellites could deliver signals to households either directly (to homes with dishes and satellite decoders) or via cable systems.

Right from the start, Astra was a commercial success. All 16 of its transponders were leased out quickly. Its signal covered around 15 million European households by the early 1990s (see Table 1). Astra channels initially included, among others: Sky Television, Sat.1, RTL Plus, MTV Europe, Screen Sport, Lifestyle, and the Children's Channel. As SES launched additional satellites, it added channels to its cable and DBS lineup. Kirch's movie channel, Pro7, for example, was an early addition to the Astra lineup. Astra offered more channels and a greater variety of programming than either the German or French DBS satellites. 3Sat, a tripartite alliance of ZDF with the Swiss and Austrian public broadcasters, leased a transponder on Astra in 1990. So did Eins Plus, the satellite channel of ARD. ARD and ZDF dropped their transmissions on SAT-1 and SAT-2 in 1993. As a result of this experience, the two public broadcasters became strong supporters for prolonging the life of the PAL standard in Europe and determined opponents of the MAC standard and its variants. By 1994, SAT-1 and SAT-2 no longer carried any television broadcasts.[22]

In 1994, a proposed joint venture called Media Service GmbH, combining the resources of Bertelsmann, Canal Plus and the Kirch Group (co-owners of the Premiere analog pay-TV service) to launch a digital pay-TV service, was blocked by the Commission of the European Union on the grounds that it would negatively affect competition in broadcasting. In the summer of 1995, Bertelsmann negotiated a deal with ARD, ZDF, and Canal Plus to create a common standard for decoders. Apparently these negotiations were not successful, but in February 1996, a joint venture of Deutsche Telekom (26.8%), Vebacom (23.9%), Bertelsmann (9%), CLT (8.8%), ARD (4.5%) and ZDF (4.5%) called the Multimedia Betriebsgesellschaft (MMBG) was announced. The MMBG would offer digital pay-TV services via satellite and cable using a decoder called the 'Mediabox' developed by Seca, a French-based firm jointly owned by Bertelsmann and Canal Plus. MMBG said that it had already ordered between 100,000 and 150,000 Seca decoders to prepare for the launch of the service.

In early March 1996, an alliance was announced involving Rupert Murdoch's News Corporation, Bertelsmann, Canal Plus, and CLT. Murdoch apparently had his eye on winning a stake in Premiere and using it as a platform for launching his digital services on the European continent. Premiere had 1.2 million subscribers to its analog services as of the summer of 1996, but it was still not profitable. Nevertheless, Premiere was headed toward digitization and increasing the number of channels to 100 and Murdoch must have figured that it was his best bet to get a piece of the lucrative German media market. Kirch was intent on blocking this. Murdoch eventually opted out of the deal on 7 March 1997.[23]

The Kirch Group was excluded from the MMBG and the Murdoch deal because Kirch thought that the Seca encryption system was not strong enough to prevent the sale of inexpensive decoder clones. Because of this, other pay-TV services would not use Seca

Table 1. Astra household coverage in Europe, mid-year 1997

	Universes				ASTRA Coverage		
Countries	**TV Households**	**DTH/SMATV and Cable**	**DTH/SMATV**	**Cable**	**DTH/MATV and Cable**	**DTH/SMATV**	**Cable**
Austria	3.09	2.08	1.07	1.02	2.06	1.05	1.02
Belgium	4.35	4.23	0.11	4.13	4.12	0.05	4.07
Croatia	0.70	0.19	0.15	0.05	0.17	0.13	0.04
Czech Republic	3.91	1.27	0.61	0.66	1.18	0.52	0.66
Denmark	2.32	1.55	0.91	0.64	1.15	0.51	0.64
Finland	2.04	0.92	0.15	0.77	0.84	0.07	0.77
France	21.47	3.70	1.80	1.90	2.07	0.83	1.24
Germany	33.12	28.50	10.69	17.81	28.45	10.64	17.81
Hungary	3.76	2.32	0.83	1.49	2.20	0.71	1.49
Ireland (Republic)	1.15	0.64	0.11	0.52	0.63	0.11	0.52
Italy	20.20	0.76	0.76	0.00	0.49	0.49	0.00
Luxembourg	0.16	0.15	0.02	0.14	0.15	0.02	0.14
Netherlands	6.45	6.28	0.30	5.98	6.26	0.28	5.98
Norway	1.77	0.98	0.27	0.71	0.88	0.17	0.71
Poland	11.72	5.17	1.82	3.36	3.96	1.50	2.46
Portugal	3.11	0.56	0.36	0.20	0.49	0.29	0.20
Slovak Republic	1.73	1.12	0.68	0.44	1.05	0.61	0.44
Slovenia	0.65	0.39	0.14	0.25	0.36	0.13	0.23
Spain	11.71	1.38	0.96	0.42	1.26	0.84	0.42
Sweden	3.96	2.53	0.77	1.76	2.04	0.28	1.76
Switzerland	2.86	2.63	0.38	2.25	2.56	0.31	2.25
United Kingdom	23.62	5.99	4.12	1.87	5.90	4.02	1.87
Total	163.85	73.32	26.97	46.35	68.26	23.57	44.70
Regions							
BeNeLux	10.96	10.66	0.42	10.24	10.53	0.35	10.18
Den/Nor/Swe/Fin	10.09	5.98	2.10	3.88	4.90	1.03	3.88
Ger/Aus/Swi	39.08	33.21	12.14	21.07	33.07	12.00	21.07
Pol/Cze/Slo/Hun	21.11	9.88	3.93	5.95	8.39	3.34	5.06
Spa/Por	14.82	1.94	1.31	0.63	1.75	1.13	0.62
UK/Ire (Republic)	24.78	6.63	4.23	2.39	6.53	4.13	2.39
Total	120.83	68.28	24.13	44.15	65.17	21.98	43.19

