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The HDTV demonstrations at Expo 92

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Attracted by the theme of Expo 92 - The Era of Discovery - 42 million visitors had an opportunity to discover European high-definition television.

In a manner fitting the scale of Expo 92 itself, the Spanish transmission authority, Retevisión, and the Vision 1250 EEIG joined forces to show the best of European HDTV technology and programmes. Despite the involvement of Retevisión also in the provision of conventional television coverage of Expo 92, and the heavy burden on both organizations for HDTV coverage of the Summer Olympic Games in Barcelona, Expo 92 visitors were able to see programme-makers at work in Europe's largest specialist HDTV studio, and appreciate the technical and esthetic quality of high-definition, wide-screen presentation in the national pavilions of all twelve Member States of the European Community and elsewhere at the Expo 92 showground.

1. HDTV demonstrations

Expo 92 was a vast international exhibition which took place in Seville from 20 April to 12 October 1992. Expo 92's theme was *The Era of Discovery* and its aim was to exhibit the most outstanding examples of human achievement in the fields of science, technology and art.

The exhibitors included over 100 countries and 20 international organizations and companies. Ten thematic pavilions were built. There were over 42 million visitors during the 6-month period, which is more than the entire population of Spain.

The audio-visual media were widely used in all the pavilions. High-definition television played a key role in the presentations at the European pavilions. The TV Technology Pavilion, a thematic pavilion dedicated exclusively to television, was built by Retevisión which provided for the production, transport and distribution of HDTV pictures from this pavilion, in close cooperation with Vision 1250.

This joint venture by Retevisión and Vision 1250 reflected the respective rôles of each organization in broadcasting. In effect, Retevisión is the Span-

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ish public body responsible for all radio and television distribution and broadcast emission in Spain (terrestrial and satellite), and for this purpose it operates a network of over 42000 km of microwave links, many of them digital working at 140 or 34 Mbit/s. Vision 1250, the European Economic Interest grouping (EEIG) set up in 1990 for the promotion of 1250/50 HDTV, now has more than 35 participants from 15 countries, including manufacturers of production equipment and receivers, television and film producers, EBU Member-organizations and transmission authorities. Vision 1250 operates a fleet of some 25 outside-broadcast vehicles supported by a core staff of about 70 specialists drawn from the participating organizations.

At Expo 92, Retevisión and Vision 1250 together engaged in two main activities in the HDTV domain:

- Programme production at the Retevisión studio, including outdoor production.
- Distribution of HDTV programmes from the Retevisión pavilion to the national pavilions of the Member States of the European Communities and other Expo buildings, including high-definition programmes received via satellite from other key events in Europe (European Football Cup from Sweden, tennis from Paris

and Wimbledon, Olympic Games from Barcelona, concerts, etc.)

These activities took place throughout Expo 92. Towards the end of the exhibition it had been planned to broadcast some HDTV programmes to the "Eurosites" set up for the Barcelona Olympic Games, but these had to be cancelled because of the involvement of Retevisión and Vision 1250 in HDTV transmissions at the Olympic Games.

2. The TV Technology Pavilion

The TV Technology Pavilion was one of the ten thematic pavilions. It was built by Retevisión to house its HDTV promotional activities, its transmission facilities and the public exhibition areas. The main features of the pavilion were:

- A 5000 m² building on the bank of the Expo lake.
- A 400 m² HDTV studio, built as the core of the pavilion. This studio was the first HDTV studio of a such a size in Europe.
- An HDTV demonstration room with seats for an audience of 130 and HDTV projection facilities.
- A head-end equipment room for the HDTV and conventional television contribution and distribution networks.
- A master switching and routing centre for HDTV and conventional television.
- A 41-m high tower to carry radio link equipment.
- A radio link terminal room.
- An up-link satellite earth station.
- A roof with an open canopy to house five satellite receiving dishes with diameters ranging from 2.8 m to 4.5 m.
- A public exhibition area used to show a tutorial exhibition on television technology and examples of Retevisión's work.
- Offices.
- A recreational area, based mainly on terraces, overlooking the Expo lake.

