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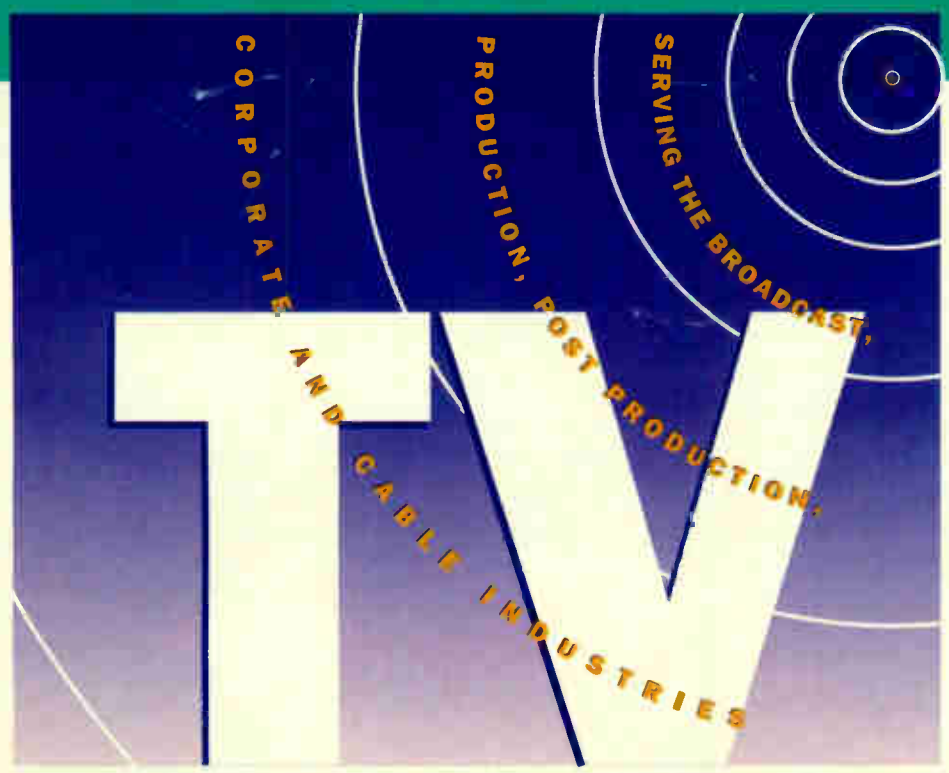

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World Cup Soccer Kicks Off in U.S.

EBU Distributes International Coverage Using Advanced Fiber/Satellite Network

by Arthur Cole

DALLAS

As World Cup Soccer kicked off in the U.S. last month, the demand for programming was extremely high as broadcasters from nearly 200 nations lined up for coverage.

Coordinating much of the coverage was be EBU Sports International (ESI), a subsidiary of the European Broadcasting Union created for the sole purpose of providing audio and video feeds for the 1994 World Cup.

The tournament is expected to generate more than 5,000 hours of programming, including opening ceremonies, 36 qualifying matches, plus a play-off series for the championship match.

ESI has set up production facilities at the nine cities where matches are scheduled — Boston, New Jersey, Washington, D.C., Dallas, San Francisco, Los Angeles, Detroit, Chicago and Orlando. Each site has a full complement of video and audio equipment, including Pesa distribution amps and video monitors; JVC goal-mounted cameras; Sony field cameras, editors, switchers, mixers and monitors; FOR.A editors, switchers and mixers; Tektronix vectorscopes, waveform monitors and audio monitors; Grass Valley processing amps, sync generators and frame synchronizers; Panasonic video monitors; Telex IFB systems; and Leader vectorscopes and waveform monitors.

FIBER FROM THE FIELD

Signals are being delivered to a broadcast center in Dallas using a DS-3 fiber optic line from AT&T, a U.S. long-distance telephone company.

"If you were to string out all the fiber optic cable used in the World Cup, it would probably wrap around the Earth one and a half times," said Kevin Carbone, a spokesman for ESI. "It is easily 40,000 miles of fiber."

In Dallas, the broadcast center has been outfitted with Sony cameras, recorders, switchers and slow-motion systems; additional cameras from Ikegami and JVC; FOR.A switchers, Pesa routers; and Abekas and Chyron graphics equipment. Audio gear includes Sony mics, boards and recorders; Shure mixers and mics; Grass Valley switches; and Electrosonic mics, as well as terminal equipment from Tektronix.

Cooperation and competition: Nearly 200 nations have arranged to downlink feeds of World Cup Soccer action.

Routing throughout the Dallas center is analog. ESI chose Sony's Betacam SP as its tape format and is producing everything in NTSC, even coverage that is being viewed in PAL and SECAM countries.

"NTSC equipment was the most readily available in the U.S.," Carbone said. "It will be up to each broadcaster to convert it to their own format."

One of the most complicated aspects of the project is audio routing. Commentators from around the world are at each venue providing dialogue for their home audiences. ESI is using a custom-designed patchbay system as its "commentary switching center" to route commentary along with the correct video feed to the

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Orbit Adopts Latest Technology
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BUSINESS

U.S. FIRM LOOKS TO BUY PESA ELECTRONICA

MADRID

In a move that would shift control of one of the largest video equipment manufacturing companies in the world to the U.S., Amper Group S.A. of Spain is considering an undisclosed offer from an Atlanta-based investment firm for the purchase of Pesa Electronica.

Under the proposal, the U.S. group, led by Percival Hudgins & Co., would inject at least $15 million into Pesa at the onset, although the actual purchase price has not been disclosed. A final decision is due by June 15.

Pesa Electronica is the parent company of Pesa Inc., which in turn owns a majority share of the Pesa-Chyron Group, consisting of effects systems manufacturers Chyron Corp. and Aurora, edit systems maker CMX, transmission equipment manufacturer Pesa-MCI, and router manufacturer Pesa Switching Systems.

Percival Hudgins & Co. is an investment firm that specializes in international ventures. Company officials could not be reached for comment.

Amper Group is a Madrid-based conglomerate with worldwide holdings in telecommunications and microelectronics companies. Its major shareholder is Telefonica, the Spanish telephone company, which is about 40 percent owned by the Spanish government.

SATELLITES

EUTELSAT TESTS SIMULCAST FEED

LONDON

In a move that could foster a gradual transition to digital broadcasting, rather than an abrupt one, Eutelsat and NTL have successfully simulcast a digital channel and an analog channel over a single 36 MHz transponder.

The test was made at the recent Cable & Satellite '94 exhibition. The analog channel with multiple sound carriers occupied 27 MHz of bandwidth while the digital channel, with CD-quality sound and an auxiliary data channel, used the remaining 9 MHz.

The digital channel was compressed using the MPEG method on an NTL System 2000 unit. The transponder was located on a Eutelsat II-FI at 13 degrees east.

Simulcasting digital and analog satellite feeds has long been a goal of the industry because it will allow cable head-ends to adopt digital technology quickly, while still allowing direct-to-home providers to deliver analog.

In other news, NTL and Pace Micro Technology formally completed an alliance announced last year by creating a new company, Pace-NTL.

The new company will focus on MPEG 2 products.

Meanwhile, the Cable & Satellite show reported a 35 percent increase in foreign attendance this year.

TELECOMS

BA, STET ENTER VIDEO AGREEMENT

ROME

Bell Atlantic, the U.S. telephone company bent on entering the video delivery business in the U.S., is now looking to export its technology overseas.

Bell Atlantic (BA) recently entered an agreement with STET, the Italian telecom holding company, and SIP, Italy's operating phone company, aimed at developing BA's Interactive Multimedia TV (IMTV) and Stargazer operating platform for the European and Latin American markets.

Under the agreement, BA has the option to purchase up to 49 percent of STREAM, STET's subsidiary for interactive multimedia services. STREAM is expected to develop IMTV services and provide programming and content.

SIP plans to conduct a technical trial for video-on-demand services by the end of 1994, with a market trial of 2,000 customers planned for 1995. The service would be delivered over SIP's existing telephone network.

EQUIPMENT

BRAZIL'S TV GLOBO RAMPS UP STUDIOS

RIO DE JANEIRO

TV Globo in Brazil is in the process of setting up four new studios with more than 11,000 square feet of space each.

One of the main contractors is Sachtler AG of Munich, which will provide its Gridclimber and Scenery hoists, as well as Pantographics and Lita trolleys. In all, Sachtler will provide 5,000 separate units valued at more than US$6 million.

Lighting fixtures include 2 and 5 kW types, and all equipment conforms to the DIN/ISO, VDE, and VBG 70 safety regulations of Europe and Germany.

EVENTS

SONY TO SPONSOR GOODWILL GAMES

ST. PETERSBURG, RUSSIA

Sony Electronics' Professional Media Division has announced it will sponsor the 16-day Goodwill Games, beginning here on July 23.

Sony will provide all recording media for Turner Broadcasting, organizer of the event.

The games are expected to generate 64 hours of original programming, plus 17 hours of weekend coverage.

The agreement also allows for participation by Sony Music, Columbia Pictures and the Consumer Products Group.

"(This agreement) is one element in a comprehensive five-year, multimillion dollar sales and marketing agreement with Turner," said Ken Wiedeman, vice president of the Professional Media Division. "Sony will provide all of the professional recording media for Turner's acquisition, production, broadcast and distribution needs."

The Goodwill Games are jointly presented by participating Russian and U.S. sports organizations, as well as the Russian Olympic Committee. More than 2,000 athletes from more than 50 countries are scheduled to participate.

NETWORKS

TV AZTECA ALLIES WITH NBC

MEXICO CITY

The recent alliance between the U.S. network NBC and TV Azteca, the former government-owned broadcaster, is seen as one of the first results of the NAFTA agreement here.

Under the deal, NBC holds options to acquire 10 percent to 20 percent of TV Azteca over the next three years. In the meantime, NBC will send a team of managers to TV Azteca to oversee operations, although Azteca officials will retain management control.

SMPTE

SMPTE SCHEDULES SECOND CONFERENCE IN EUROPE

COLOGNE, FRANCE

Following a successful program in 1992, the SMPTE has again scheduled a European conference during the Photokina Fair in Cologne. The conference will take place September 22-24, just two days after IBC in Amsterdam.

The conference will be centered around the theme "Convergence of Imaging Media," and will attempt to shed light on some of the compatibility issues among the various media.

The event will lead off with a day of tutorials focusing on "TV Imaging and Computer Imaging — How to Speak Together." Technical sessions will follow.

The conference languages are English and German, with simultaneous translation provided.

EQUIPMENT

CANAL+ ADOPTS DIGITAL BETA

PARIS

In a move designed to foster full-digital operation from production to transmission, French broadcaster Canal+ has begun a program to replace its existing fleet of Betacam VTRs with 82 Sony Digital Betacam machines.

The replacement program was announced in April.

"This decision means that we are able to complete the digital production chain we already had in place," said Daniel Thomas, director of engineering and maintenance at Canal+. "It gives us a logical way of providing our subscribers with the best possible quality."

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Opinions Vary on Berlusconi

Industry Applauds His Leadership Abilities But Worries About His Influence on the Media

by Andrea Rivetta

ROME

What is going on in Italy? While the country's traditional political situation had gone substantially unchanged since World War II, events in recent months have turned everything upside down.

The center party traditionally held a relative majority, but has now been reduced to a small party with very few representatives in the recent elections. Meanwhile, the pro-Communist left was able to maintain a strong opposition force, but was unable to gather much clout in the new government. So the ruling administration was captured by a center-right political grouping, rallied and guided by one of the most powerful men in the world of communications: Silvio Berlusconi.

ITALIAN MIRACLE

In his election program, Berlusconi promised a "new Italian miracle." Certainly, the first miracle was his own: He managed to seize power with a party born just a few months before.

Berlusconi is the only private publisher in the world who owns three national television networks in a single country and has a majority interest in three others (two of which are pay TV). The annual advertising business volume of these networks is 4 trillion lire. In the world of communication, he is also the owner of two periodical press and book publishing houses (business volume: 1.8 trillion lire per year), as well as several daily newspapers (120 billion lire per year).

His domain also includes ownership of the Milan A.C. soccer team and other companies engaged in various sporting activities (200 billion lire), housing construction enterprises (160 billion lire), insurance and finance companies (900 billion lire) and companies concentrating on large-scale consumer products distribution (4 trillion lire). All of this adds up to an annual business volume of more than 11 trillion lire.

And now this man has become prime minister of the Italian government. Obviously, many people are wondering about the effects of this new situation.

"Any conclusions you might draw now are bound to be premature," said Riccardo Fausone, president of the Italian Broadcasting Association. "It remains to be seen whether Berlusconi will be successful in shedding the garb of the industrialist.

"Just remember that Berlusconi, in starting out, gave the broadcasting industry a boost in the beginning," he added. "But then the development of the market and of the Fininvest Group brought a phase of aggression on the market that everybody had to pay for. There was also a pricing crisis in the post production sector, and it was caused by his aggressive policy in optimizing his own organizational structures and demanding terms in his favor.

"You cannot draw simple conclusions from an analysis of the past. Politicians always have been the representatives of economic power; in this case, the issue is clearer and the stakes are higher. He will have to be less aggressive in commercial terms and more credible politically. That in itself is already an advantage."

FORMING OPINIONS

Antonio Orizzonte, president of Associazione Broadcasting Italiana (an association of high-frequency equipment producing companies), also was willing to see how things develop before forming an opinion.

"I would rather wait and see what the specific political developments of this thing turn out to be," he said. "The situation is rather unique in that, like all unexpected situations, it generates a little bit of fear. On the other hand, there is no lack of positive signals, starting with the fact that for the first time we really have almost all ministers who are new and come from professional circles. The only thing that confounds me, and many others, is the sheer quantity of personal interests Berlusconi has in so many areas of the economy.

"In the high frequency area, specifically, I believe that what people expect of him will come true at last, after 20 years of anarchy in legislation and governing standards. Since he lived through all this himself, he ought to be particularly sensitive to this point. There is of course always one big unknown in this equation and that is how well he succeeds in keeping his own concerns aside as he tackles the big problems."

In his election program, Berlusconi promised a "new Italian miracle."

Felice Lloy, president of UPA (the principal association of advertising users), said he is optimistic that Berlusconi will benefit the economy.

"We have always wanted a government that would stimulate productivity and an economic revival," he said. "We have had administrations that made trouble for business rather than helping, as if business were the stepchild of Italy's growth. Today it seems that we are in for a drastic change of course, with possible benefits also in social terms. This new era — with a prime minister so close to our field of activity — is bound to be auspicious."

Within Fininvest, however, there is a certain amount of fear that Berlusconi will neglect his company in an effort to avert criticism of using political office to enrich himself.

"Knowing Silvio Berlusconi well, there is reason to fear (from our viewpoint) that he will devote himself mostly to the country as a whole, rather than to his business," said Manlio Cruciatti, technical director of Videotime, a member of the Fininvest Group concerned with the technical and production aspects of television. "Right now it is impossible to visualize a scenario. Much depends on the reshuffling of the entire telecommunications setup in Italy — whether cable will be shared, whether satellite use will be liberalized and what's going to happen to cellular phones."

BASIC COMMITMENTS

How deeply Berlusconi will remain an investor in business and industry is also the subject of speculation.

"We have to wait for the dust to settle," said Felice Agostini of transmitter manufacturer Teko Telekom. "There is one conceivable scenario: the hope that Berlusconi will not allow himself to be swept into this adventure and will instead decide to assign priority to his role as a new man in government, behaving correctly above all to silence the critics.

"But I do not believe that he will turn away from his business that quickly," he added. "Perhaps, in a second phase, he might get one or two of his networks back into the game, maybe even with one or two RAI [Italian Radiotelevision].

"As a matter of fact, through his own personal history, he has demonstrated an attitude as a monopolist rather than as a free-trader. If that turns out to be so, then the development of the market will fall mostly to local broadcasting outfits that will be pushed by the need of banding together for sheer survival.

"On the technological side of radio and television, I think we will have to wait a while before we see some tangible development. The first situation that will develop will probably be tied to public radio/television. We hope that this will not be expressed by a mere shift of the technological business to companies close to Berlusconi."

Other manufacturers were also willing to adopt a "wait-and-see" attitude.

"Everything will depend on the overall choices," said Roberto Valentin, of antenna manufacturer ABE. "There are two possible scenarios. If Berlusconi first and foremost acts as the prime minister, then he will be the first guarantor of clarity and openness at all levels and, hence, we will at last have sure and properly applied rules. If, instead, Berlusconi tries to derive personal advantages from his new position, then there would certainly be benefits, but only for those who are involved in certain areas.

"In both cases, however, I am convinced that there will be a substantial revolution on the market and a new course in the direction toward profitability," he continued. "The difference resides in the democratic way in which the distribution of advantages will be handled. Still, I believe in people, and I am thus ready to have faith."

However, faith may not be enough for everyone, even members of the more religious segments of society.

"As I see it, the government as such gives cause for worry," said Don Armando Cattaneo, a member of the Board of Directors of Corallo, a Catholic radio and TV consortium. "But for the telecommunications sector, Berlusconi's experience and personal style will bring greater attention and awareness. It was not just by chance that he appointed as his vice premier his own minister of posts who has specific competence in this matter." ■

Editor's note: Andrea Rivetta is a freelance broadcast journalist based in Rome.

Multibeam Antennas Gaining Ground

by Camilo Torres

GUEST COMMENTARY

Fast-moving developments in CATV/satellite-delivered TV programming have left many cable engineers confused about their reception options.

Engineers are often faced with conflicting decision-making criteria. Some feel it is best to keep costs down, while others prefer to invest now to avoid future obsolescence. However, one thing seems certain: The need to receive signals simultaneously from multiple satellites is on the rise.

THREE OPTIONS

An analytical engineer might reduce his satellite earth station options to three main strategies.

The traditional method would be the use of single parabolic antennas. This would be effective for CATV systems that do not have land restrictions or are not concerned with today's constant programming changes.

Also, small systems of 30 channels or less often find it difficult to justify a larger expenditure because the profit potential for tiering, pay-per-view and other pay services is reduced due to the size and channel-capacity of the system. So the addition of another single parabolic earth station seems to be the most used route.

The second method used to receive more than one satellite would be the use of cost-effective multiple-beam parabolic retrofits in dual, triple and, in some cases, up to five-beam configurations. Usually, these commercial grade retrofits are designed to see adjacent satellites within a 12-degree view arc.

The third option is the use of a full-arc spherical earth station antenna, like Antenna Technology's quasi-parabolic Simulsat antenna. In a fixed position, these antennas offer instant access to all 35 satellite positions in the C- and Ku-band frequencies, eliminating the threat of future obsolescence.

To receive new satellites or programs, a Simulsat user simply adds another feedhorn along with appropriate electronics. Consequently, many Simulsat users maintain at least one spare feedhorn for changes or special events. This allows easy access to programming without interrupting existing channels.

Over the next several years, more satellites will be launched and others will be retired. This will create many changes and sometimes confusion concerning available satellite programming.

As evidenced by history, programmers often switch from one satellite to another with little notice. Many cable companies have found that profitability does not stem from the number of subscribers that initially add service. Instead, long-term retention is the key. As programmers move to other satellites and cannot be quickly recovered, dissatisfied customers cause a drop in retention.

The choice of whether to use separate parabolic antennas, a multiple-beam retrofit antenna or a full-arc reception antenna is often dictated by space availability. CATV systems are typically built in high density areas where land space is at a premium. Often, space for two or three parabolic antennas is either not available or has higher value for an alternate use.

Even with sufficient space, the creation of an antenna farm may be aesthetically undesirable. Additionally, many local ordinances make it difficult to get even one antenna installed and nearly impossible to get a second or third earth station installed.

The larger Simulsat full-arc antenna utilizes the space of approximately one-and-a-half parabolic antennas of equivalent size.

Since most operators are faced with the need to view multiple satellites, it is important to understand the differences, applicability and trade-offs between parabolic systems and the spherical scanning of the full-arc reception Simulsat antenna. These differences are especially important now that the U.S. has begun implementing closer satellite spacing.

As with all antennas, a retrofit system does have practical limitations when used on parabolic antennas. This is because the gain of the off-boresight feed is not the same as the gain of the boresight feed due to phasing problems and an overall reduction in the amount of surface illuminated. In a parabolic beam scanning or parabolic multiple beam operation, a feed placed at the focal point receives a beam from the reflector. Displacement of the feed in a transverse plane to receive an adjacent satellite produces a linear phase shift across the aperture, thus changing the direction of the beam by the angle 0.

The popularity of multibeam antennas is likely to increase.

OPPOSING SHIFT

In the opposite direction of the shift, a coma lobe, the combination of the main beam and first side lobe, is introduced. This shifts the main beam, degrading the gain. Hence, multifeed parabolic antennas produce maximum narrow gain only on axis. Off-axis, directivity is reduced, beam-width broadens and the coma lobe broadens.

The amount of degradation is commonly dependent on three factors:

1) f/d (focal length to diameter) ratio

2) surface accuracy

3) the distance in degrees of the off-boresight the antenna is illuminating.

Antennas of similar physical size but different designs in depth offer vastly different performances when utilizing a multiple feed retrofit. A commercial grade 5-meter antenna of .38 f/d will have an off-boresight degradation of approximately .5dB at 3 degrees and 1.8dB at 8 degrees from a boresight gain of 44.0dBi. A 5-meter antenna with a .30 f/d will have an off-boresight performance of .5 to .7 at 3 degrees and 2.7 to 3.0dB at 8 degree degradation from the boresight gain of 44.0dBi.

SURFACE ACCURACY

Performance of the antenna is in large part dependent upon surface accuracy. Older antennas may have had different tolerances to begin with or have lost their parabolic shape due to insufficient structural back support or poor installation. This deviation from a perfect parabola surface is especially critical with the use of a multibeam retrofit.

Experience has proven that an antenna with a poor surface accuracy does not perform as well off-boresight, especially with older antennas retrofitted specifically for the off-boresight feeds. This could cause a multitude of satellite signal performance differences to the CATV system attempting to "get by" with a retrofit.

Other areas which should be considered are the increasing prominence of terrestrial interference (TI) and adjacent satellite interference, which in part correspond to the particular sidelobe suppression for the parabolic retrofit. For example, when retrofitting an existing cassegrain-type antenna, the chances of acceptable adjacent satellite isolation and acceptable performance in a TI environment are less, compared to a prime focus antenna. Side lobe levels will be approximately 9 to 13 dB down for a typical 5-meter cassegrain and from 17 to 22 dB down for a prime focus retrofit.