Produced by Société Européenne des Satellites, Harlet Information Group, L-0815 Chateau de Bertzdort, Luxembourg. Tel: (+ 352) 710 725–370, Fax: (+ 352) 710 725–526, Internet http://www.astra.lu.
*ASTRA is a trademark of Société Européenne des Satellites.

decoders and customers would have to buy or rent more than one kind of decoder box if they wanted to subscribe to more than one pay-TV service. On 12 March 1996, Vebacom, the telecommunications subsidiary of Veba AG, said that it had abandoned MMBG to set up a new joint venture with Metro Group (one of Germany's largest retailers and operator of the Kaufhof department stores) and the Kirch Group to launch a digital pay-TV service called DF1 in Germany. Murdoch announced that BSkyB would also participate in DF1 on 8 July 1996. The digital signals would be delivered by 20 Astra transponders (10 each for Kirch and BSkyB) and decoded by set-top boxes developed by a subsidiary of the Kirch Group, BetaTechnik. Kirch's DF1 channels included a lot of movie channels (Kirch owned the rights to a number of major film libraries) and two digital sports channels: DSF Plus and DSF Golf. BSkyB's channels would be quite similar to those it already offered in Britain. The Kirch decoder was

called the 'D-box' and the company claimed that it was capable of being reconfigured to provide decoding of signals from more than one pay-TV system.[24]

Kirch intended DF1 to be a 'body blow' to MMBG. According to one analyst, the root of the problem was the intense rivalry between Kirch and Bertelsmann:

> Everything is up for grabs ... Kirch and Bertelsmnan will fight it out to the end to win market share, to control Premiere and to be the best in providing content. It will be a bitter contest. The market may not allow both to survive. It may force them to unite.[25]

DF1 was launched formally at a Formula One grand prix race in Hockenheim on 28 July 1996, but unfortunately no one was watching because the decoders had not been manufactured in time to be distributed to retail outlets. The initial price was DM1100 (over $600); and there would also be a monthly charge of DM30 per month for the basic package of channels. Until May 1997, the boxes had to be purchased; after that date, they could be leased for DM20 per month.

DF1 was not successful. Only 11,000 subscribers were signed up as of November 1996. The high price of the decoders was a major deterrent for consumers. Even though Astra's analog satellite signal was available to over 10 million German households, consumers still needed to buy or rent a new digital decoder, a D-box, to enjoy the new digital services. Kirch's efforts to negotiate access to the high-quality cable services delivered by Deutsche Telekom were unsuccessful, thus excluding DF1 channels from the 16 million German households who had cable but no satellite connection. Deutsche Telekom rejected Kirch's demands for exclusive control over the digital program guide that came along with DF1 services.[26]

In July 1996, Bertelsmann purchased CLT and merged it with its Ufa film and television division to form CLT-Ufa. The new company had ownership interests in 17 European television channels: RTL, RTL2, Super RTL, Premiere, and VOX in Germany; M6, Serie Club, Multivision, TMC, and RTL 9 in France; RTL4, RTL5, and Veronica in the Netherlands; RTL TV 1 and Club RTL in Belgium; RTL Tele Leutzberg in Luxembourg; and Channel 5 in Britain.[27] The European Commission approved the merger on 8 October 1996, because it recognized that CLT-Ufa would have to compete with the Kirch Group in Germany and other media enterprises in other countries and therefore would not have a dominant market position.[28] The German Cartel Office approved it in January 1997.[29]

In December 1996, ARD and ZDF announced that they would offer a 'free' (unencrypted) digital TV service on the Astra satellite. In order to receive the signals, all one needed was a satellite dish (with Universal LNF) and a DBV-compatible television receiver. According the SES estimates, 1.4 million German households were already equipped with the right kind of satellite dish, but it remained to be seen whether those households would run out and purchase a new receiver, especially since the receivers were still quite expensive and the new services were basically just simulcasts of the existing ARD and ZDF programs.

ARD and ZDF also tried to make their Electronic Program Guide (EPG) a standard in Germany for digital television services. Such a guide had proved important to the success of the DirecTV services in the United States, because it made possible 'point and click' access to programs and to easier taping of broadcasts on connected VCRs.[30] But obviously there might be problems for consumers if the ARD and ZDF program guide were not compatible with the one offered by Kirch and his partners on DF1.

On 21 May 1996, the chief executive of ARD, Albert Scharf, predicted that

low-income households would become 'isolated' if pay TV were allowed to purchase the rights to broadcast sporting events and recently released movies.

> Events that people will be talking about cannot be reserved for a small group of wealthy people—the free TV viewer must continue to have open access in the future to top films and sporting events ...[31]

Scharf was criticized immediately by private broadcasters for proposing restrictions on the activities of pay-TV operators. A spokesperson for Sat.1, Kristina Fassler, said:

> He's not living in the real world. ... The public broadcasters are obligated to provide basic television. There is no way that top sporting events and top Hollywood films can be included in that basic package. People are willing to pay for these things. They have market value.[32]

Fassler went on to point out that the German public broadcasters were being squeezed financially as advertising revenues were declining in the face of increase competition from private broadcasters and that Scharf was simply making an argument for 'more money'.[33]

On 23 June 1997, the Kirch Group and CLT-Ufa announced a compromise deal to develop digital pay-TV around Premiere using the D-box decoder. Canal Plus agreed to sell its share of Premiere so that Kirch and CLT-Ufa would both own 50% of the joint venture. In return, Canal Plus would be allowed to purchase Kirch's interest in the Italian pay-TV venture, Telepiu. Kirch was forced make this deal with Bertelsmann because DF1 still only had 30,000 subscribers and Deutsche Telekom continued to refuse to permit DF1 to gain access to the Telekom-controlled cable networks.[34] If German and European authorities approved the new deal, the way was cleared for the launch of a successful digital pay-TV service in Germany. There would be only one of them, however.