After Expo 92 this pavilion will continue to be used for television. It is included in the promotional plans for the area as a television production and training centre, and it will also become the main base of Retevisión in Seville.

TV Technology Pavilion at Expo 92



3. The HDTV studio

The implementation of the studio equipment was agreed between Vision 1250 and Retevisión. Vision 1250 provided most of the video equipment on a temporary basis and Retevisión provided audio, lighting and complementary equipment.

The high-definition equipment provided by Vision 1250 consisted of:

- three HDTV Plumbicon cameras, BTS model KHC 1000;
- one vision mixer, BTS model RMH 1000;
- two analogue VTRs, BTS model BCH 1000;
- a down-converter (1250 to 625 lines), Snell & Wilcox model 2010;
- a character generator, Aston model HD 1250;
- distribution, equalization, monitoring, routing and control equipment.

Retevisión, for its part, provided equipment for:

- the audio production room, fitted with a seven-channel system and based around a 36-channel mixing console;
- audio editing, consisting of two 24-channel digital recorders, a Midi system and several sound sources;
- lighting, flooding 1200 lux, with a total electric power over 0.5 MW;
- HDTV paint-box (Quantel);
- off-line editing (Betacam SP);
- complementary HDTV editing and monitoring facilities;
- intercom (Pesa);
- pedestals and ancillary equipment.

The Institut für Rundfunktechnik (IRT) cooperated in the definition of the audio system, including the audio for the demonstration room. Audio engineering facilities were provided by Retevisión.

The studio was built with a large window giving on to the public exhibition area so that visitors could watch the production activities.

The demonstration room was separated from the studio by a large sliding door, and equipped with lighting systems, so that it could be used independently or integrated into the studio for programme production with a public audience. It was



equipped with two Seleco HDTV front projectors, model HDFP-1250, working in tandem, and a screen of 4 x 2.25 m. The Seleco projectors, which were also provided by Vision 1250, displayed a very bright, high-quality picture, so that low lighting could be kept on, enabling visitors to move around, without disturbing those watching.

The studio also had an off-line editing room with Betacam SP recorders, for editing after down-conversion from 1250 to 625 lines. The on-line editing was done in the studio apparatus room after normal working hours. This arrangement allowed highly-efficient use of the studio and its equipment.

4. Additional HDTV production facilities

Although most of the production took place in the studio, Expo 92 provided excellent opportunities for outdoor production in the exhibition grounds. Vision 1250 made some OB production vans available in the April-May and September-October periods for this purpose. These facilities consisted of:

- A BTS light OB van with two CCD cameras. This OB van was used for production of the Opening and Closing Ceremonies, for aerial shots from the Expo tower, and for production of documentaries at several pavilions.
- A BTS heavy OB van with four Plumbicon and two CCD cameras for production of the Opening and Closing Ceremonies, musical shows and theatrical performances;
- an Ex-Camera OB van with a single camera which was used occasionally to complement the above facilities.

During the mid-Expo period, the OB vans could not be made available due to Vision 1250's commitments to the Olympics and other sporting events.

5. Production management

Retevisión is not a programme producer, so a specialized group called "Sevilla 1250" was set up to manage both the indoor and outdoor production facilities. Sevilla 1250 was established by Retevisión, the parent organization, and EFE, a television production agency which provides production services to regional and private television organizations in Spain.

5.1. The tasks of Sevilla 1250

5.1.1. Service provider

The HDTV production facilities were offered to Vision 1250 member producers to whom Sevilla 1250 provided services, mainly in the form of operational teams. The key feature of the arrangement was low-cost HDTV production, but unfortunately this was counter-balanced by the very high hotel prices and logistic difficulties.