Another important consideration is that most retrofits do not meet the 2-degree spacing requirement. However, it has been proven that a very accurate 3.7-meter antenna can provide acceptable satellite discrimination if conditions are perfect.

The problem with 2-degree spacing on most retrofit antennas is that the actual main lobe beamwidth does not fall within the required envelope at the 1-degree points on the plot of the log theta curve.

In spherical beam scanning a feed illuminates only a portion of the reflector, the area represented by the aperture. The feeds are placed along an arc such that the aperture produces a beam in one direction, while a feed looking at a reflector segment produces a beam in another direction. Here, the feed illuminates the reflector consistently for all beam positions until one starts to actually look over the edge of the reflector.

Scanning is only limited by the physical size of the reflector and that point at which the opposite edge of the reflector begins to block the reflected waves from the operational zone. No coma lobe is produced since the feeds are always in focus.

The quasi-parabolic Simulsat utilizes the on-focus beam principle in the elevation plane and spherical beam scanning principle in the azimuth plane.

REFLECTOR DISH

The Simulsat is a reflector dish for TVRO applications, and receives signals (in the above-mentioned shared space concept) from up to 35 C- and Ku-band satellites with a 70-degree arc. It is based on research that began in Great Britain in 1945 and was continued by Bell Labs in the 1950s. Since that time, a continuum of programs has been carried on by NASA, the U.S. Air Force, the U.S. Army and other agencies.

From a technical standpoint, the primary limitation of the Simulsat design is spherical aberration. In order to collimate energy from a plain wave to a point source through a single reflecting surface, Fermi's principle of least path dictates a parabolic reflector. A spherical reflector is a deviation from a parabolic reflector having aberration. The greater the curvature, the more loss in gain and the higher the sidelobe performance of the antenna.

The classic approach to the solution to spherical aberration problems has been the choice of a large radius of curvature: The larger the radius of curvature, the less the spherical aberration. However, large radius of curvature implies a large structure. Large structure is counter to the desires of a practical antenna system.

Large radius of curvature also dictates large focal length or large f/d ratio, usually on the order of one. Thus, a 16-foot diameter antenna would have a 16-foot or more focal length. This does not lead to practical structures.

Antenna Technology Corp.'s approach to the problem has involved integrating the feed structure design of the required radiation characteristics and matching that to the reflector surface to provide optimum performance and a minimization of the spherical aberration.

With the increasing amount of programming causing cable systems to downlink from multiple satellites, any new system will have to demonstrate flexibility, capability and technical performance.

The professional engineer should strive for the most efficient, professional system design that takes into account present and future needs.

Today's decisions will dictate tomorrow's profits. ■

Editor's note: Camilo Torres is Antenna Technology's area manager for Mexico and Central and South America. He holds a degree in civil engineering from St. Thomas University, Colombia.

Orbit Adopts Latest Technology

Digital Betacam, Advanced Compression Systems Top the List of Gear at Network's Rome Facility

by Chris Dickinson

ROME

Orbit Television, the new all-digital satellite broadcasting station based in Italy, will broadcast from one of the world's most advanced facilities, equipped with serial digital routing and Sony Digital Betacam VTRs.

Orbit, which is backed by a group of Arab businessmen, has 20 channels aimed at Southern Europe, North Africa and the Middle East using digital compression equipment supplied by Scientific Atlanta and NTL.

Orbit refused to disclose the total cost of the operation, but the contract to supply uplinking and settop decoders alone is worth up to $125 million.

ON THE AIR

Orbit's first promotional channel aired on ArabSat in the middle of April, with the full 20-channel service due to have been launched by the end of May.

The company has signed agreements with The Discovery Channel, All News Channel, CNN International, and BBC World Service Television to uplink their services, plus other programming agreements with Columbia TriStar, ESPN, CBS, ABC, NBC and E! Entertainment.

John Fernandez, Orbit's director of broadcast operations and engineering, says that although the service has to build up an audience from scratch, the potential is huge.

"Our markets in the Middle East and North Africa have pent up demand for entertainment and information," he said. "Building the region's first fully digital transmission center will give Orbit the competitive edge in serving these markets."

The encryption codecs used by Orbit are currently the System 2000 from NTL and Scientific Atlanta, but the company says it plans to move to Scientific Atlanta's 4000 system when it becomes available. Scientific Atlanta is also providing Orbit's satellite earth stations and head-end equipment.

To get programming material from the U.S. to its headquarters in Rome, Orbit has signed a contract with COMSAT World Systems for the lease of a digital 72 MHz channel on Intelsat. COMSAT says it will deliver feeds from the U.S. broadcasters uplinking on the Orbit service.

Orbit also plans to activate a satellite-based return service, bringing some programming back to the U.S. to target communities with large Middle Eastern populations. This in-bound channel is expected to be activated later this year.

The Rome operation is one of the most advanced of its kind anywhere, with an extraordinary amount of state-of-the-art equipment. The basic concept was taken from Hong Kong-based Star TV, where Orbit's general manager Philip Braden, was formerly in charge of operations.

"The engineering team that built Orbit was also at Star TV, so we had recent experience of designing and building a multi-channel system from the ground up," Braden said. "The reason we have gone for such state-of-the-art gear is we wanted to buy the best technology for the application at the time, and that is serial digital."

THE RIGHT PEOPLE

Braden added that the decision to base the operation in Rome was made because of the location and the availability of the right people.

"We chose Rome for its access to the European labor market; getting 600 trained staff together in four months is not easy," he said. "We also needed a friendly and respected operator, which we have in Telespazio. And Rome is a beautiful city."

Orbit placed orders with several leading manufacturers. Dynatech Video Group has supplied much of the routing equipment, while Sony has provided VTRs, editing system, and playout machines. TSL, a U.K. design and installation company, was contracted to install the master control and transmission facilities.

At the heart of the system lies a digital routing matrix from Alpha Image, a Dynatech subsidiary. The system is expandable to 256x256 and links the 14 online edit suites, two non-linear edit suites, a Quantel Henry, and a high-end Alpha 500 compositing suite for stings, idents, promotions, and trailers.

Other Dynatech products to go into the facility include 13 Digital Master Control DMC-601 units and a TAS Total Automation System to automate all 20 channels and provide an additional by-pass channel in case of failures, emergencies and special applications such as live broadcast feeds.

Sony supplied 120 Digital Betacam VTRs, which were rigorously tested by Orbit before acceptance. Sony also supplied two library management systems (LMS), eight Flexicart multicassette automation systems, five DMX-E2000 digital audio consoles, six DVS-2100 and three DVS-6000C component digital switchers, six BVE-2100 and six BVE-9000 editing systems, and nine DME-3000 digital multi-effects systems.

COMPRESSION CONCERNS

Braden said he was at first a little hesitant to use Digital Betacam because of fears about cascading compression schemes. Digital Betacam and the transmission system both use compression. But Braden said a battery of tests, undertaken with the help of Scientific Atlanta and NTL, showed there were no ill effects.

"We conducted a series of tests at the NTL labs in England, basically to beat the hell out of the system. But we had no problems at all," he said. "After that, it came down to a financial decision."

Quantel was another supplier to Orbit. In addition to the Henry, Orbit acquired 16 single Picturebox stillstore systems and 11 twin Pictureboxes, two Picturenet controllers, a Picturebank, three Paintboxes and a Hal compositing system. Quantel's installation arm, Quantel Broadcast Systems, also put together the entire graphics area for Orbit, supplying six custom desks, as well as racks and peripherals.

David Sadler, Orbit's chief engineer, said the Quantel equipment gave him flexibility in routing.

"We will be using Picturenet to connect the total of 27 single and twin Pictureboxes to the three Paintboxes; thus we will be able to create top-quality graphics on Paintbox and immediately commit them safely to air," he said. "Having the additional firepower of Hal and Henry will obviously further enhance our capabilities, in terms of compositing and editing for anything from promotions and stings to complete news items."

Separately, Aston Electronics supplied Orbit with 16 Motif character generators, each with dual language English and Arabic fonts.

Snell & Wilcox provided a number of its top-end Alchemist standards convertors with Ph.C phase correlation motion compensation system.

Pro-Bel provided 124 of its third generation stereo digital audio convertors for patching into the central matrix. ■

Japan Muses Digital Information Highway

by Mark Hagan

TOKYO

Despite Japan's recent flip-flopping on digital HDTV, it appears that the country is eagerly pursuing a U.S.-style "information superhighway" that, by all indications, will be digital.

It even appears that the highway will traverse the Pacific Ocean now that an agreement of cooperation has been reached between Japan and the U.S. At a recent meeting between Edward McCracken, co-chairman of the U.S. National Information Infrastructure (NII) Council, and Katsuyuki Hikasa, Japan's new minister of Post and Telecommunications, the two agreed to cooperate on the construction of a global fiber-optic information network.

Current plans call for Japan to build in optical-fiber network for domestic communications, and the country is eyeing a wider network to link up with South Korea and other Asian nations. The Global Information Infrastructure (GII) project is being promoted by the U.S. and is now fully supported by Japan, according to Hikasa.

In a related move, the ministry has convened a panel to discuss Japan's broadcast system standard. Last February, Akimasa Egawa, administration bureau chief at the ministry, drew a firestorm of protest following his statement that Japan would probably adopt digital HDTV technology in the near future. Much of the protest came from the NHK network, developer of the analog MUSE transmission system currently in use.

Although Egawa retracted his statement the next day, it did little to cause the world to abandon its rush toward digitization.

The new panel is to consider the issue of switching the country's analog broadcasting system to digital. A policy recommendation is expected by March 1995. However, it is widely believed that a decision has already been made to gradually digitize Japan's entire broadcast system by 2009, starting in 1996, although no statements have been issued publicly.

Meanwhile, the prestigious Nihon Kezai Shimbun, Japan's leading financial newspaper, has reported that the ministry is also considering lifting a ban on the entry of broadcasting companies into the telecommunications business. The paper cited a plan for all-digital broadcasting through communications satellites beginning in 1996, and then through broadcasting satellites from 2008. Between the year 2000 and 2009, ordinary telecasting will be digitized.

Adding to the digitization movement, KDD, the international telephone service, has announced the development of technology for the compression and digital transmission of HDTV. Officials stated that they have successfully compressed HDTV signals to a 30:1 ratio for digital transmission at 45 megabits per second (Mbps) on a U.S./Japan undersea fiber cable.

KDD contends this will facilitate the easier and cheaper transmission of HDTV across borders.

Of course, it is difficult to foretell what the future holds, and with the political climate in Japan such as it is, it is risky to predict where developments will lead in the long term.

With NHK investing so much time and effort into the analog MUSE system, it is hard to imagine the network abandoning the system without getting as much use out of it as possible.

However, in a country known for its ability to break technological barriers, it is equally hard to imagine the Japanese foregoing digital technology in the next generation of telecommunications. ■

Mark Hagan is a Tokyo-based media consultant. He can be reached through ***TV Technology.***

CONTINUED FROM PAGE 1

World Cup Soccer Kicks Off in U.S.

proper destination.

"If you count the number of commentary positions at each venue, we have over a thousand," Carbone said. "Of course, not all the venues will be in operation at the same time, but we might have as many as 150 commentaries going out at any given time."

RADIO COVERAGE

The audio system also feeds radio broadcasters around the world. The EBU is making available feeds consisting of commentary, crowd noises, or both. In this way, radio broadcasters can air an entire feed from the U.S., or pull only the crowd noises and insert their own commentary on top.

While coverage of the tournament is available in the U.S. on the ABC network and ESPN, the cable sports channel, demand has been greater overseas, where nearly 200 nations have signed up with Comsat World Systems for programming.

Comsat is using a computer network and three operators at the Dallas facility to coordinate programming to the correct uplink.

Signals are being delivered to a broadcast center in Dallas using a DS-3 fiber optic line from AT&T . . .

"Our presence in Dallas requires telephones and computers only," said William McNamara, manager of system engineering support for the project. "We are not actually routing any video through our systems, just making sure it gets to the correct earth station."

From Dallas, the feeds are being shuttled via the same DS-3 network to two AT&T GateWay uplink sites, one located in Etam, W.V., for the Atlantic Region, and the other in Triunfo Pass, California, for the Pacific Region.

INTELSAT CARRIAGE

The signals are being carried on an Intelsat 6 series satellite at 335.5E for the Atlantic feed. In the Pacific region, an Intelsat 701 at 174E is being used. Both birds use C-band.

"It has been a logistical chore, mostly," said Carl Jeffcoat, vice president of engineering and operations at Comsat. "It has not been quite a challenge technically. We are not using anything like channel compression; most are regular channels. But it is just a lot more channels to a lot more locations."

One of the more difficult problems has been meeting the rather flexible needs of each country. Coverage requirements could increase or drop off entirely during the tournament, depending on a particular team's success.

To overcome the problem, Comsat arranged various weekly and monthly contracts, allowing broadcasters to renew or cancel without a lot of hassles.

Much of the day's coverage is being handled on a day-to-day basis, however.

"As requests come in, ESI tells us what source is there, and we just make sure it is delivered," McNamara said.

In addition to the regular feeds, Comsat is coordinating delivery of post-game coverage, interviews, etc. Broadcasters are using various uplink facilities around the U.S., including Washington International Teleport in Washington, D.C., Micronet in Glenwood, Calif., IDB in Staten Island, N.Y., and Hero Communications in Miami.

For the U.S., ABC and ESPN are picking up the EBU feed and supplementing it with their own coverage.

NEEDED ATTENTION

Part of the reason the World Cup is being held in the U.S. this year is to draw some attention to a sport that has captured a fairly small audience here. Traditionally, U.S. broadcasters have been reluctant to air soccer matches because the continuity of play does not lend itself to commercial breaks.

However, ABC and ESPN have lined up sponsorship to provide uninterrupted play with breaks during half-time only.

"The problem with soccer is that it does not stop, even for penalties," said Jonathan Leess, vice president of production planning at ABC. "In baseball, you break in between innings, and even hockey gets timeouts during whistles."

So while U.S. viewers have a chance to experience European-style soccer, ABC and ESPN have a chance to experience European-style broadcasting. ■

Creating Order Out of Xaos

Pandemonium's Wide Range of Effects and Tools Helps Give Global Design Its Award-Winning Edge

by Piero Cecchini

SPECIAL REPORT

Founded in 1988, Global Design is one of Italy's leading television graphics and video design companies. The company recently received the Gold Medal for art direction at the New York Television and Promotion Festival.

"Metamorfosi", the award-winning project, was produced in-house on a Silicon Graphics Indigo workstation using Xaos Tools' Pandemonium and nTitle software. The company also used Pandemonium to create three short commercials for Kodak Fun cameras and one for Emporio Armani, as well.

FILLING A VOID

Pandemonium is a tool that I have wanted for a long time. There are many interesting 3-D packages on the market today, but before Pandemonium, special-effects image manipulation software was like a black hole. In particular, well-designed software that allows designers ample freedom to experiment was noticeably missing.

We did our first Pandemonium job for Emporio Armani. We used a mixture of Pandemonium effects and tools, such as color correction utilities to enhance still photos; zoom, pan and dissolve effects to create the sequence, and the Impressionist effect to convey the sense of warm, naturally painted imagery. We then tweaked the result with the Function Tool.

Both the client and the creative community loved it. Soon after this job, we created three commercials for the promotion of Kodak Fun cameras — Flash, Panoramic and Aquatic — for our client, J.W. Thompson.

Pandemonium proved to be indispensable. For the Flash commercial, we completely changed the lights, atmosphere and even the product in the hand of the actor (which we did on the Quantel Paintbox), we color-corrected the imagery using Pandemonium's Glow Matte effects to simulate a flash.

ZOOM AND VORTEX

For the Panoramic commercial, we used the Zoom and Vortex effects. Vortex was extremely useful because we had to widen the image in order to simulate the panoramic film format. Using the Function Tool's sliders, we obtained a double zoom out, replicated the sides dramatically and — because the scenography was a pile of colored empty boxes — it came out perfect.

The Kodak Aquatic clips required more visible manipulation of the original footage. Before creating a bubbly effect, we added a warp animation to obtain the waving effect to simulate the underwater atmosphere. We were thrilled with the final results, and so were our clients.

I think Pandemonium gives the designer more than special effects. The program supplies digital artists with a graphics tool that traditional artists have always wanted: a tool that transforms through randomness. When-ever you work with real objects, there comes a time that you want to capture the randomness of natural phenomena for that distinctive touch that makes your work unique. Pandemonium is a great tool to create that natural and unique look.

Since our main work — design for television IDs, program titles and graphics — has become more and more a mixture of different components, we have developed new needs. We need not only technology that can compute faster, but also software we like to design with. This means that tools are necessary to stimulate our ideas and to help us develop in-house projects that combine different media in an entirely new way. Pandemonium is such a product.

Underwater Magic:
Global Design used Pandemonium's warp and bubble effects for this Kodak spot.

I enjoy working with Pandemonium from the earliest steps of a project because it offers tools that allow experimentation and visual research. Quite often, I am experimenting with an effect in the middle of a job and I see a result that inspires ideas for other projects.

This is exactly what happened when creating the Metamorfosi, which contains a 35-second sequence of 11 animated letters. In this sequence we created a 3-D animation, applied Pandemonium effects (in this case, Vortex for the morphic mirror) and post-processed the sequence with matte and dissolve effects.

DIFFERENT MORPHS

At this point, I have tested different ways to obtain that "metamorphosis" effect through the Warp Transition tool. This worked great in transforming one scene into another thanks to the common white background and the different colored subjects.

Feedback is another positive aspect of Pandemonium. In terms of design or concepts, feedback means that you can visualize your ideas more or less immediately in order to verify or adjust the hypotheses, based on what you have in mind. Sometimes the feedback will prompt you to use another tool, sometimes you expect what comes up, and sometimes you will be surprised. Even though you might not like the outcome of special effects for one job, the feedback experience could be useful on another.

SOUND CHECKS

One tool that I am anxiously waiting for — but I know that everybody is working on it — is the capability to put previews together with soundtracks. Such a tool would be the "cheer on top of the cake," as we say in Italy.

Within the changing industry of communications, design will remain the most important component because it gives shape and flavor to most of the images that surround us. Assuming this responsibility as designers, we enjoy the fact that there are tools to help us produce the most interesting and intriguing images for our clients and viewers. ■

Editor's note: Piero Cecchini is founder and owner of Global Design.

For further information on Pandemonium, contact Hans Hartman at Xaos Tools (telephone: +1-415-487-7000; FAX: +1-415-588-9886), or circle **Reader Service 22.**

3D Studio Gains in Release 3

by Bruce Goren

COMPUTER VIDEO

Most modern post facilities around the world are now stocking up on Indigos, Macs and IBM PC compatibles to integrate computer video into their suites. The debate is over which platform is superior (except perhaps between competing product managers). For now, it is a draw and everyone wins, mostly because there is so much re-engineering work to be done, and jobs to turn out — if your facility has the technology.

In the mid-to-late 1980s, the name I do business under, Cheap Computer Graphics, was something of an oxymoron, evoking knowing sly grins from producers. Back then, decent software, even on the PC, was well over US$10,000, and memory was hundreds of dollars per megabyte.

START-UP COSTS

By the time you finished adding a Truevision Targa or Vista graphics card, single frame edit controller with time code, a sync generator, RGB/NTSC encoder, TBC, monitors, scopes, a souped up CPU, and even the lowest end acceptable VCR (VO-5850 or AG-7500), we were talking between US$35,000 and US$60,000 just to get started.

Today's top-of-the-line personal computers offer more than 10 times the speed and capacity at roughly half the price of the first generation of machines. The cost of professional grade animation software has plummeted from the US$10,000 to $15,000 range, down to US$2,500 to $3,000. You can realistically expect to build a workable system for one-third the start-up investment of my ancient origins.

Carrying the banner of great affordable software is Autodesk of Sausalito, Calif., (Telephone: +1-415-332-2344; FAX: +1-415-331-8093) which recently unleashed a bigger and better version of its 3D Studio — Release 3, for MS-DOS-based systems.

The program boasts over 250 new features and enhancements. Rendering speed and image quality are the main focus of the improvements, with many tweaks you might not immediately notice.

Forget about frame buffers, single frame controllers, even tape machines — 24 bit color boards are now a commodity item you buy for a few hundred dollars mail order. Of course, those of you on the leading edge of technology will have to wait six months after you buy the latest, greatest hardware to get usable software drivers.

Full function TBCs, and even waveform monitors and vectorscopes, are available on ISA boards. Overpriced single frame controller cards have been all but replaced by overpriced software-only solutions that will no doubt yield to the pricing pressure of the marketplace soon enough.

For videotape previews (or final delivery to non-broadcast clients) of your animation, buy an 8mm VISCA capable editing deck and control it with software directly through your RS-232 serial port. More often than not these days, clients take their finished product in digital file format instead of film or tape, for various disk based presentation objectives.

UPPING THE ANTE

With more users eyeing output at 24-bit, Autodesk significantly upped the quality ante. 3D Studio's images are now computed at 64-bit accuracy for "Super-Truecolor," 48 bits of color and 16 bits for Alpha. Also, analytical anti-aliasing, gamma correction and NTSC color correction combine to make a professional look easy to achieve.

Image quality equal to what you would expect from software running only on expensive workstations is no longer just hype, but an honest comparison. One shining example is the new metal shading mode for objects made out of copper, gold, brass, etc. Objects can also be modified with Renderman-like shaders. WIRE makes your model look like it is made out of shadow

3D Studio Release 3 offers improved rendering speed and image quality.

casting glass filaments, wrought iron, copper pipe, you name it.

The materials editor has a new look, and the resolution of the graphical user interface is now at a more workable 640 x 480 and fills the screen with new buttons and sliders. Two additional samples windows also have been added across the top. New mapping types — specular, shininess, and self illumination, join the old group of texture, opacity, and bump bit-mapped modifiers or masks, catching up with a few rendering goodies first offered on the PC platform by competitor CrystalGraphics in the Topas package.

While a second texture map is now available, Topas still offers greater multiple map latitude. Sadly, my biggest complaint about 3D Studio still hasn't been sufficiently addressed. Using standard SVGA boards and drivers, the 2-D Shaper, 3-D Editor and Keyframer modules cannot display a background image in anything better than a "proxy" mode using three variable clip level shades of gray.