Digital Broadcasting in France

Canal Plus was the first company to offer digital pay-TV services in Europe with the launching of its Canalsatellite Numerique service with 20 channels in April 1996. By the end of June 1997, it had 400,000 subscribers. By fall 1997, the service would have 46 channels. Canal Plus had over 4 million subscribers for its analog pay-TV services. Canal Plus acquired Nethold BV, the main pay-TV company of the Netherlands for $2 billion in September 1996. Nethold had 8.5 million subscribers in Europe, Africa, and the Middle East. Nethold had already launched digital services in Italy, Benelux, and Scandinavia.[35] So Canal Plus would now have a major presence in those countries as well as in Spain (see the next section for details).

The main competition to Canalsatellite in the digital category was TPS, a joint venture of TF1 (the privatized public broadcaster that was now the top broadcaster in France), France Television (the non-privatized public broadcaster), M6-Metropole Television (owned by Bertelsmann and CLT), and Compagnie Générale des Eaux. TPS began broadcasting in January 1997 and had more than 175,000 subscribers by September 1997.[36]

Another potential competitor for Canal Plus and TPS in France was Multicable, a 60/40 joint venture between Lyonnaise Communications and France Telecom, that operated a cable pay-per-view system in Paris. The service, which included cable modems that permitted high-speed Internet access, was launched in October 1995.[37]

To summarize, digital television had been introduced earlier in France than in the other large Western European countries. French consumers were particularly eager to

subscribe to both the analog and digital services provided by Canal Plus because they were dissatisfied with the restricted choices of programming available to them via terrestrial broadcasts (dominated until recently by public broadcasters). Cable services were just beginning to be offered and they still had a very limited share of French households. It helped somewhat, also, that the managers of Canal Plus were strong supporters of François Mitterrand and the Socialist Party.

Digital Broadcasting in the Rest of Europe

In the rest of Europe, the basic story was of partnering of local interests with one of the European media giants for analog and digital pay-TV services. Dealmaking accelerated as the 1998 EU deadline for deregulating telecommunications approached. The main pay-TV service in Italy as of summer 1997 was Telepiu. Prior to the Kirch-Bertelsmann detente in Germany, it was jointly owned by Kirch (45%), Canal Plus (45%), and Mediaset (10%)—an arm of Silvio Berlusconi's holding company, Fininvest. After the detente, Canal Plus held 90% of the venture. In Spain, there was a joint venture between Canal Plus and Prisa, Spain's largest media group and publisher of *El Pais* (a national newspaper), called Sogecable that owned the first digital pay-TV service, CanalSatelite Digital (CSD). Its main rival was Distribuidora de Television Digital (DTD) which was owned by Spanish telecommunications company Telefonica and a variety of other shareholders. The two Spanish rivals fought over the decoder issue, as in Germany.

Summary of the Digital Scene in Europe

By the summer of 1997, digital TV services had been successfully launched in France, the Benelux countries, and Scandinavia and were in the process of being launched in Britain, France, Italy, and possibly also Spain. All of these services used equipment compatible with the DVB transmission and reception standards, but there remained some disagreement over standards for 'controlled access'—the way in which encryption was incorporated into set-top boxes and receivers to guarantee that only paid subscribers could receive broadcasts. The two basic encryption systems were controlled by Canal Plus and Kirch (although Kirch relinquished some control over the D-box to Deutsche Telekom in July 1997 to secure access to the German cable network). Digital television in Europe was limited to standard-definition television with 4:3 or 16:9 aspect ratios. Europe was not implementing HDTV versions of DVB yet.

NHK Sticks with MUSE

As the FCC process unfolded in the United States, NHK made efforts to accomodate the FCC's preferences for an HDTV system that was compatible with the US system of local terrestrial broadcasting. When the FCC called for a simulcast approach to the transition from NTSC to HDTV broadcasting, NHK put forward its 'narrow MUSE' system which allowed the broadcasting of a lower-quality MUSE signal over existing 6 MHz channels. NHK engineers were well aware that narrow MUSE was not likely to fare well against rival American and European systems because the latter did not have to be compatible with the original MUSE/Hi-Vision approach. They believed that their experience in creating and operating working HDTV broadcasting systems would help to make up for their disadvantages elsewhere. Nevertheless, the spirit of the effort was one of grudging acceptance of the new rules and gloom about the expected outcome.[38]

Things got worse for Hi-Vision when the FCC decided in late 1990 to favor an

all-digital HDTV system. There was no way to erase the analog parts of the MUSE/Hi-Vision systems without giving up on the idea of exclusive DBS delivery of HDTV and re-engineering the MUSE circuitry designs, the two cornerstones of NHK's HDTV technology strategy. Still, there were those in Japan who argued for just such a development—particularly the private broadcasters and some of the manufacturers, especially those who were behind in building the analog systems. NHK and its chief allies stuck with MUSE Hi-Vision, however.

As the future for international acceptance of MUSE/Hi-Vision grew dimmer, there were a number of minor rebellions within Japan. The first rebellion was connected with the formation of the Broadcasting Technology Association (BTA) in 1983 for investigating the possibility of deploying an improved definition television (IDTV) system in Japan. While this group included 19 manufacturers and a number of private broadcasters, and it had the somewhat unenthusiastic blessing of the Ministry of Posts and Telecommunications (MPT), it was opposed by NHK and MITI as being antithetical to the notion of fast deployment of HDTV systems.