5.1.2. Programme producer

This was initially planned to be a secondary task, intended only to ensure that a minimum amount of production was carried out. It later became the principal responsibility due to the difficulties mentioned above. Sevilla 1250 was also responsible for the negotiation of rights.

During the Expo period the HDTV studio worked for around 1000 hours; programme production was of the order of 250 hours and, after editing, 30 hours of HDTV programmes were released.

The programmes produced by Sevilla 1250 dealt mainly with the following subjects:

- documentaries about certain pavilions;
- musical shows;
- theatrical performances;
- folklore dances from countries participating in Expo 92;
- official ceremonies ;
- interviews;
- overview of Expo activities (Expo parade, etc).

The operational and maintenance teams for the studio and outdoor production were provided by Sevilla 1250, but highly-specialized vision engineers were provided by Vision 1250.

6. HDTV programme distribution

The distribution of HDTV programmes was another key activity, intended to demonstrate the state of development of the European 1250/50/2:1 HDTV system. This was also a joint venture between Retevisión and Vision 1250 under the aegis of the European Community and with the cooperation of some manufacturers who are members of the EU 95 consortium, namely Nokia, Philips, Seleco and Thomson.

This promotional activity mainly consisted of screening of the latest HDTV programmes, including those specially produced for this occasion and the major sports events, such as tennis from Roland Garros and Wimbledon, the European Football Cup and the Olympic Games. The screenings could be seen by the public at the EC pavilion, the pavilions of the twelve EC Member States, the Retevisión pavilion and some other Expo sites such as the Royal Pavilion, the Press Centre and the Hispasat pavilion.

■ **6.1. Implementation of the HDTV programme distribution:**

■ **6.1.1. HDTV optical-fibre distribution network**

This network was planned and installed by Retevisión and laid out in the same ducts as were used for the conventional television network, while remaining completely independent of it. The network was in a star configuration, linking the Retevisión pavilion to the European pavilions and other Expo 92 sites. It was bi-directional and each branch was controlled independently by a switching matrix (24 x 48).

The network allowed the distribution of up to four simultaneous programmes. These were:

The so-called "official programme".

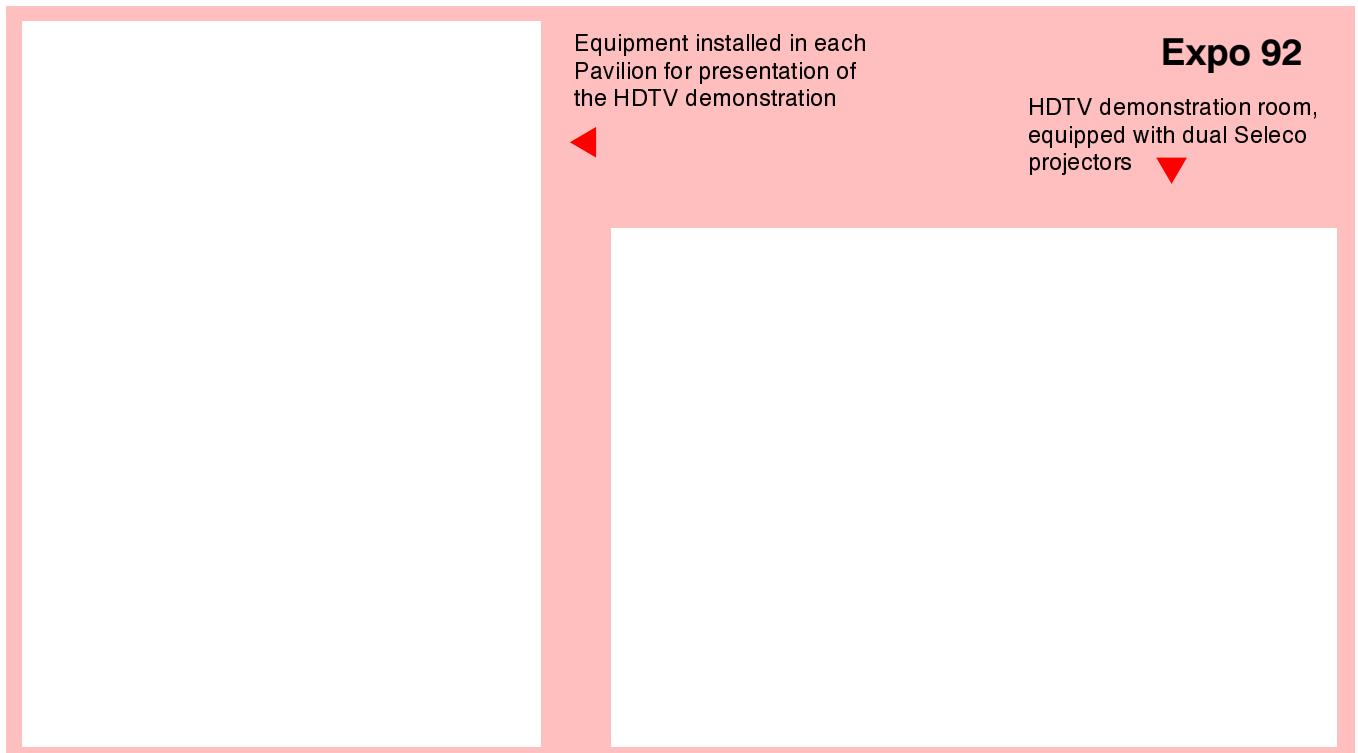
This was distributed in baseband components (Y, C_R, C_B) with source quality. For economic reasons, four multi-mode optical fibres were used to distribute this programme (one fibre per component plus two sound channels). This programme was distributed to all European Community pavilions from 10:00 to 22:00 hours daily throughout the Expo period.