I find the resulting hi-con image mostly unusable or unbearable. Perhaps I have been spoiled by running Topas on a Targa board or SoftImage on the Indigo Elan.

In its latest version 5.0, Topas even offers automatic perspective matching of your model to a background bitmap. But in all fairness, some of 3D Studios' more ardent fans feel the proxy background quality is just fine, thank you.

I recently completed a free-lance job using 3-D Studio and the IPAS Boutique to create particle systems effects at a major post house for a nationally syndicated science fiction weekly program. Not being able to display 8-bit dithered or true color background frames in the 2-D shaper or 3-D editor from the locked-off camera original cost us. I had to eyeball-calibrate using output from a video printer, knowing the editor could make fine tuning adjustments with a Kaleidoscope in final assembly.

MORPHING MAGIC

My favorite new feature of Release 3 is that the Keyframer now permits morphable materials. For instance, it allows you to animate wood into brass without the extra steps of rotoscoping a texture map movie as a pre-produced dissolve.

In addition, a new interrogative prompt is invoked with the ALT key plus selection of any command with an unfamiliar function. This brings up context sensitive on-line help within 3D Studio.

Render region and render object are welcome additions that I have enjoyed saving time with on competing applications. The most enjoyable lighting enhancement is an effect I first saw described as a shader in The Renderman Companion called slide projector light.

3D Studio now enables you to use a still or animated bitmap as a lighting filter — kind of like projecting a 35mm slide or motion picture. Use it for animating dappled shadows of swaying trees through an open door or simulating the subtle play of color on the floor of a church generated by sunlight through stained glass art work.

Renderfarms was the buzzword at this year's SIGGRAPH gathering. The idea is to distribute the time-intensive task of rendering the hundreds of individual images that make up an animation across a network of otherwise idle CPUs and then harvest the finished images to a huge drive on the server.

The 3D Studio Advanced User Guide warns that configuring a network is no trivial task — my nomination for understatement of the year. Once you have a network in place though, renderfarming means you can churn out solid minutes, instead of mere seconds, of complex animation overnight.

There is no additional software cost for this capability. Your single 3D Studio license permits installation of the software on as many computers as you have connected (network machines will only respond to command line, batch file or network rendering commands), up to a theoretical limit of 9,999 nodes. Piracy is governed by the hardware dongle on your main workstation, which unlocks the full modeling and editing functions of the program for a single seat.

Enhancing 3D Studio's efficiency even further, you can send an animation out to be rendered on the network while you are still working on editing models or choreographing motion with your main PC. Better yet, like the batch mode of Topas, single machines now can be easily set up to automatically render multiple sequences of animations unattended.

This is done by creating a network queue and invoking slave mode. Your single machine, as the only available machine of the "network," renders each task in turn. This is a vast improvement over the previous requirement of tediously writing batch files with a text editor. But take heart, if writing batch files is your thing, you now have a text editor built right inside 3D Studio. It is also useful for messing around with the 3DS.set parameters.

One of the best things about 3D Studio is the wide range of third-party developers who have signed on to the product. Autodesk recently entered a development agreement with software developer Xaos Tools of San Francisco. This is another major blow to competitors like Topas originator CrystalGraphics, whose user numbers are now dwarfed by the 25,000 customers that Autodesk 3D Studio has accumulated in only three years. Ironically, Topas, like CubiComp before it, first offered an add-on image processing option years ago called Image-Paint — but its command line interface was difficult to use and the package was overpriced.

CHECK IT OUT

In an upcoming Yost Group IPAS Boutique to be released this spring, there is reportedly a motion dynamics .KXP to facilitate graphical editing of spline-based function curves to control positional and rotational velocity.

New smoke and fire particle systems have also been hinted at. I am still waiting for a good procedural crater routine, but in the meantime, maybe the displacement mapping procedural modeler I have heard about will suffice. This will work much like pulling raytraces of fractal heightfields.

Schreiber Instruments is about to release a new six-pack of IPAS2 (compatible with 3DS release 2) special effects routines to add to its Imagine collection. They were kind enough to include me in on the beta testing stage of development.

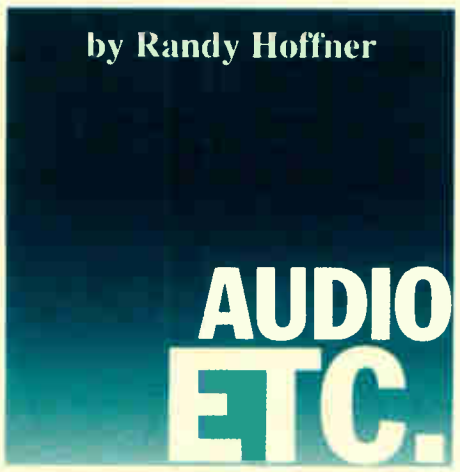
Lightning is very useful. While not totally realistic, it is an effect you will use over and over. Another effect, Comet, looks very nice, but you will not find much use for it. Rings gives a nice pyrotechnic touch to logo animations, radiating ripples of color off a selected object. Particle Cloud is very computationally intensive (slow), but it is a great implementation of chaotically distributed particles.

Another useful IPAS routine that will soon be available is an Imagine-to-3DS file converter. There is a lot of model geometry data being generated on Amigas in this format. Watch for this product from Syndesis Corporation.

But what if you need high quality output to broadcast videotape formats such as D-1, one inch, Beta-SP? Before you sell your home, consider this. Instead of investing enormous amounts of money in a broadcast quality tape

(continued on page 17)

Tightening Up Audio Tolerances



The introduction to CCIR Report 412-4, "Transmission Time Differences Between the Sound and Vision Components of a Television Signal," states: "In the early days of long-distance transmission, when the video and sound were transmitted via different facilities, there occasionally existed a perceptible lack of simultaneity between sound and vision... Today, even though the sound and vision of a television programme may be transmitted via different facilities, the transmission velocities used are such that little or no lack of simultaneity between sound and vision is experienced."

It is true that the diplexed systems typically used to transmit television video and audio over telco circuits, satellites and the like do not generate significant relative timing differences between audio and video. But if you have watched any television recently, you have probably realized that there are indeed ways to subvert relative audio/video timing.

CAUSES OF DELAY

Consider what we glibly refer to as "analog video." Virtually every videotape recorder newer than a two-inch quad machine employs a digital time base corrector. Digital frame synchronizers are used routinely to time externally produced signals to the television plant, and a given video signal is frequently subjected to a cascade of two or more such frame synchronizers. Digital video effects units are used to put pictures within pictures.

All such devices have one thing in common: some finite amount of time delay caused by analog/digital conversions and digital processing.

The result of the digital processing that virtually every video signal undergoes one or more times before it is transmitted is delay relative to the audio signal, which itself often undergoes no such treatment.

The most straightforward solution to this problem is to convert the audio signal to the digital domain, then delay it until it is time-coincident with the video signal.

Human perception of audio/video timing disparities works against the television engineer. Our sensory systems find it much easier to accept sound delay with respect to picture than they do picture delay with respect to sound. Up to a point, it is natural for sound to lag behind vision — the lag increases with distance between stimulus and observer — because sound travels much more slowly than light.

We all remember the high school example of someone hammering at a distance, in which we see the hammer hit well before we hear the impact. There is no natural situation in which the sound of a physical event precedes its vision, so the human sensory system has a much lower tolerance for audio preceding than for audio following associated video.

Unfortunately, the audio/video world in which we currently work is far more likely to produce delay of video than audio. As things move increasingly into the digital domain, the situation will be different: Both audio and video will be subjected to digital processing and other actions that will produce delay, and in all likelihood they will be delayed by different amounts.

Fortunately, both audio and video are in the digital domain, and this will make it relatively easy to put them back in sync.

The result of digital processing . . . is delay relative to the audio signal, which itself often undergoes on such treatment.

TOLERANCE SPECIFICATIONS

There is, of course, general recognition of this problem. The Radiocommunications Sector of the International Telecommunications Union, which was formerly known as the CCIR, is currently working to specify tolerances of delay between video and its accompanying audio.

Those familiar with the work of this international standards-setting body know that, being both international and bureaucratic, its wheels turn rather slowly. So there is certainly time for us to review some of the ITU Radiocommunications Sector's work on A/V timing. (Although the name of the organization has changed, existing reports, recommendations, and other documents are still called CCIR documents.)

CCIR Report 1081, "The Relative Timing of Sound and Picture Signals," refers to studies that have been carried out by the European Broadcasting Union and in Australia that suggest that delay of sound with respect to picture on the order of 40 milliseconds, corresponding to a path distance of about 40 feet from the listener, is often detectable.

The Australian CCIR input document cited a 20 millisecond sound advance with respect to picture and a 40 millisecond sound delay with respect to picture as "detectable" in material with frequent audible and visual cues, such as lip-sync. The document reported a sound advance of 40 milliseconds or a sound delay of 160 milliseconds as "subjectively annoying," even with relatively uncritical material.

The EBU recommends limits for audio/video outputs intended to feed broadcasting transmitters of 40 millisecond sound advance and 60 millisecond sound delay with respect to picture.

The digital processing delays I have spoken of are cumulative, but, while any single one may be small, their combined effect can be devastating when cascaded.

While no recommendation yet exists for end-to-end A/V synchronism, there actually is one for so-called "connections," or point-to-point links. CCIR Recommendation 717, "Tolerances for Transmission Time Differences Between the Vision and Sound Components of a Television Signal," recommends "that for any connection used for the international exchange of television signals the time difference between the sound and vision components should not exceed 20 ms if the sound is advanced with respect to the picture, or 40 ms if the sound is delayed with respect to the picture."

Adherence to this recommendation would, according to the Australian study, keep the relative A/V timing within the detectable — although not subjectively annoying — region.

A draft recommendation has been produced by ITU Working Party 11C for end-to-end relative picture/sound timing. This draft recommendation specifies some rather curious numbers, in that the tolerances are twice as tight for 625-line television systems as for 525-line systems.

While the history of the disparity between tolerances in that draft is unknown to me, I suspect that the human sensory system's sensitivity to relative picture and sound timing discrepancies is pretty much the same in areas that use 525-line systems as it is in those that use 625-line systems. For 625-line television systems, the draft recommends that tolerances be set at 20 milliseconds for sound leading picture and 40 milliseconds for sound lagging picture. This conforms to Recommendation 717 and corresponds to +1, -2, 625-line video fields.

BEFORE AND AFTER

The same draft recommends tolerances of 33 milliseconds when sound leads picture, and 66 milliseconds when sound lags picture for 525-line systems. This corresponds to +2, - 4, 525-line video fields, or a tolerance half as tight as that for 625-line systems. It also pushes the tolerance for sound leading picture rather close to the "subjectively annoying" point cited in the Australian study.

It would seem that a single set of tolerance numbers, or at least two sets that correspond to the same number of video frames within each video system, would make more sense than the numbers cited above. If the 625-line tolerances are translated into 525-line numbers, they become 16 milliseconds for sound leading picture and 33 milliseconds for picture leading sound, corresponding to +1, -2, 525-line fields.

There does not seem to be any technical reason to subject NTSC viewers to subjectively annoying delays of picture with respect to sound, and even less reason to institutionalize it in a worldwide standard. ■

Randy Hoffner can be reached through ***TV Technology****.*

MPEG Group Looks to Add Dolby's AC-3 System

by Chris Dickinson

LONDON

In a bid to unify the audio schemes of digital television transmission standards in the U.S. and Europe, the Moving Picture Experts Group (MPEG) has tested the Dolby AC-3 audio compression system with a view to making it MPEG-compatible.

The Grand Alliance in the U.S. has chosen AC-3 as the audio system in its proposed digital high definition television standard. But the Digital Video Broadcasting (DVB) group - which is deliberating on a rival European digital HDTV standard - plans to use the MPEG-compatible Musicam digital audio system. Digital Audio Broadcasting (DAB) in Europe also uses Musicam.

The BBC and Deutsche Telekom of Germany have conducted listening tests on AC-3 — plus a third audio system from U.S. telecommunications giant AT&T — on behalf of MPEG, with the aim of defining multichannel audio variants of the MPEG standard.

A source within DVB said the likelihood was that AC-3 would be fitted into the MPEG structure retrospectively, even though the standard was set in principle at the end of last year.

"To get Dolby into MPEG would require special procedures because, in principle, standardization ends when you go to committee. This happened in November 1993," the source said. "From then on it should not be possible to incorporate a new system."

Dolby officials said it had come out well in MPEG's tests and hoped AC-3 would eventually be accepted.

Graham Carter, broadcast project manager at Dolby in Europe, said the original requirement was for the multichannel audio system to be backward-compatible with existing two-channel MPEG systems. But the tests indicated that a non-backward-compatible system — like AC-3 — might perform better. He said MPEG had called for further tests.

"In due course — about two year's time — MPEG should bring a non-backward-compatible system into the standard," he said. "Hopefully that will be AC-3."

The AC-3 scheme is already used in the film industry to create surround sound effects. It works by compressing up to six channels into the space normally required for one channel on a CD.

In its multichannel form, AC-3 consists of three front channel (left, right and center), two surround channels (left and right) and a sixth, bass-only effects channel.

In the U.S., digital television is expected to roll out with a two-channel variant of AC-3, expanding to the full six channel system at a later date, Carter said. The two-channel form has also been incorporated into the General Instrument DigiCipher II digital transmission system for satellite and cable TV. ■

Taking a Closer Look at COFDM

by John Watkinson

SPECIAL REPORT

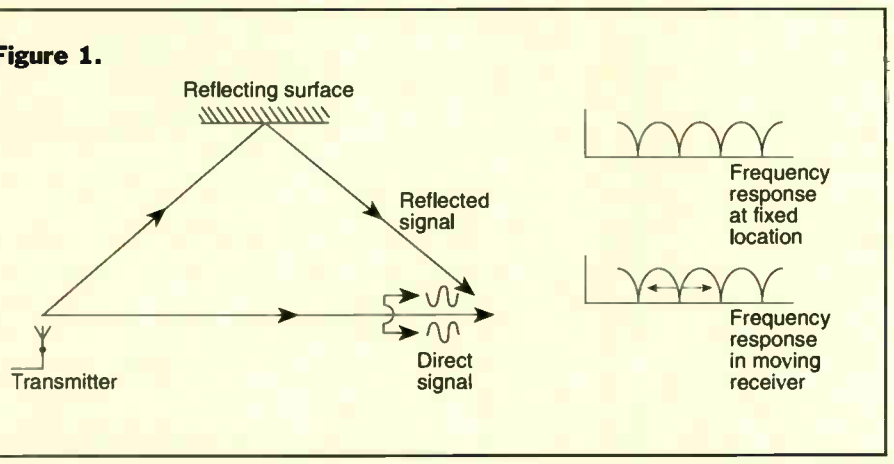
COFDM, or Coded Orthogonal Frequency Division Multiplexing to give its (mouth)full name, is an advanced technique developed in Europe for multichannel digital satellite and terrestrial broadcasting. In this column, I will provide a look at how it works and provide examples of its use in digital radio.

Now that the consumer has been exposed to digital audio in the form of CD, DAT, DCC and MiniDisc, his expectations have been raised, not only in the area of sound quality but also in convenience of operation. In comparison, the performance of current radio broadcasts and receivers needs to be revisited.

SPECTRUM USAGE

A further issue is spectrum usage. In a given location, there is only one radio spectrum, and pressure for it to accommodate more services will only increase. Existing FM radio channels use a lot of bandwidth and are based upon technology that is several decades old. In conventional terrestrial broadcasting, channels can be re-used by transmitters located a certain distance apart, but midway the channel cannot be used at all; it becomes a taboo channel. There is thus economic pressure on broadcasters to transmit programs using a smaller chunk of the spectrum and to find ways of eliminating taboo channels.

Figure 1.



While the introduction of FM improved the reception quality compared with AM, it requires a large antenna — preferably one which is directional — to reject multipath signals. Reception on car radios is at a disadvantage as directional antennae cannot be used. This makes reception prone to multipath problems.

When the direct and reflected signals are received with equal strength, it can be seen from Fig. 1 that nulling occurs at any frequency where the path difference results in a 180-degree phase shift. Effectively a comb filter is placed in series with the signal. In a moving vehicle, the path lengths change, and the comb response slides up and down the band. When a null passes through the station tuned in, a burst of noise is created.

Reflections from aircraft can cause the same problem in fixed receivers. A further problem with FM radio is that trying to listen to a national channel on a long journey requires a lot of retuning.

Digital audio broadcasting (DAB), also known as digital radio, is designed to overcome the problems which beset FM radio, particularly in mobile reception. Not only does it do that, it does so using less bandwidth. DAB relies on a number of fundamental technologies which are combined into an elegant system. Audio data reduction is employed to cut the required bit rate. Transmission of digital data is inherently robust as the receiver has only to decide between a small number of possible states.

MULTIPATH SOLUTIONS

Sophisticated modulation techniques such as COFDM help to eliminate multipath reception problems while further economizing on bandwidth. Error correction and concealment allow residual data corruption to be handled before conversion to analog at the receiver. As a result, the sound quality will be essentially determined by the performance of the data reduction codec and not by the RF transmission channel.

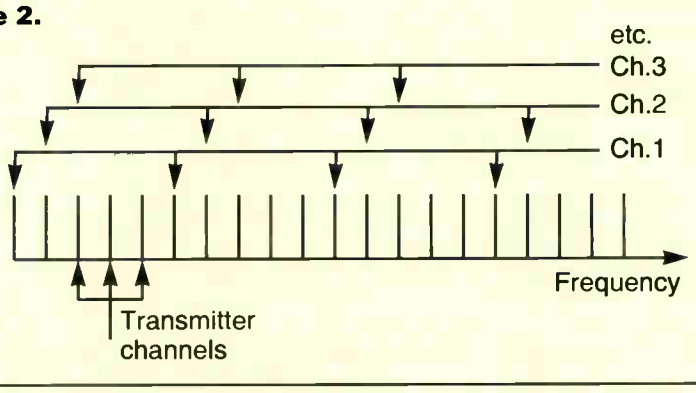
The system can only be realized with extremely complex logic in both transmitter and receiver. But with modern VLSI technology this can be inexpensive and reliable. In DAB, the concept of one-carrier-one-program is not used. Several programs share the same band of frequencies.

Receivers will be easier to use since conventional tuning will be unnecessary. Selecting the required program is done by controlling the decoding process to select the appropriate data stream, and mobile receivers can simultaneously accept signals from several transmitters as a journey proceeds.

To follow how COFDM works it is necessary to introduce a little spectral theory. A serial digital waveform basically contains a train of rectangular pulses. The transform of a rectangle is the function sin x/x, and so the baseband pulse train has a sin x/x spectrum. When this waveform is used to modulate a carrier, the result is a symmetrical sin x/x spectrum centered on the carrier frequency.

Nulls in the spectrum appear spaced at multiples of the bit rate away from the carrier, and further carriers can be placed at such spacings so that each is centered at the nulls of the others. The distance between the carriers is equal to 90 degrees, or one quadrant of sin x. Owing to the quadrant spacing, these carriers are mutually orthogonal, hence the term orthogonal frequency division. A large number of such carriers will interleave to produce an overall spectrum, which is almost rectangular.

Figure 2.



PULSE TRAINS

In practice, perfect spectral interleaving does not give sufficient immunity from multipath reception. In the time domain, a typical reflective environment turns a transmitted pulse into a pulse train extending over several microseconds. If the bit rate is too high, the reflections from a given bit coincide with later bits, destroying the orthogonality between carriers.

Reflections are opposed by the use of guard intervals in which the carrier returns to an unmodulated state for a period that is greater than the period of the reflections. Then the reflections from one transmitted bit decay during the guard interval before the next bit is transmitted. The principle is not dissimilar to the technique of spacing transitions in a recording further apart than the expected jitter.

As expected, the use of guard intervals reduces the bit rate of the carrier because, for some of the time, it is radiating carrier not data. A typical reduction is to around 80 percent of the capacity without guard intervals. This capacity reduction does, however, improve the error statistics dramatically, such that much less redundancy is required in the error correction system. Thus the effective transmission rate is improved. The use of guard intervals also moves more energy from the sidebands back to the carrier. The frequency spectrum of a set of carriers is no longer perfectly flat but contains a small peak at the center of each carrier.

Fig. 2 shows how the multiple carriers in a DAB band are allocated to different program channels on an interleaved basis. Using this technique, it will be evident that if a notch in the received spectrum occurs due to multipath cancellation, this will damage a small proportion of all programs rather than a large part of one program. This is the spectral equivalent of physical interleaving on a disk or tape. The result is the same in that error bursts are broken up according to the interleave structure into more manageable sizes that can be corrected with less redundancy.

NO MORE TABOOS

The ability to work in the presence of multipath cancellation is one of the great strengths of COFDM. It means that several transmitters can radiate exactly the same signal so that the same channel is effectively re-used throughout a whole country without taboo channels being necessary. With traditional modulation techniques this would be quite impossible because in certain locations between transmitters there would simply be no signal. With COFDM, repeaters can be installed in shadow areas, such as underpasses, and these can also use the same frequencies. A mobile receiver can retain the same tuning on a long journey.

Fig. 3 shows the block diagram of a DAB transmitter. The standard digital audio sampling rate of 32 kHz will be used to give an audio bandwidth of 15 kHz. Incoming audio data is passed into the bit rate reduction unit, which uses psychoacoustic coding to cut the data rate to some fraction of the original. In the DAB systems proposed for Europe, the compression technique being considered is the Layer II version of MPEG audio. This middle layer codec gives sufficient coding gain for the application but avoids the greater complexity of Layer III.