The BTA favored the deployment of what they called an enhanced definition TV (EDTV) approach for private broadcasters, which would provide sharper pictures first without the wider aspect ratio (EDTV-I or 'Clear-vision') and then with wider screens (EDTV-II or Wide-aspect Clear-vision) but would not require satellite delivery or major upgrading of terrestrial facilities. EDTV-I experimental broadcasts began in 1989; EDTV-II broadcasts were scheduled to begin in 1995. In February 1989, the BTA invited Faroudja Laboratories of the United States to demonstrate its SuperNTSC system, an IDTV system which was considerably better than their EDTV-I. The manufacturers supported these efforts as a hedge on their investments in HDTV technologies, but they still put most of their money into the development of Hi-Vision products.[39]

The Early Days of the Japanese HDTV Market

Japanese manufacturers began to offer HDTV equipment on the consumer market in very small quantities and at very high prices as early as 1990. Sony's HDTV receiver, for example, was priced at around $33,000 when introduced in December 1990. Subsequent products marketed by Matsushita, Hitachi, Mitsubishi, and JVC all were priced at over $30,000 per unit. In March 1992, Sharp introduced a product that it called 'Home Hi-Vision' with much lower picture resolution than the earlier products, but with all the other attributes (widescreen, CD-quality stereo sound, and the ability to decode MUSE-encoded signals) at a price of $7500. Some of the other manufacturers claimed that this product should not be marketed under the Hi-Vision label because of its lower resolution, but others moved quickly to develop and market similar products. They soon put their own 'dumbed-down' versions of Hi-Vision receivers on the market in the $5000 to $7000 per unit range.

NHK and the larger manufacturers remained committed to a full implementation of Hi-Vision for receivers and tried to make the best of a bad situation by marketing the early products primarily to industrial and business users. They were helped considerably during this period by the initiation of two public programs funded respectively by MITI and MPT: the 'Hi-Vision Communities Concept' and the 'Hi-Vision Cities Concept'. The MPT program was a bit grander than the MITI one, but neither was very specific about its goals and focused primarily on subsidizing local purchases of HDTV equipment for community purposes.

A successful example was the establishment of a 'Hi-Vision Gallery' in Gifu, a small

town between Tokyo and Osaka. The Gifu Museum digitized a number of works in its collection and displayed them, along with a linked database, in a special gallery devoted to this purpose. As a result of the success of the Gifu Gallery, NHK worked hard to try to get other museums in Japan and abroad to use Hi-Vision technologies in exhibitions. The Metropolitan Museum of Art in New York did so in 1991 for an exhibition on the works of Frederick Remington. Unfortunately for NHK, the Metropolitan's program was badly executed and did very little good for the global Hi-Vision cause.

There was also talk of reviving the neighborhood movie houses of small-town Japan with these programs, an issue of considerable importance to the Japanese elite. But the total financial support for these efforts was extremely limited and therefore not much came of them. Indeed, one can argue that both MPT and MITI were somewhat relieved that the NHK-led efforts failed because they did not relish the idea of further decentralizing governmental control over high-technology industrial promotion efforts.

In the meantime, prices for genuine HDTV receivers had declined considerably. In June 1993, Sony introduced a 32-inch set priced at 1.3 million yen ($13,000) and Matsushita marketed a 36-inch set in November 1993 at 1.5 million yen ($15,000). The lowest priced (non-dumbed-down) sets cost 980,000 yen ($9800) in 1992–3.[40] Only 15,000 units were sold in 1993, however.[41] A consortium of Japanese and American semiconductor firms was established in January 1992 to develop less expensive Hi-Vision chip sets. Its members were: Fujitsu, Hitachi, Texas Instruments Japan, and Sony. On 6 December 1993, the consortium announced the marketing of a new Hi-Vision chip set at 70% the price of previous sets. However, even at the lower price, the set still cost over $900.[42]

NHK responded by developing inexpensive 'downconverters' which enabled homes with satellite dishes and tuners and regular NTSC or PAL/SECAM TVs to watch Hi-Vision broadcasts. These downconverters sold well. So did widescreen EDTV televisions (without HDTV circuitry). About 1.5 million wide-screen sets were sold in 1994 and about 3 million in 1995.[43] If you combined the number of HDTV sets, with the number of regular and wide-screen sets that could display HDTV broadcasts thanks to a downconverter, the number of households that could view 'HDTV' began to look pretty respectable (see Table 2). In 1994, NHK upped the number of hours of Hi-Vision broadcasting per week from 8 to 9. The plan was to go to a full day of HDTV broadcasts by 1996.

The MPT Pushes for All-digital HDTV: the Egawa Incident

On 18 February 1994, Akimasa Egawa, Director General of the Broadcasting Bureau of the Ministry of Posts and Telecommunications (MPT) discussed NHK's annual budget proposal at a closed meeting with the Social Capital Committee of the Shinseito (Renaissance) party, a newly formed offshoot of the Liberal Democratic Party that allied itself with the Komeito (Clean Government Party) and the Minshato (Democratic Socialist Party). At the meeting, Egawa argued that Hi-Vision was becoming obsolete because the trend in television globally was toward digitalization. He said that he thought that Japan needed to make a rapid transition from Hi-Vision to an all-digital system. Egawa did not receive any support from the politicians at this meeting, and his proposals were leaked to the press.

On 22 February 1994, Egawa held a press conference in which he repeated his arguments of 18 February. Loud and immediate protests came from NHK, the Electronic Industries Association of Japan (EIAJ), and a number of consumer electronics manufacturers, retailers, and consumer groups who considered this move to be precipi-

Table 2. Cumulative sales of Hi-Vision receivers, MUSE-NTSC converters, and wide NTSC receivers in Japan, April 1996 to June 1997

	Hi-Vision Receivers	Receivers with MUSE-NTSC Converters	Widescreen NTSC Receivers
Apr-96	158	260	5187
May-96	169	274	5363
Jun-96	191	303	5590
Jul-96	212	339	5866
Aug-96	217	354	6050
Sep-96	233	373	6266
Oct-96	249	392	6481
Nov-96	278	416	6768
Dec-96	314	451	7173
Jan-97	321	462	7307
Feb-97	336	477	7492
Mar-97	359	504	7803
Apr-97	371	530	8010
May-97	382	547	8157
Jun-97	398	572	8335

Source: EIAJ via the world wide we at http://j-entertain.co.jp/hpa-data/.

tous. Tadahiro Sekimoto, president of NEC Corporation and chairman of the EIAJ said: 'The ... Hi-Vision system is the only HDTV system in practical use in the world today. We believe that this system will be used long ... into the next century, and we will firmly support the system.'