The HDMAC programme.

It was intended to receive this programme via satellite, however it was also originated from a laser disk. The signal was baseband HDMAC and it was distributed through a single multi-mode optical fibre to all EC pavilions whenever there was an HDMAC satellite transmission. Throughout the second half of the Expo period it was complemented from 10.00 to 22.00 h. with HDMAC programmes originated from laser-disks.

Contribution/distribution.

These facilities were implemented with two mono-mode optical fibres. They were used on request to carry HDTV component signals in one or the other direction between the Retevisión pavilion and any of the European Community pavilions and other Expo sites. One or two different signals could be transported to or from any



pavilion (or to several pavilions at the same time), the limitation being the availability of the necessary optical multiplexers.

■ 6.2. The head-end equipment

The head-end equipment was installed at the Retevisión pavilion and was provided by Vision 1250 and Retevisión.

Vision 1250 provided:

- Two analogue VTRs, BTS mod. BCH 1000.
- A digital VTR, Ex Camera 2D1 model plus a spare D1 machine.

Retevisión provided:

- A 24 x 48 switching matrix (Pesa). This matrix was arranged in three wideband (30 MHz) video layers and two audio layers. The HDTV matrix was actually a part of a larger matrix used for conventional television routing, but it could be operated completely independently.
- The optical multiplexers. This type of equipment was intended for services provided "on request", that is, to be installed whenever a service was required. For cost considerations, therefore, the equipment was limited to the maximum expected simultaneous requests (seven pairs).
- Test pattern generators and measuring equipment.

■ 6.3. Receiving facilities at the pavilions

The facilities installed in each pavilion consisted of a switching, distributing and format-conversion system and the so-called Olympic receivers. These were either direct-view or rear- or front-projectors, provided by the manufacturers.

The systems were planned by RAI-Radiotelevisione Italiana for Vision 1250 and installed by Vision 1250 in the thirteen European Community pavilions plus the Retevisión pavilion. They served to adapt the Y, C_R, C_B format used for the optical fibre transmissions and feed the local distribution system in RGB trilevelsync (TLS) format, provided switching between the official, HDMAC and "on-request" programmes, as well as handling the distribution to the Olympic receivers installed in the pavilion. All the related equipment was installed, together with the optical fibre receivers, in a main rack. Local equalizing, distributing and format conversion apparatus, needed to match the RGB-TLS signal to the H/V drives required by the Olympic receivers, was contained in separate racks.