The data reduction unit could be at the studio end of the line to cut the cost of the

(continued on page 13)

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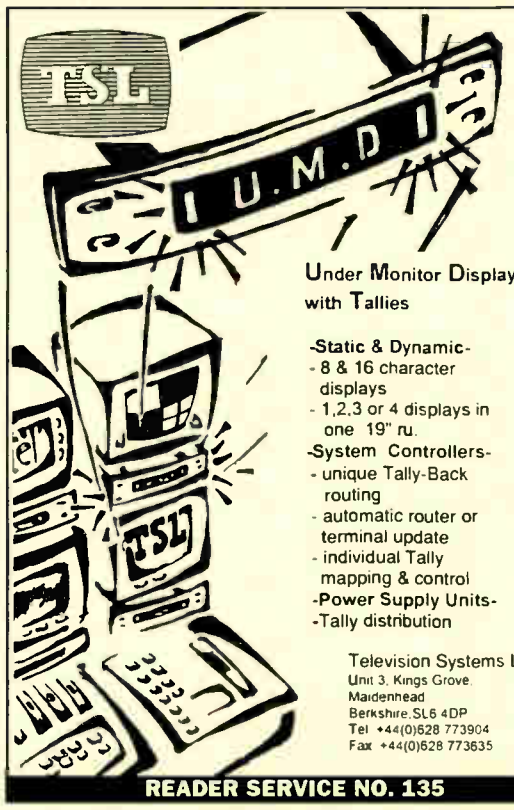

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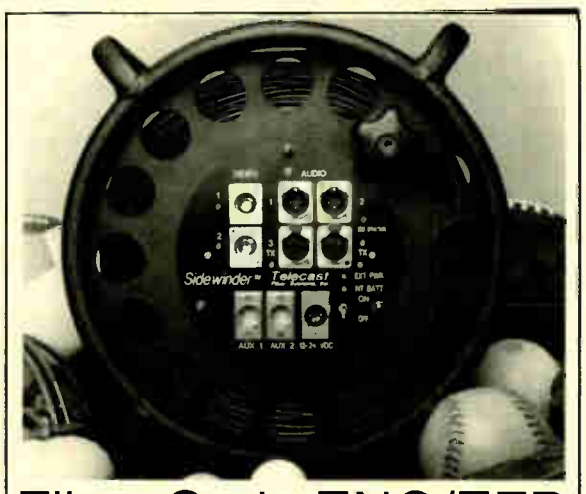

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Broadcasters Back COFDM

by Chris Dickinson

WASHINGTON, D.C.

An informal alliance of broadcasters from the U.S. and Canada have decided to bypass the U.S. Federal Communications Commission and the Grand Alliance HDTV consortium to conduct their own tests on a rival modulation system for digital HDTV.

The group, known as the Broadcasters Caucus, is awarding a contract in July for the supply of a test transmission system based on Coded Orthogonal Frequency Division Multiplex (COFDM). The Grand Alliance, which has its own digital HDTV system in trials, uses an alternative modulation system known as 8-VSB (8-level vestigial sideband).

All the European digital HDTV systems under development in the Digital Terrestrial Television Broadcasting (dTTb) group use OFDM or COFDM. In addition, Japanese broadcaster NHK has built a COFDM system, which is currently undergoing tests.

The Broadcasters Caucus — which includes U.S. private and public broadcasters, the National Association of Broadcasters, plus Canadian Broadcasting Corporation and Canadian Association of Broadcasters — intends to see if COFDM can offer better results than 8-VSB. If it does, the FCC could come under great pressure to adapt the Grand Alliance system to include COFDM, or face a revolt from the broadcasters.

Lynne Claudy, director of advanced engineering and technology at NAB, said broadcasters wanted to see for themselves how COFDM operated. He said it was not too late to have the Grand Alliance system changed.

"Final tests by the FCC advisory committee of the scheme put forward by the so-called Grand Alliance do not complete until March next year, so COFDM could be included," Claudy said. "If, on the basis of the evaluations we plan, COFDM does not have substantial benefits over 8-VSB, it would be dropped. But if it goes the other way and it shows clearly superior results, some decision would have to be made to delay the FCC advisory committee's process."

> **"There still is no COFDM system, there are only prototypes . . ."**
> ***— Joe Flaherty***
> ***chairman of the FCC advisory committee***

Claudy said benefits touted for COFDM include its superior handling of multipath propagation compared to 8-VSB, and a greater degree of flexibility for channel management, allowing more services than simply HDTV. He added that the Broadcasters Caucus wanted to bring on board broadcasters from other countries operating 6 MHz, particularly from Mexico and South America.

"We feel 6 MHz countries have an equal interest in testing COFDM, and we are seeking other interested parties to join us," he said.

However, Joe Flaherty, senior vice president of technology at CBS and chairman of the FCC advisory committee overseeing the Grand Alliance tests, said that it was unlikely COFDM would be accepted.

"There still is no COFDM system, there are only prototypes," Flaherty said. "If they were developed years ago, we would have been able to look at them.

"As an engineer, I would like to see them tested," he added. "But I have been at this ten years, and we cannot afford more delays."

Separately, Flaherty admitted that the FCC was coming under pressure to allow broadcasters to use the channel allotted to HDTV for other services.

"There have been big changes with the Grand Alliance system since it came together," he said. "Now we have scalable possibilities in the structure, where we can have high definition or do other scalable things, including data. So now people are asking if they can do other things with the spectrum.

"As it stands, only a digital HDTV service will be allowed, but the new FCC has not yet made any pronouncements on the subject."

He added that the quality of HDTV pictures would be one of the principle incentives for consumers to buy digital TV sets. In addition, because satellite and cable companies are planning digital HDTV services, terrestrial broadcasters would have to invest in HDTV to survive.

"Anybody who does not apply for a license is a fool," Flaherty said. "There is a three year period to get one, and some people will do it early and some late.

"As we get close to the moment of truth, that is when businesses begin to take things seriously, and what we are really seeing is some last minute football." ■

CONTINUED FROM PAGE 11

Looking at COFDM

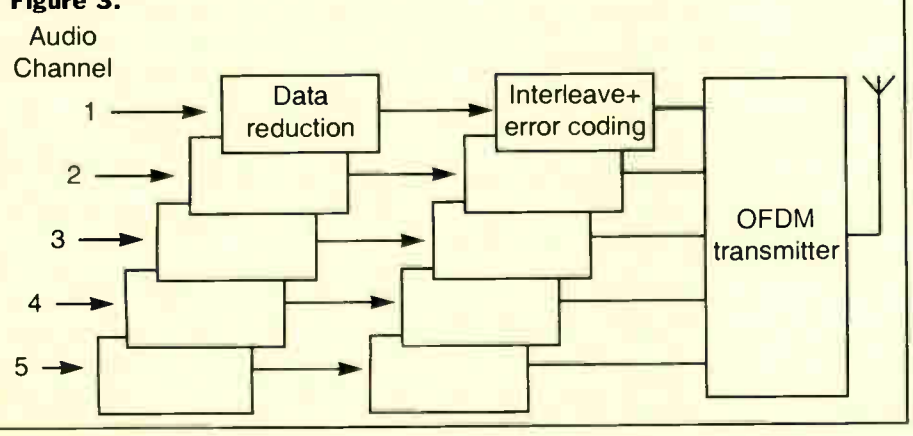
link. The data for each channel are then protected against errors by the addition of redundancy. Convolutional error correcting codes are attractive in the broadcast environment. Several such data reduced coded sources are interleaved together and will undergo a randomizing process before being fed to the modulator.

A DAB receiver must receive the set of carriers corresponding to the required program channel. Owing to the close spacing of carriers, it can only do this by performing Fast Fourier Transforms (FFTs) on the whole DAB band at the bit rate of one of the carriers. If the carriers of a given program are evenly spaced, which in practice they will be, a partial FFT can be used that only detects energy at discrete spaced frequencies and requires much less computation. This is the DAB equivalent of tuning. The presence or absence of energy at a given frequency effectively reflects the state of the transmitted bit at that time slot and so the FFT effectively demodulates as well.

Data from the selected carriers can then be combined into a single bit stream, and the error correction codes will then be de-interleaved so that correction is possible. Corrected data then passes through the expansion part of the data reduction codec, resulting in conventional PCM audio which drives DACs. ■

John Watkinson is an independent consultant in digital audio, video and data technology and is the author of seven books on the subject, including The Art of Digital Audio and The Art of Digital Video; acclaimed as definitive works. He is a Fellow of the Audio Engineering Society and is listed in Who's Who in the World. He regularly presents papers at conventions of learned societies and has presented training courses for studios, broadcasters and facilities around the world. He is currently writing a book on video and audio data reduction.

Figure 3.



A Matter of Life and Tape

SOMEWHERE OUT THERE *You might not have noticed* that tape is dead. If I had one message pounded continuously into my brain at NAB it was that there is no more need for tape.

Name a major NAB exhibitor, and chances are you have named a new random-access video product exhibit: Abekas, Accom, Apple, Asaca, Avid, BTS, Channelmatic, CMX, Dynatech, EVS, FOR.A, Hewlett-Packard, IBM, Ikegami, ImMIX, Kodak, Lightworks, Matrox, Micropolis, Montage, NEC, NewTek, Optical Disc Corp., Panasonic, Pioneer, Quantel, RCI, Rorke, Silicon Graphics, Sony, Tektronix, Thomson, TouchVision, Ultimatte and probably a few hundred others I am too dumb to remember at the moment. Then there were the little guys, like ASC, and Ciprico. Heck — even a lens manufacturer like Canon has videodisc products.

Then there were the companies making software, bit-rate reduction systems, edit controllers and audio random-access storage systems; I think just about every square inch of NAB floor space was devoted to non-tape. I am surprised that I did not see a disk dispenser on my way out of the powder room or a convention center snack bar offering a "special" of a glass of water, a half-ounce hamburger, and a non-linear editor for US$10,000 ($9,999.95 without the editor).

END OF AN ERA

About the only major equipment manufacturer that did not seem to join the anti-tape bandwagon this year was Ampex, and it did not have nearly the presence on the show floor as in previous years. Rumor had it that this might be their last NAB show, and even they were planning to sell off their tape division. I recovered when RCA shrank from NAB's largest exhibitor to its smallest, and I recovered when Ampex stopped exhibiting at the SMPTE convention, so I guess I can survive NAB without Ampex, but — (sniff) — it will be the end of an era.

But while the Ampex era at NAB may be over, the era of tape is alive and well. Despite Ikegami's balsa-wood disk-drived mock-up, what people shoot with camcorders is tape. What people rent at video stores is tape. What Star TV airs from its satellites is tape.

So if Ampex does not exhibit at NAB '95, it will not be because tape is dead, but because the computer industry (supposedly the major force killing tape) is buying more tape from Ampex than is the video industry. This year, something like two-thirds of Ampex's business is in storage of computer data on tape; a couple of years ago, two-thirds was video. You do not need a weather computer to tell which way the wind is blowing.

Of course, I am not saying the computer industry does not use disks and RAM — it sure does. But it also uses tape — plenty of it — especially when massive storage is required.

Let me talk about mass storage for a moment. An SDI video signal is 270 megabits per second (Mbps). There are 60 seconds in a minute, 60 minutes in an hour, 24 hours in a day, and 7 days in a week. That makes SDI over 163,296 Tbpw (terabits per week) per channel.

The Information Superhighway, they keep telling me, has at least 500 channels. Now I am up to 82 Pbpwpiss (that's petabits per week per information superhighway spigot). One more step: 52 weeks per year yields 4.2 Ebpy (exabits per year, or "eppies" as we call them for short).

I love engineering notation — it trivializes everything. I just wrote about exabits as easily as I might have written about kilobits (easier — there's one less letter). Eight eppies would fit very neatly on a one-exabyte disk drive (Exabyte, with a capital E, makes tape drives for the computer industry for precisely the reasons I am driving at here), but I have not discovered any exabyte disk drives yet.

HOW TO MEGABUCK

Hey — no problem! Those same eight eppies will fit just as neatly on 1,000 one-petabyte disk drives, which are — alas — similarly elusive creatures. They will also fit on a million one-terabyte disk drives. The funny thing is: I have not seen any of them yet, either. At NAB, I did see several 9 or 10 gigabyte (GB) disk drives made by Seagate (the numbers vary according to how you like to count data). BTS had a dozen of them in their latest random access video product, said to cost "about as much as a digital VTR"; Rorke Data had them raw in their booth for about US$5,500 a pop. If we estimate that each offers 10GB of storage, it would require 100 drives to store a single terabyte, a cost of about US$550,000.

One terabyte is a lot of storage, but my eight eppies need one exabyte, so I need a million times more drives. Of course, it is unlikely that this will cost 550,000 U.S. megadollars. I am absolutely certain that Rorke or Seagate will provide a substantial discount to someone who buys a hundred million drives.

Am I being silly here? Of course! I have postulated a year's worth of 500 channels of programming, and who would ever want to keep so much stuff at once? And I have left out bit-rate reduction. Silly me.

First of all, why keep a year's worth of programming on a server when the paperless society has already given us the greatest way to move large amounts of data around: overnight mail. Weekly shipments mean delivering only about 2 million giant Seagate drives to each server each week. (See? There is money to be made in information technology.) With 100:1 bit-rate reduction (better than anyone has shown yet), maybe it will only be 20,000 drives. You could always use two-day delivery if you want to save money.

Foolish me! I forgot that most of those 500 channels will just be the same old movies over and over again. Fact of the matter is, one concept of 500 channels is 20 channels of TV programming and 20 two-hour movies, each repeated at five-minute intervals. The reason for all the repeating is to keep people out of video stores. I mean — you are watching a movie, and you hear the call of nature. With a VCR, you hit pause. With the information superhighway, you must have an equivalent.

The equivalent is 24 cable TV channels with the same movie. You stop the movie on one channel and, when you are ready to resume viewing, you are within five minutes of where you were, only on a different channel. That is the broadband spigot version. In the telco-based narrowband version, the server feeding your spigot knows exactly where you were and sends a disk head to just that point when you hit "unpause."

I just wrote about disk heads in the last paragraph so you would be familiar with what I was saying. The way most of us grew up, random access means disk. Well, I have news for you: in the land of memory buffers, tape is a perfectly good random-access medium.

Let me go back to the broadband spigot, only this time let me install a small digital tape drive into your settop box. Except for Ampex, just about every videotape manufacturer in the world is working on the standardization of that drive, which will use 1/4-inch tape and record up to 50 Mbps. That rate is maybe a dozen times higher than the 4 Mbps that people are talking about for sending movies into homes.

. . . while the Ampex era at NAB may be over, the era of tape is alive and well.

So instead of watching right away, a graphic comes up that says you have 10 minutes to use the facilities, make popcorn and get settled. In said 10 minutes, your tape drive fills up at 50 Mbps. Then it squirts out the movie at 4 Mbps for the next two hours, and, when you want to pause, you pause the tape. If you do not want to wait 10 minutes at the beginning? Fine! That is where the buffers come in.

SONY'S PLORDER

Did you happen to see Sony's NAB off-floor compression demonstration? It was not too bad. They presented JPEG, MPEG, and what the company is calling SPEG, and showed off problems of multiple passes through a compression system and switch glitches. That's right, Sony showed compression problems while Panasonic's off-floor demonstration was about problem-free bit-rate reduction.

One part of Sony's demonstration showed what I like to call a "plorder." Sony rigged up a D-1-based instrumentation recorder, a couple of buffers, and a bit-rate reduction encoder and decoder. The numbers were similar to the ones I mentioned a couple of paragraphs ago.

A camera shot the audience. The encoder compressed it. The buffer fed it at a higher data rate to the recorder. The recorder recorded it. Then it shuttled to someplace where something was already recorded, while the recording buffer filled again. The player played the data into the buffer. The decoder read it out of the buffer at a slower rate. The audience got to watch delayed pictures. The tape shuttled back. The cycle repeated. And the camera and display pictures were absolutely seamless. One machine was recording and playing different video; hence, a plorder.

That was not the first time tape has been used as a random-access system. In the 1950s, CMX introduced a notion: off-line editing. The surprising thing was that it was a non-linear, disk-based system — a quarter-century ago!

About 10 years later, after CMX switched from disk to tape, CBS and Sony came up with another non-linear editing system. It used Betamax videocassettes. That was followed by — if memory serves (pun intended) — Montage's non-linear tape-based editor, Ediflex's non-linear tape-based editor, and on and on.

I think all of today's non-linear systems can trace their roots to one of those tape-based non-linear editors. Today, they use disk instead of tape — except when they are being loaded, that is.

THE HUMAN COMPUTER

Sure, I heard about a young cameraman who strapped a computer across his chest and shot directly into a disk drive so he could say he did not have to load his non-linear editor from a tape. I have also heard about a guy who tied helium-filled balloons to his lawn chair and screwed up air traffic. So? Ikegami's mocked-up camcorder is supposed to show an easier way to record on disks in the field: shoot, pop out a disk drive, call for instant delivery, etc.

But you do not need to go through all that. The first camcorders were introduced only a dozen years ago. All the ways you recorded pictures before that can be used to record to disk just as well as to tape, if you want to. And for certain applications, that's probably a good idea. I imagine that an editor experienced on a disk-based system can probably finish a breaking news story faster on that machine than an editor experienced on tape can on a tape-based machine.

But I must say that there is a future in tape. Do you think Apple and IBM joined the (1/4-inch) Digital VCR Conference just for fun? Why do you suppose Kodak and Quantel (to name just two NAB exhibitors) record their electronic film images on tape?

For the moment, disk seems to have certain advantages over tape in non-linear editing, and its supporters point to technological advances in compression and drive size as indications that disks will soon take over the world. But that assumes that tape is undergoing no development whatsoever.

Up to now, VTRs have been constrained by the stunt modes that require picture-per-track scanning or something similar. But if a buffer can turn a recorder/player into a plorder, it can also create stunts from non-standard scanning. That opens such possibilities as perpendicular scanning, increasing tape densities to the range of eppies per cassette. ■

Mario Orazio is the pseudonym of a well-known television engineer who wishes to remain anonymous. Send your questions or comments to him c/o ***TV Technology****. Or drop him a note on e-mail 581-6729@MCIMail.com.*

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In Defense of Inclined Orbits

by Phil Dubs

VIA SATELLITE

Inclined orbit satellites have been characterized as inferior, low-quality birds for Third World countries. Misconceptions have resulted in questions about the signal quality of inclined satellites and their acceptance in the cable and broadcast industries.

However, those concerns are countered by the acceptance of inclined orbit satellites carrying television signals for networks such as MTV-Japan, NBC, CNN, NHK, World Cup Soccer '94 and many others.

So what do these networks know that we do not? Actually, nothing. The quality of these satellites is just as good as any similar vintage geostationary bird.

With today's congested equator there is more demand for transponders than are available in orbit. This is especially true for the POR (Pacific Operating Region), IOR (Indian Operating Region) and the western hemisphere beams of the AOR (Atlantic Operating Region) that service Central and South America.

Cable TV in Latin America is growing rapidly, just as it did in the United States during the 1970s. The need for additional cable programming in Latin America has increased dramatically. Getting those cable and broadcast signals "south" has put a strain on the limited amount of satellite transponders available to AOR users, just as it did for GEMS Television before it moved to a fixed-orbit satellite.

The inclined orbit satellite is not very popular in the AOR. By contrast, the POR has some very prestigious users and the inclined orbit satellite is accepted without hesitation. INTELSAT inclined orbit satellites provide transponders for networks such as MTV-Japan, NBC, CNN, NHK, Tokyo TV, IDB, Fuji TV, Channel 9 Australia and the Armed Forces Radio and Television Service.

So why have inclined orbit satellites been so misunderstood and underutilized? I think it is because years of using geostationary orbit satellites have spoiled us. After all, why move our antennas around to track the bird when the bird is supposed to be rock solid in the first place?

FIGHTING GRAVITY

Satellites have a definite life span that is mainly dependent upon the fuel capacity used for station-keeping. Station-keeping counters the gravitational effects that the sun and moon exert on the spacecraft's orbit. Over time, if no counter measures are taken, the spacecraft meanders into a figure-eight orbit centered over the earth's equator, making it impossible to provide full-time signals to a stationary ground antenna.

To keep them stationary, ground-based engineers send command signals to the satellite to keep it within a box +/- .1 degrees of longitude, or about +/- 40 km. On newer birds, the box is +/- .05 degrees. This small amount of drift is all but negligible, except for some very large ground antennas. Very large antennas have to track station-kept satellites in the same way that is required for inclined orbit satellites.

Station-keeping does have one drawback. The station-keeping thrusters use up the limited amount of fuel with which the satellite is deployed. Because station-keeping thrusters are fired about once every day, the life span for the typical station-kept satellite is about 10 years.

As the satellite gets closer to the end of its useful life span, a decision has to be made to either extend the life of the satellite and allow it to drift into an inclined orbit or to remove it from station-kept service.

By not firing the thrusters as often, a satellite is allowed to drift into the figure-eight orbit. Inclined orbit satellites are permitted no more than +/- 5 degrees of north/south drift, at which time they are considered difficult to track. East/west station-keeping is maintained at all times. In fact, east/west requires a lot less fuel than the north/south direction. Once the +/- 5 degrees is approached, the satellite is retired. Therefore, with an accumulation of .89 degrees a year, about three to four years can be added to the useful life span of a satellite that otherwise is about to die.

Because no other parameters of the satellite's qualities change — specifically the power, coverage, contours, G/T, etc. — you would be hard pressed to detect any difference in the signal between a geostationary orbit satellite and one that has been permitted to drift back into inclined orbit.

Figure 1 displays satellites in inclined orbit maintained by INTELSAT.

RIGHT ON TRACK

So what do MTV-Japan and NBC, etc., know that we do not? Mainly, it is that an inclined orbit satellite simply is a lot easier today than it was in the past.

Tracking controllers such as the ATC-300 from Andrew Corp. (telephone: +1-708-349-3300; FAX: +1-708-349-5943) provide very accurate tracking for large and expensive commercial antennae, but they cost

(continued on page 18)

Building a Better System

CABLE TECHNOLOGY

by Jon Hazell

Incompatibility between cable equipment and consumer electronics, a source of ongoing frustration for consumers, has become a hot focus issue for the cable industry and TV manufacturers.

The story is almost as old as cable itself; in order to receive scrambled cable signals, a cable subscriber must have a descrambling/demodulation device. The device, usually a box sitting on top of the TV, selects each cable signal, descrambles it if necessary, and outputs it to the television on one standard channel.

However, the subscriber's television must always be tuned to that channel. The television's remote control is rendered nearly useless, and any advanced features of the set, such as picture within a picture, will not work. Without two converters, it is not possible to record one scrambled program on a VCR while watching another on the TV set. To add to the consumer's irritation, the cable company usually charges extra for the converter box and its remote control.

CABLE COMPLAINTS

To many consumers, the cable company is the easiest target for these frustrations. The real story is a lot more complicated than that, and the problems behind it will be rather difficult to solve.