The official position of NHK was that Japan should continue to use the MUSE/Hi-Vision approach until it is clearly demonstrated that an all-digital system is both of higher quality and of comparable or lower price. The large investment in new satellites, picture tubes, and chip-sets as well as the relatively early roll-out of the system made it very difficult for Japan to put MUSE Hi-Vision on hold while waiting for all-digital HDTV. For the most part, the consumer electronics manufacturers agreed with NHK.

The EIAJ asked Egawa to withdraw his proposal and the latter complied immediately.[44] However, there were many favorable comments in the Japanese press about his stand, and even a few manufacturers admitted that the MUSE Hi-Vision system might become obsolete in an age of all-digital systems. Other manufacturers argued that Hi-Vision was already mostly digital, so they did not see going to an all-digital system as a radical improvement. But they were obviously concerned about the slow growth in sales of HDTV receivers. A spokesman for Matsushita Electric Industrial Company said 'As a manufacturer, we will offer what the consumer wants ...'.[45] Seichiro Ujiie, president of Nippon Television Network (NTN), a private broadcasting network that had been critical of MUSE Hi-Vision from the start, said that he thought Egawa's remarks constituted 'a good start' toward an all-digital system in Japan. The National Association of Commercial Broadcasters (NABC) proposed adopting a digital TV system with the launch of the BS-4 broadcast satellites, scheduled to begin in 1997. NHK was opposed to this because they wanted to protect their investment in MUSE Hi-Vision technologies.

NHK's counterstrategy was to talk about its own vision for the future of broadcasting: integrated services digital broadcasting (ISDB). Digital HDTV would be one of the new services provided via ISDB. NHK proposed the goal of offering ISDB by the year 2007

(or perhaps as early as 2005). Until that time, MUSE Hi-Vision would remain the system of choice for HDTV. ISDB would permit enhancements to existing services in two main areas: (a) interactive video and (b) 3-D and virtual reality video. An experimental broadcasting satellite in the 21 GHz band called COMETS was scheduled for launch in 1996. NHK engineers would use COMETS to do experiments related to ISDB. In addition, they would test new digital transmission technologies like orthogonal frequency division multiplexing (OFDM) in the next few years. The president of NHK, Mikio Kawaguchi defended the continued reliance of Japan on satellite broadcasting by arguing that satellite systems were very reliable and that cable and optical fiber systems were vulnerable to disruption by earthquakes.[46]

On 27 April 1994, the MPT released the report of an advisory panel to Mr Egawa that argued that the Japanese government should establish digital broadcasting standards by 1996 in order to 'keep pace with global trends in communications ...'.[47] The report stated that one of the key advantages of digital broadcasting was that it would permit a rapid increase in the number of television channels via multiplexing. It pointed to the rapid development of digital systems in the United States and Europe and to the need for Japan to maintain consistency in its terrestrial, cable, and satellite broadcasting systems.

On 29 March 1995, the MPT released a report of the Study Group on Broadcasting System[s] in the Multimedia Age.[48] This report was much like the one released the year before, but contained updated information about the deployment of digital television systems in Europe and the United States and announced the intention of the Telecommunications Technology Council of MPT to formulate standards for digital broadcasting in Japan by 1996.[49] Apparently, the same Council had already devised a temporary standard for digitizing television services for communication satellites (CS), distinguished from the broadcast satellites (BS) by having somewhat lower-powered signals and therefore requiring slightly larger dishes for reception.

Toshiba introduced a 32-inch Hi-Vision receiver in June 1995 at a price of 530,000 yen ($5300). On 31 July 1995, Shigeru Yamazaki, director of the Digital Broadcasting System Research Division of NHK's Science and Technical Research Laboratories warned that there were still 'a number of unresolved technical issues' standing in the way of making a transition to digital satellite and terrestrial broadcasting. He called for more work on COFDM and on multiplexing of SDTV signals. Japanese government official and business representatives began to debate the question of whether it was desirable to digitize the MUSE Hi-Vision system or to start from scratch.[50]

The MPT changed its strategy after the failure of its direct attack on MUSE Hi-Vision in February 1994. In May 1994, the MPT's Telecommunications Council made public its report on Japan's advanced information network. The report was a response to the initiative of the Clinton administration to create a National Information Infrastructure (NII) on the model of the Internet and the feeling of many Japanese that Japan had fallen behind in this area. The Ministry of Education and the MPT had fought over the building of Japan's Internet, thus causing a serious delay. As a result, Japan had not benefited from the rapid growth in demand for internet services that accompanied the invention of the world wide web and web browser software like Netscape Navigator and Microsoft's Internet Explorer.