The receiving systems, distributed amongst fourteen pavilions, comprised fourteen main racks, smaller racks, over 10 km of cables and 40 Olympic receivers. The latter were delivered and installed by the EU95 manufacturers with an average of three receivers per pavilion. The majority were 36-inch direct-view receivers; ten of them were 56-inch rear-projectors (Philips HD-PTV) with 50 to 100-Hz conversion and and four

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Dr. Franco Visintin graduated in electrical engineering in 1960 at Rome University "La Sapienza". The following year he joined RAI-Radiotelevisione Italiana where he held several engineering posts in the technical and television production areas of the Milan production centre. He is currently Technical Director of this centre.

Dr. Visintin has been involved in research and experimentation with all major television developments in the past three decades, ranging from the introduction of colour television to stereophonic television. Since 1982 he has also been concerned with HDTV research and production activities and has given a number of lectures on the subject in international symposia.

In 1990 Dr. Visintin was appointed Deputy Director General of the "Vision 1250" EEIG, which is working to promote programme production with the European HDTV standard.

were 100-200-inch front-projectors (Seleco HDFP-12509).

Additional receiving facilities were installed in three other Expo sites by Retevisión with the support of Vision 1250 .

Technical assistance for the high-definition programme distribution system was ensured by a Vision 1250 "Demo Task Force", operating seven days a week from 10:00 to 22:00 hours. This five-person multi-national team, together with a Retevisión team who operated the VTRs feeding the networks, proved to be very efficient and a good example of international co-operation.

7. Programming

The programme selection for distribution to the European pavilions was managed by the European Communities' Programming Group, chaired by a delegate of the European Commission's Directorate General X.

The programmes through the first network (official programme) were distributed daily from 10:00 to 22:00 hours. They were provided by the European Commission, Vision 1250 members or Retevisión and consisted mainly of:

- Programmes specifically produced for the occasion, i.e. the Commission's *The return of Columbus* or Retevisión's ... *y Sevilla*. The sources for these programmes were alternatively analogue (BCH 1000) or digital (dual D1 machines).
- Programmes produced by Sevilla 1250 at the Retevisión studio, such as a demonstration synopsis, with *Le son et la lumière* by Thomson, as an introduction and *Expo 92, la ciudad animada*, an overview of the Expo grounds and its main activities. All these programmes were delivered from analogue sources.
- Programmes offered to the European Commission's Programming Group by various Vision 1250 members; these were essentially documentary, entertainment or corporate presentations.

The HDMAC programmes consisted mainly of sports events such as tennis (Roland Garros and Wimbledon), football (the European Cup from Göteborg) and the Olympic Games from Barcelona. Other events, for example the *Gala Sevillana*, an opera performance from Vienna, were also distributed. The satellites used for these transmissions were TDF-1, Olympus SSP (although this

satellite suffered from station-keeping problems) and Eutelsat II-F3. The BBC Wimbledon transmission was of particular interest because it was the first transmission of encrypted HDMAC.

Apart from these live HDMAC transmissions, a regular HDMAC programme was provided from 10:00 to 22:00 hours from a laser disk source (Philips LD player) in the second half of the Expo period. These programmes were mainly documentaries and light entertainment.

The transmission of the Olympic Games from Barcelona raised special problems. In Spain the HDMAC transmission had to be received directly from an FSS satellite transponder by the Olympic receivers, and this made it necessary to adopt special transmission parameters in the satellite; because of this, the transponder availability was not confirmed until the last moment. Retevisión therefore prepared the transmission of Olympic pictures from Barcelona to Seville through a digital microwave radio-link operating at 140/70 Mbit/s and distributed them in baseband component form, with source quality, as the official programme. A back-up signal was provided through another satellite channel at 45 Mbit/s. The HDMAC picture was transmitted through another transponder in the same satellite and was distributed in parallel through the HDMAC network.