Television and VCR manufacturers want a simple and inexpensive interface. In an ideal world, they would like signals to be unscrambled so that cable service could be connected directly to the back of the receiving equipment. For their part, cable companies are leery of instituting a single scrambling system—once pirates defeat the system, it would be nearly impossible to restore signal security without modifying every receiver or going back to settop converters.

In addition, many receivers are mostly made of plastic and are poorly shielded. Frequently they are subject to signal ingress from off-air stations that can interfere with cable signals, causing ghosting and other artifacts. Again, the first reaction from consumers is that there is something wrong with the cable system, when in fact the problem is caused by their own television sets.

WHAT TO DO?

What can be done to satisfy the needs of both industries? There are several alternatives.

One possibility is called "interdiction," in which the cable company replaces the settop converter with equipment located outside the home. Addressable controls are built into an enclosure that is either mounted on an outside wall, a pedestal or a utility pole.

Inside the enclosure is a directional coupler to tap the signals out of the main system. There is also an equalizer, a broadband amplifier, a power supply, a data transceiver to allow communication between the cable company and the box, and interference oscillators that can be tuned to interfere with certain channels, effectively scrambling them. The wideband output is fed to the customer's receiver.

From a frustrated consumer's point of view, interdiction solves many problems. The wideband signal can be tuned by a TV and VCR, and the television's remote control will work again.

Cable systems reap some benefits, too. Services can be activated and de-activated from a central office. Also, most interdiction scenarios provide for interdiction hardware to be present at each potential customer's location, whether or not it is connected. This allows connections and disconnections to be made without an expensive truck roll. It might also allow a viewer to order individual events or channels without being a regular cable subscriber, and security is heightened because the customer does not have access to the scrambling equipment.

Interdiction has been successfully implemented in several locations over the last three and a half years (mostly in areas of high density or high customer turnover, such as hotels, apartment complexes and hospitals), but there are still some major problems with it.

Television and VCR manufacturers want a simple and inexpensive interface.

For example, the poorly shielded tuners in most receivers are subject to greater interference from off-air signals than are traditional settop converters. This is because all of the cable channels have to be tuned and not just the single output channel of the converter.

Interdiction hardware is also relatively expensive, and there initially were concerns about equipment reliability, since interdiction enclosures are sometimes exposed to the elements.

Another major concern is power. Currently, power for cable converters is supplied by the customer. Power for an interdiction terminal usually has to be supplied by the cable system, which can be costly and inconvenient.

Clearly, while the interdiction systems that have been built have proven hardy, installing them is a significant operational and technical challenge for most cable systems.

That brings us to multiport, another possible solution to the cable incompatibility problem. A multiport standard, ANSI/EIA 563, was developed in the mid-1980s by a joint committee made up of the (U.S.) National Cable Television Association and engineers from the Electronic Industries Association.

The standard calls for a connector to be mounted on the back of the consumer's receiver, accommodating a plug-in converter with a variety of possible configurations ranging from descrambler to digital decoder. The receiver's tuner would be used and the receiver would function normally if the connector is not being used.

For the consumer with a multiport connection, the cable box is gone, along with its interface problems. Potential off-air ingress problems still remain, however. For the cable company, multiport decoders promise to be significantly cheaper than standard settop converters, since the tuner is not included.

For television manufacturers, however, multiport is an extra expense added to a business that has a very small profit margin to begin with. Also, it is thought that it would take at least 10 years to see multiport significantly penetrate the market, since current TVs and VCRs do not have it.

QUICK FIXES

There are several other possible solutions or partial solutions to this dilemma, some of which are available now. For example, many televisions and VCRs are now delivered with universal remote controls that can be programmed to operate other equipment, including cable boxes. The device handily eliminates the pile of remote controls needed to operate a cable converter, a television, a VCR and other consumer gear.

Other solutions reside in the much-maligned cable converter box itself. The converter is gradually becoming a much more powerful device, and many new cable converters have on-screen displays that make it easy to set audio levels, order pay-per-view events, set favorite channels and lock out channels for parental control. Dual-tuner converters may soon be on the market to eliminate the problem of recording one scrambled channel while watching another.

So where are we today, and where are we going? Right now, we have a settop converter box, lots of remote controls (at least one of which is lost), an expensive television with many features we cannot use and a VCR we cannot program.

Tomorrow may be marginally better, perhaps with the use of a universal remote control. In a year or two, we may be able to control the VCR through the converter box. In five or six years, we may lose the converter as we know it to an interdiction or multiport system, and most consumer interface problems will be solved.

It could be a neat package. Unfortunately, while we are trying to get the current technology sorted out, someone creative is dreaming up new technologies to cause more problems (like digital compression, HDTV, computer interfaces, etc.)... but I guess that is what keeps life interesting. ■

Jon Hazell can be contacted care of ***TV Technology****.*

CONTINUED FROM PAGE 9

New Tools Found in 3D Studio

machine, take your picture files to a service bureau for layoff.

How do you transport those hundreds of megabytes of Targa files? Why not load all your computer picture file data onto the same kind of tape drive archive system that an ACCOM or Abekas digital disk drive would use? Then you would simply restore the files to the service bureau DDR, and tape layoff becomes nothing more than a simple dubbing operation, taking no more than around 30 seconds per shot. It takes just minutes of bay time to play back all your disc material, making a high quality master in whatever format you need.

Most decent post facilities have these drives, and many of the best post houses are offering very reasonable rates for this new service. But remember that this is a two-way street. What better way to get quality video files for rotoscoping than to have a post house dub your camera original to a DDR, and then dump those files to 8mm Exabyte data tape for you to translate into sequential Targa or GIF images on your hard drive?

Abekas drives use an 8mm tape backup system manufactured by Exabyte to dump off or restore data archives. Abekas Inc. has been exploring connectivity with computer graphics hardware via ethernet for years, and more recently directly over SCSI-2 connections.

Exabyte 8mm SCSI format 5 GB data tape drives are slightly esoteric but available as computer peripherals on the open market. What you probably need is a user friendly way to get your PC to talk to this drive and translation software to turn your .TGA, .BMP, .JPG, .TIF, etc. images into Abekas YUV files (CCIR-601 color space) in the process. ASDG of Madison, Wis., (FAX: +1-608-271-1988) is the answer.

Available in versions for PC Windows 3.1 or NT environments, as well as Macintosh, SGI or Amiga, the ASDG Abekas Driver is an 8mm Exabyte device driver. Although it lists for US$495, registered 3-D Studio owners can get it for only $349.

Included is a reduced function version of its Image Independence file translation software. Package deals are available, bundling the software with an Exabyte 8mm drive for only US$2,400 to $2,800, depending on configuration and discounts. This is a must-have combination for an animation workstation from now on.

To confuse matters, ASDG is reportedly working on a driver that would allow desktop computers to directly control an Abekas A-65 DDR. I have also seen their beta version of an interactive fractal lightning/electrical sparks effects generator for the Indigo to be named LXF. It is much easier than rotoscoping on a paintbox all day.

Despite its rather plain graphical user interface and several minor faults, 3D Studio is clearly the animation champion on the PC platform. You should choose it because it remains reasonably priced and rich in features, while nurturing a rare crop of outstanding third party add-ons. The list price of 3D Studio is US$2,995, while US$497 buys an upgrade from earlier versions.

A new and expanded World-Creating Toolkit CD-ROM includes over 1,000 images for texture mapping, 500 pieces of model geometry and 100 Postscript fonts. Autodesk provides a CompuServe (GO ASOFT) treasure chest of downloadable files, surrounded with communal support and cheered by evangelical users, dealers and programmers. ■

Bruce Goren is owner/animator of Cheap Computer Graphics in Val Verde, Calif. He is also a television engineer at KLCS-TV in Los Angeles. Contact him via electronic mail on CompuServe at 71470,2767.

CONTINUED FROM PAGE 16

Tracking an Inclined Orbit

about US$10,000 each. The ASTRO-GUIDE TRAX IIe, is an example of one of the newer low-cost trackers. It can control just about any antenna that has both motorized azimuth/elevation and it has sensors to feed back the distance the antenna has moved.

Polar-mount antennas are the most common type in the field. They offer easy access and repeatability to the satellite belt. Polar-mount antennas can be equipped economically with tracking motors and sensors for azimuth and elevation control.

Tracking systems rely on the microprocessor's ability to store the quality points, or satellite position, within the inclined orbit. The microprocessor and its associated software can also anticipate the next quality point during its figure-eight movement. When the tracker is first put into operation, the first 24 hours are used to build a "map" of the figure-eight orbit. This map becomes a representation of the precise orbit of the satellite.

By using the signal strength fed to the tracker from the automatic gain control (AGC) of a standard satellite receiver or an optional built-in beacon receiver, small amounts of north/south and east/west antenna movement confirm the strongest signal. The exact location is stored in memory for this satellite, and the process continues until a total of 255 points are detected and confirmed.

Once the map has been stored, the operator has the option of either tracking from the stored map only or continuously updating. The continuous update mode confirms the strongest signal at each quality point and, if different, replaces the old point with the new coordinates.

Figure 1.

Atlantic Operating Region	
Name	Location
INTELSAT V	310 degrees east
INTELSAT V	329 degrees east
INTELSAT V	338 degrees east
Pacific Operating Region	
INTELSAT V	177 degrees east
INTELSAT V	180 degrees east
INTELSAT V	183 degrees east
Indian Operating Region	
INTELSAT V	91.5 degrees east
INTELSAT V	66.0 degrees east
INTELSAT V	57.0 degrees east

Because the stored maps go out of date after time, the continuous mode offers seamless operation with a minimum of human intervention. A battery provides backup power to the memory to protect maps that previously have been built.

LCD readouts help by indicating the status of the tracker. Details include: Sat currently being tracked, Signal Level, Azimuth, Elevation, Map #, Quality Points and Refresh Mode Selected. In addition, a full software dialogue is provided to assist in initial settings and operation.

The display will alert you if the antenna should wander outside a pre-set box, by displaying the "HIT LIMITS" notation. A "NO SIGNAL" display indicates there was a loss of signal to the tracker.

PLAYING IT SAFE

As a failsafe, one satellite, usually geostationary, can be set as a reference satellite and stored in memory as "0.0." If there is a total loss of the tracking satellite, the failsafe satellite can be recalled from memory. Then the tracker will attempt to "find" the missing bird based on a "best guess" using the stored maps as a starting point.

And if one inclined orbit satellite does not satisfy you, there is enough memory to store four inclined-orbit types along with 32 additional geostationary birds. Keeping track of all these birds meandering about is easier if you use the RS-232 interface and control. A full software dialogue provides a simple connection with your computer. If your antennas are miles away, control and operation are possible for remote locations using the RS-232 and a modem interface.

If you are curious about inclined orbit satellites and would like to access one using conventional geostationary positioning equipment, do not worry. It takes 15 minutes to a few hours for the satellite to move outside the "window" of a 5-meter TVRO non-tracking antenna. The capture time depends on the inclination of the bird and at what point it is in the figure-eight.

Finding one of these birds when it is off the belt is a little tricky. Consult the governing agency such as INTELSAT and they can give you a "window" of opportunity when the satellite is due at the belt.

Recycling has become second nature in today's society. So when recycling becomes a hot topic at the water cooler, you can tell them the satellite industry has found a way to recycle at 22,300 miles above the earth. ■

Phil Dubs is director of operations and engineering for Gems Television, a programming service of International Television Inc., of Miami, that provides two network feeds to 18 Latin American countries, as well as Mexico, the Caribbean and the United States.

USER REPORT

Channel 4 Upgrades With Harris

by Tito Angulo
Technical Director
America Televisión

LIMA, Peru

The America TV network is 77 percent owned by Televisa and 23 percent owned by the Peruvian government. It includes a 30 kW station in Lima and low-power stations in outlying regions.

In 1993, America TV began to upgrade existing transmission facilities and to establish new stations to expand coverage. Near the time of the National Association of Broadcasters convention in April 1993, we ordered a Harris Platinum Series 30 kW transmitter for our Channel 4 station in Lima. The new transmitter was purchased to replace a 30-year-old RCA transmitter, which was no longer working properly.

Because Channel 4 operates 24 hours a day, transmitter reliability is very important. The Harris Platinum Series transmitter, with an all-solid state design, provides a high MTBF (mean time between failure) rate as well as high stability. It is a good product.

ON-AIR MAINTENANCE

Harris Platinum Series VHF transmitters use multiple solid state RF power amplifier modules that operate in a parallel-redundant configuration. Modules can be inserted or removed while the transmitter continues to operate. The result is a transmitter with an ultra-soft failure architecture.

Within 60 days after we placed our order, the Channel 4 transmitter was completed and shipped. Before it was shipped, I visited Harris's factory in Quincy, Ill., to witness performance.

Our transmitter, power supply, diplexer and associated equipment arrived at the Lima airport at 7 a.m. on the first Friday in July. The following day, we transported the equipment to the transmitter site up the side of a mountain. This phase was very complicated, requiring a big truck and a crane.

We arranged with Harris for a field service engineer to supervise the installation and check out the new equipment. Working around the clock, the technical staff completed the equipment installation within five days.

With the Platinum transmitter, Channel 4 ordered Harris's Platinum Sentry, which uses telemetry to provide a high level of remote monitoring and control capability. Based on a personal computer, Platinum Sentry makes it possible to check complete transmitter status and to initiate some control functions from a remote location via a modem.

BROADCAST CHALLENGE

The environment of Peru is a challenge to broadcasters, with the sea to the west, a mountainous terrain and jungles. Nevertheless, America TV is committed to providing quality coverage with every station it operates. The goal of this network is to ensure that viewers throughout the country receive the same quality signal available in Lima, using equipment of the same quality.

The Harris Platinum Series 30 kW transmitter

In addition to the Channel 4 transmitter, we have purchased 12 Harris Platinum Series "EL" 1 kW transmitters to upgrade existing facilities in five cities and to establish new stations to expand coverage. We have completed installation of the transmitters in the five existing facilities. The 1 kW transmitters can be housed in a 2 kW rack to allow for future upgrades.

LOW POWER RESPONSE

Harris introduced the low power solid state "EL" transmitters two years ago. About four years ago I spoke to E.L. Corujo, sales director for Latin America, and told him that while high power transmitters were fine for big cities, networks needed low power transmitters as well. Harris responded.

Factory support after the sale is very important, and Harris's customer service and parts support is very good.

Our technical staff includes four engineers and 10 technicians who are responsible for studio, transmission and satellite equipment for all of the television stations operated by America TV. Four of our staff technicians have traveled to Quincy to attend a special training program Harris sponsors on its Platinum Series transmitters.

I am very happy working with Harris. ■

Editor's note: Tito Angulo has worked in the broadcast industry as an electrical engineer for 15 years.

The opinions expressed above are the author's alone. For further information, contact Harris-Allied (telephone: +1-217-222-8200; FAX: +1-217-224-1439), or circle **Reader Service 67.**

BUYERS BRIEFS

The VHF K-Line transmitter from **Browning Labs** is an all solid-state system except for the video and sound output tube.

The system employs modular construction for easy access to all components for replacement or repair.

Other features include IF diplexed operation, stereo and high-speed CMOS logic for control, protection and monitor functions.

The K-Line is available in 5, 10 and 20 kW versions.

For further information, circle **Reader Service 97.**

Numerous RF products are available from **IRTE**, designed to meet the flexible needs of broadcasters.

In addition to its lines of television transmitters and transposers, the company manufactures dipole curtain antennas for VHF BI and BIII and FM, as well as for UHF B IV and V. Also available are UHF diplexers, triplexers and quadriplexers, power dividers, hybrids and combiners.

The company also specializes in waveguide filters, termination equipment, directional couplers, coaxial lines and connectors and power amplifiers up to 10 kW.

For further information, circle **Reader Service 25.**

Italy's **Linear Vescovi** manufactures a wide range of transmitters, modulators, amplifiers and other RF gear, as well as microwave links and antennas.

Power levels range from the 100 and 200 W AMV amplifiers to the 1,500 W AMV, and larger.

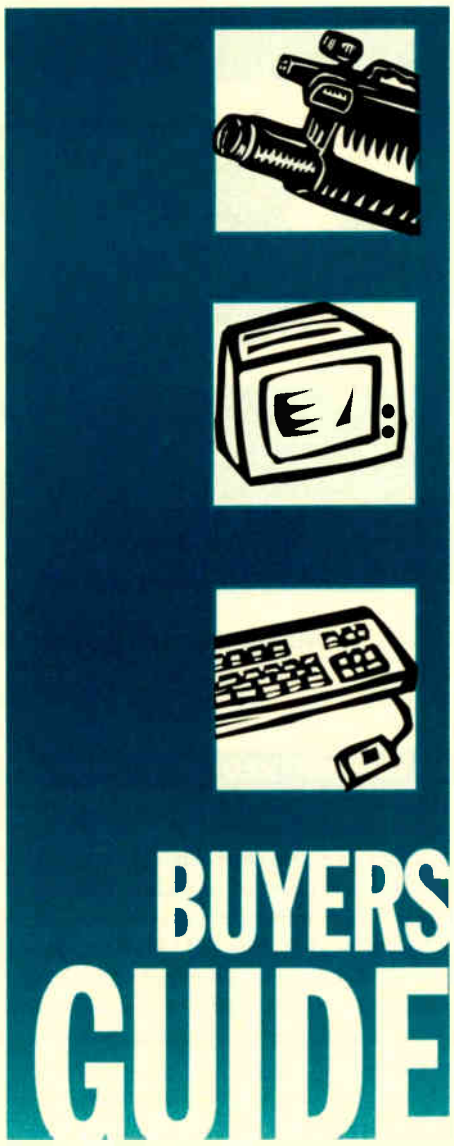
For further information, circle **Reader Service 115.**

Offering a wide range of transmitters and RF equipment is **Thomcast**, the company created as the result of Thomson-CSF's acquisition of the broadcast activities of Asea Brown Boveri.

Thomcast offers UHF transmitters and transposers ranging from 1 W to 240 kW, and VHF units from 1 W to 40 kW.

In addition, the company offers a complete line of AM and FM radio transmission systems, as well as satellite gear and consulting and design services.

For further information, circle **Reader Service 92.**



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MARKETPLACE

HIGHLIGHTING THE LATEST PRODUCTS AVAILABLE TO PROFESSIONALS IN THE VIDEO INDUSTRY.

WAVEFORM/VECTORSCOPE

Hamlet has introduced the 301WVCA waveform/vectorscope, the most recent addition to its range of in-picture measurement and monitoring devices.

The 301WVCA is a 1RU unit that provides all analog measuring and monitoring functions and facilities from just one device. It performs in both NTSC and PAL and includes SCH monitoring, oscilloscope mode of operation and instant priority remote control selection.

With its unique patented display technique, the 301WVCA processes live or test signal pictures without distortion.

For more information, contact Steve Nunney in the U.K. at +44-494-775850; FAX: +44-494-79128, or circle **Reader Service 102.**

DIGITAL VIDEO INTERFACE

Digitalvideo Computing aims to reach system manufacturers and system integrators with the SCSI/Video digital video interface for workstations.

SCSI/Video is a board with 3.5-inch form factor and allows real-time input of D-1, 4:2:2 studio videos to and from workstation disks. Applications for SCSI/Video include video disk recording on workstations, video server, video-on-demand, desktop video, video-on-LAN and multimedia.

For more details, contact Birgit Haberecker in Germany at +49-8152-93010; FAX: +49-8152-91331, or circle **Reader Service 79.**

CAMERA MOUNT

The Pro-Jib by Miller Fluid Heads offers film and video camera operators pan, tilt and tracking movements in a single mount.

The anodized alloy and stainless steel components of this camera mount can support a fully equipped Betacam camcorder or film camera. The arm attaches to most conventional tripods, and all fastenings and control mechanisms are ergonomically designed for comfort and smooth operation.

For more information, contact the company at +1-201-473-9592; FAX: +1-201-473-9693, or circle **Reader Service 27.**

BETACAM CAMCORDER

Sony's BVW-400AP one-piece camcorder is fitted with three 2/3-inch FIT Hyper HAD CCD chips, each with 440,000 picture elements.

The Hyper HAD sensor is an HAD sensor with an OCL (on-chip-lens) layer placed on its surface. This CCD technology offers a 60dB signal-to-noise ratio and a resolution of 700 lines.

The variable speed electronic shutter of the BVW-400AP can be controlled via a front panel switch.

For more details, contact your nearest Sony representative.

MANAGEMENT SOFTWARE

Under the control of Odetics' Archive Management Software, a digital disk recorder is used as a cache for day-of-air spot replay while videotape is used as a storage medium for program material and spot archive.

This software controls the recording of new material into the cart machine and automates the transfer of archive masters to the digital cache. The process is fully automated and managed in conjunction with the playlist so that material is downloaded hours in advance.

For further information, contact Frank Borst in Singapore at +65-320-8377; FAX: +65-320-8328, or circle **Reader Service 31.**

DIGITAL MIXER

AVS Broadcast has launched Integra, a digital vision mixer and DVE system that offers the ability to create up to five layers of live video in a single pass, as well as up to two channels of 3-D DVE, each with its own key channel.

At the core of the Integra is a digital component processor that allows for integration into any multiformat post production environment. Inputs from analog and digital VTRs, paint systems and character generators are processed in digital 4:2:2:4 and can be output in a wide range of analog or digital component output formats.

For more information, contact Lyndsey Andrew in the U.K. at +44-81-391-5678; FAX: +44-81-391-5409, or circle **Reader Service 89.**

RECORDING CONSOLE

The Solid State Logic G Plus range of recording consoles incorporate as standard many features previously only available on SL consoles as custom options.

Operational features of these new consoles include audio phase scope, remote-controlled talkback system, 3.5-inch disk drives and automated Solo and PPM metering for digital recordings.

Audio enhancements include redesigned group and main mix amps for lower noise and extended LF response and linear crystal oxygen-free cable.

For more information, contact Colin Pringle in the U.K. at +44-865-842300; FAX: +44-865-842118, or circle **Reader Service 126.**

DISTRIBUTION SYSTEM

Standard Communications has launched the Stratum Series, a compact, modular VSB-AM headend distribution system.

The main integration component of the system is the Stratum NAM550, which provides redundancy, remote re-channelization, standby power capability and self-aligning output levels when monitored by the system status controller.