The MPT began to hit on the theme of promoting multimedia business and making Japanese businesses more web-savvy by upgrading the national telecommunications infrastructure. The MPT had been trying for years to find a convincing rationale for spending trillions of yen on adding optical fiber to the infrastructure. There was also a bit of bureaucratic competition in all of this. The idea of promoting multimedia

businesses by building a new information infrastructure was a way for the MPT to wrest some control over high-technology programs from the Ministry of International Trade and Industry (MITI).[51]

Digital Multiplexing in Japan

The MPT was responding to the rise in interest in digital multiplexing as a way to quickly provide Japanese households with a greater range of choice in television programming. Cable TV penetration was limited (20% in 1993) in Japan thanks to a combination of high costs and regulatory barriers. In the late 1980s, JCSAT, a joint venture of Hughes Aerospace with a collection of Japanese firms, began to offer a bouquet of channels to subscribers with special satellite dishes to receive CS signals. In April 1991, Japan Satellite Broadcasting (JSAT or JSB) began broadcasting encrypted 'conditional access' (pay-TV) television signals via the BS-3 broadcast satellite. JSAT was owned by Itochu Corporation, Mitsui and Company, Ltd, Sumitomo Corporation, and Nissho Iwai Corporation (all four are *sogo sosha* or trading companies). The satellite service of JSAT was called WOWOW and competed directly with the NHK NTSC and HDTV satellite services. Unlike NHK, JSAT decided to speed adoption of its services by subsidizing the costs to consumers of acquiring decoders. It also began to market its services aggressively in department stores and consumer electronics outlets. The number of subscribers grew rapidly to around 2 million in late 1996.[52]

In the fall of 1996, three new firms were created with the intention of providing digital TV via direct broadcast satellites: PerfecTV, JSkyB, and DirecTV Japan, Inc.

PerfecTV was a joint venture of the same firms that owned JSAT. It launched a 70-channel service in October 1996 and was able to sign up 100,000 subscribers by January 1997. PerfecTV planned to increase its channel offerings to 100 by the fall of 1997.

JSkyB was a joint venture between Rupert Murdoch's News Corporation Ltd and Japan's Softbank Corporation. It planned to offer initially a 12-channel service (to increase later to 150 channels) in alliance with Nippon Television (NTV) beginning in April 1997. News Corporation and Softbank each purchased 21.4% of the equity of Asahi TV, hoping that they might also provide terrestrial broadcasts of their services using Asahi's terrestrial antennas. Asahi was unwilling to do this, however, so in March 1997 News and Softbank invited Sony and Fuji Television in to become equal partners in JSkyB. The addition of these two new partners gave a considerable boost to the venture's future prospects.[53]

DirecTV Japan (DTVJ) was a joint venture of Hughes Electronics (35%), Culture Convenience Club (35%), Matsushita (10%), Mitsubishi Corporation (5%), Mitsubishi Electric Corporation (5%) and Dai-Nippon Printing Company (5%). It planned to offer a 100-channel service beginning in the fall of 1997.

Sony was awarded a multi-million dollar contract to build satellite broadcasting facilities for DTVJ in March 1997.[54] It received a contract to build similar facilities for JSky B. All of the digital broadcasters planned to use MPEG-2 video compression, consistent with the DVB's effort to foster global standards for digital television broadcasting.

JSkyB and PerfecTV agreed to offer each other's programs, to share the same JCSAT-4 communications satellite, and to use the same satellite decoders for their services.[55] DTVJ would also use the JCSAT-4 satellite (since Hughes was already a major shareholder in JCSAT), but reserved the right to use a different type of decoder. On 17 June 1997, however, all three digital satellite broadcasters announced their agreement to

adopt a common standard for decoders so as to avoid consumer confusion. Apparently, DTVJ was responding to pressure from the MPT to adopt a common decoder.

The Radio Regulatory Council had to decide whether to permit digital broadcasting on the new BS-4 broadcast satellites, and if so whether it should encourage digital HDTV or multiplexed SDTV broadcasts. On 11 March 1997, Shuji Jusuda, the new Director General of the Broadcasting Bureau of the MPT said that the start of digital broadcasting in Japan would be moved up to begin before the year 2000. Jusuda said the MPT intended to conduct experiments using the BS3-b satellite to test a variety of digital broadcasting systems. The MPT was pushing, in particular, for the Radio Regulatory Council to authorize the use of the BS-4 satellites for digital broadcasting instead of waiting for the another 5–10 years for the launching of the next generation of satellites operating at 21 GHz (as NHK preferred). NHK said that it was willing to conduct research on this question, but added: 'There will be many issues to be solved for the realization [of the digital broadcasting] to take place because it will have a big impact on television viewers as well as broadcast stations. Consensus must be built among concerned people.'[56]

There was a major shakeup in the top management of NHK in the spring and summer of 1997. A new Executive Director General of Broadcasting, Naoyuki Kohno, was appointed on 21 May 1997. A new President of NHK, Katsuji Ebisawa, was appointed on 31 July 1997. Early statements by both new executives pointed to a change in attitude in the NHK management toward the acceleration of digital broadcasting in Japan.[57] Many additional questions will remain, of course, but it appears that the long campaign of NHK to delay digitization was over and that the various commercial interests desiring a rapid transition to all-digital systems had carried the day. What remained unclear, however, just as in Europe and the United States, was the future of digital *HDTV* as opposed to multiplexed digital standard definition television.

Conclusions

In Japan and Western Europe, the response to the US decision to pursue an all-digital HDTV system was to re-examine their earlier decisions to adopt hybrid (partly digital, partly analog) standards. The Europeans dropped HD-MAC quickly, whereas in Japan resistance from NHK and allied consumer electronics manufacturers to abandoning MUSE/Hi-Vision delayed the decision to move to digital broadcasting. By mid-1997, both Europe and Japan were committed to a rapid transition to digital broadcasting via direct broadcast satellite. Neither was likely to move quickly to digital HDTV broadcasting, however, for the same reasons that computer companies in the United States were reluctant to support the Grand Alliance/ATSC HDTV standard. They worried that the HDTV consumer equipment would be too expensive and that there would not be adequate sources of new revenues to justify the purchasing of transmission equipment by broadcasters. They eventually responded positively to the evident desire of consumers for greater programming choice and wide-screen, but not high-resolution, images.