8. Transmission facilities

The transmission facilities installed by Retevisión at its pavilion were as follows:

- An up-link earth station installed on top of the Retevisión pavilion. It had a 9.2-m. diameter antenna, and 3+3 channels with a maximum of 1.2 kW output power each. This up-link station, although prepared for HDTV transmissions (FM analogue or QPSK digital), was used only for conventional television because of the cancellation of the HDMAC emission plan;
- An optical-fibre link at 140 Mbit/s to a twin up-link earth station located in Madrid.
- Digital terrestrial radio-links to Madrid and Barcelona, working at 140 or 70 Mbit/s.
- HDTV digital codecs working at several bit-rates (developed by the European project EU 256)
- 2 receiving antennas (4.5-m diameter) for fixed and broadcasting service satellites. These antennas were used for reception of the HDMAC and digital signals.

9. Conclusions

The two main HDTV demonstrations at Expo 92 were a remarkable success.

It is important to note how well the complex equipment, including production, transmission and receiving facilities responded to the severe test of a six-month period of continuous activity.

The distribution and display equipment was used for more than 2100 hours in the six-month period which, at the present time, constitutes an endurance record. Even more remarkable was the response of the high-definition analogue VTRs, which were in use for a much longer period as, they were also used overnight for on-line editing.

This test will surely be of interest to the manufacturers of the equipment used.

The efficiency achieved in the use of the HDTV production facilities (studio and post-production operations) must also be noted. This was largely comparable to what can be achieved with conventional television production facilities. This was one of the main goals attained, and it is even more remarkable because the operational team in charge of the studio was relatively small and had only had a short, intensive training period.

In the authors' view, the objectives of the respective organizations for the promotion of the European HDTV system were realized, and their commitments to Expo 92 and the European Community were successfully fulfilled.



European Broadcasters' Executive Development Programme



In the past few years, it has become increasingly apparent that the way in which television and radio broadcasters have traditionally managed their affairs is less relevant to the modern European environment. In many countries, the broadcasters' comfortable and predictable monopoly, operating within clearly-defined national boundaries, has all but disappeared. Unfamiliar, intensely-competitive broadcasters, aided by new technologies, are forcing a re-assessment of the rôle of the public-service broadcasters. Shrinking revenues are forcing a re-evaluation of the scale and structure of broadcasters' cost bases.

The **European Broadcasters' Executive Development Programme** is a new training initiative designed specially as a forum where senior managers of European broadcasting companies can address common strategic challenges. It has been developed specifically for this purpose by the London and Paris offices of **Mercer Management Consulting**, a major international strategy consulting firm. Mercer is a leader in media industry strategy development, and has created many other valuable management development programmes for top-level executives.

The programme is designed for senior-level managers in influential programming, production and administrative positions, and will provide a unique opportunity to stimulate thinking on the challenges that lie ahead, through interaction with colleagues from other European broadcasters. The programme is in four parts, beginning with *preparatory work* to identify strategic projects to pursue in the remainder of the programme. Then comes a four-day *Seminar*, focussing on strategies, audiences, resourcing and organizational change. Computer-based simulation techniques will give an opportunity to pursue unfamiliar, high-risk strategies and explore new solutions to familiar problems. The seminar is followed by *project team work*, by correspondence over a three-month period, on a subject of mutual interest. A one-day *de-briefing* session concludes the programme.

Initially, programmes will be held in Lyon, France. A maximum of 25 to 30 participants will be admitted to each programme. The next programmes, beginning on 1 February and 7 June 1993, will be held in English. The programme beginning on 27 September 1993 will be in French. The fee is £1850.- (excluding accommodation).

For further information, please contact:

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