The rack system can contain eight vertically-mounted modules and a power supply in a seven-inch space. The RF output channel frequency, visual carrier level, visual/aural ratio, visual modulation and audio deviation can be controlled remotely by accessing the system monitor.

For more details, contact Clayton Dore in the U.S. at +1-310-532-5300; FAX: +1-310-515-7197, or circle **Reader Service 21.**

DIGITAL AUDIO EDITING SYSTEM

The Avid AudioStation is a digital audio editing system designed for use as a transfer station for dialogue editing and other specialized audio editing applications.

AudioStation features include master/slave machine control; edit decision list (EDL) import and auto conform, with support for more than eight EDL formats; time compression/expansion; pitch shift; track bounce/mixdown; project management tools; and storage options, such as fixed magnetic, removable magnetic and optical disks.

For further information, contact Lynne Gardiner in the U.K. at +44-753-655999, or circle **Reader Service 90.**

ENG/EFP LENS

Canon's J20ax8B/H20ax6 ENG/EFP lens, designed for CCD cameras, is equipped with variable zoom speed control and uses the Internal Focusing System, which reduces angle distortion.

By intensifying anti-reflection paints in the lens barrel and multilayer coated elements, the lens reduces ghosts and flares so that CCD cameras can be used to shoot bright objects.

For more details, contact the company in Japan at +81-44-733-6111; FAX: +81-44-711-2317, or circle **Reader Service 3.**

MEASUREMENT SYSTEM

Neutrik has enhanced the specifications, processing speed and options available on its A2 two-channel audio measurement system.

The new version of A2 is also retrofitable with a digital I/O option that automatically detects analog or digital signals, reads and writes the AES/EBU and IEC958 (SPDIF) format, provides an electrical analysis of the digital bit stream, displays all important status information and monitors the digital audio-signal.

For more information, contact the company in Switzerland at +41-75-232-9666; FAX: +41-75-232-5393, or circle **Reader Service 56.**

S-VHS MACHINE

The BR-S525E S-VHS machine features JVC's newly-developed automatic variable tracking system and offers noiseless variable-speed playback for sports and special-effects editing.

The BR-S525E can provide playbacks at speeds ranging from -2 to +3 times normal and features a built-in TBC with digital noise reduction.

With JVC's BR-S822E and RM-G870E, variable motion control editing is possible, offering slow-motion or reverse edits with jitter-free starts from still frames.

For more information, contact the company in Japan at +81-426-60-7560; FAX: +81-426-60-7569, or circle **Reader Service 17.**

Send new product press releases along with black and white photographs to: **Marketplace Editor, P.O. Box 1214, Falls Church, VA 22041**

USER REPORT

Comark Gives WCET-TV an Edge

by Jerry Blankenbeker
Director of Technical Services
WCET

CINCINNATI, Ohio

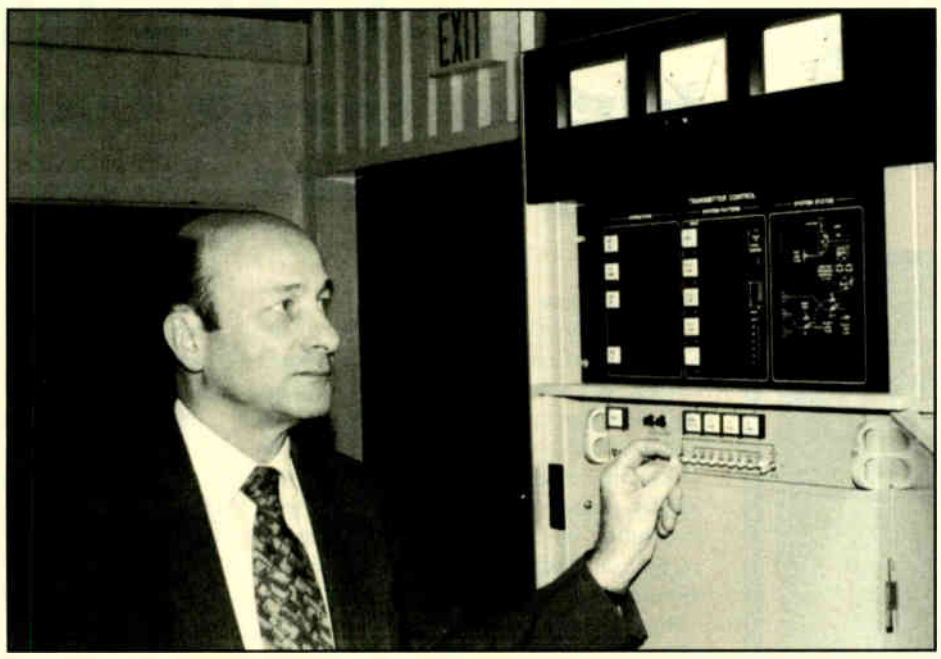
WCET has been operating as a non-commercial educational television station since June of 1954. The transmitter location overlooks downtown Cincinnati, with transmissions emanating from the top of a self-supporting 900-foot tower. WCET is co-located with the WLWT, the Cincinnati affiliate of the NBC network.

Our station recently installed a Comark UHF CTT-U-150ICR television transmitter. In early 1992, WCET was in the planning stages of upgrading our transmitter plant. The older transmitter utilized inefficient high power integral cavity klystron amplifier tubes modified for pulsed operation.

We were fortunate to obtain a vacant metal transmitter building adjacent to our older facilities. The building dimensions (30x40 feet) were somewhat smaller than our former structure. However, with some appropriate remodeling, there was adequate space for the transmitter equipment and a small office area. In addition, a new concrete pad was poured outside to house the high voltage power supplies and heat exchangers.

A MATTER OF WEIGHT

Structural weight considerations were addressed because of the large RF system (5,500 pounds) that would be mounted to the roof understructure. A structural engineering firm assisted us in evaluating the roof weight load requirements. The firm's analysis resulted in a recommendation for adding five additional ceiling purlins to the building beam structures.



Jerry Blankenbeker views the new Comark UHF transmitter at WCET.

The new high power tube development technology has seen great improvements in UHF operating efficiencies, substantially reducing commercial power consumption. This consideration was very high on our transmitter upgrade planning criteria.

The obvious choice was the water-cooled IOT (inductive output tube). The company with a proven track record in manufacturing and integrating IOT transmitters was Comark Communications, based in Colmar, Pennsylvania.

We can achieve our full licensed transmitter power (110,000 W) by combining the individual 37,000 W visual power output from each of the three HPA stages. In common mode configuration, the calculated maximum power output capability from each EEV 7360 IOT amplifier is 42,000 W. This provides a degree of headroom to facilitate obtaining full visual power output very easily.

When planning our transmitter design, we positioned ourselves for future ATV transmission options. One of the single IOT stages could be pulled off and reconfigured onto a separate UHF TV channel for HDTV transmissions. This also would require adding a separate exciter and transmitting antenna.

The Comark dual exciters incorporated in our transmitter are of the latest "IOX Series" design. They feature greater degrees of optimization and correction capability. The exciters incorporate "AGC" sampling from the V2 high power output stage. The "AGC" function will drop out automatically at V2 power levels below 85 percent of the normal power output. An exciter interface panel provides OFF/ON "AGC" and UP/DOWN "manual" RF drive adjustments via remote control.

REDUNDANT COMPONENTS

One of the major planning considerations in our new transmitter acquisition was redundant system components. The configuration of the Comark transmitter system provides us with the ability to remain on the air, even at reduced power levels. The transmitter's design incorporates three water-cooled EEV 7360 IOTs (inductive output tubes) connected in parallel through a pair of magic-tee combiners.

The first magic-tee combiner (3 dB) is interconnected to the second magic-tee combiner (4.77 dB), achieving proper power matching in normal operating mode. To combine either V1 only or V2 only, along with V3, the second magic-tee must be internally reconfigured to a (3 dB) combiner (motorized changeover). The out-of-band RF components are filtered through a bandpass filter as the signal passes onto the antenna or system load.

All three HPAs have their own dedicated 32 KV power supply and SCR voltage controller. The state-of-the-art SCR controllers are designed to ramp the incoming AC voltage into each of the high voltage power supplies. The controllers will instantaneously shut down in the event of an IOT "crowbar" or overcurrent situation.

The exciter RF output contains all common mode VISUAL/AURAL components. These common mode RF exciter signals pass through a dedicated intermediate solid-state amplifier driver. The AIR/STANDBY changeover relay selects the exciter signal that will be routed to the transmitter. Through appropriate RF attenuators and phasing networks, the signal is interconnected to three 800 W solid-state (Class A) drivers.

Each of the 800 W RF drivers feed a single IOT high power amplifier stage. We selected (Class A) solid-state drivers for our transmitter to obtain optimum signal linearity without the need for complex correction networks.

In a common mode integration, it is imperative that visual/aural components do not result in intermodulation and cross modulation distortions. We have been delighted with the transmitter proof-of-performance test data, which has verified a near ideal common mode signal transfer through the solid-state driver amplifiers.

A great amount of heat is generated in the 800 W RF solid-state drivers, feeding each IOT amplifier stage. One of the air conditioning design considerations relating to our transmitter configuration is the generation of approximately 120,000 btu per hour of sensible heat losses, which is exhausted into the building proper. The transmitter and our metal building's heat loads have translated into a cooling requirement of approximately 20 tons of building air conditioning.

Comark made several on-site field surveys following the transmitter contract award. These surveys provided the required information to properly lay out the specific WCET transmitter system components on the final installation drawings. The Comark field engineers were efficient and knowledgeable in getting the transmitter installation completed on schedule.

WCET went online with our new Comark transmitter on January 13, 1994. The transmitter's performance and picture quality is outstanding. We expect to see some significant reductions in commercial power usage. At this writing, we do not have actual power consumption figures because of some accounting/meter reading problems at our local power company.

POWER SUPPLY

By the way, we have experienced power supply failures in some of our solid-state RF driver units. The source of the problem is thought to be faulty filter capacitors. Comark and the power supply vendor are working with us in solving the problem.

The IOT high power amplifier units are much more delicate in operating stability than our previous klystron tube amplifiers. The IOT tubes have performed very satisfactorily after warm-up, but we have experienced a few cold start-up problems at sign-on.

We found that during the past winter's extremely cold nights, it was best to kill only the RF drive during our sign-off period (12:45 a.m. to 6:30 a.m.). We kept the (50/50) water and ethylene glycol mixture circulating, and the beam voltage remained on throughout the night.

The Comark customer service personnel have been very responsive to our questions and needs. WCET is delighted with our new Comark transmitter and expect it to serve us for many years to come. ■

Editor's note: Jerry Blankenbeker has been in television broadcast engineering for 38 years. He has been the director of technical services for WCET for the past four and a half years.

The opinions expressed above are the author's alone. For further information, contact Comark (telephone: +1-215-822-0777; FAX: +1-215-822-9129), or circle **Reader Service 78.**

USER REPORT

South Korea Tunes In to Larcan

by Chong-Hien Kim
Deputy Director
MBC

SEOUL, South Korea

MBC Namsan station, the main station of MBC, is located at the Seoul tower, which rises some 250 meters above Nam Mountain.

MBC went on the air in August of 1969 with a tube type 2 kW transmitter. This power output has been increased several times, and in 1982 we upgraded to 50 kW of output power with two 25 kW tube transmitters operating in parallel. Our antenna is a 4 dipole, 4 panel, 4 bay unit supplied by Rohde & Schwarz in Germany.

There has been a tendency to update tube equipment to 100 percent solid state, and in 1990 we had the desire to change into solid state in order to produce better video and audio performance. In 1992, we decided to replace our transmitter with the Larcan M-Series.

EXCELLENT DESIGN

We discovered that Larcan's design concepts and specifications were excellent, and the simplicity made troubleshooting and replacement easy. We especially liked the strip-line circuitry used in the power amplifier and RF combining sections.

We negotiated with Larcan engineers and purchased two 30 kW transmitters in 1992, and an additional unit in 1993. We sent our engineers to Larcan during the testing of our transmitter system so that they could learn in advance how to operate and maintain it. This proved to be very helpful.

The Larcan Model TTS30MH transmitter is very small compared to others we have seen. Our 50 kW transmitter is made up of three of these units, outputting 50 kW of power by paralleling any two (A+B, B+C, C+A) of the three transmitters. It has an automatic switching system which will replace any one transmitter with the standby transmitter in case of a failure.

The switching system also allows the manual selection of any single transmitter (A, B, or C). This microprocessor-based switching system makes sure we are able to provide power output under any emergency. We use two exciters in a hot standby configuration, and supply all three transmitters from the automatic changeover switch.

Each of our 30 kW Larcan transmitters consists of two 16 kW amplifiers in parallel. Each amplifier and its related equipment is independent from the others. Within the 16 kW amplifier cabinet are two trays, each of which produces 9 kW of visual power and 1.5 kW of aural power.

Above each amplifier cabinet is a separately mounted exhaust blower connected to an air duct in the ceiling. Air is drawn through a filter in the back door, across the amplifier tray, and out through the top of the cabinet. Each blower moves 3000 CFM of air.

POWER DRAW

The power supplies are 50 volts unregulated, so we installed Hipotronics voltage regulators on each transmitter. Three phase, 4-wire power is fed to each regulator through an Islatron active tracking filter supplied by Larcan. In case of power failure, we have two generators, and each transmitter is connected to a UPS to prevent it from going off the air.

Video and audio performance is excellent, especially in South Korea where we are uniquely NTSC with two-carrier multichannel sound. Larcan's engineering has provided a system to meet this specification; the superior stereo separation and cross modulation performance has received great compliments from other broadcasters. Also, video frequency response and K-factor performance are highly superior.

On the power amplifier modules, if the input-to-output power changes, an LED goes out on the front panel and the fuse of the bad FET is blown. A new FET is put in place and a current meter is simply connected across the fuseholder while the static bias current is adjusted for 500 mA. It is not necessary to do a sweep test on the module after it is repaired. The performance of operating modules can be simply monitored with a spectrum analyzer on the module's front panel BNC connector.

The output air temperature from each amplifier is approximately 15 degrees Celsius above the input air. We installed an air filter in the front of each amplifier cabinet and increased the airflow to further reduce the operating temperature of the amplifier. Since that time, we have maintained a very stable operation. ■

Editor's Note: Chong-Hien Kim has 29 years of experience in TV/FM engineering. He has been in engineering with both KBS and MBC in Korea.

The opinions expressed above are the author's alone. For further information, contact Larcan (telephone: +1-905-564-9222; FAX: +1-905-564-9244), or circle **Reader Service 110.**

USER REPORT

Dielectric Give WBHS Higher On-Air Quality

by Allen McCarty
Chief Engineer
WBHS-TV

TAMPA, Florida

WBHS-TV, Channel 50, is part of the Silver King Communications Broadcasting Group. We have a Home Shopping Club affiliation agreement for most of the broadcast day, which equates to hours of revenue producing time, in addition to all of the locally produced community-related programming. We account for every second of air time and take steps to ensure dependable air integrity.

Our transmitter plant consists of an NEC 120 kW transmitter, combined with an NEC 60 kW transmitter, to produce a combined output power of 180 kW visual and 18 kW aural. We required RF equipment that would combine different power levels, phase relationships, and provide switching into multiple combinations of klystrons and antennas to assure an adequate on-air signal at all times with the push of a button.

RF SUPPLIER

Previous experience and research led us to select Dielectric Communications of Raymond, Maine, as the supplier of the RF, transmission line and antenna systems. We purchased a three-tube magic tee combiner/diplexer system, 1350 DTW transmission line and a TFU-28G antenna.

The waveguide filters — combined with waveguide phasers, switching and system loads — provide for precision balancing of the transmitters in all configurations.

The company's innovative transmission line, known as DTW, provides the efficiencies and power handling of circular waveguide with the wind loading and performance of coax. Surveys of its antenna patterns always result in the predicted coverage we expect and rely upon. There was no other choice.

Our transmitter plant has been greatly enhanced by Dielectric's support, in both the system design and everyday operation. The performance and reliability of the equipment has made my job easier by just knowing everything works.

We schedule our maintenance early on Friday mornings, from midnight to 7 a.m., and we rarely go off the air. If you push the right button, the Dielectric phase shifter moves, a switch activates, and we are still on the air. However, we still have access to the selected portion of our transmitter needing attention.

The ease and speed of configuration usually allows us to finish our work and start the weekend early (if we don't sleep all day Friday).

SUCCESSFUL RESULTS

The end result of our TV 50 project has been successful, due in part to the innovations and support of Dielectric and all of its staff — from the sales, engineering and design to product support groups, accounting and shipping.

We ventured into several other projects after WBHS-TV went on the air, one of which was the creation of a low-power TV network.

Low-power TV rarely had successful coverage, but the Dielectric people came through again, this time with the design of a true broadcast quality antenna for LPTV, available in standard and circular polarization (TLP Series). The success of our project is directly attributable to the performance of the antenna and the coverage it provides.

Mockups of the tower and mounting parameters are fabricated for every antenna, and

(continued on page 28)

USER REPORT

Jampro Widens KGW's Coverage

by Eric Dausman
Dir. of Operations & Engineering
KGW-TV

PORTLAND, Oregon

KGW-TV, Channel 8, received a construction permit to upgrade our translator station near Corvallis and Albany, Ore., in early 1993. We had requested a change of operating power, site and antenna pattern. A Jampro UHF slot antenna was chosen for the project.

Part of our service area includes two counties 75 miles south of Portland in the Willamette Valley. These two counties have a difficult time receiving Channel 8 because there is a full power Channel 7 station operated by Oregon Public Broadcasting nearby.

This creates a strong adjacent channel reception problem for off-air and cable homes. A translator is necessary to put quality television into viewers' homes.

PAST EXPERIENCE

There are many antenna manufacturers to choose from when buying a low-power UHF TV antenna. We wanted to purchase from a company that had significant experience, a strong quality reputation and offered a good price. Jampro has an excellent reputation in the radio and TV antenna industry and has designed a new line of low power slot antennas for the UHF TV market.

I have worked with Ross Shelton, sales engineer, at Jampro many times in the past 22 years. Back in 1972, he gave me some used antennas and the technical help to retune them. The new antenna was put in use at the California Polytechnic State University campus radio station KCPR (FM) in San Luis Obispo. Last time I was there, it was still in operation.

We needed a wide cardioid pattern on UHF Channel 26 to cover the service area. Jampro has many standard patterns to choose from and can customize for special needs. The company offers a full range of antenna gains. The antennas feature uniform elevation patterns over the frequency range specified. Optional pattern tilt and null fill are available.

Our antenna was specified for a 1 kW input. The antenna, a JA-LS, comes with 1 5/8-inch 50 ohm EIA flange input. There is a short matching section connected to the feed point in the center of the antenna pointing directly out the rear.

This caused a slight problem that we had not anticipated. The matching section ran into the tower leg. We compensated by turning the antenna about 10 degrees one direction, and turning the mounting brackets about 10 degrees in the opposite direction. This allowed the tuning section to clear the tower leg, which kept our directional antenna oriented as specified in our construction permit.

EIGHT-BAY DESIGN

We installed a 90-degree mitered elbow at the end of the matching section to turn the transmission line down the tower leg. The antenna is connected to the transmitter with a 1 5/8-inch air line.

Our antenna is an eight-bay design. At this frequency, it was 14 feet, three inches high. Because of the elevation of the antenna site, we chose 0.75 degrees of electrical beam tilt in the design. Eight pairs of winged reflectors shape the pattern to the desired coverage area.

The Jampro antenna is an all-welded design. There are no bolted connections other than the mounting brackets and the transmission line input. I have experienced problems with other slot antennas that do not use an all-welded design. Loose hardware and corrosion in joints will cause all sorts of problems in subsequent years, including arcing and intermodulation. Down time and tower crews are expensive. The all-welded design should prove very reliable.

Installation was very easy. The antenna was shipped almost completely assembled; the only assembly requirements were to attach the mounting brackets. The antenna was hoisted up the tower and completely installed in about two hours.

Our TTC XLS-1000 transmitter was turned on at low power, and we watched the reflected power meter. No problems emerged, so we cranked up the transmitter to 1,000 W. It was time to drive around the service area and see if the antenna was working as designed.

REAL PROOF

We measured the field intensity at several points. The results compared favorably to the predicted levels.

After a year of continuous operation, we feel that the Jampro antenna meets our expectations of an excellent quality product at a good price. The new translator station is delivering a much higher quality picture to the two-county area than Channel 8 could deliver because of the adjacent channel interference.

Best of all, Jampro delivered what it promised on time, and the project is well received in the community. ■

Editor's note: Eric Dausman has been employed by KGW-TV for three years, having previously worked for the NBC network in New York.

The opinions expressed above are the author's alone. For further information, contact Jampro (telephone: +1-916-383-1177; FAX: +1-916-383-1182), or circle **Reader Service 59.**

INFORME DE USUARIO

ITS DA CONFIANZA EN EL AIRE

por Ricardo Jarquin
Ingeniero de Transmisión
Trinity Broadcasting Network

SAN JOSE, Costa Rica

Hemos usado los transmisores para televisión marca ITS desde el año 1989. Nuestro primer transmisor fue el ITS-230, una unidad que se ha comportado realmente como un caballo de batalla. Lo instalamos en la cima del volcán Irazú, a una altura de 3.432 MSNM (11.260 feet ASL) en un recinto de concreto.

Este transmisor operaba solo, sin la asistencia de un operador. Los equipos ITS cuentan con un sistema de encendido automático el cual se activa con la presencia de una señal de video. El equipo necesita únicamente energía eléctrica, video, sonido y el sistema de antena transmisor.

Con esto es suficiente para disfrutar de un sistema de transmisión altamente confiable (por parte del transmisor). Si Ud. dispone de un sistema de transmisión de retorno a estudio de microonda o algún canal por el cual pueda transmitir datos al estudio, podrá agregarle al transmisor cualquier marca de interfase de comunicación de datos y tener el control de todas las lecturas del transmisor.

Puede Ud. controlar desde al excitador, hasta la etapa final de potencia—así como el control de las principales funciones como: activación y desactivación del alto voltaje; función de "standby" (en reserva) y operación; subir y bajar la potencia. Igualmente Ud. puede probar al excitador, reinicializar luego de una falla, así como recibir indicación de las fallas.

Todos estos controles, indicadores y medidas de voltajes, corrientes y potencias vienen dispuestos y accesibles en tres conectores múltiples en la parte superior trasera del transmisor listos para conectar la unidad que Ud. Disponga comprar.