Both Europe and Japan were moving, therefore, toward the digital delivery of wide-screen and regular standard-definition signals with MPEG-2 compression, QAM modulation for satellite and cable, and COFDM for terrestrial. The United States, in contrast, had chosen to pursue both HDTV and multiplexed standard-definition broadcasting with MPEG-2 compression, and VSB transmission for satellite, cable, and terrestrial services. As before, Europe and Japan chose greater certainty in television standards than the United States, but this time they listened to the objections of their

private broadcasters and consumers and did not permit the consumer electronics manufacturers and public broadcasters to control the standards-setting process.

Notes and References

1. This was Decision 93/424/EEC. For a history of this document see the previous HDTV Report from Stanford Resources, Inc. See also the historical information provided by the EU at http://apollo.cordis.lu
2. *Second Annual Report on Progress in Implementing the Action Plan for the Introduction of Advanced Television Services in Europe*, Report from the Commission to the Council, the European Parliament, and the Economic and Social Committee, COM (96) 346 Final, Brussels, 26 July 1996, p. 16.
3. In mid-1997, the number of member organizations was 200.
4. The DVB Group benefited from the earlier work of the European Launching Group for Digital Video Broadcasting, beginning in 1991, under the leadership of Peter Kahl of the German Ministry of Telecommunications. See Xiudan Dai, *Corporate Strategy, Public Policy and New Technologies: Philips and the European Consumer Electronics Industry*, London, Pergamon, 1996, pp. 248–249.
5. The group had been meeting on an *ad hoc* basis for over a year prior to the signing of the memorandum of understanding. A smaller pan-European group began to discuss digital television in 1991 soon after the announcement by General Instrument in the United States that it had succeeded in building an all-digital HDTV system. D. Wood, 'The DVB project: philosophy and core system', *Electronics and Communication Engineering Journal*, 9, 1, 1997, p. 5; Suzanne Perry, 'European group to announce digital HDTV strategy', *Reuter Business Report*, 26 May 1993; and Andrew Hill, 'Europe switches over to digital TV', *Financial Times*, 17 December 1993, p. 16.
6. Ivo Addams, 'Reshaping TV for the Information Society', background brief for the European Commission's Conference on Wide-Screen Television, Brussels, 1996. Ivo Addams is a pseudonym for Adam Watson-Brown.
7. *Ibid.*
8. Wood, *op. cit.*, Ref. 5, p. 7.
9. Ulrich Reimers, 'DVB-T: the COFDM-based system for terrestrial television', *Electronics and Communication Engineering Journal*, 9, 1, 1997, pp. 28–32.
10. DVB press release dated 29 May 1997.
11. Joseph Flaherty, '2000 and beyond ... the digital milennium', *HDTV Newsletter*, 11, June–July 1997, pp. 29–32; and 'Flaherty says TV set-makers are stalling European HDTV', *Communications Daily*, 11 June 1997, via Nexis-Lexis. See also Joel Brinkley, 'US and Europe in battle over digital TV', *New York Times*, 25 August 1997, via the world wide web at http://www.nytimes.com.
12. *Digital Terrestrial Broadcasting: The Government's Proposals*, London, Her Majesty's Stationery Office, August 1995, CM 2946.
13. See the BBC web site at http://www.bbc.co.uk/info/digital/
14. 'Digital television network: evidence to the inquiry into the future of the BBC and British broadcasting', *M2 Presswire*, 21 February 1997, via Nexis-Lexis.
15. Raymond Snoddy, 'BIB plans shopping lines on terrestrial television', *Financial Times*, 6 May 1997, p. 22, via Nexis-Lexis.
16. 'Hyundai-TV/COM and Grundig alliance awarded digital satellite receiver contract by British Sky Broadcasting', *Business Wire*, 7 May 1997, via Nexis-Lexis.
17. Raymond Snodstdy, 'ITC: challenge over award of digital licenses', *Financial Times*, 25 June 1997, via the world wide web at http://www.ft.com/hippocampus/723c6.html
18. 'EU's Van Miert voices concern over BDB digital TV license bid', *AFX New*, 5 June 1997, via Nexis-Lexis.
19. 'Germany's ground breaking multimedia legislation', *Newsbytes*, 22 December 1995, via Lexis-Nexis.
20. 'Mediaset agreement reached with strategic partners: a first step towards a public offering of the company', *PR Newswire*, 20 July 1995, via Lexis-Nexis.
21. Elie Noam, *Television in Europe*, New York, Oxford University Press, 1991, pp. 301–303.
22. Hans J. Kleinsteuber, 'New media technologies in Europe: the politics of satellite, HDTV, and DAB', *Irish Communications Review*, 5, 1995, pp. 12–14; John Peterson, 'Toward a common European

industrial policy: the case of high definition television', Department of Politics, University of York, n.d., p. 12; and Peter Humphreys, *Media and Media Policy in Germany: The Press and Broadcasting Since 1945*, 2nd edn, Providence, RI, Berg, 1994, pp. 270–271.