En cuanto al desempeño del transmisor como tal, ha sido una experiencia muy agradable sin mayores problemas que resolver. Claro, hemos reemplazado fusibles quemados, y hacemos verificación del paso de banda de la cavidad cada año por lo menos. Hay que mantener limpios a los filtros de aire.

Nuestros equipos trabajan 24 horas al día todo el año sin interrupción salvo cuando hay cortes de energía (en caso de corte de energía el sistema de control "recuerda" el status de operación que tenía el transmisor antes del corte).

El equipo viene respaldado por un manual de servicio de dos volúmenes en los cuales se encuentra desde la teoría de operación de cada circuito hasta los detalles de ciertos componentes.

El manual se puede considerar todo un tratado acerca de un transmisor de televisión, con esquemas y diagramas pictóricos de cada tarjeta así como la lista de partes de todos los componentes.

En cuanto a calidad, es sencillamente excelente, empezando por su modulador totalmente diseñado por ITS que utiliza un cristal de referencia para el video y un sintetizador PLL con referencia de la frecuencia de video (47.75 MHz) para mantener la separación de 4.5 MHz entre ambas portadoras.

Después del modulador tenemos el conversor "UP", donde además de realizarse la conversión de IF a RF (a la frecuencia de transmisión), también tenemos el control automático de ganancia (AGC), control automático de nivel (ALC), corrector de frecuencia de la portadora de video (ICPM).

Seguidamente tenemos el amplificador de 3 W donde hay otros circuitos asociados con el control de la calidad de la señal a transmitir. Estos incluyen: otro circuito de AGC y el corrector de intermodulación. A la salida de este amplificador hay un atenuador de 6 dB, para desarrollar un nivel alto de potencia (donde hay mas corrección) y poder dar mejor calidad de señal al amplificador de 50 W.

Como paso siguiente tenemos el amplificador de 50 W el cual es el excitador del amplificador final compuesto por el tubo 9017 y la cavidad mas un filtro de muesca ("notch") que elimina cualquier espuria fuera del canal transmitido y el segundo armónico de la frecuencia principal.

El sistema de protección mantiene control de la corriente máxima de placa, corriente máxima de grilla 2, potencia reflejada máxima (10 por ciento máximo) y corriente máxima en la grilla de control.

Nuestra cadena de televisión ha instalado los transmisores ITS en Honduras (San Pedro, Sula y Comayagua), en Nicaragua (Esteli), y en Costa Rica en diversos lugares desde unos cuantos metros sobre el nivel del mar en Puerto Limón, hasta 3432 metros sobre el nivel del mar en el volcán Irazú y Cerro de la Muerte.

Nuestra experiencia ha sido muy buena con estos equipos y la pequeña diferencia que pueda existir en precio con otros equipos de menos especificaciones—vale la pena pagarla. ■

Nota del director: Ricard Jarquin es el ingeniero de transmision a cargo de la red centroamericana de estaciones de television cristianas afiliadas a Trinity Broadcasting Network (TBN).

Para mas informacion referente a ITS, communique con ITS al telefono: +1-412-941-1500; FAX: +1-412-941-4603, o marque el **No. 42** *del* **Reader Service.**

USER REPORT

Acrodyne Helps WGKI to Grow

by Daniel Somes
Chief Engineer
WGKI-TV/WGKU-TV

CADILLAC, Michigan.

Our stations, WGKI-TV (Channel 33) in Cadillac, sister station WGKU-TV in Gaylord/Vanderbilt, Mich., and translator W40AY in Traverse City, Michigan, are full-service UHF stations. While we are only four years old, we are rapidly expanding each month, breaking away from the current trend in the U.S. broadcast industry of downsizing and cutbacks.

From the beginning, we have had some obstacles to overcome. Our market is very large geographically, with vastly changing terrain. Being a new UHF station, we needed to select a transmitter that addressed three main points: dependability, efficiency and cost.

LENGTHY STUDY

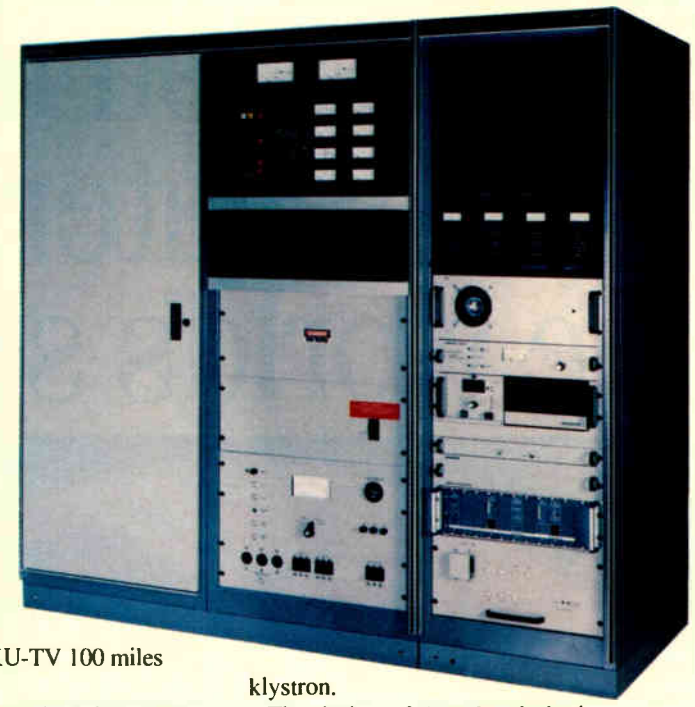
After a lengthy study, Acrodyne stood out as our best choice for a transmitter. For us, Acrodyne has shattered the belief that the "the bigger the company, the better the product."

The TRU-5KA is an air-cooled transmitter with tetrode tube technology. The final is a Thompson TH-382 with a tuned bandwidth of approximately 12 MHz. The driver is 200 W, utilizing a TH-339.

Aside from the obvious operating cost advantages of the tetrode, it is a highly linear device, allowing combined amplification (no separate aural tube) with minimum precorrection. It is also highly stable, eliminating periodic adjustments. Acrodyne's built-in self-protection circuitry and proven dependability drastically minimizes our transmitter downtime for maintenance needs.

We went on line with the TRU-5KA, and found that for a 5 kW transmitter with our effective radiated power of 61.7 kW, we were penetrating areas we never thought we'd reach.

The transmitter had surprising efficiency and, with the exception of the life expiration of the tube and a one-time problem with the screen grid, the transmitter ran superbly for two and a half years. We then upgraded to a TRU/25KV, and moved the TRU 5KA to its new location, with sister station WGKU-TV 100 miles away.



The 25 kW enabled us to both increase our geographical signal reach and strengthen our existing signal in previous trouble spots. It is a water-cooled transmitter with a TRU 1KS solid state driver. The final is a Thompson tetrode TH 563.

This hypervapotron-cooled tube has an incredible history of well over 20,000 hours. This is definitely a big advantage, as we need a long life expectancy from our tubes. We are hitting our ERP of 216K at only 60 percent power, which we hope will extend the life of the tetrode, while still operating at a fraction of the cost of a klystron.

The design of Acrodyne's logic interface is spectacular. Our down-time is practically non-existent. If we were to have a problem with the final or water cooling system, the logic switch-over interface will automatically put the driver on the air. This would allow maintenance to be performed without losing revenue.

Being able to keep at least the 1,000 W driver on the air is a godsend, as the signal will still be picked up by our microwaves, keeping our satellite stations up. Although we have had no major problems with our final, we have utilized the switch-over because of power outages that would have normally shut us down. Instead, our power transfer switch kicked over to the backup generator, which powered up the driver.

FILLING THE BOWL

Our final transmitter is a 1 kW LPTV. It is also a tetrode model using a Burle 9017. This transmitter was put in so that we could penetrate a large community in our market that was previously missed because it was in a "bowl" area.

All three of our Acrodyne transmitters run superbly. Ease of installation and maintenance, durability and dependability and the excellent support from Acrodyne made us very happy with our transmitter choices.

We have plans to purchase two more transmitters, both solid state 1 kW models, for our Upper Peninsula coverage area. These will be the same as the IPA on our 25 kW model, so we know that they will be great. ■

Editor's note: Daniel Somes attended the U.S. Air Force and Colorado Technical College. He has worked for WGKI since 1990 and was promoted to chief engineer in 1992.

The opinions expressed above are the author's alone. For further information, contact Acrodyne in the U.S. (Telephone: +1-215-542-7000; FAX: +1-215-540-5837), or circle **Reader Service 34.**

BUYERS BRIEFS

AB Eletronica's L series of power amps range from 100 W to 10 kW outputs using thermionic tubes in a range of ceramic triodes and tetrodes.

The unit uses combined amplification of the video and audio carriers, and power supplies are equipped with logic circuits to provide automatic cut-off functions with override facilities after eight automatic alarm resets.

The amps are also able to be remotely controlled or connected to a changeover unit. Drive power is delayed at start-up, and filament hearing power is stabilized on all models.

For further information, circle **Reader Service 32.**

The ITS-830 1 kW solid state UHF transmitter from **ITS Corp.** features high-gain power amplifiers driven directly from the exciter to eliminate a single driver stage.

Each amp has its own power supply and cooling to enhance redundancy.

The unit is internally diplexed (combined visual and aural) and features output circulator protection, output bandpass and trap filtering, full remote control capability, +/- 1 kHz frequency stability and video ALC.

Translator versions are also available, including 500 W and 2 kW power levels.

For further information, circle **Reader Service 57.**

ITELCO's T674K 40 kW UHF transmitter features common amplification and an exciter composed of several plug-in boards for easy service and maintenance.

The driver amplifier is composed of four solid state amps and a power coupler to provide a driving power of 420 W at the input of the final stage. The final amplifier utilizes an IOT tube working in common amplification mode to deliver about 41 kWps.

Power consumption at black level is 65 kVA.

For further information, circle **Reader Service 38.**

Thomson Tubes Electroniques' TH 760 IOT is a 60 kW vision amplification unit (40 kW in common amplification) featuring a simple plug-in design for easy installation.

The input circuitry features a tetrode-like cavity that eliminates spurious resonances, and the tube roll-back unit is interchangeable with other models.

The unit is available in an operating frequency up to 810 MHz and offers gain of greater than or equal to 20 dB.

For further information, circle **Reader Service 133.**

In 1986, Comark invented IOT transmission technology. Eight years later, we still set the world's standard.

Despite what you may have heard, IOT technology wasn't born yesterday. We saw its potential to change the transmitter industry quite some time ago.

We showed the first Klystrode amplifier at NAB in 1986, and put the first IOT transmitter into full-time broadcast service in 1988. Since then, we've used more than three million hours of on-the-air experience to lead the way in IOT research & development.

In 1991, our patented aural carrier corrector technology and advanced linearity corrector were developed to meet today's requirements for high efficiency common amplification transmission. And in 1992 we introduced the exclusive DUAL USE™ system that lets you operate with NTSC today and, in the future, convert to D-HDTV.

But we didn't stop there. At NAB 1993, we introduced our third generation IOT system, the IOX. Its ultra linear Class A drivers, optically-isolated solid state control logic, constant impedance output filter, leading-edge crowbar design and IEC-215 implementation make it the most advanced UHF-TV transmitter in the world today.

So if you're looking for the most advanced, proven IOT solution, go with the company that's been pioneering the technology for eight years—not eight months. For more information, or to request a set of our latest **HDTV TECH BRIEFS.™** call us today at 1-800-688-3669.

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Circle 95 On Reader Service Card

USER REPORT

PESA-MCI Meets Many Station Needs

by Matthew A. Sanderford
President
MARSAND Inc.

FORT WORTH, Texas

While building WLFL, Channel 22, in Raleigh, N.C., I attended the 1981 NAB convention in Las Vegas to shop for RF equipment. I was approached by Tom Vaughan, president of Micro Communications Inc. (now called PESA-MCI), and he convinced me to try a new product called a circular waveguide for high-powered UHF TV.

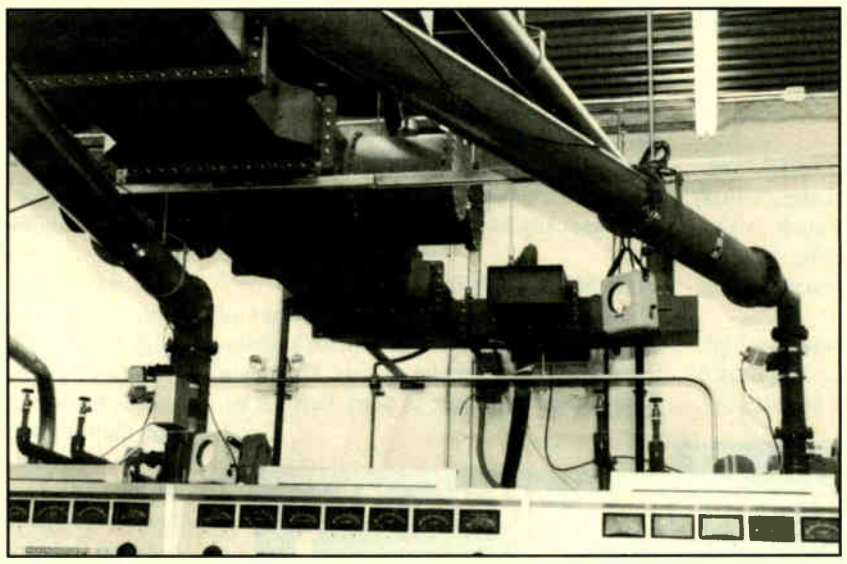
Although the product was untried at the time, my background in research and development, as well as genuine curiosity, convinced me to try it. This move has led to a successful relationship, which continues to this day. Although there were some difficulties in the beginning with the circular waveguide, the innovation and perseverance of MCI has proven the company to be a catalyst and leader in the RF field.

TIME AND TIME AGAIN

During the construction of KWKT, Channel 44 in Waco, Texas, I again turned to MCI for the diplexer portion of the RF plant. As predicted, the diplexer was delivered on time, and it has performed to specifications with no problems to date.

In 1991, I was commissioned to build WGMB, Channel 44, in Baton Rouge, Louisiana. In this case, used studio and transmitter equipment had been purchased and was to be restored.

I went to MCI for the re-channeling of a used diplexer, new harmonic filters, and peripheral RF line components. Again, the service and product were superior as deadlines were met and costs kept within budget.



A PESA-MCI installation at KNVO in McAllen, Texas

In the fall of 1992, while building KNVO, Channel 48, in McAllen, Texas, I relied on MCI to provide the diplexer and RF peripherals to complement the 70 kW transmitter.

The diplexer was switchable for bypass by either aural or visual klystrons, while sending the one to the antenna and the other into the dummy load. This proved to be a real bonus during the initial months, when multiplexing became a necessity into each of the klystrons during times of trouble.

When the station began to broadcast in stereo about a year later, the system performance, including the MCI waveguide, exceeded the anticipated specifications.

PROJECTION COMPLETION

When I needed to make an addition of ports for a client who had installed a system that incorporated MCI equipment as far back as 1980, I went to MCI in hopes of locating some records that would help me specify and complete the modification.

Dennis Heymans, MCI's sales and marketing manager, pulled out some old records of the site and within hours had specified and configured the necessary parts, following up with assembly and dimensional diagrams for the installations.

By manufacturing a special length "U-Link," we turned a five-port into a seven-port patch panel. The simplicity of the design brought us in under budget, and it affected the entire installation within a few hours overnight.

I have already been commissioned to build another UHF station, and, with the partial front payments generated, have already placed the diplexer order with MCI.

I have always found MCI to be very responsive during the past 13 years. I commend Tom and his staff for the cutting-edge mentality that characterizes MCI. ■

Editor's note: Matthew A. Sanderford is president of MARSAND Inc., a broadcast engineering consulting firm. He has built over 17 television stations and has been consultant to numerous others. He is a registered professional engineer in the state of Texas and a member of SBE and IEEE.

The opinions expressed above are the author's alone. For further information, contact MCI (telephone: +1-603-624-4351; FAX: +1-603-624-4822), or circle **Reader Service 68.**

BUYERS BRIEFS

The STV-784 BTSC stereo generator by **Modulation Sciences** produces a full 55 dB of stereo separation (equivalent mode). Audio processing is self-contained, but can be omitted on special order.

The unit contains three isolated composite outputs, a front panel multimeter to measure all modulation modes, stereo phase, and audio processing action.

The STV-784 is fully remoteable, and is backed with the company's three-year warranty.

For more information, circle **Reader Service 15.**

DB Elettronica manufactures its products in strict accordance with international standards, while utilizing the advantages of modular construction.

The company produces a wide range of devices, including the VAM 01 stereo television modulator; the MTU/5 wideband transmitter for bands I, III, IV and V; the IFCU/5 IF-CH converter; and the CCU/5 transposer.

For further information, circle **Reader Service 13.**

The B7650 UHF transmitter from **GEC-Marconi** utilizes IOT tubes and is available in output power levels from 10 to 40 kW.

The unit utilizes broadband amplifiers in conjunction with passive filters, including those for vestigial sideband shaping using a surface acoustic wave (SAW) filter in the vision IF stages.

Dual sound using either a single carrier multiplex or two separate sound carriers is available.

For further information, circle **Reader Service 30.**

Stainless Inc. has been providing guyed and self-supporting towers for the communications industry since 1946.

The company has provided design, fabrication and installation for more than 7,000 tower systems worldwide, ranging from 10 to 2,000 feet.

For further information, circle **Reader Service 105.**

Tennaplex Systems Ltd. offers a wide range of broadband multichannel master antenna systems.

One of its newest products is an HDTV-ready panel antenna suitable for the 470 to 806 MHz band.

The company provides standard or custom horizontal and vertical patterns, and beam tilt and null fill are available at no extra cost on most models.

For further information, circle **Reader Service 12.**

France's **Velec** manufactures VHF and UHF transmitters and transposers ranging from 0.5 W to 1 kW.

Features include common amplification on models 100 W output or less (separate amplification on greater than 100 W), intermodulation of less than -56 dB and output impedance of 50 ohms.

Also featured is VSWR of greater than 17 dB and single-phase mains of 230V +/-10 percent from 47 to 63 kHz.

For further information, circle **Reader Service 44.**

USER REPORT

EMCEE Is the Right Answer for KPBI

by Bill Pharis
President
Pharis Broadcasting

FORT SMITH, Arkansas

With the National Football League NFC season rapidly approaching, Fox Broadcasting Corp. affiliates such as our station, KPBI-TV, are scampering to make certain our signals reach throughout the designated market area.

Utilizing LPTV translators aided by high gain broadcasting antennas is a key strategy in many markets, and it has been part of our overall game plan from the beginning.

Pharis Broadcasting Inc. began operation with one LPTV transmitter in 1989 on Channel 46 in Fort Smith, as a low-power station with 21,700 W ERP. Since that time, it has built five translating stations — broadcasting on channels 14, 15, 59, 60, and 63 — at strategically located points in the market.

FAR REACHING

Our immediate goal in the early days of operation was to cover the metro populations and reach cable head-ends. High gain Bogner antennas seem to work best for us, but we also use some Scala and Jampro equipment.

To deliver a maximum audience for its NFL Football package, Fox Broadcasting, at its own expense, has authorized a study to see how each of its affiliates can better reach over-the-air viewers. The network has urged stations to consider upgrades and translators.

The last two transmitter/translators we have put on-line have been 1,000 W units from EMCEE Broadcast Products, and a third has been ordered for Channel 50 to finish out the seven-station network. Our goal is to have comparable, or better coverage, than any station in the market.

John Battison, our consulting engineer, designs all of our channels to reach maximum coverage, using a directional antenna to target the population more carefully in at least one application. Though we try not to duplicate coverage too greatly, there are several parts of the viewing area in which people can receive two, and even three of our channels.

The interlock system on the EMCEE is especially good at protecting the unit from lightning damage.

LOCAL FLAVOR

Though the same programming is normally seen on all channels, KPBI has the ability to go local at any of its locations to broadcast events of interest to only that specific area.

In choosing the EMCEE transmitter, KPBI-TV required a dependable product that has strong factory support. Some of our sites are very remote (one is on top of the highest mountain in the state), and we cannot afford to be running back and forth.

The EMCEE staff, including sales chief Jim Zaroda, is consistently available to answer questions, and the technical department moves out replacement parts quickly. Recently, when a power line surge demanded a rectifier, we were able to get the part counter-to-counter and into the translator within a relatively short time.

EMCEE's transmitters are flexible as to the video source, and in two applications with stand-by generators, the EMCEE has adapted well. As with all RF equipment, they operate best when the heat exhaust is carefully directed out of the transmitter shack and the temperature kept reasonably cool.

The interlock system on the EMCEE is especially good at protecting the unit from lightning damage.

With the seven-station Fox service nearing completion, Pharis Broadcasting is planning to establish a second LPTV network in the Fort Smith market, this one devoted to sports.

We will start with one or two transmitters and expand outward, probably to a total of five. We will take advantage of what we learned the first time, such as using higher gain antennas from higher ground. With careful planning, I believe we can cover the same area we are now using seven channels to cover. ■

Editor's note: Bill Pharis has an extensive broadcasting background, starting first in television news. In addition to KPBI-TV, the company owns two radio stations and a cable TV advertising company.

The opinions expressed above are the author's alone. For further information, contact EMCEE (telephone: +1-717-443-9575; FAX: +1-717-443-9257), or circle **Reader Service 77.**

CONTINUED FROM PAGE 22

Dielectric Gives WBHS Higher On-Air Quality

it does not ship until the pattern is exactly as requested. A complete plot is provided with each antenna, and when the installation is performed according to instructions, the real-world patterns match the predicted ones.

Meanwhile, filters made by Dielectric have made it possible for us to operate on channels 14 and 69, which were previously unusable in some areas due to interference with land-mobile and two-way radio systems. This has opened up markets that previously had no other available channels.

One channel 14 transmitter is located one quarter of a mile from a commercial two-way radio site. Our transmitter was turned on without any discernable out-of-band components at the communications location.

I have been involved in all aspects of television and independent network operations and have gained a proficient working knowledge of the equipment available in the industry. I realize that TV broadcast equipment is like a fine car, boat or plane — when you find one that works, stick with it. Your job, reputation and happiness depend on the integrity of your selection. ■

Editor's note: Allen McCarty is involved in the construction and implementation of the Silver King Communications low-power TV project. His training is in the electronics and communications field. He is an SBE member, with 24 years of station construction and operations experience.