23. 'Euro pay TV alliance appears to hit snag', *The Reuter European Community Report*, 5, June 1996, accessed via Nexis-Lexis.
24. Ashley Seager, 'Germany's Vebacom, Metro set up digital TV firm', *Reuter European Business Report*, 5 March 1996, via Nexis-Lexis; Judy Dempsey, 'Fight to the finish in German digital television: Kirch's lead over Bertelsmann in the race to the marketplace may be shortlived', *Financial Times*, 12 March 1996, p. 31, via Nexis-Lexis. The remaining MMBG partners criticized the D-box for precisely the same reasons that Kirch had objected to the Seca decoder: that it would require consumers to purchase a separate decoder for each new pay-TV service.
25. Dempsey, *op. cit.*, Ref. 24.
26. 'Kirch's DF1 channels energy toward Christmas shoppers,' *Variety*, 28 October–3 November 1996, p. 37, via Nexis-Lexis; 'Kirch's digital TV hits launch snag', *Reuter European Business Report*, 4 July 1996, via Nexis-Lexis.
27. See the Bertelsmann web site at http://www.bertelsmann.de/bag/gesch_ber96/bmg/index.html.
28. Peter Klanowski, 'Ufa/CLT Deal Cleared', *Tele-satellit News*, 8 October 1996, via the world wide web at http://www.tele-satellit.com
29. 'CLT-Ufa to pay DM850M in Kirch TV pact', *Dow Jones Newswires*, 17 July 1997, via the world wide web at http://www.wsj.com
30. See Astra's web site at http://www.astra.lu/company/poress/97/970828.html
31. Erik Kirschbaum, 'ARD attacks pay TV: German pubcaster calls feevee unfair', *Daily Variety*, 21 May 1996, p. 10, accessed via Nexis-Lexis.
32. *Ibid.*
33. *Ibid.*
34. Frederick Studemann, 'Pay-TV: German rivals agree joint venture', *Financial Times*, 24 June 1997, via the world wide web at http://www.ft.com
35. 'Hyundai to incorporate openTV technology in set-top boxes for Nethod networks', *Business Wire*, 20 November 1996, via Nexis-Lexis.
36. Amy Barrett, 'Canal satellite anticipates passing its subscriber goal', *Wall Street Journal Interactive Edition*, 25 August 1997, accessed via the world wide web at http://www.wsj.com; and Melissa Pozsgay, 'Canal Plus, TPS back-to-school TV battle', *Bloomberg News*, 18 August 1997, via the world wide web at http://nytsyn.com/live/News/230_081897_110001_25750.html
37. 'Interactive multimedia trial for Paris Cable', *New Media Markets*, 29 June 1995, via Nexis-Lexis; and 'Cable modem trial takes off in French Riviera: French cable operators increasingly are looking to the Internet as a revenue source', *European Media Business and Finance*, 29 July 1996, via Nexis-Lexis.
38. For details, see Joel Brinkley, *Defining Vision: The Battle for the Future of Television*, Harcourt Brace, New York, 1997.
39. John Sie, 'HDTV and Japan, Inc.', unpublished manuscript, Tele-Communications, Inc., Denver, Colorado, revised draft, 28 April 1989.
40. *Japan Economic Newswire*, 5 April 1993, story 11, p. 1; 'NHK develops converter for Japanese, European HDTV sets', *Agence France Presse*, 13 October 1992, via Nexis-Lexis.
41. 'Is widescreen killing Japanese HDTV?' *Consumer Electronics*, 34, 9, 1994, via Nexis-Lexis.
42. 'Fujitsu develops low-cost HDTV image processing chip set', *Comline*, 8 December 1993, via Nexis-Lexis.
43. 'Japan widescreen broadcasting', *Consumer Electronics*, 17 June 1995, p. 15, via Nexis-Lexis.
44. Eiji Kawabata, 'The politics of HDTV in the US and Japan', paper prepared for delivery at the Annual Meeting for the American Political Science Association, San Francisco, 29 August–1 September 1996, p. 10.
45. *The Reuter Asia-Pacific Business Report*, 28 April 1994, via Nexis-Lexis.
46. Keiji Urakami, 'HDTV format switch not to change makers' basic strategy', *Japan Economic Newswire*, 23 February 1994, via Nexis-Lexis; Yoshiko Hara, 'Japan still riding digital fence', *Electronic Engineering Times Interactive*, 7 March 1994, p. 40, via the world wide web at http://tech.web; and 'NHK plans 50" Plasma Tube', *Consumer Electronics*, 34, 24, 1994, via Nexis-Lexis. See

also Junji Matsuzaki, 'The scenario for Hi-Vision broadcasting in Japan', unpublished manuscript, NHK, Tokyo, June 1993.

47. 'Panel urges digital broadcasting standard by 1996', *Japan Economic Newswire (Kyodo)*, 27 April 1994; and *The Reuter Asia-Pacific Business Report*, 28 April 1994, both via Nexis-Lexis.
48. An English translation can be found at http://www.mpt.go.jp/policyreports/english/Broadcasting-system/press-release.html
49. *COMLINE Daily News Electronics*, 20 July 1995, via Nexis-Lexis.
50. Junko Yoshida, 'Japan's broadcast entity drags feet', *Electronic Engineering Times Interactive*, 31 July 1995, issue 859.
51. See Chalmers Johnson, 'MITI, MPT, and the telecom wars: how Japan makes policy for high technology', in Chalmers Johnson, Laura D'Andrea Tyson, & John Zysman (eds), *Politics and Productivity: How Japan's Development Strategy Works*, New York, Harper Business, 1989.
52. *Japan Electronics Almanac 95/96*, Tokyo, Dempa, 1995, p. 202.
53. 'Murdoch's Japanese TV venture unveils new partners', *Reuter European Business Report*, 14 May 1997, via Nexis-Lexis.
54. 'JSkyB to lauch 150 digital TV channels in Japan', *Financial Times*, 18 December 1996, p. 30; 'JSkyB to employ NTV's digital high-quality system', *Japan Economic Newswire (Kyodo)*, 14 December 1996, via Nexis-Lexis; and 'Sony awarded multi-million-dollar contract to build direct broadcast satellite facility for DIRECTV JAPAN', *Business Wire*, 5 March 1997, via Nexis-Lexis.
55. 'JSkyB, PerfectTV agree to offer each other's channels', *Japan Consumer Electronics Scan (Kyodo)*, 11 November 1996, via Nexis-Lexis; 'JSkyB to share operations with PerfecTV', *Japan Economic Newswire (Kyodo)*, 18 October 1996, via Nexis-Lexis.
56. 'Ministry announces plan to go digital in land TV broadcasting', *Daily Yomiuri*, 11 March 1997, p. 20.
57. See 'Comments from the top' at the NHK world wide web site at http://www.nhk.or.jp/pr/keiei/toptalk/kaichoue/kaichoue.html