The opinions expressed above are the author's alone. For further information, contact Dielectric (telephone: +1-207-655-4555; FAX: +1-207-655-4669), or circle **Reader Service 28.**

28 BUYERS GUIDE

EQUIPMENT EXCHANGE

TV Technology's Equipment Exchange provides a FREE listing service for all broadcast and pro-video end users. Brokers, dealers, manufacturers and other organizations who sell used equipment on an occasional basis can participate in the Equipment Exchange on a PAID basis. All free listings run at the discretion of the publisher.
Call 1-703-998-7600 for details.
Submit your free listings on your letterhead and state the make, model number, a brief description, sale price and complete contact information and mail it to:
TV Technology, PO Box 1214, Falls Church VA 22041

ANTENNAS, TOWERS, CABLES

Want to Sell

6 1/8" transmission line elbows, gd cond. R Spain, KJZZ-TV, 5181 Amelia Earhart Dr, SLC UT 84116. 801-537-1414.

CAMERAS

Want to Sell

Ikegami 730A w/12x1 zoom lens, PortaBrace camera bag, (2) rain covers, multi-pin camera cable, (5) Anton Bauer Pro-Pac 14 camera batts, Anton Bauer Lifesaver batt chrgr, Ikegami pwr sply, (3) Ikegami hard shell shpg cases, vgc, $3500. C Vieira, Total Video Prod, 11 Prince St, Fairhaven MA 02719. 508-990-3677.

Panasonic WVF700 & AU410 dock pack syst, DPS camera, (3) 2/3" CCDs, 750 lines, 62 db S/N, 1 yr warr, $10800. 607-687-0545.

Sony DXC-M3, viewfinder, 12X lens, tripod adapter, case, gd cond, $1800; JVC KY-1900 cameras, (4) 10X lens, viewfinder, no case, $600/ea; JVC KY-210 w/ERM-74 12X lens w/2X extender, viewfinder, M-K50U shotgun mic, no case, $2500. Joe, Starfire Video, 910-867-5149.

Ikegami HL-79 camera, BO. R Spain, KJZZ-TV, 5181 Amelia Earhart Dr, SLC UT 84116. 801-537-1414.

Canon L-2 Hi-8 camcorder, new condition in original cartons, 15x interchangable lens, remote, 4 new batteries, power supply/charger, $2200. J Karnik Prod, 248 Village Green Rd, Encinitas CA 92024. 619-436-2308.

CAMERA ACCESSORIES

Want to Sell

Quickset QRTH-1C (2) RNB prof tripod with fluid head, Best Offer; Quickset QRD-1 (2) special tripod dolly, Best Offer. J Richardson, Showcase Chicago Channel 25, 1931 W Diversey Pkwy, Chicago IL 60614. 312-477-4900.

PortaBrace Quick Draw case, 21PW, $100; JVC M-K50U shotgun mic, $75; Canon LO-25 back control set, new, $400; JVC VF-215U viewfinder for KY-210, $100; Sony CCDQ-0.6 CMA8 to CCU-M3 & CMA8, new, $15; RMM-1800 rackmount for CCU-M3 & CMA8, new, $100; Joe, Starfire Video, 910-867-5149.

Circle (1) On Reader Service Card

JVC BY110up camera w/lens, viewfinder, carrying case & RS-110U remote cntrl unit w/130' of cable, like new, less than 100 hrs, $1095. Richard, 314-946-1686.

JVC KY 25U video camera w/KA 20 standalone back, viewfinder, Fujinon Eagle I lens, 16 to 1 case, lw hrs, $3895. D Brennan, 205-823-0088.

Sony DXC-1820 camera w/lens, case, tripod mount, lens zoom/focus remotes, needs new zoom conector repair only, gd ENG, $350; Sony DXC 1640 tube camera w/lens, viewfinder & CCU, auto iris not working, minor repair to restore, CMA-6 CCU, $300/BO. M Leonard, Public Cable, 118 Johnson Rd, Portland ME 04102. 207-775-2381 x850.

Sony DXC M3 camera under 1K hrs w/Zebras & 4 pin pwr XLR mod, new viewfinder, Fujinon Pegasus 14x1 lens, 14 pin x 26 pin umbilical for input to BVW-25 or 35, PortaBrace case, $2000. J Strickland, Strickland Video, 404-988-0803.

Procam 3-tube camera incl camera head, 1.5" electronic viewfinder, shpg case, battery bracket, AC supply, $1000; JVC KY-320CH tube color camera system (3), $1000/ea. J Richardson, Showcase Chicago Chnl 25, 1931 W Diversey Pkwy, Chicago IL 60614. 312-477-4900.

Sony Extended Definition-Beta Camcorder EDC-55, 2-chips, 550+ lines, Canon 15x lens, 1.5" VF, AC pwr/batt chrg, Y/C output 500 lines rcded, 3 NP-1As, tapes, lw hrs, gd cond, $2900/BO. C&H Video New, 408-288-8505.

Quickset Samson Series tripod w/friction head or use to rebuild yours, gd elevator tube, $50. M Leonard, Public Cable, 118 Johnson Rd, Portland ME 04102. 207-775-2381 x850.

Anton Bauer COM PAC-MAGNUM batt syst, Lifesaver quad chrg CMFC & 4 COM PAC-MAGNUM 13 cells, all in excl cond, $700. FS-X Video Grp, NYC. 212-517-1566.

CATV/MATV EQUIPMENT

Want to Sell

NEC TV 820 EN TV tuner/demodulator, $75. M Leonard, Public Cable, 118 Johnson Rd, Portland ME 04102. 207-775-2381 x850.

DIGITAL EFFECTS

Want to Sell

Alta Pictoris video compressor w/effects, freeze, mosaic, poster, 50 event memory, GPI input, clean, $3600. Joe, Starfire Video, 910-867-5149.

CrossPoint Latch 6065 chroma keyer, BO. QV Productions, POB 3236, Santa Clara CA. 408-248-8208.

Microtime Genesis I Act I digital video effects unit, $3500. J Richardson, Showcase Chicago Chnl 25, 1931 W Diversey Pkwy, Chicago IL 60614. 312-477-4900.

Video F/X non linear editing suite, Macintosh based NTSC, $3000/BO. S David, Frontline, Radmansgatan 3, 211 46 Malmo SWEDEN. 011-46-40-977578.

EDITING EQUIPMENT

Want to Sell

Sony BKE915 interface, new, $300; BKE916 interface, new, $300; BKE906 time code, $300; BKU905 time code plug in, $300; BK-806 time code plug in, $300; BK-801 remote for 800 series VTR, $300; BK-811 panels, $10; BK-805 rack mount, $50; FCG-700 frame code generator, new, $300. Joe, Starfire Video, 910-867-5149.

Videonics video titlemake, almost new, $300. J & K Productions, 9258 Terra Linda Drive, Elk Grove CA 95624. 916-685-4460.

Ives II A/B V2.4C controller, frame accurate, programmable A&V fades, GP1, TC, EDL print & serial, TC gen/read w/3 parallel interfaces, excellent, $1850/BO; same unit as 2-mach cuts, $1200; A/B box, $900; interfaces for above, (3) JVC, (2) Sony, Panasonic, $175/each. Steve, 608-251-8855.

Sony VO Editing system, Sony VO 5800 player/recorder, Sony VO 5850 edit deck, Sony VO 5600 player/recorder, (2) Panasonic BT-S1300N color monitors, very good condition, $7500. C Vieira, Total Video Productions, 11 Prince St, Fairhaven MA 02719. 508-990-3677.

Paltex Abner A/B roll controller with 3 cable for type 5 Sony, $2500; Sony 5850, 5800 & RM 440 edit syst w/cables, gd cond, $5000; Knox K-100 CG, $400; will deliver within 500 miles. R Schroeder, American Odyssey Video, 206-838-8338.

Videomedia Mickey II A/B roll editor, $1000/Best Offer. QV Productions, POB 3236, Santa Clara CA. 408-248-8208.

JVC ESP-2 RM-86U edit remote control, Best Offer; Eeco-Ives II A/B microprocessor based video tape edit system, $1100. J Richardson, Showcase Chicago Channel 25, 1931 W Diversey Pkwy, Chicago IL 60614. 312-477-4900

PEDESTALS

Want to Sell

MOVIE PRODUCTION EQUIPMENT

Want to Sell

Panasonic PTB1010UF 80-120" diagonal picture size, 1100 lines resolution, wireless remote cntrl operated, $4800. 607-687-0545.

SIGNAL PROCESSING

Want to Sell

I-DEN IVT-7 digital TBC, Y/C, input & output, composite & 7 pin for 3/4", drop out compensation circuits, like new, $1100. T Keegan, Video Keepsakes, 55 Andover Pl, Robbinsville NJ 08691. 609-443-1101.

Intergroup 9026 auto transition event storage bank, $100; Channelmatic RPS-3002A (4) power supplies, Channelmatic SSS-3005A (4) sequence selector, Channelmatic AVS-3031-A AV switcher, Channelmatic VCR 3031A (12) VCR module, Ramko LA2R (8) audio amp, Channelmatic PCM-3000A controller, Channelmatic UAD-3000A answer device, Channelmatic CTD-3001A tone decoder, Channelmatic CTD-3001A tone decoder, Channelmatic BDD-3010A (4) decimal decoder, Channelmatic N/A switcher, $4000. J Richardson, Showcase Chicago Chnl 25, 1931 W Diversey Pkwy, Chicago IL 60614. 312-477-4900.

SWITCHERS

Want to Sell

Crosspoint Latch 6119, 3 buss, 6 input, prod switcher with audio-video relay option, $500; Intergroup 9035 prod switcher, $1000; Intergroup 982 10 input, 1 output to audio follow video monitor switcher, $200. J Richardson, Showcase Chicago Channel 25, 1931 W Diversey Pkwy, Chicago IL 60614. 312-477-4900.

CEL Professional studio Switcher effects system including P152A touch screen controller, P148 mixer combiner, P147-30 digital frame sync TBC, P169V video matrix routing switcher, P169A audio follow video switcher, including all instruction/service manuals, ramp test generator, extender cards & latest software, $4900. Bill, 502-426-6278.

JVC KM-2000 8-buss switcher/SEG w/heavy duty Starcase flightcase, $1500. John, 415-882-7766.

JVC KM-1200EB 4 input switcher, new, $1300; GVG-100 pulse regeneration board, new, $300. Joe, Starfire Video, 910-867-5149.

Ross 10 input, 1 ME, basic effects, works good, book, tally card & cables, $1500/BO. Bemie, TV-50, 890 San Marcus Lan, Duarte CA 91010. 818-303-7161.

TAPES/CARTS/REELS

Want to Sell

TRANSMITTERS/ EXCITERS

Circle (127) On Reader Service Card

Want to Sell

RCA TTU-30 with Townsend exciter, no Klystrons or buckets, otherwise complete, in service until 1/93, will sell whole until 7/1/94, then will part out, Best Offer. S Shumate, WVIR-TV, POB 769, Charlottesville VA 22902. 804-977-7082.

UHF TV transmitter, 60 kW Klystron, well maintained, still on air. 702-386-2844.

TUBES

Want to Sell

RCA 7007/6166, RCA 5762, 4x500, new, not rebuilt. 305-757-9207.

RCA Cavity parts, new, other RCA parts "A Line" thru "E Line". 305-757-9207.

RCA 7007/6166, RCA 5762, 4x500, nuevo, no reconstruido. 305-757-9207.

RCA partes de repuestos, nuevos, otros partes de repuestos de RCA en almacen para las lineas de "A" hasta "E". 305-757-9207.

USED EQUIPMENT

Want to Sell

TV FILM EQUIPMENT

Want to Sell

Panasonic ET-100DS line doubler, converts NTSC composite & S-Video signals into RGB, doubles horizontal scanning frequency from 15.75,Hz to 31.5kHz, resolution 560 lines horizontal & 450 lines vertical, $1500/BO. 808-875-8871.

Moviola 4 gang sync block with mag head, nver used, $100; 16mm sound film projector, BO. J Kamik Prod, 248 Village Green Rd, Encinitas CA 92024. 619-436-2308.

RCA film chain, new in crates, never used, TK-29 camera, multiplexer, TP-66 projectors, TP-7 projector, Best Offer or tax deductible. R Spain, KJZZ-TV, 5181 Amelia Earhart Dr, Salt Lake City UT 84116. 801-537-1414.

VIDEO PRODUCTION EQUIPMENT

Want to Sell

Laird 1500 (3) color character generator with dual disc drive, 70 resident fonts, standard keyboard, demo, $1500/each; Intergroup 625-4 chromakeyer with 4 input selector switch, $200; Laird 7000 character generator with expanded software includiing Laird FM-1605 Spanish font, $400. J Richardson, Showcase Chicago Channel 25, 1931 W Diversey Pkwy, Chicago IL 60614. 312-477-4900.

Telemation Compositor character generator with 2 extra rebuilt disc drives, extra keyboards, manuals, Best Offer or tax deductible. R Spain, KJZZ-TV, 5181 Amelia Earhart Dr, Salt Lake City UT 84116. 801-537-1414.

Knox K40 character generator, user friendly, high resolution, self-contained 58-keyboard unit, 64-page memory, 6 fonts with double size font capability, 32-color palette, roll, crawl, title, italica, flash, non-volatile memory, intemal sync generator, $1250/BO; Crosspoint Latch 6025 color background generator, variable color, hue, Saturation, $150/Best Offer. Mobile-Video Productions, Bethesda MD. 301-656-2525.

VIDEO PRODUCTION EQUIP...WTS

Barco Data 9000120 450 lumens, composite or graphics video, wireless remote, digital, RGB, almost new, $4800; Nova 620 TBC, freeze frame, thin & rackable, use w/Super VHS, VHS, 3/4", 1", etc, great, $1800; Lenco PVS-430 videoscope used for the SC Phase for edit syst, $1400. Jaye, Nimbus Prod, POB 5903, Tak Pk MD 20913. 301-507-3358.

JVC CRU-4900 3/4" port rcdg deck, lw hrs, PortaBrace case w/JVC AP47U batt chrgr/pwr sply & 4 batts, $600; Sony BVU-150 3/4" SP port rcdg deck, 6 hrs, blown pwr sply, excl for parts/head drum w/manual & Sony soft case, $500. J Strickland, Strickland Video, 404-988-0803.

Sony EV-S3000 new in box, $995; Panasonic MX-12, new in box, $1295. 614-946-6611.

Panasonic AG 7500A (2) S-VHS HiFi edit decks with new recording & playback heads, A750 controller wired with GPI output, like new, $7000/package; Panasonic WV-MX50 S-VHS digital effects mixer & audio mixer loaded with special FX & wipe patterns, like new, $3500. T Keegan, Video Keepsakes, 55 Andover Pl, Robbinsville NJ 08691. 609-443-1101.

VCR/VTRS/RECORDING MEDIA

Want to Sell

Panasonic AG-7750 S-VHS edit recr with TBC, $3595; AG-7650 S-VHS source with TBC, $2795; AGF-700 time code cards (2), $350/each; Winsted slide kits (2), $75/ea, all vlh, mint. Videobrite, 707-571-8888.

Sony 4800 3/4" port with PortaBrace, pwr, cable, batt, $375; JVC CP-5000U 3/4" plyr, excl, $100. Steve, 608-251-8855.

JVC ESP-2 CR-600 3/4" source VTR; $2500; JVC ESP-2 CR-850 (2) 3/4" edit vrt, $2500; Sony VO-6800 (2) 3/4" port VTR, $500/ea. J Richardson, Showcase Chicago Chnl 25, 1931 W Diversey Pkwy, Chicago IL 60614. 312-477-4900.

Pioneer VDR-V1000 rewritable videodisc rcdr w/Laserdisc, 32 min component rcdg time, mint, $23K/BO. 808-875-8871.

Sony VO-5600 3/4" video rcdr w/search rev & forward, excl cond, $1000. Jaye, Nimbus Prod, POB 5903, Tak Pk MD 20913. 301-507-3358.

Sony BVU 110 field recorder/player, PortaBrace bag with side pouch, (3) Sony BP-90 deck batteries, AC power supply, BP-90 battery charger, excellent condition, $1500. C Vieira, Total Video Prod, 11 Prince St, Fairhaven MA 02719. 508-990-3677.

Ampex 350/440 parts, transport & electronics parts, some new, most used, super cond, motors, headstacks, guides, etc, & Scully 280 electronics complete, $100/ea, everything reasonably priced; Ampex MM 1100 16-trk 2" 15/30ips in superb cond, unit has very little use, heads good, all electronics have been checked out, has updates, counter, MDA fans, AC stabilizer card, mods, BO. M Gore, 415-469-0136.

Sony VO-6800 3/4" port VCR, excl cond w/PortaBrace case, $650/BO. Mobile-Video Prod, Bethesda MD. 301-656-2525.

Sony VO-5600, lw hrs, $900/BO. QV Productions, POB 3236, Santa Clara CA. 408-248-8208.

Panasonic 7400 port S-VHS HiFi video rcdr, rarely used, cables, batts, carrying case & more; Sony DXC-M2 3-tube color bdct camera w/batts, chrgr, extra long extension cables & heavy duty carry case; Bogen heavy duty tripod & many extras incl at no chrg, $3999/all or BO. B Johnson, 800-428-4129.

Hi8 camcorder w/underwater bag, Kyocera camcorder, same as Sony V-99, hard case, hi-pwr batt adaptor w/several batts & car rechrger, $1100; Sony RME-100V editor, edit from camcorder to most VCRs, memorizes 9 edits, $100; Sony 2850A 3/4" editor VCR w/flying erase heads, $1000; Panasonic A-95 editor & K-12 char gen, $225; small AC Sony audio mixer, $100, you pay freight, will consider trades of quality video/audio gear. Bruce, 406-542-2563.

Sony VO-5800 3/4" edit deck, well maintained, $1500. John, 415-882-7766.

JVC CR4400 (2) 1 w/pwr sply & batt chrgr, 1 w/gd PortaBrace case, $500/both or BO; Sony SLO 380 (2) Beta I Porta Paks, 1 w/PortaBrace case & AC-340 pwr sply/chrgr, $150/both or BO. M Leonard, Public Cable, 118 Johnson Rd, Portland ME 04102. 207-775-2381 x850.

Sony Hi8 industrial deck VCR, EVO9500A, $1650; Panasonic 7400 port S-VHS deck, $1550; Panasonic PVS 4990 digital VCR, $850, all like new cond. CW Productions, 803-531-1662.

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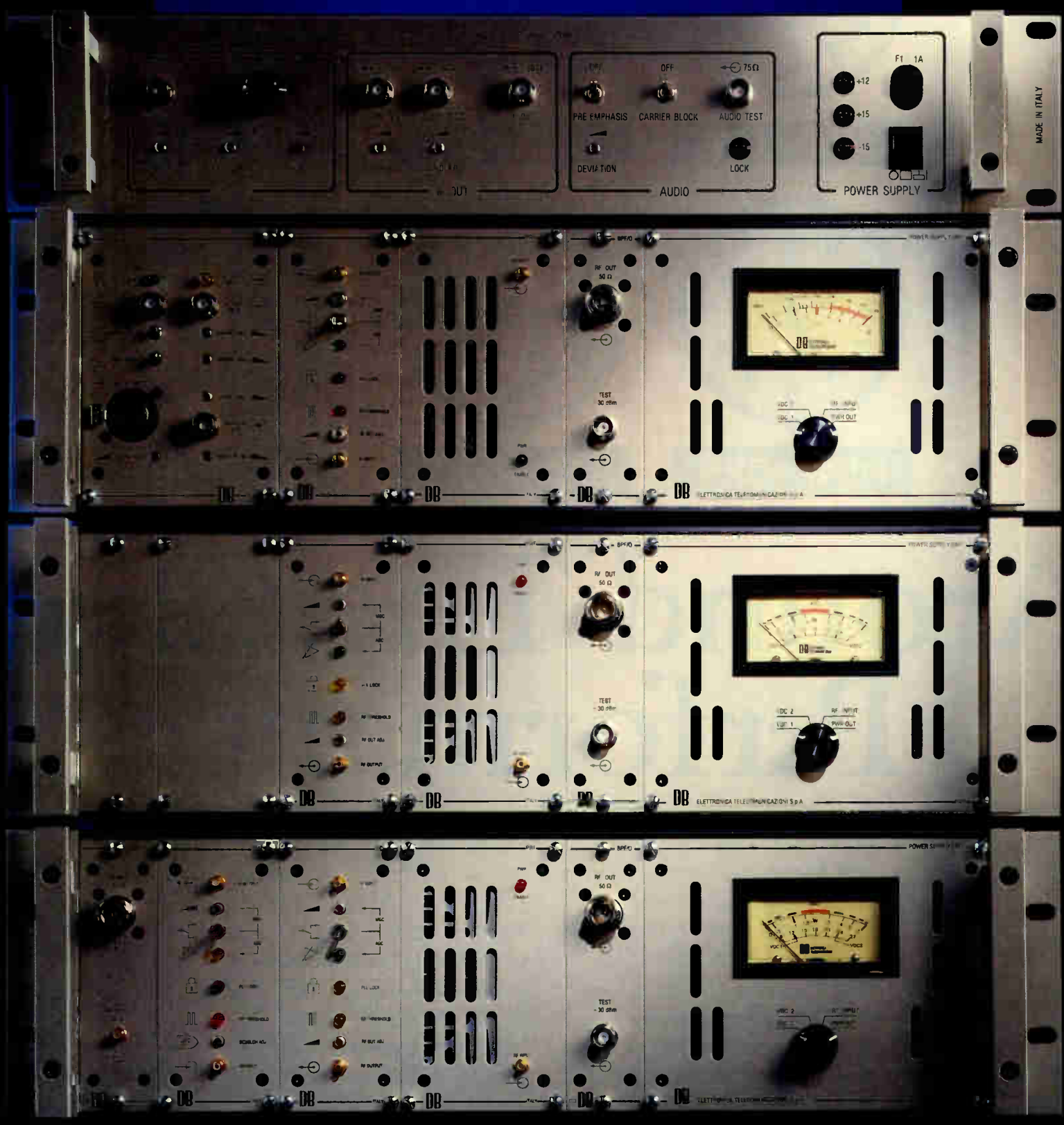

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